Use and design of information technology in third world contexts with a focus on the health sector

Case studies from Mongolia and South Africa

Dr.Philos. thesis

Norsk Regnesentral
ANVENDT DATAFORSKNING
Norwegian Computing Center/Applied Research and Development

NOTAT/NOTE

IMEDIA/06/98

Jørn Braa

Oslo
July 1998

NR Norsk Regnesentral
ANVENDT DATAFORSKNING

NR-notat/NR Note

Tittel/Title:
Use and design of information technology in third world contexts with fokus on the health sector
Case studies from Mongolia and South Africa

Dato/Date: July
År/Year: 1998
Notat nr: IMEDIA/06/98
Note no:

Forfatter/Author:

Jørn Braa

Sammendrag/Abstract:

This is a reprint of a thesis for the degree of Doctor Philosophiae submitted to the Faculty of Mathematics and Natural Sciences at the University of Oslo. The thesis contains a main contribution, eight articles and four appendices. The articles provide empirical material which is discussed and summarised in the main contribution.

The thesis is based on fieldwork in Mongolia and South Africa. The theme of the thesis is use and design of information technologies in disadvantage areas, the "third world part" of the third world. The focus is on the health sector and ways to use IT to support a decentralised primary health care structure.

The adjudicating committee consisted of professor Geoff Walsham, associate professor Mikko Korpela and associate professor Kim Halskov Madsen.

Emneord:

Indexing terms: Information technology, Primary health care, Development, Design, System development

Målgruppe/Target group:

Tilgjengelighet/Availability: Open

Prosjektdata/Project data:

Prosjektnr/Project no:

Antall sider/No of pages: 325

Satsningsfelt:

Research field:

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by

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Thesis submitted for the degree of Doctor Philosophiae

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December 1997

Abstract

While the overall aim of my PhD research has been to explore the wide area of information technology, development and health care related to the third world, a concrete objective has been to investigate if the Scandinavian approach to democratic design of information systems may be useful in third world contexts and how it may be adapted to such contexts. Over the last 4-5 years I have conducted a comparative case study in South Africa and Mongolia with a focus on use and design of information technology (IT) in relation to the ongoing health sector reforms. Both countries have been involved in drastic transformations during the period, and processes of change have formed an important part of the context of my research. A main finding (1) in my research is that despite of these large-scale efforts to bring about change, significant and successful changes towards decentralisation and local involvement are hard to come by.

The research approach has been explorative and bottom-up, and included participative and action oriented research. In South Africa I have been involved in a community based system development project aiming at developing health districts. In Mongolia I have been involved in a countrywide survey of information and computer usage. Findings (2) in South Africa show that the Scandinavian approach is important but adaptation to third world conditions where the community rather than the work place is in focus, is needed. Findings (3) in Mongolia imply that IT-applications in the third world sometimes may cause more striking changes and improvements than in the first world, despite the inferior infrastructure.

The three areas of findings, marked as 1, 2 and 3 above, have led to the development of an analytical framework within which IT and the third world may be interpreted. The framework, which is presented in the main part of this thesis, contains three parts; a model of the third world as a dynamic patchwork of uneven development, a model of information systems conceptualised as social systems, and three categories of IT introduction and use in third world contexts that are reflections of the three areas of findings. The results of the normative research reported in this thesis are presented as five research questions in the main part of the thesis.

The research has previously been reported in eight articles, presented in journals and conferences, They are included in this thesis. The thesis contains three parts; 1) the main part includes a summary of the research; the research methodology and a description of the research process; analytical concepts; a presentation of the cases; and finally a discussion of the findings in relation to design and the process of system development; 2) the eight articles; 3) appendices.

Acknowledgements

I wish to express a sincere gratitude to all those who have helped me in various ways in making this project come through.

Thanks to Joan Greenbaum who has provided important inspiration and support during a long period of time. Those who co-authored articles with me have all contributed greatly to this thesis: Ch. Nermunkh, Arthur Heywood, Maylene Shung King, Hassan Mahomed, Mike Power, Eric Monteiro, Erik Reinert, Eline Vedel, Kari Aanonsen and Vemund Riise.

A special thank to the brokers in this project, those who actually made it possible. P. Nymadawa, the Minister of Health in Mongolia who personally invited me to his Ministry at a time when mere entry in Mongolia was incredible difficult. Dumo Baqwa and Jonny Myers, who got me to the University of Cape Town and into the evolving process of health informatics in South Africa. Those of the core HISPP (Health Information System Pilot Project) team not already mentioned; Gail Kortje, Winnie Mgudlwa, Ivan Toms, Rob Martel, Nils Bergren, Calle Hedberg. My partners and colleges in Mongolia, not yet mentioned; Ts Sodnompil, G. Burendei, G Demberelsuren and P Altanhuyag in the Ministry of Health, Mongolia.

Thanks to Thomas Hylland Eriksen for valuable input and support both in the early and late phases of the project. Others that have read the manuscripts and given valuable comments are Eric Monteiro, Bo Dahlbom, Herman Ruge Jervell, Ole Hanseth, Kristin Braa, Karlheinz Kautz, Geir Kirkebøen, Tone Bratteteig and Kolbjørn Braa. Anne-Marie Humerfelt and Line Eikvil have helped me during the last completion.

I have discussed the basic themes of this thesis with Kristen Nygaard many times over many years. Riitta Hellman supported my work in the early phase of the project.

My family; Unni, Steinar and Tore with whom I have travelled 'millions' of kilometres during this project.

The research has been generously funded by the Norwegian Research Council, and the Norwegian Computing Centre where I work.

The structure of the thesis

This thesis contains three parts; the main contribution, the articles, and appendix.

Main contribution

The main contribution contains 5 sections. The first section is a summary which presents the whole picture, research questions, motivation and results of the research. This summary draws on the papers and the other sections. The other sections present the two cases in question, the research process, the theoretical concepts and discusses research questions related to system development.

Section 1. The summary part: 1.1) Introduction to the context of the third world information technology, 1.2) the concepts of primary health care and health district information systems are outlined, 1.3) research questions, motivation and results are presented.

Section 2. The research project: 2.1) The methodological approach I have used is presented, 2.2) the research process consisted of four phases related to country and research area in focus. Each phase is described and the phases are summarised.

Section 3. Theoretical concepts: 3.1) The concept of formalisation is discussed in relation to information technology, health care and the third world. 3.2) The social system model (VIII), which is presented in part one, is explored in more detail. 3.3) The concepts of community, cultivation and bricolage are presented.

Section 4. The cases of Mongolia and South Africa: The two cases are described. In both cases the focus is on the process of health information system development. In South Africa a more detailed analysis of the national process, where I have participated, is presented. In Mongolia the description is different, here I use four key symbols to explore important aspects of the nomad, Soviet and new market liberal technologies respectively. The difference in descriptions is due to the different approaches used in the two countries, but also to the shortcomings of the articles mentioned earlier.

Section 5. Discussion of the results in relation to design issues and system development processes: 5.1) Information as signs and symbol, or how the information systems are best conceptualised as social systems. 5.2) Information system as tool for health district development; cultivation and 'structuration' (Giddens, 1984) as part of a design strategy. 5.3) The problem of diffusion; Cultivation and diffusion of replicable processes. 5.4) IT and third world technology policy.

The articles

The articles included in this thesis appear in the sequence they were written. The years of publication are not reflecting this.

I. Jørn Braa, Eric Monteiro, Vemund Riiser, Eline Vedel, Kari Aanonsen (1993): Experiences from European Health Informatics: Lessons for African system development? In Mandil S, Moidu K, Korpela M, Byass P, Forster D (eds): Health Informatics in Africa: HELINA 93. Elsevier, p. 161-165.

II. Jørn Braa, Eric Monteiro (1996): Infrastructures and institutions - the case of public health in Mongolia. In Roche E, Blaine M (eds.), *Information Technology, Development and Policy: Theoretical Perspectives and Practical Challenges*, Aldershot: Avebury, pp. 171-188. (Proceedings of the IFIP 9.4 conference 1994).

III. Jørn Braa, Eric Monteiro, Erik Reinert (1995): Technology transfer vs. technological learning: IT infrastructure and health in developing countries. *Information Technology for Development*, Vol 6 (1), IOS Press. pp. 15-23.

IV. Jørn Braa (1996): Decentralisation, Primary Health Care and Information Technology in Developing Countries - case studies from Mongolia and South Africa. In M Odedra-Straub (ed.) *Global Information Technology and Socio-Economic Development*, Proceedings, Nashua: Ivy League Publications, pp. 130-142. (Proceedings of the IFIP 9.4 conference, 1995).

V. Jørn Braa, Arthur Heywood (1995): South Africa, Africa and Health Information Systems - The need for a reciprocal collaboration. In Sosa-Iudicissa, J Levett, SH Mandil, PF Beales (eds.), *Health, Information Society and Developing Countries*, IOS Press, pp.173-184.

VI. Jørn Braa, Arthur Heywood, Maylene Shung King (1996), District level information systems: Two cases from South Africa. *Methods of Information in Medicine*. Vol 36, No. 2, pp. 115-121. (First presented at HELINA 96: Health Informatics in Africa, conference, Johannesburg, April, 1996).

VII. Jørn Braa (1996) Community-based participatory design in the Third World. In Dykstra-Ericson (ed.), *Participatory Design Conference PDC'96*, Proceedings.

VIII. Jørn Braa & Ch. Nermunkh (1998), Health Information systems in Mongolia: a difficult process of change. In (forthcoming) Proceedings of the IFIP 9.4, 1998 conference; 'Implementation and evaluation of information systems in developing countries. A first version is published in the proceedings of the IRIS 20, 1997.

Appendices

Appendix 1: Six steps to develop a district health information system

Jørn Braa, Arthur Heywood, Hassan Mahomed

This is a case report from the Health Information Systems Pilot Project (HISPP), which I have been working with since its preliminary phases in 1994. Since early 1997 HISPP has been part of an initiative by the ministry of health district development programme to develop guidelines for developing district health information systems in South Africa. The six steps were formulated based on the experiences in HISPP. The intended readers are health workers and management in South Africa. The report is a practical application of my findings in South Africa.

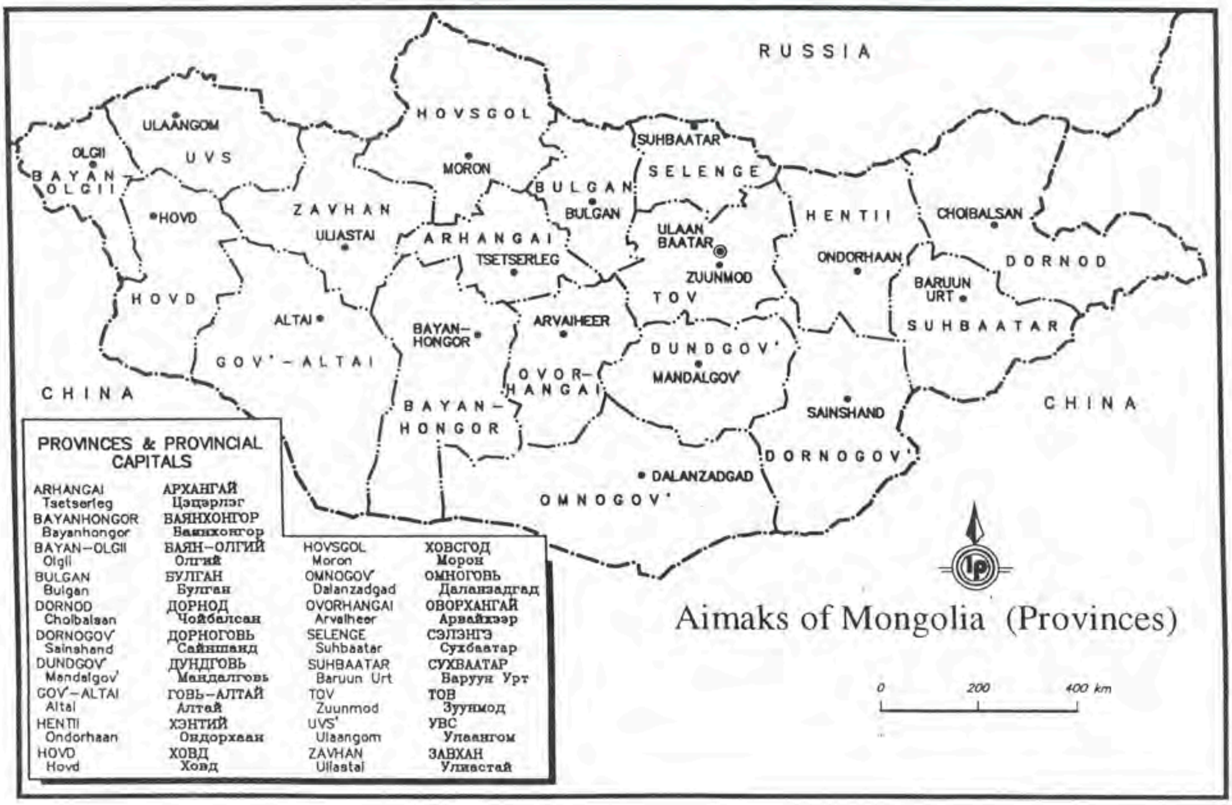
Appendix 2: The Monthly Routine Report, The RMR form. This is a data collection form developed and piloted within and around HISPP, which is discussed in Appendix 1 and in section 5.1

Appendix 3: The questionnaire used in South Africa in the survey of use of health information among health workers reported in (article VI).

Appendix 4: The questionnaires used in Mongolia that was developed from the one above (see article VIII) There are two types: 1) Questionnaire for survey of computer usage, and 2) Questionnaire for survey of health information. They are a little messy, since they have been with me in the field. These are the English versions I used to compare the various fields in the original Mongol ones. The wording is not accurate. Following each of the questionnaires a real example is given. Both from Uvs Aimak, which is described in section 4.1.2. The one who filled in the computer questionnaire is from the State Statistical office.

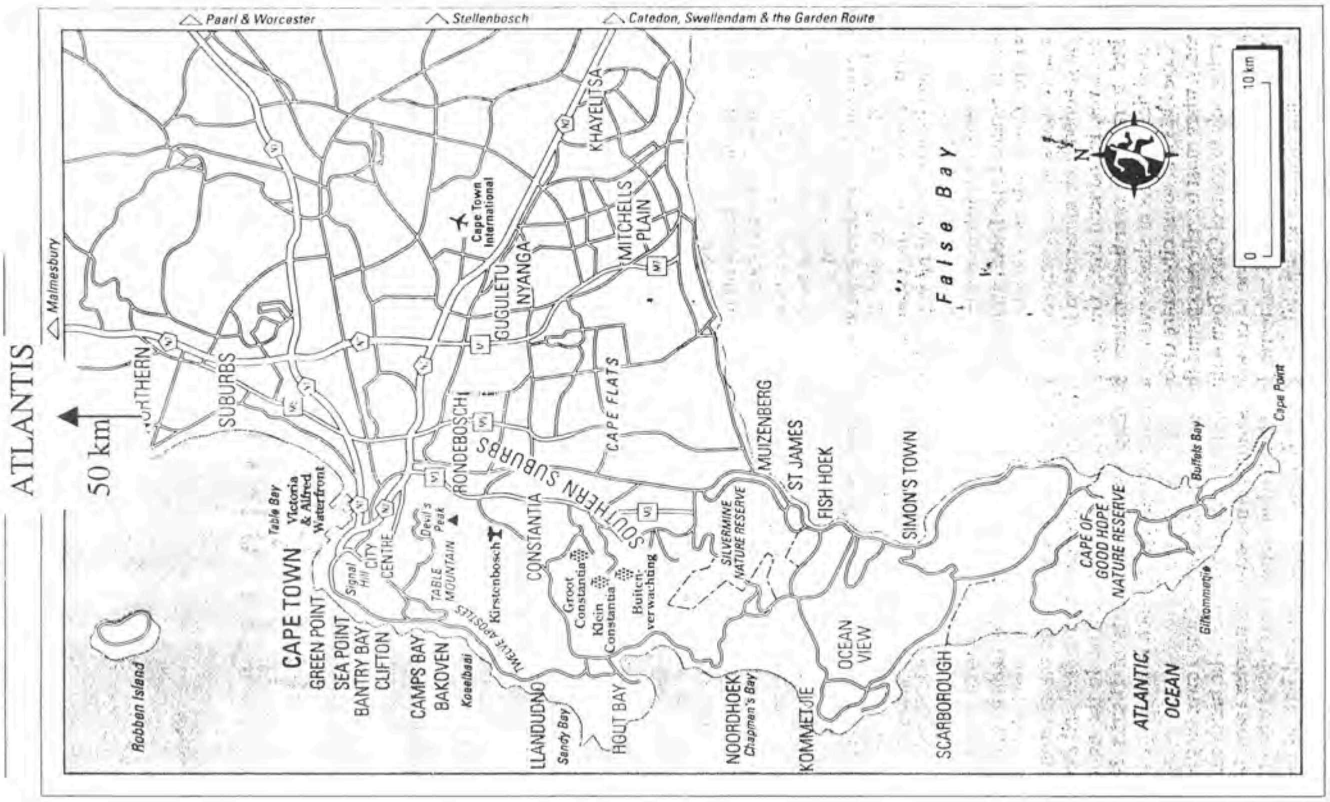
Moreover, our recommendations to the Ministry of health, Mongolia, is included. Furthermore, tables with basic aggregated data from the survey are included as well.

The following maps are from the *Lonely Planet* guide to Mongolia, Rough Guide to South Africa (Cape Town map) and from Martin J. Murray (1994): The Revolution Deferred, Verso, London (South Africa Map). In the latter map I have included the two townships of Alexandra and Mdantasane since cases from these places are discussed in the thesis.



Aimaks of Mongolia (Provinces)

CAPE TOWN AND THE PENINSULA



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Preface

1. Motivation and background

The research reported in this thesis discusses the design and use of information technology in third world contexts with a focus on the health sector. Before I embark on my topics I start with a brief outline of my background and perspectives within the field of information technology and system design and development. The Scandinavian approach to system development (e.g. Ehn, Kyng 1987) provides a major source of inspiration for my research. For a long time I have been contemplating the assumption that this tradition would provide important input to third world system development.

In the early 1970s I worked at Norwegian Electric & Brown Bovery (NEBB), where the union was one of those participating in the Iron and Metal Union (NJMF) project (Nygaard 1979) in collaboration with researchers from the Norwegian Computing Centre (NCC). This project formed the point of departure for what is later labelled the Scandinavian approach to system development. The project aimed at empowering workers in questions regarding technological changes and threats to the work place. Since the early 1980s I have been linked firstly to the information system department at the University of Oslo as a student and then to NCC as a researcher. Those two institutions have both been important role players in the Scandinavian tradition referred to here. I have thus been influenced by the Scandinavian approach.

In order to bridge previous experiences with what I regard as the main challenges of the future, I start with a snapshot of the past. Having had the 'privilege' to be one of the first workers that was targeted for empowerment by the Scandinavian approach I find it appropriate to start there, at NEBB, in1973.

At NEBB the actual technological threat was a massive introduction of the classic "work harder, think less and sweat more" planning and control systems. The production process was to be divided into the smallest operation modules possible, and each worker was to be left with a pre-defined sequence of detailed operations. Most importantly, these operations were measured in *time*. The making and maintenance of the job descriptions were given to a new group of white-collar technicians, who thus received power and control over knowledge transferred to them from the workers. The system was remarkable in the way it tried to minimise learning and innovation and it was initially presented by management as a matter of facts - take it or perish. As a result of the trade union project, management had to change this strategy. Negotiations, meetings and heated discussions followed, involving everyone. The main issue among the workers was to what extent the 'system' would be able to steal all knowledge and secrets related to the job, and whether they would be able to remain in control of the *time*. At the end of the day the system was accepted, but with important modifications. Thus the project failed to stop the rationalistic system desired by the company, but it created awareness and empowered the union.

At NEBB the Scandinavian approach meant empowerment, learning and a focus on a large and varied social group; 900 workers holding a multitude of professions, skills, ranks and statuses. People and social systems were the critical issues, not technical artefacts.

The Iron and Metal project represents the first generation of the Scandinavian approach (Kyng 1995; Bjerknes, Bratteteig 1995). The focus was on larger, varied and to some extent multileveled social systems. 'Empowering through learning' I take to characterise this generation. The second generation kept the union base and political focus but shifted towards producing technological alternatives by designing for skilled workers (e.g. the UTOPIA project (Bødker et al. 1987), the FLORENCE project (Bjerknes, Bratteteig 1987)). As a consequence the focus narrowed down to groups of workers. 'Designing for empowerment' I take to characterise the perspectives of this second generation of the Scandinavian approach.

A third generation, or phase, of the Scandinavian approach is no longer union based focusing instead on computing in context where ethical more than political issues are raised (Bjerknes, Bratteteig 1995). In my context of third world computing I will construct a third loose category where I extend the third generation to also include a range of system development practices and techniques from the field of participatory design (Schuler, Namioka 1993; Greenbaum, Madsen 1993). In third world system development lessons from all generations are needed, in *parallel,* as will be demonstrated in this thesis.

The Scandinavian approach has evolved through generations and phases as a result of historical processes, of changes in economics and relations in working life (Kyng 1995). The possible relevance of the tradition has been debated in light of those historical processes and differences between American and European working life (Greenbaum 1993; Kraft, Bansler 1992; Kyng 1994; Bansler, Kraft 1994). Discussions about working life in Europe and America however have little relevance to the research discussed in this thesis since the historical processes and contexts in the third world are different.

Over the last 4-5 years, thanks to funding from the Norwegian Research Council, I have been able to explore my topics in depth both in Mongolia and South Africa. The area of focus has been health information systems, primary health care and health sector reform. In Mongolia I have travelled 9000 kilometres in jeeps and interviewed people who probably are the most remote computer users in the world. I found that computer users in such places 'survive' through what Lévy-Strauss (1966) calls *bricolage* and tinkering and by building informal networks of support. In South Africa I have had the privilege (and still have) to participate in a system development project that may be regarded as a third world parallel to the first and second generation of the Scandinavian approach. There I have learned that the lessons from Scandinavia are indeed important, but they need to be adapted and *cultivated* in third world contexts. First of all, in the 'shanty huddles' of township South Africa, system development, *learning* and *empowerment* need to address the *community* rather than the work place. Another important difference to the Scandinavian approach is that deprived communities are not threatened by technology, they are threatened by being ignored and sidelined by the technology. Thus, appropriation of IT by the communities through "designing for empowerment" is a main objective.

During my research I have been increasingly aware of the similarities between the first world and the third world, and the mutuality needed in all networks of learning and collaboration. Thus, the third world will not learn from the first world unless within areas where the first world also learn from the third world. It may be true that the third world has a lot to learn from the Scandinavian approach, but it is equally true that the Scandinavian approach and the first world have a lot to learn from the third world. Community based participatory design is one such area (article VII).

I have come to see bricolage as necessary for third world computing and as an approach that will increasingly become important for the first world. Thus, the art or skill of bricolage the first world will need to learn from the third world if it wants to be prepared for the challenges of the future.

Research project overview

The research project presented in this thesis started April 1993 and ended June 1997, and was funded by the Norwegian Research Council.

The research may be divided into four phases according to country and research area in focus. The first three months were preparation.

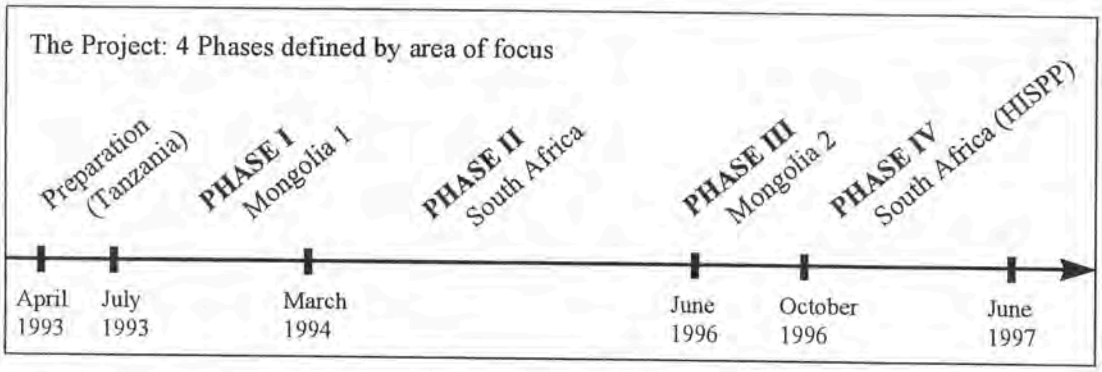

Figure 1(Preface): The four phases of the project defined by area and country of focus.

- Preparation: April - June 1993. The objective was to be able to do research in two countries.
- Phase 1: June 1993 - March 1994. Including the first field work in Mongolia, June - November 1993.
- Phase 2: March 1994 - June 1996. Between the two periods in Mongolia, based in South Africa. Stayed in South Africa the following periods: March - April 1994, August 1994 - August 1995, October - December 1995, March - June 1996.
- Phase 3: June - October 1996, the second fieldwork in Mongolia.
- Phase 4. October 1996 - June 1997. The second period in South Africa - the HISPP project. Stayed in South Africa: October - December 1996, March - June 1997.

Co-authors of the articles

The articles included in this thesis have a number of co-authors. Eric Monteiro, Vemund Riiser, Eline Vedel, Kari Aanonsen were all collegues at NCC when we wrote (article I). They all have a similar background in informatics as I have, apart from

Riiser who is a geographer. Erik Reinert is an economist working with a group of economists involved in technology policy that was part of NCC at that time. He contributed from his specific field of economy in the article co-written with Eric Monteiro (article III), together with whom (article II) is also written. The close collaboration with Eric Monteiro has continued all through the project and has inspired many parts of my work. He has also visited the system development project in South Africa..

Article (VI) are written together with Arthur Heywood and Maylene Shung King. Maylene Shung King is a medical doctor at the Department of Community Health at the University of Cape Town, where I am also based when working in South Africa. Arthur Heywood, with whom also (article VI) is written, is a medical doctor from the Public Health Programme at the University of Western Cape. Our collaboration has been particularly fruitful and he has contributed greatly to this thesis. His action oriented health information approach and the international perspective derived from his many years in Zimbabwe, Benin and Ghana have trickled down to all parts of this thesis.

Nermunkh, co-author in (article VII), is a computer scientist working at the National Institute of Health, under the Ministry of Health in Mongolia. Without him the fieldwork in Mongolia would not have been possible.

The individual articles

Here I give a brief summary of each article highlighting the issues that are important contributions to this thesis. Apart from (I), the articles included in this thesis have emerged within a particular context of place, time and current 'understanding'. They are 'means' in a bottom-up process of exploring the research area. They thus cycle through several themes on which later articles build. In this thesis the means for interpretation have then become the product. From the point of view of the reader this causes some problems; repetitions of case material, general background and themes. As an example: various aspects of the case of Mitchell's Plane is used in three articles, in (article V) it is compared with a case from Ghana, in (article VI) with a case from another district, and in (article VII) with a case from a hospital.

On the research level the bottom-up approach has resulted in a focus on the empirical more than on the theoretical. Empirical data is here more interpretation and exploration than following and evaluating well-defined processes. This is to some extent counteracted by the analytical framework provided in the last article (VIII) and presented as a result of my descriptive research question in (section 1.3.2) in this thesis. The articles included in this thesis are all (apart from article I) written 'in the field'. In terms of my field work, the bottom-up, action research approach with full participation of partners in those countries has led to less time devoted to careful writing than what would normally have been the case. Lack of appropriate literature at hand represents another problem in that regard. A time constraint imposed by the need to alternate between two complex cases in parallel has also caused problems. As an example: While (articles II, III, VIII) are about Mongolia, but written in South Africa, (article VII) is about South Africa, but written in Mongolia. Due to this tight schedule a lot of data collated has not been used, in particular from the last survey in Mongolia. The aim is to include this data in later work.

At a more complex level the longitudinal study itself has led to cycle after cycle of new interpretations, which are not captured in the articles. Two examples of this need to be mentioned:

The articles from South Africa are all written within the optimistic period of the first one-two year after the election in 1994. The New government's 'New deal'-style 'Reconstruction and Development Program' (ANC 1994a) makes up the important context. Today the RDP is more or less abandoned. The fact that the RDP both came into being and disappeared during the course of my fieldwork is not reflected in the articles. Since the National health information process is born out of the RDP, this fact is significant in the total interpretation of my cases. I therefore interpret these processes in section 4.3 and 4.4.

The articles from Mongolia focus on the crisis caused by the fall of the Soviet Union and the obstacles to change represented by the legacy of that model. During my first fieldwork the crisis was a main focus. The next time I realised that despite lacking most technical and economical infrastructures, the Mongols survived comparatively well. The countrywide communication network, as an example, implies a remarkable self-reliance at local levels. The stability (or obstacle to change) represented by the Soviet legacy is discussed in the articles. As a result of the longitudinal character of my research the stability and flexibility represented by the nomad technology also became apparent and needed to be interpreted. Since this is not reflected in the articles I describe and discuss those aspects in relation to the Soviet legacy in section 4.1.

Article I. Experiences from European Health Informatics: Lessons for African system development?

It is argued that even in Scandinavia IT is in a sense 'foreign' to the users, which has necessitated an evolutionary learning based approach to system development. The article suggests that this may be at least as important in Africa where the technology may be even more 'foreign'. These arguments are derived from three archetypal cases from hospital contexts in Norway: the bottom-up, which works fine at the local scale; the top-down which does not work at all; and the in-between which represents the trade-off between local flexibility and global standards. In the latter case the local learning was as important as in the first bottom-up case, but general applications were planned diffused between contexts. This represents the start of a discussion that continues in (article III) in relation to technology transfer and in (section 5.4) in relation to diffusion.

This article is written before the research project started and I had no experience from practical applications of IT in the third world. While the arguments related to the Scandinavian approach here lean towards the theoretical perspective (Greenbaum, Madsen 1991) (see articles III, VI), participation as a means to achieve mutual learning, my later experiences have found the political perspective to be more in focus.

Article II. Infrastructures and institutions - the case of public health in Mongolia.

This article reports from the first period of fieldwork in Mongolia in 1993. A broad survey of IT with a focus on the health information system in relation to the ongoing health sector reform was conducted. It has shown that the health information system has failed to keep up with the changes in policy (followed up in article IV). The survey shows how the state statistical institute, which had established a network covering all Aimaks (provinces), has driven the history of computing in Mongolia. The article discusses how processes of learning about IT need to be institutionalised and to become part of national policies. We propose the health sector as an arena for learning, which is discussed further in (article IV).

Article III. Technology transfer vs. technological learning: IT infrastructure and health in developing countries

It is argued that the notion of technology transfer rests on the conception of technology as artefacts. This, we argue, neglects the crucial aspects of the cultural and social context of use. Technology has to be learned rather than transferred. We argue that learning needs to integrate the local and particular with the global and standardised (as in article I). Given this we argue that learning about IT-infrastructures are crucial in third world countries and that such learning needs to take place in an environment which is to some extent sheltered from market forces. The health sector is presented as such an arena for learning (building on article II).

Article IV. Decentralisation, Primary Health Care and Information Technology in Developing Countries - case studies from Mongolia and South Africa

The two cases of health sector reform in Mongolia and South Africa are compared. Two broad areas representing obstacles to change are outlined:

1) For decentralisation the important obstacles are the vertical, fragmented and centralised structures.

2) For instituting a primary health care approach the important obstacles are the hospital-based structures and the inscribed curative ideology.

The article argues that within both areas information technology has the potential to contribute to change. This will require a focus on the local level and a community based participatory approach, which is also inherent in the primary health care approach, is suggested. This is followed up in (article VII).

Article V. South Africa, Africa and Health Information Systems - The need for a reciprocal collaboration

Through cases from Mitchell's Plain and Ghana it is illustrated that there is in Africa a resources pool of experiences, methodologies and approaches to dealing with information systems supporting the reconstruction of the health services in South Africa. It is shown that the superior first world technology of South Africa is unable to address and solve the third world problems of its own country and that South Africa has a lot to learn form third world Africa. We outline a triangular collaborative model in which South Africa, the less developed countries of Africa and Europe, make up the three parts. The model strongly advocates horizontal, mutually beneficial collaboration, as opposed to a vertical model with South Africa or Europe in central position.

Article VI. District level information systems: Two cases from South Africa.

The article focuses on health district information systems. It presents experiences from Mitchell's Plain and another project in which a process to establish a district based information system and a situation analysis of the information system was done. The two projects applied different research methods but the result shows with remarkable consistency that much time is used on data collection though information is not used on a local level. The lessons regarding system development show that prerequisites for success include local ownership, a bottom-up process based around the existing local structures and the active involvement from the community.

Article VII. Community-based participatory design in the Third World.

Illustrated by the case of Mitchell's plain a strategy for community based participatory design is discussed (building on findings in article III). This case is contrasted with a participatory design project in a hospital in a poor township. Based on the contrasting contexts for system development between the health district and community on the one hand, and a hospital on the other, important characteristics for third world system development are identified.

Article VIII. Health information systems in remote Mongolia: a difficult process of change.

The article presents a three years follow-up study of the use of IT at the peripheral levels in Mongolia with a particular focus on health information systems. Within the context of health sector reform it is shown that the obstacles to change identified in (article IV) remain the same. An extended social system model is presented. This model is used both in order to interpret the resistance to change in the social system and as a strategy for design of the *social* information system.

Section 1: The main contribution

The main contribution contains three parts: First, I give an introduction to the context and the topics: the third world, IT and the health sector. Second, I give a general introduction to the health context within which I am working: Primary health care, the district health system and health information in this context. Third, I present my research questions, motivation and results. This is the summary of the thesis.

1.1 Introduction - the third world

In this section I give an account of my topics of IT, the third world and the health sector. 1.1.1 is setting the stage. 1.1.2 gives a report from one of my cases, which illustrates the context of health district and system development. This example illustrates a main focus in this thesis, around which much of my discussion, examples and results evolve. 1.1.3 gives an introduction to the context of third world and IT. 1.1.4 reports from my cases in Mongolia and South Africa regarding introduction of IT and communication technologies more generally. 1.1.5 sums up the section in three categories of introduction and use of IT that I have observed.

1.1.1 Setting the stage

Transfer of technology from the North to the South was among the main themes at a conference on Information Technology for Development, at the University of Witwatersrand, Johannesburg 1995. There I argued that the problem and challenge is not to accomplish the transfer of IT from the North to the South, but to 'transfer' the technology from that very University, or the first world Johannesburg, to e.g. the township of Alexandra a few kilometres away. There, in the Alexandra health clinic, a computer based information system had been running for several years. By studying this system, problems, challenges and achievements regarding third world computing could be revealed (technology transfer is discussed in article III, and section 5.4).

Alexandra is situated on the outskirts of modern Johannesburg and is a particularly poor and violence-ridden township. The population has doubled over the last 8 years and is now estimated to 500.000 people, most of them living in overcrowded shacks (Mail & Guardian, Vol. 13, No 19. 1997, South African Newspaper). The contrast to the first world areas of South Africa is appalling:

> "The motorway to Pretoria has been lined by gleaming new factories and plants. But it lies only a brief drive from the fearsome shanty huddle of Alexandra township, where the Third World bangs ominously on the windscreens of passing cars." (Preston 1994, page 17)

The challenge as put forward in this thesis is to explore ways in which IT may be used to support and enhance development of deprived communities such as Alexandra: 'the third world part of the Third World'. The few kilometres between Wits University and Alexandra represent a wider gulf than what is normally addressed within the traditional technology transfer concept. To bridge this gulf, or to walk this rather unknown road, has been the main quest in my research.

Since little IT exists in such areas, the road to this problem area is rather unknown and uncertain. The whole research project could thus not be defined or specified in advance, and an explorative approach has therefore been applied. The exploration has been with regard to the steps actually taken in the field, to the research approach, as well as to the theoretical framework developed to support the study.

The first research question was to approach an understanding as to what the gulf between the two worlds, the first and the third, consisted of or what were the principal differences between them. The notion of developing countries implies the understanding of the Third world as a still imperfect replica of the First World, on the way to catch up. These linear perspectives do not explain the sprouting up of the Alexandras of this world, the big city slums following urbanisation and 'development' in the third world. The third world areas of third world countries are as much part and a result of development as it is the focus of development.

The computer based information system in the Alexandra health clinic is an excellent example of sustainable technology development in a deprived township, but it is not addressing the needs of "the shanty huddle of Alexandra". Thus it is not bridging the entire gulf between the first and the third world. A main approach in my research has been to analyse and explore the contrast between information systems addressing the needs of a hospital on the one hand, and on the other, the need of a wider community.

The information system in Alexandra health clinic is confined to the rather closed problem area defined by the clinic as such. People enter the door and become patients in a database, and procedures that are performed are registered. The information system is a traditional hospital system adapted to the local conditions. While the system supports the hospital management well, it is *not* supporting the development of health services outside the gates of the hospital. The information system addressed the relatively closed and well-defined problem areas of the hospital well, but it was unable to address the more open and vague problem areas of the community.

In order to support development of the health services and the health and social conditions of the population of Alexandra, the system must provide information on the public health status and on how the services are performing. In order to learn about the situation in the area one must first define the area, then one must know where the patients come from (perhaps they come from another area?) and the number of population in the area (age groups, women in child bearing age, etc.). What about the people who are not attending the clinic? What is their health status? Only by answering such questions is it possible to assess the health situation, set targets for the health services in the community and evaluate to what extent you meet the targets.

The information system says nothing about the infant mortality rate in Alexandra because there are no records of number of infants, or number of deaths in their information system apart from those having occurred within the clinic. Such information would have been necessary if the goal had been to manage the health services in the community, but for the hospital it does not matter, since their walls define their 'world'.

This example illustrates a central topic and main context in this thesis. The focus is on design and development of information systems to support the development of the health services *and* public health in deprived communities such as Alexandra. The IT-development is thus an integrated part of a wider health sector reform. Furthermore, the focus and aim of this change process is development of public health in the communities, which again is part of a wider socio-economic development. Thus, information systems can not be limited to e.g. the Alexandra health clinic; they need to encompass the community of Alexandra, and all health services working there. The district health information system is one 'answer' to this problem.

1.1.2 Report from research in South Africa - District health information

In both South Africa and Mongolia I have studied the ongoing health sector reform, which in both locations aims at a decentralised health system based on the primary health care approach. The rather specific context of health sector reform forms the background for the empirical findings and discussion in this thesis. I will therefore give an overview of the primary health care approach (PHC) and district health system in (section 1.2). Primary health care is a preventive and holistic approach to health care emphasising the community, as opposed to the traditional curative and instrumental hospital-based approach (WHO/UNICEF 1978).

The district health model is proposed as the most effective way of delivering primary health care and of organising health services (Amonoo-Lartsen et al. 1984; Janovsky 1988). The health district includes all health services within a district, a geographical area, and a management team. The district level hospital is thus included in the district structure. The example from Alexandra illustrates important differences between a hospital-based perspective on health care, on the one hand, and a PHC perspective on the other. While the hospital aims to cure the patients entering its gates, the PHC approach is broader and aims at improving the health status in the district as well as more general socio-economic development (see article VI).

As was illustrated by Alexandra, neither a district system, nor a district information system is yet in place in South Africa. Moreover, primary health care was poorly developed prior to the election in 1994. On this background I have since 1994/95 been engaged in a process to develop district information systems in three districts in the Western Cape Province in South Africa. Since 1996 this has been carried out within the "Health Information System Pilot Project", the *HISPP* for short. The project is a collaborative effort between the health department of the Western Cape province and the universities of Western Cape and Cape Town and the Norwegian Computing Centre.

In (articles IV, V, VI, VII) I have described the initial phases of HISPP and the work in the 'coloured' township of Mitchell's Plain. Here I use Khayelitsha, a 'black' township where HISPP is also working, as an example (see aerial photograph in figure 1.1). Khayelitsha was created in the early 1980s. The outburst of violence in the townships in Cape Town in 1985-6 and the global urban-rural drift led to a stream of refugees and squatters to Khayelitsha. In September 1986 the population was estimated to be 120.000 (Harrison, McQueen 1992) and has now reached an estimated 300.000, mainly Xhosa. The great majority is living in shacks, fairly similar to those in Alexandra. The informal community structures are powerful, while most

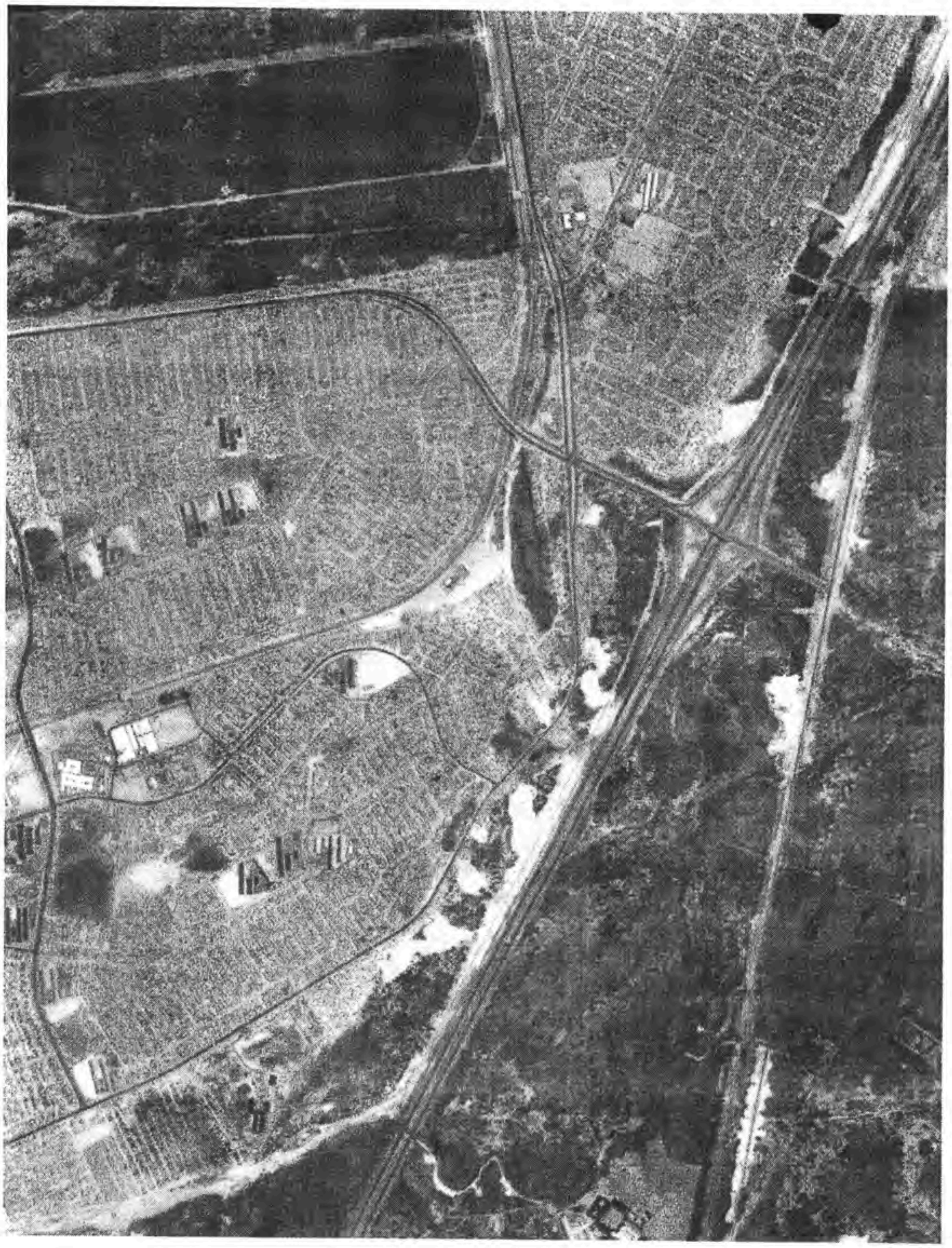

Figure 1.1. Aerial photograph of Khayelitsha, Cape Town, covering a part of 'site C' (top right) and 'Site B' (left). See the Cape Town map for location. All dwellings on the photograph are informal shacks. The large buildings are schools and the highway leads (up) to the centre of Cape Town. Khayelitsha and Cape Town illustrates well that the third world and the first world are only a few steps apart from each other and that the two parts make up a dynamic relationship. Several hundred thousand people live in shacks next to the modern highway and airport. Without the prosperity of Cape Town, there would have been no Khayelitsha and, without Khayelitsha (or the other townships

and shantytowns) there would have been no prosperity in Cape Town. The photograph is being used instead of a map in the Geographical Information System that is under development within the HISPP. The black population in South Africa has been provided with poor education under Apartheid, and are in general not familiar with maps. A photograph is more intuitive and may be easier to understand.

formal structures and public services are either lacking or are very weak. It is a large and complex area, a true creation of apartheid and the notorious 'Group Areas Act'. This law from 1950 gave the government powers to segregate the entire country by allocating separate areas to the different population groups. To implement this policy, the Act provided for forced removal and resettlement (Stent 1994).

HISPP aims at developing a district health information system based on participation with the community and the health services. It is among the first computer based information systems in the area. The information system aims at establishing routines for data collection, analysis and use of information in order to support management, health workers and the communities within the district. A district database, district information office and the selection and training of a team of people responsible for information at each clinic, health program and community group, are important elements in this effort. The following are main experiences from community based participatory design within HISPP thus far:

1. System development that is based within and focusing on the community is truly multileveled.

The health district consists of several levels, i.e. community, clinic, hospital, district management. The 'multileveledness' we met was one step further in that each level, or place consisted of two different levels, the 'within the service' level, and the 'service in the community' level. The information system would need to take the needs of the *community* into consideration (article VII).

2. Information systems need to be understood as social systems

System development in such contexts is about people. The information system aims at integrating all the health services in the area, some 15-20 health facilities and programs within various vertical structures. The core of the system is a team of health workers in each of these health facilities working together and feeding data into a district database. The core information system thus consists of "40 people in 20 units, some forms and reports, and one computer". The understanding of information systems as social systems (Kling, Scacchi 1982; Walsham et al. 1990) is therefore necessary in such contexts. The social system paradigm is presented in (article VIII) and in (section 1.3.2).

3. Cultivation and bottom-up development

Design and development of 'social' information systems is best understood as cultivation (Dahlbom, Janlert 1996) aiming at creating sustainable processes. Since the system is social, its survival and sustainability depends on the ownership and commitment to the system at local level, within the social system. Our experience shows that a *participatory process*, along with some (small) results along the way, is crucial in creating such ownership. It follows that the process needs to be based on a bottom-up approach. This is in line with the arguments regarding PHC and sustainability put forward in the next chapter.

4. Diffusion of information technology is best understood as cultivation of replicable processes

The district health information system needs to be implemented in all districts in South Africa. Districts are different in terms of history, politics, social and ethnic groups and so forth. Implicit in the notion of information systems as social systems is that each of them is unique. In HISPP we are working in three districts, which are all very different in terms of history, culture and socio-economic conditions. This can be illustrated by comparing Khayelitsha with the adjacent township of Mitchell's Plain, inhabited by 'Cape coloureds', which are as culturally different from the Xhosa, as two groups may be different from each other. The coloureds are the result of the mixture of all ethnic and race groups having been present in Southern Africa - and of Apartheid laws. The Population Registration Act from 1950 entered the entire population on a central register and classified it as being either White, Native or *Coloured*. Coloureds are those individuals who are not White or native.

What Khayelitsha and Mitchell's Plain have in common since 1994 is an aim to develop the best possible health system to serve their communities. The notion of information systems as social systems implies that the systems in Khayelitsha and Mitchell's Plain will differ in their capacity as cultural systems, as the cultures they emerge from. But, it also follows that the two systems will be as *similar* as social systems as the common denominator, the new unified health system and the New South Africa, make them. The information systems will be cultivated, governed and generated based on different beliefs and values, but the social, technical, and physical structures and concrete manifestations and outcomes, will be rather similar.

The information system, which I regard as a social system, literally grows into place within the cultural context in question. The information system is cultivated from and by the social system in question and will thus be expressed within this culture. Information systems are never implemented into a void. The legacy, ranging from existing information systems to social and cultural patterns, will always form the point of departure.

Diffusion is thus to spread *replicable processes* (the 'similar') and to *cultivate* them in each district (the particular and 'different').

1.1.3 Third world - Simple term, complex reality

In this section I first describe the term the third world[1] as I use it. Secondly I see this in relation to the debate surrounding underdevelopment. Thirdly I outline how others are using the term.

An approach to the third world

I understand the third world as a dynamic patchwork, or mosaic, of uneven development. Modern as well as not-modern parts with a continuum between, exist side by side, and are to a certain degree mutually dependent and products of each other. I use the term the third world in opposition to the first world to denote poor, deprived and underdeveloped communities sectors, regions and countries of the *world*. Such a perspective de-emphasises the strict demarcation lines between developed and developing countries, since aspects of the third world are part of 'all worlds'. As seen on the aerial photograph of Khayelitsha, hundreds of thousands of people are living in shacks next to the modern highway, leading to the modern metropolis of Cape Town, location of the world's first heart transplant.

The city of Bangalore in India has over more than a decade developed into a major centre for producing software. This process of increasing integration of the city with the global economy has resulted in a twin process of prosperity and deprivation. While the minority of the population is increasingly taking advantage of the prosperity, the majority faces increasing deprivation, poverty and access to public services (Madon 1997). Development, it seems, is not about even distribution of welfare, but about creation of differences. India has more poor people than Africa south of the Sahara, and, at the same time, more people that live in a first world economy than many first world countries. Thus, the 'great divide' is as much within as between countries.

Such processes of uneven development are not confined to the third world. Big city slums, permanent unemployment and deprived communities are also part of a contemporary notion of the first world.

Perspectives on uneven development

In a classic economic study Amartya Sen (1981) analyses poverty, deprivation and famines, as being due to uneven distribution of resources and of uneven economic development:

> "Starvation is the characteristic of some people not having enough food to eat. It is not the characteristic of there being not enough food to eat." (Sen 1981, p. 1)

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[1] The term "Third World" was first used by a French demographer in 1952 as an allusion to the "tiers teat" (third state) of French society before the revolution in 1789. In this context the use of Tiers Mooned would express ideas of "neglect, exploitation and revolutionary potential" (Wolf-Phillips, 1987).

'Dualism' is a term central to the early development discourse. The central assumption here was that both economy and society were divided into two sectors: The 'traditional' and the 'modern'. Underdevelopment was seen as the consequence of deficiencies internal to the underdeveloped countries themselves, the heritage, not of their colonial, but of their pre-colonial past. This perspective implied that the blame for underdevelopment was laid upon the third world itself (Worsley 1984). Frank (1973) criticised the "dual society" thesis and claimed that it was false. He rejected the assumption that the past and present of underdeveloped countries resemble earlier stages of the history of the now developed countries.

> "The now developed countries were never *under*developed, though they may have been *un*developed. ... contemporary underdevelopment is in large part the historical product of past and continuing economic and other relations between the satellite underdeveloped and now developed metropolitan countries."(Frank 1973, pp 95)

Frank sees the satellites as consisting of a minor metropolis and its satellites. What is a metropolis at one level is thus a satellite of some larger metropolis (ibid.). Galtung's (1971) "Structural theory of imperialism" provides an analogue framework. Here the opposition, or mutual duality, between the *core* and the *periphery* is replicated recursively within both the core and the periphery.

The political economic theories on underdevelopment thus tell us that underdeveloped areas are not remnants of a traditional past but products of ongoing and historical economic processes. Southern Africa have over a long time been integrated in the capitalist economy by labour migration and the communities come have been geared to the production and reproduction of labour (Cliffe 1978). Though research over the last couple of decades has shown that the social and economic processes at the 'periphery' are much more complex than Frank's model would suggest. Research from e.g. Southern Africa, and in particular from Zambia with its copperbelt reveals that the relations between the rural and the urban areas is much more complex than implied by the statement "Southern Africa the labour reserve" (Amin 1974). While one village may be integrated in the urban economy, the neighbouring village may not. Moreover, the economy of the periphery may have an internal dynamic of its own, which is not only a reflex of the core. See (Ferguson 1990a, 1990b) for a thorough analysis and critic of the (strict) 'core-periphery' model in relation to the copperbelt.

Perspectives on the concept of a third world

In his development theory and the Three Worlds, Hettne (1990) argues that due to the ongoing process of differentiation the third world as a concept will not survive for long.

Friedman[2] (1992) criticises the term the 'third world' for another reason, namely because it identifies places and not people. He wants to directly target development to

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[2] The 'core-periphery' model was identified by Friedman in 1966 as part of a development strategy which aimed at creating unfocused growth in urban areas (core) that were supposed to trickle-down in wider areas (periphery) (Friedman, 1966). Frank (1973) and others turned this into a model of underdevelopment. Friedman (1992) now reject his early position in favour of a more radical approach to development.

the, "the wretched of the world"; those marginalised and impoverished as a result of development. Therefore he prefers a focus on disempowered people rather than on geographical entities like regions or countries.

In their "Geography of the Third World", Dickensen et al. (1996) discuss these arguments and argue that the third world is still the most appropriate term to define and discuss the majority of countries and the majority of the world's population. The heart of the concept, as they see it, is that the third world identifies an economic dimension relative to the first world. The third world consists of those countries that are given a common sense of identity through deprivation, relative to the rich countries of the first world

Summary: The third world - as I use it

I apply my notion of the third world as a dynamic patchwork, or mosaic, of uneven development, to comply with central aspects of the views referred to above. While the central aspect of *dynamic* in the core-periphery model is kept, the complexity emphasised by contemporary research is included. Moreover, I use the third world to denote the poor and deprived. Thus the focus of development is people, which complies with Friedman's view above. The opposition between the first world and the third world implies that when the scope is extended to a group of countries or the world, I use the term to denote third world countries as opposed to first world countries.

The third world therefore consists of modern as well as non-modern parts, which exist side by side, and with a continuum between them. In relation to IT, the imprecise 'modern' may be understood as areas of the economy and infrastructure, broadly understood, that are more structured and formalised. These terms are characteristics of the ideal type first world, whereas the opposition, the third world, is characterised by being diffuse and less formalised.

Nowhere is this contrast clearer than in Cape Town where a number of large shantytowns as Khayelitsha are situated next to the international airport. The airport is standardised and formal, and each important procedure performed is similar to the procedures in Beijing or Ulaanbaatar. It represents the global, as a stepping stone to any place in the world, and it represents the rich sectors. The formalised and standardised environments are well suited for computerisation.

Khayelitsha, in contrast, is largely informal, organised at the local scale, and it is poor. You are not likely to meet one single passenger from Khayelitsha at the airport. There are less obvious areas for computerisation in Khayelitsha than at the airport.

The focus of my research has been the differences between the rich and the poor and the modern and 'the-not-modern-in-the-same-way' areas of third world countries. The third world as a term is not perfect in depicting those differences. In my context I need a term that includes 1) the technical; formal-informal, local-global (standardised), 2) the dynamic; core-periphery, and 3) the economical and developmental, rich-poor, i.e. economically developed-not economically developed. Thus, in my use of the third world those three aspects are included.

1.1.4 First world / third world - and information technology

In this section I first illustrate aspects of the first world - third world opposition in relation to technology by using the hospital-primary health care opposition. The second section outlines how I use oppositions in a rather intuitive way in my research.

The hospital - primary health care opposition

The hospital was born out of industrialism in the period 1780-1840, is based on a factory metaphor and has been instrumental in forming medicine and medical practice since it's arrival (Focault 1975). While the hospital represents a technology that has developed and matured over a long time, the primary health care approach is new and is a much less stable concept. The opposition between the well-defined, closed and structured hospital on the one hand and the less defined district, a part of the real world, on the other, represents a main theme in this thesis. I relate this to the somewhat analogue opposition between a 'discrete-entity' perspective and a 'social system' perspective on information systems (Kling, Scacchi 1982).

Walsham et al. (1990) argue that the discrete-entity models of information systems are allied to the formal-rational perspective on organisations, which view them as well defined machines that are best described by formal models. Focault (1975, 1980) relates the hospital to a similar perspective. The primary health care approach and the health district, on the other hand, I relate to a social system perspective. In primary health care, I regard design and development as basically being about *cultivation* (Dahlbom, Janlert 1996) of a social system. Cultivation is used as opposed to construction, in order to emphasise that the process of change needs to be based on what is already existing (ibid.).

The opposition between a primary health care system and a hospital is not absolute. The primary health care approach and the health district contain formal components, such as hospitals, clinics, standards, medical practices, and so forth. On the other hand, the hospital is made up of people, and may therefore be conceived as a social system. Despite the formal and rule based models, work practices within the hospital, as in working life in general, are to a large extent informal (e.g. Wynn 1991).

My point is that a hospital may be analysed as a closed unit in relation to an anonymous stream of patients, and it may be constructed accordingly. While a hospital may be pre-fabricated and moved into an area, a district may not. In a district, the actual situation in the community, the social system, forms the point of departure. While the hospital represents the standardised and context-free end of a continuum, the health district represents the less standardised and more context-sensitive end. I see this opposition between context-free and context-sensitive to represent important differences between the conditions for use and development of IT within first world and third world contexts respectively. See (articles III, VII) and (section 5.4).

Contrasts and oppositions in interpretation and analysis

In this thesis I use various 'oppositions' as an intuitive analytical framework within which to interpret my empirical observations. Here I argue that this is a rather common approach, and I give an overview of some oppositions I use.

To analyse a phenomenon in contrast to its opposition is a much-used approach. Bjerknes (1992) uses contradictions as an analytical tool in system development. Examples from scholars I cite in this thesis are: web/ social models vs. discrete-entity models (Kling, Scacchi 1982); bottom-up vs. top-down (Walsham 1992); process vs. structure, which constitutes the duality of structures (Giddens 1984); trust in the modern vs. trust in the pre-modern (Giddens 1990); the notion of time in traditional vs. modern society (Bourdieu 1963); core vs. periphery (Galtung 1971); bricoleur vs. engineer (Lévy-Strauss 1966); preventive medicine (PHC) vs. curative medicine and 'engineering' (Pacey 1983).

Since I use elements from Lévy-Strauss' theories, it is necessary to mention that his structuralism may be perceived as a 'grand theory' which assumes that both the human brain and social classifications are based on binary oppositions. Furthermore, that there are universal oppositions in social classifications that include nature-culture, raw -cooked, woman-man. These universals exist only at the level of structure and never at the level of manifest fact (Lévy-Strauss 1963; Leach 1970).

I use a number of oppositions in order to interpret a phenomenon. The oppositions are ideal types with a continuum between the ends. Moreover, there are analogies, but no equalities between the oppositions. Not all people in the third world are poor. Nevertheless, the rich - poor opposition describes important aspects of the relationship between the first world and the third world. Similarly, hospitals are not (totally) context free, but they are more so than are primary health care systems.

Giddens (1990), for example, states that while pre-modern societies are characterised by trust in localised systems, modern societies are characterised by trust in abstract systems. This is of course not 'true'. Pre-modern societies have trust in religion and god, which indeed are abstract. Moreover, localised trust is indeed important in modern society. A main theme in this thesis is how information systems in the modern health system are based on, and is creating, localised trust between people. Nevertheless, the opposition between local and 'global' trust captures important aspects of differences between the third world and the first world. The point is that there is always a continuum between the ends when using oppositions in interpretation of the world.

The oppositions given in the figure below all represent central aspects of the phenomenon third world, IT and health care, as I have studied it in Mongolia and South Africa. There is certainly no equality between the bottom and top end of the oppositions, but there are some analogies that I find useful in exploring my topics.

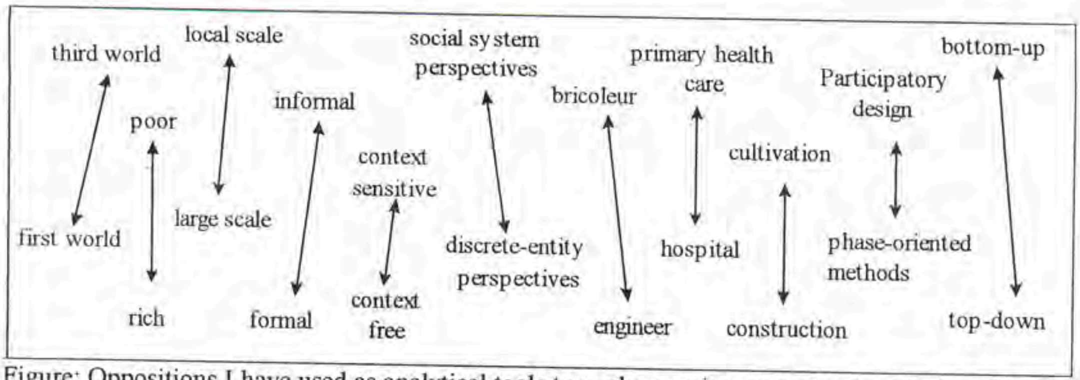

Figure: Oppositions I have used as analytical tools to explore various aspects of my topics. They are used in a common sense and intuitive way.

1.1.4 Report from research in Mongolia and South Africa - IT in the third world sometimes causes striking paradoxes

In the previous section, the point was made that the informal and less structured aspects of third world contexts made introduction of IT more complicated than typical in more formalised first world contexts. In this section I will show that the opposite situation is also true. I present examples that show that appropriate IT will in many cases cause more striking changes and improvements in third worlds contexts than in first world ones. Moreover, advanced IT may sometimes be easier to introduce in third world contexts than in the first world.

As outlined above, the third world consists of a patchwork of more or less formalised parts and of uneven development between areas and sectors. Given this background, a point to make is that there are islands of potential computer usage in 'all worlds'. This model is useful in interpreting diffusion of IT in the third world. It is important to realise that diffusion of IT in the third world does not confirm to a notion of linear stage-wise development. A few examples will help clarify this point.

The spread of computers and the Internet in the third world over the last few years needs to be interpreted within such a patchwork framework of uneven development.

The following story serves as an example of this: In 1988 I visited the 'PC-street' in Beijing; the place where the computer related business was concentrated and from where most computers in Mongolia originate. At that time the activity was rather modest and concentrated around a few shops. In 1996, guided by Mongolian 'IT merchants', I revisited the place that was now occupying several blocks and was teeming with activity. PCs from this market now find their way to the most remote Mongolian administrative centres in increasing numbers.

Another example from Mongolia also illustrates this point: Uvs is, even by Mongolian standards, a remote and isolated small town in north-west Gobi. In 1996 we identified 37 computers in professional use in 20 organisations, whereas in 1993 there had been about 10 in 8 organisation, and in 1991 only one computer was in use, in the State statistical office (see section 4.1.2).

When I first started the research project (1986 - 1989), it was hard to find computers at all within third world contexts, a situation that has now changed drastically.

The 'Internet revolution' has also caused changes in the third world. During my first field trip to Mongolia in 1993 I, as well as the Mongols, was literally isolated from the outside world. Fax transmissions were possible, but rare and extremely expensive, telephone calls likewise. During my second fieldwork, in 1996, Mongolia was connected to the Internet and I got free access through my partner from the first field trip, who now had his own computer company.

Mongolia is a vast country with literally no roads. Appropriate IT; i.e. communication using modem and computers between the provinces and the capital has since 1990-91 counteracted this problem. Even though the telephone lines were poor, they managed to 'tinker' the transmissions through on a routine basis (article II, III). During my second fieldwork to Mongolia, a new telephone exchange in Ulaanbaatar and some new lines had improved the situation, and data transmissions had increased many times. The roads, on the other hand, had not improved during the period.

In three Aimaks (provinces) I have visited the governmental administrations are doing trials on establishing data-network for communication within the Aimak, between the Sums (counties) and Aimak centres. Because, as one of my informants put it: "there are few cars, little petrol, the roads are often not possible to drive, and the postal system is poor, how else can we run the Aimak?" The telephone lines are also poor, but the file transfer technology is robust. Electricity has been the critical factor. These areas where electronic communication is now being introduced, are literally nomads land; there are no roads and the horses outnumber the occasional jeep by a hundred to one. Thus, McLuhan's "Electronic nomad" is not only an abstract metaphor (McLuhan 1994; Bakke, Julsrud 1996)

During 1991-92 I surveyed the use of electronic communication at the central governmental levels and bureaucracies in Norway, where one of the most advanced IT infrastructures in the world is installed. Very little electronic communication took place, even though the technical infrastructure was established and ready.

In 1993 I did a somewhat similar survey of the use of electronic communication between the peripheral (Aimaks) and central governmental levels in three Aimaks in Mongolia (articles II, III). At both central level and in three Aimaks I observed that data were routinely interchanged twice a month. I found that a regular and stable interchange of data between all Aimaks and the centre had been established already in 1990-91. Thus, it is documented that during a few years in the early 1990s the Mongol 'nomads' had a far more advanced usage of electronic communication than modern Norway had.

This is a paradox in many respects:

- Third world Mongolia had a far more advanced usage of electronic communication within the governmental sector, despite a largely inferior infrastructure, than had first world Norway.

- Mongolia was earlier than Norway in the development of practical applications of electronic communication within the governmental sector. This is of particular significance since electronic communication is an area central to development of contemporary IT.

This finding is important because it contradicts the idea that technological development follows stage-wise and linear trajectories.

In South Africa the development of cellular phone technology is underway to provide urban and some rural deprived communities with a stable telephone system for the first time. The latter example illustrates another aspect of uneven development of technology.

- New technology may cause more striking improvements in third world than in first world contexts.

When cell-phones came to Norway, it was in addition to a well functioning telephone system. While before most deprived areas of South Africa were without telephone, at least some of these areas are now covered by a wireless network. Here, the situation is that something that was not existing, has come into being. The example from Mongolia illustrates a similar tendency in that, due to a poor transportation infrastructure, electronic communication causes radical improvements in interchange of information. In Norway, on the other hand, fax, telephone and a well functioning postal system, was already in place.

The above examples confirm my understanding of the (third) world, as consisting of a patchwork of areas of uneven development. Moreover, these examples show that the potential for IT in third world contexts is no less than in first world ones.

Institutional legacy and resistance to change

When computers were introduced to the health information offices in the Aimaks (provinces) in Mongolia, contrary to the case of communication, the *lack* of impact was striking. Here the aim was to support local analysis of data, local decision making and decentralisation of the health system. But, contrary to these aims, little change occurred, and the old centralist health system remained more or less as before. When the statistical health workers in Mongolia got their new computers they were interpreted within the perspectives they had on the old technology. They first started to use them as a replacement of the typewriter, pen and paper and 'carbon paper', and subsequently the calculator. They interpreted and appropriated the technology within their mental symbol system (Ingold 1986). The organisation, direction and content of work did not change as a result of the new technology.

I have observed a similar tendency in South Africa: the large number of computers being introduced in the health sector are not, as such, bringing about much changes; the old statistics and letters are only produced in new ways. Information technology tends to bring about incremental changes within the more formalised areas of the society and the economy, replacing current procedures and tasks by more efficient or automated ones, producing statistics more quickly, organising and storing data in databases.

A main finding common in the two countries is that the institutional legacy from the old systems, the apartheid and the Soviet state respectively, still made up considerable resistance to change and thus represented substantial obstacles to the health sector reform underway in both countries.

1.1.5 A summary: three findings about IT in the third world *and* in the first world

This section is summarised in three findings about IT in both the third and the first world. These findings show that there are both differences and similarities between IT development in the third world and in the first world.

1. *Difference 1.* Information technology is generally more easily applied in first world contexts than in third world ones. The third world is characterised by being less formal and structured than the first world. Since information technologies are formal systems, there are fewer 'obvious' areas for IT application in the third world than in the first world. Moreover, system development in the third world will tend to deal with more uncertainty both with regard to the context, and the area of focus. System development therefore needs to be based on a social system perspective. Development of IT to support the primary health care approach, as the case from Khayelitsha, illustrates those aspects.

2. *Difference 2.* Application of IT in third world contexts may cause more striking changes and improvements in third world contexts than in first world ones. The advanced usage of electronic communication observed in Mongolia in relation to Norway illustrates this point.

3. *Similarity.* Established organisational structures, such as the health system, are difficult to change both in the third world and in the first world. This is illustrated by my case studies both in Mongolia and South Africa, where efforts to use IT to support the health system reform have been fraught with problems.

1.2 A general introduction to Primary Health Care and the district approach

In this chapter I give an introduction to primary health care, the health district approach and the role of information systems in these contexts.

1.2.1 Primary health care

Until the middle of the century, health care in the third world consisted largely of attempts to import hospital-based medicine as it had evolved in the first world. These efforts were of negligible benefit to the poor majority of the population. By the 1950s, however, planners and administrators worldwide realised that the hospital-based approach to health care had failed (Mull 1990). In the two decades that followed, the World Health Organisation (WHO) and other international agencies tried to remedy the deficiencies and inequities of that earlier model via highly targeted programmes aimed at eliminating certain widespread diseases as malaria. However, these efforts also met with little success. It was in the wake of these disappointments that the primary health care (PHC) movement was born (ibid.)

At an international conference held in Alma Ata in 1978, WHO and UNICEF introduced the term "primary health care" (PHC). They issued a declaration that this was the approach that countries of the world should adopt in order to reach a stated goal of achieving "health for all by the year 2000" (WHO/UNICEF 1978). The declaration was unanimously approved by the 138 member nations of WHO.

PHC was to be truly comprehensible. Essential health care should be made accessible to individuals, families and communities by means acceptable to them, with their full participation, and at a cost that they and their country could afford. Health is a basic human right and is defined as "a state of physical, mental and social well-being and not merely the absence of disease or infirmity." Thus, socio-economic development is included in the PHC concept. Article VII, paragraph 4 and 5 in the Alma Ata declaration say:

> "Primary Health Care:
>
> 4. Involves, in addition to the health sector, all related sectors and aspects of national and community development, in particular agriculture, animal husbandry, food, industry, education, housing, public works, communications and other sectors; and demands the co-ordinated efforts of all those sectors;
>
> 5. Requires and promotes maximum community and individual self-reliance and participation in the planning, organisation, operation and control of primary health care, making fullest use of local, national and other available resources; and to this end develops through appropriate education the ability of communities to participate;"

Many of the comprehensive goals of PHC have proven to be very ambitious, and expensive. Houses, clean water, food, roads, and so forth are not under control of health planners, but part of a general economic development. But even when narrowing down the focus, the comprehensiveness inherent in the concept of PHC is extensive, and will include many sectors. In order to attack child malnutrition in a comprehensive approach, for example, safe water, adequate food, health education of the mothers, and the like, need to be provided.

"The ink on the Alma Ata declaration had hardly had time to dry", when a narrowing down of the PHC approach was first proposed, which has later to be called selective primary health care (Kadt 1989). A heated debate followed and the selective approach was labelled "the counter revolution" (Newell 1988). Sandiford et al. (1992) argue that the rationale behind the selective approach was largely the structural adjustment programs aiming to devote increasingly scarce resources to (selective) areas where they would achieve the greatest impact. In particular international funding agencies find such vertical programs attractive because 1) of their quantifiability and lower cost, 2) they are controllable and easy to implement, and 3) they do not require of governments a revolution in political thinking (Mull 1990). Though, the most significant convert to the selective approach has been UNICEF with its emphasis on GOBI (growth monitoring, oral rehydration, breast-feeding and immunisation) (Kadt 1989).

The selective primary health care approach is criticised for not being sustainable, since nothing of lasting value is left behind once the specific intervention has ended. The following arguments are important:

- Community empowerment, which is seen as the very essence of primary health care is not inherent in a selective approach. (Rifkin, Walt 1986; Newell. 1988).

- The critical element in PHC is *process*. It is the process itself that leads to the empowerment of the people through the building of the local institutions (Rifkin, Walt 1986).

- A multi-sectoral approach to primary health care is needed, which is in contrast to a selective approach (Rifkin, Walt 1986; Kadt 1989).

Conclusion of the selective vs. the comprehensive PHC debate

This debate shows two issues which are important in this thesis:

Strong forces are pulling development of health services, and thus health information systems, towards selective, vertical and fragmented approaches aiming at central control. This is a main obstacle to change observed in both Mongolia and South Africa, in particular with regards to the development of district health information systems. The above debate shows that the observed centralist tendency is general.

The debate and disagreement among scholars and practitioners reveal that the concept of primary health care is neither stable, standardised nor matured. Disagreements about goals, concepts and standards are also obstacles to the development of district health information systems. Primary health care is thus in contrast to the hospital based medicine which has been rather stable for two centuries (Focault 1975). I will argue that the selective approach is born out of a general hospital perspective.

1.2.2 The health district approach

The overwhelming problems facing implementation of a comprehensive PHC approach, on the one hand, and the obvious flaws in the top-down selective and vertical approach, on the other, led to a focus on decentralisation (Mills et al. 1990). The district health model is proposed as the most effective way of managing and delivering primary health care and of organising health services (Amonoo-Lartsen et al. 1984).

The district health system is the official WHO policy and is defined as a more or less self-contained segment of the national health system. It comprises a well-defined population, living within a clearly delineated administrative and geographical area. It includes all institutions and individuals providing health care in the district. Therefore it consists of a large variety of interrelated elements that contribute to health in homes, schools, work places, and communities, through the health and other related sectors (Janovsky 1988).

Unified management of the *whole* district organised through a District Management Team is a key issue in the model. If we compare with the above example from Alexandra it is important to note that the hospital is but one component among several in the system. An information system to support the district management team will therefore have to include the hospital and other health facilities, but it can not be restricted to those facilities.

A main characteristic of PHC and the district model is that of variation. Awareness of this aspect is of particular importance when designing district information systems. A point of departure is that there is no 'right' or 'wrong' way of providing primary health care in a country, or even to all regions of a single country:

> "Countries and communities vary in terms of size, geography, climate, population, communications, level of political, economic and social development, health needs and resources, and local leadership. Systems of providing health care need to be evolved which meet each locality's circumstances and problems." (Amonoo-Lartson et al 1984, page 15)

Despite the variety there are number of common features within the PHC approach which are increasingly being adopted. Thus, standardised approaches are emerging. I highlight one of the significant new developments put forward by Amonoo-Lartson et al. because I have found it to be crucial in overcoming the problem represented by the fact that all districts are different, the notion of a bottom-up approach:

> "Development of 'Bottom-up' as opposed to 'Top-down' planning, i.e. taking the needs, resources and opportunities in local communities as the starting point for planning health services, as opposed to planning on the basis solely of needs and policies as seen as the national level." (Amonoo-Lartson et al 1984, page 16).

Management of primary health care is a very different kind of management task from that of a hospital. Furthermore the district has a multilevel structure (ibid.):

- Village or small community. Services provided by a health post, community health workers are mainly in the field of prevention, first aid, simple diagnosis, childcare etc.
- Health centre provides clinical services, diagnosistic and treatment services for patients referred from community health workers or sub-centres.
- The district level. A district health team is responsible for planning, management and support of the district hospital, health centres, sub-centres and health-posts throughout the district. At district level there may be a hospital, or a health centre taking care of patients and problems referred to them from levels below. Beyond the District level there are the National or Provincial levels.

1.2.3 Information systems - crucial in PHC management

Information is seen as one of the keys to ensuring a rational allocation of resources and setting of priority within primary health care (Sandiford et al. 1992; Moidu, Wigertz 1989). Local analysis and use of information is of particular importance in the primary health care concept (Duane et al 1987). Because health information needs to be generated and used within the local context in order to be sensible and ensure quality, top-down information systems are generally of little use in health care management (Power,1992).

Traditional health information systems deal with population data and impact of services collect data in order to make *retrospective* analysis - at a higher level. In primary health care the challenge is to analyse and use the information *immediately*, at the same level where it is collected, thus local information to support local action (Opit 1987). Where the hospital information system focuses on the part of the population entering their premises as patient records in a database, the primary health care system must encompass the entire population living in a geographical area, a district (articles VI, VII).

In order to decide what action to be taken the following questions need to be asked (Heywood et al. 1994): Who is getting sick? What diseases are affecting them? When: in what season, after what event? Where did they get sick? Why did they get sick? How can the health team improve the situation? Which strategies or approaches can be used to improve the situation? Similar questions are also applied to identifying health care resources. These two sets of questions indicate important aspects of the district information system; Information about the community (community diagnosis) and about the health resources. In addition information about the actions taken and impact measured are needed.

Targets, indicators, action, assessment - the information cycle

The use of goals, targets and indicators, is a way to operationalise the use of information. Long-term *goals* such as "improve the health of mothers and children" are usually set at national / policy level. The challenge at district and local levels is then to convert these general ideas into meaningful *operational targets* that are "*SMART*" - i.e. Specific, Measurable, Achievable, Relevant and Time-bound (Heywood et al. 1994, see step 3 in 'Six steps to a district health information system', appendix 1). The local role-players need to be involved in this target-setting process and become part of the plan to achieve these targets. *Indicators* are measures used to see how far the programmes have advanced towards achieving their targets.

In HISPP we apply the following *action-led*, as opposed to *data-led* (Sandiford et al. 1992, article IV), information cycle (see the 'six steps', appendix 1):

1. Use information to *analyse* the situation,

2. Based on *goals*, the analysis in 1) or the assessment in 5), set or modify *targets*

3. Define or modify *indicators* that can measure achievements toward targets

4. Initiate, sustain or modify action to meet the targets

5. Use information and indicators to *measure* and *asses* the action and to what extent the targets are achieved. Cycle back to 4), 3), 2) or 1), depending on the character of needed modifications and changes.

The short cycle between 4) and 5) represents the normal and routine operational modus. The cycle back to 3) is required when the quality or availability of information is poor. The cycle back to 2) is typical when assessment indicate that the targets are not sufficiently operational. The cycle back to 1) represents more fundamental changes, or the development of new targets and indicators.

1.3 The research questions, motivation and results

In this section I present my research questions, motivation and results. Given the context and topics described in the two previous sections, this section is thus a summary of the thesis.

My research has the following assumptions as a point of departure:

1. The economic and technological differences in the world are large and increasing
2. Technology is important in forming these differences and is therefore important in counteracting them
3. Technology is *endogenous*, rooted in people and not things. Development of technology will therefore need to be developed from within with given *social system* as the base.

A consequence of the above is that the third world needs to develop *endogenous* practices and capacity in *system development*, as formulated by Korpela (1994). My focus on the 'third world' part of the third world is also based on these assumptions. Additionally, in poor communities development needs to be endogenous to some extent. Thus, endogenous system development needs to address the underdeveloped areas, and not only the developed areas of the third world.

Given these assumptions, the general research questions I started out with were the following:

⇒ **General research question A (descriptive).** How can introduction of information technology and the following change process be understood and interpreted within a third world context?

⇒ **General research question B (normative).** How can information technologies be designed and used in order to enhance development in the third world? More specifically in the development of deprived communities, areas and regions - *the third world part* - of the Third World.

Since the beginning of my project, my research has consisted of a duality between the interpretative in (A), how to best understand the world, and the formulation of strategies about how IT may best be designed following the aims in (B). Following this duality I present the results of my research in two parts. First I give a motivation for the two research questions; 'why IT is important in a third world perspective'.

Second, I present an analytical framework, which is summarising how I have come to answer the general question in (A), about how the introduction of IT in the third world may be interpreted. The framework consists of an analytical model of the third world, a social system model and three categories of introduction and use of IT in third world contexts interpreted within this framework.

Third, and based on the above, I present my results with regard to the more normative research question in (B). This I do by dividing (B) into a sequence of more specific research questions. For each of these five specific questions I will present motivation and results. The following are brief summaries of the research questions elaborated in this chapter:

⇒ **Research question 1.** How may appropriate IT policies for the third world be formulated?

⇒ **Research question 2.** How can the Scandinavian approach and participatory design tradition be modified and adapted to third world conditions?

⇒ **Research question 3.** How can IT be designed and used to support a primary health care approach and a decentralised district based health system?

⇒ **Research question 4.** In what ways may the interpretation of information systems as social systems have impact on design and change strategies?

⇒ **Research question 5.** How can 'action research', and system development projects more generally, be spread or diffused from one or a few, to many or 'all' places?

1.3.1 Motivation - Why IT is important in a third world perspective

> "The imbalances in economic growth, if allowed to continue, will produce a world gargantuan in its excesses and grotesque in its human and economic inequalities" (Human development report, (UNDP 1996), p. 8)

In this section I provide arguments in support of the general assumptions presented above, which formed the point of departure for my research.

The citation from UNDP (United Nation Development Program) above says that the differences in the world between the rich and the poor are huge and increasing. These differences between the first and the third world form the point of departure for my research. One way to counteract the gap is to explore ways in which IT may be used to promote development of deprived sectors and regions in the third world.

New perspectives within economic theory emphasise the role of technology in economic development. The "technology-gap approach to economic growth", sees technological differences as the prime cause for differences in economic growth across countries (Fagerberg 1994).

> "How can one account for these differences? The suspicion that it may have something to do with technology has been around for a long time." (Fagerberg 1994).

> 'Technology is central to regional change, positive and negative, and to economic change, job-creating and job-destroying. It is the most obvious cause and effect of cumulative wealth of rich nations. Technology also promises, more than any other phenomenon, to bring poor nations out of poverty' (Malecki 1991, pp. 6-7).

While "technology-gap" theories to explain growth are not new, Fagerberg (1988, 1994) and others (Malecki 1991; Lundvall 1992) now see technology as rooted in people - knowledge - and not things. This new perspective holds that technology is basically not an exogenous factor, but rather an endogenous one; related to the behaviour of people and the accumulation of knowledge - *learning*. Technology then is seen as being embedded in people and in the institutional and cultural context and therefore "more often than not difficult and costly to transfer from one setting to another" (Fagerberg 1994).

> "Much of what we call technological change is the process of learning by people and, through them, by organisations and nations. The skills embodied in people result in some companies - and some regions and nations - being more prosperous and successful than others."(Malecki 1991, p. xi).

Information technology is linked to economic development and therefore tends to be concentrated in the most modern sectors of the economy and regions of a country – and of the world. For this reason a side effect of IT might be a worsening of the gap in development between sectors and regions within a country, and between countries. Sectors and areas where IT is at best poorly applied will tend to lag increasingly behind sectors where IT is highly applied.

1.3.2 General research question A (descriptive): Interpretation of IT in third world contexts

⇒ How can introduction of information technology and the following change process be understood and interpreted within a third world context?

In the following I present the result of my research into this question in the form of an analytical framework. The framework contains three parts: 1) a model of the third world, 2) a model of information systems conceptualised as social systems, and 3) the three categories of IT introduction and use from section 1.1.5.

1) A model of the third world: a dynamic patchwork of uneven development

An important part of my research has been to develop an analytical framework in which to interpret and understand information technology within third world contexts. I use the term third world as opposed to the first world to denote poor, deprived and underdeveloped areas, regions and communities within the third world. An understanding of the third world as consisting of a dynamic patchwork of uneven development is a key in this model, as laid out in (section 1.1).

I relate this model to Galtung's (1971) "Structural theory of imperialism" where the opposition, or mutual duality, between the *core* and the *periphery* is replicated recursively within both the core and the periphery. In a global perspective this opposition is between the third and the first world countries. This opposition is then replicated into the more local perspectives within the region, country and area. The dynamic relationship between the developed and underdeveloped areas of a third world city illustrates this point: underdeveloped big city slums are serving developed industrial areas in a mutual relationship.

I outline main issues in relation to 1) IT and to 2) design of IT in the third world as follows:

1. Main issues in relation to IT and the third world are:

- **Formalisation**. IT is linked to historical processes of formalisation. The dichotomy between formal and informal sectors of society and the economy is therefore useful. It follows that the third world is in general less formalised than the first world. Despite this, the third world may within some areas be as 'advanced' in terms of IT as the first world. Section 1.3.2.3 summarises this paradox.

- **Uneven development**. The third world is best understood as a dynamic patchwork of areas in different states of development. Development between areas, sectors and communities are uneven and development occurs incrementally as well as in leaps, and development may be retarded. Development is thus not linear, since latecomers may be the first and economically developed areas may turn deprived.

*2. Main issues in relation to **design** of IT in the third world are:*

- **Social system model** (see below). Information system development in third world environments needs to be based on an understanding of information systems as being social systems (Walsham et al. 1990). Main arguments are that the contextual constraints (articles VII, VIII) and trust in the local scale are more critical in third world than in first world contexts. The latter implies that information systems tend to appear more explicitly as social systems in third world contexts than will normally be the case in first world contexts. "40 people, 20 organised units and 1 computer", is a typical situation in my case material.

- **Local scale and community based**. Localised trust, the community, and face to face commitments are more critical to social structures and institutions in third world environments, than in first world environments. In first world environments, trust in abstract systems is similarly more critical. The first world is the formal, large scale, universal and more "context-free", whereas the third world is the informal, local scale and more "context-sensitive". I relate those arguments to Giddens' (1990) distinction between localised trust and trust in abstract systems, which he uses to characterise pre-modern and modern cultures respectively.

- **Bottom-up and process oriented**. Following the two issues above, (Walsham 1992) and evidence provided by my research (see articles IV, VI, VII), third world system development needs to be rooted in the local social system and driven from within, thus bottom-up. Sustainability relies on cultivation of empowerment and a sense of ownership towards the information system; thus a process oriented learning approach. Rifkin and Walt (1986) argue in a similar way with regard to how to develop and sustain a primary health care system: the critical element is process, which lead to empowerment, which again lead to sustainability (see section 1.2).

2) Social system model - as I use it

The social system paradigm implies that information systems are best conceptualised as social systems in which the technical part is only one of the elements (Walsham et al. 1990). The technical and social are regarded as inseparable. The opposition between discrete-entity models and web models form a point of departure.

In the web models, Kling and Scacchi (1982) give a theoretical framework for understanding why and how large information systems tend to be tied to the social context through a complex web of associations. Kling and Scacchi propose the web models in opposition to what they describe as discrete-entity models that represent the commonly held view that information systems are basically socially neutral technical systems. Implications for system development are laid out as follows:

> "When an analyst uses a discrete-entity model to understand the computing capabilities of an organisation he usually begin by asking, "What kind of equipment and facility do they have?" In contrast, analysts using a web model begin by asking: What kinds of things do people do here?" (Kling, Scacchi 1982, p. 9)

The web-model emphasises historical legacy and context in system development:

> "Since information systems are bound up with the infrastructures available, and since these evolve over time, computing developments are shaped by a set of historical commitments. In short, web models view computing developments as complex social objects constrained by their context, infrastructure and history." (Kling, Scacchi 1980, p. 69)

Walsham et al. (1990), building on the web models, state that large information systems are best understood as social systems. Due to the contextual constraints, they regard the social system perspective on information systems as being particularly critical in the third world (Walsham et al. 1990). Regarding information system as being part of the social context, something much bigger and qualitatively different from the concept of a computer, or a technical system, explains the difficulties in changing the information systems - or the health system, or both that I observed in both Mongolia and South Africa.

Regarding health information systems I have studied as information infrastructures provides another useful explanation. Within this framework, information infrastructures develop and grow over a long time with layers upon and within one another. New features tend to get added as extensions or changes of something already there, the *installed base*. As the installed base grows, it becomes more important and it becomes increasingly difficult to build new systems from scratch or to implement substantial changes (Hanseth 1996). If we combine this concept of health information systems as being information infrastructures, with the concept of the very same information system being social systems (Walsham et al. 1990), it becomes clear that the installed base is made up of a web of social systems.

Given this background I view information technology as consisting of a *socio-technic web*, which is best conceptualised as being made up by social systems. Technology is thus "not material culture but rather a total social phenomenon that marries the material, the social and the symbolic in a complex web of associations" (Pfaffenberg 1988, p. 249). This view has parallels to the actor network theory, where society is regarded as a socio-technic web where technical objects participate in building heterogeneous networks that bring together nodes of all types, whether human or non-human (Akrich 1992; Callon 1991).

Against this background of regarding information systems as social systems, it is obvious that those technologies are not neutral but have politics, meaning and behaviour inscribed into them (Akrich 1992; Pfaffenberg 1988, 1993; Winner 1986). Inscriptions range from conscious design to the more implicit legacy. Akrich (1992) take the designers and innovators as her point of departure. They concretise their visions and world views into a *scenario* that is *inscribed* into the object of focus as a *scenario for action*. The way these visions again are *translated* into the object will also depend of the context of use, how users and other actors appropriate the visions of the designers.

In my cases the indirect or 'unconscious' inscription through practice and legacy is more important than the conscious design. The numerous ways in which the ethos of the Soviet model is inscribed into the health system in Mongolia exemplify this (see articles II, III, IV, VIII). The nomad culture traditionally gives children low status until they have proven themselves able to survive the harsh conditions of their world. The ways in which this ethos is reflected in the health and information system in Mongolia, as inappropriate efforts to attack infant mortality (article IV), illustrate the subtle ways in which indirect and unconscious inscription may occur (see section 4.1).

Already in 1925 Marcel Mauss showed how social interaction and rituals, as the interchanging of gifts, 'tied up', confirmed and committed social relationships and constituted and reproduced social institutions. In somewhat similar ways the interchange of data and reporting systems seem to constitute and reproduce the social relationships and the social fabric within the health services (see section 5.1).

By becoming routine, these activities and institutionalised practises of information handling and interchanging constitute the institutional structures. This duality of social structures, as both containing process and structure, or social action and conditions for social action, is captured in Giddens' (1984) notion of structuration. The "structural properties of social systems are both medium and outcomes of the practices they recursively organise" (ibid. p. 25). Giddens' structuration I use to explain how social action (process), as observed in relation to information systems, (re) produce and eventually change social structures.

Lévy-Strauss (1973) regards material artefacts, and other concrete and visible parts of a social system as taking part in a dynamic relationship with the internal culture and social structures. The external structures are signs that are communicating 'stability' with the internal social structures and belief system. I have formulated this dualism between the visible and invisible in the 'iceberg model' in section 3.2, which I have used in particular in the interpretation of the case of Mongolia. Moreover, I use the model to explain that the technical, concrete and visible parts of an information system are inseparable from the social system of which it is part. Furthermore, I use it to explain how changes in the external structures (the 'visible' parts of the information system) may have impact on the internal structures.

In my understanding and use of the social system model I include elements regarding social systems and structures from Lévy-Strauss' (1963, 1973) *structuralism* and Giddens' (1984) *structuration*.

Given the perspectives on technology as being rooted in people and not in things (Fagerberg 1994; Malecki 1991; Lundvall 1992), I include more general aspects of technology in the social system model.

3) Introduction of IT in the third world - Three categories

In section 1.1.5, I presented three categories of findings regarding introduction and use of IT in the third world. These findings show that there are both differences and similarities between IT development in the third world and in the first world.

Category 1: First difference. *IT is generally more difficult to apply in third world contexts than in first world ones - information systems need to be understood as social systems*

The context of system development in Khayalitsha, as outlined in 1.1, I take to represent typical aspects of third world 'contextual constraints'. The problem area addressed by the system development project in this example is rather informal, and the context consists of multiple social systems. The information system itself is literally a social system: "40 people, 20 organised units and one computer". Moreover, people and organisations will typically have no prior experience with IT, and training and support will have to be established during the process. These are the contextual constraints that I claim make the social system model crucial in third world system development. My research on strategies in third world system development is related to these issues of third world computing (see articles IV, VII, VIII).

Since IT development build on historical processes of formalisation (e.g. Greenbaum 1998; Jervell 1991; Berg 1997) there are fewer formalised and thus standardised areas for IT application in third world than in first world contexts. This implies that the 'informal' context of system development that is found in the health district in Khayelitsha is typical for third world system development. System development in the third world therefore tends to deal with more uncertainty both with regard to the context of use and of system development and the goals and area of focus (article VII).

Category 2: Second difference. *IT may be surprisingly appropriate in some third world contexts.*

While the first difference indicates the difficulties of system development in third world contexts, the second illustrates an advantage of implementation in third world contexts. In (section 1.1) I showed how Mongol 'nomads' during a period in the early 1990s had a more advanced usage of electronic communication than had the technically advanced Norwegian governmental sector (see articles II, III for the Mongolian case). This example together with the example of wireless cell-phone technology in South Africa indicate that application of IT in third world contexts may cause more striking changes and improvements in third world contexts than in first world ones.

This tendency is important because it indicates that the potential for IT development in third world contexts is not as easy to predict as one may tend to believe based on the argument under Category 1. above, i.e. that introduction of IT in the third world, as a rule, is fraught with more problems than is the case in the first world. Moreover, it is contradicting the assumption that development of technology in third world contexts is following linear trajectories.

I interpret this phenomenon of technological 'leap-frogging' based on the following two aspects:

1. Computerisation happens within artificial environments, or islands, which may be *small*. Computers linked over a very poor telephone line, as is the case in Mongolia, may be enough. Thus, there is a potential for computerisation also in the third world.

2. The historical process of formalisation, as seen in the development of health information systems I have studied, creates a complexity that make further changes increasingly more difficult. The process leads to layers upon layers of information systems that make up an increasingly complex web, or 'spaghetti' (article VI). Following the social system paradigm, this web consists of social systems, thus explaining the resistance to change (article VIII). The more developed and complex this web, or 'installed base', become, the more difficult it is to implement changes (Hanseth 1996).

These two aspects represent a paradox within third world IT development. On the one hand there are less obvious areas for introduction of IT in the third world, but on the other, these areas may in certain circumstances be easier to computerise than is the case in similar first world areas. Moreover, the changes may be more striking and have more impact in the third world.

Establishing networked technologies in areas where there are initially few, as in Mongolia and third world South Africa, represent big 'leaps' compared with the previous state. Contrary to this, when the networked technologies are already comprehensive, as in Norway, establishing more will only represent incremental changes. Moreover, the obstacles to change represented by the legacy of existing technologies, are less important in technology poor areas than in technology rich areas.

I believe this paradox is important in interpreting introduction of IT in the third world, and introduction of IT in general. This view comply well with the contemporary notion of information infrastructure development and the resistance to change observed in connection to increasingly complex web that makes up the installed base (Hanseth 1996; Ciborra 1997).

Category 3: Similarity*. Established organisational structures, as the health system, are difficult to change both in the third world and in the first world.*

From very different points of departure and with very different legacies of the past, both Mongolia and South Africa have embarked on the development of a decentralised health system based on a primary health care approach. When comparing the two cases in 1995, I found that the efforts were met with similar problems in both countries (article IV). The obstacles were:

1. For decentralisation of the health system as well as the information systems the important obstacles are the vertical, fragmented and centralised structures (articles IV, VI). The resistance I later interpreted as being related to the notion of information systems being social systems. By analysing the complex structure of previous information systems in the health system, it becomes clear that the *installed base* is made up of a web of social systems (article VIII).

2. When instituting a PHC approach the important obstacles are the hospital-based structures and the curative ideology inherent in the system (article IV). In Mongolia we found that values, meaning and behaviour from the previous Soviet system were inscribed into the 'social' installed base (article VIII). The Soviet model was in many ways sharply contrasting decentralisation and 'prevention'. Together with the above, this indicates the importance of history and legacy in the study of information systems.

In Mongolia and South Africa the efforts to develop a decentralised information system to support a PHC approach have been fraught with problems. A main reason for this is that the concept of health information systems being social systems is in general not recognised by those involved in policy making, design and implementation of these systems (in article VIII these arguments are used in relation to Mongolia). This problem exists also in the first world. The obstacles to decentralisation in 2) above, the existing vertical, fragmented and centralist structure, are also similar to the obstacles to changes of information infrastructures found also in the first world (e.g. Hanseth 1996; Ciborra 1997).

The problems in 2) about the hospital-based structures and curative ideology I have described in (section 1.1 and 1.2). In (article VIII) we argue that this ideology, meaning and behaviour are inscribed into the social system. The social system thus needs to become part of the change process.

My argument is *not* that the problems system development is facing in the third world are unique. The point is that, due to contextual constraints, problems related to the context, the social system, are more critical in third world environments than they will tend to be in first world environments. The point here is that the social system model is of particular importance in the third world (Whalsham et al. 1990).

1.3.3 General research question B (normative): IT for development

⇒ How can information technologies be designed and used in order to enhance development in the third world? More specifically in the development of deprived communities, areas and regions - *the third world part* - of the Third World.

In this section I present each of the five normative research questions. They are all in various ways derived from the two models of the third world as a dynamic patchwork, and that of information systems as social systems, described in the previous section.

1.3.3.1 Research question 1. IT-policy and the third world

⇒ (1) What are important characteristics for appropriate IT policies for the third world?
And, how may IT policies for the third world be formulated?

Motivation

I understand IT policies in the broader context as ways of supporting use, learning and diffusion of IT. Since the conditions between the third and the first world differ, IT policies and design strategies developed for the first world, will need to be changed and modified in order to be adapted to third world contexts.

In my perspective one important objective of an IT-policy will be to support development of endogenous system development capacity. In order to achieve this the problems of the deprived areas and communities within the third world needs to be addressed. Moreover, the local scale, and the social systems, will need to be addressed.

New theories in economy referred to above have led to a focus on technological learning as captured in the policy labelled "National innovation systems" (Lundvall 1992; Nelson 1993). This policy is endorsed by OECD (OECD 1991), and it was adopted by South Africa in 1996 (Government 1996).

The perspective of a National Innovation System is based on two sets of assumptions (Lundvall 1992, p. 1):

> "First, it is assumed that the most fundamental resource in the modern economy is knowledge and, accordingly, that the most important process is learning. ..
>
> Second, it is assumed that learning is predominantly an interactive and, therefore, a social embedded process which cannot be understood without taking into consideration its institutional and cultural context."

Technology is here understood as knowledge.

> 'When 'knowledge' is used in the production process it is called technology, and new, recombined or rediscovered knowledge, introduced into the economy, is called innovation' (Johnson 1992).

Earlier I used a citation from UNDP regarding the potentially "grotesque" consequences of the present imbalance in economic growth. With reference to the new economic theories and policies referred to here UNDP emphasises that those theories focus on human development and endogenous factors:

> "The new growth theories confirm the human development position that the driving force of all economic growth is people. ....
>
> In the new theories what increases productivity is not an exogenous factor, but "endogenous" ones - related to the behaviour of people responsible for the accumulation of productive factors and knowledge." (Human development report, UNDP 1996, p. 51)

Central issues in the policy of National Innovation Systems include the fact that national policies on technological learning are seen as important in economic and technological development. Innovation is not seen as 'products', or discrete events uniquely localised in space and time, but as processes. It is seen as a ubiquitous phenomenon resulting from on-going processes of learning in all parts of a modern economy (Lundvall 1992). Learning and innovation are seen as partly emanating from routine activities in the prevailing economic structure. The areas where technical advance will take place will then primarily be where the national economy is engaged in routine activities. (Andersen 1992).

Learning is used in a broad sense, including both processes leading to new knowledge or new combinations of old knowledge, and processes putting old knowledge into new heads (Johnson 1992). The following terms, which are denoting an increasing scale of social interaction, are according to Johnson (ibid.) central in these theories: *Learning-by-doing* (Arrows 1962), is basically concerned with improving efficiency in production. *Learning-by-using* (Rosenberg 1982), addresses the creation of new practices in use of technology. *Learning-by-interacting* (Lundvall 1992) addresses linkages between users and producers.

Country-specific factors are assumed to influence the process of learning, innovations and thus technological changes and many writers in this area view countries as separate technological systems. This is expressed by the concept "national system of innovation" (Lundvall 1992; Nelson 1993). Despite the increasing globalism they still believe that national institutions and policies are instrumental in innovations. Below I argue that, due to the comparably poor economic base in the third world, a one-sided focus on the national may not be appropriate.

The new South African policy on science and technology - 'preparing for the 21st century' - is based on the concept of national innovation systems (White paper on science and technology, 1996). Though, this version of the policy states that development of the health sector and development of deprived communities more generally are key issues in this policy. The visions of the white paper is

> "on the one hand to become economically competitive on a global scale and, on the other hand to provide essential services, infrastructure and effective health care for all South Africans." (Mtshali 1996, Minister of Art, Culture, Science and Technology)

This South African position of targeting health and essential services for all as part of the policy on technology, I take to represent an important third world adaptation of the policy of innovation systems. In the next section I elaborate further on this issue.

Results of Research question 1: Third world IT policy

Given the policy of National Innovation Systems as a point of departure I suggest two areas where this policy needs to be adapted in order to be appropriate in the third world:

1. The health sector and the implementation of a primary health care policy are suggested as an arena for technological learning and for diffusion of IT in areas sheltered from market forces (articles II, III).

2. South - South collaboration about IT to support a primary health care approach is suggested in order to enhance technological learning among third world countries (article V).

The following two assumptions are important in adapting an IT policy to third world conditions:

- IT tends to be concentrated in the economically strong sectors, the first world part of the third world, and

- The economic base in the third world is generally poor.

Given this background, I argue that the policy of National innovation systems, as such, needs to be adapted in order to be appropriate in the third world. I propose two areas in which such technology policies may be adapted:

1. The health sector as an arena for technological learning and diffusion of IT

In (I, III) we argue that learning about and diffusion of IT need to take place in areas sheltered from the market forces in the third world. This is in general how the countries of the first world historically have developed their own economies. At the same time, this is a policy the same first world countries are denying the third world to use today.

The health sector, following a primary health care approach, is particularly suitable as an arena for learning about and exploring IT and endogenous system development. Main arguments are (articles II, III):

- By basing an IT-policy on the implementation of a primary health care approach, a focus on the third world part of the country and economy may be ensured. This may counteract the tendency of an increasing gap between areas and sectors. .

- The focus on a primary health care approach ensure the focus on the community, the social system and the context-sensitive part of IT, which are the crucial areas of third world system development.

- Development of the health services is a key issue in socio-economic development. The primary health care approach is central in development of deprived communities, areas and regions.

- Health is central in the life and consciousness of each individual, family, group and community. Health is the body and mind of each individual. Health is the local scale in terms of world-views, culture and values.

- Health information systems contain the whole range of problems and challenges regarding exploitation and use of IT. As discussed earlier, it is both local, global and networked

- The health system extends throughout the society and includes all social classes, ethnic groups, geographical areas and administrative units.

2. South - South - North collaboration: learning and diffusion in networks

The World Health Organisation applies a standardised and universal approach to the development of the health services based on PHC and decentralisation represented by the district health system (Janovsky 1988; Mills et al. 1990). This world-wide standardised approach includes the use of information, as well as global and national health indicators and standards. Therefore, since similar problems are addressed world-wide experiences from trials and errors may be valuable across third world countries. My research provides evidence that the problems and challenges are to some extent similar in as different countries as Mongolia and South Africa (article IV) and that South Africa has a lot to learn from Ghana (article V).

In (article V) we argued that information systems to support primary health care was an area where mutual learning between third world countries was needed and practically achievable. It is on this background I suggest to extend the concept of national innovation systems to encompass South - South collaboration, thus an 'international innovation system'.

Maintaining the focus on primary health care may help preventing the focus to 'slip away' from the local even though the scale of focus becomes international.

In (article V) we outline a triangular collaborative model in which South Africa, the less developed countries of Africa and Europe make up the three parts. The model strongly advocates horizontal collaboration, as opposed to a vertical model with South Africa or Europe in central position. The challenge is to establish mutually beneficial collaboration between participants despite differences in economic development. In (article V) we show that South Africa has a lot to learn regarding information systems and primary health care from other countries in Africa. Europe, on its side, has a potential to learn from community based system development in Africa.

A policy that aims at fostering learning of information technology through socially embedded processes will have as a main target what Korpela (1994) formulated as *endogenous system development.* This implies a two component approach: 1) develop capacity for system development in the third world, and 2) develop "African solutions to African problems". Practical efforts in addressing local needs (2) is a means to achieve capacity in endogenous system development.

The poor economic base in the third world is an additional argument in favour of South-South collaboration

In the third world the technological and economical base are generally weaker than in the first world. A third world country on its own will therefor not necessarily be able to take full advantage of a national system of innovation policy. The institutional base for learning might simply be too small. South - south collaboration might be a way to counteract some of these problems:

1. Where there is more (economic) activity, more learning and innovations will emanate (Gregersen 1992). Several countries together will increase this base.

2. It is more easy to learn from comparisons from similar systems than from vastly different ones (Johnson 1992). First world technologies are in general developed to solve First World problems.

Since the technological base in each third world country is too week to make use of the concept, and because of 2) above, the building of South-South collaborative networks could counteract some of these problems. Since first world technologies are developed to solve first world problems, and because of 1) above, problems particular to the third world could be addressed by collaboration in a network of countries sharing these problems. Hence the health services as an arena.

1.3.3.2 Research question 2.

Participatory design in the third world

The Scandinavian to system development forms a point of departure in this thesis.

In (article I) presented at the first Health Informatics conference in Africa (HELINA) we (authors from NCC) argued that lessons from the Scandinavian tradition would be important in Africa. Odedra (1992) argues that the main problem facing introduction of IT in Africa is the 'foreignness' of the technology. Based on experiences from three system development projects in hospital contexts we argued that also in Norway IT is, in a way foreign to the local users. This has necessitated an evolutionary and participatory approach, which takes system development as a mutual learning process based in the social context. Given this background we argue that an evolutionary learning approach may be at least as important in Africa where the technology may be even more foreign and the infrastructure less developed.

Given this background I have formulated the following research objective:

⇒ **Research question 2.** What are main characteristics of system development in third world contexts and what are appropriate approaches to system development in such contexts?
How can the participatory design tradition be modified and adapted to third world conditions?

Motivation: participatory design in the third world

System development in third world contexts needs to be process oriented, bottom-up, based on a social system paradigm, and focus on the local scale and the community. These are the findings from my research as summarised in the third world model in (1.3.1.1) (based on articles IV, VI, VII).

Those 'needs' comply well with the central issues in the Scandinavian approach, which are based on a social system model. In particular the early union based projects had a wide social system perspective. (e.g. Nygaard 1979; article VII). The focus has always been on the local scale, process, empowerment and learning.

The following two areas are important in the Scandinavian tradition as I use it:

1. Democracy and influence in working life: empowerment and local ownership

The participatory design tradition is based on participation and co-operation from those who are users and otherwise involved in the system to be designed. The general ideology is that development of technology should be based on the needs and interest of the users, and that they have the right to influence (Sandberg 1979; Bjerknes et al. 1987; Emery 1993). The revised "Worker Protection and Working Environment Act" (AML 1977) resulted from a democracy programme conducted by the Norwegian trade unions in co-operation with the employer's federation illustrates this perspective. The AML states that workers and their representatives shall be kept informed about systems used for planning and performing work, and about planned changes in such systems. Sufficient education for using the systems and participation in the design process is emphasised. The main idea is that the workers themselves should control and be responsible for performing work (Bjerknes, Bratteteig 1995).

2. A learning approach: A process-oriented perspective, as opposed to a product oriented

This perspective emphasises human learning, work, and communication in system development (Floyd 1987; Greenbaum, Kyng 1991). Prototyping (Floyd 1984; Kautz, 1993), use of mock-ups and other "cheap tools" (Kyng 1989; Ehn, Kyng 1991), 'future workshops' (Kensing, Madsen 1991) are examples of techniques supporting a learning process. The process-oriented perspective represents an evolutionary approach, and is a contrast to structured approaches, which are based on static phases and an early specification. Experimentation and exploration are parts of the learning approach, in particular in situations with uncertainty with regard to both context and goal of the system development (Davies 1982; Andersen et al 1986).

Research on IT and development that I am building on

Research on IT and development issues, as reported within and prior to the IFIP 9.4 working group on 'Social implications of computers in developing countries' have been important in my exploration of strategies in third world system development (see the following proceedings (Bhatnagar, Bjørn-Andersen 1990; Cyranek, Bhatnagar 1992; Odedra-Straub 1996; Roche, Blain 1996).

Important inspiration comes from the following:

- Introduction of IT in Africa is difficult due to the 'foreignness' of the technology, six case studies from Africa (Odedra 1990, 1992).
- The social system paradigm and bottom-up approaches are of particular importance in the third world (Walsham et al. 1990, 1992).
- Efforts to use IT as tools for decentralisation in third world countries have in general not succeeded because the IT projects have focused on technical issues and not on the social systems (Madon 1992; Madon, Walsham 1995).
- Knowledge, mastering and practices of system development need to become endogenous and locally rooted, not only the system development process. Demonstration of successful system development in Nigeria (Korpela 1994).

Critics of top-down development projects in the third world

The general critic of top-down and large scale strategies on technology transfer and development in the third world, as put forward by anthropologists (e.g. Archetti 1986; Dyson-Hudson 1985; Van der Ploug 1989; Eriksen 1989), have been important in informing my research. These authors emphasise that development need to be based on participation, local knowledge, tradition, culture, resources, ownership and needs. The process needs to be used as a way to learn and adapt the technology. A long time horizon will therefore be needed in order to obtain local adaptation and sustainability.

Results of Research question 2:
Community based participatory design in the third world

My research offers evidence that all three generations of the Scandinavian approach will provide important inspiration for third world approaches to system design (articles IV, VII): 1) the broad and multileveled "empowering through learning"; 2) the more focused "design for empowerment"; 3) practical participatory techniques and approaches (see Preface). I regard the Scandinavian approaches as particularly important when a whole social system is addressed by the design efforts. When the aim is to base development on what is within the social system at the outset, and to root and adapt it there, it follows that bottom-up, participatory approaches, are needed. Thus it follows that bottom-up approaches are of particular importance in third world contexts (Walsham 1992, articles IV, VI, VII).

The more narrow and computer-based focus of the third generation participatory approaches is important as a strategy to approach the areas of computer usage within the social system perspective. In both Mongolia and South Africa I have experienced a typical third world situation: "40 people, 20 organised units and one or a few computers", which emphasises the need for a social system model. Though, as indicated by the rapidly increasing numbers of computers in e.g. the Aimaks in Mongolia, this 'typical' third world situation might change over time. However, the present situation emphasises the crucial role of the *one computer*. Sustainability of the narrower computer based system, including the users, is of particular importance in third world contexts. Constraints regarding lack of resources, technical equipment, skill and the need for local adaptation make participatory techniques and approaches appropriate and necessary. The focus on the very local scale, the computer users, learning, tinkering and the prototype represent practical approaches to address such contextual constraints. I include such elements in the 'bricolage' (Lévy-Strauss 1966) 'toolbox' "close to the operational level" (Ciborra 1994, 1997), which is needed in a third world system development strategy.

System development - adaptation to third world contexts

The Scandinavian approach and participatory design typically address the workplace while a third world environment typically consists of economically deprived communities where the majority might be without formal employment. It is therefore obvious that the social systems to be addressed by the system development processes will not be confined to the work place. The community is generally seen as a key level for social development in the third world. Such development will rely upon community participation in decision-making for social development at the local level (Midgley 1986). The primary health care approach is in a similar way based on the community (see section 1.2). Thus, third world participatory design approaches need to emphasise the community, rather than the workplace. IT to support primary health care provides examples and models of such a community approach.

Greenbaum and Madsen (1993) put forward three rationales for using participatory design approaches:

- a pragmatic perspective, a functional way to increase productivity;
- a theoretical perspective, a strategy to overcome the problem of lack of shared understanding between developers and users;
- a political perspective, a democratic strategy to give people the means to influence their own work places.

In addition to the three that they suggested, I propose:

- A community perspective, a strategy to enhance both the communities as well as prepare technical development that goes beyond mimicking the first world. This perspective is based on the social system model.

This perspective is derived from the political perspective, but is extended to encompass both the workplace and the community (see articles IV, VII). The contextual constraints in third world computing necessitate a twin practical perspective:

- A bricolage perspective, a strategy to base system development on the potential given by the situation, context and resources available in a bottom-up approach.

This is a pragmatic third world perspective, a functional way to get things working despite lack of the resources and network of support that are taken for granted in the first world.

Key issues in these two proposed third world perspectives are:

- A multileveled participatory approach. The community approach as exemplified by IT to support health districts represents multiple groups, levels and perspectives.
- The multiple levels imply complexity, unevenness, and uncertainty, which imply an evolutionary participatory strategy focusing on learning, improvisation and experimentation. In this thesis I link this strategy to bricolage and cultivation.
- System development in the third world in general connected with contextual constraints and more uncertainty than in the first world.

Cultivation - a community based strategy

Based on the notion of information systems as social systems combined with the quest for bottom-up development, I propose *cultivation* (Dahlbom, Janlert 1996; Hanseth 1996) as strategy in community based participatory design. Bricolage is the practical local scale approach based on the resources present in the local social system, which is needed in a cultivation process. I see cultivation as a natural consequence of the understanding of information systems as social systems, something that grow into place, based on the potential in what is already present. Based on the experiences from the HISPP case as a point of departure, I take cultivation to include the above characteristics used on a community based participatory design approach.

- Cultivation and bricolage represent incremental development and a process oriented learning perspective. Cultivation of processes that grow into place by means of bricolage.
- Cultivation is included in the strategy of 'replicable processes for vertical and horizontal diffusion', (Research question 5).

Cultivation and *bricolage* is discussed in (section 3.2.2).

1.3.3.3 Research question 3. IT to support a primary health care approach

The health sector has been the practical arena within which my research has been concentrated. The general normative research question (B), about how to bring about development of deprived communities and regions, I have thus given a practical translation. Development of health services following a primary health care approach is key elements in most concepts of development. The United Nations Human Development Index, as one central example, is calculated as a function of health, education and productivity (UNDP 1992). Research question 2, about how the participatory design tradition may be modified to third world conditions, is explored within the context of developing IT to support the district health system and a primary health care approach.

Decentralisation of national health systems, the primary health care and district approach have been the concrete arena for exploring all my research questions. Those issues have been central in the revolutionary processes of change that have taken place in both Mongolia and South Africa during the research period. In South Africa the development of the health services is seen as a key to the development of communities that have suffered under apartheid. A key issue of my research has been to explore how IT may be developed and used to support a primary health care and district approach. The exploration of this question has provided me with the empirical data and practical hands-on experience that have been needed in relation to the other research questions. An introduction to the field of health care is given in (section 1.2).

⇒ **Research question 3.** How can IT be designed and used to support a primary health care approach and a decentralised district based health system? And to emphasise the process, how can IT be used as a tool in such health sector reform?

Results of Research question 3:
IT to support health district development

A main finding in both Mongolia and South Africa is that the reform of the health sector towards decentralisation and a primary health care approach have been extremely difficult to come by. In both countries I have analysed the problems to be partly due to the resistance to change found in the prevailing health systems.

1. For decentralisation the important obstacles are the vertical, fragmented and centralised structures.

2. For instituting a PHC approach the important obstacles are the hospital-based structures and the curative ideology inscribed in the wider network.

Given this background and results from a comparative analysis of the process of building districts in two townships in South Africa (article VI), I came to the following conclusion:

- Information systems are important tools in district development and help bring about unification and integration in a decentralised health system.

The district model (see articles VI, VII, and section 1.2) is the way in which the WHO suggests to organise the health system and the primary health care approach. The district is an appropriate level wherein to centralise the flow of information. It is global enough to allow for integration and not only further fragmentation. At the same time it is local enough to manage and co-ordinate the local level health services. Research in this field has led me to a conceptualisation of the district health information approach as being qualitatively different from a hospital based approach (articles IV, VI, VII).

Given this background I formulate the following strategy:

- The health district is an appropriate level for diffusion and learning of IT.

This strategy is a concrete elaboration of the general principle of using the health sector as an arena for learning about IT (research question 1).

The district (Aimak in Mongolia) makes it possible to integrate the local level (e.g. health facilities) within the district. At the same time it makes national integration of all the districts manageable. In South Africa 177 districts organise 3440 health facilities and the districts are managed through 9 provinces. In Mongolia 18 Aimaks organise 326 Sums, thus the same ratio of about 20 sub units per 'district', and about 20 'districts' in one province (South Africa) or country (Mongolia). The population is about 18 times bigger in South Africa than in Mongolia.

1.3.3.4 Research question 4. Design strategies based on the notion of information systems as social systems - 'structuration'

⇒ **Research question 4.** In what ways may the interpretation of information systems as being social systems have impact on design and change strategies within the context of the health information systems I have studied?

Motivation

The resistance to change I have observed in the health services in both Mongolia and South Africa has shown that health information systems are 'social' in a very literal sense. They make up a complex web of 'social' information systems that are nearly 'physical' obstacles to change (article VIII). My research has provided evidence that the processes and structures being institutionalised by the information systems often seem to be their most important outcome (article VIII). Given this background I suggest to include these 'structuration' (Giddens 1984) aspects of information systems in a design strategy.

Results of Research question 4
Structuration as part of design strategy

Given the social system paradigm and following the 'duality of structures' the following forms a point of departure. The information systems are on the one hand made up by social action, which, on the other hand, is creating social relationships and structures, which again form the conditions for (the former) social actions. In (article VIII) we proposed to bring those structuration aspects of health information systems into 'conscious' tools in the design process. The strategy towards bringing about changes will be to aim at changing the work practices in relation to the information handling at the local level.

This research question is a direct result of the investigation into the problem of developing health districts. It represents an effort to build a theoretical framework and general strategy based on practical experiences. Furthermore, this framework has been fed back to the practical context of health district development and has led to a more precise applied design strategy:

- The applied strategy: Information systems as tools for health district development.

- The general strategy: The structuration aspects of information systems as tools in institutionalising new work practices, awareness and local empowerment.

'Structuration' as a strategy in system development is a very 'slow', evolutionary and incremental approach, which require a long time horizon. As cultivation, it is based on the resources available.

In Mongolia we proposed practical interventions aimed at changing work practices in relation to the information system and related procedures and in that way start 'structurating' a new decentralised structure. We aimed at creating awareness, responsibilities and empowerment at local level through new practical routines. As an example, we suggested to change the job description, responsibilities, daily procedures and focus of the Sum statistical feltsher in Mongolia (article VIII). This strategy is further discussed in (section 4.2).

In South Africa the HISPP project has suggested to use information system as a 'structuration' tool for developing a unified district structure. The information system will create new routines and structures for collecting, analysing, reporting and using information that are 'horizontal' and district oriented rather than 'vertical' and centralised. Redirecting and centralising the flow within the district are gradually forming new processes and structures. The district information system is thus used to institutionalise new practices and by doing that produce and gradually reproduce 'every day' the new institution, this time the *district*.

Health workers from different facilities, institutions and programmes will work together and thereby develop a unified district information system. The *trust* embedded in the fragmented structures will thus gradually be transformed to trust in the new *district structure*. This strategy is further discussed in (section 4.2).

1.3.3.5 Research question 5. How to *diffuse* system development

Bottom-up development represent a fundamental problem of *scope*: How can local scale approaches, which are indeed examples of bottom-up and local adaptation, contribute to, and become part of wider scale and global developments and strategies?

⇒ **Research question 5.** How can action research, and system development projects more generally, be diffused from one or a few, to many or 'all' places?

Motivation - why spread?

Engelstad and Gustavsen (1993) argue that the problem of diffusion has been a major problem within the Scandinavian tradition in action research during its thirty years of experience. I take their findings and arguments to have general value. Interpreted in light of my own research I highlight their findings as follows:

1. Isolated projects have no lasting effect and need to be diffused to other places in order to be sustained.

2. Diffusion is not achieved through the 'force of the good example'; 'best practices' and 'one case' can serve as example for other cases.

3. Diffusion needs to be fostered through dialogue in networks where participants are engaged in dialogue.

In my research in South Africa I have been increasingly aware of this problem of how to diffuse results from one, or a few places, to many. In the HISPP the objectives have been to develop three pilot health districts, out of a total of *177* such districts. Together with colleagues from HISPP I participate in a committee which aims at developing guidelines for district health information systems in South Africa. The committee is under the district development office in the Ministry of Health. The goal is to diffuse the results from the pilot projects to all districts in South Africa. As a first input to this process of diffusion we have developed the "Six steps towards a district health system" (appendix 1, see section 4.2.2), which are general guidelines given a concrete application through the HISPP case.

This large-scale *horizontal* diffusion has not been the only challenge with regard to diffusion in HISPP. The other area is what I label *vertical* diffusion. Each health district is multileveled and consists of many health facilities, health programs, Non Governmental Organisations, community groups and the like, which all need to be addressed by the system development process. In Khayelitsha, as an example, there are at least fifteen key organised units that need to be addressed. Thus, within each district and community, the process needs to be diffused. I label this vertical diffusion. The 3440 community health centres that are organised under the 177 districts in South Africa illustrate the scale addressed by the vertical diffusion within the districts.

Result of Research question 5
Diffusion and learning in network

As argued earlier, information systems are social, and can therefore not be transferred as such. Dialogue between participants in networks (Engelstad, Gustavsen 1993) forms the background for the model of diffusion of action research and system development I use in this thesis. I extend dialogue in network to include the concept of mutual learning which is one of the key concepts in the Scandinavian approach (Bjerknes, Bratteteig 1987; Bødker et al 1987) (see article I).

The needed trade-off between the local and particular and global and standardised in system development is discussed in (article I). In (article III) this opposition is discussed in relation to learning and diffusion of IT, and a model for classification of IT according to context-sensitive and context-free aspects is presented.

Given this background I suggest vertical and horizontal diffusion of replicable processes as a general strategy for diffusion. While the vertical denotes the particular and context-sensitive, the horizontal denotes the global, standardised and context-free. This model is suggested as a generic model that may be used within a district, within a country and between countries in a South-South effort. The horizontal and vertical processes are mutually dependent. The model implies that diffusion, in order to be successful, require a network, and it needs to take both the vertical and horizontal aspects of IT into consideration. In the following I outline the model using the HISPP case as an example. The model is further discussed in (section 5.3).

1. Vertical replication - a community based cultivation approach

At each particular location the information system needs to adapt, to 'grow into place'. The multileveled approach as applied in the health districts in HISPP implies that the process at one level will have to be replicated at the other levels. The approach to manage the complexity in each district is to create and cultivate sustainable processes within each organised unit in the multiple levels of a district: First at the district level thereafter in the health facilities, community interest and task groups, and health programs. Between a number of health facilities at the same level, within a district, the process of replication is horizontal. In HISPP the "generator of activity" is a step-wise model, "six steps to a district information system" and the more general information-cycle from (section 1.2.3).

This strategy is a practical application of the community based participatory design approach outlined in research question 2.

2. Horizontal replication - diffusion by dialogue and mutual learning in networks

This can be illustrated by the HISPP process that includes horizontal replication of the process, *diffusion*, between three districts in a mutual network. I use the metaphor of a seed to be spread and cultivation as the approach towards nourishing the processes thus initiated. In order to replicate the HISPP process in other districts the "six steps" in 1. above is used as a "seed". The seed represents the standardised, global and context-free. The cultivation of the seed at a particular location represents the particular and the context-sensitive. Note that the standards as represented by the 'national' in a national information system are constraining, as is the 'seed'.

In order to diffuse the results further, I suggest, in line with Engelstad and Gustavsen (1993), that a network of mutually collaborating projects in various districts and provinces is gradually established. Diffusion will then include the replication of the process in one or more pilot districts in a province, and then as a next step to replicate the process within each province. National standards will need to be developed during this process.

This model of large-scale diffusion and learning of IT, including both vertical and horizontal replication, and collaboration in networks, is suggested as an appropriate framework for South-South collaboration (research question 1).

1.3.4 Summary of the research

In this section I have presented the results of my research in relation to a number of descriptive and normative research questions. These are based on the articles included in this thesis. The research questions thus make up a framework for presenting main findings from the articles on which they are based.

The opposition between the descriptive and normative, or between understanding and intervention, has formed a dynamic framework for my research. While having my understanding as a point of departure, the investigation into the normative aspects has involved intervention and has represented a means to develop my understanding further. As a next step, the new understanding initiates new interventions, and so forth. This has made up the 'duality' of my research. In the figure below the relationship between the various results of the research questions are outlined as a web of many-to-many relations.

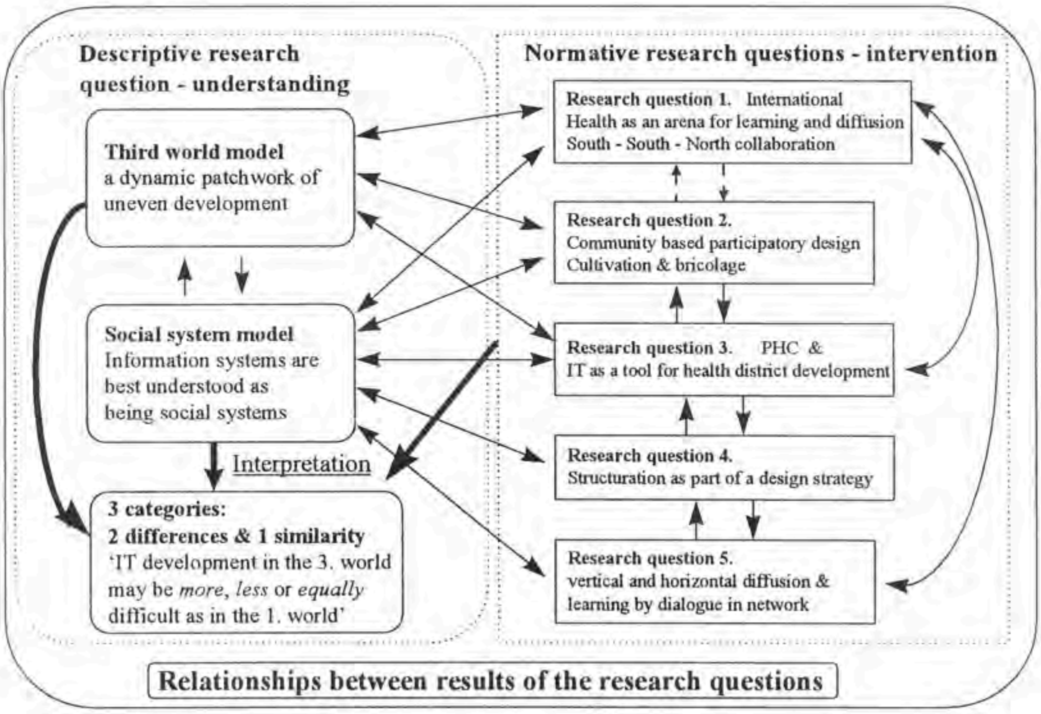

Figure 1.3: The research questions and the relationship between them.

The objectives of my research have been related to learning and understanding more than to concrete products. Nevertheless, I have formulated concrete results from the normative research questions. These results are mostly derived from analysis, but also to some extent from experience. Research question 3, regarding district health information, is rather heavily based on experience, both from Mongolia and South Africa. This is the reason why normative suggestions derived from this question are concrete, i.e. linked to application areas and places. The other research questions have the practical cases from this research question as a main point of departure. While research question 4 has the same experience base as research question 3, research question 4 is based only on experiences from system development in South Africa. Research questions 5 and 1 are both based on analysis and not on direct experience. Though, research question 5 is rather concrete since there are concrete plans, results and contexts for diffusion.

The limited extents to which most of the normative concepts are tried and experienced imply that they are not stable end-products. They are better regarded as concrete starting points, assumptions that may form the basis for trials and changes in future research.

The third world model and social system paradigm together with the three categories, on which they are applied, summarise the descriptive and 'understanding' part of the research. The three categories of differences and similarities between IT in the third world and in the first world make up an analytical framework that explains three main 'clusters' of my observations:

1. The complex and multileveled context of potential (Mongolia) and actual (South Africa) community based participatory design.

2. The striking potential for appropriate third world IT development as illustrated by the communication network in Mongolia.

3. The resistance to change found in the existing health information systems in both Mongolia and South Africa.

The three categories may be laid out as 'IT may be *more*, *less* or *equally* difficult to develop in the third world as in the first world'. This may sound like a 'so what' statement, but it may as well be taken to mean that the differences between the first world and the third world are not of principal character. Moreover, it follows that the third world may be more 'advanced' than the first world within some fields. Thus, there are areas where the first world may learn from the third world. Community based participatory design and bricolage may illustrate such areas. Korpela et al. (1996) use similar arguments and argue that 'tripartite partnership in system design'; between designers, workers and communities, is an area where the third world has experiences that should also be relevant in the first world. System development in more difficult contexts in the third world will generate experience important also in the first world.

In (article V) we propose a mutually beneficial South - South - North collaborative model. The fact that also the North learn from the collaboration is crucial to the reciprocity of the network. This model is radically different from the typical vertical North - South model. This imply that Norway, as an example, establish one-to-one collaboration with Tanzania on the one hand and with Mozambique on the other, without including collaboration between the two neighbouring countries as part of the model. Such vertical models aim at 'Northern control' as opposed to 'Southern learning'. The South-South-North model, on the other hand, aims at learning between all participants, and implies localised control.

This thesis discusses a broad area, both in terms of geography, themes and ongoing historical events. Obviously I have not been able to cover the area as such. The trade-off has been between the risk of being too superficial, or too complex. The approach with which I have tried to counteract this problem is, on the one hand to concentrate the research on a few rather concrete research questions and, on the other to be explicit about findings and conclusions within these areas. As argued above, the results I regard as points of departure for future research.

While being concrete, many of the results are nevertheless rather general, as formulations of strategies and abstract models. Though, since all the research questions are related to development of health district information systems, they nevertheless form a concrete basis for future research. Thus, the processes of health sector reform and health district development that are going on in most third world countries, will remain a focus of my research.

Section 2: Research Methodology and Process

The actual research process unfolded in four phases, each within one of the two countries and with a slightly different focus and research context. First I outline the general research approach. Second I give a more detailed account of the research process and the methodological considerations within the different phases.

2.1. Methodological approach

The issues I describe in this section are the following: 1) participant observation and fieldwork, 2) data collection techniques, 3) intervention and design in context, 4) explorative approach, 5) approaches to define a research project.

A main research objective has been to study local processes within the framework of the more global processes in the two countries. To address this problem area the anthropological methodology of fieldwork and participative observation was a logical choice. Participative observation includes a focus on the local, group and individual level. The investigation of the interaction between use of information technologies and the context of use requires rather profound observation and a certain level of participation and involvement. This is necessary in order to get 'inside' the object of study and is particularly important within an abstract area as information technologies in the context of use. If one were to observe a woman in front of a computer in a small town in remote Mongolia, notes from such observation would not be enough to cover the complexity of the situation. Participation is a key to move towards more information and deeper understanding than mere observation provide.

2.1.1 Participant observation and fieldwork

Participant observation

In the book 'Participant observation', Spradley, (1980), describes five types of participation that ranges along a continuum of involvement, both *with* people and *in* the activities that are observed, as shown below.

DEGREE OF INVOLVEMENT	TYPE OF PARTICIPATION
High	Complete
	Active
	Moderate
Low	Passive
No involvement	Non-participation

Figure 2.1: Involvement in participant observation (Spradley 1980, p. 58).

Complete participation comes when the researchers study a situation in which they are ordinary participants. The active participant seeks to do what other people are doing, not merely to get acceptance, but to more fully learn the cultural rules for behaviour. Moderate participation occurs when the researcher seeks a balance between being an insider and an outsider. The researcher engaged in passive participation is present at the scene of action but does not participate or interact with other people to any great extent.

Spradley (ibid.) emphasises that the degree of involvement is both *with* people and *in* the activities. The focus of my research has been health workers, information users and computer users in a variety of settings in Mongolia and South Africa. My involvement in their primary activities has been low, due to the nature of their work. Within the process of change and development within the information systems, on the other hand, I have had a relatively high level of intermittent involvement in both countries. My research may differ from typical participant observation research in that I am observing levels of 'daily work' as well as a wider process of change, which addresses the daily routines. Thus, I focus on my involvement in the process, rather than 'activities' in the following outline of the involvement.

The context of research in Mongolia and South Africa has been different. The differences in involvement illustrate this. In South Africa my involvement has been active to complete, whereas in Mongolia it has been moderate to active.

In Mongolia I was based in the Ministry of Health, in a team whose brief it was to analyse the information systems and to suggest changes. Thus my involvement in the process of reforming the information systems at central level was active. In 1996 I had one partner and in 1993 an additional person was added. The focus of our work was to study usage of information and computers within the health sector all over the country. When we worked together with people who were engaged in changing the information systems, our involvement was active. When we studied the wider health sector, using interviews, questionnaires and observation, our involvement was moderate. Exceptions were when we were engaged in helping with software problems, in which cases our involvement became very active. Note that we were regarded as representing the Ministry of Health, though on a low technical level. We also studied a wide range of computer users outside the health sector in Mongolia. In these cases our involvement was moderate, exceptions also here were when we became involved in software problems.

In South Africa I immediately became a participant in a committee that had a mandate to analyse the health information systems and propose changes. This work later turned into the work in the action research project HISPP (Health Information System Pilot Project), which was and still is aiming at developing a new district health information system. Involvement in a system development project has made it possible to explore conditions for participatory design in third world contexts in cooperation with others; co-researchers, health workers and people from the community. Based on this background I will classify my involvement in South Africa as complete. Although in South Africa I have also used moderate involvement in the study of a number of information systems around the country. Examples of the latter are the accounts of the information systems in Mdantsane (see article VII), and the Alexandra health clinic, described in (section 1.1).

A fieldwork approach

Traditional anthropological fieldwork is another methodology used. Fieldwork, from this point of view, is a first source of knowledge with philosophical and theoretical elaboration coming later. The fact that fieldwork plays such an epistemologically central role is what separates social anthropology from other social science disciplines (Clammer 1984). Fieldwork techniques assumes that it takes time to understand the cultural, socio-economic and political context in a place foreign to the researcher. The traditional view has been that the period in the field should not be less that one year, so that the people's annual calendar could be witnessed (Hicks 1984).

My objective was to understand the local within the context of the global. Fieldwork approaches I have used ranged from concrete participative observation, questionnaires and interviews etc., to the more 'osmotic' - to grow into place and cultivate the surroundings. On the osmotic end there was a huge difference between South Africa, where I was regarded as something of an immigrant after a few months, and Mongolia, where I remained a stranger. Language and the availability of newspapers and literature were also radically different in the two countries.

My aim has been to follow the processes of technological and social change in two countries, which requires a longitudinal approach. Following Pettigrew (1990) a study at one point in time will have (possible) changes to the foreground, whereas a longitudinal study can show continuity. Thus, a study of changes will also have to grasp what is not changing. In both Mongolia and South Africa I have been able to follow the processes over a four years period.

Interestingly, though, a main finding common in the two countries is that the institutional legacy from the old systems, the apartheid and the Soviet state respectively, still provided considerable resistance to change and thus represented substantial obstacles to the health sector reform underway in both countries. The finding - or understanding of this stability inherent in the institutional structure emerged slowly and incrementally as a result of the time span and longitudinal character of the study. In this way it confirms the somewhat paradoxical statement by Pettigrew:

> "The more we look at present-day events the easier it is to identify change; the longer we stay with an emergent process and the further back we go to disentangle its origins, the more we can identify continuities." (Pettigrew 1990, p. 271

This focus on the stability within the change is interesting, because to some extent it also holds with regard to the process of technical changes. In Mongolia we found (see articles IV, VIII) that the introduction of computers into the health sector at peripheral level did not, as such, change much in the way things were done.

2.1.2 Data collecting techniques

The techniques I have used to get data in Mongolia have been different from the techniques used in South Africa. Semi-structured interviews have been a main approach in Mongolia. In the last fieldwork we used questionnaires and the questions in these we also posed in the interviews. A total of 157 formal interviews have been conducted during two periods of four months, in 1993 and 1996. I started out with a stable set of questions and then improvised towards an open-ended range of questions. In South Africa I have worked in teams most of the time and data has been obtained in formal meetings as well as more informally by walking and driving around. The first 6-7 months in South Africa I participated in teams organised by the new government to assess the present health information systems in relation to the proposed health sector reform. During this period I participated in more than 100 formal meetings. Even though the context and formal setting was different, we followed a similar semi-structured approach.

In Mongolia I depended on an interpreter, whilst in South Africa most people speak English. Therefore informal walking around as well as participation in meetings as a participant alongside the others have been widely used as techniques in South Africa, and not in Mongolia. In Mongolia we also walked around, but with an interpreter it became more of a 'formal' process.

Questionnaires

The research has been basically qualitative and interpretative, but, I have used 'semi-quantitative' methods such as questionnaires as well. In South Africa we have used questionnaires (see appendix 3) to support focus group discussions (see article VI). This approach was based on a similar survey done in Ghana by my partner Arthur Heywood (Heywood, Campbell 1997). Later, building on experiences from South Africa, we used questionnaires (see appendix 4) to support interviews in our survey in Mongolia (see article VIII).

In South Africa we distributed questionnaires regarding attitudes towards the use of information, planning, self-assessment etc. to a number of health facilities (article VI). We analysed the results and used this as a point of departure for focus group discussions with staff at the same facilities. This approach proved to be useful because the staff had started to discuss and reflect upon the questions, and because we could start out the discussions based on their own immediate understanding of the problems.

Based on experiences from South Africa, we developed two different questionnaires in Mongolia;

1) Health information questionnaires assessing knowledge, impressions and use of information among health workers, and

2) 'Computer' questionnaires assessing skill and quality of use among computer users at Aimak level. The most important effect of the questionnaires was to facilitate interviews and discussions and to tune in and redirect the focus. Thus the methods

used were basically qualitative and interpretive with the support of quantitative collection of data (see article VIII)

The formal aspect of the survey described above was only one part of our participant observation approach. As important were the informal aspects. Those we interviewed and collected questionnaires from, we also visited at their work places in the local community and spent considerable time together with many of them. Everywhere we asked to see computer applications, reports, statistics and other things produced by computers. This 'hands on' user contact was valuable in assessing computer usage within the health services.

2.1.3 Intervention and design in context

An important part of my research has been related to intervention and design of health information systems. The action-oriented part of this has mainly been the work done in relation to the HISPP project, which is based in three districts in South Africa. Though, also in Mongolia I have been involved in overall design local level information systems. The approaches I have used fall within the notion of action research. Action research has been typified as a way of building theory and descriptions by engagement with the world in the context of practice itself (e.g. Whyte et al. 1991; Vigden, Braa 1997). The Scandinavian approach brings the critical perspective into action research (Bansler 1989; Ehn, Kyng 1987). The political and empowerment perspectives inherent in the Scandinavian approach have been particularly important in the context of my research.

The approach I have used is parallel to what Elden and Levin (1991) label cogenerative learning, which emphasises participation in action research. Participants all bring with them their frameworks of understanding into the process, out of which a new framework, or 'practical theory' of the local situation, emerges. Though, number of participants and the relation between them has been much more complex and multileveled in my research than the simpler 'insider' and 'outsider' put forward by Elden and Levin (ibid.). In particular I will emphasise the fact that I have all the way been participating with researchers from medical research, which is a different field from my own. Thus, many 'frameworks' have been involved.

Action research evolves within a dynamic field characterised by the following oppositions: *change* vs. *understanding*, *change* vs. *prediction*, and *understanding* vs. *prediction* (Braa 1995; Vigden, Braa 1997). My action research has aimed at changes. Understanding through interpretation has arrived from this process.

Prediction, as testing of hypotheses and causalities between intervention and results (Argyris, Scön 1991), have not been possible thus far within the context of health services. This is due to the complex situation where the entire context has been in a state of rather fast 'drifting' due to political changes. In the context of South African politics a main challenge is to arrive at a point where interventions are possible. Though, results from some practical interventions will be evaluated by the end of this year; introduction of new forms and routines for data collection were introduced in the three pilot districts in May.

Within the process of South African politics itself, though, we have evaluated our interventions. Our action research has since 1994 involved two health districts. In (VI) we evaluate the results of two different approaches, or interventions, towards establishing a process towards a district health information system. This has been very useful in building theory. This emphasis on the process and the larger political context illustrate a main theme in this thesis; when the installed base is involved in large hierarchical systems as in health care, even minor practical changes at 'ground level' include substantial negotiations in the wider social system.

In order to provide some background to the points above I outline some aspects of the action research I have been involved in:

The action research has included participation with people from multiple levels; community, health services and local, provincial and national health management, as well as with other researchers. Design and implementation of a district health information system in for example Khayelitsha is complicated and it encompasses a broad range of activities, places and people. First of all: in order to get started the project needed to be accepted by the community through meetings and negotiations. Activities that followed include: design of the overall system through the creation of visions, mainly by the use of drawings; the more detailed definitions and negotiations of data sets and data collection tools; design and first version of the district database; establishing of the human components of the system, i.e. two people at each facility; training; keeping all the various organisational participants on track; negotiations and meetings.

Two examples: The overall design activities have been about creating a common understanding of the present, and on that basis exploring visions for the future. Such exercises have been much linked to the visual and concrete, like the drawings from South Africa that are included in this thesis. These activities have been based on social interaction and discussions, at meetings, workshops or at site, and they have been going on over a very long time (1994-97, and continuing).

The first approach to develop a district database was to have ten people from the three districts on a course. After the course we had a workshop where we made a first design. Then the database was coded, and distributed to the three districts where testing, modifications and the creation of new ideas and visions started (shortly after I left in order to write this thesis).

2.1.4 Explorative approach

Not much research is done in the area of 'IT, third world, development and health', with which I have been working. For that reason my focus has been on empirical work and on exploring the problem area. To get *access*, to research objects and to resources, has been a main concern in the early part of the project. It created uncertainty with regard to both defining a research project and to actually plan it. This uncertainty I have tried to handle by combining flexibility and improvisation on the implementation levels with a rather strict overall plan. The overall plan was to do fieldwork in two countries over a period of 3-4 years. Moreover I wanted to be engaged in an action research project.

Flexibility within the framework is illustrated by the fact that I, at one point, set out to do research in Algeria and Tanzania, which eventually became Mongolia and South Africa due to political events. The action research planned for Tanzania came into being three years later in South Africa, as described in the next section. Within the overall plan I have the possibility to some extent to let the events lead the way, as a nutshell in a stream. The focus has been on the direction, try to do the most possible out of the potential in the situation, and to 'learn while walking'. It has complicated the project that 'where to walk' and to be 'allowed to walk', have been as central and integrated issues as 'how to walk'. I give a description of the research design and process in a later section.

The construction of the present thesis that is the end result of the project is also part of the methodological considerations. A main characteristic of an explorative study such as this is that you use the road, or the project trajectory, as a means to define it. Thus the end result becomes the process towards it; the means become the end.

This thesis includes eight articles. The most stable part of the research approach has been to write and get comments on articles along the way. This process has brought me in interaction with the relevant research communities, and thus been important. Towards the end of the project these articles, which served as the means, actually make up part of the result. From a readers point of view such a constructed thesis is by no means perfect. The articles are in some instances repetitive, explorative and not as to the point as normally required by an article, not as consistent in relation to each other as chapters in a book. The articles represent fieldwork descriptions and analytical perspectives written for different academic audiences during the project phases.

2.1.5 Approaching a definition of a research project

A central problem in defining the research could be phrased as the question:

How to study IT in a third world context where there are few, or no computers, and where those who do research on IT do not focus on third world issues?

In 1986 I did my first investigation into possible ways to define a research project on IT, development and the Third World when I travelled to Algeria where I had contacts. A major problem connected with studying IT in Third World contexts very soon appeared. How to study the use of IT where there was no IT. In Algeria IT was present as main frames in central government administration, or it was located in the modern, and in that context important, westernised sectors, such as in the oil industry. One place I visited was Ghardaia, a major town and administrative centre in Sahara, and a place I would have liked to do a case study. The problem was that I was not able to find one single computer.

In 1988-89, during a seven-month stay in China and India, I made a second effort. These are Third World countries with considerable technical skills and capacity. In the Beijing Academy of Science there were PhD candidates from all over the world. But, they did not address the problems I was interested in. Their research was focused solely on the technical aspects of IT. They developed advanced software, did research on e.g. parallel programming and negotiated with Japan in order to produce software for companies there.

Bangalore in India is a major centre for software production. Here I observed a similar pattern to that in China. The focus was on technical aspects and software production and not on how to apply the technology within application areas in order to bring about development, improved practices or changes. The Third World that was present at the doorsteps of the software factories in Bangalore was not part of their plans or concepts for the future. In both China and India the focus was on software engineering rather than system development. Neither in India nor in China I was able to find areas where I could study IT outside the very modern sector. Lack of resources and a network of contacts were only part of the problem. The main problem was that

1) in the third world contexts I wanted to study there were no IT-applications, and

2) research and technological focus was to a large extent focused towards software engineering and 'first world' issues. Third world problems were not an issue in the IT communities I visited.

In 1990 I developed a research proposal together with other researchers at the Norwegian Computing Centre. The focus was on investigating system development in the Third World and to see whether experiences from the Scandinavian tradition in action research and participatory design would be of value. The envisaged methodology was based on comparative case studies of practical system development projects and on establishing a network with researchers and institutions in the Third World. We did not get funding, but the general research approach has since been applied in this research.

In 1991 - 92 I studied anthropology in order to develop a research design, and to explore appropriate fieldwork methodologies and ways to interpret the social context. At that time I did research within the health sector at the Norwegian Computing Centre. I started to explore international research on health information systems and health sector reform, a field that perfectly suited my research interests. All countries have national health information systems that extends to the most peripheral level with computers at national level and often provincial and some places district levels. With such an approach I would be able to study IT in Ghardaia even though there were no computers there, because Ghardaia would be networked to the national system using paper-based messaging and feed into it and be fed back from it. Another issue is that, as noted earlier, the PC revolution now has provided some of the Ghardaias of the world with computers.

Access and funding

The next problems were: How to gain access and to get invited and to be able to study relevant cases in two countries?

In order to pursue this approach I maintained my contacts in Algeria and extended them to the health sector. At that time the situation in Algeria slowly escalated into a civil war and fieldwork became impossible. During the time things were getting worse in Algeria, I had already established initial contact with the Ministry of Health in

Mongolia and I had started to work with people from AMREF (African Medical Research Foundation) in Tanzania.

In parallel with this process of gaining access I got funding from the Norwegian Research Council for a period of four years. The funding included support for fieldwork in Mongolia and Tanzania. The fourth year I planned to work in the system development project with AMREF.

The fieldwork in Tanzania did not turn out as planned. This fieldwork relied on the collaborative system development project that was to be carried out together with AMREF, which relied upon additional funding. Early in 1994 the donor agency suddenly withdrew, and my research in Tanzania could not be carried out. Fortunately, based on a travel grant to Tanzania and contacts in Cape Town, I was able to begin in South Africa.

Thus, a planned comparative study of Algeria and Tanzania turned out to be a study of Mongolia and South Africa. The action research project planned for Tanzania was being realised as something different; the *HISPP*, three years later in South Africa. Obviously, research projects don't always turn out as planned. In hindsight, the research project may seem logically constructed; comparison of IT and health in two countries, yet the story revealed here may indicate circumstantial results. The truth is somewhere in between. The research design has resulted from a planned and explorative approach, based on situated improvisation.

Getting access to research objects, limited resources and the ever-changing real world and political contexts have been main problems. I have spent considerable time negotiating and 'tinkering' in order to get access into the countries and organisations where I have been working. The efforts of being engaged in action research has led to much time and concentration spent on negotiating with donor agencies and others, both within and in relation to Mongolia, South Africa and Tanzania. Funding has been important, but political support at various levels has been equally crucial. The preliminary work leading to my cases underlines the critical issue of negotiating access to research areas, as put forward by Easterby-Smith et al. (1991).

Gaining access to areas where I could carry out research has been a main concern in this study, particularly in the initial and early phases of the project. Easterby-Smith et al (1991) use the terms brokers and patrons to examine what they regard as an increasingly important issue of gaining access to do research in organisations. Brokers are social 'fixers' who use their secondary resources, such as information and a wide range of contacts, in order to achieve their ambitions. Patrons are people with direct control over primary resources such as people and money. The former, as gate-keepers, control access to the organisation, and the latter control resources. The role and influence of the two groups is not very different, because both are involved in making commitments on behalf of the organisation. Support from both groups is necessary in order to gain access, but the brokers ('fixers') are the most important.

2.2. The research project

The research project presented in this thesis may be divided into four phases according to country and research area as described in the preface.[3]

In this section I first give a brief general introduction to the two countries. Then I describe each of the four phases. Finally a summary is given.

In June I finally got the invitation from the Minister of health in Mongolia, and in July my family and I went there. In this section I will give a brief account of the research carried out in each of the four phases. In order to make this account understandable I start with a general introduction to the two countries.

2.2.1 A brief introduction to the two countries

The cases of both Mongolia and South Africa are presented later. Here I outline some basic background in order to give some context to the research phases.

Mongolia

Mongolia is particular in that it is a large country, more than 1.5 million square kilometres, sparsely populated, but extensively cultivated through a nomadic mode of production. The country is located in the northern part of Central Asia, between Russian Siberia on the north, China on the south, and Kazakhstan to the west. While not having common borders with Kazakhstan, the westernmost Aimak (province) in Mongolia is populated by Khazaks. Mongolia is a country of extreme contrasts in that pastoral nomadism flourishes alongside Soviet Union-style industrial modernism. The nomad culture is a dominant part of the renewed nationalism following the liberation from the Soviet Union.

Mongolia has 2.2 million inhabitants. More than 50% of the population is 'urban' and lives in 3 industrial towns and 18 Aimak (province) centres, including 26 % in the capital city of Ulaanbaatar. About 28% of the population live as nomadic herders scattered in small groups of families. The condition of infrastructure is poor in Mongolia; this is shown by bad roads (or tracks), lack of petrol, poorly developed telephone and postal systems.

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[3] Funding was obtained for fieldwork in Mongolia and Tanzania, but access was not yet obtained. In April - May 1993 I stayed with AMREF in Tanzania and we worked out a joint research proposal for developing a district health information system. AMREF did research on the use of information to support decision-making at health district level in collaboration with Liverpool School of Tropical medicine. The project we proposed drew on this work. As outlined earlier, early 1994 the funding was denied and I went to South Africa. The reason for mentioning this here is that the work I did together with George Kanga, AMREF, on defining a district health information system, based on the case of Kisarawe district, has been influential in my later work.

During the 1920s Mongolia became a close ally of the Soviet Union, and was since the 1930s a defacto member of the Soviet Union. This era ended in 1990 when Mongolia got its independence following a popular uprising. Many changes have taken place in the political and socio-economic situation since then. The country has changed from a single-party system to a multi-party system. The transition from a command economy towards a market economy has been marked by a severe economic crisis with shortages of food, medicines, fuel and everyday necessities as well as huge unemployment.

Mongolia is divided into 18 provinces, *Aimak* in Mongolian. Aimaks are further divided into 326 counties called *Sum*. Each Sum has an administrative centre and a small hospital. As part of the general decentralisation of power, functions and responsibility have been handed over from the Central Government to the Aimak. The Sums are further divided into 1381 Bags, each containing 50-100 families. In addition there are four industrial cities in Mongolia, including the capital of Ulaanbaatar. These are organised differently from the Aimaks. The actual numbers of administrative units are from (Ministry of health, Mongolia, 1992). Since then the numbers of Bags and Sums have increased because the Aimak centres have been made Sums and Sum centres have been made Bags, but my newer sources all give different numbers. Therefore I use the 'old' numbers. In the articles (apart from article VIII) I use a different spelling for 'Sum' (Som) and for 'kh' ('h') in names of places. Now I write Khufsgul Aimak, while in the articles I wrote Hufsgul.

During the 70 years of partnership the Soviet Union imposed on Mongolia a technological paradigm based on centralism, specialisation, large scale manufacturing and the 'Planned economy'. Mongolia followed the Soviet Union in the process of modernisation with an emphasis on giant industrialised schemes. The health system in Mongolia was built on a similar Soviet model: centralised and vertically organised and with a focus on curative rather than preventive medicine. The system is based on specialised services at the central level and thus on extensive transportation of patients - i.e. on free petrol from the Soviet Union. When the Soviet Union stopped providing free petrol the system collapsed, as it was not sustainable.

Substantial changes have occurred in Mongolia during the research period. When we first went to Mongolia in 1993 the economic breakdown that followed the collapse of Soviet Union was at its peak. Basic food as milk, bread, vegetables and meat were barely obtainable through the formal system. The new market economy flavour was barely visible in the wider society. Three years later the visual changes were immense: modern cars, nouveaux riches and tins of beer everywhere and basic consumer goods were easily obtainable and small private market stalls and private markets flourished. During my second fieldwork, the second democratic election was held and the Mongolian government changed for the first time in 70 years.

The Internet was introduced in Mongolia in 1996, but it was expensive, 90 US $ per month for connection and additional cost per time unit. A relatively well-paid civil servant earned 50 US $ a month in 1996. Universities and research institutes get Internet for only 5 US $ due to foreign funding.

The nomad culture of Mongolia has shown to be more adaptable to the post Soviet changes than has Russia, as indicated by the development of the exchange rate between the Rubel and the Togrig (Mongol currency): it used to be 1:10, in 1996 it was 150:1.

South Africa

South Africa is also large in terms of area (1.2 million square kilometres), but smaller than Mongolia. The total population is 37.5 millions, of which 55% is estimated to live in urban areas (Census 1996). The population contains many ethnic groups and is a mixture resulting from the historical migrations of blacks southwards, the presence of the indigenous Khoisan of the Cape, the arrival of the Dutch and British colonists and the slaves brought in from Asia and Africa. The different groups of South Africa, as defined by Apartheid, are the following: Black (75%), White (14%), 'Coloured' (8%), Asian (3%) (Welsh, Brittain 1994).

The modern history of South Africa is dominated by Apartheid, which replaced the old British colonial system in 1948. Two of the previous Apartheid Laws had particular crucial impact:

- The notorious 'Group Areas Act' from 1950 gave the government power to segregate the entire country by allocating separate areas to the different population groups. To implement this policy, the Act provided for forced removal and resettlement (Stent 1994).

- The Bantu Homelands Citizenship Act from 1970 created 10 'Homelands' on less than 14% of the land to which 75% of the population was allocated. All black South Africans were to become citizens of the tribal homelands, irrespective of whether they had ever lived there. A consequence of this was that blacks became aliens in South Africa (Stent 1994).

The five townships which are described in my cases, are all physical 'creations by destruction' by the Apartheid State and the historical legacy play a crucial role in their development. Mitchell's Plain and Atlantis (see articles IV, VI, VII) are both 'coloured' townships which were created after the Apartheid state forced them out of the areas in Cape Town where they lived. The physical destruction of District Six, a 'coloured' part of Cape Town, is particular infamous in that regard. Mdantsane (see article VI) is the black 'shadow town' to the 'white' East London situated in the former homeland of Ciskei. Khaelitsha and Alexandra (section 1.1) are both informal shantytowns created by 'illegal' immigrants to Cape Town and Johannesburg respectively, after the break-down of Apartheid's influx control in the mid-80's.

After the April, 1994 election a new Government of National unity took over. The cases I describe from the health sector are all related to the implementation of the official policy of the New South Africa. The new South Africa is administratively an 'amalgamation' of the four previously rather independent provinces and ten homelands. Together with the segregation of races, this has caused a rather severe fragmentation of the governmental structures as reflected in the health structures described in my cases.

I have been living and working in Cape Town and the Western Cape province, an area which is in many ways very different form the rest of South Africa - and Africa. Politically, it is the only province where the old Nationalist Party still holds power. What the Apartheid State labelled the coloureds, people of mixed race and the descendants of those who originally lived there, make up the majority of the population in Cape Town and in Western Cape. During the apartheid years coloureds had some privileges in relation to blacks, but not at all in relation to whites. A labour preference act gave coloureds the right to employment before blacks. The privileges of the coloureds and a shared language with the Afrikaaners, along with the fear that blacks would take over jobs, houses, etc., are considered to be among the reasons why the coloureds voted for the Nationalist party.

During the research period substantial changes have also taken place in South Africa. My first visit to South Africa in March - April 1994 coincided with the right wing's attempt on armed resistance in the Boputatswana homeland and the 'zulu-march' towards the ANC head quarter in Johannesburg which led to shooting and a large number of deaths. Both incidents were signs of what at that time seemed like an unsure future. Fortunately, things developed peacefully, the first multiracial election was held and a new government of national unity was brought to power. After the election there was a period after the election of optimism about social and economic development represented by the Reconstruction and Development Program (RDP), however the present is to some extent characterised by disappointments over lack of delivery of the development objectives. The RDP will be discussed later in the South Africa section.

2.2.2 Phase 1. The first period in Mongolia

Organisation of the research

The fieldwork in Mongolia was organised as a collaborative project based in the Ministry of Health. Our general objective was to evaluate the health information systems and propose improvements. The WHO had just funded introduction of computers to the Aimaks (provinces) and following that process was our main focus. Another important issue was telecommunication.

The market economy and privatisation had led to high prices, and some confusion regarding what kinds of services that would remain public and available for a reasonable price. On this background the Minister of Health wanted us to emphasise electronic communication. He even thought about establishing an independent radio-based communication system for emergency purposes because 'We cannot risk not to be able to get urgent information on e.g. outbreak of plague, because the telecommunication providers are not reliable'. He wanted a system that he could trust regardless of what would happen within telecommunication policy. In order to learn from others, we were asked to include other sectors in the study, in particular users of telecommunication.

I worked together with two other persons from the Ministry of Health in the project, Burendei and Nermunkh. The two were typical for the first generation of computer professionals in Mongolia. Both studied computer science at universities in the former Soviet Union, Kazakztan and Azarbadjan respectively, and came back and started to work in the public sector. Later, Burendei started his own computer business. They knew the computer scene in Ulaanbaatar, and they had friends working with computers in many sectors.

The research approach

We embarked on a systematic round to most organisations which were using computers in Ulaanbaatar and all health institutions and health programs. Due to a severe shortage of petrol, we had problems in travelling to other Aimaks. However, we managed to arrange two field trips to more distant Aimaks; Khufsgul Aimak in the Siberian part of Mongolia and to Bayankhongor Aimak in the Gobi. In addition we visited the nearby Tov Aimak several times.

Our general approach during the first fieldwork in Mongolia had a very open and wide scope and direction. We set out to 'count all that was countable' and to follow all leads. In Mongolia the focus was on computerisation in general, whereas in South Africa, due to differences in scale, the focus has been limited to the health sector. We wanted to collect as much data as possible, to do as many interviews as possible and to see and meet as many computer users as possible. Our perspectives were based on two major processes: The health sector reform and the wider socio-economic changes going on in Mongolia. We carried out a total of 97 interviews. 60 of these were from within the health sector. The others were done with representatives from a broad range of institutions, organisations and occupations: the railroad administration, the central custom office, the state statistical office, the Ministry of Agriculture, the Ministry of Transportation and Communication, the Stock exchange and brokers, the University, new private IT companies and nomads.

The interviews we conducted were semi-structured. We had a set of questions we wanted to get through and after that we improvised with follow-up questions and tried to get as rich a picture as possible.

Our work in the health sector focused on use of information in implementing a primary health care policy. We visited a large number of hospitals and health centres at local levels, and met with many health workers and managers. We had a wide approach in our interviews including both the problems they were engaged in and how information was used or could have been used to support their work. We asked people about the work they were responsible for, the health problems, and how they addressed the problems. Then we asked how the present information system reflected the problems, how the system was used and how it could be improved. We went on to look at the information provided by the information system (reports, statistics) and discussed improvements. We analysed the information provided by the information system in various areas and asked to what extent the real situation and main problems were covered. Our focus was on how to 'informate' (Zuboff 1989) the health sector, on the quality and content of information in relation to decision making and a primary health care approach.

Planning is difficult in Mongolia. In Mongolia things tend to happen when they are ready to happen. Whereas in the more modern first world things are supposed to happen when they are planned to happen. In Mongolia our interviews and visits were nearly all made without prior appointments. In the beginning we tried to get appointments, but that turned out to be very difficult. Detailed day to day planning, like having an appointment at 2 o'clock next Wednesday or tomorrow, is not the way Mongols are organising their work, or life. But, if we showed up we would be able to meet with the people we wanted straight away, if they were present. If they were not present, we would always be able to meet with somebody else, if that was of interest to us. This was the approach we used also during the second field work period.

In the case of visiting people at their work place and asking for interviews we used a particular Mongol pattern to our advantage. It is part of Mongol culture and custom that a traveller is received well and is given food and shelter. This is followed to such an extent that it is normal to set out for a considerable distance without bothering to bring food and water for the travel, because you can always stop by a family and get what you need. This custom is translated into the modern office world with the result that everyone would interrupt their work and spend time with us.

When we had to deal with things that had to be arranged in time, like getting transportation, hiring a car, getting petrol, etc. we too ran into problems. With the arrival of the market economy, the capitalist entrepreneur is put forward as the ideal. The customs referred to above has been focused upon, and unfortunately, taken to be connected to laziness. In a survey published in the Mongol Messenger, a weekly English newspaper, a sample of Mongols were given a set of characteristics that they should evaluate between true and not true to be valid for the Mongols. The characteristic that most people felt suited best to the Mongols was 'laziness'.

Bourdieu (1963) described similar habits towards planning as being linked to traditional attitudes towards time. The traditional production was an organic whole, linking the present and the 'forthcoming'. The modern production, on the other hand, made a split between the present and the forthcoming, turned it into an abstract, calculated and planned future. The experienced forthcoming, understood as the horizon of the perceived present, is essentially different from the future as an abstract series of interchangeable, mutually exclusive possibilities.

> "Such calculations are only possible through the dissolution of the organic unity which combines present and 'forthcoming' in the process of production. A unity which is indeed that of the product itself and which is lost in the transition from the technology of the craftsman, making entire products, to industrial technology, founded upon specialisation and the division of labour. The tasks of the peasant are not so easily reduced to small bits. They are, in effect, part of the natural world, possessing their own principles of unification and division which allow little scope for arbitrary dismemberment.
>
> Between calculated planning and mere foresight lies the same gulf as between mathematical demonstration and practical demonstration by cutting and folding." (ibid. p. 67)

Nomad families are moving when pasture and water tell them to. This is according to a plan, in 'space', but not in time.

Bourdieu (1963) links attitudes that are in contrast to 'rational' planning to the notion of time in traditional and pre-capitalist societies. My observations in Mongolia indicate that such habits are not exactly in line with the new entrepreneur ideal required by the 'organisational' part of market liberalism. The habit of situated planning, on the other hand, I have found to be very flexible and therefore rather adaptable to certain aspects of the modern market economy. Another point to be made is that those nomadic attitudes towards time I have found *not* to be inconsistent with being able to master and tinker with IT.

Few people were speaking English, and there were very few written sources in English. Thus, the Mongol society is rather difficult to understand for a non-native speaker. My approach towards a more general understanding of the country and culture and IT in this context, was the following: My points of departure were a few key symbols in relation to the Mongol culture and technology (the ger, the nomad tent), the Soviet technology (the giant schemes and the statistical systems), and the new market economy (the stock exchange). Interrogation into these key symbols, and their relationship in the ongoing process of change, formed the understanding of Mongolia I used in the interpretation of the data obtained through the more formal parts of the study. I outline this analytical framework in the case report in a later section.

Outcome

Two main themes came out of this phase: 1) IT to support a primary health care policy and decentralisation within the health sector and 2) technology policy and development issues across all sectors:

1. We found that the existing information system did not support the new decentralised health management at Aimak level and a primary health care approach. The information was not analysed and used at local level and local needs were barely addressed. The legacy of the previous Soviet style system made up important obstacles to change. This legacy was an obstacle to the objective about a decentralised management structure and a preventive and generalist-oriented primary health care approach (see articles II, IV).
2. Due to the combined effect of the economic crisis and the introduction of the new market economy, the health sector, and other public (poor) sectors, were unable to take advantage of the new communication. Against this, we argued in favour of using public money to support and to provide basic communication infrastructure also for the public sector. The suggestion to use the health sector as a sector sheltered from the market economy for learning about and diffusion of IT grew out of this (Article II, III).

2.2.3 Phase 2. The first period in South Africa

This period in South Africa is characterised by optimism, activism, and the *RDP* (Reconstruction and Development Programme). A large number of committees were organised around the RDP. The RDP states that the new reconstructed health system will be based on the Primary Health Care approach, and organised with health districts as a basic building block.

When I arrived in South Africa, I immediately became part of this 'movement'. In all provinces Strategic Management Teams (SMT) were organised in order to plan the reconstruction of various aspects of society. In the Western Cape the health SMT established 30 task groups covering different areas of the health sector and engaging in one way or another some 410 people. Each task group was required to make a situation analysis, and, in conjunction with other groups and the SMT, to draft plans for the reconstruction of the different parts of the health services in the Western Cape province. One of these groups was a task group for "a health and management information system for the Western Cape".

The research

I was based at the Department of Community Health, University of Cape Town, and together with other researchers I became part of the process of ongoing social and political changes in South Africa. In the SMT health information task team in Western Cape, I became a member together with Arthur Heywood, University of the Western Cape, and we have worked together since then. In the task team, we interviewed central role players and made an inventory of the complex system of different information systems serving the different institutions and health programs. In its final report, the committee proposed establishing several pilot health information projects at district level (Baqwa et al. 1995). These pilots later became the HISPP (Health Information System Pilot Project).

I also became a participant of committee work at national level. During my first visit to South Africa, I participated in a workshop that initiated the post election process towards a National Health Information System in South Africa (NHISSA). I became very involved in the first phase of this process and have been able to follow it since then (see section 4.2.4). Several national technical committees with members selected from the provincial groups were organised. Examples are the two teams I participated in, 'inventory of existing health information systems' and 'design of a disease surveillance system'. Other teams were concerned with standards, health indicators and human resources development, and so forth.

The work in South Africa developed along trajectories different from the fieldwork in Mongolia. The work in South Africa became very organised, and committee based activities made up the substantial part of my work the first 7-8 month of this period. Thereafter initial work leading up to the pilot projects became the main focus. In February 1995 I had attended my first 100 planned and scheduled meetings as part of the work since August 1996 (December and January are mostly summer holiday). Some of them might have qualified as interviews in another classification, but most were meetings in a literally sense. Meetings are important in decision making and are as an ideal aiming at consensus.

During all of these meetings I have observed a particular trend towards preferring to work out solutions and arrive at agreements in meetings, working together towards consensus. If there is disagreement, the meeting will continue, or a new meeting will be scheduled, or one will be 'forced' towards unanimity. Majority decisions alone are not regarded as satisfactory. This tendency may, at least in part, be a result of the African tradition of communality, which is linked to the community and the local scale. As a general method and implementation tool it has its problems when lifted from the local to the global or to the more complex and diverse. The method was insufficient as the institutional base for planning and implementing RDP projects. Larger planning and implementation processes easily suffocated and came to a halt.

By following the trajectories of these different committees, and the development of the process itself, I have learned a lot about a small but rather representative sub set of the post election political development and the development of the Reconstruction and Development Program (RDP).

The main approach in our survey of the health information system in the Western Cape province was meeting with and interviewing key informants within the various institutions, both institution heads and workers dealing with information. The other approach we used was to survey at the local level, all health facilities and programs within a particular area. The work in the three districts that eventually became the pilot projects was the focused area here (see article IV).

We also distributed questionnaires regarding attitudes towards the use of information, planning, self-assessment etc. to a number of health facilities. We analysed the results and used this as a point of departure for focus group discussions with staff at the same facilities. This approach proved to be useful because the staff had started to discuss and reflect upon the questions, and because we could then start the discussions based on their own immediate understanding of the problems.

Meetings and planning not only characterised our work, but that of the entire South Africa, which was continuously engaged in meetings (and to some extent still is) as part of the Reconstruction and Development Program. As seen from ground level the huge focus on planning and meetings, and consensus, was part of the reason why the RDP increasingly ran into problems with *delivery*.

South Africa is an open society where you can move around freely, English is used everywhere, there is considerable literature, and variety of journals, magazines television and radio programs accessible in English. Within this background I had an osmotic approach to understanding the South African society in the wider context through living there over a long period, reading, travelling and being together with people. The practical techniques and methodologies used in South Africa have therefore been different from those used in Mongolia.

Outcome

The research focus within the three main areas were the following:

- IT and the health sector: The findings from first phase in Mongolia were confirmed in that the existing vertical information systems and structures made up considerable resistance to change; information was not used at local levels and the information system did not support a primary health care approach. Much focus was on analysing the particularities of the district health information system as opposed to a hospital-based system (see article VI)

- Information system design: the concept of community based participatory design was outlined (see articles IV, VII)

- Technology policy and development: The understanding of the third world as a dynamic state formed through its relationship with the first world, led to a focus on a critique of technology transfer and suggestions about south-south collaboration (see articles III, V, VII).

2.2.4 Phase 3. The Second fieldwork in Mongolia

Many changes had occurred between 1993 and 96. On the research micro-level there was continuity, though. Of my two partners from the first fieldwork, only Nermunkh was left in the Ministry of health, and he became my full time partner. The project was this time placed in the National Institute of Health, a newly established research institute. Our 'patron' and protector was the same person as last time, the Director of Public Health. Following the election in September 1996, a small revolution took place in the Ministry. New people took over all important positions, we lost many contacts, but managed to make new ones.

The first visit to Mongolia in 1993 happened in a period when the old and substantially weakened administration tried to come to grips with a totally new situation. This second time was characterised by the initial steps of a totally new and inexperienced administration.

Two major WHO initiatives in the field of health information went on in the Ministry of Health in parallel with our research:

1. In the Aimaks, all statistical feltshers from the Sums were gathered for a two-day seminar on the international ICD10 coding standards (see section 3.1). We utilised this opportunity in several Aimaks to hand out the questionnaires we had designed for our survey.

2. A major two week workshop on health information systems with attendance from all the Aimak statistical physicians, responsible for health information in the Aimaks. We also attended this workshop.

The significance of the two events is discussed in relation to international standardisation in (section 3.1).

The survey

The wide-scope approach of the first field work in Mongolia was replaced by a much more focused one. The work over the two-year period in South Africa had resulted in a clearer focus in my research. By pursuing a similar approach in Mongolia it would also be possible to compare the development in the two countries. This time we would try to replicate the questionnaire-based survey we had done in South Africa (see article VI, VIII, and appendix 3, 4). The main focus was a survey of health information and computer usage in the Aimaks. In Mongolia the most important effect of the questionnaires was to facilitate interviews and discussions and to tune in and redirect the focus. Thus the methods used were basically qualitative and interpretative with the support of quantitative collection of data.

The questionnaires were distributed at the ICD10 seminars and they were filled in by a number of people who we could not meet for interviews. To others they were distributed when we went around and interviewed people. We used two different questionnaires:

1) Health information questionnaires assessing knowledge, impressions and use of information among health workers, and

2) 'Computer' questionnaires assessing skill and quality of use among computer users at Aimak level.

Of the former questionnaire 307 were collected, and of the latter 74. In addition to the health sector, we visited the State Statistical Office and the Stock Exchange in all Aimaks we visited.

The design of the questionnaires started with a direct translation of the one used in South Africa. This first version had already been tried on health workers in the nearby Tov Aimak when I arrived. Based on these experiences we designed a new version of the health questionnaire and a computer questionnaire. The questions focused on issues we wanted to follow up from the survey we did three years earlier. Several colleagues from the Ministry of Health proposed additional questions and the two questionnaires we designed grew rather big; five pages each. We then tested the new questionnaires in the same sample area. Based on these results we had a rather thorough analysis of the questionnaires together with Dr. Demdrelsuren at the Faculty of Medicine. We wanted to measure how, and to what extent the local level health workers and management used and analysed information. To that end we designed several questions measuring knowledge on target populations, targets for the institution, indicators, how to analyse data, how information was linked to targets and so forth. Such questions are very context-sensitive, both with regard to Mongol culture, health system and geography. In order to 'translate' 'target' from English to Mongol it is necessary to involve a comparative analysis of the Soviet based health system model with the ideals of primary health care. While a target in the previous Soviet model was linked to numbers of e.g. beds and patients, targets in the primary health care model are linked to better services for the most needy groups, which are definitely children and mothers in Mongolia. A question like 'do you analyse data?' and 'do you use information in your work?', have little value alone. In order to interpret such questions we also posed various other questions measuring knowledge.

The computer questionnaire had similarly many potential pitfalls. Based on our first trials we found that the question 'do you use the computer to analyse data?' needed to be extended into several concrete questions about how, *because many used the computer and spreadsheets only to print calculations done by hand.*

At this point in time the ICD10 courses were in progress and we had to start to use the questionnaires after this second redesign. We soon learned that several of the questions were not necessary. The questionnaires became rather long and people used about 45 minutes to fill them in. This did not cause problems since nearly everybody who were asked filled in the questionnaire.

The questionnaire as a tool inn our survey

We very soon learned that the information officers at local Sum level were very skilled in some aspects of information handling, namely in upward bound reporting and statistical matters, and not in others, such as use of information at their own and lower levels. There were discrepancies between information officers and other staff when it came to knowledge about 'what was going on'. These discrepancies we learned about by 'using' the questionnaires and not so much by analysing the answers, because we could see and discuss with those who did not want to fill in because they 'did not know anything about information.' These two early results made us focus on the structural set-up of the health system at local level; routines and work procedures, job-descriptions, specialisation and responsibilities among staff, flow of information etc.

Rather early in our tour around Mongolia, the use of the computer questionnaires, including interaction with those filling them in, taught us that:

- There is a remarkable discrepancy between the health sector and other sectors with regards to skills in using computers and in educational backgroound.
- Women are the majority of computer users, across all sectors and levels of skill and including those responsible for the computers, in remote areas of Mongolia.

These two examples illustrate the role of the questionnaires in our study; the questionnaires posed the questions and provided us with focused areas of concern. In order to answer these questions we had to apply qualitative methods; interviews, discussions and observations.

More important than the formal aspects of the survey described above was our participatory observation approach. Those we interviewed weere visited at their work place in the local community, and we spent considerable time together with many of them. Everywhere we asked to see computer applications, reports, statistics and other things produced by computers. At Sum level we asked to see data collection tools, feedback reports, local statistics, registers, forms etc. In the Aimak health information offices we asked to see computer based tools, printouts, and discussed the range of hardware and software related problems they had. In most places we provided support on various technical aspects and on software problems such as problems with the printer set-up, use of the Mongol Cyrillic alphabet in a spreadsheet, etc. We also installed some new software. This 'hands on' user contact was valuable in assessing computer usage within the health services.

As important as the 'technical' encounters outlined above was the rich picture provided us by sharing, in a literal way, the conditions of rural and remote Mongolia with those we travelled among. Visiting 13 Aimaks included driving 9000 kilometres in a Russian jeep. This brought us down to the Southern Gobi, north to the Mongol Siberia, west to the central mountains, on to the Great Lakes of western Gobi, and to the mountainous remote western part of Mongolia. Ethnic minorities mostly populate the three westernmost Aimaks. In the one Aimak furthest to the west, Bayan-Olgji, 90% are Kazaks. Most meals and most nights on the road were spent together with locals and we spent several days together with many of the people we interviewed. In this way I could get my own experiences of contemporary remote Mongolia that informed, guided and became part of the study. In 1993 we were not able to do extensive travels to the Aimaks due to petrol shortage. In 1996 the situation was better, but still problematic. Many petrol stations were empty or the petrol was rationed (this rich picture is described further in section 4.1).

Outcome

The second fieldwork in Mongolia confirmed the findings from the first: The behaviour and meaning of the previous Soviet system are inscribed into the health system as well as into the health information system and made up important obstacles to change (see article VIII):

- The inherited centralist and vertical management structures make integration and devolving of decision making power to the Aimak level difficult.
- Due to the ideological legacy of the centrally planned economy the information systems are upward bound reporting systems with a data-led and statistical bias. Local analysis and use of information is not part of this model.
- Primary health care is a very broad concept and as an approach to health systems development it is the very antithesis of the centralised and specialised health system inherited from former Soviet Union.
- System development in such contexts needs to address, and be based in the wider social system.

2.2.5 Phase 4. The HISPP project, the second period in South Africa - focus district

The fourth phase of the project consisted of work in the HISPP (Health Information System Pilot Project). HISPP includes three pilot districts: Khayelitsha, Mitchells Plain and Atlantis, all situated in Cape Town. These districts have been part of my research all along. The preliminary phases of the project started already in 1994/95 and are described in (articles VI, VII). The project is a collaboration between the provincial health authorities, the University of Cape Town, the University of the Western Cape and the Norwegian Computing Centre. The project started formally in early 1996, and has funding from NORAD to mid 1998.

In each of the three pilot districts, a committee was set up with people from the local level health services, Non Governmental Organisations and community structures. These committees manage the project at the local level. They form a team, which participates in the activities of the project. The project has employed a full time co-ordinator, and a full time site facilitator at each site, and three part timers including myself. An executive committee containing representatives from the health authorities, sites and universities manages the project.

In appendix 1 the development of HISPP is described in relation to a 'Six step' model and the actual design and further implications are described and discussed in later sections. The HISPP team consists of the same people that I have been working with since 1994.

The task of the project is to develop a health information system in each pilot district. In our design that includes the integration of all health facilities and programs by means of a district information office and a database. This includes dozens of different organisational units that have to be included in joint efforts. In each individual health facility our aim is to organise an information team of at least two people. A typical problem we have been struggling with in this regard is that the person selected tends to be too senior to actually be able to handle the task, and the process stops. Organising people in task groups and committees have been a major part of the work.

The situation analysis and design of the system has been another major task. The design includes a wide range of social aspects such as the responsible in each facility, the reporting forms and routines as well as the database. Forms have been designed in collaboration with those involved and later piloted, evaluated and changed.

The database was designed and constructed by having a group of people from each pilot site on a three-day course in Access database programming. Thereafter we had a one-day workshop where a first overall model was designed. Then it was programmed and then implemented and tested.

We initiated a process towards putting together of annual reports for the three districts. This involved local people from different organisations collating available data for 1996 and writing a single comprehensive annual report. Because districts were new, it was the first time such reports were produced. The different role-players belonged to different institutions and were part of different information systems. The annual report process was initiated in order to start changing the fragmentation, to create activity and awareness about the district approach and the project. In the preliminary and initial phases it had been difficult to move from 'talking' to 'doing'. The annual report became both a means and an end, and was crucial in forming teams and in creating activity. It became a process tool. Committees had to be formed on tasks and on organisational units. Workshops and meetings were held.

In order to maintain the momentum in the process the production of a monthly report was set as a new goal. The monthly report is a concrete and visual way to formulate the output of the district information system and it would make up a routine replication of this more 'one off' annual report exercise. The annual report was used to design a preliminary data model that is taken further by the monthly report. The district database and the monthly report are being developed further in a joint effort, which includes co-operation with the various levels of users. The work reported in this thesis ends with the development of the early versions of the district database and the monthly district reports. The HISPP case is described in Appendix 1.

The basic characteristic of this work is the need for diffusion: From the district level and 'down' to all facilities in the district, and horizontally, to all other districts in South Africa. In one of our districts, Khayelitsha, a shantytown with about 300.000 inhabitants, we are introducing the first computer based information system. 15-20 health facilities and programs are directly involved, alongside community groups. This is a typical third world situation. The applications have to be both flexible and easy to use and to adapt (i.e. 'move'). 'Horizontally' there are our two other pilot sites, as well as 174 other districts in South Africa.

In the rather turbulent context of South African health and information system reform the HISPP, although on a modest scale, has made some progress, at least in generating experiences. Within this background HISPP participates in a team that was set up at the national level in May 1997 in order to write up guidelines for the design and development of district health information system in order to diffuse the process all over South Africa. The 'Six steps to a district health and management information system ' and the HISPP case in Appendix 1 are inputs to this national process of diffusion. Given the situation problems regarding *diffusion* have been a major research focus in this phase (see section 5.3).

Outcomes

A main research objective and result during this phase has been to develop a theoretical framework to understand and interpret the empirical material I have gathered during the project. This analytical framework is presented in section 1.3. The social system model is presented and applied to the case of Mongolia in (VIII). The discussion part of this thesis draws on this framework. The results of this phase centres around the following themes:

- Practical experience in community based participatory design (see appendix 1)
- 'Information systems, tools for district development'. The concept of duality of structures used in a design approach (see article VIII and section 5.2)
- Cultivation rather than construction - district information systems are social systems and should grow into place based on what is already there (see section 5.3)
- How to diffuse participatory design pilot projects and results from action research from a few to all e.g. districts. *Spread in networks* (see section 5.3).

This phase of developing district health information systems and the process of designing and implementing such a network for diffusion of the results is the ending point of the research reported in this thesis. System development in general, and action-based research in particular, is an ongoing process.

2.2.6 A summary - The interpretation of the two cases

The fact that two countries were studied has been important in the interpretation, or construction, of both cases in that it led to a focus on the intersection of the two cases (see figure 1, Preface). First, in Phase 1, I had only one case, Mongolia, and I explored many possible interpretations. Beside health sector reform I focused on conditions for learning about and appropriating information technology in remote and typical third world contexts. Technological learning, systems of innovation and a recommendation to use the health sector as a protected arena for learning about use and diffusion of IT, came out of this (see articles II, III).

Later, in Phase 2, when I could add South Africa, I narrowed down and concentrated on the health sector and thus on analysis of the two cases. The difficulties to change the health information systems and health systems in general, and the need for bottom-up participatory approaches in order to implement changes according to the primary health care policy were emphasised (see articles IV, VII).

The comparison, and the observed equalities in problem areas and inequalities in the range of approaches and experiences, led to a quest for South-South collaboration (see article V). When I had worked in South Africa over a longer period, I focused on how the participatory design tradition could be adapted to third world contexts. The suggested community based participatory design approach came out of this (see articles IV, VII).

Later again, in Phase 3, I went back to Mongolia for the second fieldwork. The focus here was a detailed study of how information and computers were used at local levels (see article VIII). From there I went directly back to South Africa and Phase 4. This interaction between the two cases led to a more in-depth study of what was common; the resistance towards changes inherent in the installed base. Due to time constraints the empirical material in Phase 4 is not documented in an article. However, the discussion part of this thesis draws on it. A main outcome of this phase is the development of an analytical framework within which 1) information systems are interpreted as social systems, and 2) this model is used in a design strategy (see research questions 4). This framework is presented and applied on the case of Mongolia in (article VIII), which was written in South Africa in 1997.

The cases were also very different, and I have 'allowed' them to develop independently to some extent. In South Africa my engagement as a *complete* participant (Spradley 1990) in action research in HISPP produced a stream of challenges, and possibilities. At the same time this brought me in close contact with the global process towards a National Health Information System, where also, in some minor way, I became a participant.

In Mongolia things were different in that I was more of an observer and less of a participant. I could therefore follow the introduction of computers and efforts to change the health system and information system in a more 'laboratory' way. Thus, I maintain three streams in my interpretation of the two cases; areas that are common in the two cases, and the particularities of each of the two cases.

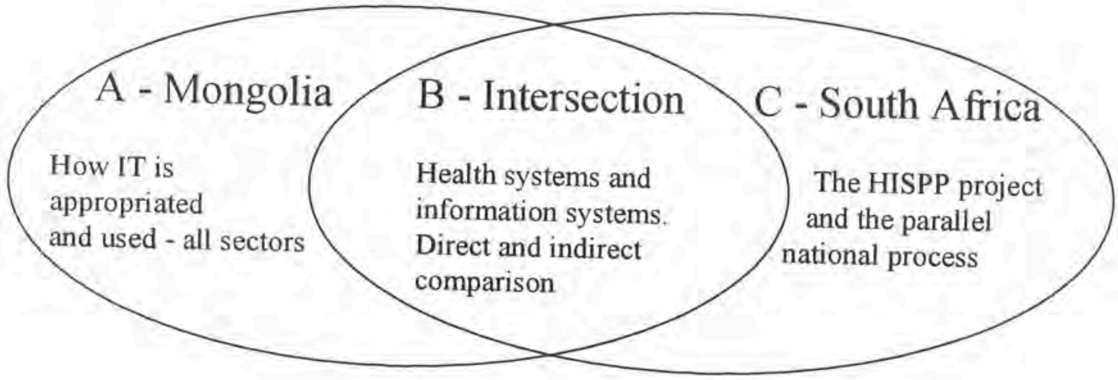

Figure 2.2.6 : Research focus, problem areas and findings: A) Results particular to Mongolia, e.g. how IT is appropriated and used in Mongolia, all sectors including health; B) The intersection between the two country cases: health systems and information systems, direct and indirect comparison of e.g. decentralisation, primary health care and health system reform. C) Results particular to South Africa basically related to HISPP project, and the parallel national process.

The research approach has thus been different in the two cases. The aim of my research has been to interpret processes regarding introduction and use of IT. This I needed to do within a framework where the wider social, technological and cultural aspects of the society, and how these were changing, were interpreted. In South Africa the amount of information to interpret was overwhelming: newspapers, radio, television, books, research reports and so forth, alongside "free access" to people, with whom you share a language. In Mongolia there was no such sources of information. Therefore, when there was no books to read, I had to look for other *signs* to interpret.

To the notion of information systems as social systems I added Lévy-Strauss' theories of how the concrete and visible may be interpreted as signs, pointing at the inner and 'hidden' social and cultural structures. This became a guide to my interpretation of IT, other technologies and the wider society in Mongolia, and thereafter also IT in South Africa.

Community based participatory design, as I have defined to include the concepts of bricolage and cultivation, as well as approaches from the Scandinavian tradition, addresses the *social system*. Thus, the notion of social system has become a main framework in my research, marrying the interpretative and the proactive.

Section 3. Theoretical and analytical frameworks

In this section I first outline the process of formalisation and how it relates to IT and health care. Second I outline two dualities of information systems and present the 'iceberg model' which capture this duality. Third I present and discuss three terms in relation to community based participatory design; *cultivation*, *bricolage* and *community*.

3.1 Formalisation IT and health care

First I describe IT and formalisation. Second I describe Formalisation within the health sector. Third I relate these aspects of formalisation to my cases and compare the third and the first world.

3.1.1 IT and formalisation

The computer is a formal system and is applied within a formalised and closed domain. When a computer program is constructed, the programmer selects and decides which objects, and which properties of these objects, that are needed in order to perform the task. The formalised domain is then a description of a systematic aspect of the context (Kirkebøen 1993).

Only very few aspects of the world may be formalised in such ways that a computer may be applied. IT development builds on historical processes of formalisation in the society (e.g. Jervell 1991; Berg, 1997; Greenbaum 1998). These processes are, according to Jervell (1991), resulting from a dynamic interplay between the use of formalised and closed descriptions, which leads to the building of artificial environments, which again make it possible to formalise and close more.

> "Without this formalisation there would have been practically no arithmetical calculations, text processing and book keeping to be done on the computers." (Jervell 1991, p. 176).

Jervell's description of the process of formalisation in interplay with the building up of artificial environments is analogues with e.g. Star and Ruhler's (1994) notion of infrastructure. "Infrastructure both shapes and is shaped by the convention of practice." (Star and Ruhleder 1994):

- Infrastructure is fundamentally a relational concept. Depending on where you are, you only see the relevant or visible part of the infrastructure. Everything else is invisible or in the background. It becomes infrastructure in relation to organised practices. Thus they ask, when - not what - is an infrastructure.
- Infrastructure is invisible and transparent. It does not have to be reinvented each time or assembled for each task, but invisibly supports those tasks. It follows that it becomes visible upon breakdown.
- Infrastructure is sunk into institutions and technology, and is embedded in conventions of practice

Having spent days and nights in petrol queues in Mongolia I learned that distribution and availability of petrol also is part of the taken for granted and invisible infrastructure of the first world, as are electricity, water, heating, food in the shops etc. All these forgotten prerequisites will become visible upon breakdowns.

Important in my context, is the concept of information infrastructures. They develop and grow over a long time with layers upon and within one another. New features tend to get added as extensions or changes of something already there, the installed base (Hanseth 1996). As the installed base grows, it becomes more important and it becomes increasingly difficult to build new systems from scratch or to implement substantial changes. The diffusion of standards is a reinforcing process leading towards irreversibility and giving the installed base the role of an autonomous actor. As a consequence, new developments must take the installed base into account, and therefor information infrastructures are designed in an evolutionary way.

Hanseth (1996) bases his concept of the installed base as an autonomous actor on case studies on more technical layers of information infrastructures (EDI, Internet, TCP/IP) as the technical aspects of interchanging data. The installed base gets aspects of autonomy and irreversibility because of difficulties of changing already accepted and diffused technical standards, because the systems are large and complex and because many people and institutions have been involved in a political process of standardisation.

Berg (1997) describes a similar process of formalisation, using map and terrain as metaphor and medical records and work practices as examples. The formal, i.e. the closed description, is the map, the empirical is the represented, the terrain. The former is the model of medical work, while the latter is the work as practised. In this way the formal world is produced by "chains of re-representations", as Berg uses Star (1989). The map, or a formal model of an already formalised part of the world (e.g. a medical department and a journal system), is thus a map of a previous map. The original terrain is long gone. Such re-representations develop in a dialectic process influenced by the politics of the real world.

The (figure 4.2.2) showing the model of the district information system from the HISPP example in (section 4.2.2) of a first formal model, or map, of the emerging district. In (appendix 1), there is a drawing of a first simple data base model from HISPP, which is based on the first model. This example illustrates that the map is also forming the 'terrain'. The model of the district information system is a designed model, which aims at transforming the previous fragmented structures into a unified district system (see article VI).

3.1.2 Formalisation in the health sector

Medicine is formed by the hospital

Focault (1975) shows in his book, 'The birth of the clinic', that the arrival of hospitals in the period 1780-1840 affected the way diseases are understood and defined. During this period a rational and precise language for describing and handling diseases was developed. Industrialisation, which led to a demand for labour and then to health of the population, became a central economic and political focus. Hospitals had thus far only been used to hide away the sick. Now the hospitals needed to be turned into as curing-machines. This led to a reorganisation of the hospitals and a redefinition of medical practice:

> ".. the space of the hospital must be organised according to a concrete therapeutic strategy, through the uninterrupted presence of hierarchical prerogatives of doctors, through systems of observations, notation and record-taking, which make it possible to fix a knowledge of different cases, to follow their particular evolution, and also to globalise the data which bear on the long-term life as a whole population, and finally through substituting better-adapted medical and pharmaceutical cures ... The hospital tends towards becoming an essential element in medical technology, not simply as a place for curing, but as an instrument which, for a certain number of serious cases makes curing possible." (Foucault 1980, p. 180)

The arrival of the hospital led to a spiral of developments and institutionalisation within the health profession, medical education and medical knowledge. Institutionalised medical education required standardised medical knowledge. These developments both required and led to increased formalisation and standardisation of medical terminology and knowledge. Diagnoses and system are results of such processes (Kirkebøen 1993).

Given this background we can say that the tendency is more that medical practice and understanding is shaped by the hospital than the other way around. This is important in explaining the difficulties I have observed in the implementing of a primary health care approach and the development of appropriate information systems in this regard. This is so because information systems to support primary health care differ in fundamental ways from traditional hospital information systems (see chapter 1.1 and 1.2).

International standardisation

An important example of the latter is the ICD (International Classification of Diseases) coding scheme administered by the WHO (World Health Organisation). The ICD is both a result and a cause within the process of formalisation and standardisation. ICD is about one hundred years old. It has been revised about every ten years since the end of last century. The current version is ICD10. Its aim is to make it possible to collect and compare global information across countries and organisations.

Health data, patient records, forms, registers and the like, are all formalised and closed descriptions. The data on infant mortality reported in Mongolia, as an example, is defined internationally according to the ICD as death occurring after live birth and before one year of age. Thus, the data collected in those very remote locations of the world is in fact defined through an international process administered by WHO in Geneva. Standardisation within health care is typical for the historical process of formalisation.

Bowker and Star (1994) argue that the ICD scheme is an important infrastructural component of medical and epidemiological software. This was clearly demonstrated when South Africa decided to base all medical coding and their planned new national information system on ICD10. Unintentionally, this decision excluded US software from the tender process since coding in the USA is based on a specific variation of the ICD9.

Two major WHO initiatives went on in the Ministry of Health in parallel with my second field work in Mongolia in 1996. Both had to do with standardisation of health information:

Training in ICD10. All those responsible for data collection at the local Sum (county) level, the 'statistical feltshers', were gathered for a two day seminar on ICD10 in each Aimak (province).

Standardised use of information in primary health care management - the concept of indicators. Those responsible for information in all Aimaks, hospitals, various health institutions and the Ministry of Health were gathered in a two weeks workshop on health information for PHC management. A set of national indicators concerning health status and health service performance was developed. The WHO arranges similar workshops in other countries. I see this as part of an international effort to standardise and formalise the PHC approach. The concept of linking indicators, based on international standards (the ICD10 training), to targets, which are based on problems, is a movement towards making performance and impact of health services measurable. ('goals, targets and indicators' has been a main part of our work in HISPP, see 'The way forward' in (article V)).

3.1.3 Computers work within formalised islands - both in the third and the first world

Computers are only applied within formalised areas and artificial environments, which may be seen as artificial islands within an untamed open world. These 'islands' result from twin processes of formalisation and the construction of artificial environments (Jervell 1991). These process have been going on over longer time and within broader areas in the first world than in the third world.

Differences between hospitals and primary health care illustrate differences in formalisation. Hospitals have been formalised and standardised over two centuries, whereas the primary health care concept was first formulated in 1978. Moreover, scholars and practitioners are still debating how PHC is best implemented. Compared with the hospital, PHC is thus much less stable and mature, both as a general concept, and as an institutionalised set of work practices. Design of the information system to support a primary health care approach is therefore also about the design of new work practices and new social structures. Both the 'model' and the 'terrain' is being designed and cultivated simultaneously. For this reason, development of information systems to support primary health care needs to be part of the wider health sector reform (article VIII).

As argued earlier, the fundamental difference between the hospital and the PHC approach implies that approaches towards system development within the two areas will differ.

In both Mongolia and South Africa I have observed a strong resistance to change inherent in the health system. It is not simply to design a new 'rational' information system, the prevailing information systems and institutional structures, the installed base, must be taken into consideration. As Hanseth et al (1996) explain, the installed base represents an accumulated resistance against change.

Within the present context we can say that the process of formalisation has led to closure of increasingly many aspects of the health system, in standards, information systems and routines, information infrastructures. Closure for some time occurs when consensus emerges. When the social groups involved in the process of using and designing the technology decide that a problem is solved, they stabilise the technology (Bijker 1993). Closure thus means that 'decisions are taken', it becomes increasingly difficult to implement changes, and the information infrastructure becomes irreversible (Hanseth 1996).

To use Berg's (1997) metaphor of map and terrain: The more the new maps are based on a sequence of previous maps, or re-representations, the less radical the changes will tend to be. Changes will tend to be in the form of "piecemeal engineering" (Popper 1986). The more open the terrain is, the less complex and irreversible will the installed base be, and the bigger is the scope for decisions. It is important to note that revolutionary changes overrule any degree of irreversibility. As is evident from the overall context of my case material, even the most irreversible structure, as the Soviet Union, may change. Structuration theory and the duality of structures (Giddens 1984) explain that even the most irreversible structure may change because they are constructed by social action. I will come back to the duality of structures in the next section.

The more formalised an area is, the bigger the "artificial island" is, the more difficult is it to implement changes and build new IT systems from scratch. It follows that the installed base tends to be less tamed and closed in the third world than is the case in the first world. This explains the paradox in (section 1.1); why 'nomads' in Mongolia, despite a largely inferior infrastructure, at one point in time had a far more 'advanced' usage of electronic communication than what was the case within the technically advanced government sector in Norway.

In the process of designing information systems to support primary health care in HISPP in South Africa we have been involved in a 'first closure' and a first 'formal map' in the districts we are working in. This process has been characterised as uncertain, with respect to goals and context of system development. People are not familiar with computers, the situation is open and there are many potential ways to design a system, and so forth. In (article VII) I discuss this and argue that such uncertainty may be a general tendency in third world system development.

Problems of uncertainty caused by complexity in the first world

In the contemporary first world the increasing complexity of the existing information infrastructure has led to analogues problems. It has become increasingly difficult to get a 'total' overview and to control the development of the information systems. The autonomy and unruliness of the installed base has led to the notion of *drifting* to capture how large information systems are evolving (Ciborra 1996a, 1997). The development may not be controlled totally, but a strategy which incorporates tinkering and bricolage is a way to approach the problem (Ciborra 1994). Within a similar background, Orlikowsky (1996) uses *improvisation* to indicate how the uncertainty may be managed.

For different reasons, though, problems faced by third world computing have parallels with problems increasingly faced within the more complex areas of the first world. I have suggested bricolage and cultivation as remedies to overcome the problems in the third world contexts. Similar remedies are suggested within the complex first world contexts (Dahlbom, Janlert 1996; Ciborra 1994; Hanseth 1996). Thus, the study of modern IT under more difficult conditions in the third world is also of relevance in the first world.

3.2. Dualities of information systems Information

In my research of the health information systems in Mongolia and South Africa, two perspectives on the social system model, and how social systems may be interpreted, have emerged.

1) In both Mongolia and South Africa, the large information systems 'are' social because they consist of, and are made up by, social actions. They are thus difficult to separate from the wider social context. I have used Lévy-Strauss' structuralism to interpret such social systems by analysing the relationship between the visible, concrete, or externalised structures on the one hand, and the invisible, internalised structures on the other. When we drew up the information flows in the health sector in South Africa, we at the same time drew up the structure of the social system. In a similar way to what Lévy-Strauss (1973) compared with freezing the time by taking a photograph to make the inherent structures appear.

2) The large information systems 'are' social in that they consist of social relationships and structures, which are created by social action (in 1). As a next step these structures and relationships make up the conditions under which social action takes place. This duality of structure (Giddens 1984) is an 'active' and dynamic mechanism that is important in (re) producing institutions.

In the following I first outline a few aspects of Lévy-Strauss' structuralism and then of Giddens' structuration, which I have used in relation to the two above perspectives on social systems. Thereafter I present the iceberg model which capture the dual aspects of information systems regarded as social systems.

Lévy-Strauss' structuralism –visible and invisible structures

> "The circular arrangement of the huts around the men's house is so important a factor in their social and religious life that the Salesian missionaries in the Rio das Garcas region were quick to realise that the surest way to convert the Bororo was to make them abandon their village in favour of one with the houses set out in parallel rows. Once they had been deprived of their bearings and were without the plan which acted as confirmation of their native lore, the Indians soon lost any feeling for tradition; it was as if their social and religious systems (.. one cannot be dissociated from the other) were too complex to exist without the pattern which was embodied in the plan of the village and of which their awareness was constantly being refreshed by their everyday activities."
>
> (Lévy-Strauss 1973, pp 286)

Inspired by Dahlbom and Mathiasen (1993) I use the Bororo example to illustrate some structural aspects of information systems. I use the example to demonstrate the relations between the visible, concrete and identifiable parts of structures and the internalised and invisible parts: between the arrows of information flow and the more invisible structures that the information flows are outcomes of. Between the technical aspects of the information systems as computers, reports, standards and data collection tools, on the one hand, and the underlying invisible parts of the installed base on the other. These visible manifestations are again communicating with, and having impact on the underlying invisible symbolic structures.

Lévy-Strauss sees social products as artefacts, tools, food, buildings, cloths, language, myths, family relations and the like as signs, and as means of communication. These signs are communicating the social order, and in illiterate societies they were important in communicating the social order from one generation to the next. On the one hand the meaning and behaviour were inscribed into these objects as an outcome of the internal and symbolic structure, while on the other hand the meaning and behaviour were communicated back to the internal structures.

When artefacts and other social products are seen as signs, as means of communication, they gain importance beyond their material functionality. Computer systems therefore, argue Dahlbom and Mathiassen (1993), also symbolise and communicate a social organisation. An implication of Levy-Strauss' view is that new artefacts, a new village structure or a new information system, are not introduced into a material void, they take their place among the other artefacts and are given a local adaptation.

As illustrated in the above quotation, the missionaries' strategy was a radically different one, as was their purpose. They made the Bororos abandon their circular arrangements, which played an important role in the organisation of their social and religious life. A diameter running through the village divided the population into two halves. Two rules based on this division were of particular importance: an individual belongs to the same moiety as his mother and he can only marry a member of the other moiety (Lévy-Strauss 1973). Once the Bororos had been deprived of the signs represented by the village structure, which communicated the social order and acted as a confirmation of their native lore, they soon lost their feeling for tradition. By changing a material structural foundation the missionaries created an opportunity for imposing other cultural norms and religious beliefs.

This example has clear parallels with the conflict between the nomad culture and the radically different imposed Soviet structure in Mongolia. It is a popular view that the nomad culture survived in the gers, the nomad tents, because these were not removed by the Soviet style modernisation. The ger has a role similar to the circular arrangements in Bororo (section 4.1).

I began to use these aspects of Lévy-Strauss' structuralism during the first fieldwork in Mongolia. When I arrived in Mongolia everything was very different from other parts of the world I had experienced. The massive and very visible Soviet technology implanted in a naked and barren landscape, which is extensively cultivated by a nomad mode of production, is indeed very symbolic. Moreover, due to language problems, there were very little written sources to rely on. All this led me to put much emphasis on the material and concrete signs of the nomad, Soviet, and new capitalist social system and culture. My interpretation of Mongolia evolves around four key symbols (see section 4.1.1), which I have used as keys to my understanding of the wider social systems of Mongolia, as well as to the health information systems.

Interpreting social systems using Giddens' "duality of structures"

The primary 'information' purposes of systems can be to provide information for such purposes: decision making; surveillance; statistics, or production, e.g. registration of patients that as a secondary product may provide statistics or information of the former type. Information handling creates processes and (re) produce social relationship. By becoming routine, these *processes* of information handling and interchanging constitute the institutional *structures*. This duality of social processes, as both containing process and structure, both *action* and *conditions for action*, is captured in Giddens' notion of structuration (Giddens 1984, p. 25):

> "Crucial to the idea of structuration is the theorem of duality of structure, .. The constitution of agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality. According to the notion of the duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organise. Structure is not 'external' to individuals: .. as memory traces and as instantiated in social practices . .. Structure is not to be equated with constraint but is always both constraining and enabling.."

Social structure is on the one side something that is enabling and constraining and on the other side what is actually happening. Social structure is understood as both the prerequisites for, and framework within which social action may unfold, and at the same time it is the total amount of social action that is actually going on. Social structure is created by the social action, which again is enabled and constrained by the social structure.

Information systems are part of the structural properties of the social systems of which they are part. According to Giddens these structural properties of social system are "both medium and outcome of the process they recursively organise" (ibid.). This can be illustrated by the fragmented health information infrastructures we have studied in South Africa (see article VI). Under apartheid health services were organised according to race. Facilities belonging to each institution were located in a fragmented fashion according to race. Then various types of health services where organised in different institutions according to type of service (e.g. curative, PHC, psychiatric). Reporting and information systems were established, and as part of colonial and apartheid ideology, they became very centralist.

The outcome of these processes is reflected in the one way arrows in the drawings of the information flow and in the fragmentation of the health services (see article VI, and section 4.2). The other way around, it is easy to see that these information systems again, are means to preserve the structures of which they were outcomes. Not only the fragmentation, also the distribution of power and scope of decision making is constituted and preserved through the meaning and behaviour inscribed in the information systems, symbolised in the one-way arrows. In Mongolia we found the upward bound system of reporting information to be instrumental in disempowering the local levels of the health system. This is reflected in the one-way arrows pointing upwards in the drawing of the information flow (VIII).

Structuralism, as represented by Lévy-Strauss, implies a rather one-to-one relationship between action and structure, and gives little room for manoeuvre within a given structure. Structuration theory, on the other hand, accept the possibility of radical and revolutionary changes. Gilbert and Gugler (1992) study third world urban development and discuss these aspects of structuration theory in contrast to structuralism:

> "Within sociology, 'structuralism' has given way to the idea of 'structuration' (Giddens 1984). Put crudely, the latter approach accepts the possibility of change within broad structural constraints. Human agency can modify society even when odds are against it. Hence social movements may spring up against dictatorships and transform the way that the state acts." .. "In short, there is no automatic route which the third world countries are bound to follow. Their futures are not determined by the inevitable forces of the world economic system and by the societies constructed in response to that system." .. "The theory of structuration implies that different paths to change can be followed even by societies facing similar internal and external constraints. Unsatisfactory though it may seem, such an approach strongly suggests that there can no longer be a master plan for social change." (Gilbert, Gugler 1992, p. 3)

The Iceberg model - the relationship between what is visible and what is not

Inspired by the theories of Levy-Strauss and Giddens outlined above, I present an 'iceberg model' to illustrate the dynamic relationship between the *visible* and *invisible* structures built into information systems. The iceberg metaphor also illustrates the relation between the relatively small visible tip and the much larger invisible body.

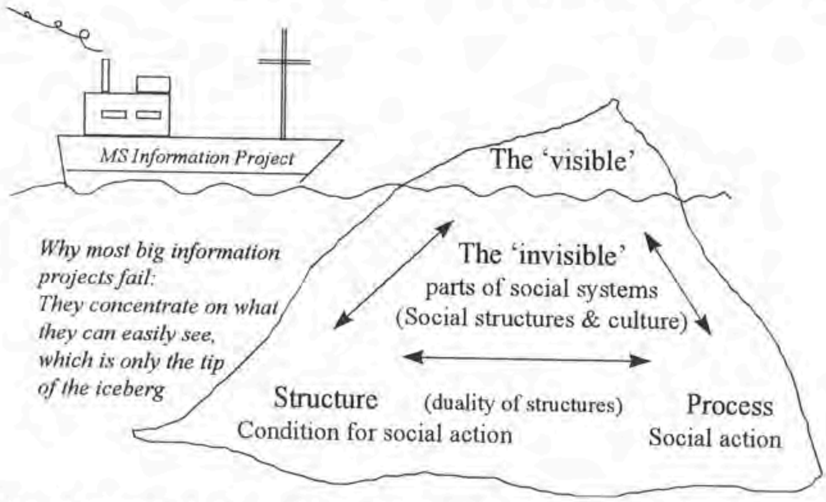

Figure 3.2[4]: The iceberg model. The visible and the invisible part of social systems; culture and social structures. Computers, information, flow of information, routines and procedures are all parts of the 'visible' part of the in formation system regarded as a social system. The flow of information is reflecting social structures, and takes part in shaping social structures. The ship illustrates the information system project which bases their strategy on a discrete-entity model, which only includes the tip of the iceberg in the system analysis. Since health district information systems are social systems, the entire 'iceberg' including the invisible parts of the 'social' information system needs to be considered.

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[4] This drawing was first used in a presentation called "District Health Information Systems need to be prioritised in national policy" at the "18th African Health Sciences Conference", Cape Town, April, 1997.

The structures in question I categorise as being related to social structure or culture. Social structure includes the modern sector as well as traditional systems based on kinship. The visible social structures as illustrated in the Bororo example and the information flows represent the kinship and modern sector type respectively.

I used this model as an illustration of why and how large system development projects within health care often failed. The message was that when analysing and trying to change large information systems, what you see is only a small part of the wider social systems.

The metaphor also illustrates the 'buoyancy' and resistance inherent in the social system, and the installed base. One cuts away a part and something slightly different will appear. It will not disappear before it is completely melted, or worn away. The tip and the body are mutually dependants.

In a practical approach to system development in South Africa I have used the iceberg model to argue heavily around the fact that what you see, is not all there is, and that to change systems is difficult. The argument is that information systems are in fact social systems. Viewing the visible structures as signs representing and communicating with the internal structures is useful as a guide 'down' to the more invisible social system and installed base. The interpretation and mapping of the signs represented by health information system is thus a reflection of the hierarchical structures in the health sector down to the individual health worker.

3.3 Community based participatory design - a design strategy based on the social system paradigm

In this section I present in more depth three concepts that are used in relation to the community based participatory design approach from research question 2 (section 1.3); cultivation, bricolage and community.

Cultivation

The concept of cultivation proposed as a contrast to construction, is suggested by Dahlbom and Janlert, (1996). Cultivation denotes a way of shaping technology that is fundamentally different from rational planning, engineering methods and construction of technology. Cultivation is about interfering with, supporting and controlling natural processes that are in the material, "the tomatoes themselves must grow, just as the wound itself must heal, ..".

> "Construction is a radical belief in our power to, once and for all, shape the world in accordance with our rationally founded goals. Cultivation is a conservative belief in the power of natural systems to withstand our effort at design, either by disarming them or by ruining them by breakdown." (Ibid. 7)

Cultivation is founded on the understanding of technical systems as "organisms" with a life of their own (Ciborra 1997). It turns the focus on the limits of rational, human control and addresses the autonomy of the installed base (Hanseth 1996). Cultivation is thus seen as in opposition to structured methods and consisting of incremental and evolutionary approaches, as captured in Popper's (1986) "piecemeal engineering".

The social system perspective put forward here is inspired by the Scandinavian approach. Though the more narrowly focused perspectives of the present blend of participatory design and the third generation of the Scandinavian approach (see Preface) is also important within a social system perspective. In Mongolia I have experienced what I label a typical third world situation: "40 people, 20 organised units and *one computer*". This typical situation I have used to emphasise the necessity of basing third world computing on a social system paradigm. However, the typical situation also emphasises the crucial role of the *one computer*. Local adaptation and sustainability of the more narrow computer based system, including the users, are of particular importance in third world contexts. The constraints regarding lack of technical skills, relevant information system expertise and general infrastructure and support, make techniques and approaches from the present 'blend' of participatory approaches appropriate and necessary.

Bricolage - a third world approach to technology development

Dahlbom and Mathiassen (1993) address similar social system problems and suggest the 'bricoleur', or 'tinkerer', as an alternative to the rational engineer in the design and change process. Levy-Strauss uses the bricoleur as an opposition to the engineer to illustrate the differences between scientific enquiry in illiterate and modern societies (1966). The engineer starts out by defining and specifying his goal, then choosing and constructing his tools in order to reach this goal. The bricoleur on the other hand, will take the possibilities given him by his tools and other possessions as his point of departure, and define the goals and way forward according to that. The bricoleur will improvise out of the possibilities given by what he has in hand and the results might look like patchwork. Particular tools will be used for many purposes. The bricoleur thinks in association to concrete observable things, which helps him to remember, while the engineer builds on abstract mathematics and technical drawings. The engineer builds abstractions on abstractions where the bricoleur builds abstractions on observations.

In system development, a bricolage approach allows and encourages tinkering by people close to the operational level by i.e. combining and applying known tools and routines at hand to solve new problems. The value of tinkering lies in keeping the development - or cultivation - of the information system close to the competencies of the organisation and its ongoing fluctuations in local practices (Ciborra 1994). In similar ways the present 'blend' of participatory approaches has a bricolage approach inherent by its flexibility and multiple ways to address user participation. I also take bricolage to denote a strategy of tinkering and improvisation between and within levels, as part of the cultivation.

The bricoleur is the road-side 'bush' mechanic you meet in Africa or in Mongolia who gets the car going by way of 'magic' - or by whatever is at hand in an improvised way. In Mongolia I found that bricolage was built into the organisation of the technology. The Russian jeeps, as an example, had to be driven by a combined bricoleur and driver. The radiological equipment likewise. The informal networks that were supporting computer users in the Aimaks illustrate a similar tendency. This I take to be related to the less stable and more uncertain technical environment in the third world. The network of support, taken for granted in the first world, is not present to the same extent. Technology will need to rely on local ability to find a possible, not necessarily optimal, way when a break-down occurs.

The bricoleur discovers functions in a bottom-up manner as potential in artefacts, materials, and other resources at hand while inquiring into particular tasks. Due to contextual constraints, bricolage is particularly appropriate in third world system development where local resources and potentials form the point of departure. In the remote areas of Mongolia we found that use and development of IT relied upon bricolage and tinkering in informal networks of computer users supporting each other (see article VIII).

In this thesis I examine the potential in community based health district information systems in accordance with such a bricolage approach. Levy-Strauss sees art as music and poetry, as a trade-off or mixture of a bricolage and an engineer approach that makes up 'sauvage', or free niches of associative and free creativity in the modern society. Thus, bricolage and more structured approaches need to be combined. Various aspects of the Scandinavian approaches and participatory design exemplify the combination of an engineer and a bricoleur. Prototyping, as an example, combine structured modular programming with improvisation in and within the environment and with users. In a multileveled approach the user need not be restricted to the computer user. As outlined in (article IV, VII), the community represents many levels of such users.

Community - localised trust

The term the *community* has a range of meanings. It ranges from the community as a physical place, the local level, and its various formal and informal institutions, via grassroots organisations and non-governmental organisations (NGOs), to institutions less directly linked to the physical place like various communities of interests and unions. The community is linked to the local and 'smaller' scale.

Community based institutions will typically be built on *trust* by face to face commitments rather than faceless commitment, to the concrete, local and physical more than to the abstract (Giddens 1990). Giddens (ibid.) notes that the nature of modern institutions is deeply bound up with the mechanisms of trust in abstract systems; the law, medicine, banks, social security, various kinds of expertise, and so forth. The traditional institutions, on the other hand, he holds, are similarly deeply bound up with the community as a place. Trust in traditional society is related to "facework commitments", whereas trust is related to "faceless commitment" in modern society.

My research has shown that trust in the personal, individual and face-to-face relations are indeed important within the modern health institutions in South Africa and Mongolia. Moreover, it is obvious that trust in the abstract, as in religion and god, is indeed part of traditional society. I nevertheless agree that the difference between the local, personal and concrete on the one hand, and the global/universal, abstract and faceless, on the other, are important aspects of the difference between the third and the first world. Translated into a strategy of IT development in third world contexts it again emphasises the importance of the social system paradigm in third world computing.

A community based participatory design approach, as presented in (article VII) adds a political perspective (Greenbaum, Madsen 1993), to a social system perspective. Midgley (1986) argues that the community is the key level for social development in the third world. In South Africa a political perspective is added to this issue. The community is widely used as a political term, meaning both the focus of social and economic development and as a (potentially) powerful role player, represented by a wide range of institutions. In the political discourse the term community is used analogous to the combination of the terms such as working class and unions, object and subject in social and political development. In the ANC's National Health Plan (ANC 1994b) the community is used to denote the smallest building blocks of the health system, each will be provided with a community health centre. A number of communities then make up the health district. Formal community participation is granted at both community health centre level, and at district level regarding the management of the district.

The health system is being developed in order to serve the community better. Therefore, the focus should be on the needs of the community, rather than, but not excluding e.g. the nurses need for a system that fit their perceptions and is user-friendly, protect their turfs, reduce paper work, etc. Korpela (1994) pursues a similar point when he argues that the clients of information system users also should be taken into account. Within this framework a community based participatory design approach will aim at empowerment and influence.

In both Mongolia and South Africa community involvement is very limited because the process has been dominated by health personnel and bureaucrats.

A community based multileveled approach will change the scope of action because goals that are beyond the health services themselves are brought into focus (article VII). This view is in contrast to what is argued by e.g. (Sandiford et al. 1992), namely that health information should be restricted to the scope of action of the management in question. From this perspective only information that may be acted upon is relevant; Since the health services have no influence on housing and other socio-economic factors, information on these issues is not relevant. The community, on the other hand, will have a much wider scope of action if they turn the information into political and social action (see article VII).

Section 4. Presentation of the two case studies - Mongolia and South Africa

In this section I give a richer description of the two cases of Mongolia and South Africa in relation to the particular focus my research had in the two countries. The two countries are different, as were my research approaches in the two countries. The aim is to provide a richer background to the cases described in the articles. While the case of Mongolia requires a richer description of the society and culture, the case of South Africa needs a better description of the processes which form the context of my research. As a result the descriptions of the two cases in this section will differ.

First I present the case of Mongolia, then the case of South Africa. In both cases a focus is on the process of developing the national health information systems in relation to the ongoing health sector reform. In the concluding part I discuss the fact that rather similar obstacles to the development of health information systems and health sector reform are observed in both countries.

4.1 The case of Mongolia

> "There were 767 monastic centres in all. Of these, 724 have now been torn down or rid of lamas. Six are not rid of them. The fate of 37 has not yet been decided." Report from the Department for Religious Affairs 1938, after Yunden et al. 1991, p. 78)

> "Thank's to Stalin's concern, in the country where the Living Buddha was worshipped, there appeared the industrial combinative; into an uncultured land there penetrated the light of culture" In praise of Stalin, 1941, after (Siclos 1991)

The two citations above indicate a strategy where the construction of the new society was assumed to require the destruction of the old. In a way similar to the strategy of the missionaries in the case of the Bororo (Lévy-Strauss 1973), the communists literally eliminated the physical structures of the old belief system of Lamaism. Out of the 'cleared land', the industrial combinative, the modern state, enlightenment and the new 'homus sovieticus' would appear.

In this section I will present and discuss examples of technology where the ancient system of belief meets the Soviet modern one, and lately, both those two 'systems' have met the market liberal modernism. Within this dynamic field, consisting of three clearly separable world-views, I have identified four ideal types ('clusters') of technologies. These four ideal types represent key symbols (Ortner 1973) within the nomadic culture, the Soviet era centralism and planned economy and the new actor: capitalism and market liberalism.

The iceberg model provides a tool in this respect; the key symbols and other visible parts of the nomadic and the Soviet technology represent pointers into the internalised structures. Technology is regarded as a social system, and "marries the material, the social and the symbolic in a complex web of associations" (Pfaffenberg 1988).

Due to contextual constraints (language, written materials, travel) my interpretation of the key issues of the Mongolian context unfolded 'bottom-up' through daily study of 'typical' aspects of Mongol life. I have used the concrete and material as signs into the social systems. The typical I found to be linked to the opposition between the giant scale Soviet technology on the one hand and, on the other, the local scale Mongol dwelling, the *ger*. The information systems I have studied I interpret within a parallel framework. On this background I have used four key symbols representing clusters of technologies and meaning in my research.

In the following I first describe the Mongol society based on four key symbols. Second I describe computer usage in the Aimaks. Third I describe the process of developing health information systems.

4.1.1 Mongolia: four key symbols

- The *ger*, the Mongol tent, or dwelling. The ger is both a reflection and a confirmation of the Mongol cosmos and the nomad technology. In the centre of the ger is the 'heart', golomt, the fireplace, which in addition to representing the difference between life and death during the winter, symbolises the ties with the ancestors.

- The *central housing and heating system*, I regard as symbolising the new, or contrasting, Soviet modernism; the giant is beautiful, the centralism, and the industrial combinat. Several hundred thousand people are connected to one of two such 'heaters' in Ulaanbaatar. In this way the reliance to the ancestral heart, which represents local self reliance, is replaced by reliance to the 'heart' of the modern state, which represents the modern national and welfare state, the new homus sovieticus.

- The *State statistical computer based information system*, I see as symbolising the other main characteristic of the Soviet technology, the planned economy. At the same time the dull computer of the past, is contrasting the 'glorious' computer of the future. This is put forward as a symbol of the new market economy in the next paragraph.

These three ideal technologies, or key symbols, I see as being 'summarising' symbols, to borrow a term from Ortner (1973). They are reflections of the whole universe of meanings, and values. More so the two former than the latter, which is more indirect and will need some interpretation. The fourth key symbol I put forward is representing the new market economy, or more precisely, the promised prosperity.

- The *'shining' or 'glorious' computers* in the new, elegant and (western) modern Stock exchange. This latter key symbol is at the elaborative end of a scale where the summarising key symbols are at the opposite end. This symbol, linked as it is to the stock exchange, 'promises', where the centralised heating system 'summarises' the Soviet ideology.

The two first symbols are chosen because they represent the Mongol society, the two latter because they represent computer use in modern Mongolia.

4.1.1.1 The ger - symbolising self reliance and the local scale

When a Mongol woman buys a sewing-machine she has an allotted place in her ger to put it, and this place is the same in every ger across the steppes (Humphrey 1974). Mongols have socially-designated places in their tents for people and objects. Present-day Mongols persistently categorise objects in terms of their position in space, and they use this categorisation to define social positions. Travellers as long ago as in the 13th century noted this characteristic of Mongol life (ibid.).

The ger is the white, round, felt-covered tent, which, with variations, have been used by nomads in Central Asia for a long time. When the top of the ger is closed the ger can stand against the lowest temperatures possible only heated by scarce cow dung. The ger is easy to move and is assembled in an hour or two. The majority of Mongolians still live in gers. Even in the capital of Ulaanbaatar it is estimated that at least 40% of the total population live in the ger-towns that make up the suburbs.

By its outside orientation in relation to the sun - the door is always facing south, and the strictly rule based internal construction and behavioural patterns are both representing and reproducing the entire cosmos. The ger both represents and symbolises the independent, harsh and self-sufficient nomadic life. The functional aspects are inseparable from the symbolic. The Soviet modern apartment blocks in Ulaanbaatar are placed without regard to the sun. Why? I asked: "A house is not a ger, it is two different systems", I was told.

The family was before, and has again become, the main unit of ownership and production in herding. At least before, and seemingly still, their life is organised in an exceptionally rigid and formal manner, closely tied to the old social conditions. Explicit rules and prohibitions within the domestic circle of the ger maintained categories of age, sex, seniority, wealth, and religious status. The ger was the focus for relationships between people widely separated by daily occupations. It provided a space in which every category of person or object in the nomad's world could be located, and so became a kind of microcosmos of the social world of the Mongols (Humphrey 1974).

Since it appears to be such a tight connection between the visible and invisible structures, an approach to study changes in social relationships and technology may be to study the developments in the system of categorisation. Such changes that occurred over a couple of generations prior to 1971, are registered by Tserenxand (1971), and analysed further by Humphrey (1974), where the two drawings of before and now (i.e. 1974) are taken.

The ger is divided into four sections, with the 'ancestral heart' - *golomt*, in the centre. The area between the door and the heart (south), is the junior or low status half, called the lower part. The half to the north is the honorific 'upper' part, the *khoimor*. The half to the east is the male, or ritually poor half, while the western half is the female, impure, or dirty section, though only up to the khoimor. Within these four areas the ger was further divided into named sections. Each of these was the designated sleeping place of people in different social roles and the correct storing place of various artefacts. There was no single place in the ger where arbitrary things could be placed indifferently. People and roles were tightly connected to their objects. People could move around the ger, but they had to sit, eat and sleep in their correct places.

The ger as an illustration of technological change and diffusion

The two drawings illustrate how new technology have been adapted in between the existing symbol system and, on the one hand, are *given* meaning from the old categories and, on the other, are *giving* meaning to old and new categories. The ger illustrates that the visible parts of technology as a social system are communicating meaning and behaviour, in a dynamic dialogue with the internalised and invisible part of the social system, as put forward in the iceberg model. Moreover, the ger illustrates that technology is diffused and introduced in dialogue with the existing system (Pacey 1990). Building on Tserenxand (1971) and Humphrey (1974), I categorise the technological changes reflected in the two drawings of the ger as follows:,

New functions merged into old categories.

As may be seen in the two drawings, many new technological artefacts are merged into the old categories. This happens typically when the functions of the new objects are equivalent to a traditional function. Examples here are the new metal stove which replaced the fire place, the new wardrobes and chest-of-drawers replacing the old bags and painted chests, and the iron buckets and china crockery are replacing the wooden pails and root-wood bowls.

New functions give new categories in between the old.

The radio represents a new function and was given a new place and category. After the time of the drawing, the television set is introduced and placed similarly. The motor bike I have seen many places, always placed next to the door, at the 'dirty' side, not among the horse gear at the 'pure' side.

Old categories get new content, objects are give value by old categories.

The Buddhist altar, which formerly was the centre of the honorific arrangement reserved for men, was as reported by Tserenxand in 1971, virtually never seen. My observations, some 25 years later, indicate that the Buddhist altars are still very rare, even though there is a Lamaist revival in Mongolia. This place is everywhere used for a shelf with family photographs and ornaments, thus reserving the khoimor for honoured images, and thus substituting photographs of family members for pictures and statues of Lamaist deities.

The status of children are being negotiated by new and old categories

There have been many governmental campaigns towards giving more value to children in Mongolia. It has been a move towards placing the children's bed in the khoimor, the most honoured place in the ger (Humperey 1974). It can be seen in the first drawing that there is no category for children's bed. In the 'present' drawing, children's bed is included as are toys. Children traditionally slept on the ground, beside the parent's bed. This is widely thought to be inadequate. Mongolia has traditionally had (and still has) a very high infant mortality. Neglect of children is important in this picture. This issue is an underlying theme in the example of information handling and infant mortality in (article IV).

Figure 4.1.1.1a: The traditional ger (after Humphrey 1974). 1) Saddle, lasso, etc. 2) bridle, 3) Airag, preparation of fermented mare's milk in leather bag, 4) youghurt, 5) storing felt, skins, 8) Mongol and Tibetan books, 9) the centre of the Xhoimor which extends to 8 and 19, Buddhist altar, painting statues, praying wheel, chest with valuable things; 10) chest with wife's valuables; 12) marital bed; 15) coocking pot, cleaning rag; 17) low table for serving tea etc.;18) fireplace; 19) dried dung fuel; 22) the lowest place, barely counted as being inside.

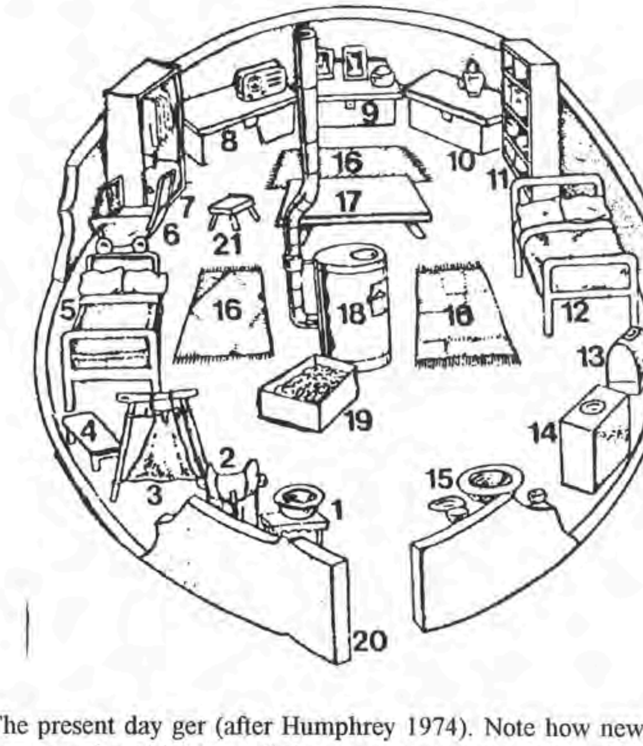

Figure 4.1.1.1a: The present day ger (after Humphrey 1974). Note how new technologies and world views arrive in between the old (the radio), as replacements of the old (fireplace, wardrobe), as transformations of the old (the holy parts, the books, the role of women) and sometimes as something totally new (the washbowl). 1) the washstand, the new 'hygienic corner'. 5) the new children's bed, 7) wardrobe, 8) chest; 9) chest with valuables, framed photographs of family members, ornaments, prizes, diplomas, 11) Book case 13) portable sewing machine, 15) coocking pot, utencils for washing

up. The sitting places have not changed: in front of 5) junior male guests towards the door, older towards the xhhoimor, outside 10) the male head, in front of 12) wife children, female guests.

A popular belief is that the inferior status of children in the harsh world of the nomads is due to the fact that children would have to prove their strength by surviving before being given value. It is in order to change cultural attitudes towards children that the government has used the ancient structures and categories as means to inscribe new patterns of behaviour. Radical and modern parents will tend to follow this policy, while more traditionally minded people find reasons to put children elsewhere (Tserenxand 1971).

The use and meaning of the material objects may change because of changes in social roles.

The place where the books are kept is changed between the two drawings. In former times, books were appropriate only for lamas and senior men, and were kept in the senior male part of the khoimor wrapped in silk. Women were forbidden to read them. Since the revolution, literacy has been a main concern by the government. The success of this campaign is manifested by the fact that now, the bookshelf is placed by the head of the parents bed, on the woman side.

New objects and technologies transcend and transform old categories.

The washstand is a new object that by its very existence transforms old categories. Before, washing was nearly non-existent, one reason was that it was regarded ritually wrong because it polluted the spirit of the water, scarcity of water may also have been a reason. It is placed close to the door, in the men's half, opposite the place where dirty utensils are kept. By its presence the washstand creates a space which is open to all, and this is new (Humpherey 1974). This development is the result of the government's campaigns on hygiene over many years.

Summary

The ger is an example of the material structures and signs that, following Lévy-Strauss (1973) communicate cultural and social behaviour and meaning from one generation to the next. In this way the material technology may be seen as 'frozen' social action, representing social structures. These structures will then again set the conditions, for further action, action that reproduce and change the very same social structures.

It is important to stress that the visible, the material or concrete objects, or categories, are not mere reflections of the internal structures. On the contrary, the objects are *actors* in the wider network that are carrying scripts for action (Achrich 1992).

The *khoimor* is an actor in favour of the government in their efforts to increase to symbolic value of children by locating the children's bed there, or in favour of the traditionalist or Lamaist position. This example illustrates that social structure is both a means and an end, and that it is both constraining and enabling. The shifting status of books and women, and the new category for behaviour and relationship created by the washbowl, are further illustrations in support of this view. The visible structures of the ger are thus used as actors in the government's policy to introduce new values and behaviour.

The strategy based on structuration proposed in this thesis (research question 4) aims in a similar way to use the structural properties of social systems as actors in a change process at the local Sum level in Mongolia (article VIII). The example from the ger shows that changes in behaviour and meaning occur through rather slow processes, and is best understood as *transformation* of the social system. The existing social system forms the point of departure. It is worth mentioning that the local self-reliance inherent in the ger and nomad technology is a substantial aspect of the communities in Mongolia. This property needs to be addressed and strengthened in a strategy to empower the local community level within the health system in Mongolia.

The ger as a flexible technology in the process of change

Over the last years the conditions for the nomads have changed drastically. State owned herds that were organised in brigades are now privatised. Over the same period the economic crisis has caused the money economy to be replaced partly by a subsistent economy. It was something of a mystery how the 600000 inhabitants in Ulaanbaatar survived with no food in the shops, as was the case in 1993. The large urban population, 51% of the total, survived well, considering the severe difficulties. People survived through networks with the countryside and the informal networks. The nomad mode of production turned out to be very flexible and adaptable to the new situation.

The remarkable smooth transition to private ownership of the herds is due to the fact that the herds were also before organised in smaller units at the Bag level. A rather pragmatic collectivism, which allowed for substantial private herds, may also be part of the reason. In 1990, well before the privatisation, Khufsgusl Aimak had 1.8 million animals, of which 600.000 (i.e. 1/3) were private (source: Khufsgul Aimak statistical office).

To have a few animals is a typical strategy for public servants, health workers, and others working outside the nomad economy in the Sums, and to a lesser extent in the Aimak centres. Health workers we interviewed (in both 1993 and in 1996) could most places tell us that they had not got their salary the last few months, but that didn't matter much, since they had a few animals themselves and their relatives had more. The Sum hospital were organised in a similarly subsistent and sustainable way; they had their own herds of animals, kept by their own herders.

The nomads in the Gobi show a quick adaptation to the market in China and the demand for cashmere (made of goat wool) in that the number of goats has increased rapidly. In Gobi Altai Aimak the number of goats increased from 580.000 in 1995 to 904.000 in 1996 (source: Gobi Altai statistical office). People take cashmere over the border and return with a variety of consumer goods, which is then sold and further resold.

In the suburbs of Ulaanbaatar, the ger represents the in-between technology. All 'constructed' homes in the city are flats in state owned apartments. The setting up of a ger in the suburbs of Ulaanbaatar has offered a cheap and easy route to private home ownership on their own piece of land. Around the gers all sorts of shacks pop up serving as storage room, summer dwellings, tool and repair shops and small businesses. Thus the ger represents flexibility and adaptability.

It is something of a paradox that the 'ger-system' has proven to be more adaptable, viable and flexible within the contemporary economy, than has the modern Soviet technology. This is in accordance with the trends in modern organisation theories, which emphasise flexibility, i.e. the ger system, as opposed to the inflexible and large scale organisations, and long term planning, as is typical for the Soviet model (see for example Clegg 1990).

4.1.1.2 Homus Sovieticus - The 'Soviet Man' - central housing and heating system

The Soviet Union imposed a centralised technological paradigm on Mongolia. A typical exponent for this system is the schemes for housing and heating. Large apartment blocks where constructed and the heating was provided by a central power station. This centralised system is the extreme opposite principle from that of the traditional ger based on decentralised self-reliance. Several hundred thousand inhabitants in Ulaanbaatar all rely upon one central coal-burning factory to get heating through the winter. This was conscious social design on a large scale from the part of Soviet Union. The heart of the national state should replace the ancestral heart of the ger.

The objective was to create the new Soviet Man. The inscribed meaning and behaviour were that people should give up the independent nomadic life, modernise and become part of the new society. Change the 'contracts' and relations necessary to survive that up till then was with the kin, with that of the state. This meant to go from individualism and self-reliance in small groups connected with considerable uncertainty, to a collectivism where everything was certain and provided by the state.

The introduction of the Soviet technology has many parallels with the Bororo example in that the technology and accompanying world-views are radically different from the old. But the agents of change did not do as the missionaries. The 'scenario' got its unique pragmatic Mongolian translation. The old nomadic ger system was kept alongside the new Soviet system resulting in a polarised organisation of society: either you where living in an apartment block and linked to a huge central heater or you lived in a ger, heated by dried cow dung.

It is a commonly held view in Mongolia that the reason why the breakdown of the old system went much more smoothly in Mongolia than in e.g. Russia and that the culture survived the way it did, is that the old ger system was kept in parallel. As discussed above, when the money economy broke down the rural population quickly adapted to a subsistent economy, and the cities survived through their rural networks.

The central heater as technology

The central heater and power station represent a very vulnerable technology. In 1996 it was feared that the power stations in Ulaanbaatar could break down the coming winter. This was regarded as a potential catastrophe since several hundred thousand people rely solely on this system for heating, the apartments are not insulated, and the temperature is stable around 20-30 below zero for several months during the winter. In a high profiled and much talked about effort, experts from the USA had replaced the Russians in order to try to prevent the latent catastrophe. As discussed above, heating is directly linked to the ancestral heart of the Mongol.

Regarded as technology the central housing and heating system has several strange aspects. One is the vulnerability of relying on such a centralised system in stead of a decentralised system. This has clear political connotations; the extreme belief in the large scale, 'mother factory', and centralised solutions in the former Soviet Union. Another strange issue is the fact that all houses in Mongolia are built without insulation. It is indeed the opposite of adaptation to the local technological culture. In Mongolia, the main issue in the ger system, is insulation, and decentralised and minimal heating. The Soviet model is the opposite.

The entire system is built such that the centre is only pumping out heat without regard to the end-use. It starts in September and from then on the only regulators in the individual apartment are the windows. The system is to an extreme extent what Pacey (1984) labels a technical-fix approach to technology: a mechanical focus on production as opposed to end-use. The technological model presented her is typical for the former Soviet Union and represents the ultimate inflexible, large-scale engineer approach.

4.1.1.3. The dull computer and statistics for the planned economy

The planned economy was an as important part of the Soviet model as was the giant industrial, and housing schemes. But its execution was more widespread and affected every bit of activity in the society. The state statistical office with offices in every Aimak was important in this respect, because they collected statistics on all categories that was part of the planning, and calculated to what extent the plan was fulfilled or not. A plan according to the planned economy consisted of numbers of what was to be produced or performed during a period of time. While their importance and size have decreased, the state statistical office continues as before.

The state statistical office is located in all provinces and was the first to introduce computers to the remote areas in Mongolia and they established a nation-wide communication network already in 1990-1991. In this way the state statistical office have been important in the process of introducing IT in Mongolia. Even though they had a vital importance in executing the planned economy, the statistical office had a rather different and more 'dull' appearance than have now the central stock exchange.

In each Sum one person is responsible in collecting the wanted statistical data from that level and to pass it into the Aimak office every month. Here the data is analysed and passed on to the national level, and to the Aimak government.

As seen from the information system the behaviour and meaning that were inscribed into this network were double: 1) to get people to focus on the quantitative aspects of all phenomena and to regard quality as fulfilling the quantitative plans. This pattern was inscribed in a large network. In all organised part of the society and economy people where responsible for collating and sending in statistics. 2) As a consequence the focus of all parts of the system was directed towards quantitative plan fulfilment and issues that could be quantified, as the planning for more beds and patients in the hospitals, as opposed to planning for better quality of care.

The economic system in Mongolia became very inflexible as a result of the conscious inscription (1 above) and the consequential (2 above) inscription of a 'statistical' behaviour. The health information system is in many ways a 'blueprint' of the State statistical system in that it has the same ethos of the planned economy inscribed into it.

If we compare with the stock exchange there is also another aspect worth noting. The computers in the central stock exchange gave status to those who used them and they where all young men. The book-keepers of the planned economy had no status given to them by the computers. They were early in introducing computers but here the computers were seen as an extension of the execution of the planned economy that by most people has been regarded at the best as rather 'dull'. At the central stock exchange, on the other hand, the computers were inscribed a meaning as a messenger from a bright future.

In our survey of health information systems and computer usage in remote Mongolia in 1996 we discovered that most computer users were women. The women in question were not only 'users', but also responsible for maintenance and running of the computers (see section 4.1.2)

4.1.1.4. The glorified computer - spear-heading market liberalism

In Ulaanbaatar the first new landmark after the break down of the old was the new stock exchange that was established in a beautiful old theatre building right on the central square. The stock exchange was built as a 'temple' to market the market liberalism. Computers and marble were flown in as were the designers and the result was as spectacular as it was expensive. The centrepiece of the Stock exchange is 28 computers placed on pedestals in two rows in such a way that the potential users in the one row face those from the other row, with an open space between the two rows. At the end of the floor, placed in an elevated position is the speaker, furnished with the 29th. computer. Spectators were let in and could watch the marvel from the old gallery. Facing the gallery, on the wall above the speaker five (digital) watches are placed, showing the time from Tokyo to New York. The people working there on the floor were mostly young men in suits.

A main idea with the 28 networked computers was communication between the dealers and their partners in the Aimaks and in the cities. The intention was that the 'broker' in the Aimak should send the inquiries they had collected from their customer using the computer to their dealer at the stock exchange, who then would buy or sell accordingly. In 1993 the electronic communication did not work and they only used telephone.

The Stock exchange was opened in February 1992. When I was there 18 months later, in September 1993, the communication with the provinces was still not established and not much was bought and sold. When mentioning these 'misrepresentations' I was told that they were still in a training phase and that the prime benefit of the stock exchange was to educate the Mongols. For this, they have had foreign help, both in funding and training.

This set-up was an as conscious a social design as was the Soviet central heating system. The aim was to get people to embrace the new market economy. In this project the stock exchange was a spearhead with branches in all provinces. All Mongolians got a voucher worth T 10000 with which they could buy shares in privatised former state owned companies. This 'scenario' of getting people to embrace the new system in a general sense and to go out and become a part of it by buying shares, in a concrete sense, was inscribed in a larger designed network. Here the stock exchange, the computers and information systems, new laws and rules, the privatised enterprises, new political and economic institutions, banks etc. where all actors. The 'glorified computers' were parts of this network. It symbolised the new time, and everything that was new, modern and different from the old 'grey' and dull Soviet system.

The inscriptions in the computer system at that time and concerning the aspects highlighted here, was of the indirect and symbolic kind - the computer as a fetished object (Pfaffenberg 1988). The inscribed meaning was not related to the functionality of the computer system, but to its appearance.

What were they actually using the 29 computers for at that time, back in September 1993? We did our usual survey and found: the activity was rather low and nothing were sold or bought; 6 computers were actually in use and the dealers were busy playing the popular computer game 'Tetris', the only world known computer game made in the former Soviet Union. When I visited the place during my second travel to Mongolia, three years later, I was informed that computer games were now strictly forbidden in the stock exchanges country wide, because they had had serious problems with computer viruses some years ago. The lost empire had struck back!

In this section I has focused on the computers at the central stock exchange as symbols for the new economic paradigm. Another side of this is that the stock exchange over the years has developed a country-wide computer based network linking their branches in all provinces. In doing this they are among the pioneers in diffusing information technologies to the far-off Aimak centres. Though, the State statistical office located in all provinces was the first to introduce computers and networks nation wide. Even though they had a vital importance in executing the planned economy, the statistical office had a rather different and more 'dull' appearance than had the central stock exchange.

4.1.1.5 The four key symbols in my context

The ger is generally regarded as a kind of microcosms of the social world of the Mongols (e.g. Humphrey 19974). The central heating and power station is the first thing you see in any Mongol Sum, Aimak or town and I feel that it symbolises the wanted shift of social contracts and relationships, from the kin to the state. The legacy of the previous Soviet model is inscribed into all aspects of the installed base, and make up a main obstacle to change.

Mongolia followed the Soviet Union in the process of modernisation with an emphasis on giant industrialised schemes. The health system in Mongolia was built on a similar Soviet model as was demonstrated through the central heater and power plant: a centralised system extending to the peripheral level. The system relied heavily on a strong central planning process. The health information system in Mongolia I have found to be a 'blueprint' of the State statistical system and it has the same ethos of the planned economy inscribed into it.

The focus in the health system was (still is) on curative rather than preventive medicine. Something that also has a parallel in the central heater, where the focus is on production of 'heat', not on use or insulation, i.e. prevention. The health system was based on specialised services at central level and thus on extensive transportation of patients - i.e. on free petrol from the Soviet Union. When the Soviet Union stopped their support of for example free petrol, the system collapsed as it was not sustainable (see articles II, III, VIII). In the previous system there was no category of general or family doctor and Mongolia has a high degree of specialisation of physicians. As a consequence, local (Sum) self-reliance was difficult, only the Aimak centre could host all the categories.

The health system thus, was as vulnerable as the central heater since it was based on the universal scale, when breakdown occurred, all would go wrong. A central part of the inherent ideology is that reliance on the centre and the extended network is maximised. The ger model, in contrast to this, is based on the local scale with maximised self-reliance and minimised reliance of the extended network.

The ger model thus symbolise many of the central issues in a primary health care policy, since the system is based on empowerment of the local level and maximising self reliance and sustainability. The implementation of a primary health care policy is much prioritised, but hard to come by, mainly because of the legacy from the Soviet period.

The Stock exchange is important as a symbol of the new, and their nation wide computer system is among the three-four most important in Mongolia. The 'glorified computer' as such, is only one of several symbols representing a belief in a future prosperity, like e.g. the Mercedes Benz or the new classy nightclubs.

An example: the legacy of the previous system make changes difficult

In this section I give an example from (article IV) where the legacy from the previous Soviet model as illustrated by the key symbols, make changes towards decentralisation and primary health care difficult. It is indicated how culture may have impact on this change process.

The statistics from Bayankhongor Aimak show that the infant mortality rate (IMR) in the Aimak is decreasing, and that the level is not high as compared with other Aimaks. This is true, but this average hides the real situation: The IMR in the Soms vary between 0% and 27%. Particularly in the mountainous region, the IMR is high and increasing. When visiting local hospitals in this Aimak, we learned that the majority of infant deaths took place at home, a fact that is not reflected in the statistics. The official statistics simply give the number of deaths with no analysis of the causes of death. This illustrates how the statistical bias from the planned economy is inscribed into the health information system. Reporting of data is the issue, not local use.

In Erdenetsogt, a small town in the mountainous region, we were told that only one out of 17 infant deaths (19% IMR) by early September had occurred at the hospital! Therefore the hospital could not be blamed for the high infant mortality rate. Both the number of deaths occurring at home and the infant mortality rate had increased in comparison with the previous year. The problem, we were told, was the shortage of petrol and the corresponding poor ambulance service.

In other Sums the situation was similar, but the analysis of what caused the high IMR got more nuances linked to socio-economic changes: privatisation of live stock which have caused the herders to take less care of the children. Parents work out in the fields while elder children take care of younger children. Also the herders have moved farther away from the hospital located in the centre.

According to a primary health care approach the way to counteract the high and increasing infant mortality would have been to move the health care delivery out to the small communities. But this did not happen. This example illustrates that the curative ideology and hospital-bias, which are legacies from the previous system are deeply inscribed in the structure of health system and in the health workers themselves. The previous centralist top-down system has created a disempowered local level. The workers' attitude is that when they are working in a hospital and the infants are dead on arrival, there is not much that they can do. To address this problem the structure of health care delivery the staff's assumption of responsibility and their way of thinking need to be transformed from a curative to a preventive bias.

As discussed in relation to the ger, in the nomad culture mortality among infants and young children is regard as 'natural'. Such inherent attitudes may also be part of the explanation for why little action took place.

In this example the health information system was not used to analyse the infant mortality, the most important health problem in the area. While the example shows that appropriate information is crucial in addressing such problems, it also shows that information is not acted upon unless as part of a wider health sector reform. Moreover, this example shows that the legacy from the previous Soviet model as well as the traditional culture is important factors when interpreting the health and information system in Mongolia. I have found the key symbols to be useful tools in this regard.

4.1.2 Computer usage in the Aimaks

In (articles II, III, IV, VIII) use of computers in the Aimaks are described. In this section I provide a richer background for those descriptions. First I describe computer usage in a typical Aimak. Second I give an account of women and computing inn the Aimaks.

Computer users in Uvs - a typical Aimak

The Aimak centres would have typically 20-30.000 inhabitants, contain government administration, hospitals, schools and a number of parastatals and companies. A typical example: Uvs is, even by Mongolian standards, a remote Aimak in the north west part of the country, bordering the Tuva region in Russia. The Aimak has a little under 100.000 inhabitants and a more than 100.000 square kilometres vast land of glacier-topped mountains, deserts and enormous saltwater lakes. Ulaangom, is a fairly typical Aimak capital with 29.000 inhabitants. They have power supply from Russia, but as they had not paid their bill, they had been without electricity the last 4 months prior to our visit. At the time of our visit they generated electricity for a few hours a day to the hospital, government building and some companies. Some of the institutions had their own emergency power generator.

A survey of the computer users in Ulaangom showed 20 different user organisations with about 40 computers and more than 50 people used these computers, more than 3/4 of these were women. Two schools also had computers used in education. Contrary to what one would believe, only about 1/4 were under the age of 28-30 and most users where in the age group 30 -40. The reason for this was that people kept their position after the computers were introduced. Computer usage had developed quickly over the last years; two years earlier only 8 organisations had about 10 computers, 5 years earlier it was only the State statistical office who possessed a computer.

Table: Computers in Ulaangom, Uvs Aimak - 37 computers in professional use					
State statistical office	3	Custom	1	Public insurance company:	
Government building (rest)	7	Passport - Police	1	- for individuals	1
Health Information office	1	Meteorological institute	2	- for companies	1
Hospital financial office	1	Pharmacy (Mongoleminpex)	1	Fur / leather company	4
Environmental office/ National parks	1	Water supply	1	4 Banks (2+2+2+3)	9
				NIC - Petrol monopoly	3
2 schools got 8 '286' PCs each in 1995. One school has 15 old Yamaha computers (only floppy)					

Figure 4.1.2: Inventory of computers in Ulaangom, Uvs Aimak, September, 1996. The actual number of '37' is best interpreted as 'about 40'.

Our main source in this survey in Uvs is a young man working in the Stock exchange. He is 'breaking the rule' regarding age, sex and background. He is as close you can come to a hacker in the Gobi desert, 20 years old, and he has worked with computers in the stock exchange since finishing school two years earlier. In all Aimaks we have visited there was typically one resource person, like this man from the stock exchange, who formed the 'nucleus' of an informal network of computer users. At the stock exchange they connected with Ulaanbaatar every day if they had electricity using the 'X-talk' data transfer software. In other Stock exchange branches they used PC-mail (e-mail system), but in Uvs the telephone line was too bad and direct transfer of data is much more robust than is an e-mail system. They transfer data on transactions, stock rates and they interchange general information, letters etc. The main usage of the computer is to keep the stock register and customer accounts for the Aimak.

In Uvs only two persons could be labelled programmers. Our friend in the Stock exchange was one of them. The other was a young woman with technical university from Ulaanbaatar. She was on 2 years maternal leave, but before she left she set up a in-house network of four computers in the fur/ leather company where she worked, the first internal network we saw in any Aimak. Our friend had been around and helped most of the computer users in the Aimak and he assessed more than half of the computers to be under-utilised and most users to be 'poor'. Most places used computers only for office work, and there were few databases and other special user applications. Many companies purchased computers only because it was 'modern' to have them. Lack of training and basic skill is the main problem.

In the state statistical in Uvs office four women were working and they had three computers. The women in charge, in her 50's, educated as an economist, had been there for 25 years. Of the other three, two were economists and one was engineer in electronics, educated in Novosibirsk, Russia. She, and the other we met with where both 28 - 30 years old. The office was located in the government building where there were a total of 10 computers. The resource person sorting out the technical problems regarding these computers was the engineer in electronic.

Two women worked in the health information office in Uvs. They were among the reasonably good computer users and produced a monthly report, they had started to use Spreadsheet (which they learned by themselves) to make tables to compare development in some indicators (i.e. infant mortality rate, infectious diseases) over the last ten years. But, as was the case elsewhere, they were not particularly focused on getting people to use the information and do their own analysis at Sum level. Sum level is seen as the source of the information they are collating and reporting to central level. When they have technical problems they ask the young man in the Stock exchange and sometimes her 'friends' in the State statistical office.

Women and computing in remote Mongolia

The fact that mostly women are in charge of computing in the Aimaks was a pattern that we had slowly realised, but it was in Uvs that we first documented it. In the remaining four Provinces we visited after Uvs we researched whether this observation could be confirmed, which it was. Men working in the office sector tend to float up to managing positions. Thus, when you enter an office and ask for an interview you often end up with a man in managing position. We then had to focus more on gender issues and the roles of the different people working there in our interviews. Example: in a bank in Gobi Altai Aimak, we interviewed the man in 'charge' of computers. There they were ten computer users, but he was too busy with other things to actually take care of the problems regarding the computers, there where others who where better in that. Yes, he was the only man. Based on results in the last Aimaks we visited we feel the female rate of 66% among our respondents in sectors other than health, as under-representing the actual rate.

People explained the female dominance in computing as follows: Before, under the Soviet period, men were typically educated in agriculture or engineering and employed in the more physical part of working life, like construction, mechanics or transportation, and of course as herders. Men would typically work outdoors. Women, on the other hand were typically educated in economy, statistics and health, and got employment 'indoor', as office workers, teachers and as health workers. Offices where book keeping and statistics were carried out within government and parastatals typically employed mostly women. All men did not work as construction workers, but, as we were told, those who work in the office and bureaucratic sphere tend to be engaged in politics, management, and now business and they 'float up' well beyond were computers are personally used. Office work, also at high level, is left mostly to women. The computers, when introduced, found their way into exactly those areas occupied by women. Women in Mongolia, as in the former Soviet Union, are well educated, in 'small-scale' engineering, electronics, they often take care of the whole range of computer related work.

Female dominance where also the patterns in the Aimak offices of the stock exchange even though these jobs where established in 1992-1993, so the women where not already in position when the computer was introduced. They were all appointed for the job to take care of the computer. The young man presented above was in fact the only man in charge of computers we met in the ten Aimak Stock exchanges we visited. The pattern of female dominance is reproducing itself based on the traditional division of work in remote Mongolia. It must be added that there is nothing glorious with the stock exchange offices in the Aimaks. They are - in appearance - grey and dull as any hidden away, backyard office in remote, post Soviet, Mongolia.

Work with computers is not seen as a 'hot' thing career wise and explains why men are virtually absent from the computer scene in remote Mongolia. 73% of the respondents in our survey said it was popular to work with computers, but when we asked whether working with computers was seen as a way to improve career opportunities, 50% of the no-health group answered no, and only 18% yes. In the health group the figures were 44% no and 26% yes. The statistical feltshers were much more likely to answer 'no' to this question than the physicians in charge, thus underlining the lack of a career path for statistical feltshers.

In Ulaanbaatar we noticed a new tendency in that working with computers is increasingly seen as prosperous and part of modernity and post Soviet capitalism. Young men are increasingly filling the computer-based posts in the private sector. This process might change the pattern of female dominance in remote Mongolia over the years to come.

When the stock exchange was established in the provinces it was as something that was quite similar to e.g. banks; book-keeping, customers and a computer. Thus, a job many women would be qualified to take and feel comfortable in. When it was introduced in Ulaanbaatar, on the other hand, it was regarded as more special, not similar to anything seen before in Mongolia, not as an extension of something known.

4.1.3 Health information system and the health sector reform

The study of the health information system in relation to the health sector reform has been a main focus in my research in Mongolia (see articles II, III, IV, VIII). Here I give a brief summary of my findings related to two drawings also found in (article VIII).

Within the health care system the political changes have resulted in a major shift in policy: decentralisation of health management and a shift of focus from curative to preventive care. In Mongolia infants and children under 5 years make up nearly 50% of all deaths. This have led the Ministry of Health to conclude that there are serious shortcomings in preventive programs, the quality of medical care and health education in spite of the good health infrastructure (Ministry of Health, 1992). The new policy based on decentralisation and primary health care is initiated in order to rectify these shortcomings.

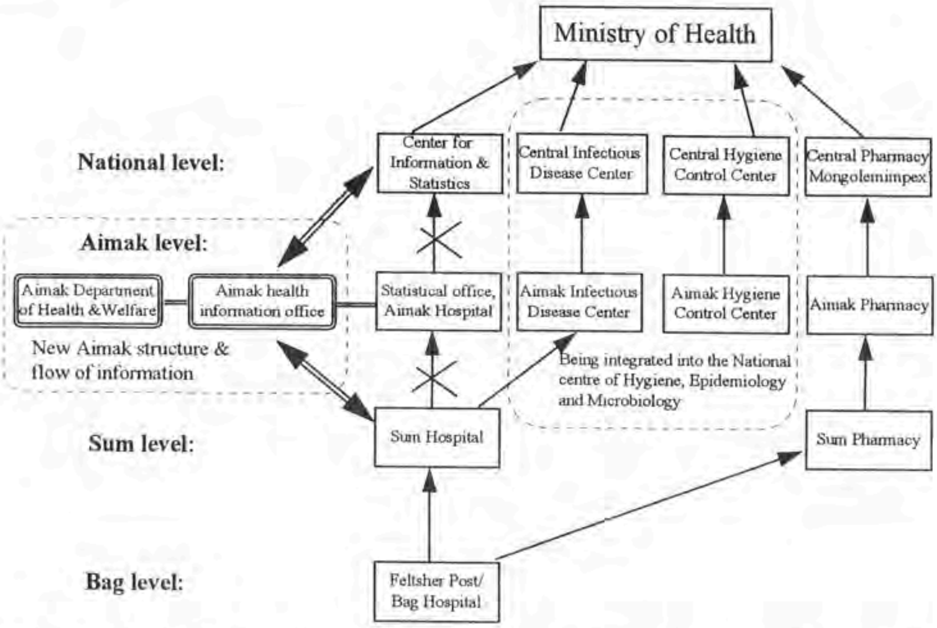

Figure 4.1.3a: Previous and present structure and flow of information in the health sector. During our first survey in 1993 the structure was as outlined in the right hand side of the figure. In 1996 the structure had changed as showed in the added new structure on the left-hand side of the figure and the Infectious disease centres and Hygiene control centres were being integrated. Aimak health information offices are now established under the new Department of Health and Welfare.

In building these new decentralised structures, the availability and support given by appropriate information is regarded as important. To support this process the WHO in 1993 funded the introduction of computers in 15 Aimaks. In 1993 and again in 1996 we found that the health information systems had failed to keep up with the changes at the policy level, and had not developed into a system to support decentralised health management. The systems still had the old model based on the needs of a centralist planned economy and a corresponding health system with bias to hospitals and curative care inscribed into them.

In the above (figure 4.1.3b) the efforts towards decentralisation of the national information systems is illustrated. The strong vertical and centralist character of the system has made integration at Aimak level difficult. Despite the aim of health sector reform, the efforts to develop the health information system have been based on the central planning model of a statistical reporting system. This model complies with a discrete-entity model and is thus restricted to the more technical aspects of the information system. A main finding from my research is that development of information systems to support primary health care need to be based on a social system model (article VIII).

The survey presented in (article VIII) shows that local use and analysis of information have not been part of the change process. The local level in the Sum and Aimaks are still regarding the information system as an upward bound reporting system. The information system is neither seen as a tool in managing the local health services nor in improving the services. Moreover, the local level is not empowered to initiate and carry out action based on local conditions and information.

The Aimak contains administration, governmental functions, hospital and schools, and corresponds to the district in the terminology of health sector reform. It is a vast area that is further divided into Sums, which again is divided into Bags (see figure 4.1.3b).

The health information office in the Aimak is responsible for the information systems and is run by a statistical physician, together with one or two statistical feltshers. The offices are equipped with at least one computer and they were furnished with modems during 1996. This communication system was not working yet when we surveyed the system during the last half of 1996. The main source of data is the reports from the Sums. Though the Aimak hospital and other health institutions are also included.

Our survey revealed that the main problem with the information system was that it was still purely a reporting system and that local analysis and use of information was neither part of the focus nor the job description of the staff responsible. The information office was responsible for the information systems in the Sums and the system of Sum statistical feltshers, but use and analysis of information at Sum level was not part of their job description. Among the issues suggested to the Ministry of Health was that the information office should redirect their focus and make the Sum level a main target (appendix 2).

The Sum is the county or community level, where the primary health care approach is actually implemented: children are immunised and the first level of health care is provided. The Aimak centre is also organised as a (city) Sum within this framework. In each Sum there is one statistical feltsher responsible for collecting health data and reporting to the Aimak statistical office. Not many countries in the world have such a vast network of information officers extending to such a peripheral level. It is a direct legacy of the previous Soviet based system of central planning and control, known as the planned economy. The main problem of the information system is derived from this fact; it has too much focus on reporting data up to the next level, and too little on local analysis and use.

The statistical feltsher is also responsible for primary health care in the Sum, which includes immunisation and the liaison with the feltshers in the Bags. Feltshers are paramedical personel used among scattered population. The statistical feltsher, the hospital manager and the Bag feltshers thus constitute the Sum primary health care team. This set-up gives the statistical feltsher a key role both within the information system and within primary health care delivery. A main problem in the reformation of the health system that we have identified is that this crucial double role of the statistical feltshers is not recognised and as a consequence, that they are not used according to their potential (article VIII).

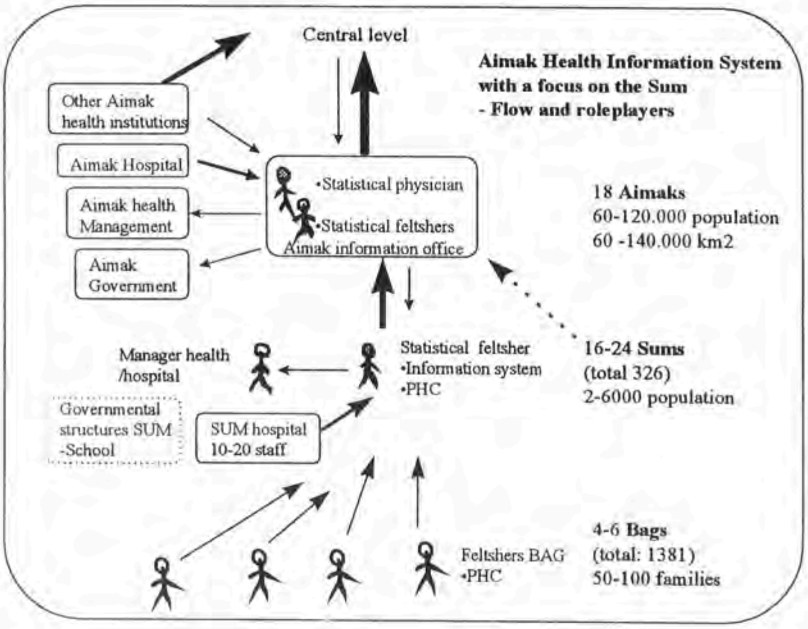

Figure 4.1.3b: The Aimak information system; role players and flow of information.

In (article VIII) we outline a strategy where information systems are used as a tool in initiating and driving health sector reform. In (section 5) I give a similar analysis of the case from South Africa and formulate a general approach of using information systems as tool for district development (research question 3).

4.2 The case of South Africa

South Africa is a good place to adjust what might be left of stereotype ideas about the third - first World dichotomy. Here you find the entire spectre of economic and social conditions from the modern industrial and rich first world to the most impoverished urban slums and underdeveloped rural areas of the third world. Millions of people are living in typical Third World urban slums that are under-developed in terms of health, sanitation, schools, electricity, housing, etc. In South Africa there are also impoverished rural areas comparable with similar areas elsewhere in Africa. The Apartheid State has formed every piece of the social geography of South Africa.

But, the third world areas outlined here are nowhere 'clean and pure', untouched by the first world. They are all meeting and interacting at the same global economic and social scene. Political, governmental, economic and cultural institutions are cross-cutting or shared by 'all worlds'. They are all shopping at 'Shoprite' or 'Pick'n Pay', if not by the same amount of cash; they are all looking at television, if not at the same shows; they are driving or dreaming about the same cars. They are all cheering when the national South African rugby and soccer teams are winning, even though soccer is all black as rugby is all white. But they are also killing each others in high numbers and fear is reigning many places. The impact of the Apartheid legacy on future developments in South Africa is not easy to predict.

The focus on the health sector has been my approach to grasp some of the complexity of South Africa and the developments since the new government took over in 1994. This I have done in a somewhat similar way as I used the four key symbols in Mongolia. While the health sector reflects the wider society of South Africa, the development of the health information systems reflects the challenges, conflicts and problems regarding the reconstruction of the society. In this section these two aspects are described; the health sector and the process.

In this section I first describe the health information system in South Africa. Second I present the HISPP (Health Information System Pilot Project). Third I describe the Reconstruction and Development Program. Fourth I describe the process towards a national health information system in South Africa.

4.2.1 Health information in South Africa

1. The apartheid legacy: health and information systems in South Africa

South Africa under apartheid had one of the least equitable health care systems in the world. It is a system that has served very well the health needs of 20% of the population and left the majority, mostly blacks, with very poor health status and health services. Reform of the health system must address two main features:

1. The health system is highly specialised and centralised. The focus is on technologically sophisticated hospital care; consequently primary health care (PHC) delivery is poorly developed. While having the best technical and medical resources

in the region, South Africa has not demonstrated any ability to use its wealth for the benefit of the majority of its own population. The division (or segregation) between the first world and the third world health care delivery is exemplified by children dying of measles 25 years after the first heart transplantation was performed in Cape Town. The highly specialised, high-tech hospitals are concentrated in the modern and developed "white" urban areas, while "black" and rural areas remain largely underdeveloped and are left with poor, typical third world health services.

2. The health system is extremely fragmented. It is fragmented vertically by race and horizontally by type of service. Typically, in one geographical area there will be multiple authorities providing health services with little or no co-ordination. The apparently chaotic health care system in South Africa reflects both the historical development of health services from colonial times and the effect of apartheid ideology. Until May 1994, there were fourteen departments of health at central level : the "general" Department of National Health and Population Development, three for the apartheid specific "white", "asian", and "coloured" administrations and ten for the "black" "homelands" and "self-governing states". Outside the "homelands" public hospital services are provided by the provincial administrations. At the local level, more than 400 local authorities and regional service councils of different types are responsible for PHC and public health services. The for-profit private sector provides health care for the small minority with health insurance. The mining industry provides health care for its large workforce.

One result of the national elections held in April 1994 is that nine new provinces are being welded together from the four original provinces and ten "homelands". Top priority has been given to organising the health services into districts of 100,000 to 500,000 people. As was shown in (section 1.2), this has significant implications for information systems and for management of health services.

2. Health Information infrastructures – a complex web

The fragmentation and lack of co-ordination in the health systems have resulted in fragmented and uncoordinated health information systems. The research reported in (articles IV, VII) has revealed that there are literally hundreds of forms, log-books, registers and the like in use, as demonstrated by the 172 data collection forms in use in three services in the small town of Atlantis (article VI). Most health workers are engaged everyday in reporting what they are doing by filling in registers, tally sheets, and on a weekly basis by aggregating this information into new forms that are then reported to various head offices which, on their side, are barely using these huge amounts of data. These information infrastructures have been shaped over the years. New registers, data collecting forms and routines are added, mostly because the head office, province, national or some other authority require it; New people get new responsibilities at the collating or receiving level and new routines and data collecting forms are implemented. At a later stage the original purpose with the particular reporting system or form is forgotten, but the system remains as before. New computer based information systems are introduced and developed. In this way the spaghetti-like information infrastructure as showed in the (figure 4.2.1) of Mitchell's Plain (see article VI) has evolved over long time.

The problem is parallel to that of a computer program where new code-segments are added in a spaghetti-like manner each time additional features and changes are needed. The result is a system that is working, but without anyone knowing exactly. It is therefore difficult to cut even small parts of the system because it is difficult to know how that will affect other parts of the system. For this reason the computer program itself make up a resistance to change and a preserver of long forgotten implemented changes.

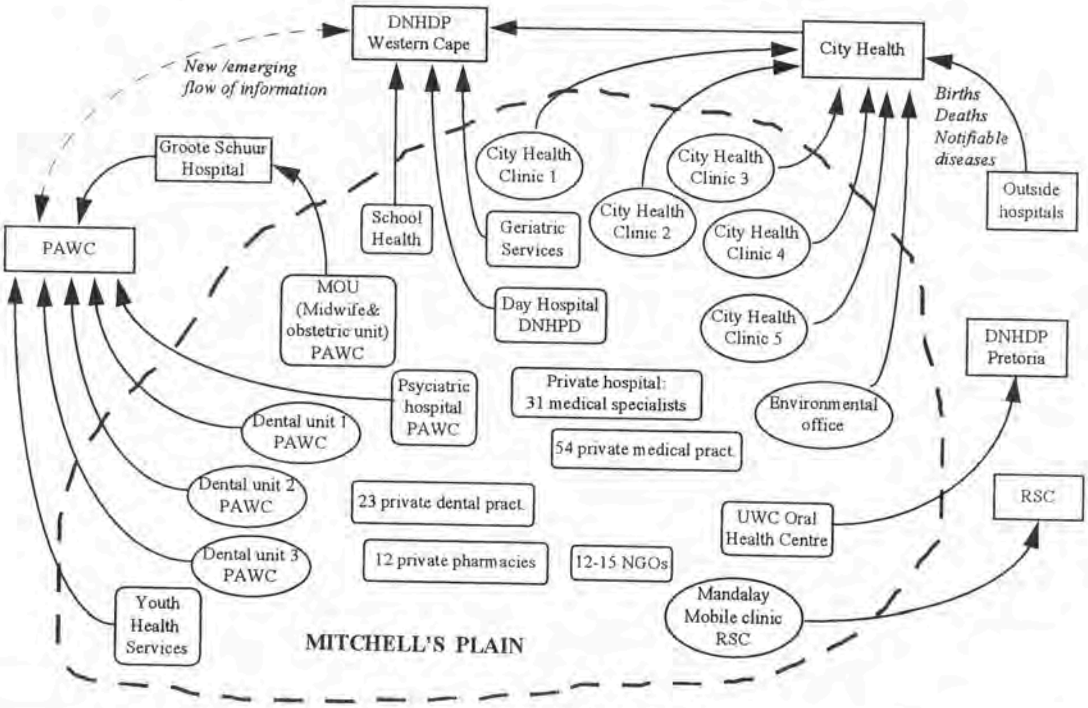

Figure 4.2.1: The figure shows the flow of information in Mitchell's Plain health district. Abbreviations: DNHDP (Department of National Health and Population Development (pre-election name)); PAWC (Provincial Administration Western Cape); RSC (Regional Service Council); NGO (Non Governmental Organisation); UWC (University of Western cape); City Health (Cape Town City Council Department of Health.).

The institutional spaghetti made up by the chaotic information infrastructure has made it difficult to implement changes. The institutional and 'social' character of the resistance to change that that is observed illustrate the point argued in (section 3.2) that the installed base is 'social'.

The New South Africa's plan for reconstruction

In the reconstruction of the health services, the National Health Plan (ANC 1994b) and the RDP gave the following tasks top priority:

- to draw all the different role players and services into a unified National Health System under a single Ministry of Health;
- to use the PHC approach and to focus on community participation;

- to create health districts that will be responsible for PHC in a decentralised national health system.

To support this development and to make rational planning possible, both the NHP and the RDP state that an effective National Health Information System (NHIS) must be introduced.

In the previous health information systems the data collected and the information provided are strongly biased towards hospitals and curative health care. In order to support the new PHC approach the NHIS must address equity in health and the needs of preventive care. More emphasis will be placed on communities and less on health facilities. Community participation in the planning, managing, monitoring and evaluation of health services is another crucial issue of the PHC approach. The community will need appropriate information in order to determine their health needs and to monitor and evaluate the health services.

To achieve all this the NHIS must provide comparable data on all health facilities and populations within defined areas. This will require local integration of health services and of their health information systems and will also require close co-operation with other sectors. In South Africa the district health system will be the foundation of the restructuring process. This policy was confirmed in 1997 (Government Gazette, 1997). According to the view in this thesis (articles IV, VI, VII) the district need to become a foundation also within a national information system. As will be shown in the later section on the national process in South Africa, the national level tend to have a different view on the role of the district in the national information system.

4.2.2 The HISPP (Health Information system pilot project)

The HISPP project and its initial phases have been a main focus in my research. The history was outlined under Phase 4 in chapter 2. The initial phases are described and discussed in (articles IV, V, VI, VII). The HISPP case is presented in Appendix 1. In this section I will first describe the district information system model as a unified model in contrast to the previous, but still reigning, fragmented structures. Second I outline the multileveled district model. Third I outline the framework of diffusion to other district within which 'six steps', which are described in (Appendix 1) are written as guidelines. In (section 5.1, 5.2, 5.3) the HISPP case is further discussed.

Information systems as means to empower the district

The situation analysis given above showed a vertical and top-down oriented information and health systems, which made local management and empowerment difficult. In the past the lack of local structures was intentional from the part of the government. Today this situation is different and the official policy is to develop local governmental structures and local empowerment more generally. The district health model is a main means in this regard.

The district health information systems can be a powerful tool to develop new district structures and to create awareness among health workers and in the community. An effective district health management team needs a constant supply of reliable information to enable it to plan, implement and evaluate the tasks that are needed to run a district. In the (figure 4.2.2), the HISPP district information system model is described.

Compared with the drawing of the information flow in Mitchell's Plain, it represents a complete contrast. While in the previous situation all information flow went out of the district to top management located elsewhere, the new model centralise the information that is shared within the district in the district health information system. This 'centralist' aspects of the model seeks to empower the district. In addition to this shared information, each facility and local organisation have their own routines and systems for keeping their local data. The process towards the district information system needs to be driven from within and be based on sub-areas, organised units and facilities within the district (article VI, VII). Therefore, the centralism in the district model relies upon further local empowerment within the district. Thus, the district model itself contains the local global opposition. The way envisaged to involve all levels within the district is to replicate the processes of action and information usage, which are outlined in the 6 steps under, within all organised units and task groups.

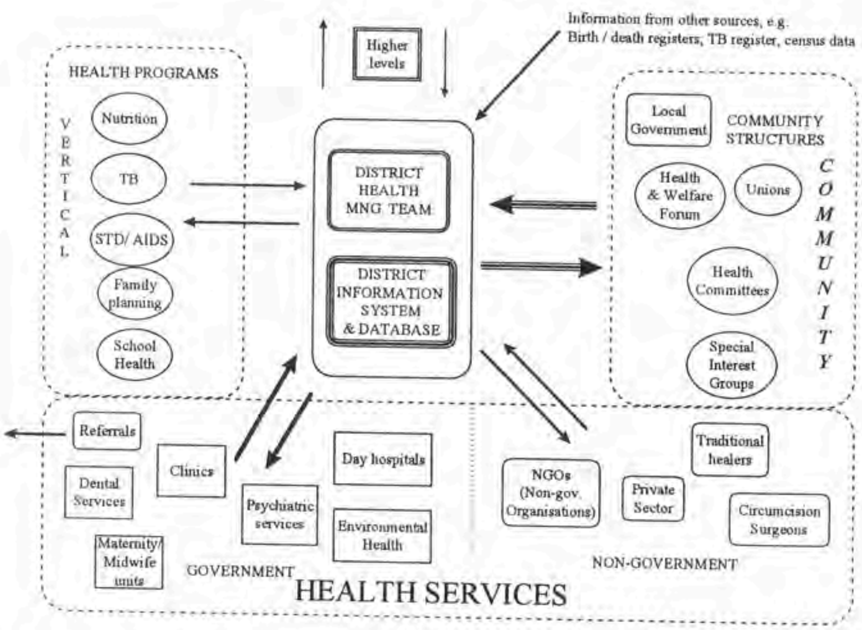

Figure 4.2.2: A model of the district health information system. The various actors in the district feed into the system and get information out.

Various levels, layers and perspectives

The information system model is based on the district model presented in chapter 1.2. The structural aspect of the district model is represented in the above (figure 4.2.2). All health services, public, private and traditional, other related activities, as well as the communities are feeding into the system in various ways.

The information system described here is social in a very literal way. The core system consists of "40 people in 20 units, some forms and reports, and one computer and a database". While this fact naturally lead the focus to the 'social', it does not imply that the system become less 'social' when all units have their own computer. The '40 people' will nevertheless be social actors, though in slightly different ways. The approach used by the HISPP is analogue to prototyping, but based within a social system paradigm. The focus is thus on the behaviour of the wider social system as a prototype, and the approach may be labelled social prototyping.

The district model is multileveled. In chapter 1.2 the 'formal' levels were described as being the small community, the health centre, and the district respectively and in addition there were the higher levels. In (figure 4.2.2) a number of organised units are described, which all represent different levels or layers of the system. Each unit will tend to have their own perspective on the information system, and within each unit there will be differences between management and health workers. The main difference between levels will be between the community as users and participants in the health services, and the health services as providers of these services. Finally, the difference in perspectives between the political authorities at various levels, the health services and the community is important.

The multileveled character of the district health information system together with the substantial way in which it is embedded in wider social systems, make its development quite a complex issue. I suggest an approach based on cultivation as an appropriate way to address the complexity of the district. The approach is based on vertical and horizontal diffusion of replicate-able processes (see section 5.3). The main 'process engine' is the 'Six steps to a district health and management information system', which are presented in (appendix 1).

Six steps to a district health information system

In May 1997, we were asked by district development office in the Ministry of Health to participate in writing up guidelines for district information system development. The aim was to diffuse the process from HISPP and other pilots to all 177 districts in South Africa. Given our experience we identified six steps that the HISPP process had involved. In order to make the steps concrete and more generally applicable we then described the HISPP case as an application of those steps.

The 'steps' are meant as guidelines to all districts. It contains a step-wise approach from 'nothing' and onwards. While being step-wise, it is first of all cyclic in that each step needs to be repeated continuously in parallel with the others. Step 0 though, select sites, is only cyclic in that the process is meant to be diffused incrementally in a network. The 'Six steps' (appendix 1) is a first version of these guidelines and health management and workers at district level in South Africa are the intended readers.

The challenge and problem of diffusing the process to all health districts have sparked the concept of vertical and horizontal diffusion of replicable processes (research question 5, see section 5.3). The steps are seen as a generator of activities in the vertical cultivation of the district. The network of districts is seen as the means for horizontal diffusion.

The following are the six steps (see appendix 1):

- STEP 0 - Select pilot sites as forerunners - the pilot project approach

- STEP 1 – Form an information team, and cultivate it further
- STEP 2 - Do an information audit
- STEP 3 – Set Objectives, targets and indicators. Concrete targets and indicators need to be defined, implemented, evaluated and modified in a cyclic process. Once the simple indicators are being effectively used, increase the number and start more complex analysis. In section 5.2 and 5.3 I discuss how this cyclic 'step' is used as a tool for instituting primary health care awareness. The cycle goes like this: analyse the situation (step 2); set targets; define information needs and indicators; act on your targets; use information and indicators to assess progress; based on this, modify, add or change targets; (re)define indicators and then repeat the steps in an ongoing process.
- STEP 4 - Create district based information system and structures. This 'structural' part of the information system needs to be developed in a cyclic prototype approach in a joint effort with the step 3. In section 5.2 and 5.3 I discuss how this cyclic 'step' is used as a tool for building and structurating the district. The cycle goes like this: establish routines for collecting and analysing the data; define and produce outputs; define and establish a first version of the database; use the information in action; then evaluate and modify and repeat these steps in an ongoing process.
- STEP 5 - Develop staff skills
- STEP 6 - The information cycle - the ongoing cultivation process

4.2.3. The overall context - the rise and fall of RDP

Before the 1994 elections the ANC produced a vision document - the Reconstruction and Development Program, which provided a detailed account of what the party would like to achieve in government. Already the title clearly expresses its intent: the reconstruction and development of communities that had suffered under apartheid. The proclaimed ideals for reconstruction of the society were general and widely supported and reflected a social democratic, basic needs agenda. During the first year after the election the RDP became a widely used symbol of the New South Africa. All activities, even the opening of a new bar, were claimed to be pursuing the goal of the RDP.

Unfortunately though, the RDP suffered from the same syndrome as other developmental visions in Africa since independence - it was strong on prescription, but week on mechanisms for implementation (Munslow, FitzGerald 1997). The institutional mechanisms that were created proved to be far to inadequate and delivery of specific RDP development products were slow. Quite surprisingly, taking the high profile of the RDP and its symbolic meaning into account, the RDP was virtually abolished in less than two years. In March 1996 the RDP office was closed. The RDP was replaced as the strategic development centrepiece by the plan for Growth, Employment and Redistribution (GEAR). GEAR provides a typical World Bank aligned economic policy: discipline in the fiscus and in the monetary policy, investments, stable exchange rate, reducing tariffs, and export-led growth.

The political changes with regard to macro-economic policy in the ANC have been quite remarkable. During the exile years a radical socialist rhetoric dominated. This was followed by a more pragmatic and cautious attitude during the negotiations leading up to the election - and the RDP. With GEAR, a new turn has occurred. According to Munslow and FitzGerald (1997) this is because sections of the left in ANC hung onto the paradigms and options of the Soviet Union era much longer than was feasible. Finding themselves inadequately prepared within the new paradigm, they consequently all too readily conceded ground to neo-liberal conventional wisdom.

What went wrong with the RDP?, ask Munslow and FitzGerald:

> "Quite simply, establishing a visionary framework and then launching some headline grabbing projects was not sufficient to re-orient the complex structures of government at the various levels. ...
>
> The constraints were just too great. These began at the highest level with the tensions between the constituent parties of the government of national unity. It moved down into turf protection of existing bureaucratic structures at both horizontal and vertical levels. There was also quite simply and profoundly the inexperience of the exercise of power in confronting the impediments, inertia, and pre occupation's of the new government." Munslow and Fitzgerald (1997, page 16),
>
> "the architects of the RDP programme had vastly underestimated the impact of global considerations on the new governments decision makers, e.g. the effect of participation in regional, continental, and global finance institutions. An unstated assumption underlying many of the RDP's values, methodologies, and plans was a cosy world of autonomy and self-reliance, which unfortunately only existed as a development fantasy."(ibid. page 47)

The RDP shares with the primary health care approach that many of their basic values are out of touch with the global economic market liberal trends.

It is important to bear in mind that the South African revolution is a negotiated one. Important in the 'sunset clause' was a guarantee that public servants would not loose their job. This clause left the new government with limited means to restructure the civil service. Towards the end of 1994 (23 December) the Weekly Mail and Guardian saw the civil service as the basic obstacle to development. It was unreliable and inefficient; it was too big, too old guard and too much apartheid duplication.

The negotiated revolution also implied that all old governmental plans, briefs and budgets for the various sectors were kept. It was thus a revolution that had a character of being run by the accountants and bureaucrats in the civil service.

RDP has all the time placed great emphasis on community participation. Despite this fact, there has been a striking reluctance to leave initiative to the communities and to experiment with ways to create activity in a bottom-up manner (Camoron 1996). Cameron suggests several reasons why community participation has been hard to come by: the RDP office is being flooded with applications from communities, yet they are not being processed because there is no real framework for community participation. The concept of community participation is also very vague and there are often competing civics in the same area all claiming to represent the community.

In Mitchell's Plain where we are working (see articles V, VI, VII), as an example, there has been three competing RDP forums with different political alliances.

The inability to create activity at local level had a lot to do with the engineering paradigm or the structured approach, including central control and a belief in an early specification and planned development. It was in this context that we developed the pilot project approach in HISPP. While the RDP approach had an appearance of not being able to take a first step without having a comprehensive plan, we depicted our approach as the need of 'learning to crawl before walking' and 'a journey starts with the first step'. This is captured in the approach 'Six steps towards a district health information system' (appendix 1).

4.2.3 The process towards a National health information system

In this section I describe the process towards building a National Health Information System in South Africa (NHISSA). The NHISSA project followed a trajectory very similar to the RDP. Before the election and in the first period after, the focus was on supporting the new health policy, which emphasised district development and the primary health care approach. Later this approach was replaced by a technocratic approach towards implementing a hospital / health facility based information system. The information system was envisaged by the national office to be uniformly implemented from scratch countrywide and the process thus emphasised central control. Due to disagreement between the provinces, other stakeholders and the national level, this approach ended in mid 1996 when a national tender for development of the system was turned down.

The idea of developing such a large and all encompassing information system from scratch turned out to be impossible. Since then the responsibility for the development of the NHIS has been devolved to the provinces, while the national office remains in control of co-ordination, standards, and so forth.

The process towards a national information system illustrates two themes central in this thesis:

1. *The installed base, which is clearly social, has considerable resistance to change.* The problems faced by the NHISSA process demonstrate the importance of the existing information infrastructures in such development efforts. Large information systems are difficult to develop from scratch. Such information systems are evolutionary and develop incrementally through negotiation with the installed base.

2. *It appears to be difficult to drive a process towards national health information systems based on a primary health care approach.* The new health policy in South Africa is based on a primary health care approach. In accordance with this policy the NHISSA process started out with a focus on districts, but very soon got overwhelmed by a traditional hospital and facility based technocratic approach. This discrepancy between the official primary health care policy on the one hand, and the practical implementation approach not reflecting this policy, on the other, is striking.

The findings in both 1. and 2. are analogues to those from Mongolia.

Background

The political debate before the election ensured wide recognition of the fact that information systems are needed to expose inequities in health status and in access to health care, and that the same information systems can be used to plan and monitor health services and to guide the allocation of resources. Reconstruction and Development Program (ANC 1994a) and the ANC National Health Plan (ANC 1994b) both include development of a National health information systems as a priority.

While these two documents were being published, a national workshop on health information was held at Broederstroom and initiated the NHIS (National health information system) process. I participated at this workshop. Entitled 'Towards a national health information system for South Africa' (Harrison 1994) the stated goal was to "explore ways of linking all community-based and facility-based systems into a national health information system". At the workshop the new national information system was outlined in accordance with the health sector reform prescribed in the RDP and in the National health plan. The focus was on equity in health service provision, a unified health system, a primary health care approach and the new district health system.

One of the few areas of disagreement was that many felt that the districts proposed in the National health plan were too big in order to ensure a primary health care approach. This disagreement illustrates the change in focus, since the notion of a district together with the focus on primary health care, very soon disappeared from the concept of a National information system.

After the election the new Ministry of Health created a number of committees to work on priority areas for reforming the structure and operations of the health services. One of these areas was the NHIS. To get development on the NHIS under way, each province and the Department of National Health set up implementation committees with various technical work groups. We summarised the development already in 1995 (Braa, Power 1995): This initiative with its narrow focus on implementing one system has overtaken the primary initiative with its comprehensive scope and emphasis on policy.

A break with the past

The Broederstroom workshop was held soon after a congress organised by the South African Medical Informatics Group (SAMIG). Theoretically, SAMIG as the national professional association would have been the appropriate organisation to arrange the workshop and its congress would have been an appropriate site. But given the political situation, having little collective insight and doubtful political credibility, SAMIG could not have done this and the initiative had to be taken by the Health Systems Trust (Power 1995), a large NGO that had not been involved with the previous apartheid regime.

The old information structure was felt to be important in maintaining the old power structure and therefore a new structure was seen as an important tool in the reconstruction of the health services. On this background, considerable prestige was put into the NHIS process. The NHIS process was from the beginning led by an outside consultant from the WHO, a fact that was not without problems. By bringing in an outsider, the new people in charge brought about a break with the past. The past was seen as being represented by the people engaged in the process of reconstructing the health information system before the election, as SAMIG mentioned above.

The responsibility for actual implementation of the NHIS rests with each province. Since everybody was expected to implement the same systems the provinces were asked not to engage themselves in developing new systems while waiting for the advances of NHIS. As time passed without new systems being delivered from the centre several provinces started to work towards developing new systems because the process already had a momentum. An inherent conflict developed between the provinces and central level based on the provinces wanting to move in opposition to the central's wishes to wait. The new Constitution gives the provinces considerable independence in such matters.

Changes in focus

During the first period after the election the perspective on health information system within NHIS shifted from being explicitly linked to the objectives of the National health plan, e.g. how to support a primary health care approach and the district health system, towards a more technocratic and 'non-political' one. This represents a shift of perspectives from being based on a social system paradigm to being based on discrete-entity models. 'A computer under each baobab tree', as critics labelled the latter approach.

The new national information system was now being perceived as being composed by a number of technical components: patient database, finance/budgeting, disease surveillance, human resources, pharmacy/drugs etc. There were no 'conceptual' components linked neither to district management nor to a primary health care approach. The visions about the new information system brought forward focused on technical aspects: networked computers in all clinics, health centres and hospitals. The vision was that of an all-covering and complete computer-based nation-wide information system.

A specification of the process and of the new information system

This perspective based on a discrete-entity model was brought forward in an 'invitation to bid' from mid 1995 (bid 1995). The specified system was planned implemented in all public sector health facilities, including 369 general hospitals and 54 specialised hospitals and 3143 primary health care centres, and a number of support institutions. In the primary health care centres an 'appropriately scaled-down' version of the complete information system would be implemented.

The invitation to bid was for the first four modules of the management information system of the national information system of South Africa. These first modules were: patient registration, a core patient record, appointment scheduling, and patient billing. The system should be 'complete' in that it should also include a number of other specified modules.

When including the other modules, the system that was specified in the bid was a traditional, but very extensive, hospital information system. In addition to the above four modules the specification included pharmacy, laboratory, blood transfusion, radiology, theatre, nursing care planning, stores inventory, purchase control, facility management, finance, personnel, clinical costing, medical modules, etc. Of the more peculiar requirements was that the system must provide the means to maintain a dietary profile for a patient including food preferences and food allergies. This is highly revealing since there was not one single requirement particular to needs of the 3143 primary health care centres that was also targeted by the system. E.g. requirements regarding management of immunisation, monitoring nutritional status, a tool to establish community health and demographic profile.

I will analyse this outcome of the process with regards to 1) the *content*, i.e. how values and approaches towards health sector reform is reflected in the system specification, and 2) the *process*, the approach to system development and design reflected in the envisaged way forward.

1. The content

The system specification is rather detached from a concrete situation analysis at both the global health system reform level, and the health facility level.

The specified system is not addressing central needs of the health system reform. The needs of primary health care and the district health system are not addressed at all.

The specifications assume that a hospital system can be scaled down to a primary health care system. In (article VII) we argue that this is not possible since the needs of primary health care are different from those of a hospital. The health facilities where the specified system in question was supposed to be implemented range from specialised hospitals to clinics without electricity and telephone lines, from advanced curative care to prevention. It is obvious that the needs will differ.

Moreover, there are significant differences between a primary health care and a district approach on the one hand, and the hospital approach on the other (articles IV, VI, VII, section 1.2). To base information systems to support a primary health care approach on specifications based on hospitals is therefore not a good approach.

In an addendum to the invitation to bid an excerpt of the 'Year 2000 health indicators for South Africa' (the most current version of these indicators are published in the Government Gazette, 1997). It is stated that these indicators are to be measured by the NHIS and make up a core of a system data dictionary. The information system specified in the bid is seen as making up a major part of the NHIS. Since these indicators are based on the current health policy one would think that they made up the basic requirements on which the system specification was constructed. But this is not the case. An example:

One indicator is as follows: Proportion of children immunised against diphtheria, pertussis and tetanus, polio, hepatitis, tuberculosis and measles before their first birthday. The numerator is the number of children being immunised at the 3143 PHC centres targeted by the specified information system in question. But, a module addressing the needs of managing immunisation is not specified. Other similar examples of requirements based on national health policy and a primary health care approach not being addressed by the system specification could have been mentioned.

Given this background, the specified system has an appearance of being detached from the South African reality. It is not adapted to the local conditions.

2. The process

The invitation to bid (paragraph 4.2) states that the introduction of the system

> "will not be the conventional installation in one hospital, and then gradual implementation in other hospitals. The strategy to be adopted calls for a few core functions to be installed in ALL the hospitals and ALL the PHC centres, within a period of about 24 months with the appropriate training to the staff concerned and the commencement of day-to-day operations." (Invitation to bid, 1995)

Further more, the bid should not include any costs for 'application development' or 'modification'.

All hospitals and all PHC centres include the 369 general hospitals and the 54 specialised hospitals, and the 3143 PHC centres. The envisaged system development strategy reflected here was based on an extreme belief in structured methods, total control and a view of the world as not containing conflicts. To implement a computer based networked information system from scratch in 3566 hospitals and clinics ranging from among the most to the least modern in the world, within a time frame of 24 months, is very difficult. The need for participation and learning as inherent in the social system model, and the resistance in the installed base are important factors in this analysis.

Participation and learning

Central in the envisaged strategy is the assumption that it is possible to specify the information system prior to its implementation. In (article VII) I discuss the design and development of a hospital information system in Mdantsane in South Africa. I argue that the success of the system was mainly due to the participatory and evolutionary approach chosen. This was needed in order both to learn enough about needs and context so that the information system could be specified, and to create the needed ownership towards the system. Similar conditions and problems are general to third world contexts, and thus in most of the 3566 sites targeted by the information system in question. More generally, system development in such context need to be based on a social system model (Walsham et al. 1990; article VII), and a bottom-up approach (Walsham 1992, articles IV, VI, VII, VIII).

The information infrastructure and the installed base

In (article VIII) and earlier in this thesis the concept of information infrastructures and the resistance towards change inherent in the installed base have been outlined (Hanseth 1996). The 'installed base' in this case contains e.g. hospital information systems running in hospitals where management doesn't want to throw them out, the systems are delivered and maintained on a contractual basis by companies who don't want to be sidelined. In addition there are a whole range of provincial political and institutional set-ups with vested interests in the area.

The tender was turned down

It became increasingly clear that the idea of developing a totally new health information infrastructure from scratch was an impossible project. Important in this regard was the fact that the provinces started out with a very different installed base. Health information systems in different provinces, homelands and institutions had developed differently. The rich areas had a lot while the poor areas had much less. The large academic hospitals had rather comprehensive information systems. Those who had a lot in terms of information systems and computers didn't want to scrap it, and those who had nothing wanted to move ahead and get something. Moreover, the richest provinces who also had a more developed infrastructure got their budgets cut while the poor provinces had their allocations increased. Thus, the envisaged develop-from-scratch approach was not realistic when considering the installed base, in particular since it turned out that the provinces had to pay themselves.

In early 1996 the tender was turned down. According to 'rumours' a foreign company won the tender at the special evaluating committee but this tender was again turned down in the tender board containing people from all provinces as well as the political and business levels. It is said that 'corporate South Africa' didn't want such a large contract to go abroad. Moreover, it was decided that a national tender was not in accordance with the fact that the control of such development projects should be in the hands of the provinces, according to the constitution.

The effort to develop a national system from scratch failed because of the resistance in the installed base and because negotiation with, and adaptation to, the installed base was not part of the strategy. The resistance ranged from people, institutions and business engaged in existing information to the political and corporate levels. It is interesting to note that the 'actor networks' making up the installed base extend far beyond what is normally recognised in a system development project. This is of course so because the system was very large and was supposed extend throughout the entire health sector. As one observer stated: "as the knots in the contract increases, so does the number and complexity of the stakeholders."

Summary of the national process in South Africa - Resistance in the installed base

The experience from the national process in South Africa shows that to build large information infrastructures from scratch without negotiating with and adapting to the installed base is very difficult. The conflicts erupting through such efforts tend to get a political appearance since bits and pieces of the prevailing infrastructure are deeply embedded in the institutional and social context, which is political.

Information infrastructures of this type are much too complex to be implemented in a top-down fashion based on requirements specified prior to its implementation. They are evolutionary systems and important parts of their requirements will have to be learned along with its implementation.

Currently the process is partly based upon activities and developments in the provinces and partly on national co-ordination and sharing of experiences. This is a much sounder approach that make it possible to pay due attention to the wide range of local differences and needs. The centre needs to take care of the standards; defining the necessary gateways between the local and central level, pursuing an appropriate balance in the dynamic opposition between local need for flexibility and the centres need for standards.

An important lesson is that developments and changes, totally new or extensions of old, of systemic / networked information systems within the health information infrastructures happen in an evolutionary fashion based on processes of learning. There are forces of resistance in the existing systems or installed base which go against changes because they are not part of its 'natural momentum', i.e. extensions and changes in accordance with what already exists. These forces are part of the social and political world.

4.3 A comparison and summary of the national processes in Mongolia and South Africa

In (article IV) I compared the cases of Mongolia and South Africa with regard to development of national and local information systems to support the ongoing health sector reform. Despite very different contexts and legacies from the past I found striking similarities.

In both Mongolia and South Africa the old institutional structures, which are replicated in the information structures, made up considerable obstacles to decentralisation and local empowerment. While in South Africa the obstacles appeared as fragmentation, top-down and 'chaos', in Mongolia the obstacles in addition to the 'top-down' appeared more as strong centralist and vertical structures. These differences have to do with differences in history and context. The ways in which the 'history' inscribes meaning and behaviour into the structures in such ways that they become actors in the later change process were rather similar in the two cases. In (article VIII) we used a social system model to explain that information systems had inscribed into them politics, meaning and behaviour.

The ideology, politics, work-practices and structures that have been inscribed into the information systems with regard to a primary health care approach, are rather similar in Mongolia and South Africa. This similarity indicates that the problems observed in relation to developing information systems to support a community and primary health care approach have a more general character.

Obstacles to a PHC approach - discussion based on the two cases

The cases both in South Africa and in Mongolia show that national health information system processes have a strong tendency to drift away from official PHC policies towards traditional technocratic approaches. In both Mongolia and South Africa the official policy is to base the health sector reform on a PHC policy; the development of a national health information system is seen as a priority and important in supporting the PHC policy. Despite these facts, as shown here and in the case of Mongolia, the national information system processes tend not to focus on a PHC policy. I suggest three closely connected areas of arguments to explain this tendency.

1. The difference in perspectives between the centre and the local level

The process towards national information systems is driven from the centre, or national level. The notion of scenario imply that the designer work out a scenario that is inscribed as a script for action in the object being designed (Achrich 1992). The scenarios, loosely imagined or carefully written up, as seen from the centre on the future role of the national information system, will be governed, consciously or not, by their understanding of the problems, on their *perspectives* (Nygaard, Sørgaard 1987). The centre will naturally focus on their own needs. An example: In South Africa a new health insurance scheme is to be introduced covering all individuals. As seen from the centre, the main concern is to manage and control this scheme and this was the reason behind the priority given to a national patient database and a unique patient identifier. The scenarios as seen from district and community perspectives are very different. The PHC approach focuses on local analysis and use of information: aggregated data and indicators, not individual data.

In Mongolia it is a similar drive towards a patient database. Though, here they have such a database, but it is paper based at Aimak level, where the focus is on computerisation.

Since implementation of national policies rests with national levels, their scenarios for action and perspectives on use will tend to govern the practical policies. Therefore, a national PHC policy with regards to implementation of national health information systems will tend to drift towards more technocratic approaches based on needs as perceived by the national level.

2. Hospitals and discrete-entity models have dominated health information

My research in both Mongolia and South Africa has revealed that the understanding of information systems within health care is dominantly based on a hospital based and curative approach (articles IV, VIII), which I relate to discrete-entity models (Kling, Scacchi 1982). Since information systems to support a primary health care and district approach need to be based on social system models (article VIII), this causes serious problems. The dominant role of discrete-entity models within health informatics may be understood as a historical legacy. The arrival and development of the hospital has been instrumental on how medicine and diseases have been defined, understood and standardised historically (Focault 1975, see section 3.1) It is not the other way around. Computers and health information systems build on this process of formalisation. Within hospitals there are large numbers of events, e.g. procedures, laboratory tests, that are being registered and thus make up information systems that have developed over a long time.

Historically, health information systems have focused on hospitals and formalised procedures (Rodrigues, Israel 1995). The PHC approach focuses on what is going on in the community, which is a less formalised area. Example of a typical formalised and closed problem area is a patient database covering those who have been served by a facility. A less formalised, and thus difficult area, is a similar register over those children who need care in a community, which is a typical PHC focus. The content of such a register will rely on assessments of needs and an analysis of the situation. The area has to be defined and formalised, before the information system can start 'counting'.

The following factors are important in explaining why implementation of health information systems, despite a PHC focus, tend to drift towards a traditional hospital approach.

- While PHC systems need to be based on social system models, discrete-entity models are inscribed as behaviour and ideology in medical systems and curative models.

- PHC information systems are less easy to define than more traditional hospital based information system.

- Examples and applications of health information systems are mostly from the hospital area.

3. PHC is an opposition to a technocratic engineer ideal

PHC as a concept is in various ways in contrast to the previous, and still prevailing, curative biased and centralised health structures in both Mongolia and South Africa: specialised is in contrast to generalised, as centralised to decentralised and as curative to preventive. In (article IV) I discuss some arguments brought forward by Pacey (1983), who draws a line between similar dichotomies regarding health care and society and the notion of technology. He claims that preventive medicine, together with maintenance and hygiene, challenge the usual focus of technology on problem solving in that they are concerned with problem prevention. Prevention, maintenance, organisation and end-use are all invisible to those who identify technology with hardware. In this way curative biases towards medicine are analogous to "technical-fix" biases towards technology. Such "technical-fix" attitudes are analogous to the structured methodology where needs analysis and specifications is completed before the system is implemented, as exemplified by the methodology chosen in the tender process above.

Drawing on Pacey and the case and discussion earlier in this section, I argue that the use of traditional structured approaches themselves will tend to drive the process towards a 'technical-fix', technocratic approach. Moreover, since a curative approach is at the core of the medical profession, choices of methodology will tend to drift towards structured methodologies, which again will have problem in addressing a PHC approach. Thus a vicious circle is developed.

Section 5. Discussion of results in relation to design issues and system development process

In this section I discuss some of the results presented in relation to the normative research questions in section 1.3. Community based participatory design (research question 2), information systems as tools for district development, the cultivation and structuration approach (research question 3 and 4), vertical and horizontal replication and diffusion (research question 5) will be discussed. The discussion is mostly based on the cases from South Africa, because similar questions are discussed in relation to Mongolia in (article VIII). First I outline two perspectives on information that are important in the discussion.

In this thesis I have interpreted information systems within two different perspectives:

1. *Information as 'information', the rational of the information system*: The survey of the health information systems in both Mongolia and South Africa has focused on the lack of appropriate use of information at local levels and on how this could be rectified (all articles apart from I). The information cycle in (section 1.2.3) and step 3 in the 'six steps' (appendix 1) illustrate this information perspective.

2. *Information as trust, relationship and structure - 'institutional glue', a consequence (but not purpose) of information systems*: The structures and ideology instituted by the information systems make up considerable obstacles to change (articles III, IV, VIII). The processes and structures being institutionalised - or *structurated* - by the information systems often seem to be their most important property and outcome (article VIII). The approach of using information system as a tool for district development and the structuration approach illustrate this structural perspective on information systems (research question 3 and 4).

The distinction between these two aspects of information systems is important in the following discussion.

In the first section I present some examples and discuss information as signs and symbol in relation to the social system. The focus is on 2) above, information as institutional glue. Given this background the second section discusses cultivation and health district development and the third section diffusion. The fourth section relate diffusion to third world IT development.

5.1 Information as signs and symbol – a social system perspective

In 'Information in organisations as signal and symbol', Fieldman and March (1981) interpret information as *signal* and *symbol*. They focus on information as 'information' as I label the one perspective here. This aspect of information is outlined in the first section. In the second section I present and discuss in more depth the second perspective on information systems, information as *institutional glue*.

5.1.1 Information as 'information'

Feldman and March (1981) provide four useful explanations for the "over-consumption" and lack of use of information, which may be applied to my cases:

1) Organisations provide incentives for gathering extra information. These incentives are buried in conventional rules for organising, as the division of labour between information gathering and information using.

2) Much of the information in organisation is gathered and treated in surveillance mode rather than decision mode: the focus is on negative trends, which trigger action.

3) Much of the information in organisations is subject to strategic misrepresentation.

4) Information use symbolises a commitment to rational choice.

When I have discussed the need for local analysis and use of information to support a primary health care policy the objective has been to change the content, direction and use of information (see articles IV, VIII). As argued by Feldman and March (ibid.), such a proposed strategy will be difficult to implement since the current and 'opposite' practice is buried in conventional rules for organising. The strategies reflected in the four explanations are all inscribed in the installed base. A cultivation approach, including the use of the information cycle (section 1.2), is the proposed strategy to gradually change the installed base.

5.1.2 Information as institutional glue in the social system model

First I present a theoretical framework for analysing information as sign and symbols for trust and social relationships. Second I discuss this in relation to examples from the HISPP case. Third I apply this micro-level analysis on the macro-level findings and find that the information systems are both formed by, and forming the institutional structures.

Theoretical background – information as 'gift' and personal 'prestations'

In 1925 Marcel Mauss (1954) showed how social interaction and rituals, as the interchanging of gifts, 'tied up', confirmed and committed social relationships and constituted and reproduced social institutions. In his theory the gift points to a kind of elementary morality of reciprocity, creating relationship not only between individuals but also between groups.

Mauss uses the Kula ring as example. This is a system of ceremonial exchange of shell necklaces and shell armbands among islands off the coast of New Guinea described by Malinowsky (1922). Kula is an important element in the negotiation and maintenance of prestige, status and rank and it performs important functions in regional integration. The point in my context is that the necklace gets its value through its history of owners, it is regarded as being part of persons. The commitment and obligation to repay is thus what is confirming, and (re) producing social relationships, rank and power in societies Mauss label 'archaic'. The reciprocity and obligation to repay is linked to the belief that the gift retains a relationship to the giver and that social identity, status and prestige are at stake in gift exchange. Mauss uses the term 'prestation', which differs from the gift, to refer to the total social context or relationship in which the exchange of gift is embedded.

In somewhat similar ways the interchange of data and reporting systems seem to constitute and reproduce the social relationship and the social fabric within the health services. In this way the health information system makes up important parts of the nuts and bolts of the health system. In this perspective information systems are seen as interchange of data and information that is containing obligations to repay in ways analogous to Mauss' theory about the gift. Repayment is about confirming social relationships and statuses within the social system. This perspective is important in interpreting the duality of information system and their role in 'structuration'. In the next section I give examples from South Africa to support this view.

Information as gift - discussed by examples from HISPP

In the clinics in Mitchell's Plain health workers doing home visits, use Fridays to make reports to the head office in Cape Town on visits they have done during the week. The information they present to the head office they don't use themselves. For their own purposes they keep other registers. At a visit to the head office I asked if they used the information that those workers reported. The answer was that they did not, since how could they have used such information? When I asked why and when the procedure was established nobody could answer. The very time consuming routines were clearly established at some point in time as a control mechanism, and as a control mechanism it works at local level, even though the head office has not touched it for many years.

In the Day hospital in Mitchell's Plain the manager wanted to change the routine reporting forms used in the various departments into simple tick sheets. The old forms included a lot of details that were not necessary in a management perspective, only the numbers were needed. But the health workers refused the tick sheets because they felt that a 'tick' did not reflect the amount of work it represented. They did not use the information. The reporting system was thus seen as a way to legitimate their work. In figure 5.1.2 examples of the old and the new form used in the reception area are showed. The old form looks busier; the reason why it was preferred by the staff. The old form contains text and figures, with a certain personal touch in relation to each action performed. The old form thus represent a 'personalisation' of work, which is not seen as being represented by a 'tick' in the new form.

The reporting system in question has been established at one point in time, for some purpose, but is now turned into a means for reproducing and confirming the social structure. When the manager in this case introduces changes the health workers resist because they feel that the stable social order is under pressure and that they loose documentation supporting them. Note that this example is about internal flow of information in one of the facilities showed in the Mitchell's Plain drawing (figure 4.2.1).

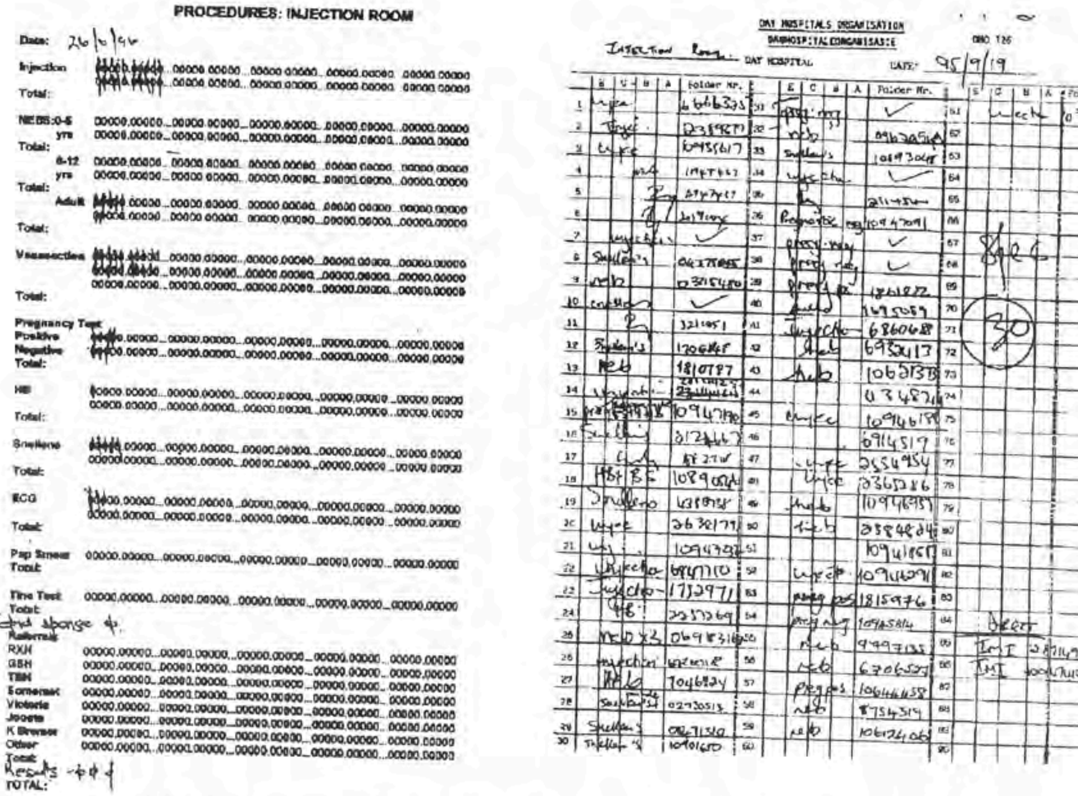

Figure 5.1.2: Two forms for data collection from the reception area in the day hospital in Mitchell's Plain (see figure 4.2.1) is shown. The 'information poor' one to the right was intended to replace the 'information rich' one to the left. The two forms contain the same information in terms of relevance for use. The new tick sheet contains even more so because the categories regarding type of tests and totals are already included. The folder numbers entered in the old sheet are not used. The staff did not like the new forms because they felt that it did not represent the amount of work performed. It looked less 'busy' and more anonymous than the old, which both looked 'busy' and had a personal touch. Note the column categories 'E', 'C', 'B' and 'A' in the old form representing the legacy of the past: 'European', 'Coloured', 'Black' and 'Asian' (not in use).

Many similar episodes have occurred during our work in HISPP, since we are part of rather radical changes that include simplification of local reporting systems and a focus on local use of information. In a day hospital in Khayelitsha the health workers in the psychiatric unit complained because they were now only required to report two single figures per month to head office, the numbers of total attendances, and new patients. In the old forms they reported a lot of details about each patient. Without this documentation, how could they defend their job? This example shows a similar removal of the personalisation of work being replaced by one figure. In the new form (see annex 3, the RMR form, entry 28 and 29, category 'mental health') there is one entry for one figure, say '17', where there before were 17 rather detailed accounts of action.

In a Non Governmental Organisation working in the Atlantis area, where one of the HISPP sites is located, they gave a rational explanation of these 'contractual' aspects of information. The main purpose of their information system was to provide their funders with comprehensive reports documenting their work. Without thorough documentation they feared loosing their funding. In this example the reciprocity between information reported and security regarding jobs and money received is explicit.

These examples illustrate that such information systems consist of dynamic social relationships and are embedded in social arrangements. Since information interchanges even at micro level have such social complexity, it is given that the installed base makes up a complex and unwieldy web of social structures. The reporting mechanisms are creating relationships between groups and hierarchical levels. The reports produced by the peripheral levels and individual health workers are seen as reflecting the work done, in addition to what is signified by the information itself.

There are parallels to Mauss' theories about the *gift* referred to above. Mauss uses the term prestation to refer to the total social context or relationship in which the exchange is embedded. The forms may thus be seen as representing a personalisation of work, given as prestations to other levels in the organisation, thus creating commitment, and institutional 'glue'.

Mauss uses the Kula ring, which involves great distances between islands, to illustrate that social structures on a larger scale are involved in such exchanges. The following example illustrates this point with information systems.

In the drawing of information flow in Atlantis (article VI) in the next section, an arrow is leading from the hospital PAWC (Provincial administration Western Cape) to 'Malmesbury', and not to Cape Town PAWC, which would have been logical. The reason is that Atlantis is a 'coloured' town that was created in the 1970s as an effort to stop the influx of coloureds to Cape Town. According to the past Apartheid laws, Atlantis should be administered by the hospital in Malmesbury, a 'white' town. Thus the ritual interchange of data and reports between these two hospitals were in the past 'producing and reproducing every day', the unequal relationship and impoverished status of Atlantis vs. Malmesbury. Thus, the arrows in the drawing are not mere flows of information. They are indeed signs of hidden structures, as described in the 'Iceberg model' (section 3.2.1, figure 3.2).

The disempowered Sum level in Mongolia is likewise reproduced routinely by the one-way (i.e. unequal exchange) reporting system (article VIII).

Information systems are both formed by and forming institutions

This section has shown how the information system at micro-level forms and confirms social relationships and thus acts as institutional glue. Given this background it follows that the resistance to change we have found to be represented by the fragmented health information structure is in fact caused by a complex web of social relationships.

The examples and analysis given in this section provide evidence that it is not only the social structures that are shaping the information systems, the latter are also influential in shaping the social structures, as illustrated in the iceberg model. This is carried out through first reproducing and reinforcing the social structure every day by the activity of literally thousands of health workers actively engaged in collecting and reporting data. Secondly because all these people have got particular roles and statuses by and for the information system and thus new relationship with other people in this network.

I have found that Mauss' theories about the exchange of gift provides a useful framework for explaining the dynamics in 'actor-networks' (Akrich 1992; Callon

1991), which I have observed in both Mongolia and South Africa. In this section I have described such networks consisting of individuals, social groups, data collecting and reporting forms, and information systems. These networks range from the very local scale, as within the day hospital in Mitchell's Plain, to the national scale including towns and regions. The notion of actor-networks is useful in interpreting such dynamic relationships because it provides an analytical framework which is linking the local and global levels. Moreover, the same analytical framework can be used at both local and global scale.

5.2 'Information systems, tools for district development': design by cultivation and structuration

In this section I present a design strategy based on, and aimed at, the structuration aspects of information systems. While building on the analysis in the previous section, this strategy aims at using the 'institutional glue' to transform the old structures into new ones. In (article VI) a strategy to use information systems to develop the new unified health district is outlined. In (article VIII) we developed this idea further and analysed how the design of information systems could influence changes towards decentralisation and a primary health care approach in Mongolia. Here I will apply a similar analysis on the South African case and outline a more general approach of using information systems as tools for district development.

The Bororo example indicates that changes in material and concrete structures lead to changes in the internal structures of a social system. 'Conscious structuration' as put forward here, aims at changing by transforming the internalised structures in the district as a social system. In the Bororo example, the missionaries destroyed the old material structures and established new ones in order to replace the Bororo beliefs and religion with their own. This approach may be labelled creation by destruction.

Two aspects of structuration: behaviour and meaning

The approach towards cultivation and 'structurating' the new district that is proposed here is opposite to any 'creation by destruction' strategy, because it builds on resources and processes present in the district. The strategy is evolutionary and incremental and aims at transforming the existing institutions by changing the way in which they are reproduced through 'daily' routine behaviour. Furthermore, by building on cultivation of local resources, both the aims and means are local empowerment.

The strategy to use information systems as tools for district development addresses two aspects of the district, which follows the two perspectives on information outlined earlier:

1. *Information as 'information'*. The meaning and ideological aspect: the primary health care approach. My research offers evidence that the primary health care ideology differs radically from a traditional curative one. Furthermore, the primary health care ideology needs to be internalised in each health worker in order to be successfully implemented (article VIII).

2. *Information as trust, relationship and structure.* The structural and organisational aspect: the district. The aim is to cultivate a unified district, with a unified and sound management structure, local empowerment, responsibility and a sense of ownership towards the district and the information system among health workers and community.

Both aspects of the strategy are outlined below. The evolutionary step-wise development of the information system as a social system has clear parallels to prototyping, thus *social system prototyping*. I use two drawings from Atlantis to illustrate the approach (see article VI).

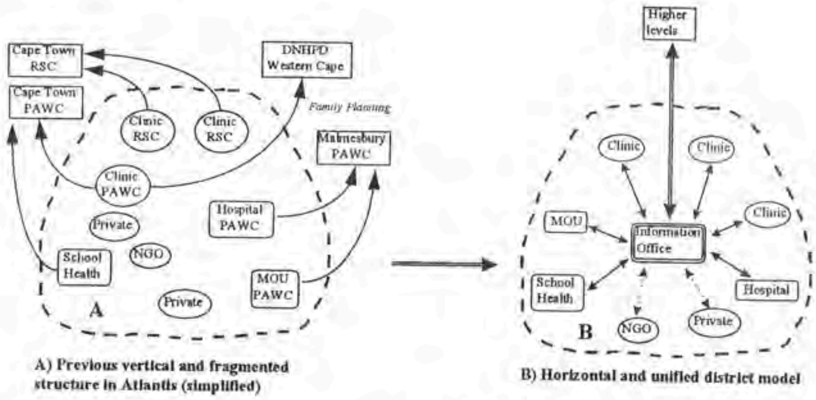

Figure 5.2.1: The task is to move from the previous fragmented structure (A) to the new unified district structure (B). This is a simplified version of the figure in (article VI).

1. Cultivating and internalising the primary health care ideology

In Mongolia we documented that the health system down to level of the health worker behaved in ways contrary to a primary health care approach. The tendency was that health facilities were passively waiting for patients instead of creating preventive action in the communities (article IV). Analysis of the information system showed that a primary health care policy was not followed; targets were neither defined nor pursued, information was not used as a means to define goals or targets, data was not analysed, and information was not acted upon (see article VIII).

The strategy towards cultivating and internalising a primary health care ideology and behaviour that I propose, is evolutionary and incremental. It is based on cyclic iteration of actions connected to the terms *goals, targets* and *indicators*, which is outlined in section 1.2.3, and in 'step 3' in the '6 steps' (section 4.2.2, and appendix 1).

By implementing a system of continuos usage of goals, targets and indicators, the district information system will support new practices of 'PHC focused behaviour' through local use of information.

2. Cultivating and internalising the district structures

In section 5.1.2 I gave examples on how information and reporting systems are rooted in the local social structures as a mechanism that confirm and reproduce the mutual trust in the institutions. The strategy is to gradually 'redirect' and transform the trust reflected in the reporting and information systems from the previous fragmented centralist structures ('A' in figure 5.2.1) to the new district ('B' in figure 5.2.1). Trust in the new district system need to be established through a participatory bottom-up approach, where all levels are collaborating in the cultivation of the new district structures.

As discussed in section 5.1.2, the arrows in the drawing are including social processes of interaction. Redirecting and centralising the flow within the district may be seen as attempts to institutionalise new work practices and procedures, as well as to empower the district. By doing this, the aim is to produce and gradually reproduce 'every day' the new institution, this time the *district*.

The *trust* embedded in the fragmented structures will thus gradually be transformed to trust in the new *district structure*.

A summary - Cultivation of trust, behaviour and meaning

The cultivation of the new district will go on at two levels:

1. Cultivation of primary health care awareness, practices, and ideology.

2. Cultivation of trust, awareness, ownership and empowerment in the new district.

In section 5.1.2 I gave examples of how trust in the abstract system was personalised through the information system. This shows that the new system to be established needs to take the 'richness' regarding documentation of own work as a point of departure. Trust in the new district system needs to be cultivated, to some extent, based on the trust in the present structures. A recurrent theme we heard from health workers was that they did not want to replace the present 'rich' documentation of their work with a 'tick' or a 'digit'. Only those who are working with them need rich data, as names and procedures regarding individual psychiatric patients. Such data should not be reported to the new district management. Since trust in the abstract health system is personalised through reporting of concrete data, cultivation of trust in the new district needs to take this fact as a point of departure.

This problem has been addressed by establishing an integrated database in the district including each facility, health program, and so forth. The individual unit's database will then be an integrated part of the district information system. In this way the 'rich picture' may be maintained in the district database, but in such a way that only the useful data is collected. Those who are using the information will then decide what to collect. In this way the rich picture, 'documentation' of own work, may be maintained, and trust in the district structure may be cultivated.

There are two important issues that make it realistic to achieve the objective of replacing the trust embedded in the previous fragmented structures, with the information systems as means, with a similar trust in the new district system:

1. The new district is given authority that before rested with central levels, and

2. The new district management will be established in the 'neighbourhood'.

The authority in 1. and closeness in 2. together makes an appropriate foundation for a multileveled participatory cultivation process.

The strategy put forward here is based on similar analysis and proposals made in Mongolia (see article VIII). I therefore argue that the strategy is rather general and may be relevant in *health* sector reforms also in other countries.

5.3 Diffusion of replicable processes

In this section I discuss the model of 'vertical' and 'horizontal' diffusion of system development (research question 5). While horizontal denotes diffusion to new places, vertical denotes the cultivation of the system development process by growing to place 'vertically' at the one location. Vertical also illustrate the fact that in the case of district and community based system development the process of cultivation, as it grows 'deeper' involves new levels. The process starts at district level, as a next step, the 15 clinics within the district need to be involved in a horizontal network, thereafter the replication of the process within each of the clinics need to be cultivated.

The focus on bottom-up development of information systems has one serious problem - that of *scope*. The focus on the local and the unique is at the same time a narrow focus. Earlier I criticised the top-down national effort of implementing local information systems in South Africa (section 4.2.4). They were aiming at implementing a poorly defined scaled-down hospital system in 3143 PHC clinics in a top-down manner. The point here is that the arguments about bottom-up, local participation and adaptation in principle will tend to address only one or a few of the sites in question. If the bottom-up approach is to be an alternative to a top-down one, the problem of *scope* needs to be addressed.

The strategy proposed in this thesis is based on cultivation of replicable processes and vertical and horizontal diffusion. The community and social system perspectives imply that multiple levels need to be addressed, thus 'vertical' replication. 'Vertical' also denotes to grow into place in 'deep' social system. When the aim is to go beyond the single location, horizontal diffusion is needed.

First I present an approach for vertical replication of system development based on the structuration approach in the previous section. Second I discuss 'horizontal' diffusion in networks. Third, I relate this to a strategy of building national information systems bottom-up.

1. Vertical replication - a community based cultivation approach

The multileveled approach implies that the process at one level will have to be replicated at the other levels. This vertical cultivation process is represented by each of the health districts in HISPP. The approach to manage the complexity in each district is to create sustainable processes, in each organised unit. First at the district level, thereafter in the health facilities, community interest groups and health programs, then the sub-units and so forth. The scenario applied is that the places where people are best prepared and interested will take the lead, become pioneers, and others will follow through a co-ordinated approach based on mutual learning and co-operation.

In HISPP the generator of activity is the "six steps to a district information system" (section 4.2.2, appendix 1). These steps are cyclic and aim at initiating and sustaining processes based in social systems. Within the district the aim is then to gradually spread ('horizontal') the process to all sub-areas and units, where the process again is cultivated ('vertical').

The two perspectives on information as signs and symbol outlined in the beginning of section 5 and applied on the structuration approach in section 5.2, are applied also here. The structuration approach in the previous chapter is similarly reflected in the following twin processes approach:

1. *Information as 'information'*. (Step 3 in the '6 steps'): set targets, define information needs and indicators, act on your targets, use information and indicators to assess progress. Based on this assessment, modify, add or change targets, (re)define indicators and then repeat the steps in an ongoing process.
2. *Information as trust, relationship and structures*. (step 4 in the '6 steps'): In a joint effort with the above: establish routines for collecting and analysing the data, define and establish a monthly report, graphs and so forth, define and establish a first version of the local part of the database. Use the information in action, evaluate and modify, add to and change the information system. Repeat these steps in an ongoing process.

The aim of the above action and learning processes is the cultivation of the social systems within which these processes are carried out. These processes are repeated within the district as a whole and within the various sub-parts, as the day hospitals, clinics, community groups, task groups and so forth. The two cyclic steps represent the engine that generates activity within the six steps. The other areas covered by the 'steps' are part of and resulting from this engine, i.e. analyse the situation (step 2), form a team and develop it gradually (Step 1), and train and develop staff skill (step 5). The overall aim is to develop - structurate - the district. It is an application of the concept of prototyping within a social system model: social system prototyping.

2. Horizontal replication - seed and cultivation

In South Africa the objective is to spread knowledge, products and the process from some few districts to all the 177 districts. In Mongolia a similar process is envisaged in the Aimaks. Concrete 'things' to be spread are experiences formulated like the HISPP case and the 'six steps' (appendix 1), procedures, software and other products. Alone these are all 'dead' things and will need to be put in, or spread through, a context of mutual learning, commitment and enthusiasm. The main component to be spread (i.e. *horizontal*) is the idea, which in order to grow need to be cultivated (i.e. *vertical*).

The HISPP process that includes three districts can illustrate this. A horizontal replication of the process between districts is already included in the HISPP approach. Diffusion of action research projects as HISPP is seen as a general problem, and design and use of networks for diffusion through a process of dialogue is proposed (Engelstad, Gustavsen 1993)

I use the metaphor of a seed to be spread and of cultivation as the approach towards nourishing the processes thus initiated. In order to replicate the HISPP process in other districts the engine represented by the "six steps" is used as a "seed". A network for diffusion, I suggest, will basically contain a number of mutually collaborating projects in various districts and provinces. A first step will include the replication of the process in one or more pilot districts in one province, and then as a next step to replicate the process within each province.

A general problem with 'pilot' schemes is the high risk of termination or long delays before 'going to scale'. The process of diffusion rely upon a certain momentum.

Cultivation, in a multileveled context, includes initiating, nourishing and keeping alive, a number of system design and development processes at various levels, and covering different areas. The processes will be replications, and thus relatively similar based on the same model as they are. But, since they are based on different resources and unfold in different social contexts, they will also differ. Each 'replication' will need to be based on what is present and at hand locally, thus the conditions will differ as will the concrete adaptation of the general approach. The strategy will need to rely on tinkering and improvisation, thus a bricolage approach.

This diffusion by cultivation approach makes it achievable to diffuse 'similar' information technologies to social systems based on 'different' cultures. In (section 1.1) I emphasised the significant cultural differences between the two districts Khayelitsha and Mitchell's Plain, the Xhosa and the Cape Coloureds, both participating in HISPP. Since cultivation is based on what is within the social system, it follows that the information systems regarded as social systems will be different, though they will also be equal. The common denominator is the health system in the Western Cape Province and South Africa, as reflected within the HISPP. Communities and health services within both districts are both part of a process to improve the health services and to implement a primary health care approach.

In order to emphasise general and international aspects of this model I argue that there are clear 'common denominators', also between countries as different as South Africa and Mongolia. The efforts to decentralise the health services and to implement a primary health care approach have met with similar problems in the two countries. Thus South-South collaboration to overcome such problems would be appropriate (see article V).

Diffusion by dialogue in network

The metaphor of a seed illustrates this process of spreading the idea, from one to many through dialogue in a network. In order for the idea to sprout, the soil must be prepared, then the saplings must be cared for, nourished, watered etc. The term *cultivation* cover this process, but the point is that the idea is not diffused only by its own momentum, it must be learned through a process where the dialogue with the outside through a network is an important component. Since the system in each district is unique in the sense that it needs to grow into its own shape within the constraints given by standards and reporting requirements, there is no universal key. The network will need to be a reciprocal one, based on mutual learning.

Before the idea of the new system is 'sown', as shown by the cases from Mongolia and South Africa, the situation is far from 'virgin'. The people will basically be the same but they will be engaged in different procedures and thus relations to each other and the technical components will be different. Thus the installed base and existing conditions and state of preparedness will vary, and the process of cultivation will start out with different preconditions.

Our experiences in HISPP have shown that local grounding and commitment is the key issue (article VI). Thus there will be uneven development in that some districts will be fore runners. These forerunners should then be used in a network to help 'preparing the soil' and helping other districts to grow. Our experience is that learning from a working example interests people, but they need a lot of support in order to define local applications. Networks will need to link the sample district with the less advanced, to provide all kinds of support, training and technical components.

The point is that the network will make up an institutional framework to support the ongoing process of learning and innovation. Networks can be designed which link all the projects aiming at developing district information systems. The 177 different districts will at any point in time be in many different states and facing different problems. 'Advanced' pilot projects will be important both in order to continue the development of the 'vertical' district information systems, and to support the continuos spread of learning as participants in the network.

The individual district information project will have to be participants in a complementary and collaborative network. The idea of having advanced pilot projects like e.g. HISPP that are only producing models, procedures, software, good examples etc. are of limited use. However, the advanced pilot project is necessary as an involved partner in continuous participation and dialogue in order to re-cultivate the models in other districts and contexts.

It also follows that forerunner pilot projects are necessary in order to generate learning and models. Thus, HISPP and other pilot projects with extra resources are needed in order to realise such a network.

Summary – A bottom-up approach to a National Health Information System

The strategy of vertical cultivation of replicate-able processes put forward here is a practical application of the community based cultivation and structuration approach to the development of district discussed in section 5.2. The 'horizontal' diffusion of such district building efforts may in a similar way be regarded as a part of a cultivation and structuration approach towards building a National information system from the bottom-up, based on districts. Since such a process will need to be coordinated at both national and provincial levels, the approach may be seen as a combination of bottom-up and top-down approaches.

As shown by the case of the national process in South Africa (section 4.2.4), the trade-off between the local and the global is complicated and a pure top-down approach is not viable. I have provided evidence that such local developments need to be bottom-up, but bottom-up development in 177 districts and 3143 primary health care clinics requires considerable coordination. The incremental diffusion through building 'clusters' of pilot projects in each province proposed here implies that there needs to be several levels of coordination above the district levels. The multiple level of the district I have discussed earlier.

The network for diffusion proposed here therefore needs to capture the need for coordination at different levels.

5.4 Approaches towards a third world IT-policy

In (articles II, III, V) I have, in accordance with research question 1, discussed third world technology policy and proposed some areas for improvements. The use of health care as an arena for learning about appropriate third world IT, and 'South - South collaboration' for learning and diffusion of IT have been suggested. In this section I relate those issues to the previous discussion and show that the "national" and "international" perspective do not cause inconsistency in the analytical framework as long as the third world and social system perspectives remain stable.

An important point in the previous discussion has been that since the information systems are social systems they can not simply be transferred from one place to another. The process of diffusion outlined above includes spread and cultivation in networks. While unique conditions in each social system imply that the processes develop differently, the network implies global standards. The cases from health care illustrate the necessary trade off between the local district and the national health system.

In this section I first outline some perspectives on the notion of technology transfer. Second I outline a model of classification of IT and argue that technological learning needs to take place within networked and context-sensitive aspects of IT. Third I outline some suggestions regarding third world IT policy.

5.4.1. Spread of technology in a dynamic third world context

In (article IV) we argued that the notion of technology transfer was inappropriate since it neglected the context of use. The notion of technology "transfer" assumes that a piece of technology may be regarded as an isolated machinery or artefact. This, as many have argued (Wisner 1983; Odedra 1990, 92; Pfaffenberger 1993), neglects the crucial aspects of the economical, social and cultural context of a technical artefact. New theories in economy referred to earlier (section 1.3.1) see technology as basically consisting of knowledge and "endogenous" factors, and thus rooted in people and not in things (Fagerberg 1988, 1994; Malecki 1991; Lundvall 1992). For this reason successful transfer of technology will often rely upon the transfer of the entire context of the technology, including work routines and organisation (Wisner 1983; Kerbal 1991). As a consequence technology transfer is also transfer of culture and world-views in general and of ways of solving problems and of defining what problems are to be solved in particular. Thus, traditional definitions of technology transfer imply a more or less successful adaptation, in the third world, of First World solutions to First World problems (article VII). 'Antropotechnological islands' is the term Wisner uses to denote "the success of the complete transfer" (Wisner 1983, page 31); the context of the original country is replicated as an island in the new and foreign context.

Odedra (1992) argues that the 'foreignness' of the technology is the main obstacle to its adaptation in a new context. The actor network theory provides a framework that implies that this context in which the technology is tied up may be extensive. The extension of the network becomes visible when the technology is moved and a breakdown occurs (Akrich 1992).

Technology diffusion as dialectic or dialogue

In his 'Technology in World civilisations', Pacey (1990) argues that transfer of technical knowledge or equipment from one county, area and culture to another normally will initiate a process of modification, adaptation and innovation that may be characterised as a *dialogue*. The deficiency of the phrase 'transfer of technology' is that it implies a process in which the recipients of a new technique passively adopt it without modifications.

> "The reality is that transfers of technology nearly always involve modifications to suit new conditions, and often stimulate fresh innovations. The obvious example is that the transfer of gunpowder recipes and some primitive handguns from China stimulated the invention of the cannon in Europe, probably in the decade 1310-20. Thus the invention of the cannon can be seen as the outcome of a dialectic or dialogue between the eastern and western parts of the Old World, triggered by the transfer of gunpowder and early firearms technology from China." (Pacey 1990, p. 51)

Sometimes the transfer itself is of minimal kind. This is also the case when some information or an unusual artefact from another country is sufficient by itself to stimulate innovation in the recipient country. Some describe this as 'stimulus innovation'. However, Pacey (1990) holds, the concept of technological dialogue or dialectic, or an 'inventive exchange', is comprehensive enough to cover all these ways in which ideas may spread and develop.

These notions of dialectic or dialogue are well suited in descriptive analyses of processes of technological change and diffusion. I extend these terms to include 1) the concept of mutual learning (Bjerknes, Bratteteig 1987; Bødker et al 1987), and 2) the concept of diffusion of action research and technology in networks by means of dialogue between participants (Engelstad, Gustavsen 1993).

The notion of information systems as being social systems and technology in general as being rooted in people implies that technology is seen as generally not easily transferable. The process of diffusion I therefore understand as dialectic processes of collaboration, learning and innovations, mutual learning, cultivation (Dahlbom, Janlert 1996), and translation (Akrich 1992; Mc Master et al. 1997). Since technology is based in people, it will have to grow into place in each instance. In the previous chapter I used the notion of horizontal diffusion of replicate-able processes in network by dialogue, and the metaphors of seed and cultivation to denote such processes.

5.4.2 Learn technology by focusing on context and network – An integrated social systems perspective

Important in a third world IT policy as argued in (articles II, III, IV) is to initiate and nourish processes of learning about use and design of appropriate IT. In order to be both specific and general about areas where countries in the third world need to focus we outline a model of classification of IT (article IV). In the article we argue that the third world needed to focus on context-sensitive and networked aspects of IT.

The model captures the opposition between the local and 'isolated' on the one hand, and the standardised and networked on the other. Furthermore, this model captured the opposition between the context-free, which I link to the discrete-entity models, and the context-sensitive, which I link to the social system models. 5.4.2a respectively. The arrows indicate the dynamic between the opposite ends, which have a continuum between them.

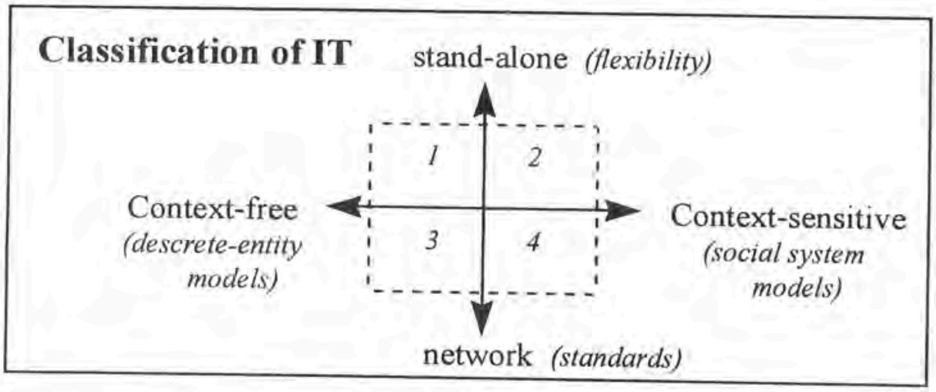

Figure 5.4.2a: The figure in (article IV) is modified with arrows in order to better illustrate the fact that aspects of both sides of the dynamic oppositions are present in an IT-application.

In (article IV) we used the model to illustrate more general aspects of IT. Square 3 was, as an example, illustrated by basic data communication, as the Internet protocols or OSI's reference model. In the present context of health care I take the context sensitive half more generally to denote primary health care and district health systems. While the left half denotes the context-free characteristics of hospitals. Important here is to emphasise that the network and standardisation aspects of health care extend from the international and all the way to the local levels. For this reason there are few 'true' stand-alone applications within health care.

In (article IV) we argue that:

- Technological learning in the third world needs to concentrate on the context-sensitive end of the continuum because the relevant learning processes underlying mastering of IT need to be sensitive to its context of use. Based on (article VIII) and the discussion in this thesis I add the argument that the social system model is of particular importance in the third world (Walsham et al 1990).

- The challenge in the third world will be to learn to master IT in its own environment, how to integrate existing systems and supporting geographically spread work routines. Thus the network part of the continuum is of particular importance in a process of learning about IT in the third world.

- The health sector is particularly appropriate as an arena for learning about IT.

Networked context-sensitivity in health care

The focus on the network and the context-sensitivity contains a crucial duality and conflict between the local need for flexibility and some independence and the central information system's need for standards and control. This duality was clearly illustrated in the case from South Africa and is illustrated in the above (figure 5.4.2a) by the two-way arrow. Though, this opposition is not only due to political conflicts, it is in many ways inherent in the social system model in that the local is unique. The following model is based on the national health information system in South Africa, but it captures some general aspects of the conflict between standards and flexibility within the local - global oppositions in an integrated system.

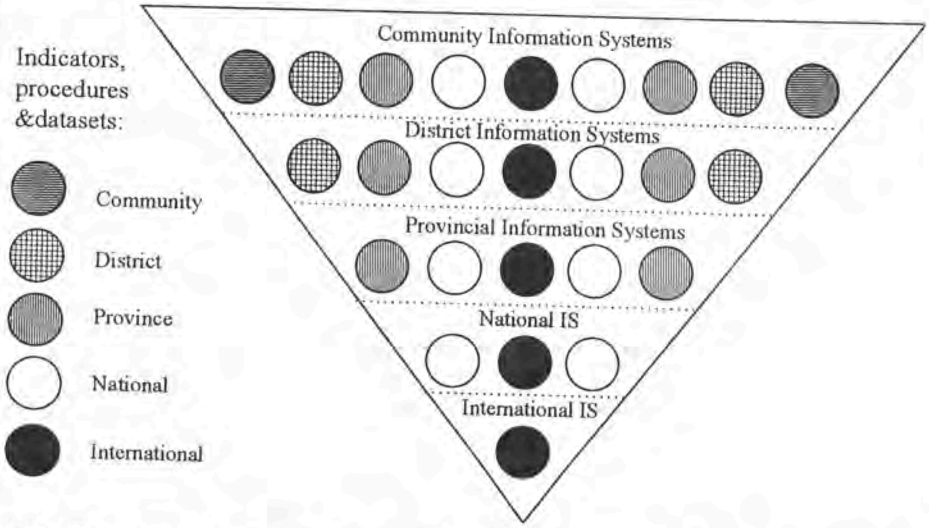

Figure 5.4.2b The triangular figure illustrates the relation between the standards (vertical) and flexibility (horizontal) in health information systems from the international to the community levels. The Routine Monthly Report ('RMR') form (appendix 3) illustrates standards at the provincial level. The districts are free to extend this data-set as long as they adhere to the standards of the 'RMR', which means that the districts need to be able to aggregate the data required by the province.

Information systems at a certain level in a hierarchy of standards need to adhere to a set of standards in order to communicate with other information systems at the same level, and at the levels above. Since the levels 'below' adhere to the same rule, communication in the network regarding the standards (issues) defined at each level is ensured. The point here is that required standards do not necessarily imply less flexibility. In the (figure 5.4.2b) 'total freedom' to collect, analyse and use data is envisaged along the horizontal axis. What is required though, is to adhere to the standards along the vertical axis. This may seem simple but it contains political conflicts as described in the section about the national process in South Africa. The reason for the potential conflicts inherent in the model is that it is rather complex and involves most aspects of the installed base.

5.4.3 "Technology transfer": cultivation and diffusion in networks

In (article VII) I explore the opposition between the context-free and the context sensitive in terms of a parallel opposition between the first world and the third world. A main argument is that system development in the third world must handle situations and problems that range from those relatively well known from the first world to those where new solutions addressing problems particular to the third world must be developed. The two ends of this continuum are outlined by the type 1 and type 2 below. Here I relate the classification in (article VII) to the discussion about technology transfer and context in (article IV).

Type 1. Technology that is first world solutions to first world needs and problems.

In (article VII), as elsewhere in this thesis, I use hospital information systems and hospital based technology more generally, to exemplify a well defined problem area and a relatively mature technology from the first world (see section 3.1). Such technology belongs to the context-free end of the continuum in figure 5.4.2a. It also belongs to the large-scale end of the local-global opposition. It may in principle be moved, or 'transferred' around the world.

In (article IV) we used the example of the British Airway's ticket booking system in Dar es Saalam, Tanzania, as an example of the 'extreme' end of context-free technology transfer. From this office I was able to book a seat from London to Oslo, but I was unable to make an internal telephone call to an office within the city. The communication technology represented isolated enclaves of modernity, 'antropotechnical islands' (Wisner 1983), in a sea of informal third world context. Air-travel illustrates well a global network of standardised and formalised artificial environments, *islands*, that is covering the world without regard to the informal and open spaces between them.

Even within relatively context-free application areas as illustrated by a hospital, the adaptation of IT in the third world is complicated and difficult. This, as argued by Odedra (1992), is due to the 'foreignness' of IT, as experienced in Africa. Though also in the first world is IT regarded as a "stranger" (Ciborra 1996b), which even more underline the "foreignness" of IT in the third world (article I).

In (article VII) the design and development of a hospital information system illustrate that due to a wide range of contextual constraints the participatory design approach used in this case was a pre-condition for its success. I argue that such contextual constraints are typical for third world contexts and that participatory design and bottom-up approaches more generally are of particular importance. This is supporting similar arguments in (Walsham et al 1990; Walsham,1992).

Type 2. Technology that is third world solutions and applications addressing third world problems and needs.

In (article VII), as elsewhere in this thesis, I use the development of information systems to support health districts based on a primary health care approach to denote informal and typical third world problem areas. Such information systems are on the context-sensitive end of the continuum. Here the complexity and uncertainty of third world computing are demonstrated. The problem area is not well defined, there are few examples to learn from and new solutions need to be developed. Not even the practitioners within the field of primary health care have a common understanding of what are the best approaches (section 1.2). The hospital concept, on the other hand, has matured and standardised over two centuries (Focault 1975)

The traditional notion of technology transfer is not addressing such challenges since there are no 'solutions' to transfer. The social system model implies that the context-sensitivity of technology is more of a rule than an exception.

System development in third world contexts and uncertainty

In (article VII) I outlined a multileveled community based participatory approach to system development as being appropriate in the context of developing typical third world information systems. System development is generally categorised as a process of identifying problems and defining their degree of uncertainty (see Andersen et al 1986; Davies 1982). In (article VII) I use the following general categories in describing the two types of technology described above (here I include the sensitivity to context):

1. Uncertainty regarding the *context* of the system development process and of the use of the information system. This is the case towards the context-free end of the continuum. This is the type 1. that is illustrated by the hospital information system. Problems and solutions are well known from the first world, but users, organisations and society in the third world environment have limited knowledge about and experience with IT. Moreover, the network of support and wider infrastructure are less developed than in the first world.

2. Uncertainty regarding the *goals* of development which include the needs to be met, problems to be solved and possible applications and solutions. These are problems like those found in the type 2 above, which are not yet solved in the first world. This is the case towards the context sensitive end of the continuum.

When uncertainty is high, experimental approaches and user participation are recommended (Andersen et al 1986; Davies 1982). In (article VII) I argue that when the uncertainty of the first kind is high, as in type 1., user participation is crucial and a wide range of participatory techniques in system development will be important. When uncertainty of the second type is high, a participatory approach is as crucial, but in many cases the Scandinavian approach and participatory design practices will have to be extended to include the community both as participants and an area of focus. This approach is outlined as a multileveled community based approach to participatory design in (article VII).

The notion of cultivation I take to be of particular importance in the latter type of technology and uncertainty, including the community based approach. Cultivation is of particular importance as a framework for being able to initiate and drive a process of system development in a multileveled and uncertain context. Practical tinkering and bricolage operate at the local scale close to the operational base (Ciborra 1994) and are thus important means in a cultivation strategy. A wide range of practical 'third generation Scandinavian approach' and participatory design techniques are addressing the local scale and is making up important tools for the bricoleur (see for example PDC '92, '94, '96 (Muller et al. 1992; Trigg et al. 1994; Blomberg et al. 1996).

I suggest cultivation as a general approach to the diffusion of technology. Again, cultivation in this respect is of particular importance within the 'social system' and context sensitive type 2. technology. The perspective I use on the third world de-emphasises national borders. Neither do national borders affect the social system paradigm, which forms a central element in my use of cultivation. Thus, extending the notion of diffusion through cultivation in networks from a "national" to a "international" perspective, does not cause a principal inconsistency in the analytical framework. In (article V) we used examples from Ghana and South Africa to illustrate appropriate South-South collaboration.

Although, there are important differences between networks and standards applied within national and international levels. In the triangular model (figure 5.4.2b) moving 'up' one level implied less constraints due to standards in the network. Thus, there will be less directly useable products to interchange in a South-South network, than is the case between districts in a province or a country.

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Experiences from Scandinavian Health Informatics: Lessons for African Systems Development ?

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Abstract

In this paper the possibility of applying an evolutionary and participatory approach to systems development in African health care is addressed. Experiences from three different cases of systems development in Scandinavian health care are discussed and assessed. It is argued that the emphasis on the associated process of learning stressed in evolutionary and participatory approaches is particularly relevant in the context of African health care.

Keywords: Evolutionary systems development; African systems development; Hospital information systems; Process of learning.

1. Introduction

Norwegian Computing Centre (NR) is an independent research institute engaged in contract research concerning applied Information Technology (IT) in various areas, including the health sector. In this paper we present experiences derived from three projects and place them into a framework which we hope will make these experiences relevant also to people working with IT-policy and systems development in an African context.

Our point of departure is the fact that, in order to achieve success in the introduction, development and use of IT we need to pay attention not only to technical aspects (possibilities and limitations of existing hardware and software), but also to non-technical aspects of IT, including social, cultural, economical and political conditions. This is particularly true in the cases where our aim is to introduce IT in people-oriented work such as health-care and complex organizations such as hospitals. When developing IT in this context, it is essential to address also the non-technical issues. As these issues, for any specific case, are not sufficiently well-known to systems developers themselves, this implies the need to have extensive participation also from potential users (e.g. nurses, medical doctors, administrators etc.). It is the knowledge, attitudes and preferences of exactly these parties which constitute the non-technical context surrounding systems development. Given this point of departure systems development is seen not only as a process of designing (or buying) and implementing technical artifacts, but also as a process of mutual learning: systems developers learn about the non-technical context, and would-be users learn about the possibilities and functionality of the given hardware and software [1, 2].

This line of thought is rather general. It remains to identify implications for systems development in African health care. Section 2 points out how the relatively weak African infrastructure reinforces the need to make learning integral to systems development. Section 3 illustrates issues related to systems development in health care by drawing on three projects we have taken part in Norway. In section 4 we discuss an evolutionary and participatory approach to systems development in light of these cases. We also critically assess the possibilities of importing and exploiting -- rather than developing oneself -- the growing stock of products available in the developed countries.

2. Infrastructure

A computer system, as any technical artifact, presupposes an infrastructure; it does not function in a vacuum. With infrastructure we refer to both (i) the human and economic resources available for introducing and maintaining IT, and (ii) the geographical and organizational layout and distribution of these factors. This kind of infrastructure is generally less developed in Africa than in Europe. In section 1 we outlined how systems development could be viewed as comprising a process of learning, building up

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relevant technical and contextual knowledge both for the systems developers and the users. If and when the infrastructure, as defined above, is little developed or maybe non-existent this learning-process will have to start almost from scratch.

3. Three Case Studies

3.1 CASE I: A SMALL LOCAL PROJECT

In 1988-91 researchers from NR, in cooperation with a researcher from the Norwegian Work Research Institute and a group of nursing supervisors at a large hospital in Oslo [3], carried out a project specifically oriented towards investigating how professionals within service-organisations (in this case nursing supervisors within a hospital) could, with the support of programmers, develop computer-based systems suiting their own needs and also the needs of the customers. One of the results of this project was a PC-based system for the nursing supervisors administration of personnel resources. A first version of this system was taken into experimental use early 1989, and from there gradually developed into a more full-scale system, which is now in regular use in 6-7 departments at the hospital.

When the project started there was no available computer based system for supporting any of the tasks carried out by the nursing supervisors, and most of the supervisors had practically no direct experience with computers. Consequently the nursing supervisors, even though they had some, more or less individual, ideas about what they would like, were not able to express these ideas in a way which could be easily translated into a requirement specification; nor to evaluate the consequences of following these ideas through (e.g. consequences for other parts of work). The computer scientist, on the other hand, had little inside knowledge about the tasks and the work situation of the nursing supervisors, and thus had to gain some of this knowledge, before they could come up with really relevant suggestions for technical solutions. To gain the necessary knowledge on both sides, we decided to develop a prototype and gradually refine it. Two important decisions were made:

1. The prototype should be a working prototype, i.e. a simple version of a usable system should be implemented.
2. Every participant should use the system in his/her department for a period of time before new functions were chosen by the project group.

A student was hired to function as a tutor, i.e. helping the nursing supervisors when needed and registering important facts related to use, functionality and design of the system. In addition the whole project group (all participants) would meet to present and discuss experiences and ideas and make decisions regarding the system and its use. Through these, and other accompanying activities, all participants learned a lot, and became still better at suggesting and evaluating relevant technical and organizational solutions. So in the end we had not only a well-suited computer- based system in regular use, but also a group of health-professionals with a lot of new ideas about how to use computers in a (more) effective manner in their work, and a group of programmers and researchers who had a learned a lot about the preconditions for effective utilization of computers in local management within hospitals. The total amount of working-time invested was about 2.5 man-years.

3.2 CASE II: A LARGER NATIONAL PROJECT

Following the project presented as case I, some of us became involved in a larger project, aiming at developing a scheduling system for nursing administrators. This project had a troublesome prehistory including 1-2 projects over 2-3 years, with quite a lot of money and effort invested but with no other concrete results than a number of documents specifying functional requirements, design-decisions etc. made within these projects.

The first of these projects was a cooperation project between a national computer company and a regional hospital, aiming at developing a combined scheduling and reporting system to be used by nursing administrators on different levels and the personnel and payroll-office. Over a period of 1-2 years a small project group, with only a few of the would-be users represented, worked out a detailed specification of the system they thought should and could be realized. But then, due to financial problems within the computer-company the process stopped, and was not re-started, until a year later, when a newly-founded company agreed to take over the project.

In this second project national funding was provided and both the ambitions and the number of participants grew. Now the goal was to develop a software product to be sold to a large number of hospitals, within and outside Norway. In addition to the regional medium-sized hospital participating in the first project two of Norway's largest hospitals were brought in. In addition programmers and consultants from altogether three computer-firms and NR were involved. Having established the new project-organization, one developer and selected would-be users from the hospitals spent about 2-3 months, reworking the written specifications, which were then given over to programmers, who had not participated in the specification process. Then followed an implementation period where many of the details of the system design - due do technical limitations - had to be changed. Also, because of various managerial and technical problems, the implementation process was significantly delayed. After about a year only about half of the specified functionality was implemented. In addition it showed up that many of the design-decisions which the programmers had made, in order to get things working, were not really acceptable to the users. Some of this was redone, but there was not enough time to redo everything, nor was there enough training in cooperation between users and programmers to find the necessary alternative solutions.

Finally a number of crisis-meetings were held where we, among others, tried to get the users to give priorities to the enhancements and changes they saw as needed. But since the users had hitherto only been asked to present their demands and agree to (very ambitious) functional specifications, and since we had not had a chance to learn enough about the tasks at hand, this attempt did not succeed. So, after a period of 2.5 years, this second project was stopped.

3.3 Case III. General frameworks and reusability

Our third case is a "big" European Esprit project in which we are currently involved The goal of this project (EuroCode) is both to make locally adapted systems supporting cooperative work (one at a state hospital in Norway) and general modules and frameworks for making particular systems of similar type *elsewhere*. In doing this we try to use an evolutionary strategy focusing on learning (as in case I), with a goal to achieve generality (comparable with the goals in case II). At the hospital in question we plan to develop a system that supports cooperative work among radiologists, and between radiologists and others physicians who even though they are not all physically in the same room would like to be able to work together on analysing X-ray images.
The collaborating radiologist got their first ideas about the technological possibilities through a demonstration of a NR- prototype called global window allowing participants at different physical locations to have the same object (e.g. a picture or a text) present on the screens, and through pointing, talking (digitized speech), writing etc. to work together on analysing and/or editing the actual object.

For the last 3 months we have carried out observations, discussions and interviews and managed to identify some promising situations for support. The first working prototype will be established in order to support the cooperative work between the paediatric radiologists and the neuroradiologists who are located 500 meters from each other. Based on this, and in cooperation with the users, we will explore new ideas and possibilities, and gradually develop the prototype further.

To make this system we have to both, develop different modules for audio control, conference managing, multicasting etc., and construct the local system by combining and adapting these modules to suit the local needs. The ambition is that through this process we will not only end up with a locally useful system, but also with a set of more generally applicable basic modules. These will be general in the sense that other systems can be constructed by other combinations and exploitations of these applications. To insure some degree of generality, we will develop a second system in a totally different context, but based on the same principles (cooperative work based on a global window). This system will support engineers who are supervising the building of a bridge in Denmark. The X-ray images will be replaced by technical drawings.

4. Evolutionary development, the process of learning and relevance for Africa

Among the points we have tried to make above are: When developing a new system in an organization, the different levels of knowledge between the developers and the local users -- the lack of shared knowledge -- may be an important obstacle. Often the developers do not have the necessary knowledge about the actual tasks and context of work on which the new system must be based. The local users, on the other hand, do have this knowledge. But to be able to envisage the possibilities of the new technology, and hence to be able to formulate their needs, they must develop some knowledge about technological possibilities and limitations. As illustrated by the first and third cases, this can be solved by an evolutionary strategy, actively involving both parties through the entire lifetime of the project, and thus allowing development of the necessary knowledge as you go along.

In the remaining parts of this section we elaborate a few issues regarding the need for an evolutionary and participatory approach to systems development in health care in general and in health care in African countries in particular.
The fact that in health care the objects of work are human beings, who need various kinds of special treatment, implies that only a few of the applications of IT developed for other more material- and paper-oriented organizations are easily transferable. There therefore generally is a need to develop or at least adapt systems especially for use in health care.

The organizational complexity of health care added to its human-oriented character makes technology transfer more cumbersome. There are conflicting interests, values and goals among nurses, medical doctors, administrators and governmental policy-makers. Differences between hospitals and primary health care and central vs. peripheral regions, add to this complexity. It is difficult to move a set of solutions and systems from another domain to health care. The number of different professions (e.g. different types of administrators, doctors and nurses) involved tends to make it necessary to use quite some time, to identify common goals and needs, before making far-reaching decisions on the introduction of IT. Altogether this underlines the need to apply evolutionary and participatory approaches in systems development within health- care.

The problems of transferring IT applications from within other sectors to health-care has some analogy with the efforts made to transferring IT from Europe and other Western countries, to Africa. Odedra points out, that the main problem in this transfer, is the "foreignness" of the technology [4]. The technology is developed for the Western market, a cultural setting quite distinct from the African one. The need for cultural adaption of the technology is pressing, as are the needs for transferring knowledge about the technology. Not quite so obvious is the necessity of developing knowledge about the use of the technology in the local context.

The first two cases illustrate two contrasting approaches in systems developments: an evolutionary approach encouraging broad participation and mutual learning as you go along (case I), and a more traditional approach where somebody is expected to finish the needs-analysis and system-specifications before somebody else implements the specified system.(case II). And as indicated, while the latter approach led to failure, the former approach led to success. But does this mean that an evolutionary approach as in case I, is always useful - or is this only applicable when we want to make a system to be used by a limited group of people within one specific context? Part of the answer to this last question we believe may be found in case III, where we try to work in parallel on evolutionary development both of locally suited systems and of more generally applicable modules. And this brings us to our next topic. The fact that the number of generally applicable modules ready for use in development of systems are growing, has led a number of people to believe that a dramatic increase in productivity in systems development could be achieved by turning it into a question of assembling or reusing ready-made building blocks, akin to other industrialised work procedures and factories [5].

In Africa and other developing countries, this expression of the maturity of IT has taken a similar course: is it conceivable to simply exploit, avoiding the costs of development, the vast body of modules provided for by developed countries ? It is an appealing idea: I]t is generally believed that developing countries have a considerable advantage over those that are more developed because most of the expenses and problems in development of new technology have already been paid and solved elsewhere. [6]

There is probably a significant gain to be achieved through reusing modules and exploiting technological progress made in developed countries. But one should not be misled into expecting that this will be easy. In case III, the developing of the system at the state hospital, the process of learning is as important as in case I. This holds, even though we are reusing and exploiting general applications. No matter how many ready made parts and modules you have at your disposal, you will still need to insure learning in the process.

5. Conclusions

In our paper we have presented experiences from three projects focusing on the processes of development rather than on the specific systems and applications developed. In doing this we have tried to point to the importance of evolutionary approaches allowing for learning to take place, especially in developing and introducing new IT applications within health- care. The necessity of developing local knowledge is derived from our own experiences in Norway, and from the evolutionary and participatory tradition practised in Scandinavia in general. These experiences show that also in Scandinavia IT is, in a way, foreign to the local user organizations. This foreignness, we believe, will exist in African systems development to an even greater extent, thus - together with the partly lacking infrastructure - probably making a learning oriented approach at least as important in the African context as in the Scandinavian. The importance of adopting such an approach to systems development in African health care may be the principal lesson to be drawn from the surveyed experience from European health care.

The trend towards standardization in IT is gaining momentum internationally; it represents the maturing of IT. It makes it conceivable to make systems development vastly more effective: By relying upon ready made components large applications may be made with comparably little technical effort. But even then one must pay attention to the process of learning. The ready-made components *alone* are of limited use; they must be understood and mastered through practical use within the actual context.

7. References

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9 Infrastructure and institutions: the case of public health in Mongolia

Jørn Braa and Eric Monteiro

Introduction

This chapter presents a strategy for helping developing countries to learn about, master and exploit information technology (IT). We argue, by drawing upon changes in the perspective on economic development, that there is a need to support the development of localized knowledge by linking and aligning it with the institutions and infrastructure of technological development (Braa, Monteiro and Reinert 1995, Hyden 1994, Nelson 1993, Perez 1983). Fagerberg (1988) explains differences in economic development between countries and regions by differences in technological development. This is consistent with recent directions in economics which emphasize technical innovation and learning when accounting for economic growth (OECD 1991). Since the distribution and exploitation of IT is closely linked with economic development, the application of IT tends to be concentrated in the most modern sectors of the economy and regions of a country — and world. Since IT is a key factor in technological development — and thus economic development (ibid.), it follows that a side-effect of IT might be the maintenance or increase of differences in technological and economic development between the North and the South, and between regions and sectors in the South (and North as well). The rapid development of telecommunications aggravates this tendency by dividing 'networked' sectors, areas and countries from 'non-networked'.

In this chapter we discuss ways in which this tendency can be counteracted in developing countries by the use of IT to promote development of deprived sectors and regions. Unfortunately, there are no established ways of using IT to develop areas and sectors that lag behind in the modernization process. Since there are no off-the-shelf solutions, new solutions must be developed through a process of trial and error — a process that generates learning.

Elsewhere we have made a distinction between context-free and context-sensitive aspects of IT (Braa, Monteiro and Reinert 1995). We argued that a process of learning is necessary to address the problems of context-sensitivity and to exploit and adapt IT in appropriate ways at local level. To institutionalize such a process of learning we argue that development needs to create an environment for learning about appropriate use and exploitation of IT in areas sheltered from international competition. This is what the North has done historically, and it is what the North is currently doing in connection with its IT infrastructure or 'information highway'. The health sector, we argue, is a suitable candidate for such a protected area because: 1)it contains the whole range of problems and challenges regarding the exploitation and use of IT, and 2)it extends throughout the society — through all social classes, all geographical areas and all administrative units (WHO 1988, 1988b).

The remainder of our chapter is organized as follows. Since we draw upon the recent changing view of economic development, we start by giving a brief, historical outline of different views on the subject. A case study of the health care sector in Mongolia is then presented. Based on this study, we subsequently discuss and describe how issues related to the development of an information infrastructure fit into the changing perspective on economic development. We conclude by offering a handful of policy guidelines which follow from our earlier discussions.

Changing perspectives on development: The role of institutions

From 1955 to the early 1990s, Hyden (1994) identifies four distinct phases through which the development debate has passed. He distinguishes between the ideological perspectives of the architects of development — the policy makers and people occupying positions of power in governments and agencies, and the theoretical perspectives of the auditors of development — the scholars and academicians producing theory. We briefly review these four phases as they relate to our discussion.

1955—1965: 'Trickle down' and structural functionalism

The emphasis in this period was on the 'trickle down' effect of modernization from the 'Progressive elites' to the common man. The relative success of Europe in post-war reconstruction, making use of the Marshall Plan as a Keynesian tool, emphasized the role of government in the development process. The focus was not on equity but on growth which was to be achieved through public investments and the support of entrepreneurs in targeted fields. For example, 'progressive farmers' were given a key role in modernizing agriculture.

Structural functionalism, the first generation of development theory, stressed the integrative role of structures in society and emphasized structures over individual actors. It was built on the assumption that development is an evolutionary process, using Western democracy as the ultimate stage. It was based on the positivist assumption that development was equivalent to modernization and that anything traditional was backward and had to be abandoned. The theory was first constructed in the intense Cold War climate and grew out of the ambition to develop a 'grand theory' that could provide a counter point to the universalist ambitions of Marxist theory.

1965—1975: 'Basic needs' and neo-Marxist political economy

The period Hyden labels 'Basic needs' began with the radicalization of the development debate in the second part of the 1960s. Development was no longer equivalent with growth. Growth without equity, it was argued, was growth without development. The progressive farmer was abandoned in favor of the poor peasant and 'trickle down' was no longer considered adequate. Neo-Marxist political economy and dependency theory were the theoretical response to the radicalization of the development debate. Greater attention was given to equity as opposed to growth. Neo-Marxists stressed the international character of these structural constraints and the need for the poorer countries to emancipate themselves from their dependence of the richer nations. Development of the core, it was argued, led to underdevelopment of the periphery.

1975—1985: 'Small is beautiful' and neo-liberal political economy

The phase Hyden labels 'Small is beautiful' emerged in reaction to the centralized and state driven bias of the two former phases and was nourished by the general lack of success in implementing development programs. Thus, much greater emphasis was given to private and voluntary initiatives and the role of the state was down-scaled. Small-scale and private efforts were expected to achieve what large-scale government bureaucracies had failed to do. This phase of development ideology evolved along two fronts with rather different biases. One focused on 'grassroots' organizations and the involvement of people and communities at local level in implementing development programs. The other, focused on the market with initiatives by the World Bank and International Monetary Fund encouraging structural adjustment in direction of greater market orientation.

In this period, the doctrines of neo-liberal political economy were the dominant issues in the development debate, highly influenced by economists close to the World Bank. Development should occur by relying on the market forces. The neo-liberal 'rational-choice' theory influenced thinking about development in the social sciences. Contrary to both structural functionalism and neo-Marxism, the importance of individual actors was stressed. Development was seen as the aggregate outcome of a multitude of individual decisions. The 'oppressed' peasant gave way to the 'rational' peasant.

1985—Present: 'enabling environment' and new institutionalism

There has been a growing recognition that because they are small and dispersed, people-based institutions within the informal sector, agriculture, or elsewhere, cannot make much progress toward development unless they are incorporated into broader institutionalized networks. Local initiatives can only flourish and become viable if governments are ready to create an environment in which they are allowed to grow. Hyden defines an 'enabling' environment as open and pluralist, providing the conditions in which economic and political restructuring can take place in a constructive fashion.

'The new institutionalism' is the label Hyden uses for the theoretical counterpart to the enabling environment. The move away from the neo-liberal model was mainly based on its simplistic methodological assumptions — from the unseen hand of the market to the individual actor making 'rational' choices. It is increasingly recognized that value preferences — the backbone of 'rational' choice — are not given but shaped by the context of social interaction. Scholars are increasingly concerned with 'institutions' — the layer between individual actors and societal structures, as Hyden puts it. 'The new institutionalism' has a voluntarist perspective, but argues that social action is primarily integrative, aimed at going beyond self-interest. Although this theoretical perspective on development is still evolving, Hyden foresee an increased focus on institutional issues; both the question of how to strengthen them ('institution building') and how to use them as 'tools' for development.

This approach can be seen in the new economic theory and its concept of 'national innovation systems' (Lundvall 1992, Nelson 1993). These systems serve as enabling environments for technological learning and as arenas where learning may be institutionalized and generated through governmental support. An example is the creation of 'information highways'. This trend is a reaction to the prevailing neo-liberal perspectives and reflects the changing perspective on the development process.

The case of Mongolia

Two roads to the future

The collapse of Soviet Union triggered a process of economic and institutional reform in Mongolia based on a rather extreme form of (neo-liberal) market liberalism. For example, in the telecommunications sector prices have been set in such a way that only the richest companies can afford to use the emerging data network or international telephone lines, which are arguably the most expensive in the world. At the local United Nations Development Program (UNDP) office, we were told that it was common to send documents with people to Beijing so that they could be faxed from there. As Mongolian Telecom interprets the prevailing market ideology, their task is to make money, not to provide public services. This attitude is an extreme example of the 'neo-liberal' economic perspective described above.

At present, most developed countries endorse the use of public money to establish 'information highways'. This exemplifies the recent policy shift toward establishing 'enabling environments' and the 'new institutionalism'. Elsewhere (Braa, Monteiro and Reinert 1995), we have presented examples from South Africa which reflect attitudes toward telecommunications that are more in line with current trends. Since South Africa was liberated five years after Mongolia, these two countries clearly illustrate the shift in development perspectives outlined above. When Mongolia defined its new way forward, it was heavily influenced by the then prevailing neo-liberal political economy. The New South Africa, on the other hand, has defined its new policy in the Reconstruction and Development Program (ANC 1994) which reflects the concepts of the 'new institutionalism'.

However, the differences between the two roads toward development followed by Mongolia and South Africa cannot be fully explained within the framework of shifting perspectives. As a part of the Eastern Bloc, Mongolia had a centralized structure and planned economy. As a result of a popular uprising and a natural reaction to the breakdown of the Soviet Union, Mongolia — as well as the rest of the Soviet bloc — adopted the exact opposite policy of extreme market liberalism. Although reactions to the simplistic explanations of the 'neo-liberal economy' had already resulted in the emerging 'new institutionalism' by the time the Soviet Union collapsed, these new perspectives on development have had little impact on policies in the former Soviet bloc.

Methodology

During 4 months in the summer and autumn of 1993, one of the authors conducted an investigation of IT in Mongolia and of its health information system. The study was based in Mongolia's Ministry of Health (MoH), and its purpose was to propose ways of using IT in order to improve the health information systems both at the central and local levels. The study was carried out with the help two counterparts from the MoH — Nermunkh and Burendei — who also acted as interpreters. The main objective was to find more efficient ways to use information in local decision making. Methods used in the study were semi-structured interviews, participatory observation and discussions. A total of 90 interviews were conducted, written down and analyzed, 60 of which were from within the health sector. The other 30 were done with representatives from a broad range of institutions, organizations and occupations: the railroad administration, the central custom office, the state statistical office, the Ministry of Agriculture, the Ministry of Transportation and Communication, the Stock exchange and brokers, the University, new private IT companies, and herders. In total, one month was used visiting the regions of Siberia (Hufsgul Aimak), Gobi (Bayanhongor Aimak) and the central Tov Aimak. Health institutions on all level were visited, i.e. central level, Aimak level (province), Som level (municipality) and Bag level (former Brigades). The State Statistical Office and the Stock exchange/ brokers are users of computers and telecommunication and were visited in three Aimaks.

Background information

Mongolia is a large, landlocked and sparsely populated country in the northern part of Central Asia, located between Russia on the north and China on the east, south and west. It is about half the size of India, but contains only 2.2 million inhabitants. The geography includes steppe, mountain forests and Gobi desert. Averaging 1600 meters above sea level, Mongolia has an extreme continental climate with sharp seasonal and daily variations in temperature. Sixty per cent of the population live in towns and settlements — 3 industrial towns and 18 Aimak (province) centers — including 26 per cent in the capital city of Ulaanbaatar. Fifteen per cent of all rural families, or 136,000 people, live as semi-nomadic herders scattered in small groups of families. Most of the rural population — and nearly half of the urban population — live in traditional tents. One Aimak is divided into several Soms. The condition of infrastructure is poor in Mongolia; bad roads (or tracks), lack of petrol, and poorly developed telephone and postal systems.

Animal husbandry accounts for about 40 per cent of the Gross National Product and 34 per cent of all able bodied people are employed in this sector. Since the time of Genghis Khan Buddhism has been the religion of the Mongols, and Khublai Khan made Buddhism the state religion of the Yuan Empire of China. During the 16th century Tibetan Lamaism was established in Mongolia and strong links with Tibet were developed. During the 1920s Mongolia became a close ally of the Soviet Union. Tibetan Lamaism did not easily fit into traditional perspectives on development and modernization, and was particularly antitheitic to the socialist view of development exemplified by the Soviet Union. Under communism freedom of belief existed but religious feelings could not be openly expressed. In 1937, following the Stalinist system, 700 Buddhist temples and monasteries were destroyed in Mongolia. Since 1990 many hundreds have been re-opened and built. Worship of Genghis Khan and the glorious past — suppressed under communism — and a renewed Buddhism are main features of the new Mongolian nationalism.

Many changes have taken place in Mongolia's political and socio-economic situation since 1990. The country, formerly a part of the Soviet bloc, has changed from a single to a multi-party system, and is making the transition from a planned to a market economy. Today there is a severe economic crisis, characterized by shortages of food, medicines, fuel and everyday necessities. Unemployment is substantial. The Gross National Product (GNP) was estimated at US$780 per capita in 1986, but has fallen to an estimated US$299 in 1992, and was still decreasing in 1993.

Mongolia had been an integrated part of the Soviet command economy. Animal and mining products were exported in exchange for oil and all kinds of industrial products and machinery. Mongolia followed the Soviet approach to modernization, emphasizing giant industrial schemes. The governor of Hufsgul Aimak told us: 'The ideology of planning has now changed from the former 'giant is efficient' to the present 'small is beautiful'. He also explained how the changes had affected his Aimak — a huge and sparsely populated area of more than 100,000 square kilometers bordering Russian Siberia. With Soviet money, mines and industries were to be built together with a town constructed for a population of 100,000 people. A railway line was to connect the new town with Erdenet, a mining town constructed in a similar way. But there had been few state investments in the Aimak the last 15 years because, as the governor explained: 'Everybody waited for the Russian money. In the future we must rely upon the development of many small enterprises'. But how and when this new policy would produce investments and employment remained crucial but unresolved questions.

The existing health management and information system

A process of decentralization of governmental functions is currently underway. Power, functions and responsibility are being handed over to local governments. Within health care this has resulted in a major shift in policy — the decentralization of health management and a shift from curative to preventive care. In building these new decentralized structures the availability and support of appropriate information is of primary concern. So far the present Health Information System has failed to keep up with these changes. The existing information systems for data collection, analysis and reporting were implemented in 1965, and have remained basically unchanged. The systems are based on the needs of a centrally planned economy and a Soviet influenced health system with its bias on hospitals and curative care.

Although the health service infrastructure extends to the community level, the emphasize is on curative rather than preventive medicine. The three levels of health services are:

1 The Bag (former Brigade) health unit is the primary level of health service. About 1,600 of these have one 'feltsher' and no beds, about 50 have 3-4 beds and 45 bag health units have 10 beds and one physician. A feltsher is educated at medical college and is called 'little doctor'. There are 330 Som (municipality) hospitals, ranging from 10-100 beds and from 1-15 physician.

2 There are 30 centralized hospitals in Aimaks (provinces) and cities ranging from 200-600, beds and from 30-100 physicians.

3 There are 20 specialized hospitals located in Ulaanbaatar.

The health system consist of four vertical organizations:

1 The main hospital based curative system with referral of patients all the way from the bag to the central level.

2 The Infectious Diseases Control Centers which are responsible for the control of infectious diseases including immunization management and vaccine storage. A number of specialized centers and hospitals at the Aimak and central level are part of this organization.

3 The Pharmaceutical Service System is organized in two parallel tracks. One track is a state monopoly where drugs are purchased and distributed. Drugs are sold to Aimak pharmacies and resold to Som pharmacies which sell their drugs to the public. The other track is the hospital system with a pharmacy in each hospital from the central to Som level.

4 The Hygiene Control Center has offices in each Aimak. They are responsible for water supply, sanitation and hygiene as well as inspection and control of food, use of chemicals, occupational health etc.

In the new decentralized health structure, these four institutions should be coordinated and placed under a joint management at Aimak level. To support this new management structure an integrated information system which collects and analyzes information from all the health institutions is needed in each Aimak. The current information systems are extremely fragmented and are not useful in this regard.

The main aim of the present system is to provide the center with information. Local use of information is not an integrated part of the system and the mechanisms of feedback to lower levels are poor. These features of centralization strongly contradict the needs of decentralized administrative institutions, which emphasize local decision making and as a result require local information support. The national health information system can be perceived as consisting of four different vertically organized systems:

1 The main hospital based health statistical system. All Som hospitals have one statistical feltsher who collects data from the Bags and from the Som hospital and reports to the Aimak; both to the central Aimak hospital under which they are organized and to the Infectious Disease Control Center. All Aimak central hospitals have a statistical unit of one statistical doctor, who reports to the director of the hospital, and 3-4 feltshers. This unit is organized under the statistical office in the Ministry of Health, where national reports are produced.

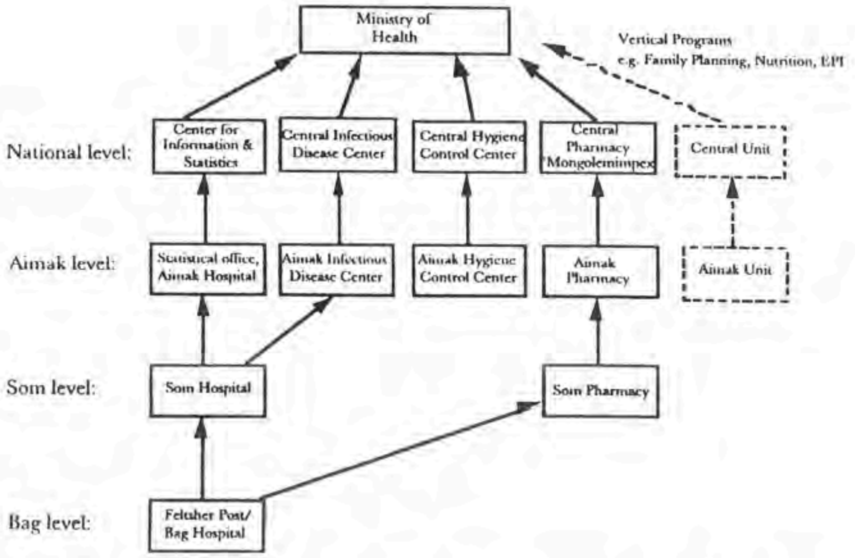

Figure 9.1 Structure and flow of information in Mongolia's health sector

2 Information on infectious diseases and immunization. This information is collected by the Infectious Disease Control Centers in each Aimak. They get routine reports from the Som hospital.

3 Pharmacy and drugs. All pharmacies control their stock against an inventory list and regularly report to the level above. At present a computerized drug invoice and inventory system is being developed, funded by the WHO.

4 The Hygiene Control Centers collect information about sanitation, hygiene and water supply. An improved information system on water sources and quality is given the highest priority

In addition, a number of vertical programs have their own information systems, for example, Family Planning and Extended Program on Immunization. Figure 9.1 provides a visual representation of the flow of information with the health system.

Numerous statistics for measuring the performance of the health care sector are generated by the existing system. The question is whether they provide relevant information. Several example are illustrative.

Due to the economic crisis in the country the number of patients in hospitals has dropped from about 500,000 a few years ago to an estimated 200,000 in 1993. The official statistics show that the number of cases of syphilis and gonorrhea have decreased, whereas surveys indicate that the number has increased. The reason is that the hospital data fails to recognize that people have partly stopped coming to hospitals.

Similarly, despite high female literacy and an extensive network of health care facilities, Mongolia has a higher maternal and infant mortality than countries with similar socio-economic characteristics. Respiratory and diarrheal diseases have been the major killers of infants for the past twenty years. The maternal mortality has increased in recent years. In order to improve mother and child health three major programs have been launched: one against diarrhea, another against respiratory diseases, and a family planning program. Lately there has been a slightly decrease in infant mortality, but nobody knows why. Is it a 'mechanical' result of decreasing fertility, or the result of the program against diarrhea, or the one against respiratory diseases, or is it simply a result of under-reporting deaths as some people claim? Answers to these question are vital to efficient public health care (PHC) management. But as the officers in charge of PHC in the Ministry of Health explained, the present system does not answer any of these questions, it simply reports the number of deaths.

The importance of better information in PHC program management can be illustrated further by an example from Henti Aimak where a five year program against diarrhea has been carried out. In order to ensure the management and continuous evaluation of the campaign, two different kinds of information were prepared. First, surveys of mothers who had been through the campaign's education were compared with surveys of mothers who had not, and second, statistical data at the bag level was analyzed. The director of the former health directorate of Henti Aimak maintained that this information support was a prerequisite for the success of the campaign, and claimed that the campaign was a success. In 1986, just before the implementation of the program, 60—70 per cent of the mortality of children under 3 years was caused by diarrhea, and the child mortality rate was 12.6 percent. By 1993, only 10 per cent of the mortality was caused by diarrhea, and the mortality rate of children under 3 years had fallen to 4.0 percent.

Finally, the situation in the province of the Bayanhongor Aimak of Mongolia illustrates the need for cross-comparisons among local sites. Official statistics report a decreasing infant mortality rate (IMR). This is correct but misses a vital point; namely, that there are huge variations between parts of the province. The IMR in the districts varies between zero and 25 percent. By analyzing the reports from each district and plotting them onto a map of the province, a distinct pattern emerges. In the mountainous northern part of the province, the IMR was dramatically high and increasing. In order to take appropriate action, this information is vital. But it is 'averaged away' in the official statistics. Again, the simple counting of deaths, without any concern for where and why the infants had died, is of little help when trying to cope with the problem of infant mortality. For example, in visiting local hospitals here, we learned that the majority of infant mortality occurred at home, a fact not reported in official statistics.

Telecommunication in Mongolia

Both telephone and postal services are used in order to collect health information in Mongolia. Only urgent information, on which the monthly reports are based is collected by phone. The reporting of paper-based and more comprehensive information is slow and not entirely reliable. Mail from a Som to the Aimak center easily takes two weeks, and from the provinces to the capital at least one week must be added.

Telecommunication from computer to computer is barely developed in Mongolia, but a message handling center based on a PC network will soon be established in each Aimak. These centers will have the capacity of 12 subscribers, but the price will be so high that no public sector organizations, particularly those in the health sector, can afford to use it. In this way the tariff policy of the state-owned Mongolian Telecom, and consequently the Ministry of Transport and Communication, poses a serious obstacle to developing a nation-wide data communication infrastructure in the public sector. Only banks, the Stock Exchange and some private companies will be able to use the data network being implemented.

However, an ad-hoc public sector system of data interchange between computers using modems does exist. The State Statistical Office has established a system connecting their branches in the Aimaks to the center. Several times a month routine data is sent from each Aimak to Ulaanbaatar. The frequency varies according to agricultural seasons, as data on animal breeding and harvesting make up a substantial part of the routine data. The network is operated by making a 'manual' call through a manual exchange, from a telephone connected to a computer to a telephone connected to another computer. Once a connection with the operator at the other end has been established, both operators turn on their modems. The transmission starts and the success of the transmission is displayed on the screen. The software was developed by the State Statistical Office and is also used by (at least) the Stock Exchange and the Railway.

A new digital telephone exchange is being installed in the capital, Ulaanbaatar. In the Statistical Office in Bayanhongor we were told that this had already markedly improved the situation. Before, they could spend a whole day trying to get a connection to Ulaanbaatar, but now it takes no more than 5 minutes. They must still order a line through the manually operated telephone exchange in Bayanhongor, however, the speed of the transmission is normally 1200 baud.

In Tov (the central) Aimak, the Statistical Office plans to establish this kind of network within the Aimak. By providing the Som local governments with computers and modems, and using the Aimak office as a communication center, a public sector network at the Aimak level will be implemented. The idea is that documents, mail, messages and data will be sent between different parties in both Soms and Aimak. From the Aimak local government point of view, these slow lines of communication are a major obstacle to efficient management. The modem and computer network should to improve this situation by speeding up communication within the Aimak. First, they will use the network to collect statistics. Thereafter they will use it to send mail. In the beginning the main users will be the local governments themselves, the health sector and other public sector organizations. Banks at the Som level are interested in using the system to remit money. The Agricultural Exchange wants to use it to send data. Finally, the general public will use the system.

In each Som there is a meteorological station transmitting data to the center several times a day, using a leased line. The director of the Statistical Office in Tov Aimak said that they hope to use the free capacity in this network of leased lines to implement their data network. There are computers in about 10 of a total of 27 Soms, but all of these are owned by private organizations. So far, two modems have been distributed for test purposes. At present there is no money available for the purchase of computers and modems in the Som local governments, so the full implementation of the network must wait.

The knowledge of IT in Mongolia

In general, the IT professionals in Mongolia were in the former Soviet Union or Eastern Europe. Only recently have the university and the technical institution in Ulaanbaatar started programs in computer science. This contrasts with the situation in health care where most professionals are educated in Mongolia. Two institutions have played a major role in the history of informatics in Mongolia: the National Computing Center (NCC) — now reduced to the computing department — of the State Statistical Office, and the computing center of the Academy of Science. NCC was involved in researching the technical aspects of IT and in developing practical solutions. Being the processing unit of the State Statistical Office, NCC was also a dominant user of IT, functioning as the Computer Center, processing data, and making statistics for ministries and other state organizations. Since it conducted research in IT, developed practical solutions and used these solutions, NCC played the key role in adapting IT to Mongolia's conditions. However, it is important to stress that the planned economy's need for statistical information was the driving force behind both IT use and development.

A few years ago about 40 programmers and 30 electronics engineers were among the more than 200 people working in NCC. They formed a true center of IT knowledge. But today there are only 12 IT professionals.

The computer department of the Academy of Science has experienced a similar, dramatic decline over the past few years. For example, Monel was a computer company coming out of the Academy of Science. It had more than 200 employees and produced micro-computers and developed software before it closed in 1993. The decline was due to the changing political and economic situation; the state no longer has money for research and the development of solutions. Adapting to a market economy implies that firms must sell services in order to survive. Unfortunately, due to the economic crisis, there is no market, and hence no investment in system development. At the same time, a market economy does not demand the enormous amount of statistics a centrally planned economy does. Thus, a declining market for NCC. The introduction of micro-computers is also part of the problem, since organizations purchase their own computers and process their own data.

A substantial part of the IT professionals in Mongolia worked in these two institutions. Today some of them work in computer departments of different organization and some have started private companies, but a substantial part of the computer professionals in Mongolia are not employed in IT today. They are either unemployed or working in different businesses in order to survive. A typical private company in the IT sector is a computer repair shop which also repairs televisions and other electronic equipment. Desk-top publishing is another sector with some demand. The typical business for a former computer professional is buying commodities in China and selling them in Russia, and dealing on the black market. For example, the apartment block where one of the authors stayed in Ulaanbaatar had been turned into a company involved in a multitude of small businesses — from running the apartment block to trading sheep hides for cabbage from China. The director of this company was a professor in computing at the Academy of Science who had brought some of his research staff with him. The foreman of the truck is a former researcher in parallel programming. Clearly, the decline of these two institution has resulted in a de-skilling of Mongolia's IT capabilities. Further, no new 'enabling environment' or system of innovation has been developed to take their place.

In an 'ideal world', these IT-professionals would have started companies, made innovations, diffused technology and boosted the economy. But in the real world this is not occurring because there is no sustaining market. By using one of the most successful new computer companies as an example, we will illustrate these problems and also possibilities. Sanchir Technologies was founded 3 years ago. They sell micro-computers, train users, and do some software development. Sanchir employs 12 persons. They work mostly in desk-top publishing, and have adapted a graphical package to Mongolian Cyrillic. They have also developed some small systems based on dBase and spread-sheets. A substantial portion of their activities, and their success, is based on two customers — the WHO and the DANIDA (donor money). Within health and education, desk-top publishing is used to produce publications and books in the Mongolian Cyrillic language. These projects include both development and adaptation of software, technical support, and training of users in three Aimaks.

Sanchir is also working on a third domestic project — software development and the adaptation of a movie animation system for the Mongolian television. Unfortunately, however, the latter does not have the money to engage Sanchir at present. Nevertheless, this example demonstrates that an important side effect of the donor money from WHO and DANIDA, which was used to support publications, has been the creation of a sound computer company, the development of software and knowledge, and the diffusion of technology. The Mongolian television company illustrates that appropriate computer solutions are wanted and needed, but are not affordable in the domestic market. This example supports our main thesis: *a market for domestic IT solutions must be created using public or donor money.* When IT is being developed and put into use, demands arise, and enterprises dealing with technical and software support and system development will emerge.

It is clear from these examples that the software being developed in Mongolia has a technical bias; software for data transmissions using modems, and a keyboard for Mongolian Cyrillic. So far, few end user applications have been developed. One reason is that the use of IT is still quite limited, and when it is used, it is still mostly for word processing. Thus far, software development has focused on overcoming the major obstacles to the use of existing software. However, since the polytechnic universities in the former Soviet Union, where most IT professionals in Mongolia were educated, are biased toward hardware and electronics, the technical knowledge and capabilities of Mongolia's IT professionals is high. This may provide some reasons to be optimistic about future developments.

Communicative infrastructure

Integrated, open systems

In the health care sector, the trend towards open and integrated systems corresponds well with the requirement for developing district health information systems. District systems, in turn, permit aggregation of information at higher (non-local) levels of decision through the National Health Information System. This allows the addition of new services such as electronic referral of patients to central hospitals with confirmed time reservations. The problem, however, is one of 'scalability' — how can systems be designed which are useful at the local level but also permit integration and aggregation to higher levels?

Since a decentralized structure requires the integration of lower levels, the information systems to be developed must solve real problems at the local, program, and organizational levels, and at the same time be able to interchange information across different levels. Such systems operate through the country's 'communicative' infrastructure. The process of decentralization of governmental functions and health administration underway in

Mongolia is typical of many developing countries. In health care, this process is encouraged by WHO as part of the PHC strategy. An important part of this strategy is to strengthen local health management and supporting managerial tools. Local processing of information using micro-computers can play a key role in this regard. In the developing world, the health sector typically consists of vertically organized and independent institutions. Throughout Mongolia the Infectious Disease Centre and the pharmacies are examples of such organizations. The Expanded Program on Immunization as well as the Family Planning Program are examples of centralized organizations difficult to integrate below the top level.

Communications as the 'key technology'

In a sense, IT as a whole is a 'key technology'. We argue, however, that open, integrated systems are of particular importance for the developing countries. We have already explained how economic development has generally occurred by sheltering key technologies. In order to connect this general argument with the discussion of communicative infrastructure, one must recognize (or accept) that the relevant 'key technology' is communication technology itself. Accordingly, the Clinton administration has launched the 'National Information Highway' project which aims at providing the U.S. with a high-speed, flexible communication infrastructure. Despite the fact that the development and establishment of sophisticated communication technology is prohibitivelt costly, the deregulation of telecommunications is believed by some to further monopolize the market (Mulgan 1991, Wilson 1992). The rate of adoption and diffusion is some times greater *outside* the OECD countries.

The pivotal role of key technologies in the techno-economic development paradigm makes leap-frogging (the rapid catching-up of economic growth) theoretically possible (Toussea-Oulai and Ura 1991). A recent OECD report on the subject notes, 'Advanced telecommunications, then, seems to offer the perfect example of a major leap-frogging opportunity...By paving the way for the diffusion of modern information technologies, it can be the key to boosting a county's overall growth rate and competitiveness on world markets.' (Antonelli 1991, p. 11). This occurs because, in advanced telecommunications the '...correlation between innovation capacity and internal diffusion capacity appears to be missing...' (ibid., pg. 47). This, perhaps surprising, empirical fact (see Antonelli 1991) is due to a few crucial characteristics of communication technology. First, communication technology is complex in a quite different manner than other 'self-contained' technologies (Schmidt and Werle 1992). Second, it is 'systemic' as opposed to self-contained — to use Antonelli's terminology. Diffusion presupposes the establishment of a comprehensive technological network which represents an enormous amount of sunk investment in equipment. This makes it extremely difficult for early investors to change rapidly. This is exactly the situation a number of the industrialized nations encountered which invested heavily in telecommunications in the 1960s and 1970s; and it is a situation which developing countries should seek to avoid. In Norway, and other Western countries, for example, the data networks were developed before most target organizations realized they could be of any use. The public sector only slowly learned to use the extensive data networks. In Mongolia, on the other hand, the public sector immediately recognized the advantages of telecommunications as the example of the 'home-made' modem illustrates.

An appropriate data network does not exist in Mongolia due to tariff policy. Due to poorly developed telecommunication facilities and her location in the center of Central Asia, Mongolia is among the most isolated countries in the world. As a result, a communication policy should be encouraged to counteract this isolation by setting the lowest possible tariffs on international calls. Now the policy is quite the opposite: the tariff is put as high as possible, making international calls and other uses of the telecommunications infrastructure affordable only to the richest international organizations.

In this chapter, we have emphasized different aspects of learning in connection with technology. We have also explained how learning about the communicative infrastructure which makes open and integrated systems possible is particularly important for developing countries. Recognizing the importance of creating this kind of knowledge is not the same as actually producing it. There are a number of obstacles, not the least of which is the fact that a communicative infrastructure needs a physical carrier. This would typically be the national telephone network; however, these networks are extremely costly, especially in developing countries where resources are scarce.

There is clearly no easy way out of this dilemma. But by being aware of the problem, one can prioritize investments to support an appropriate (tele)communications strategy. Learning to cope with this technology is, as pointed out earlier, crucial for its successful exploitation. In the case of communication technology this implies that rather than waiting to build an infrastructure of equal quality to those in industrialized countries, developing countries should begin immediately, by making use of whatever is available. There are a number of examples of electronic networks which have been established in such an incremental, bottom-up approach through local initiative (Fredrick 1992, Levinger 1993, Schuler 1994). In fact, Horejs' chapter in this volume provides a detailed description of this process.

Conclusions: Toward a national health information system

The availability of appropriate information is the key to efficient public health care (PHC) management in Mongolia, and, we believe, in developing countries in general. We conclude by way of a handful of policy guidelines which may help Mongolia — and other developing nations — build a national health information system.

First, local use and processing of information is the key to improving the quality of information at both the local and central levels. What should be viewed as relevant information depends on its 'granularity', as the following example shows. In a local community like Shargalzuut in Bayanhongor Aimak (Mongolia), infant mortality is too small make generalizations about its causes. But visiting the neighboring village of Erdenetsog, it appears that the mountainous region of northern Bayanhongor share some common features regarding infant mortality. However, this fact is difficult to see at both the national level — since the data is too aggregated — and the local level — since too little data is available. Thus the Aimak — comparable with what WHO calls a 'district' — is the appropriate level for processing and analyzing this type of data.

Second, the WHO calls for the decentralization of health care services (Mills et al. 1991). This corresponds, in technical terms, to the development of relatively independent, semi-autonomous, local systems which allow integration and communication. In short, open and integrated systems. Communication between the various sub-systems requires a data network. Today such data networks, even ones that are state-owned, are expected to function according to free market principles. But this effectively blocks early use of the system. It also seems unreasonable considering that key technologies in industrialized countries moved from a sheltered environment to the marketplace only after some time.

Third, as the Mongolian case clearly demonstrates, specific institutions can play a key role in receiving, adapting and diffusing IT. In Mongolia, the National Computing Center of the State Statistical Office and the computing center of the Academy of Sciences developed both practical solutions and carried out important research. Institutions like these form part of systems of innovation that are important in all nations. As in Mongolia, such organizations and institutions are most often financed by public funds and are thus sheltered from the market economy. The modem based data network described earlier is an example of one innovation coming out of this system; keyboards and software for Mongolian Cyrillic is another. However, in Mongolia there is very little experience with systems development without a technical bias — outside the laboratories and for end-user organizations. Without this experience, we believe, the effective use of IT will not be possible.

Finally, we recommend the health sector as an area for learning about the use and development of IT, since one can improve PHC delivery while at the same time learning to exploit IT. With the Center for Health Statistics and Information in the Ministry of Health already playing, the WHO has funded a distribution of micro-computers to the health administration in all Aimaks. In order to turn this project into an efficient health administration system, new approaches must be learned and experienced. As stated above, such end user solutions are yet to be widely available in Mongolia. Technical knowledge about IT exists, but local users must learn how to use it efficiently. At the Aimak level, the State Statistical Office already has their branches making appropriate use of modem technology. Together with the central health administration the Aimaks could become an important factor in new systems of innovation which are yet to be developed. This is where efficient use of IT must begin.

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Information Technology for Development 6 (1995) 15 - 23

Technology Transfer vs. Technological Learning: IT-infrastructure and Health Care in Developing Countries

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Abstract

The notion of technological 'transfer' rests on a conception of technology as artifacts. This, as many have argued, neglects the crucial aspects of the social and cultural context of use. Technology has to be learnt rather than transferred. Based on this, we attempt to analyze the conditions and possibilities for technological learning about IT-infrastructure in developing countries. In so doing, we distinguish between local, contextual learning and institutional or technological infrastructure for learning. These processes of learning need to take place in areas sheltered from international competition. Examples from Mongolia and South African health care are used to illustrate our points.

1. Introduction

A number of people have pointed out the weaknesses – both conceptually and empirically – of a model of technological transfer from the North to the South. The notion of 'transfer' rests on a conception of technology as isolated, technical artifacts. A number of scholars have noted that this neglects the fact that the social, cultural and economical context of use differs (Kerbal, 1991; Odedra, 1992; Pfaffenberger, 1993). The problem of technology transfer should accordingly not be thought of as one of transferring artifacts but one of technological learning. And this learning, because it is so sensitive to the specific situations, is difficult to develop through traditional educational or university systems which primarily aim at general knowledge and principles. The general point of emphasising the learning required to use an artifact, as opposed to concentrating on the artifact itself, is here applied to a more specific situation: we focus on information technology (IT) in general and IT-infrastructure in particular. The crucial point, then, is to critically analyze the conditions and possibilities for appropriate processes of learning about IT and IT-infrastructure in developing countries. The aim of this paper it to contribute both to suitable concepts for framing the issue and empirical material illustrating our analysis.

In Section 2, we discuss the various levels and domains relevant to technological learning, which is a highly heterogeneous process. We argue that one has to consider localized, small-scale learning *in conjunction* with the surrounding institutional and political environment for technological learning. Localized, individual learning of IT is a major issue in the field of systems development whereas institutional frameworks for learning, discussed in Section 3, is receiving considerable attention in economic theory. We argue how the counterpart, in IT, of focusing on institutional

0268-1102/95/$07.00

frameworks of learning amounts to emphasising IT-infrastructure: open and integrated systems. In Sections 2 and 3 we illustrate the two levels of learning, the local and non-local, through examples from the challenges facing Mongolian health care information systems. Based on this discussion about the micro and macro level of technological learning processes, we argue that developing countries need to establish areas sheltered from international market forces for this learning to take place. The health care sector, we suggest in Section 4, is such an appropriate area. Section 5 sums up the policy for technology transfer to developing countries. This policy is compared with the ongoing debate in South Africa over a technology policy.

The case from Mongolia is the result of a three month field study of the existing health information systems (see Braa et al., 1994, for a more detailed account of this specific case). The illustrations from South Africa come from preliminary work in a project to develop information support systems to primary health care at community and district levels in the Western Cape province. We relate our discussion to the ANC's programme for Reconstruction and Development (RDP) of South Africa as it relates to IT and health.

2. Context and localized, small-scale learning

In systems development, as opposed to software engineering (cf. Pressman, 1992, p. 771), there has been emphasis on the importance of learning about the context of a computer system in order to make it useful (Bjerknes et al., 1990; Floyd et al., 1989). This knowledge does not exist before it is developed locally through praxis, and, as a consequence, it cannot straightforwardly be transferred.

It is the knowledge, attitudes and preferences of all parties involved which constitute the non-technical context surrounding systems development. Systems development is seen not only as a process of designing (or buying) and implementing technical artifacts, but also as a process of communication and mutual, interactive learning: systems developers learn about the non-technical context, and would-be users learn about the possibilities and functionality of the hardware and software. This knowledge is unique in the sense that it does not exist prior to the development process. Viewed in this way, system development is a process during which a new 'reality' is constructed, based on knowledge about the use of IT in the local context (Floyd et al., 1992). Similarly, social studies of technology empirically document how all users of technology shape and adapt artifacts flexibly (Bijker et al., 1992). There is thus a considerable amount of evidence indicating that technology cannot be understood as pure artifacts which may be 'transferred'.

In addition to distinguishing between mastering of technology as flexible or sensitive to context or not, there is another dimension which largely, we suggest, has been neglected in systems development: stand-alone vs. systemic/network technology. Systemic technologies quite literally need a network of several local praxises to function. The resulting network will not be established before demand arises, but must be developed gradually together with its exploration and mastering. A 'critical mass' of distributed experience has to be established. There exists empirical evidence indicating that the diffusion of systemic technologies is quite distinct from stand-alone technologies (Antonelli, 1991). Summing this up, we accordingly have identified two relevant dimensions of the fabric necessary to learn IT which gives rise to the following classification:

Classification of IT	Context-free	Context-sensitive
Stand-alone	1	2
Systemic/network	3	4

Along the top row (squares 1 and 2), we find different approaches to the development and use of basically stand-alone, isolated technical artifacts. In the present case, this corresponds, as indicated above, to software engineering and systems development, respectively. Software engineering focuses on decomposition, isolation or de-contextualisation of tasks; systems development on the mutual learning process and adaption between the design and its context of use. Along the bottom row we have technological assemblies of a communicative character. An illustration of square 3 is basic data communication, for instance, the Internet protocols or OSI's reference model.

We, however, focus on square 4 for two reasons. Firstly, we take the right hand side of the table (that is, squares 2 and 4) to be more interesting in the use of IT: the relevant learning processes underlying mastering of IT needs to be sensitive to its context of use. Learning presupposes mutual adaption, otherwise we 'transfer' IT instead of learning it. We accordingly argue that developing countries should not set high priority on hard-core, context-free computer science, say, parallel programming or database technology. Secondly, as IT matures, the real challenge will be how to integrate existing systems and supporting geographically spread work routines.

A recent report by the World Bank makes a similar point when identifying how infrastructure, broadly conceived, has been neglected in favour of more stand-alone, isolated pieces of technology (World Bank, 1994). The concern expressed by the World Bank to emphasise continuous, ongoing and flexible maintenance, rather than developing new technology, may be recognized as a greater sensitiveness to the context of a technology.

How, then, is the issue of local use and the context of information met? We illustrate the situation by drawing on examples from Mongolia.

The existing health information system in Mongolia is a centralized, vertically organised system. With complete disregard to context, statistics are gathered by aggregation of predefined entities from the local level all the way to the top. The original intention of the system was that reports, that is, the use of the information, should only be possible at the top. This is in stark opposition to our earlier remarks, that the use, interpretation and mastering of IT always have to be locally grounded. We illustrate how this disregard of the context of the information makes the existing health information system a poor basis for cost-effective health care in Mongolia.

Official statistics report a more than 50% decrease in recent years in the number of patients in hospitals. When people partly cease to attend hospital (due to, among other things, lack of drugs), an information system based on hospital data runs into problems. For instance, according to the (hospital based) official statistics, syphilis and gonorrhoea are declining, while surveys on the other hand, report increases in the diseases.

Despite high female literacy and extensive network of health care facilities, Mongolia has a higher maternal and infant mortality than countries with similar characteristics. Major infant killers have been respiratory and diarrhoeal diseases for the past twenty years. The maternal mortality has increased in recent years. In order to improve mother and child health three major programs have been launched; against diarrhoea, against respiratory diseases and a family planning program. There has lately been a slightly decrease in infant mortality, but nobody knows why: is it a 'mechanical' result of the decreasing fertility, or the result of the program against diarrhoea, or the one against respiratory diseases, or is it simply a result of under-reporting of deaths as some people claim? Answers to these questions are vital to efficient primary health care (PHC) management. But as the officers in charge of PHC in the Ministry of Health explained: the present system does not answer any of these questions, it simply reports the number of deaths.

3. Infrastructure and institutional frameworks of technological learning

Economic theory is in the midst of a paradigm shift: the very idea of how economic growth takes place is being challenged. The previous paradigm is based on what Schumpeter called the pedestrian view that it is accumulation of capital per se that propels the capitalist engine. The new understanding of the economic growth process focuses on learning and innovation as captured by the term 'national innovation systems' (Lundvall, 1992). The new ideas are becoming very influential in the OECD and in the EC, but at the same time the old neo-classical paradigm continues to be applied in policies towards the developing world (OECD, 1991).

In the new economic theory evolving, it is recognized that occasional fundamental technological changes – changes in techno-economic paradigm – alter the very basis of society; steam power, electricity, rail transportation, or IT. IT plays a role today similar to that of electricity and the railway under previous shifts in techno-economic paradigms. All countries catching up with the leader – England – up until World War I, did so by protecting the new technology activities through tariff barriers. Japan and Korea did so until recently. This option is presently being refused to the developing world by the policies of the World Bank and the IMF. The invisible hand of the marketplace will automatically assign the economic activities belonging to the previous techno-economic paradigms to the poor world.

As an illustration, consider the following case. The largest producer in the world of balls for the American game of baseball is the poorest country of the Western Hemisphere – Haiti. No US investment or new technology has managed to change the way these balls are produced, by hand with a basic needle-and-thread technology. The wage for the most efficient producers of baseballs in the world is 30 US cents an hour. In comparison, golf ball production was mechanised, and the average golf ball producer – in an industrialized country – receives a wage which is 30 times higher. Still, the industrialized world insists on believing that Haiti will get rich if she only could save more and produce more baseballs.

Providers of raw materials and labour intensive manufactured goods, the Third World countries are specialized in the very products where technological progress does *not* take place. The catch-word 'technology transfer' does therefore work against formidably strong market forces. The poor nations are locked in a vicious circle of low internal demand and a specialization in the world division of labour in producing mature products, not further mechanisable at present.

The present US and European governments' strategies for domestic development purposes vary enormously from what the same OECD countries recommend for the Third World. Whereas the *national* strategies of the OECD countries focus on creating industries with dynamic imperfect competition, all policies towards the Third World are based on the assumption that all markets are perfect and that all government intervention therefore is harmful. Likewise, whereas the government in the rich countries play a key role in establishing a technical infrastructure, for instance Clinton's 'information highway', the very same countries recommend that the creation of infrastructure in the Third World should be left to 'the free market'.

This re-thinking of economic theory thus implies a radically different role for infrastructure and frameworks – including institutions and the role of the government – for technological learning. We provide illustrations from Mongolia of technological learning. They are related to the issues of: infrastructure, institutional constructs and the role of governments (see Gurbaxani et al., 1990, for a discussion of the role of government in Singapore).

Infrastructure. Emphasising the context of local use is necessary but hardly sufficient. A number of important health issues only surface by comparing distinct sites or by aggregation. This amounts, in more technical terms, to developing a suitable IT-infrastructure also supporting gathering of non-local information. We illustrate the situation by providing examples of the need for integration and communicative infrastructure.

The situation in the province of the Bayanhongor Aimak in Mongolia illustrates the need for cross-comparison among local sites. Official statistics report decreasing infant mortality rate (IMR). This is correct but misses a vital point, namely that there are huge variations within the different parts of the district: it varies between 0 and 25. Furthermore, by analyzing these variations one is led to part of an explanation for the variations. Particularly in the mountainous region the IMR is high – and in some places increasing. Again, the simple counting of deaths, without any concern for where people die, is of little help when trying to cope with the problem. In visiting local hospitals there, we learned that the majority of infant mortality occurred at home, a fact not reported in official statistics.

Institutional constructs. Two institutions have played a major role in the history of informatics in Mongolia: the National Computing Centre (NCC) – now reduced to a computing department – of the State Statistical Office and the computing centre of Academy of Science. NCC was involved in research both regarding technical aspects of IT and in developing practical solutions. Being the processing unit of the State Statistical Office, NCC was also a dominant user of IT. It also functioned as a computer centre, processing data and making statistics, for ministries and other state organisations. Containing both research within IT, development of practical solutions and the use of these solutions, NCC played the key role in adapting IT to Mongolian condition.

It is, however, necessary to state that the needs of the planned economy, that is, statistics, was the driving force behind both use and development. A few years ago, about 40 programmers and 30 engineers in electronics were among the more than 200 working in NCC and they were a real centre of knowledge. Today they are only 12 IT professionals. The computer department of Academy of Science has a similar, dramatic decline over the past few years. Adaption of market economy imply that they have to sell services in order to survive. Unfortunately, due to the economical crisis, there is no market, and hence no investment in systems development. These two institutions were probably the closest one came to giving technological learning an institutional base in Mongolia – but they have practically been dismantled.

Role of government. Both economically and culturally, the marmot hunt plays an important role in Mongolia. Unfortunately, the animal is also a carrier of plague. Each year during the hunting season there are outbreaks in different parts of the country. As plague is extremely dangerous and infectious, fast reporting and immediate isolation of affected population and areas are required. Communicating through non-digital telephone exchanges may easily take a day. The Ministry of Transportation has, however, decided that the modern data communication network which is being introduced will function on a purely market basis. This lack of government support for infrastructure stands, as pointed out earlier, in stark opposition to the situation in the North. It effectively blocks use of modern data communication within the health care sector where gradual development and learning is necessary. Also, non-governmental organisations (NGOs), not only the government, may stimulate the demand and production of computer systems. The development of a desk-top publishing application adopted to cater for the Mongolian Cyrillic language was made possible because of projects for the WHO and DANIDA.

4. Health care as a sheltered sector for learning

The health sector could provide a suitable sheltered sector for learning about, and diffusion of, IT. There are three principal motivations underlying such a suggestion. First, health care is directly concerned with the basic needs of the population, and scarce resources to health purposes should be carefully managed. WHO strongly advocates the potential of IT for improving the quality and cost-effectiveness of health services and support activities (WHO, 1988). PHC is a concept to provide basic health care to the population, described in the Alma Ata declaration (WHO, 1978). PHC consumes more than 70 of all organised health care and represents a key factor in the struggle for delivering 'health for all' in the developing world. We thus focus on applications for supporting PHC, and the integration of these systems into the national level. Applications at district level strongly emphasise the issue of methodologies to ensure local adaption and sustained learning.

The second reason why the health care sector is appropriate, is that this sector is sufficiently complex to make full exploitation of IT necessary. The health care sector is not one homogeneous sector. It is a complex body of institutions, praxises, professional interests and other actors. It comprises both small, geographically spread primary health units and large, centralized and more bureaucratic hospitals. There is a number of relevant federal and local political institutions involved with budgeting, planning and controlling health care. The problems related to the existence of disjoint hierarchies ordered according to profession (medical doctors, nurses and administrative staff) are well-known, arguably even notorious. This makes it reasonable to talk about the politics of health care. These features of health care indicate that its complexity matches (at least those of) any other sector. It represents an instructive arena in which to learn and adopt communication technology and open, integrated systems.

The third and final reason is that the health care penetrates the entire society. In developing countries the health sector is typically among the biggest employers. The use of computers in such a situation may be of two quite distinct kinds: either more or less integrated with the organisation, the health care sector in the present case, or confined to technological enclaves. As computers are ultimately perfectly formal symbol manipulating devices, we have to recognize the limits of formalization to operate them. By keeping IT within strictly confined domains, this surrounding organisation of work routines may be sufficiently formalized as well; it makes transfer of *both* the technology *and* the restricted domain conceivable. The situation is illustrated by the fact that it is perfectly feasible to walk into British Airways' office in Dar-es-Salaam in Tanzania and make a reservation on a European flight using their computer based, world-spanning booking systems, while at the same time having problems making a local telephone call. British Airways is an example of technology transfer without any learning taking place. They simply transfer the confined context as well. But with domains, such as the health care sector, which are not readily restricted and formalized, this strategy is not viable. There is no way to avoid adaption and technological learning.

Arguing for the economical opportunities of IT is rapidly becoming a cliche. There appears, however, to be a bit of confusion as to where this growth is to take place. More specifically, the prevailing view of how to boost the economy of developing countries through exploitation of IT seems to be to focus on software and hardware *production* industry directly – to improve the trade balance by export (see for instance Nidumolu et al., 1993). Alternatively, and more in line with our argument, one could focus on improving the *use* of IT and accordingly be concerned with appropriate domains of use. Recalling the two dimensions of IT from Section 2, the former strategy is recognized to rely on de-contextualisation. It thus eliminates much of the learning taking place through flexible adaption to local conditions. At the level of technology policy, the difference between focusing on production vs. domains comes out quite clearly: subsidizing of production vs. establishing sheltered arenas for technological learning. We have little to say with regards to the former, but our suggestion to focus on health care is an endorsement of the latter strategy.

5. Conclusion

Our point of departure is that technology is learnt rather than 'transferred'. Furthermore, substantial, historical experience from the North strongly suggests that learning about IT needs to take place in sectors sheltered from international competition. This is what the North traditionally has done, and it is what they are currently doing in connection with developing IT-infrastructure or 'information highways'. This implies that the South can only catch up through a planned approach – and not by eliminating all possibilities of the required processes of technological learning. Only in this way is it conceivable for less developed countries to catch up technologically and, consequently, economically.

Technological learning takes place on different levels. On the local level, in the case of the health care sector this would correspond to PHC; it entails that IT has to be used, interpreted and learnt in its proper context of use. At the same time there is a need for an infrastructure supporting integration and aggregation of information from local sites. The real challenge is to find a reasonable balance between the local and non-local needs. As we hope to have illustrated, this balance can only be reached through practical experience and learning. To illustrate, we briefly review relevant parts of the Reconstruction and Development Programme (RDP) of the ANC in South Africa (RDP, 1994).

South Africa has one of the most in-equitable health care systems in the world. The RDP aims at altering this harmful effect of apartheid by developing a National Health System (NHS) driven by the PHC approach. The districts will form the pivotal level in the new decentralised structure. The District Health Authorities to be established will be responsible for all PHC delivery services in the district. For the new NHS to respond adequately – at both national, provincial and district levels – it will need health information to budget for equity in service provision and monitor progress towards narrowing the gap among different races, local areas and regions. The RDP emphasises that a National Health Information System (NHIS) needs data to be analyzed at all levels of the NHS. But there are, indeed, obstacles. The health districts in South Africa are not yet developed and a main obstacle in their development is the current fragmentation of health services. There are multiple authorities in the same geographical area and there are little sharing of information. A substantial part of PHC delivery is carried out by NGOs. PHC delivery is not coordinated at any level and it is unevenly distributed among and within communities.

The development of a NHIS will be an integral part of the reconstruction and development of the entire health sector, which is regarded to be a difficult long-term task. To meet these challenges the RDP emphasises that the government must develop at least one model or pilot health district in each province. The focus on pilots in order to gain experiences is very much in line with the learning approach we have put forward above.

South Africa may very well have the best technical and medical abilities, and the best developed infrastructure in Africa. But South Africa has so far not demonstrated any ability to use this wealth of knowledge for the benefit of the masses of the country. In evaluating the achievements of the different ministries after the first 100 days of government, the Weekly Mail Guardian (August 12 to 18, 1994) illustrates this point by emphasising that the obstacles are made up by the old way of doing things: 'For example, Water Affairs is a technically superior department, proud of formidable engineering feats such as giant dams and making the Vaal river flow backwards, but has never paid much attention to the 12 million people who have no access to clean water and the 21 million who have no adequate sanitation'.

The fact that children still die of measles 30 years after South Africa carried out the first heart transplantation add to, and exemplify further, this tendency. Recalling the table in Section 2, this technical fix approach to technology belongs to the left-hand, context-free side of the table. The challenge is to move to the context-sensitive, right-hand side of the table by not only building big dams, but solving the problem of clean water and sanitation for the population, focusing on PHC delivery as opposed to high-tech, prestigious surgery.

Pacey (1983) labels this dichotomy in attitudes towards technology as a perspective with the focus on use (for instance, PHC, clean water and sanitation for the population) as opposed to the traditional focus on supply (such as building big dams and power stations with no regards to the use of the output). This way of focusing on use is very much in line with the strategy we advocate towards technological learning through use.

ANC might be among the most computer literate governing parties in the world. The party has been a heavy user of e-mail since the mid-80's. For instance, information from and about ANC is available on the Internet ('gopher://wn.apc.org:70/11/anc/'), and the history of the struggle against apartheid is available on CD-ROM. The telecommunication and IT-infrastructure policy put forward in the RDP is strong in emphasising that telecommunications is an information infrastructure that must play a crucial role in the development, enhancing and facilitating of health care, education, public administration and rural development. This focus on using telecommunication and IT-infrastructure to enhance public sector is quite contrary to the marked liberal policy in Mongolia with very limited focus on public sector.

Nevertheless, even with a well developed IT-capability, it will be necessary to move from the context-free to the context-sensitive part of our table, or to focus on the real use on the ground, as Pacey puts it.

When it comes to our example, in the development of a NHIS, it will be necessary to establish pilot-projects to enable the required small-scale, contextual learning. And again, defining, collecting and using the information locally is the only way to ensure its relevance to local needs.

To sum up, based on the kind of conceptual analysis sketched earlier, together with the empirical material, we suggest that local use and processing of information is the key to improve quality of information *both* on the local level *and* centrally. The WHO calls for decentralization of health care services. This corresponds, in technical terms, to the development of relatively independent, semi-autonomous, local systems which allow integration and communication; in short – open and integrated systems. Institutions which form part of 'systems of innovation' are important for all nations. We suggest that the health sector is appropriate as an arena for learning about use and development of IT: improving PHC-delivery while at the same time exploring IT.

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Decentralisation, primary health care and information technology in developing countries: Case studies from Mongolia and South Africa

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Abstract
Many developing countries are in the midst of a process of decentralisation of their governmental structures and of their health services. In this paper examples from case studies from Mongolia and South Africa are presented. In both countries central issues are the decentralisation of health service management, and a shift of focus from a curative to preventive care (i.e. Primary Health Care). Major obstacles in the reformation of health systems in both countries are the resistance to change by the strongly centralised structures and the curative biases inherent in the present health system. In the paper, methodological approaches to overcome these obstacles are discussed: evolutionary and participatory approaches to information systems development are recommended. Because a central issue in reforming the South African health system is community participation, it should be possible to extend this ethos to community participation in the development of information systems in the health sector.

1. Introduction

The process of decentralisation of governmental functions in general, and health administration in particular which have recently begun in Mongolia and in South Africa, is paralleled in many developing countries. The World Health Organisation (WHO) encourages decentralisation as part of its Primary Health Care (PHC) strategy to strengthen health management at local level. Local processing of data and use of this information in local decision-making is believed to be important in this process. Appropriate use of information technology (IT) may play a key role in this regard. Drawing on case studies from Mongolia and South Africa, the place of IT in the restructuring of the health system is discussed. The rationale is to look for similarities and differences between the two cases, and thus identify lessons that can be generalised and seen useful in a broader context. The point of departure is the experience of fieldwork in Mongolia. Mongolia is some five years ahead of South Africa in its process of radical change. I will use lessons from Mongolia in analyzing the process of decentralisation of the health sector and the role of health information systems (HIS) in South Africa. These can be summarised in three interrelated issues:

1. *Decentralisation*. A process of decentralisation of the health sector has begun. To be successful a corresponding decentralisation of information systems is required. In the developing world the health sector typically consists of different, vertically organised and independent institutions. These centralised organisations may be efficient in some respects, but the verticality makes integration at other places than at the central level difficult. A decentralised structure requires integration at lower levels. The strongly centralised and vertically organised health system and health information system in Mongolia presents an important obstacle to the on-going process of decentralisation.
2. *Biases in information and the needs of Primary Health Care management*. The current centralised information systems are biased towards hospital care, and they are responding to the needs of PHC only to a limited extent. However, in order to provide PHC management with information appropriate for decision making, new kinds of locally based information systems must be implemented. Such systems will be based on a 'bottom-up' approach to the use of information. The deeply rooted curative bias inherent in the health system and HIS obstructs reform based on a preventive philosophy.
3. *Systems development*. The development of information systems focused on local decision making must be coordinated with a process of organisational change. The attitudes towards the use of information in health management as well as the managerial structures must be changed. This requires an evolutionary and participatory approach to system development - a process of continuous learning in order to modify and

improve both the information systems and the managerial systems.

A comparison with the situation in South Africa shows that:

1 In South Africa the old centralised structure is an important obstacle to decentralisation. An additional problem in South Africa is an extremely fragmented health care system reflecting the historical development of health services from colonial times, and the effects of apartheid ideology that organised both the health services and the society as such according to race.

2 The curative bias of the present health system in South Africa is as strong as in Mongolia. Nevertheless, a strong PHC movement and awareness may be important in counteracting this.

3 In South Africa, community participation in the development of health services is included among the issues that are given the highest priority in the African National Congress' (ANC) 'National Health Plan' (ANC, 1994a) and the 'Reconstruction and Development Program' (RDP) (ANC, 1994b). These important documents are guiding the official policies of the new Government of National Unity. The RDP has a title which clearly express its intent: the reconstruction and development of communities which have suffered under apartheid. The strong emphasis on community participation in South Africa, as opposed to the situation in Mongolia where such issues are barely mentioned, makes it useful to extend the notion of participatory design of information systems to include community participation.

In the following section, decentralisation and Primary Health Care are discussed together with the notion of technology. In the section after, the case of Mongolia is presented. Problems facing PHC management, shortcomings of the present information system and experiences from efforts in decentralisation of the information systems are reviewed. Later the case of South Africa is presented and in the final section, lessons are identified and approaches to the development of HIS discussed.

2. Decentralisation, primary health care and technology

Many developing countries are in the midst of a process of decentralisation of their governmental structures. Decentralisation can be defined in general terms as the transfer of authority or dispersal of power in public planning, management and decision making from higher to lower levels of government. Since health care is only one of the functions of government and its organisation is strongly influenced by governmental structures the decentralisation of the health sector must be analyzed in a broader context (see Mills, et al., 1990, for a comprehensive study of health system decentralisation). The district health system model, advocated by the WHO, is proposed as the most effective way of organising health services and of delivering primary health care (Amonoo-Lartson, et al., 1984). Key issues are:

1 the decentralisation of authority to a local management team, who can make decisions and control resources in the provision of health care in a geographically coherent area, a district;

2 sectoral and intersectoral co-operation; and

3 community participation in the services.

In the district system model appropriate health information systems play a crucial role in supporting local management (Wilson, et al., 1987).

In Mongolia, both the economic and administrative sectors are in the midst of a process of decentralisation. Former state-owned enterprises are being split up and privatised and governmental functions are being decentralised. In health care this process of change has resulted in a major shift in policy including decentralisation of health management, and a shift of focus from curative to preventive health care. Within a few years the Mongolian policy and ideology in general have shifted from the former 'think big and specialised' to the present 'think small and generalised'. The former one-sided focus on a Taylorised, hospital-based health care delivery, with a high degree of specialisation, is now being replaced by a stronger focus on 'the old family doctor' and a PHC approach.

South Africa has one of the least equitable health care systems in the world. It is a system that has served very well the health needs of 20 per cent of the population and left the majority, mostly blacks, with very poor health status and health services. The health system is highly specialised and centralised. The ANC National Health Plan for South Africa states that the PHC approach will be the underlying philosophy for the restructuring of the health system. Crucial to this will be the strengthening of community services through the development of a district health system. South Africa differs in many respects from Mongolia but both countries are in the midst of a transition from a deeply rooted authoritarian system to a more vaguely defined democratic system. In both countries, decentralisation of the health system and a shift of focus from curative to preventive health care, i.e. application of a PHC approach, are on the top of the agenda.

This transition from a curative based to a preventive based health system is not only a question of the changing of structures. In adapting a PHC approach, deeply rooted values and world views with regard to society, technology and health care will be challenged. The landmark Alma Ata 'Health for All by year 2000' conference (WHO, 1978) defined PHC as:

> *Essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost the country and community can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community.*

PHC is a very broad concept and as an approach to health systems development it is the very antithesis of the centralised and specialised health system of the former Soviet Union, on which the Mongolian health system is modelled. Similarly in South Africa, the first country in the world to do heart transplantation, children are still dying of measles and diarrhoea. The contrasts between specialised and generalised, between centralised and decentralised, and between curative and preventive are characteristic in comparing the old and new policies.

Pacey (1983) draws a line between similar dichotomies regarding health care and society and the notion of technology. He claims that preventive medicine, together with maintenance and hygiene, challenge the usual focus of technology on problem-solving in that they are concerned with problem prevention. Prevention, maintenance, organisation and end-use are all invisible to those who identify technology with hardware. In this way curative biases towards medicine are analogous to 'technical-fix' biases towards technology.

In health care, a curative bias reflects a mechanical perspective on health, while on the other hand, a preventive bias reflects a holistic perspective. Similarly, a one sided focus on hardware reflects a mechanical 'technical-fix' perspective on technology while a holistic perspective sees technology as a social construction and emphasises its use.

I will develop this analogy further and draw a parallel between the dichotomies mentioned above regarding the notion of technology and two contrasting approaches in systems development. What I label here as a technical-fix kind of project, e.g. construction of a bridge, a digital telephone exchange, or a hospital, is usually developed according to traditional engineering methodology. Needs analysis is completed before drawing up the specifications according to which the system is implemented. However, challenges in preventive medicine cannot be met by a technical-fix approach. The health system must be developed in a holistic approach integrating the development of organisations, technology and human capability. What is required is an evolutionary approach to systems development that encourages ongoing broad participation and mutual learning.

3. The case of Mongolia

During the summer and autumn of 1993, the author together with Ch. Nermunkh and G. Burendei from the Ministry of Health (MOH), Mongolia, carried out an investigation of health information systems in Mongolia. The main focus was on finding more efficient ways to use information in local decision making in order to support the decentralisation of the health services.

Mongolia is a large, landlocked and sparsely populated country in the northern part of Central Asia, located between Russia on the north and China on the east, south and west. The population of Mongolia is only 2.2 million. Although 52 per cent of the population lives in 3 industrial towns and 18 Aimak (province) centres, 28 per cent live mostly as semi-nomadic herders scattered in small groups of families. The 18 Aimaks are divided into 317 Soms, each having an administrative centre. Many changes have taken place in the political and socio-economic situation since 1990. The country, formerly a part of the Soviet block, has changed from a single party system to a multi-party system. The subsequent transition from a command economy towards a market economy has been marked by a severe economic crisis with shortages of food, medicines, fuel and everyday necessities as well as substantial unemployment.

3.1 Decentralisation and PHC

As part of the general decentralisation of power, functions and responsibility have been handed over from the Central Government to the Aimak administration. In building these new decentralised structures, the availability of and support given by appropriate information is of primary concern. So far, the HIS has failed to keep up with the changes. The systems are based on the needs of a centrally planned economy and a Soviet influenced health system with bias on hospitals and curative care. Formerly the health sector was evaluated and progress and fulfilment of the plans was measured according to the number of beds, hospitals, physicians, patients, diagnosed cases, etc. This is reflected in the two main characteristics of the existing systems:

1. the system is centralised and vertically organised, and
2. the data collected and the information provided are biased on hospitals and curative care.

The national health information system can be perceived as consisting of four different vertically organised systems all having their own information handling systems:

1. The main Health Statistical System produces the official health statistics;
2. The Infectious Diseases Control Centre is responsible for collecting data as well as producing statistics and information on infectious diseases and immunisation;
3. Pharmacy and drugs; and
4. Hygiene Control Centre where information about sanitation, hygiene and water-supply is collected and reported.

The verticality of the systems reinforces the problems of making use of the information locally as each of the different flows of information tends to by-pass the Aimak level. As originally intended surveys of the entire health information system are only possible at top level. These features of centralisation strongly contradict the needs of the decentralised administrative institutions which emphasise local decision making and, as a consequence, local information support. This implies that the four independent flows of information described above should be 'grasped' and integrated in an Aimak HIS. This process of decentralisation may be viewed as a democratisation of the information system since the responsibility for processing and use of the information will be given to the communities where the data is collected.

3.2 Information at Aimak level

The present HIS is designed for statistical purposes; local use of information is not encouraged and the feedback mechanisms are weak. No 'ownership' of the HIS is created among the health workers who collect the data (Nurminen, 1988). They do not regard the HIS as something they can change according to their own needs. Due to this lack of local use of information and local involvement the problems in the communities are rarely addressed by the HIS. Local use and processing of information is a key issue in order to improve quality of information at both local and central level. By quality I understand both accuracy, i.e. the data are correct, and relevance, i.e. (right) answers are given to appropriate questions. I will illustrate this by an example from Bayanhongor Aimak. This Aimak covers a vast area and contains two different mountain ranges and a part of Gobi dessert.

The statistics from Bayanhongor shows that the infant mortality rate (IMR) in the Aimak is decreasing and that the level is not high as compared with other Aimaks. This is true but this average hides the real situation: The IMR in the Soms vary between 0 per cent and 27 per cent. Particularly in the mountainous region, the IMR is high and increasing. When visiting local hospitals in this Aimak, we learned that the majority of infant deaths took place at home, a fact that is not reflected in the statistics. The official statistics simply give the number of deaths with no analysis of the causes of death. In Erdenetsogt, a small town in the mountainous region, we were told that only one out of 17 infant deaths (19 per cent IMR) by early September had occurred at the hospital! Therefore the hospital could not be blamed for the high infant mortality rate. Both the number of deaths occurring at home and the infant mortality rate had increased in comparison with the previous year. The problem, we were told, was the shortage of petrol and the corresponding poor ambulance service.

Shargalzuut is a nearby small-town with a hospital in the same mountainous region. Here too, both the infant mortality and the number of infant deaths occurring at home were increasing. In Shargalzuut they explained the similar situation differently from what they did in Erdenetsog. The problems, they explained here, were due to the socio-economic changes: privatisation of livestock which have caused the herders to take less care of the children. Parents work out in the fields while elder children take care of younger children. Also the herders have moved farther away from the hospital located in the centre.

In Erdenetsogt, the number of children attending school were decreasing. Contrary to the explanation regarding infant mortality, this problem was explained by the privatisation of livestock. They planned to counteract it by moving teachers out to the small settlements. According to a PHC approach, they might have acted in a similar way to counteract the high and increasing infant mortality, i.e. moving the health care delivery out to the small communities. With this example I want to illustrate that the 'curative bias' is deeply rooted in both the structure of health care and in the health workers themselves. The workers' attitude is that when they are working in a hospital and the infants are dead on arrival, there is not much that they can do. To address this problem, the structure of health care delivery and the staff's assumption of responsibility and their way of thinking need to be transformed from a curative to a preventive bias.

In this example, the HIS was not used to analyze the infant mortality, the most important health problem in the area. How could an information system respond better to the needs of PHC? According to Ties Boerma (1991) the following features of PHC are particularly important with respect to health information:

1 Equity in health is the underlying rationale for all health information efforts.
2 Preventive care. More emphasis has to be put on attempts to know what is happening in the communities as opposed to health care facilities.
3 Community participation is the key feature of PHC. Communities should participate actively in the health-information component of PHC-programmes.

Equity in health means that the most needy groups and individuals must be identified and strategies should be designed to redress inequalities. In the example above, the mothers and infants in the herder families should be focused on and the infant mortality should be analyzed. The HIS should make it possible to monitor and evaluate achievements in PHC programmes addressing these problems.

Preventive care focuses on what happens outside hospitals through inclusion of community surveys and community generated information. Hospital based data is not sufficient in this regard. As our example shows, the infants are dead on arrival at the hospital. As no children die from a lack of petrol (as a primary cause), the causes must be sought elsewhere, i.e. preventive action in the communities.

Community participation: information should address the health needs of the communities. In our example the infants of the herder families and remote households have a much higher mortality than others and should therefore require special attention. The community should participate in collecting and analyzing the data to ensure that the right targets are being set. Indicators on how the targets are being met should then be presented to the community to ensure community participation. Appropriate ways of presenting information using wall graphs, etc. must be explored.

Development of a HIS that respond to the needs of PHC is only possible if carried out as part of a general 'PHC-movement'. The present HIS reflects the present health system. Thus, the development of a HIS to support PHC must be integrated with the development of the health systems in general towards a PHC-approach. The limited focus on preventive care in Erdenetsog was not due to lack of information; it was due to the very thinking about health care. To develop the health system towards preventive care all health workers must be engaged and committed to changes.

3.3 Computer use and information for PHC-management

During spring 1993, all Aimaks were provided with microcomputers. As a first step, the main statistical software used at central level was distributed to the Aimaks. The plan is to 'force' all Aimaks to deliver the routinely collected data on discs. In this way the data 'must' be typed into the computer and, as a consequence, local processing of data will be possible.

The Aimak hospital in Bayanhongor and three other Aimak hospitals had already purchased their own computers when MOH provided all Aimaks with computers. In early 1994, these four Aimaks were the only ones using the microcomputers according to the plan, i.e. to produce reports for the MOH and to deliver the reports on discs. At that time none of the Aimaks used the microcomputers to analyze data according to their own needs. This indicates that the introduction of microcomputers in a top down fashion is a problematic task.

The statistical software distributed to all Aimaks is used in Bayanhongor to produce monthly statistics. The problem is that these are based on central requirements and do not address local needs. The case described above illustrates this issue. The causes of infant mortality, its distribution, and whether or not it occurs outside hospitals are not analyzed. No indicators are calculated to evaluate the performance of health services in counteracting the infant mortality. In short, the HIS is not used as a tool in local health management.

The suboptimal use of the computer in health management of the Aimak is mainly due to the organisational situation. The local government health management is responsible for health information in the Aimak but they do not 'control' the microcomputer, as this is located in the Aimak hospital. In the hospital, on the other hand, they control the computer but have no ownership in the HIS. They enter the data collected by health workers in the Soms and in their own hospital into the computer and produce the reports to be handed over to the Aimak health management. Neither the health workers who actually collect the data nor the staff dealing with the computer have any interests in the performance of the HIS. It is now planned to make the statistical office in the hospital responsible for health information in the Aimak.

In Bayanhongor, data on each death are now being entered into the computer and reports are sent on discs to MOH. Although analyses based on non-aggregated data are possible to perform, this is so far not done in a systematic way. This is not because the staff at the hospital are unfamiliar with the computer. The reason is, as pointed out above, that the staff who actually work with the computer and thus deal with the HIS have no responsibility or interests in making the HIS respond to problems and needs in health management. On the other hand, they have on their own developed several small applications responding to their needs, i.e. the needs of the hospital. These are spreadsheet and database applications handling hospital budgeting, staff register, salaries and hospital productivity. In addition, several reports are being produced when needed by the hospital management. The successful use of the microcomputer in the hospital is mainly due to the enthusiasm of the manager of the hospital. He took the initiative to purchase the computer, and he was the first one to learn how to use it. This example illustrates the importance of basing development of decentralised HISs on local initiatives and interests, and the importance of addressing the empowering of the local users and the creation of local 'ownership' to the system. Also, this case confirms Walsham's advice to developing countries to move towards Type B ('bottom-up') approaches to decentralised information systems, since Type A ('top-down') approaches are unlikely to be successful (Walsham, 1992).

4. The situation in South Africa

The population of South Africa is about 40.7 million and about 48 per cent of the population is estimated to live in urban areas. The latter figure is increasing as South Africa is experiencing rapid urbanisation. This follows the abolishment of legislation used by the apartheid state to keep blacks out of urban areas. Influx control, pass control and forced resettlement were among the means used by the apartheid state to obtain this. After the April 1994 election, a new Government of National unity has taken over. In the reconstruction of the health services in South Africa, the National Health Plan (NHP) and the RDP give the following tasks top priority:

1 to draw all the different role players and services into a unified National Health System (NHS) under a single Ministry of Health;
2 to use the PHC approach and to focus on community participation; and
3 to create health districts that will be responsible for PHC in a decentralised NHS.

To support this development and to make rational planning possible, both the NHP and the RDP state that an effective National Health Information System (NHIS) must be introduced. The NHIS is an umbrella concept which encompasses a number of different sub-systems.

A process towards developing a NHIS was initiated by a seminar in Broederstroom in March 1994. Here consensus on a national policy for setting up a NHIS was reached and task groups were formed to elaborate the policy further. After the election this process was carried on by a national committee established by the department of health for the setting up of a NHIS in South Africa. Working groups have been created in all provinces and workshops are being held. The aim is to analyze the situation in each province and to make plans for the development of the new NHIS in the provinces. Also the provincial plans for the development of HIS are to address the specific RDP health priorities (put forward by the Ministry of Health) and to monitor their implementation.

In this section, I will give a brief account of the fragmentation of the health services in South Africa and some of its historical background. I will also comment on possible strategies for developing HISs. My background in doing so is that I attended the Broederstroom seminar and for the last four months of 1994 I worked in the task group for the regional HIS in Western Cape Province. As an outsider I had a hard time struggling to understand the apparently chaotic organisation of the health care system in South Africa and the 'spaghetti-like' way different health systems and HISs are interacting.

4.1 The fragmentation of the health services in South Africa - an overview

The health system is extremely fragmented. It is fragmented vertically by race and horizontally by type of service, i.e. between preventive and curative health care and specialised services such as tuberculosis and psychiatry. There is geographical fragmentation in that each homeland and each province in South Africa had its own separate development, and there is a rural/urban fragmentation in the health services. Typically, in one geographical area there will be multiple authorities providing health services with little or no co-ordination. This system reflects both the historical development of health services from colonial times and the effect of the apartheid ideology. Until May 1994 there were fourteen departments of health at central level: the 'general' Department of National Health and Population Development, three for the apartheid specific 'white', 'asian', and 'coloured' administrations and ten for the 'black' 'homelands'. Outside the 'homelands' public hospital services are provided by the provincial administrations. At the local level, more than 400 local authorities and regional service councils of different types are responsible for PHC and public health services. The private health care sector provides curative services to less than 20 per cent of the population yet consumes 61 per cent of the total national expenditure on health.

At the local area level, the level where the PHC policy will be implemented and where equity in health is to be ensured, the fragmentation can be said to occur on two levels: the local government level and the health service level. The problem is that these two levels have no accountability to each other and neither do they have any accountability to the community. The district health system to be implemented is intended to solve this mess. Some examples from Cape Town will help clarify matters.

4.2 Fragmentation - examples from the Cape Town area

In the Cape Town area, there are four different health systems and thus four different health information systems. The fragmentation is due both to the different services the systems provide and the different populations they serve. The health department of Cape Town City Council, 'City Health', is an old institution responsible for the non-hospital health services in the urban areas in and around Cape Town, traditionally the white areas. Already in 1923 the Native Urban Areas Act restricted the movement of Africans in urban areas by means of influx control and the setting aside of areas for housing for Africans. Under apartheid, using the Group Areas Act (1950), the government embarked on a program of ethnic spatial engineering. Shanty towns and inner-city slums were demolished, and huge townships were constructed at distances from white areas.

Some 20 years ago 'Regional Service Council' (RSC) started to deliver non-hospital health services to the so called peri-urban and rural areas around Cape Town not covered by City Health. As a legacy of apartheid the City Health Department covers all the white areas and only some of the black areas, while RSC mainly covers the black areas. Each of these two health organisations run their own comprehensive computer-based information system, based mainly on data gathered from the day hospitals and clinics that they run.

The Provincial Administration of Western Cape (PAWC) is responsible for hospital services and some PHC clinics and thus forms a third health system. Their information system is based on hospital data routinely collected in all (public) hospitals in the province and from some PHC clinics that they run themselves. The provincial office of Department of National Health (NH) runs the fourth HIS in the area. It collects geographically comprehensive data from the hospitals, clinics of 46 magisterial districts (MD) and 64 local authorities (LA).

The MDs cover the entire area of the province but have no governmental authority. They are areas of jurisdiction containing a police station. The LAs, on the other hand, have some governmental authority in their municipalities and run clinics, schools, build roads, etc. The LA-municipalities (mostly white) are widely dispersed and surrounded by rural and peri-urban areas. The areas not covered by the municipalities have no local autonomy and are run directly by the RSCs. A typical situation was that farm workers living just outside the municipality had no right to access the clinics run by the LA. As a late development, the RSCs set up clinics for the farm workers thus exposing and aggravating the fragmentation along race lines. Also the PAWC could run a clinic in the vicinity, adding to the organisational fragmentation. According to the health information officer in PAWC, in one particular street in Cape Town there are three clinics run by PAWC, RSC and the municipality respectively which report to three different HISs. Such fragmentation is an important obstacle to providing information for PHC management who require a coherent overview of the distribution of clinics, their catchment populations, workloads, etc.

A study of the HISs in the Western Cape, carried out by the above mentioned task group, shows there is no integration of information from the different services; there are no common goals, no standards for reporting and different target populations are used, so that there is no comparability. There is duplication so that the same pieces of data are collected many times for different purposes. Yet at the same time there are enormous gaps and much data is irrelevant to both collectors and managers. The volume of data collected is enormous but the quantity of useful information produced from it is minimal. Much time is spent collecting data but there is in general no local use of the data. The HISs reflect the centralised and vertical structures of the health services and the top down command structures that hardly involve service providers in data analysis or decision making. Because the HISs do not address local needs and do not engage staff at local level in data analysis, a vicious cycle reinforces centralisation and fragmentation.

4.3 Restructuring the health system and developing the HIS

The NH and the PAWC are to be merged by the end of 1994. City Health and RSC will also be merged and reorganised when the new health district are to be implemented. This implies the merging of a national institution with a provincial one. Differences in culture, management structures, etc. are substantial, as are the differences in salaries and working conditions. The process of bringing the national and provincial structures together has been more complicated than foreseen. It is expected to take 3-4 years to establish the health districts. Important in these merging of organisations is the integration of their information systems. The four information systems are all centralised, as are the organisations they serve. Integration of the ISs (co-ordination of input, output and routines) should go hand in hand with, and even support, the process of integrating the organisations.

The integration at local level will require the establishing of new managerial structures responsible for PHC in the communities. I will give an example to illustrate this:

Atlantis is an industrial town with a population of 60-70,000 people situated 50 kilometres from Cape Town. As a consequence of the Group Areas Act, the town was created in 1975 as an effort to stop the influx of 'coloureds' into Cape Town. Subsidies were given to encourage the establishing of factories. After the subsidies were brought to an end a lot of factories closed down and the unemployment rate rose above 50 per cent. In the area covering Atlantis, a village and the surrounding farmland, there was one hospital, three clinics and a number of NGOs and private practitioners. Of the three clinics, two are under RSC and one is under PAWC, as is the hospital. There is no co-ordination of information and the clinics and the hospital send their reports to three different places. The private practitioners and the NGOs dealing with health care delivery do not report anywhere.

A project has been set up by the Department of Community Health, University of Cape Town, to investigate the use of health information and the routines for collecting data in Atlantis. The project has analyzed the information flow from the different health facilities. Because the system of data collecting is not objective-driven and is so fragmented the project reports that the information derived is not very suitable for local management. For example, there is no profile of patients or diseases in the area, and there is no data on effectiveness and efficiency of the health services. As the existing systems of data collecting are established to respond to central requirements and not to address needs of local decision making this is understandable. There is no co-ordination of the health services in Atlantis. Thus, no authority is yet in place that could actually use the needed information in decision making.

According to plans, the project mentioned will start developing a local HIS in Atlantis in 1995. This must relate closely to the development of new managerial structures in Atlantis unifying the different health services. It might be useful to look at the development of the HIS as a tool to support this process. Support of local decision making development of the district HIS will entail identification of needs, objectives, priorities and the range of decisions to be taken. In this way the process will focus on management performance and structures, and the further development of these, as much as the information system itself. The quality of the information system will be ensured by linking the HIS to management decision making. In this way the new managerial structures will be developed together with new managerial tools provided by the HIS.

4.4 NHIS and the RDP

The Ministry of Health has compiled a list of 26 RDP health priorities and has stated that a main target for the NHIS to be developed is to support these. The priorities are of various kinds, ranging from health programs like 'provide free access to health services to children under 6 years', to health system restructuring; 'establish health districts' and to the promotion of community participation. These various health priorities relate to IT in different ways, making it necessary to distinguish between different ways in which the HIS may support the priorities:

1. Health programs. Monitoring of certain programs through focused collection of data and calculating of indicators is a priority, e.g. mother and child health, mental health, infectious diseases, AIDS, etc. will be closely monitored.
2. Health system restructuring. The NHIS should be used as a tool in the process of restructuring the health system and creating a united (non-fragmented) NHS and supporting the new district structures. In this way the managerial tools of the HIS will be developed together with the new managerial structures of which they will be an integral part.
3. Community participation. Involvement of communities in the planning, managing, monitoring and evaluation of health services is a crucial issue of the PHC approach and a major priority. The community will need appropriate information in order to determine their health needs and to monitor and evaluate the health services. The NHIS should facilitate community participation by providing regular, useful feedback on the achievements and constraints of the health services. The information must be provided in appropriate ways, e.g. using graphs, maps and, in order to reach greater parts of the community, other techniques that could be used by the mass media. In an effort to institutionalise community participation, the RDP prescribes the setting up of inter-sectoral Community Development Committees and Community Health Committees, both to be elected from the community. The HIS should facilitate the interaction between these committees and the health services. This make it necessary to involve people from these committees as active participants in designing and developing the HIS at the district and community level. Thus, the HIS must address the needs of the community, not only the needs of the health services.

4.5 Obstacles to community based development

While having the best technical and medical resources and the best developed infrastructure in Africa, South Africa has not demonstrated any ability to use its wealth for the benefit for the majority of its own population as is evidenced by a very weak PHC structure. Only a very small part of the total health expenditures is used for PHC. The local authorities which are responsible for promotive and preventive services account for approximately 4 per cent of total public sector health expenditure. Central departments dictate what information should be collected and there is very little use and analysis of data at local level. PHC at community level and higher levels is not co-analyzed and it is unevenly distributed between and within communities. The centralisation of health services, the high-technology, the curative bias and the fixation on western models of health service delivery, all constitute powerful forces against the implementation of the new PHC based policy. 'Technical-fix' biases towards technology and health and the 'top-down thinking' reflected by such biases are significant obstacles to the 'bottom-up' approaches to development that are required to address community participation and the implementation of a PHC policy.

5. Discussion of the two cases

5.1 Comparing the two cases

While being as different from each other as countries can be, South Africa and Mongolia still share some features in their strive to reconstruct their health systems. The health system in both countries, as a legacy of the past, still reflects the ideology and economic structure of the former Soviet Union and the apartheid state respectively.

In Mongolia the extensive distribution of health care facilities in all communities all over the country reflects the ideological focus on equity - and the need of the state to control all aspects of society. Their system of referral of patients over great distances to specialised hospitals was based on the curative and 'technical-fix' biases of the former Soviet Union. After the break down of Soviet Union Mongolia discovered itself to be among the poorest countries in the world. The health system relied upon the availability of free transport (petrol) and medical equipment, drugs, etc. provided by the Soviet Union. The system was much too expensive to be viable.

In South Africa the resources of a huge country were channelled to support a minority with one of the best hospital-based health systems of the world leaving the majority with very poor health services. Today when equity in health is required it is clear that the South African health system is also not financially viable - it would be impossibly expensive to expand the comprehensive hospital based system to serve the entire population.

Thus from very different points of departures and with very different legacies of the past, both Mongolia and South Africa have embarked on the development of a viable health system based on a PHC approach. Mongolia has its advantages in that the structure, the health districts (Aimaks) and a network of staffed health facilities are in place. But the PHC awareness is still to be developed. South Africa on the other hand has not yet developed the structure but has an advantage in the well established PHC movement.

The main lesson from Mongolia is that the development of new HISs must be integrated with the development of new managerial structures. In Mongolia computers and software were simply distributed to the Aimaks. No effort was made to develop ways to make use of information in local decision making or to establish a management authority that could make efficient use of the information. The training provided was directed towards the use of computers and software. How information could actually be used in order to strengthen health management was not addressed. As a consequence the introduction of computers at Aimak level have so far not caused substantial changes towards better use of information in decision making. The centralised and vertical structure of the old system and the inherent curative bias both constitute important obstacles to change.

With the extremely fragmented health services in South Africa and their highly centralised structure it is to be expected that the structural resistance to change might be as hard as that experienced in Mongolia. Therefore the need to integrate the development of the NHIS closely with the development of new managerial structures and the strengthening of PHC management might be as important in South Africa as it has proven to be in Mongolia. Also, the curative bias of the present health system in South Africa is as strong as it is in Mongolia. The hospitals consume the substantial part of the public health expenditure and a redistribution of resources from hospitals towards PHC will certainly cause problems.

5.2 Bottom-up development

A decentralised and democratic biased 'bottom-up' approach to health systems and HIS will require local initiatives and enthusiasm. This again emphasises the necessity of empowering communities and allowing communities to participate in developing the health systems as envisaged by the RDP.

In one of the examples from Mongolia the health workers in a hospital complained that the infants were dead on arrival at the hospital. Consequently they found it difficult to take action. This illustrates that the local health workers are not (at present) taking part in a community based 'PHC-movement' and the 'PHC-awareness' in the communities is limited. In the example, the local health workers and health management neither used the HIS as a tool in detecting problems and setting targets nor did they use the HIS to calculate indicators to evaluate how targets were met. The IMR was extremely high but they did not analyze the information available in order to take appropriate action. The most important piece of information in this regard, the fact that nearly all of the infants deaths occurred at home, was not even reported. The central requirements on data collection did not ask for it. In order to change this tendency it will be important to create a sense of 'ownership' and to empower the end-users; the health workers who collect the information must feel that it is useful and they must start to use the information in their work. The example from the hospital in Bayanhongor, Mongolia, shows that such ownership is possible to create.

In South Africa the situation regarding 'PHC-awareness' is different from Mongolia. The restructuring of the health system and the PHC approach is a central issue in the political movement that has swept away the former apartheid system. As engagement and awareness are prerequisites for community participation this may be more easily achieved in South Africa than in Mongolia. But the 'information awareness' among health workers and health management seems to be as limited in South Africa as in Mongolia.

A shift of focus from curative to preventive care implies that other kinds and sources of information are needed. Focusing primarily on local information, and possibly local action and decision making, is, according to Opit (1987), a central requirement for getting the right information and making appropriate use of it. The local community is where the information missing from the hospital based system is available; such as information about who is not receiving care and about social cultural and political constraints on desirable health service action. As indicated in the example from Mongolia local use of information is also a strategy to ensure the quality of the information.

5.3 Community participation and participatory design

It is difficult to distinguish between the development of health systems and the development of the corresponding HISs. The examples from Mongolia have shown that problems with regards to information systems can be traced back to causes in the organisational context and in the nature of structures, power and values in society. In South Africa the HISs are a reflection of the fragmented health services. Thus the development of HIS must be understood as an integral part of the reconstruction of the Health System. In South Africa, community participation is seen as a central issue in building the new health system. Also community participation is a central feature in the PHC concept on which the new health systems both in South Africa and Mongolia are to be built upon. As argued in a previous section, community participation is a key feature in a HIS addressing needs of PHC.

The emphasis on community participation makes it necessary to develop further the notion of participatory design (PD) approaches to system development which addresses the participation from the (future) users of the IS (Floyd, et al., 1989; Greenbaum and Kyng, 1991; see also special issues of Communication of the ACM June/1993 and January/1994). The development of a PHC based health system that takes account of community needs should be closely linked with the development of the HIS. As the users of the PHC based health system will be the members of the community, they must be able to participate in its development. The HIS should be used in the communication between the health services and the community thus facilitating community participation. In this way HISs may play a key role in carrying out the community participation policy. In this approach the HIS should provide information on the main health problems of the community in a way that makes it easy to involve the community in setting targets for improvements. In the next step the HIS should present indicators to involve the community in both meeting the targets and in evaluating the performance of the health services in this regard.

Thus the users we must address are the users of the health services, i.e. members of the communities and not only the users of the IS in the organisation(s) in question. In this I agree with Korpela (1994) when he claims that the clients of IS users should also be taken into account in order to avoid the risk of developing 'user friendly mafia systems'. In our context, the aim should be to ensure that the health system responds to the needs of the communities.

Miller (1992) argues that the way systems are created shapes both the systems and the environment within which it operates. Thus when the objective is to develop a system to enhance community participation a PD approach should then be appropriate. The process of system development could then serve as a training field for community participation. As argued in an earlier section, the very nature of PHC and preventive action makes it important to use evolutionary and participatory approaches in the development of systems based on such concepts. Miller argues further that a PD approach has a chance to influence events if it manages to attach itself to and draw energy, legitimacy and support from a larger movement. The PHC movement in South Africa has potential in this regard.

Greenbaum (1993) put forward three perspectives for the need for PD approaches:

1 a pragmatic perspective, a functional way to increase productivity;
2 a theoretical perspective, a strategy to overcome the problem of lack of shared understanding between developers and users; and
3 a political perspective, a democratic strategy to give people the means to influence their own work place.

In accordance with the discussion above, I will put forward a fourth perspective on PD approaches; a strategy to enhance community participation. This perspective is derived from the democratic perspective above but extended to encompass both the workplace and the community. Members of the community are users of the health services. A PD approach including these users as participants focuses on the end-use of the technological systems to be developed, i.e. the community based PHC services. As pointed out in an earlier section, broad participation will be necessary in order to develop systems and technology based on the principles of PHC and preventive action. A PD approach aims at helping the community to formulate their needs and requirements for health services and uses the information system as a tool in this regard.

6. Conclusion

I have outlined two broad areas of obstacles to change in the health systems of Mongolia and South Africa:

1 For decentralisation the important obstacles are the vertical, fragmented and centralised structures.

2 For instituting a PHC approach the important obstacles are the hospital based structures and the curative ideology.

As argued above, within both areas IT has the potential to contribute to the process of change. Decentralisation will require the development of HIS appropriate to each level of government and management. Important in this regard will be to develop the HIS integrally with the development of the new managerial structures at district (or Aimak) level. In order to support PHC the HIS must address both the needs of PHC management and the needs of the community. As argued above participatory approaches to systems development might be important both in defining the needs and in making the HIS address these needs. An important issue in PHC management is to use information in decision making. So far this is not part of the PHC management culture and it will be important to integrate training in use of information in the process of developing the HIS. Therefore the process of system development will not only address the development of new managerial structures and a new HIS; ways of using information in decision making must also be addressed. Integrating these three issues will require an evolutionary approach to system development and the desire in each participant to learn continuously from his or her experience.

My aim in this paper has been to link the concept of community participation (inherent in the PHC approach) with the concepts of participatory design from the discipline of systems development. I have argued that the concepts of participatory design should be extended to include community participation in the development of health information systems to support PHC management. This would simultaneously facilitate community participation in the implementation of a PHC approach.

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Health, Information Society and Developing Countries
M Sosa-Iudicissa, J Levett, S Mandil, PF Beales, Eds
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South Africa, Africa and Health Information Systems - The Need for a Reciprocal Collaboration

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1. Introduction

South Africa has one of the least equitable health care systems in the world. It is a system that has served the health needs of the richest 20% of the population and left the majority, mostly blacks, with very poor health status and health services. The health system is highly specialised and centralised. The African National Congress' (ANC) "National Health Plan"[1] and the "Reconstruction and Development Program" (RDP) [2], both state that the primary health care approach will be the underlying philosophy for the restructuring of the health system. Crucial to this will be the strengthening of community services through their participation in development of a district health system. To support this development and to make rational planning possible, both the National Health Plan (NHP) and the Reconstruction and Development Program (RDP) state that an effective National Health Information System must be introduced. Community participation in health emphasises people centred, small scale development and the implementation of viable primary health care (PHC) programs. These are areas in which South Africa has little experience.

A quarter of a century after the worlds first heart transplant was performed in Cape Town, children are still dying of measles and diarrhoea, tuberculosis prevalence in Cape Town is amongst the highest in the world. Resources and technological capability alone are not enough to ensure development and a vital lesson South Africa has to learn is how to use its resource base to develop the country and the people. South Africa has not paid much attention to developing the "third world" part of the country. As this is the main objective of the new South African government, experiences from other parts of Africa, and thus South-South collaboration, will be important. As will be illustrated with a case from Ghana, African countries have valuable experience in developing people based PHC programs with advanced use of health information even under conditions of financial constraints.

South Africa has the potential to be an innovator in exploring ways to use and exploit information technology (IT) to develop its people. Lessons from South Africa will then be of value to other countries in Africa in the use of technology in general, and IT in particular, in a way that is beneficial to the poor majority. Thus, both South Africa and the rest of Africa will benefit from South - South collaboration.

The aim of this paper is to present and discuss a mutual beneficial model for South-South-North collaboration which includes South Africa, other African countries and Europe. It is against this background that problems facing the restructuring and development of the health sector in South Africa are outlined. This is done using the example of Mitchell's Plain, where the newly established health management team has recognised the need for a people-oriented health information system, but the existing system does not have the ability to meet these demands. It is submitted that South Africa has many lessons to learn from Ghana, a much poorer and less developed country which has gone through the process of restructuring its information system to make it objective-oriented and user-friendly. Lessons from the Scandinavian tradition of participatory design will be important in developing locally adapted health information systems in South Africa as well as in the rest of Africa.

The situation in South Africa in general and Mitchell's Plain in particular is described first, then the Ghanaian experience in health information is outlined, with lessons learned and a proposal is made for a triangular collaborative model. The authors have participated in the processes in both South Africa and Ghana.

2. The Situation in South Africa

The population of South Africa is about 40.7 million and about 48% of the population is estimated to live in urban areas. A Government of National unity has taken over since 1994 and the Reconstruction and Development program (RDP) has given the following tasks top priority:

- to draw all the different role players and services into a unified National Health System (NHS) under a single decentralised Ministry of Health;
- to use the PHC approach with a focus on community participation;
- to create health districts responsible for implementing and monitoring PHC

To support these developments and to make rational planning possible, it is widely realised that an effective National Health Information System (NHIS) must be introduced. The NHIS was initiated at a seminar in Broederstroom in March 1994 where consensus on a national policy was reached. After the election a national committee was established by the department of health to set up a NHIS. Working groups have subsequently been created in all provinces and workshops are being held to analyse the local situation and to develop the new NHIS. These provincial plans are to address the RDP health priorities and to monitor their implementation.

2.1. The Health Services in South Africa - An Overview

South African apartheid policies are well known, and the effect that these policies have had on health are extremely complex. The health system is fragmented in every conceivable way - by race, type of service and geographically. It is extremely difficult for an outsider to understand the apparent chaotic interaction between different systems which reflect both the historical development of colonial health services and the effect of apartheid ideology. The race fragmentation is fairly obvious, with different authorities providing services for each of the four race groups; within that framework, different services provide preventive and curative health care separate from specialised "vertical" services such as tuberculosis, obstetrics and psychiatry; rural services were provided by Regional Services Councils and urban health care by municipalities; each "homeland" and each province in South Africa had its own separate system functioning independently. "Academic" hospitals stand isolated at the top of the curative pyramid, run by the provinces, funded nationally and consuming enormous resources to provide high technology medical care to the few. Until May 1994 there were fourteen "departments of health" at central level and more than 400 local authorities and regional service councils of different types.

A proliferation of non-government organisations fill in the large gaps left by the state apparatus and provide a wide range of community based services, using largely external funding. The private health care sector further complicates the picture and provides curative services to less than 20% of the population yet consumes 61% of the total national expenditure on health.

2.2. Provincial Restructuring

The creation of a single, unitary and all-embracing national health system (NHS) is a major undertaking and fraught with enormous problems, both actual and potential. In the Western Cape province the curative services of national and provincial level are being merged to form the Provincial Administration of the Western Cape (PAWC) from the end of 1994. Preventive service providers City Health and the 6 Regional Services Councils will also be merged and reorganised into PAWC when the new health districts are set up. Differences in institutional culture, management structures etc. are substantial, as are the differences in salaries and working conditions. The process of bringing these diverse structures together has been more complicated than foreseen and it is expected to take up to 3-4 years to establish a viable and effective district health system.

An important factor in merging these organisations will be the integration of their information systems which are currently as fragmented as the organisations they serve. Integration of the input, output and routines of the information systems should go hand in hand with, and support, the process of integrating the organisations.

2.3. The Reconstruction and Development Program (RDP)

The RDP has defined 26 health priorities of various kinds, ranging from health programs like "provide free access to health services to children under 6 years", to health system restructuring; "establish health districts" and the promotion of community participation.

One RDP target is to create an information system to support the achievements of these objectives. This may be done in a number of ways:

- Monitoring of health programs. Through collection and analysis of appropriate data to calculate indicators, programs such as mother and child health, mental health, infectious diseases, AIDS etc. can be monitored.

- Health system restructuring. The NHIS should be used as a tool in the process of supporting the new district structures. The managerial tools of the system will be developed together with the new managerial structures, of which they will then be integral parts.

- Community participation. Involvement of communities in the planning, managing, monitoring and evaluation of health services is crucial to the PHC approach. The community will need appropriate information to determine health needs and to monitor health services. The NHIS should facilitate community participation by providing regular, useful feedback on the achievements and constraints of the health services. The information must be provided in appropriate ways such as graphs and maps and should use the mass media in order to get maximum coverage. The new field of multi-media, i.e. the integration of sound, video and information, will emerge as important tools to facilitate communication between health services and the community. The NHIS should facilitate the interaction between community committees and the health services by involving them as active participants in developing the local information system, which will address the needs of the community, as well as the needs of the health services.

2.4. Fragmentation - The Mitchell's Plain Example

The town of Mitchell's plain is a classic creation of the apartheid era - people displaced from their ancestral homes by the notorious "group areas act" and dumped on a barren, sandy waste land on the periphery of Cape Town with minimum facilities of any kind.

An indicator of the chaos in the area is that nobody knows the real population - estimates vary from 240,000 to 450,000! Similarly, basic statistics such as immunisation / antenatal coverage, Infant Mortality, perinatal mortality etc. are unobtainable and are merely guessed at. What is known for sure is that there is one of the highest incidences of tuberculosis in the world and that unemployment and the attendant social problems such as alcoholism, drug abuse and gang-related violence is widespread.

Health services are delivered by two main organisations. The Cape Town City Council provides preventive services at five clinics and the Western Cape province (PAWC) provides curative services at one 'day' hospital and a large provincial mental hospital serves the entire province as well as Mitchell's Plain. In addition, a number of vertical provincial programs (Obstetrics, Family planning, school health, youth, dentistry etc.) function independently of the main structures, responsible to separate departments at head office. All these organisations are largely institution-based, make little effort to reach those who do not come for services and have no accountability either to the population or to other service providers.

There is minimal local management and all decisions are taken by different"head offices", so that there is no co-ordination of activities and no on-the-ground responsibility for quality or coverage of service provision. Financial decisions are all taken centrally so that nobody knows how much the services cost, resulting in an extremely expensive and inefficient system.

Non-government organisations provide a variety of community based services, but hardly articulate with the basic health services. Private practice flourishes in the form of doctors, dentists and pharmacists but no data is available on what they do.

2.5. The Health Information System

Information flow follows managerial line function and results in the "spaghetti-like" way different information systems interact. Each organisation collects data independently, reports raw data to its own head office and receives virtually no feedback from managers. Because of the fragmentation, there are no common goals or targets for the services and each works in isolation, duplicating much data, leaving enormous gaps and using different target populations.

A large amount of raw data is collected, with nurses spending up to 40% of their time filling in forms demanded by superiors. All this data is transmitted manually without processing from one level to the other, with no effort to analyse locally or to convert data into indicators.

At higher levels, understaffed and poorly equipped information officers can not cope with the avalanche of raw data which has to be entered manually, resulting in a large bottleneck from which there is virtually no feedback.

All of this results in a system which demotivates staff, produces patchy, inaccurate information which is of no relevance to front line health workers and is hardly used by managers.

A study of the HISs in the Western Cape (Baqwa et al. 1994[3]) shows a general picture that is born out in Mitchell's Plain:

- no co-ordination or integration of information from the different services;
- no common goals or operational targets and no indicators;
- no standards for reporting and different target populations, so that data is not comparable;
- duplication means that similar data are collected many times. At the same time there are enormous gaps in information;
- much data is irrelevant to both collectors and managers.

- the volume of data collected is enormous but its quality is poor and the quantity of useful information produced from it is minimal;
- much time is spent collecting data but there is no local use of the data.
- the HISs reflect the centralised and vertical structures and the top down management system hardly involves workers in data analysis or decision making.
- because the HISs do not address local needs and do not engage staff at local level in data analysis, a vicious cycle reinforces centralisation and fragmentation.

2.6. The Way Forward

With the setting up of a democratic society in South Africa, initiatives have been put in place to break down the fragmented services, develop an accountable and transparent district health care system and to involve the community in managing health affairs in the area.

One of the first priorities identified by the embryonic district health management team (DHMT) in Mitchell's Plain was the need for adequate information on the area. Help was sought from the Health Information group who had written the above report. The problems were easy to identify, but local knowledge on this process of setting up an objective-oriented, people centred information system which encourages the use of local data, is not well developed in South Africa and much of the initiative has relied on the application of lessons learned in another African country - Ghana.

The process is still under way, and has consisted of an initial identification of all the role-players in the area and an analysis of the flow of information between the various levels. Diagrammatic representation of this flow rapidly identified the folly of the previous system and the possible solutions to resolve them. A survey has been conducted which identified staff attitudes to collecting and skills with using data.

Next steps include the setting of local goals, targets and indicators, modification of the flow of information so that everything passes through the fledgling DHMT and the training of workers in the analysis and use of the data they already collect. The process they will go through will follow similar lines to what was done in Ghana, though obviously with local modifications, and with a stronger technological component.

The envisaged information system will be computer based at district level. The regional health management information system (Rehmis) has established a database with data about facilities and equipment and will give the new system a kick-start. The new emphasis will be on developing a user friendly system containing a geographical information system, which can be used at local level to produce maps and graphs for both health workers and the community. In developing the information system a participatory approach will be used (Greenbaum, Kyng 1991[8]), thus linking with the Scandinavian tradition of participatory design.

3. Ghana

3.1 The Development of a National Health Information System

Ghana is a reasonably typical West African country with a population of 16 million, an economy based on agriculture and minerals and an infrastructure that was once reasonable but has slowly eroded over the past 30 years. It was the first independent anglophone African country and has long history of political commitment to Primary Health Care, but the practical implementation of PHC was beset by multiple problems of shortages of finance, poor management and lack of resources.

The health system underwent radical restructuring in the early 1990's and as a part of this, an improved health information system was seen as a priority. The process of development of the information system in Ghana is illustrative of the positive symbiotic relationships possible in a north-south collaboration. The idea of rationalising information use was initiated by the director of the national mother and child health program who felt the need to improve departmental monitoring and evaluation capacity. The national ministry, on hearing her intentions, encouraged her to develop a broader based, comprehensive management information system by including all service divisions. At this stage, financial and technical support was sought from United Nation (UNFPA) who provided technical assistance from the Royal Tropical Institute, Amsterdam, which developed a broad framework into which programs could plug and gave technical inputs as the program evolved.

A short term project developed an action-oriented health information system which aimed at improved coverage and quality of services to the people through better use of data. The system encouraged health workers at all levels of the health services to assess their performance, compare it over time and against other similar organisations, and to use information for selective support and supervision. A key element was the stimulation of regular feedback by each level to the level below it.

A working group (MISWG) was set up consisting of national, regional and district personnel, supported by technical assistance. An initial situation analysis carried out by this group found a pattern typical of many countries (Campbell et al. 1991[6]):

- program goals, objectives and operational targets were not clear;
- the concept of an indicator was foreign;
- staff did not appreciate the importance of management information and were not trained in its collection or use;
- raw data flowed vertically to program 'bosses' and key managers were left out;
- forms were too many, incomplete, confusing, poorly laid out and often redundant;
- feedback was seldom forthcoming;

An ongoing discussion ensued, and a series of workshops led by MISWG resulted in setting of goals and operational targets for program divisions, definition of indicators for each program and sources of this information, a review of the existing data collection and reporting tools, a modification of the flow of information to go through the DHMT and an intensive training of staff. The new system was implemented in one district, modified with experience over a period of 6 months and later successfully implemented in three provinces. The system has now been fully taken over and further adapted by the ministry of health and is being implemented nation-wide.

The system was almost entirely paper and calculator based, using computers only for aggregation and analysis at regional level and in some privileged districts. This was done because computers were not widely available and those that exacts had major problems because of humidity and a poor maintenance infrastructure. The emphasis was on simple individual and team self assessment at a local level, using indicators to compare performance to targets set, other similar service providers and performance in the past.

Tools used were simple - planning was based on goals, operational targets and a minimum number of indicators; to collect data, tally sheets, registers and client cards were used; reporting forms sent both numerator and denominator and calculated indicators to supervisors and were at the same time both aggregation and feedback forms; self assessment tools included line and cumulative coverage graphs, maps, and the report forms.

The new information system has had several direct and indirect benefits. A follow up study (Nyonator et al. 1993[9]) showed that people now knew their catchment areas and target population and were actually using this information to improve coverage. Teamwork benefited substantially when people knew their goals, operational targets and indicators and used assessment of progress towards operational targets as a discussion point in team meetings. Supervision improved with the introduction of the health information system, as the self assessment tools provide easy starting points for identifying support needs. Disease control improved as the "top ten" diseases were easily identified and training could be oriented to priority problems. The process of integration was facilitated as workers got to know the activities and achievements of other programs, and other management support programs were supported by having better information. A final spin-off effect was that the annual reports of the regions and the nation were standardised and data was easy to plug into a known, tested format.

The development of the system has not been without its problems, and there was often intense political pressure and resistance from certain program directors, provincial and district managers as well as the workers themselves. Implementation, too, was full of teething problems ranging from vertical line managers who insisted on "their" information still being collected, through to logistic problems of getting the right forms to the right place. Throughout the process the biggest problem was regular and supportive supervision of the level below - national level has to support regions who in turn give feedback and support to districts who actually go out and help clinics to put the system into place after training.

3.2. Lessons for South Africa

The Ghanaian system is by no means perfect, and will be continuously improved as it is used. There are however, even at this stage numerous lessons to be learned by South Africa from their experience.

The first is that many of the processes of making statistics usable are universal. It is possible to develop a simple but effective, people-centred health and management information system which supports PHC without enormous technological inputs or expensive short term 'experts'. The important thing is to involve people at all levels in all stages of planning, in order to promote a sense of ownership and commitment to the system. Committed and creative individuals are essential to push the process and to make it sustainable, and this push should come from "within", rather than outside of the health system.

Secondly, at each level, the workers themselves should do the primary analysis of data into useful information in the form of indicators which measure progress towards locally determined targets. This information can then be used locally before it is sent up to 'higher' levels. It is necessary to have staff who are dedicated to compiling and analysing data for some or all of their time, but this should be primarily to ensure completeness and accuracy of information and providing feedback to lower levels.

Thirdly, data will never be perfect, but great improvements to service delivery can be made without having precisely accurate figures, as it is usually the range within which statistics fall that is important rather than the exact number. The more staff use the data themselves, and the more feedback they receive, the more accurate will be the data they collect. Regular ad-hoc surveys done (preferably by the district themselves) to substantiate observations from routine data are much more useful than trying to collect large volumes of data"in case it might be useful one day".

Finally, it must be pointed out that, in spite of the best information system, many decisions will still be made on political grounds or "seat of the pants" intuition. All that an information system can do is to facilitate decision making and increase the number of "rational" decisions.

4. South - South - North Collaboration

While having excellent technical and medical resources and the best developed infrastructure in Africa, South Africa has not used its wealth for the benefit of the majority of its population, as shown by a very weak PHC-structure. PHC is not co-ordinated and is unevenly distributed between and within communities. The centralisation of health services, the high-technology, curative bias and the fixation on western models of service delivery are all powerful forces against the implementation of a PHC-based policy. South Africa has very little experience of dealing with the problems facing the establishment of an accountable district structure in Mitchell's Plain. Other countries in Africa have experiences that are of great potential value for South Africa. The Ghana case also shows the usefulness of appropriate collaboration between Africa and institutions in Europe.

4.1 The Triangular Model

We outline a triangular collaborative model in which South Africa, the less developed countries of Africa and Europe make up the three parts. The proposed collaborative model is related to the notion of South Africa as a locomotive for regional development, but has a slightly different focus. The model strongly advocates horizontal collaboration with South Africa as an equal participant with other African countries, as opposed to a vertical model with South Africa (or Europe) in central position. The challenge is to establish mutually beneficial collaboration between South Africa and other countries in Africa. The case from Ghana illustrates how South Africa can benefit from such collaboration while at the same time Ghana could benefit from the South African resource base in developing her infrastructure. Our model recognises the reciprocity and "South-South" character of optimal regional collaboration.

In our triangular model, Europe is important not only traditionally as a provider of technical expertise, money and technology, but as a facilitator in the process of adapting and transforming information technology to meet local needs in a Third World context. There are two areas where European know-how is important for Africa:

1. Methodologies and approaches to use of health information to support PHC in developing countries; In Ghana, an European institution (Royal Tropical Institute, Amsterdam) facilitated the successful use of health information. Other examples include the action-led approach to health information developed in Tanzania with the African Medical Research Foundation and Liverpool School of Tropical Medicine as main counterparts. (Sandiford et al. 1992[10]).

2. Participatory design and evolutionary approaches to the development of information systems; In Europe, and particularly in Scandinavia, there is a strong tradition of people centred and democratic technology development (Bjerknes et al. 1987[4], Floyd et al. 1989 [7]) which promotes action research and participatory design, including local adaptation and implementation of information systems. These methodologies, approaches and experiences will be useful in facilitating the appropriate use of IT to support PHC in Africa.

The reciprocal model emphasise that the learning process will also be beneficial for Europe. By exploring the above mentioned methodologies and approaches in an African context, participating institutions are exposed to new and challenging situations and problems. Through collaboration, these methodologies and approaches will be developed further and the "experience base" will be broadened. This will feed back to European practices in system development.

4.2. Implementation of the Model

As a result of the work of the information task group in Western Cape, initiatives are under way to establish pilot projects to develop viable information systems in some of the proposed districts in the Western Cape, linked to similar initiatives in the Eastern cape. With the creation of new provinces, the Western Cape received most of the human and infrastructural resources while the Eastern Cape is relatively under-resourced. The proposed project seeks to build information capacity in the Eastern Cape by using the resource pool in the Western Cape in collaboration with the Norwegian Computing Centre and Norwegian funding (NORAD).

By establishing collaboration between the more developed Western Cape, the less developed Eastern Cape and appropriate institutes in Norway, a"micro" implementation of the triangular model is under way.

The project also aims to develop the resource bases further by linking with development in other parts of Southern Africa and beyond by taking part in the INDEHELA initiative.

INDEHELA (Informatics Development for Health in Africa) is a proposal to establish pilot projects in Africa and to form a collaborative network between these projects. The INDEHELA initiative grew out of discussions during and after the HELINA (health informatics in Africa) 93 conference in Nigeria where collaboration between projects and initiatives in Africa were given the highest priority. At this stage the initiative links European partners from Finland, Norway and United Kingdom to African partners in Nigeria, South Africa and Zimbabwe.

5. Conclusion

It is generally recognised that the economic strength, technical capability and resource base of South Africa will be important in the development of the technical expertise, infrastructure and economy in Africa. But it is not widely accepted that the lessons already learned by poorer African countries in implementing PHC and small scale development projects, will be equally important in developing the "New" South Africa. Through the cases from Mitchell's Plain and Ghana we have illustrated that there is in Africa a resource pool of experiences, methodologies and approaches to dealing with problems facing the reconstruction of the health services in South Africa.

Through the triangular model, reciprocal South-South-North collaboration is proposed.

The development of an action-oriented, people centred information system is an essential aspect in the restructuring of a health system. If correctly done, with full participation, and information system provides a multi-faceted tool that not only monitors progress towards targets and improves effectiveness and efficiency of interventions, but increases the participation of health workers and the community in planning, management and implementation of health activities.

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Methods of Information in Medicine

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District Level Information Systems: Two Cases from South Africa

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Abstract: The health system in South Africa has to date been fragmented and centralised. The priority of the new government is to establish an integrated and decentralised district health system of which a key element is the development of district health and management information systems (H & MIS). This paper presents experiences from two projects in the Western Cape in which a process to establish a district-based H & MIS was initiated and a situation analysis of the information systems was done. The two projects applied different research methods but the results show with remarkable consistency that much time is used on data collection, but information is not used at local level. The projects have applied different approaches towards developing a district H & MIS but in both important pre-requisites for a successful, action-led H & MIS include local ownership and motivation, a process based around existing local management structures and the active involvement of the community

Keywords: Health Information Systems, Management Information, District Health Systems

1. Introduction

The creation of health districts to implement and manage primary health care is central to the reconstruction of the health system in South Africa. One of the key mechanisms identified for driving this process is development of a locally useful health and management information system (H & MIS). In spite of elaborate planning and advanced policy, no such system has to date been established at district level; one priority is to set up pilot projects to learn about constraints, possibilities and how to establish a viable information system.

This paper will present, compare and discuss findings and experiences from two health-information projects situated in the vicinity of Cape Town: Atlantis an industrial town, and Mitchell's Plain, an urban township. Both are classic creations of the Apartheid area and the notorious "group areas act". In both projects the aim has been to support the establishment of a process to develop a district-based H & MIS, and a situation analysis was done with emphasis on local analysis and use of information.

In Atlantis a comprehensive evaluation of the information system showed that the volume of data collected is enormous but that the quantity of useful information produced from it is minimal. Much time is spent collecting data but there is in general no local use of information. In Mitchell's Plain a "quick and dirty" survey, followed by focus group discussion, confirmed the findings from Atlantis. The Mitchell's Plain survey thus put more weight behind the results from Atlantis - and vice versa.

The process of developing a H & MIS has met with problems in Atlantis, as local management structures are not in place and local facilities are managed in a fragmented way from various head offices. In Mitchell's Plain these problems have been avoided by driving the process through local management and community structures.

In the next section a framework is given: the situation in South Africa is described and H & MIS in the context of district health management is outlined. Thereafter, the two cases are presented with focus both on the analysis of the current situation and on the process towards a H & MIS. The article concludes with the findings from the two cases and a discussion on their relevance with regard to the problems facing development of a district-based H & MIS in South Africa. The authors are active participants in both projects.

2. Framework

2.1 South Africa - A Fragmented Health System

The health system in South Africa has always been highly specialised and centralised. The focus was on technologically sophisticated hospital care, but primary health care (PHC) delivery was poorly developed. In addition, the health system is extremely fragmented as a range of different health authorities are responsible for different services within a single area. A Government of National Unity took over in 1994 and through the Reconstruction and Development Program (RDP) the Department of Health has given the following tasks top priority:

- To draw all the different role players and services into a unified National Health System under a single decentralised Ministry of Health;
- To use the PHC approach with a focus on community participation and intesectoral action; and
- To create health districts responsible for implementing and managing PHC.

To support these developments and to make rational planning possible, it was seen as essential to introduce an effective National Health Information System for South Africa (NHIS/SA). A national committee was established by the Department of Health with working groups in all provinces. One of the key mechanisms identified for driving the district development process is the development of a locally useful H & MIS which will provide all hospitals and clinics with basic information systems for patient administration [1].

2.2 Information System for District Management and PHC

The district health model is proposed as the most effective way of delivering primary health care and of organising health services [2]. Key issues are:

- The decentralisation of authority to a local management team;
- Sectoral and intersectoral cooperation; and
- Community participation in the services.

The South African approach is moving towards the WHO definition of a district health system [3]:

"A district health system, based on Primary Health Care, is a more or less self-contained segment of the national health system. It comprises first and foremost a well-defined population, living within a clearly delineated administrative and geographical area, whether urban or rural. It includes all institutions and individuals providing health care in the district, whether governmental, social security, non-governmental, private or traditional. A district health system, therefore, consists of a large variety of interrelated elements that contribute to health in homes, schools, work places, and communities, through the health and other related sectors."

A district management team will coordinate and draw together all these elements and institutions into a comprehensive health district. District H & MISs are crucial in achieving this [4, 5]. Major sources of information to support the district management team include [6]:

1. Health facility (hospitals, clinics, health centres) - based information.
2. Community-based information systems;
3. Special studies and information from other sources like census data, health system research, etc.

Key deficiencies of health-facility type of information for health management include:

1. It is generally restricted to medical care services; and
2. It provides information about only those persons who actually use the health facilities, and tells nothing about the health status or health needs of people who are not using these facilities.

Traditional health-information systems collect data in order to make retrospective analysis, at a higher level. In PHC the challenge is to analyse and use the information immediately, at the same level where it is collected: local information to support local action [7]. The traditional approach to health information is "data-led", where the data is an end in itself. What is needed in PCH is an "action-led" approach where information is used to influence action [8].

A district H & MIS will collect and analyse data aggregated from a variety of "production" information systems in the district; systems that register some kind of "action". The patient record-based information system in the health facilities make up an important group of these systems. From these the district H & MIS aggregates information on health differentials in different population subgroups.

A PHC-based H & MIS in a district will thus be very different from the conventional hospital information system. It is not possible to down-scale a hospital information system to fit the needs of PHC in a district, because information requirements, services rendered and functionality required are all different [9].

The concept of a district - a complex part of the real world - is very different to that of a hospital which is a well-defined problem area limited by the hospital walls. The cornerstone of the NHIS/SA will be a number of relatively independent, semiautonomous district H & MIS which allow integration and communication; open and integrated systems. Districts differ greatly in social, economic, ethnic, political and geographical conditions. They range from poor rural areas of subsistence farming to urban townships; from "shack-land" to Zulu-land. In each district, a locally adapted H & MIS must be established and the challenge will be to find a reasonable balance between local and non-local needs. In this process, learning by a process of trial and error, i.e., pilot projects, failures and advanced examples, will be of vital importance [10]. The two cases we present here are a contribution in this regard, and advanced examples will be of vital importance [10].

3. Case 1 - Atlantis

3.1 Background and Process

Atlantis is a small (60-70,000 people) industrial town created in 1975 to curtail the growth of "coloured" people in Cape Town by moving them to this area, a classic creation of Apartheid and the notorious "group areas act". Atlantis is typical in that the health services are extremely fragmented; the hospital and the clinics belong to three different health authorities with no coordination among them.

In 1994, a project was set up by the University of Cape Town to develop and pilot a district level information system in Atlantis. The objectives were to develop a minimum data set, develop an information system, and to build the capacity of health workers and local management. A thorough evaluation was done of health-information systems within the public health facilities of Atlantis, looking at information flow and evaluating each data-collection tool used in local health facilities. The participatory research process exposed local health workers to the field of health information: through their participation in various courses, by identifying and prioritising local health problems and by taking part in the evaluation of the information systems through a process of action research. Health priorities were translated into objectives for a health plan for the area. Suitable indicators will be selected to monitor and evaluate the objectives and a minimum data set will be defined to support this.

Intersectoral cooperation has been initiated through affiliation to the Atlantis Development Forum, a large umbrella organisation of all organisations and sectors in the area. It is envisaged that health-related information from other areas will feed into the district health-information system and that feedback will occur both ways.

The project team facilitated the establishment of a community health committee, using the project as focus for further development. However, a fully representative health committee has not yet been established and the community has been represented by members of the Atlantis Development forum.

3.2 Evaluation methods

The research process used in the evaluation was that of action research, with a focus on participation. This involves a series of steps: data collection, analysis, feedback, and action. The cycle repeats itself and is intended to maximise development and learning of those who participate in the process. In Atlantis the following steps were embarked upon:

- identifying all public sector facilities.
- mapping the way information currently flows by exploring various sources of data,
- identifying and training research assistants to participate in the process and involving them in the development of protocols and questionnaires,
- identifying key informants from local facilities and interviewing them.
- feedback of the results from the evaluation, to local staff and management.

The domain of study was the use and purpose of all forms for data collecting used in public health services in Atlantis. All forms in use were collected. Using available knowledge the project prepared a preliminary "Information map", showing the health facilities and their relationships with management, and how information flows between them (Fig. 1b). New information was obtained by interviewing personnel at facilities. All forms completed at a facility were assessed by the interviewee for quality using the following indicators: purpose of the document - was the information actually used and how, ease of use (i.e., the form), importance of information recorded, whether any feedback was ever received from higher levels.

The interview format was piloted and modified before the main interviews were carried out. Twenty-nine persons from four public facilities were interviewed. Summaries were compiled after each interview, providing feedback to the interviewee, and an opportunity to reconsider options and make further comments. Initial interviews were summarised and fed back for comments and corrections to those interviewed.

3.3 Results of the Evaluation

The summarised information was presented to a group of health workers and managers using a "brown paper" exercise to display data-collection tools. The aim was to display the large bulk of data gathered by staff, as well as to highlight duplication of information and the lack of coordination between the different service providers. Staff from the various departments assembled all the data-collection forms in use within their department and pasted it onto reams of brown paper. This totalled 100 forms. Each department selected a representative to present the forms from their department to the workshop and highlight the usefulness or uselessness of the forms. The forms were displayed by programme and by facility, hence all tuberculosis (TB) forms from one facility were displayed together, etc. The exercise gave staff a concrete view of how many forms they deal with and how useless much of the information is.

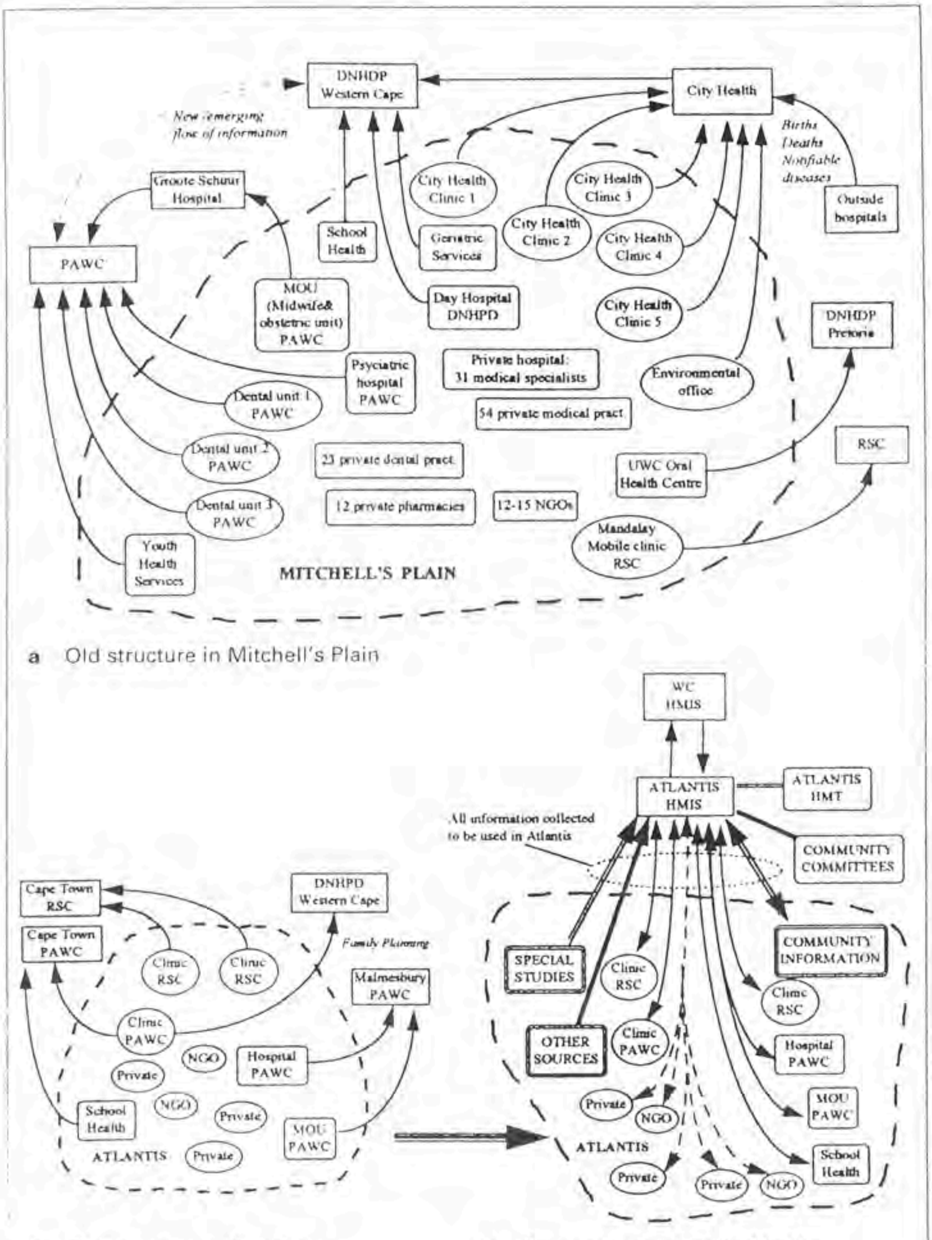
The main findings of the evaluation were:

- Patient and Management information tools totalled 172 forms for the two selected services. Management data-collection tools alone totalled 100, after the exclusion of duplicates.
- None of the interviewees reported using numerated goals, targets or objectives in the planning and management of the services they were providing.
- None of the interviewees reported using information for decision making at local level.
- Personnel had little or no feedback from data sent to service managers. In instances where feedback is given, it is often in a very confusing and unintelligible format.
- Ninety-eight percent of the forms were rated easy or very easy to use and 49 percent of them were rated as containing very important information (sometimes even when no use for the information was described).
- Data collection is primarily a function of the nursing personnel and occupies up to 40 percent of their time. Information needs must, therefore, be based on their identified needs to ensure that they collect and use information that will contribute to the more efficient delivery of health care.

3.3 Constraints Experienced

The major problem was the absence of a local management structure that could drive the process and take responsibility for the priorities identified. Numerous other issues, such as salary disparity between different employing authorities enjoyed a far greater priority with managers and health staff, shifting health information restructuring much lower down on the agenda.

The communities have so far not been actively involved in the project but the establishment of a fully representative health committee that will ensure community participation is under way. A tremendous step forward for the project was the formation of a reference group which comprised representatives of all the health authorities in the area.



a Old structure in Mitchell's Plain

b Old structure in Atlantis

c Proposed structure in Atlantis

Fig. 1 Flow of information in Mitchell's Plain (a) and Atlantis (b). Abbreviations: DNHDP (Department of National Health and Population Development [pre-election name]); PAWC (Provincial Administration Western Cape); RSC (Regional Service Council); NGO (Non Governmental Organisation); MOU (Maternal obstetric unit; UWC (University of Western Cape); City Health (Cape Town City Council Department of Health). In (c), a vision is presented of how the present situation must be transformed in order to support district structures.

members of the research team and the provincial task team for health information. Members of the newly-formed health committee were included in this process. However, in spite of the status of the reference group, the issue of authority to make decisions still presented a problem as the local health managers still had to get authorisation to make decisions.

Senior managers were reluctant to allow things to be done differently in Atlantis from other districts. The result would have been two parallel systems, the existing one and the pilot one, a situation which was not feasible given the current staff shortages within the services. Unless a provincial mandate is given that the pilot sites be allowed to run their information systems differently, the project team and health workers will not have the power to grapple with constraints such as time, person-power and staff morale.

The project has carried out a comprehensive evaluation of the present information system with full support from local health workers and facility management as well as from various persons at provincial level. It has, however, not been possible to establish a strong local management team with representatives from all services and full support from the two head offices. The fragmentation of the health services without strong local management has been the main problem in the project and has made it very difficult to go from evaluation and analysis to the implementation of changes.

4. Case 2 - Mitchell's Plain

4.1 Background

Mitchell's Plain is a commuter town on the outskirts of Cape Town, created for "coloured" people in the 1970s in a way similar to Atlantis. The population is estimated to be between 300,000 and 400,000. The incident rate of tuberculosis is possibly the highest in the world, and unemployment, gangsterism and violence are rampant. Health services are run in fragmented lines with four major authorities running the various services.

After the election in April 1994, representatives from the different health services and the community came together to start building a unified management structure at district level. Alongside the service providers the Mitchell's Plain PHC Forum, an umbrella organisation with representatives from grassroots and community-based organisations, was a driving force.

One of the first priorities identified by the embryonic district health-management team was the need for adequate information on the area. Their requested technical support from the University of Western Cape. An initial survey done in October 1994 identified significant gaps in available infrastructure as well as lack of local information about health status, institution and service management. An information committee was established to plan, develop and implement an integrated and action-led H & MIS.

4.2 A Survey of the Information System-Methods

The process started with identification of all the role players in the area and an analysis of the flow of information between the various levels. Diagrammatic representation of the current flow (see Fig. 1a) shows the fragmentation and lack of coordination of information. A survey was conducted using rapid assessment techniques to identify staff attitudes to collecting data and skills in using it.

A questionnaire was handed out to all health services in Mitchell's Plain to determine the use of data and information in their daily work. All five city council clinics, the day hospital, MOU and the dental faculty replied (12 respondents). The responses were analysed and the results were presented to the staff in meetings at the clinics and at the day hospital. "Collective" interviews and focus group discussions engaging 58 people in five groups, were held to get direct input from the staff, promote discussion on information issues and to start the process of empowering staff to use information. Quotes from these discussions are included in the results section in quotation marks. The management was interviewed separately to ensure that the discussions could take place in a relaxed atmosphere.

4.3 Results

The results show that data are kept on most activities ranging from inpatients, antenatal and immunisation, to home visits and community activities. Nobody found the statistics useful in their daily work, the opposite was more usual: "Keeping stats is a waste of good time". Everybody keeps statistics on what they do and spends a minimum of 30 min. a day totalling and transferring data onto other forms. Some staff spend all Friday doing "statistics". Each clinic sends a 30-page booklet of raw data to the head office every week, and a copy is kept on file locally.

Data are not available at one central spot in the district because of the fragmented nature of service delivery. Data are sent to different sections of different head offices, so there is no way it can be coordinated at higher levels. Information is transmitted in raw form, with no compilation or analysis. There is no local use of data and no conversion into indicators.

Analysis and use of data is seen not as the responsibility of the institution or district, but of the "head office". Nobody is clear about what is done with it, apart from "statistics", "planning" and "follow up if something is wrong".

Information is seen as being owned by the "head office"; there is no feedback on results sent there, apart from annual reports. Some workers get telephone/letter feedback if the statistics are not correct.

One encouraging exception was provided by a sister who on her own initiative kept graphs of her TB patients to see defaulter rates. However, she has moved to family planning and the graphs are not currently kept.

There is a general sense of helplessness amongst staff about information collected. They roughly estimated the time they spent on statistics to be at least 8 hours a week. This time, they felt, was used on meaningless statistics, without feedback apart from criticism, with no goals and targets to aim for and they never saw any results of their hard statistical work. Nobody on the ground level knows the basic indicators of the health status of the catchment population such as IMR, fertility rate, nutrition indicators, etc.

The total population of Mitchell's Plain was not known, let alone the catchment population served by individual clinics. Target populations for program activities such as immunisation, maternity, school health, family planning etc., were not known either. Information about the community regarding education, employment, housing and socio-economic status was vague and non-quantified. The concept of "program coverage" was poorly understood and not used.

Quality is not locally assessed in any institution. Support visits from superiors are done, but they do not discuss the data collected, unless there are mistakes.

The information system in Mitchell's Plain is designed to meet the needs of administrators in the various head offices, rather than the needs of the service providers in the field. The system is fragmented, so that data are not available at a central point for the district as a whole.

There is no district vision and no common goals, targets or indicators so that team work is minimal, even within organisations. Target populations and program coverage are unknown concepts, making self assessment impossible.

A large amount of data are collected, using approximately 20% of staff time. There are enormous gaps in information about community health status, disease patterns, quality of service and system management.

Feedback is minimal and usually only negative. This discourages staff from collecting accurate data or using it locally. Supervision is weak and does not concentrate on achievements of targets. No staff had training in information collection, analysis, use, or self assessment.

4.4 The Process

The survey has been followed up by a series of workshops and meetings and selection of a H & MIS steering committee from all health institutions and the community. Action has been taken on the findings of the survey, defining information needs and setting up a step-by-step process to develop ways of using information.

A project has been set up to provide information support to district management by developing H & MIS at both institutional and district level. A main focus is on developing an "information culture", building capacity and empowering health workers and community. The project applies a participatory design approach using techniques such as prototypes, maps and wall charts. One activity is mother and child health which involves a cross-section of institutions working together for the first time ever.

The approach to the district level H & MIS is by coordination of these activities and integration of results alongside focused activities at district level.

In order to influence the building of the new health system, the community will need regular, useful feedback on the achievements and constraints of the health services. They need information on the general situation in their community on population, health and socioeconomic conditions. They plan to use the mass media in order to get maximum coverage in interaction with their constituency.

5. The Two Evaluations

In Atlantis, structured in-depth interviews of health workers were carried out. All forms for data collection were inspected and the flow of information between the different levels of health services was analysed. The main findings were that there was no use of information for decision making; little or no feedback on information sent to service managers; no use of numerated goals, targets or objectives in the planning and management of the services; a total of 172 forms for data collection were in use; data collection is primarily a function of the nursing personnel and occupies up to 40% of their time.

In Mitchell's Plain the project analysed the present information systems using rapid assessment techniques, identified the role players in the area and mapped the flow of information. Questionnaires identified staff attitudes to collecting data and skills, followed by focus group discussions. The results show remarkable consistency with the results of the Atlantis project: Data are kept on most activities, but information is not used in daily work and most staff regarded keeping "stats" as a "waste of good time"; Staff spend up to 20% of their time doing statistics; Each clinic sends raw "stats" to different sections of different head offices every week so there is no way it can be consolidated at higher levels. These data are not available at one central spot in the district so it can not be analysed locally.

In Atlantis, data collection is primarily a function of the nursing personnel and occupies up to 40% of their time. In Mitchell's Plain, on the other hand, most staff are involved in doing statistics, occupying about 20% of their time. Friday is typically a day spent on doing statistics. The differences in how the tasks are distributed among staff may explain most of the discrepancy in reported time used on data collection in the two places. It is important to note that time used on data collection was not scientifically measured but estimated together with the personnel.

The methods used in Mitchell's Plain were less comprehensive, more "quick-and-dirty" than in Atlantis, with more emphasis being placed on the process. By confirming the findings from Atlantis, the Mitchell's Plain survey put more weight behind the results from Atlantis – and vice versa.

The results from the two projects clearly show that a substantial part of staff time is used doing statistics. The cost of data collection - up to 20% of all staffs time - is thus very high. There is full agreement between the two evaluations that there is no local analysis or use of the data collected and there is little or no feedback from head offices on data sent them. Thus, a cost benefit analysis of the information system as seen from a local level gives considerable costs but very limited benefits.

These results paint a grim picture of the present information systems at district level. It is, however, important to emphasise that information systems and information processes are integrally linked to the structure and functioning of health services. The information systems were developed to support the centralised and vertically organised health service of the past which is close to the antithesis of a district approach. It is no wonder that the information systems of the Apartheid epoch are inappropriate to support the emerging district system. The health data were collected and analysed to make retrospective analysis, to provide disease surveillance over long periods of time rather than local management over shorter periods. In the district model and in PHC the challenge is to analyse and use the information immediately and turn it into action at the local level to improve the services.

6. Towards a H & MIS

The processes in the two areas were quite different and the situation on the ground was also different, yet the constraints and challenges identified were similar. The Atlantis project was based on an information-system perspective rather than on locally felt needs and the need for a modified H & MIS was identified from the outside. No local management system is yet in place in Atlantis to use the information for decision making, as all decisions are taken by the "head offices". Efforts to develop the H & MIS have been fraught with problems as there is nobody on site with sufficient authority to drive the process, and the community structures are to date poorly developed. In Mitchell's Plain the process is driven through local management and well developed community structures. The project was based on a management and decision-making perspective, with the need for appropriate information identified by the local structures who also initiated the project. The different situations may also be explained by the fact that the process of district development has been running for a shorter period in Atlantis than in Mitchell's Plain.

A lesson from Mitchell's Plain is that development of local managerial structures relies upon and is integrally linked to the development of a H & MIS; the need for information on the district was one of the first problems identified by the embryonic district management in Mitchell's Plain.

Using Atlantis as an example, a vision for the district H & MIS is outlined in Fig. 1c. Information is centralised through the district H & MIS where it is analysed and used locally before being reported to higher levels. The process towards a H & MIS must be driven from within, by local management and community structures, and it must be based on locally felt needs. The focus must be on the processes which occur at a local level: a "bottom-up" approach rather than "top-down" development. Both projects show that health workers are experienced and trustworthy in collecting data, but that they have limited experience with analysis and use of data. An important aspect of the development of a H & MIS will be to train management, front-line health workers and community representatives in action-led information usage and to develop an information culture.

Based on lessons from the two projects - achievements in Mitchell's Plain and problems faced in Atlantis - we outline the following requirements for a successful H & MIS:

The process towards a H & MIS, as well as the system itself, must be based on local management and community structures and address local needs. Motivation, commitment and the creation of a sense of ownership of the H & MIS by all interested parties are of vital importance. This is only achievable through a participative process which engages local health management, health workers and the community in participation with higher-level policy makers and planners.

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Community-based Participatory Design in the third world

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ABSTRACT

This paper argues that participatory design (PD) approaches are of particular importance in the third world. Local adaptation of information systems, empowerment and the creation of local commitment and ownership through a participative process are issues of vital importance in third world computing. These are all central issues in a participatory design tradition. The participatory design tradition typically addresses the workplace while a third world environment typically consists of economically deprived communities where the majority might be without formal employment. This paper discusses how the participatory design tradition can be expanded in order to be adapted to third world conditions. In this context it is suggested that the community should become both a participant and an area of focus.

Keywords

Action-based projects, community, health care, information system, participatory design, third world.

MOTIVATION

This paper discusses appropriate approaches to system development in Africa and more generally in a third world environment. Through a focus on empowerment, participation and a bottom-up approach there are reasons to believe that the participatory design tradition could give important inputs to third world system development. The early union-based Scandinavian projects may prove particularly important. The aim of this paper is to discuss the relevance of the participatory design tradition in exploring ways to use information technology (IT) to develop and empower deprived communities in the third world. Because this is a little explored area, emphasise will be on presenting empirical material from two cases from the health sector in South Africa that I participated in. The first case is about the development of a hospital information system in one of the former homelands where prototyping and participation were the central issues. The second case addresses the expectation of the new South Africa: a new health system providing basic health services to everybody. Here the complexity and uncertainty of third world computing are demonstrated alongside the central role that the community can play in third world participatory design aof information systems. At an international economic policy meeting in 1995, Thabo Mbeki, the vice president of South Africa, told the world leaders that the majority of the world's population had yet to make their first telephone call. This illustrates one of the huge gaps in development between the first and the third world. It has been argued that differences in economic development between countries and regions are explained by differences in technological development (Fagerberg, 1989). From this perspective information technology is regarded as a key factor in technological development (Ayres, 1991) and the distribution and exploitation of IT is consequently seen as closely linked to economic development. Sectors and areas where IT is at best poorly applied will tend to lag increasingly behind sectors where IT is highly applied. Thus necessitating ways to exploit IT to promote development of economically disadvantaged sectors and regions in order to start counteracting this tendency in the third world.

In *PDC'96 Proceedings of the Participatory Design Conference*. J. Blomberg, F. Kensing, and E.A. Dykstra-Erickson (Eds.). Cambridge, MA USA, 13-15 November 1996. Computer Professionals for Social Responsibility, P.O. Box 717, Palo Alto CA 94302-0717 USA, cpsr@cpsr.org.

But there are serious problems to this technology-driven development strategy which has commonly relied on market economics to bring about development. When IT is introduced in developing countries it will typically be in the form of applications and systems that are "first world solutions" to "first world problems". Such IT solutions are most easily exploited in areas of developing countries that are at best only imitations of the first world--the modern industrialised sector. Successful transfer of technology will often rely on the transfer of the entire *context* of the technology, including work routines and organisation (Kerbal, 1991). As a consequence technology transfer is also transfer of culture and world views, in general, and of ways of solving problems and of defining what problems are to be solved, in particular.

Many have argued that health care is an area where the third world can enhance development by exploiting information technology (see Braa et al., 1995). To better understand how this is taking shape a brief background on health, IT and South Africa is given. A discussion of the participatory design tradition in early Scandinavian projects in comparison with a third world context is also presented here. Clearly there is a need to expand the participatory design tradition in order to adapt it to the third world conditions. In contrast to the technology-driven market approach of technology transfer to the third world, this paper ofers examples of how the community can become both a participant and an area of focus for technology development. New policies are based on the community as a key level for social development in the third world. Such development will rely upon community participation in decision-making for social development at the local level (Midgley et al., 1986).

Specifically, this paper argues that the participatory design tradition can be useful in empowering the community and facilitating their participation in management of health services at the local level. The participatory design tradition typically has addressed the workplace while a third world environment typically consists of economically disadvantaged communities where the majority is without formal employment. Thus it is important to recognise that third world participatory design approaches need to emphasise the community, rather than the workplace.

PARTICIPATORY TRADITIONS AND THE THIRD WORLD

The early Scandinavian system development research projects have been important in the evolving participatory design tradition. The focus in these early projects was on empowering workers who where affected by or threatened by new technology and on exploring ways in which their influence over technological solutions could be ensured (Sandberg, 1979, Bjerknes et al., 1987)[2]. As the book-title *Design at Work* (Greenbaum & Kyng, 1991) illustrates, the focus of even later projects remained in the workplace. In discussing Scandinavian systems development research projects and their concern for democracy, Bjerknes and Bratteteig (1995) outline four levels where these projects have addressed technological influence: 1) work situation; 2) workplace or organisation; 3) inter-organizational relations, and 4) working life (comprising legal laws and regulations for the society, including the working life). All are concerned with workplace activities.

In a third world environment the workplace is not a similarly important arena for social and political development. If we hold on to the tradition of striving for democracy and technological influence in third world computing we need to shift the focus from the workplace to the community and add the community level(s) to the above list. Greenbaum and Madsen (1993) put forward three rationales for using participatory design approaches:

- a pragmatic perspective, a functional way to increase productivity;
- a theoretical perspective, a strategy to overcome the problem of lack of shared understanding between developers and users;
- a political perspective, a democratic strategy to give people the means to influence their own work place.

In addition to the three that they suggested, I propose a community perspective as strategy to enhance both the community as well as prepare technical development that goes beyond mimicking the first world. This perspective is derived from the political perspective, but is extended to encompass both the workplace and the community. In the studies that I present here members of the community are users of the health services. A participatory design approach including these users as participants focuses on the end-use of the technological systems to be developed, i.e. community based public health care services. A central issue is to ensure community involvement and to strive towards influence, a pre-condition for community empowerment.

In exploring community based participatory design approaches, lessons from the early Scandinavian projects may be useful. This tradition can be divided into three phases. The first two phases are the first and second generation of political and union-based projects in the collective resource approach (Ehn & Kyng, 1987). The third phase is no longer union based, focusing instead on computing in contexts where ethical issues are raised. (Bjerknes, Bratteteig, 1995). This third phase I believe includes the present politically neutral participatory design tradition.

The first generation of collective resource projects aimed at empowering workers rather than management in questions regarding technological changes and threats to the workplace. The workers they addressed were not defined by profession or skill but by the fact that they were in opposition to and oppressed by capital. The unions participating in the Iron and Metal Workers Union project (NJMF) (Nygaard, 1979) were organized according to employer and not according to profession or skill. The unions thus included a wide variety of skilled and unskilled workers. The strategy at the local level was to develop knowledge about the technology in question and to propose technical alternatives to those proposed by management. One of the first reports from the NJMF project was called "Knowledge is power" and their approach could now be called "empowering through learning". The knowledge thus developed then formed the basis for action at the central trade union as well as the political level. A technology agreement giving all unions the right to negotiate over new technology resulted from the NJMF project. The second generation collective resource approach projects shifted toward producing technological alternatives by designing for skilled workers (e.g. the UTOPIA project (Bodker et al, 1987, Ehn & Kyng, 1987) and the FLORENCE project (Bjerknes et al., 1987)). As a consequence the focus narrowed down to smaller groups of skilled workers, contrasting with the first projects which aimed at empowering all workers.

This paper offers evidence that the broad and multi-levelled "empowering through learning" approach of the first generation of Scandinavian projects, in combination with a focused "design for empowerment" version of the second generation, will provide important inspiration for a emerging community participatory approach to information system design.

HEALTH CARE AND INFORMATION TECHNOLOGY

Implementation of a primary health care (public health care) approach is a key element in the two cases presented here. Public health care is a preventive and holistic approach to health care, as opposed to the traditional curative and instrumental hospital-based approach (WHO,1978). The district health model is proposed as the most effective way of delivering primary health care and of organising health services (Amonoo-Lartsen et al., 1984). Key issues in district-based care are:

- the decentralisation of authority to a local management team
- sectoral and intersectoral cooperation and
- community participation in the services.

Local analysis and use of information is a crucial factor in the primary health care concept (Wilson et al, 1987). Where the hospitalinformation system focuses on the part of the population entering their premises as patients in a patient database, theprimary health care system must encompass the entire population living in a geographical area--a district. Everyone knows what a hospital is, while the district concept is much more difficult to grasp and there are still few, if any, working examples of district based information systems to learn from. Traditional health information systems collect data in order to make *retrospective* analysis - at a higher level. In primary health care the challenge is to analyse and use the information *immediately*, at the same level where it is collected , thus local information to support local action (Opit, 1987). Community interests mean that theinformation system must give them the possibility to both survey the health system and the health status of the population and to set and assess targets. For these reasons information systems to support primary health care need to be tightly connected to the work process and community interests which are dynamic and changing.

Health services in South Africa

In South Africa the differences in development between the first world and third world are staggering. While the white minority of the country is served by one of the most technically advanced (private) health services in the world, the majority is left with very poor health status and fragmented, typically third world health services. Reconstruction of the health sector is among the priority areas in the Reconstruction and Development Program (RDP) (ANC, 1994) of the new government of national unity. The primary health care approach will be the underlying philosophy for the restructuring of the health system and the development of decentralised public health districts will be a crucial step in achieving this. The Development of a National Health Information System is a prioritised task. The process is now under way to provide all hospitals and clinics with basic information systems for patient administration over the next few years, with drug administration as a next step. All clinics and hospitals will be networked.

The exisitng health system is fragmented in every conceivable way - by race, type of service and geographic region. The race fragmentation is relatively obvious, with different authorities providing services for each of the four race groups (whilte, coloured, black and Indian). Wthin that framework, different services provide preventive and curative health care separate from specialised "vertical" services such as tuberculosis, obstetrics and psychiatry, and rural services are provided by regional services councils. Each "homeland" and each province in South Africa had its own separate system functioning independently. The result was that until May 1994 there were fourteen "departments of health" at the central level and more than 400 local authorities and regional service councils of different types. The unified district health system with new managerial structures responsible for public health care at local community level is intended to solve this outdated and complex administrative problem.

The two cases

System development in thethird world must handle situations and problems that range from those relatively well known from the first world to those where new solutions addressing problems particular to the third world must be developed. The two cases from South Africa illustrate each end of this range. The first case from Mdantsane is of the first type and pre-dates the new South Africa (after the elction of April 1994). The focus of this case was on a hospital information system that exemplifies a well defined problem area and a relatively mature technology from the first world. A main lesson is that the participatory design approach used in the development of the system was a pre-condition for its success. The second case, from Mitchell's Plain, is of the second type. It is curently ongoing and addresses the expectations of the new South Africa: a new health system providing basic health services for all including community participation in its management. Here the complexity and uncertainty of third world computing are demonstrated. The problem area is not well defined, there are no examples to learn from and new solutions must be developed. Also in this case participation is a pre-condition for progress but in a way that transcends known participatory design practices that focus on workplaces.

My background in the first case was a four day visit to the sites. Before the visits I had studied the system documentation and discussed the project several times with the person who initiated the project and developed the system. In the second case I have participated in the project as a researcher since the start of its initial phase in October 1994. The research has been funded by the Norwegian Research Council.

CASE I - A HOSPITAL INFORMATION SYSTEM IN MDANTSANE

Mdantsane is a rather typical poor South African township with a population of 300 - 350.000 people situated on the outskirts of East London. As part of the apartheid policy, Cecila Makiwane Hospital, was built for the black population in Mdantsane in 1978..When the homelands were created the 1200 bed hospital became the referral hospital of Ciskei as well as a local hospital where it provides comprehensive public health care service through mobile teams and 18 clinics. In Ciskei a group of progressive doctors created an unified health system based on a public health care approach with health districts containing a hospital and a number of clinics managed from the hospital.

In 1988 the manager of the pediatric department (6 wards, 250 beds and a outpatient section) at the hospital, who was also a computer enthusiast and a programmer, started to develop an information system. The first objective was to improve communication between the hospital and the communities they served. The hospital got many questions from clinics and doctors about the patients they had referred, but they had no feed-back mechanisms. The system now produces a letter to the referral parties within two days of arrival and one when the patient is discharged including diagnosis, treatment in the ward and recommended follow-up treatment. A copy is given to the patient. All clinics are provided regularly with a report on all patients from their area and reports on preventable diseases.

Apart from this communication function the system is tailored to the needs of the doctors who are the only users. They register patients, use the patient records and print reports. A networked computer is placed in each ward and one is in the manager's office. The core of the system is a basic patient record database including diagnosis and treatment history. Some reports are used in day-to-day management like the daily ward report while others are periodical statistics used for retrospective analysis of the major health problems incurred by children, such as gastro-enteritis, pneumonia and malnutrition. The system is not part of the hospital's (paper based) patient management system and thus represents a kind of double book keeping.

The first basic prototype was developed by the manager of pediatrics working "every night in six weeks". Eight 286 PCs were purchased and installed in the wards, the outpatient section and in the manager's office. The system was programmed in Clipper. Every night during the first three weeks the system had to be modified in order to run properly. Features to make the system more user friendly were added over the next nine weeks after the initial testing. During the next nine months the system underwent a continuous further development as a collaborative effort between the programmer/ manager and the other users; the doctors. After a year the system was developed into its final form. According to the managing doctor:

> "Literally every day during one year I had to recompile the system. Every day people pointed at some problems or they suggested improvements. Then it was important to give them what they wanted the day after, before they forgot it. In the beginning the focus was on technical problems but very soon constructive comments and proposals took over."

Shortly after the managing doctor left the hospital and a new manager took over the department. He is also an enthusiast and committed to the system but he has so far not been able to maintain or develop the system further. The system is very much a "legacy" system; it is difficult to redevelop for other than the one who developed it. There are no resources available to hire a programmer. The manager would have had to do the programming after hours, leaving too little time to get a good enough understanding of the system. Thus the system has been more or less unchanged for the last 7 years. Small problems have accumulated to bigger ones over the years (e.g. the file system needs to be reorganised), the environment has changed and new needs and requirements have emerged.

The system is very much running by its own momentum. There has been no moral or technical support from the part of the hospital to the system and there is no dedicated computer person in the hospital to maintain it. Despite this low-tech environment the system has been quite robust. During the eight years it has been in operation only about one PC and one keyboard a year have been replaced due to malfunctions. The main technical problem is cockroaches and their droppings - they love the heat and the darkness inside the keyboard. "Nine out of ten times a malfunction in the keyboard is repaired by turning it upside down and shaking it." Dust is also a serious problem.

The registration of all patients is extra work, but the doctors I met all said that the benefits of the system far outweigh the burden, and close to 100% of the patients are being registered. All notifiable infectious diseases like tuberculoses, measles etc. are to be reported on special forms to the Ministry of Health. For various reasons this was regarded as a burden by the doctors and it is not always done. Now, however, based on the diagnosis entered by the doctors the system generates the reports of notifiable diseases "automatically". This feature is very popular and the system did not get a general acceptance before it was implemented.

When the system was introduced to the surgical department it was a failure. The surgeons did not see the benefits in the same way as the pediatricians did. A main reason for this was said to be that the surgeons had other professional interests and needs. Pediatricians are more biased towards preventive care, and have a more holistic approach to the patient and her medical history than the surgeons who on their side have a more narrow and technical bias, "more case than cause oriented."

To see how the communication part of the system was perceived from the other end, I visited one of the clinics. It employs 8 nurses and 6 other staff and refers about 80 pediatric patients to the hospital every month. The head nurse told me that they were "very happy with the system". The direct benefit of the system was that they were able to learn what happened with their patients in terms of diagnosis, treatment and results. For example, they might refer a patient with what they believed was pneumonia and get back a diagnosis of asthma. They have approached other departments at the hospital and asked them to provide them with similar feedback without results.

In a new project all clinics in Mdantsane are being provided with PCs linked to the hospital with modems. It is a pilot project with an aim to asses the potential of computer aided communication in using the hospital as a resource for the clinics. Nurses and health workers are encouraged to put forward all kinds of problems and get answers and feedback from experts in the hospital.

Analysis of Case I

A system that has worked well for 8 years without major problems in a low-tech environment, is a rare case in South Africa and in Africa in general. According to the developer the most important lessons on good practice in system development were: The system must fit very well with the users needs and through their own experiences the users must feel that the system improves their situation. If not, the system will not be used. Ensuring real user involvement requires something to be put in front of the users, preferably a real application, and that suggestions and ideas from the users are implemented as soon as possible. The system should be based on local initiative and be driven from within and at least one person, the person responsible, must be committed to drive the system and the process.

The information system in this case was developed with evolutionary and "rapid" prototyping in close participation with the users. The fact that the system is regarded as very useful by the users and was developed with a bottom-up approach csupports Walsham (1992) who advises developing countries to move towards "bottom-up" approaches to decentralised information systems, since "top-down" approaches are unlikely to be successful.

The problems addressed and the technology used by the system development process was easily defined and well known; a patient record database and patient administration. As a result, the basic system could be implemented comparatively rapidly and the participatory development process could focus directly on the doctors needs. Another reason for success was that both the application and the user group were small.

The communication part of the project was more limited. The clinics did not use the reports for home-visits as was the intention. As a first step the clinics should have been included as participants in designing the system. BIn retrospect a clinical database would have been useful,. since addressing the needs of primary and preventative health care needs to transcend the hospital context presented in this case.

CASE II: MITCHELL'S PLAIN - DISTRICT-BASED PRIMARY HEALTH CARE

Mitchell's plain is a commuter town on the outskirts of Cape Town, created for "coloured" people in the 1970's as a result of the notorious apartheid "group areas act". Coloured people were defined by apartheid as being neither white, black nor Indians, but people of mixed race. The incident rate of tuberculoses is possibly the highest in the world. Unemployment, gangsterism and violence are alas rampant. Health services are run in fragmented lines with four major authorities running the various services.

Mitchell's Plain was one of the first places in the new South Africa where representatives from the different parts of the health services came together to start building anew unified management structure at district level. Alongside the seforum, an umbrella organisation with representatives from grassroots and community based organizations, was a driving force. In the new health structure the communities are given the right to participate in managing the health services in a district.

Many of the community organizations have a history dating back to the struggle against apartheid. Eastridge/ Beacon Valley development committee established in 1983 is a good example of a community action program. It has about 45 members engaged as coordinators, group leaders or community workers in 8 sub-committees such as safety and security, sport & recreation alongside health. They run an advice office and an education center in their community center. They have been aedriving force behind the public health care forum and have a motto that states: "Health action, as an entry point to social action and holistic development." As one community activist explains: "Health makes the ideal vehicle to social and political action in a wide range of areas because the health system is well developed and requires an intra-sectoral approach". Tuberculosis, as an example, is as much a socio-economic disease as it is a medical one - it can only be eradicated through social action.

One of the first priorities identified by the embryonic district health management team was the need for adequate information on the area. An initial survey done in October 1994 identified significant gaps in available infrastructure as well as lack of information specific for Mitchell's Plain about health status, institutions and service management. An information committee was established to plan, develop and implement a Health & Management Information System (H&MIS). The process started with an identification of all the role-players in the area and an analysis of the flow of information between the various levels. Diagrammatic representation of the current flow (see figure[3]) shows the fragmentation and lack of coordination of information.

A follow up survey using questionnaires and focus group discussions was conducted to identify staff attitudes to collecting data and quality of service delivery (Braa, Heywood, King, 1996). The results show that data is kept on most activities ranging from inpatients, ante natal and immunisation to home visits and community activities. The survey found that the health care professions did not think that the statistics were useful in their daily work, or as one put it: "Keeping stats is a waste of good time". Everuone had to keep statistics on what they do and spent a minimum of one-half hour a day totalling and transferring data onto other forms. Each clinic sends a 30 page booklet of raw data to the head office every week, and a copy is kept on file locally.

Data is not available at one central spot in the district because of the fragmented nature of service delivery. Therefore, data can not be analyzed and coordinated at the

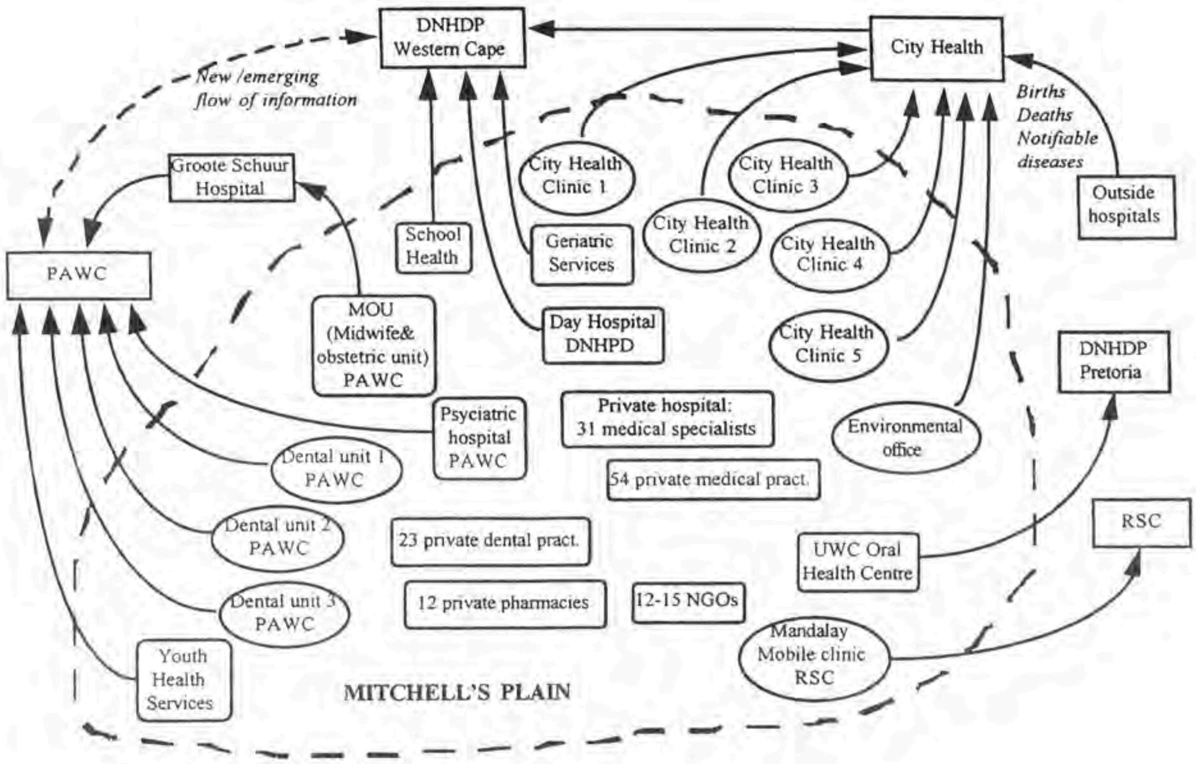

Figure 1. The figure shows the flow of information in Mitchell's Plain health district. Abbreviations: DNHDP (Department of National Health and Population Development (pre-election name)); PAWC (Provincial Administration Western Cape); RSC (Regional Service Council); NGO (Non Governmental Organization); UWC (University of Western cape); City Health (Cape Town City Council Department of Health.) Circles and boxes inside the dotted line are health services and the boxes outside are all different head offices. Points to be made are that health services are reporting to different head offices such that coordination of information is impossible at both district and central level and there is little or no feedback.

district level. As the figure illustrates, data is sent to different sections of different head offices so there is no way it can be coordinated at higher levels either. Information is transmitted in raw form, with no compilation or analysis amd there is no local use of data.

These results paint a grim picture of the present information systems. It is however important to emphasize that information systems are integrally linked to the structure and functioning of health services and these systems were developed to support the centralized and vertically organized health service of the past. It is no wonder that the information systems of the apartheid era are inappropriate to support the emerging district system. This health data was collected and analyzed to make retrospective analysis rather than to support local management. A reason why huge amounts of raw data is being sent to head office, e.g. name and address of all home visits, is to control the work of the health workers and not to empower them.

The survey has been followed up by a series of meetings and selection of a steering committee with representations from all health institutions as well as from the community. Plans have been drawn up to act on the findings of the survey, defining information needs and setting up a step by step process to develop ways of using information for decision making for management and service delivery at institution and district level. A first step is to identify the priority health problems at each level and to define concrete targets to aim for in order to solve these problems. The next step is to define indicators to be used to assess how the targets are met, to define the data needed to calculate these indicators and to set up routines to collect this data. A third step then is to start using this system of targets and indicators in the daily work, to refine and develop it on an ongoing basis and to develop what is loosely labeled an "information culture".

The project in Mitchell's Plain and similar projects in two other townships in Cape Town form an overall pilot project and have now (April 1996) gotten funding from Norway for personnel and equipmentt. The plan for the project includes a participatory approach using techniques such as prototypes, maps and wall charts in well defined sub activities in and between the institutions and in the community group. One focused activity is mother and child healthcare involving a cross section of institutions. The project group sees its main objective to provide information support to district management by developing information systems at institutional and district levels in parallel. The district system will include aggregated data from all the systems. The information system is understood to include the organizational setting and involves collecting, analyzing and using information regardless of whether it is paper- or computer-based.

The community has their own perspective about the information system. Community participation in the planning, managing, monitoring and evaluation of health services will rely upon appropriate information. In order to have influence in building the new health structure, the community will need regular, useful feedback on the achievements and constraints of the health services. In defining their requirements to the health services they need information on the general situation in their community on population, health and socio-economic conditions. Also they plan to use mass media in order to get maximum coverage in interaction with their constituency. Their need for insight into the health services is rather congruent with the needs of health management and - workers. Information on and from the community, on the other hand, is an area where the community has particular interests in documenting their needs.

The community activity is the least defined one because there are no examples to draw from. As a guideline a scenario was described and discussed. The scenario states the problem as: Tuberculouis is the most serious health problem in Mitchell's Plain with over crowded houses as a main cause. According to the scenarios a proposed action is to make a survey of the housing situation and plot it on a map, finding data on all known cases of TB and plotting them on a similar map. If the two patterns match it can be documented that bad housing is a dominant factor behind the high incident rate of TB. Since the health services are not responsible for building houses this information must be turned into action at a political level. Following this scenario the community, empowered by their own information system, has the potential to achieve more than the health services do. This scenario "correlated" very well with theprimary health care forums ideas aboutprimary health care activities to be turned into social and political action. A next step will be to collate information from many sources and produce a health and socio-economic profile for Mitchell's Plain and a corresponding action plan.

Differences in perceived goals and background may cause some problems in the collaboration between the community and the service providers. The health service part of theinformation system is much better defined and understood than the community part and the community has no examples to learn from. Together with a general lack of knowledge about IT in the communities this has caused people from the community to be "sidelined" in meetings and work-shops by people from the health services that have a much better understanding of their own needs and requirements for the information. Discussions tend to become technical, like what are the most useful data and indicators from maternal and child health, how to best represent different forms from the hospital in a database, etc. These are all special purpose questions of importance to the different sub-areas of the project and they are typically discussed in the expert language of the medical and information system professions. These languages are more or less alien to the community. To solve this problem our project is demostrating that it is necessary for the community to establish and develop their own area of technological expertise.

Analysis of Case II

In Mitchell's Plain it is the health system itself that is in focus and the aim is to provide the best possible health services to the communities. The information system to be developed shall support this process. Traditional system development aims at support for work processes that are relatively stable and that already exist. This is difficult in Mitchell's Plain where work processes, services and management structures are not yet in place and are being developed alongside theinformation system. The problems to be solved by theinformation system is not easily defined and there is no well defined step-by-step way forward to proceed. As a consequence there is substantial uncertainty in connection with the system development process. In such situations (Andersen et al, 1986) recommend explorative approaches and close user participation. The project´s prototype and participatory approach is along these lines.

The uncertainty is highest with respect to the community part and theprimary health care/district concept. The task of involving the community in both theprimary health care based health system and as participants in the system development process are problematic ones. The concept of aninformation system to support the community must be explored through experimentation. In sub-parts of theinformation system within institutions and in focused areas like mother and child health and nutrition, problems to be addressed and requirements to the system are more well-defined. In these areas the case from Mdantsane might serve as a learning example. Here the creation of local ownership and commitment and the development of a system serving local needs, both issues ensured through a participatory process, were the crucial factors. In creating communication and learning with regard to theinformation system at these different levels the entire tool-box from the participatory design tradition might be useful.

The user-role (levels) is also more complex than is usual in traditional system development. Health workers, district management and the communities are all users of theinformation system at different levels - all having different interests and relationship to the health system. Most of them are not users in the workplace-user sense, users as addressed by the participatory design tradition.

A particular aspect of the community's role is that they are users of both theinformation system and the health system. In their perspective theinformation system is to *empower* them by strengthening their involvement in the health system and the wider society.

Some researchers have proposed that health information should be restricted to the scope of action of the management in question (Sandiford et al, 92). From this perspective only information that may be acted upon is relevant according to this approach: The health services have no influence on housing and other socio-economic factors. Thus information on these issues is not relevant because it is outside the potential scope of action.

The community, on the other hand, will have a much wider scope of action if they turn the information into political and social action. This is exactly what the community organization wants to do and that is the reason why they are interested in theinformation system. From this perspective participation will empower the community and enhance involvement in a wider area. In this perspective also, the community will have particular requirements both to contents and focus of theinformation system.

The community approach includes many levels of activity: activities including activists and representatives from the community, activities where the broader community is approached, e.g. by using local radio, local papers and open meetings, and activities on the political level where more global goals on social development are addressed. Thus, a community based participatory design approach must be multi-levelled.

In the first phase of Scandinavian projects the workers aimed at influence with respect to the new technology in a situation where they were threatened or seriously affected by technological changes. In Mitchell's Plain the situation is different. Here as in many other places in the third world the communities are side-lined by the world economy and only indirectly by the technology. The objective in Mitchell's Plain is take control over the new technology and use it to empower and develop the communities. In order to achieve this the community must learn about the technology within the framework of their own knowledge and language and they must explore how it can be used to their benefit. Here the early Scandinavian projects may provide useful inspiration.

COMMUNITY PARTICIPATION AND THE SCANDINAVIAN TRADITION

This section looks at possible relations between community participation and participatory design as practiced in the Scandinavian tradition.

Can a community be compared with a union in the Collective Resource approach (Ehn & Kyng, 1987)? A community only makes sense in this respect as a organized unity striving for social development and/or political power. In pursuing its political goals a community has the potential to develop organizational structures which can be used to exercise power. The Mitchell's Plain case as well as the recent history of South Africa exemplifies this. It is a matter of fact that it was the Struggle carried out by the communities in the townships that made South Africa ungovernable and eventually over turned Apartheid - and not the unionized labor by the way of a general strike.

Communities may be compared with unions in terms of being made up of organized units pursuing concrete goals. But there are important differences apart from the obvious ones. For example, a community consists of many different organizations, political groupings, ethnic and social groups, each having different goals and agendas. For this reason different constituencies will typically be engaged depending on the issues in question. Some issues are controversial and there will be political conflicts while on other issues there is consensus. In the Mitchell's Plain case there is a general consensus in the communities over both the need for, and the importance of, an information system to support them. But there is a potential political conflict regarding the control of the process. In Mitchell's Plain the community structures are allied either with the African National Congress (ANC) or with the Nationalist Party. The community information committee has been elected by the structure of health committees mostly allied with the ANC, because that was the functioning structure at that time. As the Nationalist Party has just won the local election in Mitchell's Plain it is possible that their organization will now want to be more involved. This might increase the level of political conflict, but due to the consensus on the overall goals among the communities it should be possible to solve them along the way. Thus, despite the complexity and potential conflicts it makes sense to conceive of a community as an entity for the purpose of trying to develop and use IT to their advantage. Thus communities resemble unions in that their organizational structure and political struggles are based on coalitions of experience and local knowledge.

An important difference between South African communities and Scandinavian unions, is that technological solutions are not being imposed by management in South Africa. In Mitchell's Plain the community is primarily ignored, rather than threatened by technology. Thus for exploiting IT for their advantage, they not only have to learn about it but they also have to decide how it should be used. For this reason lessons from the second generation collective resource approach projects can be adapted from "designing for skill" to something like "designing for empowerment". It is empowerment and social development and not skill that are the issues in the community, clinics and hospital in Mdantsane and in Mitchell's Plain. The cases illustrate the potential for the broader and multi-levelled approach of the first generation of Scandianvian projects to be coupled with the empowering focus of the second generation projects and adapted to South African conditions.

The community has a "double" relation to the information system being developed in Mitchell's Plain: Together with health workers and health management the community participates in the running of the health services and information systems are needed to support this. But the community's requirements for improvements related to health go beyond what can be achieved through the health services. They included housing, jobs, sanitation, etc. These issues need to be be addressed at a more global and political level with community based development of nformation system supporting them. This multi-levelled approach has some parallels with the Norwegian Iron and Metal Workers Union project where local and national (political) action supported each other.

Health workers, health management and the community are all engaged in the participatory design process in Mitchell's Plain and the entire participatory design-toolbox may turn out to be useful. But at all levels of the design and system development process there will be strong elements of empowering as was shown in Mdantsane. Development of deprived communities in the third world is basically a political issue and resources are hard to come by. As a consequence the politically neutral approaches and techniques from the present third phase of the participatory design tradition will have to be explicitedly applied within a political framework.

PARTICIPATORY DESIGN AS A MEANS TO COMMUNITY EMPOWERMENT

In Case 1 the information system has been running for eight years and demonstrates that sustained system development is possible in a typical third world environment with limited resources and little support.

In the second case in Mitchell's Plain local commitment and ownership in the "project-process" and a participatory process have been at least as important as was the case in Mdantsane. Whereas in Mdantsane the technology and problems were relatively known, this is not the case in Mitchell's Plain and traditional system development as well as work-oriented participatory design have to be transcended. Two major development issues are:

- Traditional system development aims at support for work processes that already exist or are planned. In Mitchell's Plain the aim is to support and provide services to the community--services that don't yet exist.
- Traditional participatory design focuses on users in a workplace context. In Mitchell's Plain the focus is on improvement of the health services and on the community and their involvement.

In Mdantsane the system development process had to handle situations and problems that are relatively well known from the first world. The objective was to make an adaptation to the local third world context. In Mitchell's Plain neither the problem situation nor the solutions are known from the first world. The general objective is to develop a deprived area and empower the community. Systems development is generally categorized as a process of identifying problems and defining their degree of uncertainty (see Andersen et al, 1986). I use the following general categories in describing the situations I saw in South Africa:

- Uncertainty regarding the *context* of the system development process. This is the case when problems and solutions are well known from the first world, but users, organizations and society in the third world environment have limited knowledge about and experience with IT.
- Uncertainty regarding the *goals* of development which includes the problems to be solved and possible solutions. These are problems like those found in the second case, which are not yet solved in the first world.

When the uncertainty is high (Andersen et al, 1986) recommend experimental approaches and user participation. I argue that when the uncertainty of the first type is high, as in the first case, user participation is crucial and techniques from a wide range of praticipatory techniques will be important. When uncertainty of the second type is high, a participatory approach is as crucial, but in many cases the participatory design tradition will have to be extended to include the community both as participants and an area of focus, as is the case in Mitchell's Plain.

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[1] During 1996-7 I will be working at Department of Community Health, University of Cape Town, South Africa, but email and mail may be sent through the Norwegian Computing Center.

[2] In the 1970s I worked with the Norwegian Iron and Metal Workers union which was a key participant in the first workplace technology and democracy projects.

[3] This figure is developed as a result of a participative process involving people from the health services that took part in the information committee. Many repetitive drawings were corrected and added to. This was the first time information flows from all institutions were seen in relation to each other and it has been much used as an illustration of the (former) fragmented health structures.

Corrections:

An error occurs in the last paragraph of 'Analysis of Case I', page 19 in the original paper (marked by an X). The following paragraph is a correct version that paragraph.

"In the communication part of the project the success was more limited. The clinics did not use the reports for home-visits, as was the intention. As a first step the clinics should have been included as participants in designing the system. Though, if questions about how the clinics could best use this new information should have been addressed, more focus would have had to be put on the clinics and the communities they serve. The group of participants as well as the problems would have been bigger and more complex, and the traditional 'work-place' and 'single-user-group' participatory design approach that was used would not have been sufficient. Addressing needs of primary and preventative health care needs to transcend the hospital context presented in this case."

The following reference is a correction:

Greenbaum J, Madsen KH (1993), Participatory design: A personal Statement, Communication of the ACM, 36 (4).

Finally, the following acknowledgements need to be included:

This paper is based on work carried out together with Arthur Heywood and Rob Martell. Joan Greenbaum has been important in forming the ideas of community based participation in systems design.

HEALTH INFORMATION SYSTEMS IN MONGOLIA: A DIFFICULT PROCESS OF CHANGE

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ABSTRACT

Mongolia is undergoing a rapid transition from a Soviet style planned economy to a liberal market economy. Within this context of change we present a three year follow-up case study on the introduction and use of IT in the remote parts of Mongolia, with a focus on the health sector. IT is seen as a crucial factor in the ongoing process towards decentralised management. Though, the ethos of the old Soviet system inscribed into the information and health systems still constitutes an important obstacle to change. In order to understand the resistance to change, health information systems are best understood as social systems. A main problem has been that the efforts to change the information system have been restricted to technical aspects and that the interventions had not been seen as part of a wider health sector reform. Information handling in the health sector was more deeply embedded in work practices and less separable from the social context than was the case in other sectors. This was one reason why the introduction of computers has been more difficult and less successful in the health sector than in other sectors. We outline a social system model, which we use both for interpreting the case and for designing a strategy for change based on the use of the health information system as a tool for instituting a decentralised health management structure.

Acknowledgements

The research reported in this article was supported by dr. Ts Sodnompil, dr. G Demberelsuren and dr. P Altanhuyag in the Ministry of Health, Mongolia. The research was funded by the Norwegian Research Council.

INTRODUCTION

Many countries in the Third World and in the former Soviet bloc are in the midst of a process of decentralising their public sectors as well as their newly privatised private sectors. Within the health sector many see IT as a crucial factor in the ongoing process towards a decentralised and primary health care based health sector (e.g. Rodrigues & Isreal, 1995; Wilson et al., 1989). However, the introduction of decentralised IT does not necessarily lead to decentralisation (Madon, 1993; George & King, 1991) or empowerment of local users (Walsham, 1992). Moreover, the introduction of IT in the Third World has proven to be difficult (Odedra, 1990, Braa, 1996). Within this broader context, this paper presents and discusses a longitudinal study carried out over three years on the introduction and use of IT in general and within the health sector in particular at peripheral levels in Mongolia. The research has been based in the National Institute of Health, Mongolia, and funded by the Norwegian research council. An aim was to find out whether the introduction of computers had any impact on the new structures of decentralised management and on the use of information at local level. Computer usage in other sectors were compared with the health sector in order to identify conditions specific to the health sector and separate these from conditions due to the remote location and general lack of infrastructure.

In 1993 most provinces, *Aimaks* in Mongolian, were provided with PCs funded by the WHO. The aim was to support the ongoing decentralisation of the health services and the shift towards a primary health care approach that had followed the liberation from the Soviet Union in 1990. In 1993 we carried out our first study of IT in Mongolia with a particular focus on the Aimak level (Braa, Monteiro, 1996, Braa et al.1997). Three years later we carried out a follow up study including a survey of more than half of the Aimaks. In both 1993 and 1996 we found that the health information systems had not changed according to the shift in policy towards decentralisation, instead they remained vertical and centralist with very limited use of information at local level. Over the three years the number of computers had increased many times and we found many successful applications and areas of use, but within the health sector the results were not up to expectations. A reasonably good computer usage was only found within 6 out of the 13

Aimak health information systems we surveyed, whereas in the other sectors surveyed in the same Aimaks, the computer usage was remarkably better.

We identified three areas where the health sector had more problems than other sectors:

1. In the health sector the information system was more deeply embedded in a wider and more complex social context than in the other surveyed areas. The health information system extents to the most peripheral level of the society and includes routine work by a large number of health workers.
2. The meaning and behaviour of the old Soviet style centrally planned economy were still inscribed into the structures and very fabric of the information and health system and, due to 1. above, made up a more important obstacle to change within health than within the other sectors.
3. Technical capacity, skills and training were in general less developed in the health sector than in other sectors. Since the local health information system was made up by 30-40 people per computer, inferior computer usage had wide impact

The article is organised as follows: In the next section a theoretical framework is presented and then methodological issues are outlined. In the following section the case of Mongolia is presented in three parts: 1) an interpretative description of the health system and information infrastructures with a focus on the Aimak level, 2) the health information system at the Sum level is presented, and 3) the computer usage at Aimak level is presented. Then a summary is given.

A SOCIAL SYSTEM MODEL: ANALYTICAL FRAMEWORK

Working with data and information within the health sector includes filling in forms and registers, collating data into aggregated forms, statistics and reports and the reporting of these to higher levels. These tasks make up important aspects of most health workers jobs. The health information systems therefore tend to be deeply embedded in social work practices and are barely separable from the social context of which they are part. As will be shown in the case of Mongolia, the health system is made up of a number of more or less independent, but inter-linked, institutions, each with their own line management, work practices, culture and information systems. This description complies well with findings from similar studies in South Africa (Braa et al. 1997) and thus indicates that these are general aspects of health information systems.

In the web models, Kling and Scacchi (1982) give a theoretical framework for understanding why and how large information systems tend to be tied to the social context through a complex web of associations. Kling and Scacchi propose the web models in opposition to what they describe as discrete-entity models that represent the commonly held view that information systems are basically socially neutral technical systems. Implications for system development are laid out as follows:

> "When an analyst uses a descrete-entity model to understand the computing capabilities of an organisation he usually begin by asking, "What kind of equipment and facility do they have?" In contrast, analysts using a web model begin by asking: What kinds of things do people do here?" (Kling and Scacchi, 1982, page 9)

Walsham et al. (1990), building on the web models, state that large information systems are best understood as social systems. This idea of being part of the social context, something much bigger and qualitatively different from the concept of a computer, technical artefact, or a technical system, explains the difficulties in changing the information systems - or the health system, or both, which was observed in Mongolia.

Regarding health information systems as information infrastructures imply that they develop and grow over a long time with layers upon and within one another. New features tend to get added as extensions or changes of something already there, the installed base. As the installed base grows, it becomes more important and it becomes increasingly difficult to build new systems from scratch or to implement substantial changes (Hanseth, 1996). If we combine this concept of health information systems as being information infrastructures, with the concept of the very same information system being social systems (Walsham et al, 1990), it becomes clear that the installed base is in fact made up of a web of social systems. Social systems have considerable resistance to change, which explains the observed difficulties in being able to change information systems within the health sector or build them from scratch. This shows that, in order to understand information systems of this kind, the larger social system needs to become part of the study.

Against this background of regarding information systems as social systems, it is obvious that those technologies are not neutral but have politics, meaning and behaviour inscribed into them (Akrich, 1992; Pfaffenberg, 1988; Winner 1986). The case of Mongolia shows that meaning and behaviour inscribed into the system by the previous Soviet style system is still alive and persisting. Thus supporting the view held by Kling and Scacchi (1980, pp. 69) that "computing developments are shaped by a set of historical commitments."

In our study of the health information systems in Mongolia a duality became apparent very early on: on the one hand there is the 'visible' technical and informational aspects, the purpose of the system, (the information is collected, reported, analysed and used) and on the other hand, these activities create processes and structures. The primary 'information' purposes of the system might be to provide information for decision making, surveillance, statistics, or production, e.g. registration of patients that as a secondary product may provide statistics or information of the former type. Information handling creates processes that make up important aspects of social interaction between health workers and between the hierarchical layers. By becoming routines, these processes again make up important parts of the institutional backbone, or structure.

Already in 1925 Marcel Mauss showed how social interaction and rituals, as the interchanging of gifts, 'tied up', confirmed and committed social relationships and constituted and reproduced social institutions. In somewhat similar ways the interchange of data and reporting systems seem to constitute and reproduce the social relationship and the social fabric within the health services. The rational ideal, information for decision making, is not necessarily what governs the main impact and outcome of an information system. This tendency is supported by Fieldman and March (1981) who found that the rational ideal of information handling is rarely followed by organisations.

By becoming routine, these activities and institutionalised practises of information handling and interchanging constitute the institutional structures. This duality of social processes, as both containing process and structure, is captured in Giddens' notion of structuration (Giddens, 1985, page 25): "the structural properties of social systems are both medium and outcome of the practices they recursively organise .."

When we drew up the information flows of the information systems that we studied, we at the same time, drew up the institutional structure of the health sector (see figure). This would, following Levy-Strauss be like freezing the time by taking a photograph to make the inherent structures appear (Levy-Strauss, 1955). The mapping of the health information systems is thus a reflection of the hierarchical structures in the health sector down to the individual health worker. These institutionalised structures often seem to be the most important consequences of the information systems. Despite that, these aspects are rarely put forward as being the purpose in the design of a system. It is these properties of information systems that constitute the installed base of the health information infrastructures referred to above, and that is the reason why such information systems - or social systems - are difficult to change, or to develop from scratch.

We use this social system model to interpret and describe the health information system as well as to outline a strategy for change. We outline a strategy for change, which builds on the structuration aspects of information systems. Information system is used as a tool for developing decentralised health management and information systems in a joint effort.

THE SURVEY – METHODOLOGICAL ISSUES

From June – September 1996, we carried out a survey of the health information systems and computer usage in remote parts of Mongolia that was a follow-up of a 4-month survey we carried out in 1993. The study was based on observation and interviews in Aimaks (provinces) and Sums (counties) and it was supported by the use of questionnaires. This method of using questionnaires to support interviews we have derived from a somewhat similar study we did in South Africa (Braa et al, 1997), that in turn was based on a study in Ghana (Heywood, Campbell, 1997).

We visited 13 Aimaks, which included driving 9000 kilometres in a Russian jeep. We carried out 69 formal interviews, about one third of them involving a group of two to four people, and 381 questionnaires were collected. We used two different questionnaires; 1) Health information questionnaires assessing knowledge, impressions and use of information among health workers, and 2) 'Computer' questionnaires assessing skill and quality of use among computer users at Aimak level. Of the Health information questionnaires 307 were collected, half of which were from health workers at Sum level. The rest are from health workers at Aimak level and from health centres in Ulaanbaatar. The respondents to the computer usage questionnaire (74 in total, 42 from the health sector) were computer users at health statistical offices and hospitals at Aimak levels as well as a variety of other computer users in the Aimaks. The Aimak branches of the State Statistical Office and the Stock Exchange were visited and computer questionnaires collected in all Aimaks where we have been.

More important than the formal aspects of the survey described above was our participatory observation approach. Those we interviewed we also visited at their work place in the local community and spent considerable time together with many of them. Everywhere we asked to see computer applications, reports, statistics, collection tools, feedback reports, local statistics, registers, forms etc. The questionnaires posed the questions and provided us with focused areas of concern. In order to answer these questions we had to apply qualitative methods like interviews, discussions and observations.

MONGOLIA – A CASE STUDY

Mongolia is a large, landlocked and sparsely populated country in the northern part of Central Asia, located between Russian Siberia on the north and China on the south. Mongolia is about half the size of India (1.5 million km²), but contains only 2.2 million inhabitants. Mongolia is divided into 18 provinces, *Aimak* in Mongolian. Aimaks are further divided into 335 counties, *Sum*. As part of the general decentralisation of power, functions and responsibility have been handed over from the Central Government to the Aimak. The Sums are further divided into 1381 Bags, each containing 50-100 families.

Since the 1920s Mongolia has been a close allied of Soviet Union. This era ended in 1990 when Mongolia got its independence following a popular uprising. The country has changed to a multi-party system and towards a market economy since then. During 70 years of partnership the Soviet Union imposed on Mongolia a technological paradigm based on centralism, specialisation, big scale and the Planned economy. Mongolia followed the Soviet Union in the process of modernisation with an emphasis on giant industrialised schemes. The health system in Mongolia was built on a similar Soviet model: centralised and vertically organised and with a focus on curative rather than preventive medicine.

The centralised economic management system was as important a part of the Soviet model as the giant industrial schemes, but its execution was more pervasive and affected aspects of most activities. Information was crucial in the Planned economy and the State statistical office with offices in every Aimak was important in this respect. They collected statistics and calculated to what extent the plan was fulfilled or not. As a consequence the focus of all parts of the information systems and infrastructures was directed towards quantitative plan fulfilment and issues that could be quantified, such as the planning for more beds and patients in the hospitals, as opposed to planning for better quality of care. The health information system was in many ways a 'blueprint' of the State statistical system in that it has the same ethos of the planned economy inscribed into it.

The national health and information system

Within the health care system the political changes have resulted in a major shift in policy: decentralisation of health management and a shift of focus from curative to preventive care, the primary health care approach. Primary health care is a preventive and holistic approach to health care emphasising the community, as opposed to the traditional hospital based approach (WHO, 1978). In building these new decentralised structures, the availability and support given by appropriate information is regarded as important. We found that the health information systems had failed to keep up with the changes at the policy level, and had not developed into a system to support decentralised health management. The systems still had the old model based on the needs of a centralist planned economy and a corresponding health system with bias to hospitals and curative care inscribed into them.

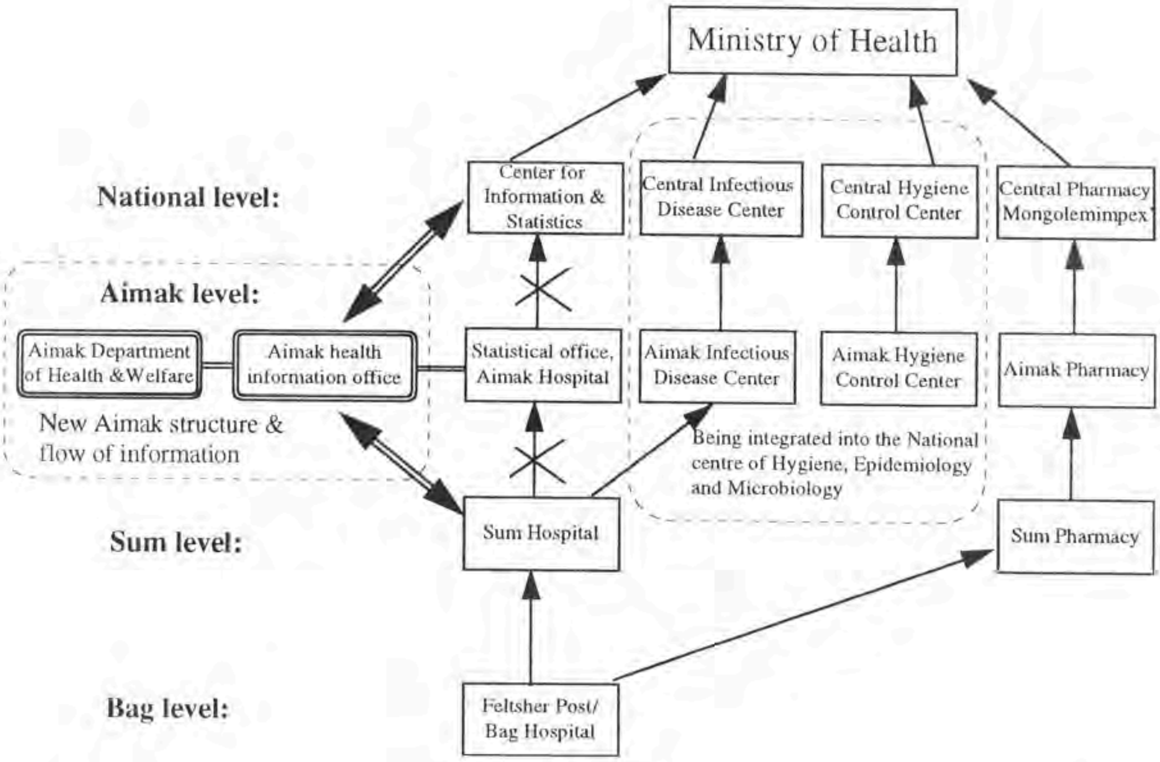

Figure 1. Previous and present structure and flow of information in the health sector. In 1993 the structure was as outlined in the right hand side of the figure. In 1996 the structure had changed as showed in the added new structure on the left-hand side of the figure and the Infectious disease centres and Hygiene control centres were being integrated.

In 1993 the information office and the main information system that reported vital health statistics was part of the Aimak hospital and their vertical structure. This structure did not support the Aimak level as the different vertical flows of information by-passed the Aimak level and made overview of the entire health system only possible at top national level. During 1995/96 the health information offices were relocated and placed under the Aimak government structures. But, as showed in the figure, the three other vertical structures in the health system are still not integrated at Aimak level and thus remain outside the 'control' of the Aimak information system.

The system run by the health information office is the 'main' information system that is linking together the Bags, Sums, Aimaks and the Ministry of Health (see figure 1 for an 'organogram' and figure 2 for a "rich picture" (Checkland, 1981). The information system is basically a reporting system: The Bags are reporting to the Sums, who are reporting to the Aimaks, who again are reporting to the Information Centre in the Ministry of Health. The health information offices in the Aimaks are staffed with one statistical physician and at least one statistical feltsher. In each Sum there is one statistical feltsher responsible for collecting data and reporting to the Aimak statistical office. This person is also responsible for the primary health care activities as e.g. immunisation, in the Sum. Moreover, this person is also responsible for the liason with the local Bag level. Given this background, the Sum statistical feltsher holds a key role in our analysis. The feltshers in the Bags represent the most peripheral level of this extensive reporting system and is reporting every month to the Sums. The health information office's responsibilities include the system of statistical feltshers in the Sums and the system of reporting from the Sums to the Aimak, to aggregate this information and to pass it on to the central level. Reports are distributed to various offices at Aimak level and on less regular basis to the Sums.

The 'main' system of reporting contains to parts: 1) the urgent statistics (e.g. infectious diseases, births, deaths) are reported monthly by telephone and is aggregated at Aimak level. 2) Records on all patient encounters and the above events are filled into various forms and sent to the Aimak. Earlier they passed the forms on to the National centre, but now they are increasingly being entered by computer in the health information offices. Modems and communication software are distributed and the plan is to start transferring data, but this system is not yet working.

In the overall design of the new decentralised Aimak health information system, outlined above, the flow of information from the vertical institutions was seen as being redirected towards the new information centre. This has proven difficult because the infectious disease centres, the hygiene and sanitation and the pharmacies are all strong and independent organisations with their own centralised structures, rules and work practices. Thus the vertical information systems in question are not mere flow of information, but are in fact institutionalised work practices. The flow of information was mainly directed to their own head offices with little or no feedback and with little or no 'horizontal' flow at Aimak level. These information systems may best be understood as social systems (Walsham et al, 1990). To change the information system alone will not be sufficient as a strategy, and the design and restructuring efforts must aim at changing the health system as a whole, including the institutionalised practises - the social systems.

Health information at the local Sum level

The Sum level is where the primary health care approach is actually implemented. Each Sum has an administrative centre and a small hospital where a statistical feltsher is responsible for the information system. The following description and analysis of the information system is based on the social system model presented earlier (see figure 2).
The Aimak / Sum information system is made up by a large number of health workers which are interacting in a network of about 20 Sums and 70 Bags, which typically make up an Aimak. We can say that directly the health information system in the Aimak consist of 20 Sum statistical feltshers, and about 3 people in the information office, and a few more from the hospital and other health institutions in the Aimak. Thus about 30 people have the information system as their main task. The non-human components of the information systems are such things as 1-2 computers, various forms and registers, routines, procedures and job descriptions. If we include the people that are less directly involved in the information system (see figure 2), as the Sum managers, the Bag feltshers, and management at the Aimak level, we can add 100 more people. Thus many people per computer make up the Aimak health information system. Despite this fact, the efforts to change the information system has focused on the technical aspects.

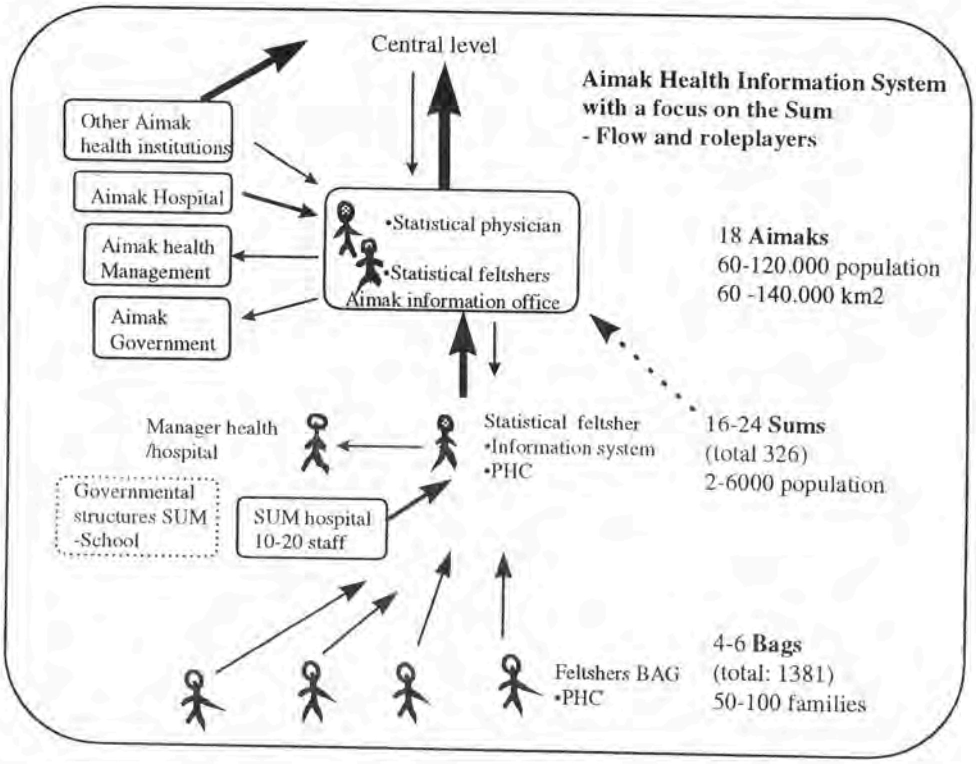

Figure 2. A "rich picture" inspired by Checkland (1981). The Bag feltsher is the peripheral level of this extensive information system. The arrows which are all pointing upwards, represent the flow of information. A point in our analysis is that the information system in this way helps creating a *disempowered* local level. A strategy for changing this situation by using the information system as a tool for empowering the local level, is outlined in figure 3.

The following are main results from the survey of the health information system at the Sum level:

- All health workers are involved in the information system by keeping registers and collecting data. Data is kept on most activities and much time and effort are used on data collection. The average health worker uses 5-6 hours a week on these activities. The Statistical feltshers all used more than 10 hours per week.
- Despite the efforts put into the information system, the health workers get little or no feedback and they don't feel they have any benefits from the efforts. In the computer survey only 25% of the Aimak health statisticians say that they feed back to the Sum on a regular basis. As a consequence there are no sense of "ownership" among local staff towards the information system.
- There is no training in local analysis and use of information at Sum level, despite the fact that the statistical feltshers at Sum level have information handling as their primary task.
- The job description, procedures and guidelines to the statistical feltsher do not include local analysis and use of information.

- There was no effort to disseminate information to other health workers and to the community and there were few, if any, efforts to involve other staff in the information system apart from their routine reporting.
- We found that basic health indicators are rarely calculated and little known among health staff. Only 19% of the statistical feltshers and only 2% from other levels than the Sum knew the infant mortality rate. Local analysis and use of information involves the concept of targets and indicators: indicators are used to assess whether targets for the health services are met.
- In knowledge and performance in analysis and processing of data the statistical feltshers performed worse and the Sum managers far better than the average: only 31% of the feltshers and 50% of the Sum managers could specify at least one target for the institution. Only 28% of the statistical feltshers but 63% of the Sum managers analysed data in order to see whether these targets were met. The statistical feltshers have information as their main task, but they are in no way involved in defining its content, direction and use. They are disempowered by the system.
- Regarding knowledge about the population they served (number of infants, children, pregnant women, women in fertile age), the health workers at Sum level had a substantially better knowledge than had health workers not working in Sums. Moreover, when it came to factual knowledge, the average health worker in a Sum hospital knew more than the Sum managers did. This latter finding correlates with the fact that the Sum managers (physicians) have a much higher turn over rate than have other staffs. Knowledge about the target population increases with the time you have worked and lived in the Sum.
- There is a general lack of involvement and responsibility towards running and improving of the health services among statistical feltshers, and to a certain extent among the Sum managers. Only 43% of the Sum managers and 20% of the statistical feltshers participate in writing up the action plan for their institution. This tendency of disempowerment is intrinsic in the upward bound reporting system.

These rather negative findings on local use of information are mainly due to; 1) the design of the information system as restricted to a reporting system is disempowering the local level, and to 2) the fact that decision making power and responsibility for taking charge and initiative have not been devolved to the Sum level. This is clearly indicated by the low local participation in drawing local action plans showed above. Lack of training in analysis and use of information is another factor. If we compare these findings with the situation analysis from 1993 given in (Braa, 1996), it becomes clear that not much has changed at the Sum level.

There are exceptions: In Alag Erdene in Khufsgul Aimak, which we visited also in 1993, they were analysing and using information in the Sum. They were calculating numerous indicators and discussed them regularly in staff meetings. They also used and disseminated among staff information from the seasonal feedback report from the Aimak information office. Moreover, the survey showed that the Sums in Khufsgul Aimak in general 'performed' better than in other Aimaks. This was linked to the fact that the information office in Khufsgul had performed well over a long period and that the Aimak management was committed to develop the information system and to involve the Sum level.

Our findings reveal that the health system still has the ethos of the centralist planned economy inscribed into it. Given this we argue that the health information system is not only a reflection of the health system. The information system is also instrumental in 'structurating' the health system. If we follow Giddens' duality of structures we might say that the behaviour of hundreds of health workers daily engaged in collecting and collating data and then reporting it upwards represent the means, while the structures thus constituted represent the outcome. The information system is thus important in (re) producing a disempowered local level. We propose a contrasting design strategy. In this strategy the structuration aspects of the information system is used to empower the local level by creating ownership in a bottom-up approach.

Computers and information at Aimak level

In 1993 the WHO provided 15 Aimaks with computers in order to strengthen the information system at this level. But, as shown in the survey of the Sum level presented in the previous section, the information system had so far failed to support the Sum level. Moreover, we found that the computer usage was less successful in the health sector than in other sectors.

We visited the health information offices in 13 Aimaks, six of which were judged as reasonably good computer users. They used the computer regularly, they produced reports / statistics both calculated and printed by the computer and they used the computer to enter some of the patient record forms mentioned in 4.2. Only 4 of the 6 though, used the computer to print listings and made reports based on these forms. Five Aimaks used the computer less regularly and only as a typewriter when producing statistics. Two Aimaks did not use the computer at all.

Even the 6 best computer users had a rather sub optimal use of the computers due to lack of training in the software they used and in general experience in using computers. All Aimaks had some kind of problems with software and/or hardware. Lack of training, basic computer literacy and technical support was everywhere a main obstacle. This situation was improving because the software distributed from the centre to enter the patient record forms has created a routine job involving the computer and thus helped staff developing basic computer literacy. Nearly all the Aimaks we visited had started to use this software to enter data during only the last 3-4 months prior to our visit.

All Aimaks analyse and report their monthly statistics in different ways, as there is no application software to support this activity. Many Aimaks use spreadsheets to make these reports. The skill in using spreadsheet vary from the very poor: use spreadsheet only to design and print forms for compiling data entered by a typewriter; to the most advanced spreadsheet hackers. The hospital in Bayankhongor runs a comprehensive personal /financial system developed in spreadsheet. This home-made hospital system was studied also in 1993 (Braa, 1996). Some Aimaks use software developed by the centre (but only distributed to a few Aimaks). And in one Aimak they have developed their own application software. Support, training and software in this area were needed and wanted in all Aimaks

The Aimak statistician's job description and responsibility only include the reporting of data from the Sums to the Aimak and not use and analysis of information at Sum level. Thus the Sum statistical feltshers were not encouraged to make local analysis of data and to promote use of information. The Aimak statisticians job description should be rewritten so that local analysis and use of information become their responsibility.

There is a high turnover in the information offices in the Aimaks and the new staff has in general no background in information and computing. In contrast to the other sectors there is no career path connected to information and computers in the health sector. This was a main problem and the reason why the health sector had poorer computer skill than other sectors. In the health sector the 83% the respondents were women and the majority had served for more than 15 years. In the other sectors the computer staff were significantly younger and women made up a similar part. Half of them had finished their education less than 5 years ago and they would have some computer training as part of their curriculum, and half of them were university graduates mostly from economy, statistics and within computing. Despite of this difference in background, the health sector organised less training than did other sectors. Moreover, the computer based applications and the procedures for information handling in the health sector were much less appropriate and tailored to needs than was the case in other sectors.

There is not one Computer Company providing support in any of the Aimaks we visited. We found that computer users in these more remote parts of the world 'survive' through what Lévy-Strauss (1966) calls *bricolage* and tinkering and by building informal networks of computer users supporting each other's. In all 13 Aimaks we visited we were able to identify such informal networks. The 'other' group tended to collaborate more with the other computer users in the Aimak than did the health group. This discrepancy had to do with the fact that the other group contained a substantial group of relatively young people with a more focused interest in computers than was the case in the health group. But, both groups had to rely upon the informal network in order to get help when needed and to learn the latest news.

A comparison of computer usage in the local branches of the state statistical office and the stock exchange shows that these organisations are more professional in providing appropriate user applications and support than is the health sector. In the health statistical offices clear guidelines and user applications appropriate to defined tasks did not support the introduction of computers. The health workers had no prior experience with computers and had difficulties in making appropriate use of the computer on their own. This is the reason why many Aimaks did not use the computers at all before they were provided with the new software for entering the patient records early in 1996. A result of these new routines of data entering is that the computer usage as well as the computer literacy is now increasing.

The computer usage in the health sector is less successful than in other sectors. This was mainly because the wider health information system had a poor quality when assessed against the requirements of the new health policy. The health information system as a whole relies on the skill, attitude and actual behaviour of a vast number of health workers. The information system consists of people. For one computer in the Aimak there are more than twenty statistical feltshers directly involved. The statistical feltshers at Sum level thus have a key role, but as shown above, they were not empowered to become fully involved or to take responsibility. On a practical level insufficient training and the fact that information handling and computer use was not built in, as part of a career path were important obstacles. Lack of appropriate tools and software within the health sector were also important.

A main problem is that even though the official policy has changed, the previous top-down model is still inscribed into the installed base and resisting change. The introduction of computers aimed at changing the focus and direction of the information system towards local analysis and use of information. The fact that this introduction has met with problems also shows that the introduction of computers is not an independent 'agent of change' and that its impact on institutional change relies upon how the introduction is used and supported by the actors in the social system. This confirms findings in (George, King 1991).

The introduction of computers had been particular difficult because it was caught in the contradiction between the installed base, i.e. the old Soviet style model, and the ideology and slogans of the new policy - and society. 'Everybody supported' the new policy, while the 'old model' provided the order of the day. This contradiction caused confusion and double communication and made it even more difficult for the health workers to acquire the necessary skill and to make appropriate use of the computers.

In Khufsgul Aimak health workers initially took the initiative to purchase the computer themselves in order to perform some defined tasks and they were not surprisingly among the most advanced computer users. As described earlier, Khufsgul was the Aimak where the information system worked fairly well at the Sum level. Thus, a relationship between good computer usage at Aimak level and good governance and participation at local level has been identified. Though, a good information system does not simply appear and create local activities and good governance. It was rather a supportive environment that involved both Aimak and the Sum levels that caused a reciprocal development of both good governance and the information system.

A design strategy for change

The design strategy we propose involves the wider social system, the behaviour and performance of the health system as well as of the information system. The interventions we suggested to the Ministry of Health aimed at changes in work practices and responsibilities at Sum and Aimak levels. Through changes in routine behaviour related to the information system, the objective is to gradually create empowerment, local ownership and a wider primary health care awareness. New daily routines aiming at local analysis and use of information ('means') will help 'structurating' new 'bottom-up' structures and local ownership ('ends'). The new primary health care approach requires local initiative, decision making and local analysis and use of data. This new ethos must be appropriately inscribed into the routine behaviour and the new job descriptions, as well as into the health system itself.

The overall design of the new Aimak and Sum based information system is outlined in figure 3. The Sum statistical feltsher is given a key role in integrating and analysing the information with a focus on local use in the Sum. Their job description, responsibilities, daily procedures and focus need to be changed accordingly. The responsibilities and job description of the Aimak information office needs to be changed so that they become responsible also for the use of information at Sum level.

Those interventions need to be accompanied by a wide range of undertakings regarding new computer-based applications, tools for making health and demographic profiles of the Sums, tools for information analysis and data collection, and so forth. To support this process a career path for statistical feltshers and physicians working with information and computers at Aimak level need to be created.

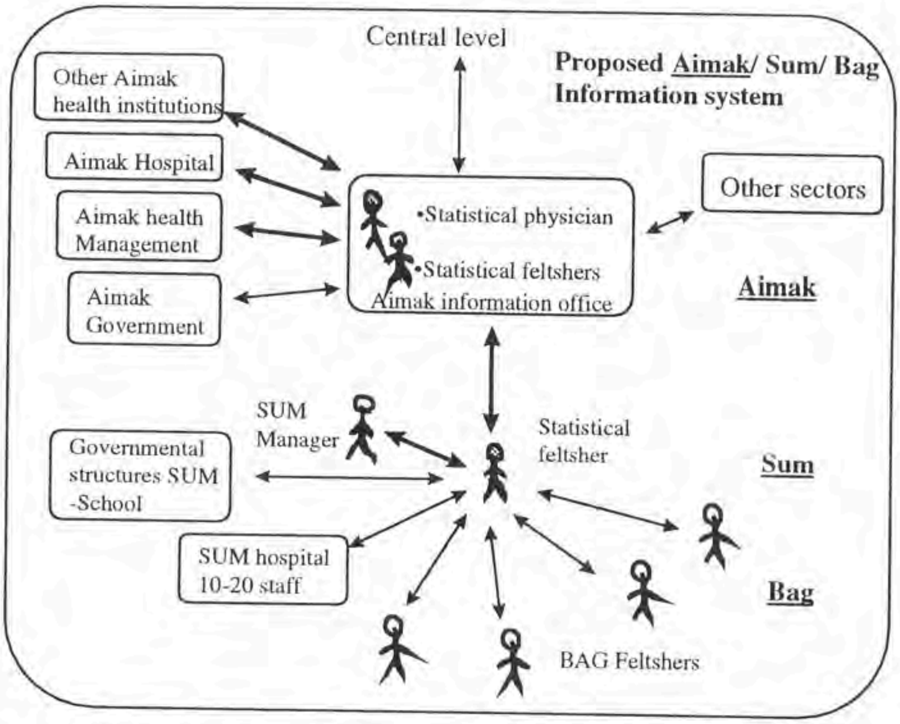

Figure 3. An outline of a design strategy where analysis and use of information at Sum level is a key. The arrows are all two-ways and indicate that reporting and feedback are of equal importance. The focus on the Sum statistical feltsher and the local scale imply that the feedback loops, which imply collection, analysis and use of information, are short. The feedback loops between Aimak and Sums need to be similarly strengthened. The Aimak Information Office is responsible for replicating and sustaining this situation in all Sums. In contrast to the situation in figure 2, the information system is here used as a tool to *empower* the local level. The proposal also includes integration at Aimak level (see figure 1).

SUMMARY

The main problem in Mongolia has been that the efforts to develop the health information system have been restricted to the technical aspects and it has not sufficiently been seen as part of a wider health sector reform. The concept of health information systems as being social systems is in general not recognised by those involved in policy-making, design and implementation of these systems. This may be the case also in the first world, but due to the contextual constraints, the social system perspective on information systems is more critical in the third world (Walsham et al. 1988). The lack of a social system perspective explains to some extent the discrepancy we observed between a 'holistic' primary health care policy approach and a 'minimalist' technical design approach. The policy involved the health services as a 'whole' (i.e. social system) and aimed at better governance, use of information and informed decision making. As opposed to this, the design and implementation of the information systems were based on a descrete-entity perspective, which only involved the 'visible' part of the information system: the content with regard to information and the technical aspects of the systems.

A similar situation is described in Mexico where the development of the national health information system gave "little attention to the socio-cultural aspects of both the users and producers of information" (Macías-Chapula, 1996). Use of computer applications in efforts to support decentralisation of governmental structures in India has been fraught with problems. The main problem in this regarded has been that system development has been viewed as a technical task without adequate understanding of the importance of the social context (Madon, Walsham, 1995). The similarity between the analysis from India and our case indicates that the relevance of our findings is not confined to the health sector in Mongolia.

It is important that interventions are not limited to the information system, but that the wider social system, in our case the health system, is addressed. This argument is supported by a study in Kisarawe district in Tanzania. Here it was shown that interventions limited to information system development, management training and use of planning and evaluation methodologies alone were not enough in order to provide health managers and health workers with incentives to rectify performance failings. Changes to the system as a whole was needed in order to strengthen health management (Sandiford et al., 1994). The case from Khufsgul Aimak supports this argument. Here the information

system, local analysis and use of information as well as good governance at both Aimak and Sum levels developed in parallel in a mutually supportive and integrated approach. Good governance could not have been developed independently and without at the same time developing the information system, and vice versa.

The problems of reforming the national health information systems towards local analysis and use of information are not restricted to Mongolia. Our comparative research in South Africa reveal similar problems there (Braa, 1996, Braa et al., 1997). While having achieved progress in the development of the national health information system in Ghana, the problems of developing local analysis and use of information remain unsolved (Heywood, Campbell, 1997).

If we follow Giddens (1984), the structures we are dealing with are not 'external' to the individuals that make up the health system, but is represented by 'memory traces', and internalised social practices. The structural properties of social systems are both medium and outcome (ibid.). Building on this, the strategy towards bringing about changes that we propose in this paper, aims at changing the work practices at the micro level. By gradually building up new work practices (means) the strategy aims at institutionalising a new decentralised and 'empowered' structure (outcome). Following the social system model presented earlier, the information system makes up important aspects of social interaction between health workers and thus forms the backbone of the health system. Moreover, the information system is instrumental in informing health management and in supporting primary health care delivery (Opit, 1987).

The present health information system is purely a reporting system. This system should be redesigned so it could also gather for use and analysis of information at Sum and Aimak level. Data should be analysed and used at the level where it is collected. Health workers at peripheral levels must become part of all parts of the information system: (1) collection, (2) analysis and (3) use of information, and not only the data collection part.

To ensure that the new system responds to local needs it is crucial that local health workers become actively involved and real participants in the process of redesigning the health information system. Participation is also needed in order to create a sense of "ownership" towards the information system among health workers.

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APENDIX 1:

Six steps to develop a district health information system

Jørn Braa, Arthur Heywood, Hassan Mahomed, Health Information System Pilot project

Since May 1997 the Health Information Systems Pilot Project (HISPP) has been part of an initiative by the ministry of health district development program to develop guidelines for developing district health and management information systems (DHMIS).

The six steps were formulated based on the experiences in HISPP. In order to make the steps concrete and easier to apply the HISPP case is presented as an application of the proposed steps. The plan is to combine the six steps with a 'clear version' of the present applied case study into written guidelines that can be used as a text tool in the efforts to spread the process to all of South Africa's 177 districts. As new districts and provinces gain experience these will be included in what will be an increasingly richer collection of examples and scenarios for action.

The concept of a district health information system

The Ministry of Health's White paper states that the South African health system will focus on districts as the major locus of implementation of health care and it will adopt the primary health care approach. (Ref MoH 1997) These health districts will be defined geographic areas containing 50 000 to 500 000 people will unify health care delivery at the local level and be run by district health management teams (DHMTs) in line with decentralised thinking inherent in the new policy. The aim is to design and develop information system that supports the health district.

There are many sources of information to feed into the district information system. Major sources of information to support the district management team as illustrated in Figure 1 include:

- Health facility (hospital, clinics, health centres) based information, including information derived from patient record systems and a variety of technical and management support activities. Public, private and the NGO sector should all feed into the district information system.
- Vertical health programs, though they are being phased out, also provide useful district information
- Community based information systems which have the potential to provide information concerning the status of the entire population with regard to priority concerns;
- Special studies, surveys and information from other sources like census data, health system research etc.

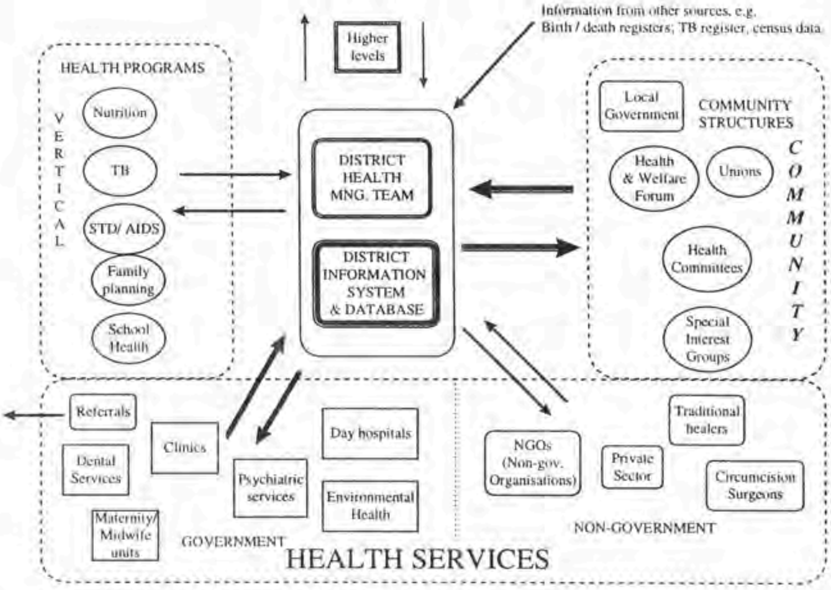

Figure: The proposed district model.

Six Steps to A District Health And Management Information System

The district health and management information system (DHMIS) can be a powerful tool to develop new district structures and to create awareness about the district health system among health workers and in the community. An effective district health management team (DHMT) needs a constant supply of reliable information to enable it to plan, implement and evaluate the tasks that are needed to run a district. Due to the past fragmentation of services and centralisation of management, most districts do not have an information system that serves their management needs; however staff tend to spend valuable time collecting a lot of irrelevant data for 'higher' levels of the health system who seldom provide feedback. Set out below are a few simple steps towards empowering district teams to turn available data into locally useful information.

STEP 0 - Select pilot sites

When you try to do everything everywhere, you can end up doing nothing anywhere! Experience shows that carefully selected pilot sites which test a new system and introduce new concepts, enable certain districts (or sub-districts) to take the lead and ensure that the results are achieved, enabling spread to other (sub) districts as soon as possible. The aim is to develop routines, guidelines, systems and ways to do things on a small, manageable scale and diffuse them to other sites as soon as they are working effectively.

An information system that supports immature district structures implies some uncertainty, and a degree of trial and error will always be necessary. Pilot sites enable managers to plan for uncertainty rather than being paralysed when things turn out to be more difficult than expected. They are an acknowledgement that one can not know everything in advance and it is always necessary to learn by local experience how to best set up the new systems and routines.

STEP 1 – Form an information team

Developing a District health and Management Information System (DHMIS) should be a participative process run by a group of people who see the need for improved information use and who are committed to improving the quality and coverage of Primary Health Care (PHC) through local action. This team should be a sub-committee reporting to the District Health Management team (DHMT) and may start small - the 'prime movers' who initiate the process and motivate others to get going. A successful DHMIS team should rapidly grow into a multidisciplinary organisation representing all health role-players including local government, provincial authorities, 'vertical' programs, NGOs, the private sector and the community. This team should include all levels of management and not just the 'top management' and heads of institutions - there need to be some workers to get things done!

A district information officer should be nominated/ appointed to run the district information centre, with a clear job description that will include co-ordination of all information handling, maintenance of the district database and updating of the district profile, as well as reporting and feedback of information.
In each facility and program an appropriate and motivated person should be identified who is responsible for the collecting, collating and feedback of information. This information co-ordinator will report to and collaborate with the district information officer and will support staff in calculation of indicators, drawing of graphs and presenting of information at routine meetings.

STEP 2 - Information audit

The team needs a task to work on and the first thing for them to do is to do an information audit to find out exactly what data is being collected for what purpose in the district. This process gets all staff thinking about:

- WHO collects data and for whom it is collected?
- WHAT data they collect, on what forms? Is it useful locally?
- WHEN data is collected and how often it is reported on and acted upon
- WHERE data is sent - is it collated at a central point and analysed by the district before going to higher authorities?
- WHY data is collected - is it for the collector or for the bosses in high places
- HOW data is collected and collated, then transformed into useful information for local action

This is the "situation analysis" of information in the district and enables the team to develop local planning tools – objectives, targets and indicators.

STEP 3 – Set Objectives, targets and indicators

Each program in the district must be encouraged to define exactly what they are trying to achieve and develop "Planning tools" that give direction to the district and enable progress to be measured.

Long term ***objectives** (goals)* such as "improve the health of mothers and children" are usually political and are set at national / policy level. The challenge at district level is to convert these woolly ideas into locally owned *operational **targets*** that are SMART - i.e. Specific, Measurable, Achievable, Relevant and Time-bound. All local role-players must be involved in this target-setting process and become part of the plan to achieve these targets.

Indicators measure how far programs have advanced towards achieving their targets. These can be quite difficult to develop, as they need to be objective, valid, reliable, sensitive. To start with, select only a few, simple indicators that your team feels are important locally! Once these are being effectively used, increase the number and start more complex analysis.

STEP 4 - Create district based information system and structures

Routines and structures for collecting, analysing, reporting and using information should be modified to become district oriented rather than 'vertical'. Facilities and programs should collate and report a minimum amount of aggregated data to the district information centre on a monthly basis. The district information centre will organise the data in the district database and produce a monthly district report. This process of routine reporting of aggregated data to the district information centre, and feedback of analysis and district summaries is a valuable tool in developing a unified district. This district information system is in principle easy to make compatible with all past and future facility based information systems, be they paper based (present) or computer based (future/NHISSA).

STEP 5 - Develop staff skills

The 'information team', who will be the prime movers in setting up the process, will probably initiate the first steps to developing a district HMIS. Very soon they will need to train the information co-ordinators and this should be the prime task of the District Information Officer. Once data starts to be converted to locally useful information, staff will rapidly become interested and will want to know how to use information themselves. Most districts already collect a lot of data - what is needed is to empower staff to identify that which is important to facility managers and the district team - i.e. the data needed to make local decisions to improve coverage and quality of services.

Start with simple analysis of existing data e.g. service coverage of immunisation or antenatal care; a profile of the most important outpatient diseases seen, or analysis of the nutritional status of your children. The program selected is not important - as long as it is seen as a local priority and provides staff with a better picture of health status or service delivery. Identify the sources of data for the indicators and collect data for each health facility for the past year on a monthly basis. This will give staff the opportunity to examine the data for quality and identify any gaps.

This training does not need to be sophisticated and does not need outsiders - the best information training is hands-on, person-to-person training during routine support, using data that has been collected locally and that will be used locally.

STEP 6 - Creating a district information culture

Once a system has started to convert data into information, this information needs to be used on a regular basis at meetings, displayed on walls for staff and the public, as well as disseminated to politicians and managers in health-related sectors. By being used, the information system is gradually improved through a cyclic process of learning. By learning through hands-on experiences, problems are identified, new needs are defined, new features are added, which the next cycle around will be criticised and improved. The analysis of data should be to the DHMT what a ward round is to hospital staff - a daily ritual aimed at improving service delivery, in which everyone participates and adds their perspective to solving problems.

These steps may be intimidating to those of us who are used to working in a centralised, top-down bureaucracy, but the important thing is to START, always remembering the ancient Chinese proverb: ***"A journey of a thousand miles starts with the first step"***

The HISPP case study

The Health Information Systems Pilot Project (HISPP) is a Western Cape based pilot project seeking to develop a district based health and management information system. The project, which started in early 1996, is based in three pilot areas in the Cape metropole: Khayelitsha, Mitchells Plain and the Blaauwberg Municipality. It is a collaborative project between two universities, the Provincial Administration of the Western Cape and the local authorities operating there and is funded by the Norwegian government through NORAD.
Figure: The task is to move from the previous fragmented structure (A) to the new unified district structure (B).

What is described below is how the steps mentioned above were applied in the case of HISPP.

Step 0. Selecting pilot sites: Start with those who take the initiatives themselves!

In both Atlantis (part of Blaauwberg) and Mitchell's Plain the process towards a district health and management information system has been going on since 1994. Based on the lessons from work in these two areas - the achievements in Mitchell's Plain and the problems faced in Atlantis - we derived some requirements for a successful information system process. The lessons are:

- The initiative to establish a pilot should come from the district itself. Choose those who have done something themselves and who are the most interested. Local commitment and enthusiasm are prerequisites.
- The process must be based in local management and community structures and address local needs. At least one committed person must be ready to drive the process and the people at local level themselves should take the initiative and start creating the process.

In Atlantis there was already a project in which the initial need for information to support local management and a re-design of the information system were identified from the outside. The project started out to evaluate the present information system and then to implement changes, but before 1994 there was no local management system in place in Atlantis to take the initiative and drive the process. Thus, the preliminary project ran into problems and it was impossible to progress from evaluation to implementation of changes because of the fragmentation of health services and lack of local management structures.

The process in Mitchell's Plain also started in 1994 in a context of fragmentation and lack of local management structures, but contrary to the case in Atlantis, the process grew up from local initiatives and was based on locally perceived needs. Mitchell's Plain was in fact one of the first places in the new South Africa where representatives from the different parts of the health services came together to start building the new district management structures. The RDP forum, which included grassroots and community organisations was part of this initiative and worked hand in hand with the health Services forum and formed an overall umbrella management structure for the district. One of the first priorities identified by the embryonic management team was the need for adequate information on the area.

In the selection of the pilot sites for the project, a number of criteria were applied:

- There should be a management structure that had an active interest in information and that had done some work on developing their own systems. This reflected some local experience and interest in health information systems.
- As the focus was a "district" based information system, entire health districts were selected - Khayelitsha and Mitchells Plain were effectively districts and the initial pilot site of Atlantis was expanded to include the area served by the Blaauwberg Municipality.
- Western Cape demographics were taken into consideration - a "coloured" area (Mitchells Plain), a "black" area (Khayelitsha) and a mixture (Blaauwberg) were chosen.
- Socio-economic status was considered a very poor area (Khayelitsha), a poor area (Mitchells Plain) and varied poor to rich area (Blaauwberg).
- The location of the area in relation to the city centre was another factor - Khayelitsha was peri-urban, Mitchells Plain was urban and Blaauwberg contained sections that could be said to be rural.

Step 1 Form an Information Team: base it on local commitment and create local ownership!

An important experience from HISPP was that the local information team and the commitment and enthusiasm of the people involved are the crucial element in setting up a district information system. The quality of information gathered is usually directly proportional to the motivation of the people involved.

What we learnt from the experience of putting together these teams was:

1. Start with a core group of interested and committed people who are actively involved in management.
2. Select a "site facilitator" or information officer in each site who is responsible for co-ordinating all activities in the district and to act as the information co-ordinator and is responsible for the district information system and the office.
3. At least one person at each facility (and health program) is selected. They work together with the district information officer and form the human part of the district information system. They repeat the district activities at facility level by forming a local team and helping to develop a facility based information system. This is essential to promote an 'information culture' and stimulate local analysis and use of information.
4. Get people from the community on board and find concrete activities in which they can participate, such as population census work and problem identification.
5. Working groups should be set up which focus on certain priority areas such as; clinic systems, day hospitals or particular programs such as child health, nutrition or environmental health. Each of these working groups will develop the information system for their own area of interest, and this feeds into the overall information system.
6. Development of human capacity is a priority activity and problem-based training must be done in relation to concrete tasks and activities in the fields of:

- Health information – i.e. use and analysis of information and basic system design
- database use and design, for those people actually using the database
- computer and Internet literacy (once computers are introduced).

Human resources in the form of a team of committed people, are the crucial elements in establishing a pilot project. Sub-teams need to be formed in each health facility, community, and health program, as well as in NGOs and the private sector. It is thus an ongoing process that weaves its way through all other activities.

Experience from the HISPP pilots tells something about how to initiate the process and overcome the first problems, and point out possible directions.

- In all three sites, enthusiasm and participation have been fluctuating. A lot of people have been active but often people are active for a time and then stop attending meetings. The project has had too little manpower to develop and co-ordinate activities in the sites.
- Another problem has been a seeming inability to get real representation from the facilities. Very often the people who join the committee from the facilities are people in charge who have no time to actually work in the project. These problems are all linked to lack of concrete results and tasks to be performed at the local level
- Community involvement has been very problematic: in both Khayelitsha and Mitchell's Plain people from the community were active in the initial phases of the project but in both places the activity then started to decrease. The reasons for this include the differences in perceived goals and background between the community and the service provider. The health service part of the information system is much better defined and understood than the community part and the community has no

examples to learn from. Together with a general lack of knowledge about Information Technology in the communities this has caused people from the community to be "sidelined" in meetings and work-shops by people from the health services that have a much better understanding of their own needs and requirements for the information. Discussions tended to become technical and held in the expert language of the medical and information system professions, such as what are the most useful data and indicators from maternal and child health, how to best represent different forms from the hospital in a database, etc. In Khayelitsha, where the language is Xhosa, language differences have caused problems.

In order to be able to address their own needs and to develop their own area of technological expertise, community groups should be organised separately and be provided with appropriate support. On this background task teams should be established. This was initially done in Mitchell's Plain, but due to political problems following the local election this initiative ended.

The concept of community participation

Community participation is part of the national health policy. and this policy needs to be given a concrete translation. As a result of the work in Mitchell's Plain we identified three areas of community participation and the need for information in each of them:

1. Role of community: participation in semi-formal health care delivery as community health workers; - Information needs: support the community health workers in their work, e.g. home visits in the community,
2. Role of community: participation in health promotion and preventive work e.g. in women groups, special interest groups to promote various good practices in the community.
   Information needs: disseminate information from the information system on major health problems and campaigns to the community, examples: tuberculosis, HIV/AIDS, traffic accidents, violence, vaccination etc.
3. Role of community: participation in formal representative policy and decision making and evaluation of the health service
   Information needs: the community representatives will need particular information on health status in the population, environmental and health problems in the community and on health system performance. With this they can define targets and goals and see if they are met.

The community task groups take the above areas as their point of departure. But, the need for focused task groups is not limited to the community. In order to move from 'talking' to 'doing' it is necessary to address the concrete and the local. The clinics would work together and form task teams, as would the day hospitals, and the various health programs. In Khayelitsha the health program task teams were instrumental in developing the annual report. The following structure reflects these issues:

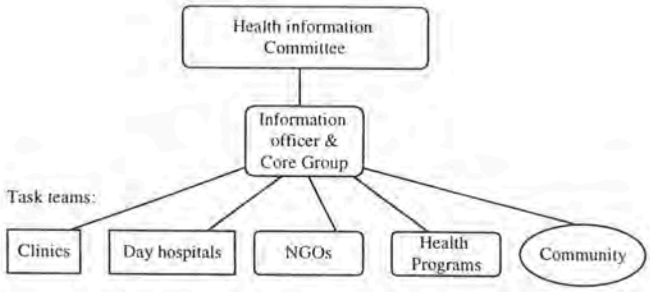

Figure: Health information task teams within each organised area.

Step2: Do An Information Audit: Forward towards an annual district report!

The crucial issue in district information system development is both to create activity and to provide results. In the initial phase of establishing a district there is a clear need for getting an overview of the situation with regard to health services, health problems, demography and socio-economic situation on the one hand, and the information systems and available information on the other. The HISPP experiences show that the above needs can be combined in a process towards a *district annual report.* The annual report was both a means and an end and was crucial in forming teams and in creating activity. During this focused activity and problem solving, human capacity is developed and appropriate training is added. The monthly report would be a routine replication of this more 'one off' annual report exercise.

The approach used to put together an annual report was as follows:

1. Collect all information that is available and that is currently collected. Seek other sources of information of interest to the district, e.g. demographic data, socio-economic data.
2. In course of this process, discuss and define the information that is needed in order to run the district and in order to calculate the needed basic indicators.
3. Through this exercise, identify the gaps, i.e. the mismatches between available and wanted information. This is a first step towards the design of the district information system.
4. The Monthly district report is being defined and emerges out of this activity. When this is routinely produced, the future annual reports will be produced more easily.

In order to obtaining data for 1996 all information that was routinely collected had to be tracked down from the districts and inputted into a specially designed computer database. This task proved to be very difficult as data had been sent to "head offices" without being kept at local level. Two people worked almost full time over three months to obtain the information in various databases, registers, files, boxes etc. at the head offices of the health authorities. All the data then needed to be validated and for this each facility in the pilot sites were visited and their data obtained from head offices was discussed. Problems with the data that were identified were:

- Gaps: e.g. data for attendance was missing for some months for some facilities making annual counts of attendances nonsensical.

- Inconsistency: e.g. more patients were seen in the dressing room than the total number of attendances in a particular day hospital.
- No standard data definition: e.g. in one hospital the total number of patient was the equal. individuals 'entering the doors. Whereas in others, it was calculated from the numbers visiting dressing room, x-ray, consultation room, etc., thus many was counted several times.
- There were huge month to month variations: e.g. twice as much attendances in one month as compared with the next for many facilities implying poor routines for data collection.
- Data was found where there should not be e.g. according to the statistics, antenatal patients were seen at a local authority clinic that did not provide antenatal services.

After a period of about six months, teams in the three pilot sites completed the annual reports. Achievements of the process were that

- co-operation amongst health authorities occurred which had not previously occurred, a level of trust was achieved which enabled open sharing of information which had been difficult under the past fragmented conditions,
- widespread interest in data and information was created through the process,
- increased participation by a wider range of people was also achieved,
- The district showed that it had the capacity to complete a complex and comprehensive information task.

Some problems that arose included the awareness that there were insufficient trained personnel at district level to manage information, staff shortages impeded the process etc. Due to the fragmented health services there was not any district-based collection of all information.

The aim was not to produce a 'perfect' annual report but to identify gaps in information. In this way, the process and the results would be an input to the design of the district information system. It would be important to use the district report - the first of its kind ever - to create awareness about the district both in the communities and amongst health workers.

Step 3. Set objectives, targets and indicators: Start with a first small data and indicator set!

In the Atlantis Pilot Project in 1994, one of the tasks was to establish a minimum data. In reality there is not one but many minimum data sets (for different levels of the health system)- and they will change over time! The only one way to find out is to start with something. In our case we started with a minimal data set originating from the provincial level.

The Routine Monthly report -

The Routine Monthly Report, the RMR form[1], has been important in kick-starting the process of developing a DHMIS. The idea of making a unified form used by all the

[1] See appendix 3

vertical institutions has been discussed since 1994, but due to resistance from the organisations, nothing came of it. In late 1996, though, things started to happen.

First it was demonstrated that no-one was using the data from the old quarterly report that was contained more than 200 data items collected on four different race groups. The data was collected in the facilities and reported to the provincial level, but from there nothing happened. A draft form was developed at a joint meeting between the Province and the local authorities in the Western Cape. After discussions with different health program managers, the form was piloted in the Cape Metropolitan Council clinics in two of the HISPP pilot sites in May 1997. Then it was given approval by top management to be implemented in all local authorities; the day hospitals in the pilot sites will pilot it still before using it more broadly. The form is to be reviewed in October and implemented for a year from January 1998.

The RMR form

The "RMR form" has been instrumental to the later movements in HISPP. The form is widely criticised to be too curative biased, and to focus too much on facility management indicators as work load. Nevertheless, the form has been extremely valuable as a process tool. It has made it possible to take the immense step from talking to doing.
As a legal prototype tool, the RMR form became the point of departure for various aspects of the information system. The form was a means to create the new horizontal structures of data collection, collating and interchange in the district, as a core in the database that is being designed, and as a core in the Monthly report. The RMR form also gave a concrete tool to start explore the relation between the information needs at different levels. There has for a long time been considerable confusion as to how to solve the contradiction between the higher levels need for standardisation and the lower levels need for flexibility when it comes to information.

Local use and processing of information is a key to improve quality at all levels in a decentralised district based health system[2]. This will rest on a satisfactory trade-off between central standards and local creativity with regards to own needs and applications. This corresponds, in technical terms, to the development of relatively independent, semiautonomous, local systems that allow integration and communication, i.e. standards - open and integrated information systems.

The RMR report is important because it was a first trial towards a standard data set to be required by the province. We started to develop the district database with the RMR form as a point of departure. Then it became immediately obvious that the district needs extended far beyond the standard province requirements, and that the needs at facility level made up further extensions.

Already for some time the triangular drawing of standards printed at the cover of the Strategic Management Team's, Health information report (see Baqwa 1995) had been

[2] See article III, IV

used in the discussion of information needs at different levels and standardisation. With the RMR report it became concrete how the provincial needs and standards differed from those of the district and community and how they could be handled. As an example, the district wanted to collect data on more age groups with regards to teenage pregnancy, than was the case in RMR report. This is no problem since it is not violating the standards given by the RMR report. In this case the district data is just disaggregated province data, and in other cases it will be additional data, e.g.

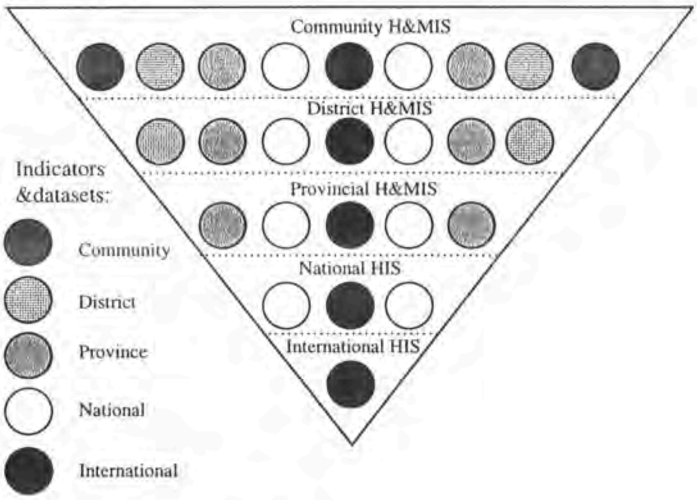

Figure: the triangular model of standards

Another contribution to goals, targets and indicators for the district level occurred as follows: two project staff members met with provincial program managers to get assistance with appropriate indicators for the district level. The national set of proposed "Year 2000 Health Indicators" was used as a basis for discussion with these program managers. This was followed up by internal discussion within HISPP (discussion which included staff working at the district level) and a proposed set of indicators was produced by the project.

The following was suggested from our experience:

1. Take the minimum data set required by the province and corresponding set of indicators. If there is no minimum data set required by the province, it must be developed. This is a national and provincial responsibility.
2. Discuss and define the objectives for the work and the corresponding targets and indicators at workshops and meetings.
3. The best way to go one step further and to actually develop an appropriate minimum data and indicator set, is to start using a first version (which is not necessarily perfect), as soon as possible.
4. Each level (and focused area) will set itself different targets. The same overall goal will have to be turned into different concrete targets at the different levels and thus develop a different set of data and indicators (see the figure X). Note also that the data

set and indicators will have to be flexible and change over time. Thus there is no such thing as an absolute minimum data set; it will depend on the time, place, level and area of concern.

5. The Routine Monthly Report form was developed as a requirement for the province and was. A useful point of departure in defining the district's information needs. The district needs more information and this was added to the data set. By defining a set of district indicators, even more data items were added to the district data set.
6. The health facility, health program and community levels have additional needs, and new data sets and indicators need to be added to the basic district set

Step 4. Create a district information system: Forward towards a monthly report, a district database and a 'human' information system!

The approach to information systems followed by HISPP acknowledge the problems implied by the dual properties of information system, illustrated by the iceberg model presented earlier. Information systems are social systems and much more complex than they appear to be. It is not enough to address the material or visual part of the system, the technical tip of the iceberg. The human components, the processes, routines and prevailing information structures, must also be taken into account. Therefore, the information system needs to be developed in an incremental and evolutionary way.

An example: in Khayelitsha the information committee wanted to move fast towards the information system and bought a computer very early in the process. One year later the computer had not yet been used. Lesson: Computers are of no use if there are no specific and carefully designed tasks to be accomplished, and even then the users have to be trained. In Khayelitsha there were at that time no people who were trained and no particular task to be computerised. Now the situation is different.

Our approach to developing the information system is derived from the following understanding of the system. Note all components are of equal importance.

A. The human components

These are discussed under step 1. The information office and district facilitator, the core team, the persons responsible in facilities, health programs and communities and the task teams. Training and learning by doing are both crucial elements in capacity development.

B. The process components;

These are part of all steps and are based on participation and incremental development: There has to be a process to develop an annual report, set targets and indicators, a monthly report, an information system, information culture, the information and learning cycle! Needs are defined, data is collected and collated and information is analysed and used, action is informed - or taken-, and needs are redefined. And the information cycle continues. Routine behaviour is established, and by becoming routine, the district information culture becomes the 'habit' and the district structures are created.

C. The technical components

1. Design forms and procedures for data collection, collation, analysis, use and dissemination.
2. Establish the district information office as the core of the district information system.
3. Produce a Monthly district report as the concrete routine output of the district information system.
4. Design and create a district database. All districts in the pilot share the basic database. Each district will be free to add tables according to their needs. Within the district all share the same database. All user groups, i.e. facilities, task teams, community etc. are free to add to the database. The district information office is responsible for the maintenance and redevelopment of the district database. The overall pilot project (or the province) has a similar responsibility with regard to the common district database.
5. As units (facilities, programs etc.) are being computerised they will get a copy of the(ir) database. Interchange of data and updating of the database will be done using Internet or disc. A web server will be the option at a later stage.
6. Ways to integrate surveys and more 'grey' information need to be sought.
7. A geographical information system is both a means to present data and to integrate and analyse information. Information in a district is of different type and from different sources and. By using maps, Geographical Information Systems helps integrating such information conceptualised in an area, the district. Work is under way to use aerial photos in stead of maps to help overcome the problem that due to lack of schooling during apartheid, many people are not familiar with maps.
8. Each district office is provided with a computer connected to the Internet. As more units get computers they will be added. Internet is used for communication in the project and will gradually be used for interchanging and reporting anonymous and aggregated data.

A first step in the human process

One or two persons are given responsibility for information in each facility. They will on a monthly basis ensure that the agreed data will be collected and then inputted into the database on a computer in the district information office. In this they work together with the district information officer who is responsible for the district information system. They are then be responsible for analysing and processing the data and feeding back to the personnel in each of their facilities on a monthly basis. They are given appropriate training in this regard. These are the kind of procedures that the project is trying to establish in its quest for a district based health information system.

The district database

The next activity is the development of a simple computerised database to support the above processes. A database is a tool to organise and store data. It contains additional tools for input of data, processing and analysing of data, and producing reports and graphics. The relational database we use (Access) is organised by tables that contain fields. Different tables are given different names and can be designed to support particular objectives and tasks. The different tables are related to each other by common key fields. and thus form a relational database.

In HISPP the database was developed in a participatory and bottom-up manner. The relevant staff were trained in Microsoft Access, then they designed a first version of a database based on the needs as they defined them themselves. The RMR form discussed above was important in this process, as a minimum data set and as a required report out of the system. Discussions around the database led to the following overall design:

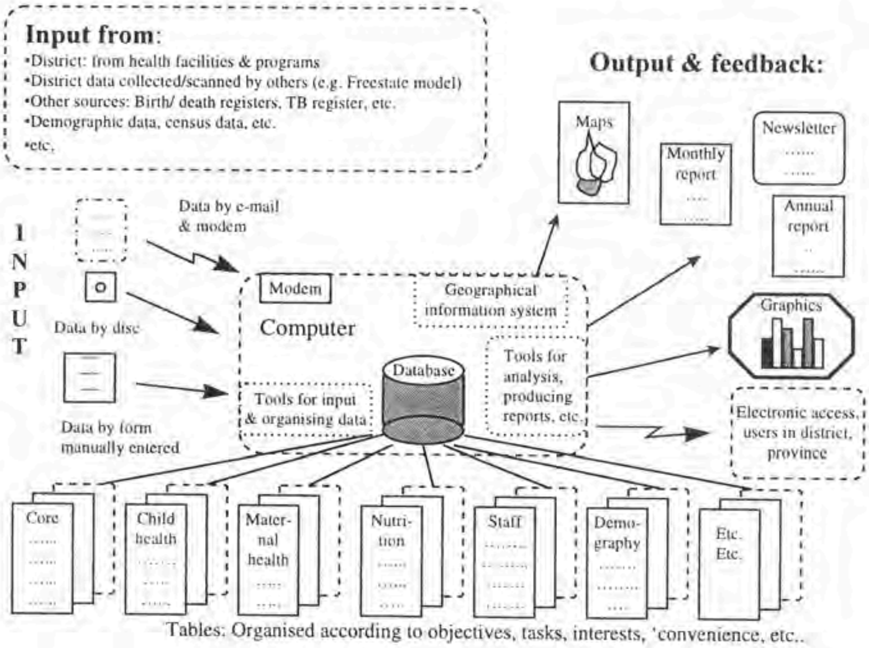

Figure: The overall design of the district database

The tables are the following

- One table common for all facilities and program is labelled 'core', including fields as total numbers of various patient age groups.
- Tables are oriented towards particular interest groups and programs. Examples are maternal health, Child health, Nutrition. These are to be further developed by the groups in question.
- Tables are connected to management information, including Staff, Resources, and Budget.
- Tables thought to be relevant or useful for the district level are Demography, Services, Surveys, Rare events, etc.

The idea behind the design of the database is to balance the need for local flexibility with the need for standardisation. At the different levels there will be standard procedures for data collection. Each facility will have to collect the minimum core data. In addition to that they will be free to add data and indicators according to their need. Facilities and programs of similar types will have to standardise on a slightly higher level, with the same amount of freedom to add according to own needs. Examples of such units are Day Hospitals, Clinics, School health, etc. The districts will have to comply with the Provincial standards. But in addition to that the districts will be free to run the information system according to local needs.

The overall design of how the levels integrate are illustrated in the triangular drawing of the standards within the levels, and freedom at the levels below (see the triangular figure above).

Step 5 developing staff capacity: Learning by doing!

Developing of staff capacity has two components: 1) The learning-by-doing, hands-on, on-the-job training, and 2) formal training. The first is integrated in all the above steps, but it should be supported and integrated with formal training.

Short courses

HISPP has developed a one-week course "an Introduction to Health Informatics" runs at Public Health Program of University of Western Cape at their winter and summer schools. The course is directed at district level personnel and covers basic information system concepts and uses a case study based on an actual district in Cape Town as a means of training. Twenty pilot site personnel have been trained on this course over two courses. The main aim here is to contribute towards developing an "information culture" at district level. The most important aspect of this training is to bring it to the district. The plan is to replicate this course in the districts on an ongoing basis.

Computer training

Database training is the other area of training HISPP has been involved in. As outlined above, the design of the database started out as a training course that was brought forward to the design of the database, and following implementation. In this way the training has been a good example of combining formal training with practical work. Already a second class has been through database training.

In a report HISPP has identified the training needs in the facilities with regard to computer literacy. A group of people should be given basic computer training in each facility. These people should then, and in tandem, be engaged from the facility to work with the district information office, and familiarise themselves with the computer there.

Step 6 The information cycle: develop the system in an incremental and participatory way!

The basic approach is to design, implement and use small parts of the information system incrementally in a participative manner. Remember: the information system contains human, process and technical components. All these components need to be developed incrementally in an integrated approach. The RMR form is designed, implemented and tested, and for sure, based on this experience it will be changed! By focusing on the RMR form, we learned in a concrete way that the district needs much richer information than does the province. Within this background the district database and the district set of indicators develop based on the districts need. When the monthly district report is produced, we will see what is missing, and subsequently improve the database, the indicator set and the monthly report. This small example illustrates the cyclic and participatory approach towards the design and developing of the district information system.

Summary

In order to develop district health and management information systems in all districts in South Africa coordination is needed at both National and Provincial levels. The HISPP experience shows that a few pilot districts in one province may be crucial in initiating the process and get other districts going. The next obvious step is to establish a few pilot districts in each province. This network of provinces needs to be coordinated and driven from the Ministry of health district development program. As a next step the pilot districts within each province will take the lead and organise a similar network of districts within the province. Note that this envisaged way forward is a replication at national and provincial levels of the process described in the HISPP case. In each district the process needs to be cycled and repeated within each health facility and community.

Appendix 2:

The Monthly Routine Report, The RMR form. This is a data collection form developed and piloted within HISPP, which is discussed in Appendix 1 and in section 5.1

ROUTINE MONTHLY REPORT: PHC SERVICES IN THE WESTERN CAPE

DISTRICT: FACILITY:

COMPLETED BY(Print name):

MONTH:		CD	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	TOTAL
TOTAL ATTENDANCES	<5 YEARS	01						
	5 YEARS AND OLDER	02						
BABIES EXAMINED 1ST TIME	< 1 MONTH	03						
DEVELOPMENT ASSESSMENT	9 MONTHS	04						
	18 MONTHS	05						
	5 YEARS/PRESCHOOL	06						
IMMUNISATIONS	TOTAL # OF CHILDREN IMMUNISED	07						
	BCG AND TOPV0	08						
	FIRST DPT, TOPV AND HBV GIVEN < yr	09						
	DPT3, TOPV3 AND HBV3 < 1 YEAR	10						
	MEASLES < 1 YEAR	11						
NUTRITION (ENTER WEIGHED CHILD ONLY ONCE IN THE MONTH)	TOTAL # WEIGHED < 2 YEARS	12						
	# < 3%ILE < 2 YEARS	13						
	# > 97%ILE < 2 YEARS	14						
CURATIVE SERVICES	# SEEN BY DOCTOR	15						
	# SEEN BY PROFESSIONAL NURSE	16						
	TOTAL < 5 YEARS	17						
	# OF GASTROENTERITIS < 5 YEARS	18						
	# OF ARI < 5 YEARS	19						
	# OF NON ACCIDENTAL INJURY	20						
	# OF STDS	21						
	# OF TUBERCULOSIS ATTENDANCES	22						
	# OF TRAUMA CASES	23						
	# OF THEATRE CASES	24						
	# OF PATIENTS X-RAYED	25						
ROFESSIONS ALLIED TO MEDICINE (PAMS)	# SEEN BY PHYSIOS & OTS	26						
	# SEEN BY SOCIAL WORKER	27						
IENTAL HEALTH	TOTAL ATTENDANCES	28						
	# OF NEW PATIENTS	29						
EPRODUCTIVE HEALTH	TOTAL # OF ACCEPTORS	30						
	# OF ACCEPTORS < 20 YEARS	31						
IATERNAL HEALTH	TOTAL ATTENDANCES	32						
	# OF ANTE NATAL FIRST VISITS	33						
	TOTAL # OF DELIVERIES	34						
	# OF UNBOOKED DELIVERIES	35						
	# OF DELIVERIES < 20 YEARS	36						
	# OF BIRTHS < 2500G	37						
	# OF POST NATAL VISITS	38						
	# REFERRED FOR TOP	39						
UNSELLED	TOTAL (INC HIV)	40						
MMUNITY ACTIVITIES	TOTAL # OF OUTSIDE VISITS	41						
EDICATION	# OF PRESCRIPTIONS ISSUED	42						
	# OF ITEMS DISPENSED	43						
IORATORY	# OF CERVICAL SMEARS TAKEN	44						
	# OF OTHER SPECIMENS TAKEN	45						
	# OF NEW [illegible]							

Appendix 3:

The questionnaire used in South Africa in the survey of use of health information among health workers reported in (article VI).

QUESTIONNAIRE FOR H&MIS SURVEY

P.2 Jan '95

Name .... Institution . . . .

Position......................... Years of service . . . . . .

Brief description of activities . . . .

. . . .

A. Information system

Do you keep / receive information on the following activities?

OPD	Yes/ No	Inpatients	Yes/ No
Antenatal	Yes/ No	Immunisations	Yes/ No
Home visits	Yes/ No	Community activities	Yes/ No
Under 5s	Yes/ No	Outreach activities	Yes/ No

Do you consider them to be: Easily available Yes/ No

accurate Yes/ No complete? Yes/ No

Do you ever use them in your work? Yes/ No

How? . . . .

. . . .

B. Health Status

Do you know the Health status of your catchment population?

IMR	Yes/ No	Approx. . . . .
CMR	Yes/ No	Approx. . . . .
MMR	Yes/ No	Approx. . . . .
Fertility rate	Yes/ No	Approx. . . . .

Others (specify) . . . .

. . . .

Where does this information come from? . . . .

. . . .

C. Priority Problems

Which are the major health problems in your catchment area

1 . . . .

2 . . . .

3 . . . .

4 . . . .

5 . . . .

. . . .

What criteria did you use? . . . .

How do you know this information? . . . .

. . . .

. . . .

D. Goals, Targets, Indicators

Are there any targets (goals/objectives) of what you (personally) should be achieving to overcome these particular problems? .

. . . .

. . . .

Do you know of any other goals/objectives/targets for the institution/program (specify) . . . .

. . . .

. . . .

. . . .

E. Vision / plans

Is there a common vision /mission statement for your institution?
(please write it down) . . . .
. . . .
. . . .

Is there an action plan for the institution?
Who writes it? . . . .
What is in it? . . . .
. . . .
Can we see it? Yes/ No . . . .

F. Target Population

Where do most of your patients come from?
What is the actual population you serve? .... people
Where does this figure come from? . . . .
. . . .
What information do you have about the population regarding:
Education . . . .
Employment . . . .
Socio economic status etc... . . . .

What proportion of the population is the target for:
Immunisation ....% Maternity (ANC, Del,) .....%
Family Planning ......% School health ....%
Others . . . . %

G. Availability / Accessibility

Are there sufficient health facilities to serve the population?
Yes / No (justify) . . . .

What proportion of the population live within 5 km of a
Static facility ....% Mobile facility ....%
Outreach point ....%

H. Coverage

What do you understand by the term coverage? . . . .
. . . .

What is the actual coverage of your service for:
EPI ....% Deliveries ....%
ANC ....% Family Planning ....%
Water Supply ....% Oral Rehydration ....%
Others . . . .%

I. Quality

How do you measure if you are providing a quality service? .
. . . .
. . . .

Do you have any written guidelines/ protocols on
Diagnosis Yes/ No treatment Yes/ No
Procedures Yes/ No Others (specify) . . . .
. . . .

J. Cost

Do you know what it costs to provide services to your population?
Specify . . . . Rands per head
Do you know your institution's:
1995 Budget Yes/ No Please state it . . . .
Breakdown by dept. Yes/ No Please give approx. figures . .
. . . .
1994 Expenditure Yes/ No Please give approx. figures . .
. . . .

K. Tools

Do you use the following tools in your daily work?

Tally sheet	Yes/ No	Register	Yes/ No
Reports	Yes/ No	Graph	Yes/ No
Maps	Yes/ No		

What are they used for? (detail) . . . .
. . . .
. . . .
How do you think they could be made more useful? . . . . . .
. . . .
. . . .
Can we see the tools you use? Yes/ No

L. Information flow

What do you do with the forms when you have completed them?
Where do you send them? . . . .
. . . .
What do you think they do with them? . . . .
. . . .

Feedback
Do you ever get feedback on results you send up? Yes/ No
How often? Weekly / Monthly / Annually / Irregular
Specify what kind . . . .
. . . .
In what form? . . . .
. . . .

M. Training

Have you ever had any training in information use? Yes / No
What type? . . . .
. . . .
How do you use the training? . . . .
. . . .
How could it be made more useful? . . . .
. . . .

Job description

Do you have a job description? Yes/No
Can we see it?
If not, how do you know what you ought to be doing? . . . . . .
. . . .
. . . .

N. Teamwork

Do you ever have meetings of the people you work with?
How often
What is discussed? . . . .
. . . .
Can we see the minutes? Yes / No
Do these meetings ever discuss data collected? . . . Yes / No

Are there other team meetings to discuss management of the institution? Yes/ No (Specify) . . . .
. . . .

O. Supervision

How often do you get support visits from superiors

Province	No	Weekly / Monthly / Irregular
District	No	Weekly / Monthly / Irregular
Hierarchical superior	No	Weekly / Monthly / Irregular

Do they use a supervisory checklist? Yes/ No
Do they ever discuss the data you collect? Yes/ No
What is the most useful form of support you get? . . . .
. . . .
. . . .

Do you supervise juniors? Yes/ No
Do you ever ask them about data collected? Yes/ No
Describe . . . .
. . . .
Can we see your supervisory checklist Yes/ No

P. *Please give any other comments on what you feel is needed to improve the health and Management Information System for you personally, and for your institution . . . .*
. . . .
. . . .
. . . .
. . . .
. . . .
. . . . etc

Appendix 4:

Background materials from Mongolia

The questionnaires used in Mongolia was developed from the one above (see article VIII).

There are two types:
1) Questionnaire for survey of computer usage, and
2) Questionnaire for survey of health information.

They are a little messy since they have been used for coding of the answers and because they have been with me in the field. These are the English versions I used to recognise the various fields in the original Mongol ones. The translation is far from accurate.

Following each of the questionnaires is given a real example. Both from Uvs Aimak, which is described in section 4.1.2. The computer user is from the State Statistical office which is mentioned in the above section.

Thereafter our recommendations to the Ministry of health are included.

Finally, tables with aggregated data from the survey are included.

1

(1)

Questionaire for Health &Management Information System Survey

1996/.../...

7 This questionnaire is to get an idea of what data you collect and what you do with it. There are NO right or wrong answers: we want YOUR impressions of what is happening to data and all replies are STRICTLY CONFIDENTIAL!!

CIRCLE/ UNDERLINE THE MOST APPROPRIATE OPTION(S)
FILL IN SPACES (NUMBERS OR TEXT)and Y/N/D WHERE INDICATED

Position.............................; Years of service..........; education..............................
Institution.............................. Aimak.........................; Som.......................

A. TIME USE (rough estimates)

How much TOTAL time do you spend collecting data / filling in registers / writing reports etc

Every day	.... hrs .... mins
At the end of each week	.... hrs .... mins
At the end of the month	.... hrs .... mins

How much of this time is spent analysing data / calculating indicators etc

Every day	.... hrs .... mins
At the end of each week	.... hrs .... mins
At the end of the month	.... hrs .... mins

B. TARGET POPULATION

3 1. Do you have a defined area/ population you serve? Y/N/D
What is the total population you serve? .... people
Where does this figure come from? ....

2. Do you know the numbers of people in of the following groups: Y/N/D

1. Infants 0-1 year ....
2. Children 1-5 years ....
3. Number of pregnants ....women
4. numbe rof deliveries ....women
5. number of women in fertile age ....women
6. number of school children ....children
7. Others ....

C. INFORMATION SYSTEM

1. Do you keep / receive information on the following activities?

1. Outpatient	Y/N/D
2. Inpatients	Y/N/D
3. Antenatal	Y/N/D
4. Immunisations	Y/N/D
5. Home visits	Y/N/D
6. Community health activities	Y/N/D
7. 0-1 years morbidity	Y/N/D
8. 1-5 years morbidity	Y/N/D
9. Environmental Health	Y/N/D
10.Other (specify)	

1

②

2. Do you make analysis of data for use at your level? Y/N/D
   1. Tabels
   2. graphs or pies
   3. Indicators
   4. Used in reports
   5. Others ....

Do you consider the information to be:
   1. Easily available
   2. accurate
   3. complete?

3.?? Do you ever use them in your own work? Y/N/D
How? ....

D. COMPUTER

1. Do your institution have a computer Y/N/D
2. Are the data you collect/keep being entered into a computer at your institution Y/N/D
3. at a higher level (e.g. Aimak) ? Y/N/D
4. If yes, do you benefit from this ? Y/N/D
5. How? ....
???6. How could the computer support you/your institution better? ....
....
7. Do your institution have need for a computer? Y/N/D
   If yes, for what purpose? ....

E. INFORMATION FLOW

1. What do you do with forms when you have completed them?
   1. Analyse locally
   2. Fill and send
   3. Other ....
   Where do you send them? ....
2. What do you think they do with them?
   1. Analyse
   2. Planning
   3. Annual report
   4. Nothing
   5. Other ....
3. How are you getting the monthly statistics from the Soms on time?(if you are in the Aimak) Y/N/D
4. How are you sending the monthly statistics to the Aimak? (If you are in a Som
   1. Telephone
   2. forms by courier
   3. forms with people going the same way
   4. by mail
   5. others (specify) ......
5. Are you sending the monthly statistics on time?
6. Do you have problems in reporting /sending information to the Aimak Y/N/D
   1. phone is not reliable
   2. mail is not reliable
   3. mail is too expencive
   4. others ......

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4
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12
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2
1V2=1 3=3
not othe
41 42 43 44
2 4
61 62 63
Cut

(3)

7. How are you calculating the monthly statistics to the Aimak 7
1. By hand
2. "Kuleramme"
3. calculator
4. other ....

8. Are you using the information from this monthly statistics ? 81
Y/N/D
specify how 82

9. How are you sending the other forms (daily sheets) to the Aimak?
1. forms by courier
2. forms with people going the same way 91
3. by mail 92
4. others (specify) 93

10. Are making calculations, analysis or in other ways using information on daily sheets? Y/N/D 101
specify how 102

F. FEEDBACK

1. Do you ever get feedback on results you send up? 11 Y/N/D
How often?
1. Every week
2. Monthly 12
3. Annually
4. Irregular

In what form?
1. Report
2. Written
3. Supervision 13
4. Graphs
5. Others ....

G. HEALTH STATUS

1 Do you know the Health status of your catchment population?

1. Infant mortality rate	Yes/ No	Approx	1
2. Chils mortaliry rate	Yes/ No	Approx	2
3. Maternel mortality rate	Yes/ No	Approx	3
4. Fertility rate	Yes/ No	Approx	4
5. Unemployment rate	Yes/ No	Approx	5
6. Others (specify)			

2 Where does this information come from?.. 2

I. PRIORITY PROBLEMS

1 Which are the major health problems in your catchment area
1. Increasing # of children not gaining weight 1
2. Respiratory diseases 2
3. High MMR 3
4. High IMR
5. High rate of poor families 4 1
6. Lack of safe water 5
7. Lack of transport services 6
8. Others 7

How do you know this information? ....

4

J. TARGETS AND INDICATORS

1. Are there any targets of what you personally should be achieving to overcome these problems?
   ....

5

2. Do you know of any other targets for the institution/ program? Y/N/D
   If yes, specify ....

3. Are you / institution using information (calculation of data into indicators) to see if you meet these targets? Y/N/D

4 How? What information are you using for for what targets?

Information	Target
1	....
2	....

K. VISION / PLANS

1. Is there an action plan for the institution? Y/N/D 1
2. Who writes it?
   1. Participated yourself
   2. Done by institution head
   3. Dont know
   4. others

5

3. Do you use local data to draw up the action plan? Y/N/D
   Explain how ....
4. Where can you get a copy of the plan?
   1. Personal
   2. with head of institution
   3. At head office
   4. Don't know

L. ACCESSIBILITY

1. Are there sufficient health facilities to serve the population? Y/N/D
2. How do most patients come to this facility?
   1. Walk
   2. horse/camel
   3. Mail car and Bus
   4. Ambulanse
   5. Other ....
   6. Don't know

7? 4

3. What proportion of the population live within 5 km of a
   1. Som clinic? ......%; Don't know;
   2. feltsher post? ......%; Don't know

6

4. How long time does the average patient have to travel to reach this facility?
   1. 0-30min
   2. 30-60 min
   3. 1-2 hrs
   4. 2-3 hrs
   5. More than 3 hrs

4

5. How long time does the average patient have to wait to get access at this facility?
   1. 0-30min
   2. 30-60 min
   3. 1-2 hrs
   4. 2-3 hrs
   5. More than 3 hrs

5

M. QUALITY and COVERAGE

1. What do you understand by the term coverage?

2. Do you use calculation of coverage to assess the quality of services? Y/N/D

Deliveries at hospital

Infants (0-1) comming fr control

Children under 5 getting all vacinations

Pregnants comming to control over the 7 months prior to delivery

Families with reliable and safe water during summer time

3. Do you have any written guidelines/ protocols on

1. Data collection Y/N/D
2. Diagnosis Y/N/D
3. Treatment Y/N/D
4. Procedures Y/N/D
5. Others (specify)

4. Do you know the following indicators?

children (0-16) being totally immunised	Y/N/D	...%
ANC cases with risk factors	Y/N/D	...%
Children NOT gaining weight	Y/N/D	...%

N. TOOLS and FORMS FOR DATA COLLECTING / INFORMATION

1. Do you use the following forms/ tools in your daily work?

1. Tally sheet Y/N/D
2. Register Y/N/D
3. Reports Y/N/D
4. Graph Y/N/D
5. Maps Y/N/D
6. Others

O. TRAINING

1. Have you ever had any training in information use? Y/N/D

What type? 1. Use of information (indicators etc.)
2. Computer training
3. Data analysis
4. Other

2. Do you have a job description? Y/N/D

3. Does it specify information use as a task Y/N/D

P. TEAMWORK / SUPERVISION (old N and O - changed)

1. Do you ever have meetings of the people you work with? Y/N/D

2. Do these meetings ever discuss data collected? Y/N/D

3. In the past 3 months, how many support visits have you had from

1. From the Aimak ...visits
2. From Ulaanbaatar (Ministry of health) ...visits

4. Do they ever discuss the data you collect? Y/N/D

5. Do you supervise juniors? Y/N/D

6. Do you ever ask them about data collected? Y/N/D

Describe

Q. COMMENTS

1. What gaps do you feel exist between the information you HAVE and the information you NEED? Please specify the areas you would like MORE information about

2. How could the Information System and the use of information be improved?

UBS TARIALAN

ЭРҮҮЛ МЭНД , УДИРДЛАГЫН МЭДЭЭЛЛИЙН ТОГТОЛЦОО СУДАЛГААНЫ АСУУМЖ

UVS-TARJALAN

264

1996. 9. 2

Энэ асуумж судалгаа нь ямар мэдээлэл өөрийн ажилдаа хэрэглэдэг түүнийг хэрхэн ашигладаг байдлыг тодорхойлох зорилготой юм. Таны үнэн зөв хариулт бидний ажилд чухал үүрэгтэй бөгөөд таны хариултыг бусдад мэдээлэхгүй гэдэгт бүрэн итгэж болно.

Та хариултаа ... зайнд бичээр/тоогоор бөглөж,
Т/Ү/М (ТИЙМ/ҮГҮЙ/МЭДЭХГҮЙ)-гийн тохирох хариултыг дугуйлана уу

Албан тушаал . Их эмч (phys) ... Ажилласан жил . 2 . . Боловсрол . Дээд.
Байгууллага . Эмнэлэг . . Аймаг . . Увс . . . Сум . . Тариалан

1
1
2
1
20

А. Мэдээлэлтэй ажилдаг цаг

1 Та мэдээлэлтэй (хүлээж авах, маягт бөглөх, тайлан бичих г.м) хэдэн цаг ажилладаг вэ?

1. Өдөр бүр 8 цаг 00 мин
2. 7 хоногийн эцэсээр .. цаг .. мин
3. Сарын эцэсээр .. цаг .. мин

9

40

Үүнээс хэдэн цагийг анализ хийх, үзүүлэлт гаргах, бусад үзүүлэлтэй жиших зэрэгт зарцуулдаг вэ?

1. Өдөр бүр .. цаг .. мин
2. 7 хоногийн эцэст .. цаг .. мин
3. Сарын эцэст .. цаг .. мин

99

Б. Үйлчлэх хүрээний хүн ам

1.Та тодорхой хүн амд үйлчилдэг үү? (Т) Ү М 1

Таны үйлчилдэг хүн амын тоо 4860 хүн - гэрүүд

Тэд хаанаас ирж үйлчлүүлдэг. Хөдөө баг сумын төвөөс.

2 Танд доорх тоо баримт (үйлчлэх хүн амын) байгаа юу ? (Т) Ү М

хэрэв тийм бол

1. 0 - 1 насны хүүхдийн тоо 189 - 200.
2. 1 - 5 насны хүүдийн тоо 578 - 600
3. Жирэмсэлтийн тоо 165 эмэгтэй
4. Төрөлтийн тоо 155 . эмэгтэй
5. Төрөх насны эмэгтэйчүүдийн тоо 800. эмэгтэй
6. Сургуулийн насны хүүхдийн тоо 540 . сурагч
7. Бусад (бич) . . . .

В. Мэдээллийн тогтолцоо

1 Доорхи асуудлаар мэдээлэл бүртгэдэг (буюу хүлээн авдаг,цуглуулдаг) эсэх

1. Амбулаторийн үзлэг (Т)/Ү/М
2. Эмнэлэгт үзүүлэгсэд (Т)/Ү/М
3. Жирэмсний хяналт (Т)/Ү/М
4. Вакцинжуулалт (Т)/Ү/М
5. Гэрийн үзлэг (Т)/Ү/М
6. Хүн амын дотор хийж буй мэдээлэл сургалт сурталчилгаа (Т)/Ү/М
7. 0-1 насны хүүдийн өвчлөл (Т)/Ү/М
8. 1-5 насны хүүдийн өвчлөл (Т)/Ү/М
9. Орчны эрүүл ахуй (Т)/Ү/М
10. Бусад . . . .

2 Та эдгээр мэдээлэлд дүн шинжилгээ хийх буюу ямар нэг үзүүлэлт гаргадаг уу? T/Y/M
Хэрэв тийм бол ямар үзүүлэлт гаргадаг . . . .
Дээрх мэдээлэл нь
1. Үнэн зов байдаг T/Y/M
2. Бүрэн гүйцэд байдаг T/Y/M
3. Хэрэглэхэд гарын дор байдаг T/Y/M
3 Гэдгээрийг өөрийн ажилдаа ашигладаг уу ? T/Y/M
Хэрэв тийм бол яаж ашигладаг вэ . . . .

Г. КОМПЬЮТЕР

1 Танай байгууллага компьютертэй юу?
2 Танд байгаа мэдээллийг танай байгууллагын компьютерт оруулдаг уу? T/Y/M
3 Танд байгаа мэдээллийг дээд газрын компьютерт оруулдаг уу? T/Y/M
4 Аль нэг түвшинд мэдээллийг компьютерт оруулснаар таны ажилд ач холбогдол байдаг уу? T/Y/M
5 Хэрвээ тийм бол ямар ач холбогдолтой байдаг вэ? . . . . T/Y/M
6 Та цуглуулсан мэдээлэл,тоо баримтаа боловсруулахад ямар тусламж дэмжлэг (компьютер зэрэг хэрэглэх, мэдээллээ өгч боловсруулах г.м) авбал илүү гэж бодож байна вэ?
Яаж: Курс, семинарт суух ..... Зөвлөгөө зааварчилгаа авбал илүү болов уу

7 Танд (танай байгууллагад) компьютер (байдаг бол нэмж авах) хэрэгтэй юу? T/Y/M
Чухам ямар асуудлыг шийдвэрлэхэд . . . . Компьютер ашиглах боломжтой болох, бэлэн болсон дүрэм бэлтгэх цаашид өөр мэдээлэлд хэрэглэх зүйтэй.

Д. Мэдээллийн урсгал

1 Та анхан шатны маягт бүртгэлийг бөглөсний дараа түүнийгээ яадаг вэ?
1. Өөрөө анализ хийдэг
2. Холбогдох байгууллагад дамжуулдаг
3. Бусад . . . .

Хэрэв мэдээлэл дамжуулдаг бол хаашаа хэнд илгээдэг вэ?
. . . .

2 Та эдгээр тоо мэдээллийг юунд ашигладаг гэж бодож байна вэ?
1. Анализ дүгнэлт хийдэг
2. Төлөвлөгөө боловсруулахад
3. Жилийн тайланд
4. Огт хэрэглэдэггүй
5. Бусад . . . .

3 Та сарын статистик мэдээ сумдаас яаж авдаг вэ? / Зөвхөн аймгийн төвд ажилладаг бол бөглө
1. Цаг хугацаанд нь авдаг
2. Цаг хугацаанд нь авч чаддаггүй

4 Та аймаг руу сарын мэдээг яаж дамжуулдаг вэ? / Зөвхөн сумын төвд ажилладаг бол бөглө
1. Утсаар
2. Биеэр болон бие хүнээр
3. Замын хүнээр
4. Шуудангаар
5. Бусад . . . . .

5 Та сарын мэдээг цаг хугацаанд нь явуулдаг уу? T/Y/M
1. Сардаа багтааж
2. Сардаа багтааж амждаггүй

6 Аймагтай/сумтай (зур) харилцахад (мэдээ дамжуулахад) ямар бэрхшээл байдаг вэ?
1. Утас найдваргүй
2. Шуудан найдваргүй
3. Шуудан үнэ ихтэй
4. Бусад . . . . .

-3-

7 Аймагт огдог мэдээгээ юугаар бодож гаргадаг вэ?
1. Гараар боддог
2. Сампин
3. Тооны машин
4. Бусад . . . .

8 Сарын статистик мэдээг та ажилдаа ашигладаг уу? Т/У/М
Хэрэв тийм бол чухам юунд ашигладаг . . . Тоолов мэдээнд хэрэг сарын мэдээгээ харьцуулах

9 Та анхан шатны маягтыг аймаг руу яаж илгээдэг вэ?
1. Биеэр болон бие хүнээр
2. Замын хүнээр
3. Шуудангаар
4. Бусад . . . .

10 Анхан шатны маягтанд анализ,статистик боловсруулалт хийдэг үү? Т/У/М
Хэрэв тийм бол ямар боловсруулалт хийдэг . . . . Дүн бүртгэлд дүгнэлт хийх хэлбэрийн сараар харьцуулж аль зүйл доор анхаарч ажиллах бэ гэдэг.

Е. Хариу мэдээлэл

1 Таны илгээсэн тоо мэдээллийг ашиглан гаргасан хариу мэдээлэл та авдаг уу? Т/У/М
Хэрэв тийм бол ямар хугацаанд
1. хоногт
2. Сард
3. Жилд
4. Тогтмол биш

Ямар хэлбэрээр
1. Тайлан хүснэгтээр
2. Бичгээр
3. Зөвлөгөө
4. График, зураг, дүрслэлээр
5. Бусад . . .

Е. Эрүүл мэндийн байдал

1 Та өөрийн үйлчлэх хүн амын эрүүл мэндийн доорх үзүүлэлтүүдийг мэдэх үү?
1. Нялхсын эндэгдлийн үзүүлэлт Т/У/М барагцаалбал . . бага байдаг
2. Хүүхдийн эндэгдлийн үзүүлэлт Т/У/М барагцаалбал . . ———
3. Эхийн эндэгдлийн үзүүлэлт Т/У/М барагцаалбал . хааяа гардаг.
4. Жирэмсний түвшин Т/У/М барагцаалбал . Нилээн доогуур
5. Ажилгүйдлийн түвшин Т/У/М барагцаалбал . . ———
6. Бусад (бичнэ үү) . . . .

2 Та эдгээр мэдээллийг хаанаас авдаг вэ ? . . . . Статистик мэдээллээс.

Ж. Нэн тулгамдсан асуудлууд

1 Таны үйлчлэх хүрээний хүн амын дундах эрүүл мэндийн тулгамдсан үндсэн асуудлууд :
1. Тураалтай хүүхдийн тоо нэмэгдэж байгаа
2. Амьсгалын замын өвчин түгээмэл
3. Эхийн эндэгдлийн түвшин өндөр
4. Нялхсын эндэгдлийн түвшин өндөр
5. Ажилгүйдэл ядуурлын түвшин өндөр
6. Ундны усны хангамж муу
7. Тээврийн хэрэгслийн үйлчилгээ муу
8. Бусад

2 Эдгээр шийдвэрлэх асуудлыг яаж мэдсэн вэ ? . . Бодит амьдралаас харагдаж байна

З. Зорилт, Үзүүлэлт

1.Та өөрөө хийж шийдвэрлэх ямар тулгамдсан асуудал байна вэ?

Эрхлэгчийн [illegible] ажил авч болохоор ажилласан бүх ажил 7/8-х [illegible]
[illegible] төсөв маш бага [illegible]

2.Үүнээс өөр танай байгууллагын тулгамдсан асуудал,зорилтыг мэдэх үү ? Т/Ү/М
хэрэв тийм бол . . . .

3.Энэ тулгамдсан асуудал,зорилтоо тодорхойлохын тулд та/танай байгууллага (үзүүлэлт гаргах г.м) мэдээллийг ашигладаг уу? Т/Ү/М

4.Ямар мэдээлэл,тоо баримтыг ямар тулгамдсан асуудал,зорилтыг тодорхойлохын тулд:

Мэдээлэл	Зорилго
1. Дээд байгууллагын	. . . .
2. Статистик	. . . .

II.Төлөвлөгөө,Зорилт

1.Танай байгууллага үйл ажиллагааны төлөвлөгөөтэй юу ? Т/Ү/М

2.Хэний боловсруулсан төлөвлөгөө вэ? . . . . Эрхлэгчийн . . .

1. Би энэ төлөвлөгөөг боловсруулахад биечлэн оролцсон
2. Байгууллагын удирдлага боловсруулсан
3. Мэдэхгүй
4. Бусад . . . .

3.Уг төлөвлөгөөг гаргахдаа байгууллагынхаа тоо баримт,мэдээллийг ашигласан уу? Т/Ү/М
хэрэв тийм бол яаж ашигласан. . . . .

4.Та энэ төлөвлөгөөний хувийг яаж олж авсан бэ?

1. Албан ёсоор
2. Байгууллагын удирдлагаас
3. Тасаг хэлтсийн удирдлагаас
4. Байхгүй

Й. Эмнэлгийн тусламжийн хүртээмж

1.Орон нутгийн хүн амд үзүүлж буй эмнэлгийн тусламжийг та хангалттай гэж боддог уу? Т/Ү/М

2.Ихэнх хүмүүс эмнэлгийн тусламж авахаар ямар унаагаар ирдэг вэ?

1. Явган
2. Морь тэмээгээр
3. Шуудангаар
4. Машин мотоциклоор
5. Тэрэгээр
6. Бусад ....
7. Мэдэхгүй

3.Хүн амын хэдэн хувь нь эмнэлгээс 5 км дотор амьдардаг вэ ?

1. Сумын эмнэлгээс 40 % Мэдэхгүй
2. Бага эмчийн салбараас . . % Мэдэхгүй

4.Тэд эмнэлгийн тусламж авахаар дунджаар хэдэн цаг явдаг вэ?

1. 0-30 мин
2. 30-60 мин
3. 1-2 цаг
4. 2-3 цаг
5. 3 ба дээш

5.Эмнэлэгт үзүүлэхэд нэг өвчтөн дунджаар хэр удаан хүлээдэг вэ?

1. 0-30 мин
2. 30-60 мин
3. 1-2 цаг
4. 2-3 цаг
5. 3 ба дээш

-5-

К. Үйлчилгээний хамралт чанар

1.Эмнэлгийн тодорхой тусламж, үйлчилгээний хамралт гэж юуг хэлэх вэ?
Тухайн хүн өөрөө үзүүлэх бүх үйлчилгээ — тодорхой бүрэн хамрагдаж байгаа б/та

2. Та өөрийн ажлын чанарыг тодорхойлохдоо эмнэлгийн тусламж,үйлчилгээний хамралтыг бодож ангилдаг уу ? Т/Ү/М

Эмнэлэгт төрсөн эхчүүдийн эзлэх хувь ...%
0-1 насны хүүхдийн идэвхтэй хяналт ...%
0-5 насны хүүхдийн вакцинжуулалтанд хамрагдсан ...%
Жирэмсний хяналт (эхний 7 сартай) ...%
Ундны усны хангамж (зуны улирал) ...% (үйлчлэх хүн амын хэдэн %)

3.Танд дараах зүйлээр ямар нэгэн бичсэн заавар зөвлөмж гарын авлага байгаа юу ?

1. Тоо баримт,мэдээлэл цуглуулах Т/Ү/М
2. Онооноох Т/Ү/М
3. Эмчилгээний Т/Ү/М
4. Ажилбар хийх Т/Ү/М
5. Бусад (бич) ...

4.Та дараахи үзүүлэлтүүдийг мэдэх үү?

0-16 насны хүүхдийн вакцинжуулалтанд хамрагдсан Т/Ү/М хэрэв тийм бол ...%
жирэмсний хүндрэлтэй эхчүүд Т/Ү/М хэрэв тийм бол ...%
сульдаатай (тураалтай) хүүхдийн Т/Ү/М хэрэв тийм бол ...%

Л. Мэдээлэл цуглуулах арга,хэрэгсэл

1.Та доорх зүйлсийг өөрийн ажилдаа хэрэглэдэг үү?

1. Анхан шатны маягт Т/Ү/М
2. Бүртгэл Т/Ү/М
3. Тайлан хүснэгт Т/Ү/М
4. Зураг,график Т/Ү/М
5. Газрын зураг (зураг дээр тэмдэглэсэн байдлаар) Т/Ү/М
6. Бусад ...

М. Сургалт

1.Тоо баримт,мэдээллийг ангилах талаар ямар нэг сургалтанд хамрагдаж байсан уу? Т/Ү/М

хэрэв тийм бол 1.Мэдээлэл ажилдаа ангилах (бэлэн үзүүлэлтийг)
2.Мэдээлэл боловсруулахад компьютер хэрэглэх
3.Анализ статистик боловсруулалт хийх
4.Бусад ...

2.Танд ажил үүргийн хуваарь бий юу Т/Ү/М
3.Таны ажилд тоо баримт,мэдээллийг чухалчилдаг уу? Т/Ү/М

Н. Ажлын хэсэг Зөвлөгөө

1.Та хамт ажилладаг хүмүүстэйгээ хамт хуралддаг уу? Т/Ү/М
2.Хурлаараа цуглуулсан тоо баримт,мэдээллийн талаар ярилцдаг уу ? Т/Ү/М
3.Сүүлийн 3 сард дараах байгууллагаас хэдэн удаа хүн ирж уулзалт ярилцлага хийж зөвлөгөө өгсөн бэ?

1. Аймгийн удирдах байгууллагаас ~~гурав~~ 1 удаа
2. УБ-т байгаа (ЭМЯ г.м) удирдах байгууллагаас — удаа

4.Тэд таны цуглуулсан тоо,мэдээллийн талаар ярилцаж байсан уу? Т/Ү/М
5.Та удирдлагандаа ажилладаг хүмүүст заавар зөвлөгөө өгдөг үү? Т/Ү/М
6.Та өөрийн цуглуулж бүртгэдэг тоо,мэдээллийн талаар асууж ярилцдаг уу? Т/Ү/М

хэрэв тийм бол ямар тоо,мэдээлэл ...

Санал

1.Таны ажил ШААРДЛАГАТАЙ мэдээллийг, таны ХЭРЭГЛЭЖ буй мэдээлэл бүрэн хангаж байна уу?
Хэрэв үгүй бол аль чиглэл (юуны талаар) зөр нэмэлт мэдээлэл авахыг хүсч байна вэ?

- *Сумандаа ямар мэдээллийн хэрэгцээ байгаагүй. Ийм ямар байдал байх бол радио, зурагт зэрэг хэвлэл мэдээлэл*

2.Эрүүл мэндийн мэдээллийн тогтолцоо,мэдээллийн ангилалтыг яаж сайжруулж болох вэ?

- *мэдээллийн хэрэгцээг сайжруулах замаар*

ТАНД ИХ БАЯРЛАЛАА

(1)

8

QUESTIONNAIRE FOR SURVEY OF COMPUTER USAGE

This questionnaire is to get an idea of computer usage, training and maintanance in the health services (and in other institutions) in the Aimaks and towns of Mongolia. Also we focus on means and needs for communication between Centre, Aimaks and Soms. We are particularly interested in local use and analysis of health information. This questionaire is used together with the "Questionaire for Health and Management Information Systems" that is distributed to health personell working with collection, analysis or use of data and information. There are NO right or wrong answers, we want YOUR impressions and all replies are STRICTLY CONFIDENTIAL!!

CIRCLE/ UNDERLINE THE MOST APPROPRIATE OPTION(S)
FILL IN SPACES (NUMBERS OR TEXT) and Y/N/D WHERE INDICATED

Position..........................
Institution.......................... Years of service.......... education..........................
Aimak.......................... Som..........................

A. COMPUTER

1 Do you use or have access to a computer in your work? Yes/ no/D know
2 Do your institution have computer(s) yes/ no /dk
286(....) 386(....)
486(....) 586 / pentium (....) others (....)
For how long time have your institute had a computer? ....Years ....months
3 How did you get it? (If more than one, write number
1. ~~Took the initiive~~ and bougt and paid it yourself FROM CENTER
2. ~~Provided by centre~~ GIFT
3. ~~Provided by other organisations~~, loan or gift your self
4. ~~Rented~~ Rented
5. Borrowed from other organisation
4 Do you have printer? Yes / no /Dk
dot writer (....) ink jet (....) laser printer (....)

B. PROBLEMS

1 Are the equipment in order now? Yes/ no/D
1 Computer not working
2 partly working /lack of spare parts months
3 Printer not working (out of paper /ribbons) months
4 others months
2 Have you had problems / computer(s) been out of order before? Yes/ no/D
1 Computer not working
2 partly working /lack of spare parts months
3 Printer not working (out of paper /ribbons) months
4 others months
3 Is lack of training/skills a problem?
4 Most SW and manuals are in english. Is that a problem Yes/ no/Dk
5 Is lack of access to the computer a problem? (So that you never learn how to use it) Yes / no/Dk
6 Has it been difficult to get reparations and maintanance? yes / no/Dk
7 specify other problems Yes / no/Dk

C MAINTENANCE AND LOCAL COLLABORATION

1 Are there computer companies in the aimak providing service and maintenance? yes / no / Dk
2 Do you collaborate / get services from a computer company in the Aimak yes / no / Dk
3 Where do you get help with "small" problems e.g. the computer is not starting normally?
1 from a computer company in the Aimak?
2 from other computer users in the Aimak Yes / no / Dk
3 from friends in the Aimak yes / no / Dk
4 from Ulaanbaatar (MoH, SSO, etc.) yes / no / Dk
5 from a company in Ulaanbaatar yes / no / Dk
6 others Yes / no / Dk

2

4. Where do you go when you have more serious problems with HW (e.g. keyboard or screen not working)

1. a computer company in the Aimak? yes / no
3 - 2. MoH in Ulaanbaatar yes / no
3. a computer company in Ulaanbaatar yes / no
4. others ......

/ 5. How long time does it take to get spare parts (e.g. keyboard)? .... Day .. Weeks ....months

6. Where do you learn about new things and get copies of additional SW, like anti-virus programs?

1. from a computer company in the Aimak? Yes / no /Dk
2. from other computer users in the Aimak yes / no / Dk
8 5 3. from friends in the Aimak yes / no / Dk
4. from Ulaanbaatar (MoH,SSO,etc.) yes / no / Dk
5. from a company in Ulaanbaatar Yes / no / Dk
6. others ......

7. How many computer users are there in the aimak (apart from health sector)?

1. State statistical office
2. bank
1 3. stock echange
4. agricultural office
5. aimak administration
6. private company(ies)
7. Others ....

8. Are you collaborating with some of these ? yes / no

1. learning from each others
4 2. getting new SW / copying games
3. getting help when problems
4. others (specify) ....

/ 9. Is it "popular" to work with computers? yes / no
/ 10. Is working with computers seen as a way to improve the career opportunities? yes / no
/ 11. Is work with computer seen as typical for a typist or clerk ("low position") yes / no
/ 12. Is work with computers seen as typical for a manager ("high position") yes / no

D. USE OF COMPUTER

1. How much are you using the computer?

1. More than 3 days a week
2. every week
3. every month
4. irregularly
5. never

2. For what are you using the computer?

1. Enter data
2. analyse data
3. make reports
13 4. make graphs
5. word processors
6. financial programs
7. others ......

3. How many people are using the computer regularly?

Number of people
with positions

4. Are you using information processed and produced by the computer?

What kind of information (specify)?
For what (specify)

5. Who else are using information from the computer?

Who What information For What purpose

3

E. TRAINING

1. How did you learn to use the computer?
   1. Trained in course
   2. Trained by colleague
   3. Using magazines and books
   4. By your self

2. Do you need training? Yes / no
   Specify your training needs ....

3. Has it been organised computer training in your institution yes / no
   how many people have been trained ....
   Specify how ....

4. Are there training needs in your institution? Yes / no
   Specify your institution's training needs ....
   Is it a plan for training in computers at your institute? Yes / no
   Specify how ....

F. USER PROGRAMS

1. What programs are you using for your health information and statistics? User programs (applications) provided by
   the center / MoH
   privat companies
   international organisations
   Which functions are they serving? Specify
   what languages used fro interaction/manuals mongolian english russian others

When using this SW	MoH	Companies	Internat.
1. Is it serving your needs?	Y/N/D	Y/N/D	Y/N/D
2. Is it easy to use?	Y/N/D	Y/N/D	Y/N/D
3. Do you need training?	Y/N/D	Y/N/D	Y/N/D
4. Do you get help and support? Yes/no	Y/N/D	Y/N/D	Y/N/D
5. Do you you need adjustment to local needs?	Y/N/D	Y/N/D	Y/N/D

G. COMMUNICATION

1. Which means of communication do you use in work?
   1. telephone Y/N/D
   2. fax Y/N/D
   3. letters by mail Y/N/D
   4. letters brougt by people going the same way Y/N/D
   5. courier (send a car / person with the letter) Y/N/D
   6. modem and computer mail Y/N/D
   7. others (specify)

2. Do you have problems in communicating with the centre? Y/N/D
   1. Telephone not reliable
   2. Lack of transport
   3. Mail is not reliable
   4. Mail is expensive
   5. Other

3. How are you communicating with Soms (or one level down)?
   1. telephone Y/N/D
   2. letters by mail Y/N/D
   3. letters brougt by people going the same way Y/N/D
   4. courier (send a car / person with the letter) Y/N/D
   5. others (specify)

4. Do you have problems in communicating with Soms (one level down)? Y/N/D
   1. Telephone not reliable
   2. Lack of transport
   3. Mail is not reliable
   4. Mail is expensive
   5. Other

5

7

5

1

6

1

4

1

(4)

I. INFORMATION SYSTEM

1. How are you receiving monthly statistics from the Soms?
    1. Telephone
    2. forms by courier
    3. forms with people going the same way
    4. by mail
    5. others (specify) ......
2. Are you receiving this information on time? Y/N/D
3. Are you entering this information into the computer? Y/N/D
    When do you enter this data?
    1. When you get it
    2. once a month
4. Are you using the computer to print the monthly statistic? Y/N/D
    If yes, do you use
    - Word processor (BRIEF etc.)
    - spread sheet
    - special user program (SC4 etc.) other (specify).........
5. How are you calculating the monthly stat for the Aimak (totals, so far this year etc.)?
    1. By hand
    2. "Kuleramme"
    3. calculator
    4. the computer (specify program and function ....
    5. other ......
6. How are you receiving the other forms ("daily sheets") from the Som?
    1. by courier
    2. with people going the same way
    3. mail
    4. others ...
7. Are you receiving these forms within the month? Y/N/D
8. Are you entering these forms into the computer? Y/N/D
    If yes
    1. When you get them
    2. Once a month
9. Are you calculating statistics / making analysis from these forms Y/N/D
    How are you calculating / making analysis?
    1. By hand
    2. "Kuleramme"
    3. calculator
    4. the computer (specify program and functions
    5. other
10. Do you use computer to make stat./analysis from other forms that you get from Soms? Y/N/D
    If yes, specify what forms
    what analysis/statistic
11. Do you make stat./analysis based on these other forms without using computer? Y/N/D
    If yes,
    1. By hand
    2. "Kuleramme"
    3. calculator
    4. other

12

(31)

J. IFORMATION FLOW AND FEEDBACK

1. Do calculate monthly statistics using the computer? Y/N/D

2. To whom and how often are you sending the monthly statistic?

1. Centre Y/N/D monthly / annually/irregular
2. Aimak management Y/N/D monthly / annually/irregular
3. hospital director Y/N/D monthly / annually/irregular
4. infectios disease centre yes / no Y/N/D monthly / annually/irregular
5. Som / Y/N/D monthly / annually/irregular
6. Others (specify) ....

3. Do you hear from those you are sending information? Y/N/D

From Centre? Y/N/D monthly / annually/irregular
??Written / meetings / supervision / telephonic

From Aimak? Y/N/D monthly / annually/irregular
Written / meetings / supervision / telephonic

From Som? Y/N/D monthly / annually/irregular
Written / meetings / supervision / telephonic

4. How are you reporting monthly statistics to the centre?

1. Using disc (calculated data) Y/N/D
2. Using disc (raw data) Y/N/D
3. sending reports printed by computer Y/N/D
4. sending forms where numbers are written by hand Y/N/D
5. sending reports calculated and printed by computer Y/N/D

K. LOCAL USER PROGRAMS AND FURTHER NEEDS

1. Have you made any small user programmes? Y/N/D

1. What purpose / kind? Specify ....
2. What SW? Spreadsheet / database programme / others (specify) ....
3. Who programmed it? ....

2. Do you need some local user programs? Y/N/D

3. Further needs - What more would you like to use the computer for (specify)?

....

4. Do you need a programmer? Y/N/D

5. Do you need more SW? Y/N/D

6. Do you get any special requests for information /analysis? Y/N/D

From Who? Centre
aimak

ON WHAT? Specify... ....

How often?

1. often
2. monthly
3. every year
4. irregular

L. SUGGESTIONS

How could computers be used more effectively? (e. g. better access, more rtaining, better programs etc.) Specify

-
-

THANK YOU

1. UVS – Statistical Office

Dawe Sra SVEROLASK

"КОМПЬЮТЕРЫН АШИГЛАЛТ" СУДАЛГААНЫ АСУУМЖ

(W) 5.2

Энэ асуумж судалгааны зорилго нь компьютерын ашиглалт, сургалт, хөгжлийн эрүүл мэндийн болон бусад салбарт хот-аймаг-сумын түвшинд хэр зэрэг байгааг тодорхойлох зорилготой юм. Түүнчлэн эрүүл мэндийн салбарт нэгжийн мэдээллийг хэрхэн ашиглаж буйг судлах явдал юм. Энэ асуумж нь компьютер ашиглалтыг (хэрэглээг) хангах болоод "Эрүүл мэнд, Удирдлагын Мэдээллийн Төгсөлцөө" асуумжийн хичээлд хамаарах юм. Таны хариулт бидний ажилд чухал ач холбогдолтой бөгөөд нэрийн хариултыг бусад мэдээлэлгүй задгаар бичих болно.

Та хариултаа ...- зайнд бичгээр/тоогоор бөглөж,
Т/Ү/М (ТИЙМ/ҮГҮЙ/МЭДЭХГҮЙ)-гийн тохирох хариултыг дугуйлана уу

3
1

Албан тушаал *инженер-оператор* Ажилласан жил . . . . . Боловсрол *д.эзу*
Байгууллага *ЗДТамгын Газар* Аймаг *Увс* . . . . Сум *Улаангом*

А. КОМПЬЮТЕР/ТЕХНИК ХАНГАМЖ

1.Та өөрийнхөө ажилд компьютер ашигладаг/ашиглах боломжоо байдаг уу?
Т/Ү/М

2.Танай байгууллагад компьютер ашигладаг уу? Т/Ү/М 4

286 (..) 386 (..)
486 (Т) 586/Pentium (..) бусад (..) 1
ашиглаж буй хугацаа 1 жил 2 сар 1

3.Танай байгууллага энэ/эдгээр компьютерыг хэрхэн авсан бэ?
1. Хөрөнгө оруулалтаар
2. Хандиваар,бэлгэнд 1
3. Худалдаж авсан
4. Түрээсээр
5. Түр ашиглаж байгаа

4.Принтер ашигладаг уу? Т/Ү/М 1
Энгийн (✓) Лазер (..) Бусад (..)

Б. БЭРХШЭЭЛ

1.Компьютер болон бусад иж бүрдэл бүрэн ажилтай байгаа юу? Т/Ү/М 1
1. Компьютер ажиллахгүй байгаа .. сар 99
2. Зарим иж бүрдэл ажиллахгүй .. сар 99
3. Принтер (лент/хоргүй болох г.м) ... сар 99
4. Бусад . . . .

2.Өмнө нь ажиллахгүй болсон тохиолдол бий юу? Т/Ү/М 2
1. Компьютер ажиллахгүй байгаа .. сар 99
2. Зарим иж бүрдэл ажиллахгүй .. сар 99
3. Принтер (лент/хоргүй болох г.м) .. сар 99
4. Бусад . . . .

3.Компьютераар ажиллахад мэдлэг/чадвар/дадлага хангалтгүй Т/Ү/М 1
4.Их нь програм, ашиглах заавар англи хэл дээр байдаг. Энэ нь бэрхшээлтэй байдаг Т/Ү/М 1
5.Ажиллах боломжоо дутагдалтай (ажиллаж суваагүй,ажиллах газ хоме компьютер хүрэлцэхгүй г.м) Т/Ү/М 2
6.Мэдэхгүй зүйлээ асуух, туслалцаа авахад хэцүү байдаг. Т/Ү/М 2
7.Бусад бэрхшээлүүд ...*Цахилгаана... светлаас зорин цэг айлгаждегүй* Electricity

В. ДЭМЖЛЭГ ТУСЛАЛЦАА, ХАМТЫН АЖИЛЛАГАА

1.Танай аймагт компьютерийн засвар үйлчилгээ явуулдаг нүүс компани ХХК байдаг уу? Т/Ү/М 2
2.Та (эсвэл байгууллага) тэдэнтэй харилцаатай байдаг уу? Т/Ү/М 2
3.Хэрэв ямар "жижиг" бэрхшээл гарахад хаанаас туслалцаа авдаг вэ?
1. Аймагт байгаа нүүс компани ХХК Т/Ү/М 99
2. Аймагт байгаа компьютер хэрэглэгчээс Т/Ү/М 99
3. Аймагт байгаа найз нөхдөөсөө Т/Ү/М 99
4. Төвөөс (ЭМЯ,МГГ,СТГ) зас Т/Ү/М 99
5. УБ байгаа нүүс компани ХХК Т/Ү/М 1
6. Бусад 99

4.Компьютер ажиллахгүй болсон үед (товчлуур,дэлгэц эвдрэх г.м) та хаанаас тусламж авдаг вэ?

1. Аймагт байгаа пүүс компани ХЭАА T/Y/M
2. Төвөөс (ЭМЯ,МТТ,СТГ)-аас T/Y/M 9
3. УБ байгаа пүүс компани ХЭАА T/Y/M 1
4. Бусад 9

5:Энэ нь хэдий хэр хугацаа шаарддаг вэ? .. өдөр 0,5 сар .. жил 2

6:Та шинээр гарсан программын тухай (вирусын эсрэг программ г.м) хаанаас мэдэж авдаг вэ?

1. Аймагт байгаа пүүс компани ХЭАА T/Y/M
2. Аймагт байгаа компьютер хэрэглэгчдээс T/Y/M 9
3. Аймагт байгаа найз нөхдөөсөө T/Y/M 9
4. Төвөөс (ЭМЯ,МТТ,СТГ)-аас T/Y/M 1
5. УБ байгаа пүүс компани ХЭАА T/Y/M 1
6. Бусад мэдээллийн хэрэгсэл сонин, сэтгүүл. 9

7.Танай аймагт хэдэн хүн (байгууллага) компьютерыг ашигладаг вэ? (ЭМ-ийнхийг оруулалгүй)

1. Ямар хүмүүс хэрэглэдэг вэ?
2. Аймгийн Статистикийн Газар
3. Банк
4. Аймгийн хөрөнгийн бирж
5. Аймгийн ХАА хэлтэс(газар/тасаг)
6. Аймгийн захиргаа
7. Компани пүүс ХЭАА
8. Бусад сургууль, хилийн отрядын анги, гэх 5

8.Та хэдэнтэй хамтран ажилладаг уу? T Y M 1

1. Суралцдаг
2. Шинэ программ авч өгдөг
3. Бэрхшээлтэй үед харилцан туслалдаг
4. Бусад ....

9.Компьютерыг ажилдаа хэрэглэх нь түгээмэл зүйл үү? T Y M

10.Компьютерыг ажилдаа хэрэглэх нь албан тушаал ахих боломж гэж та бодож уу?
T Y M

11.Компьютер нь бичээч болон дунд тушаалынхны хэрэглэдэг зүйл үү? T Y M 1

12.Компьютер нь удирдах албан тушаалтны хэрэглэдэг зүйл үү? T Y M 2

Г. ХЭРЭГЛЭЭ/АШИГЛАЛТ

1.Өөрийнхөө ажилд компьютерыг хэр ашигладаг вэ?

1. хоногт 3 болон дээш удаа
2. хоног бүр
3. сар бүр
4. тогтмол биш
5. огт хэрэглэдэггүй

2

2.Та ямар зорилгоор/юу хийхэд ашигладаг вэ?

1. мэдээлэл оруулах
2. дүн шинжилгээ хийх
3. тайлан хүснэгт гаргах
4. график байгуулах
5. бичиг хэрэг
6. санхүү бүртгэл
7. бусад зорилгоор мэдээллийн баази байгуулах, тоглоом, бэлэг дурсгал

3.Компьютерийг байнга хэдэн хүн ашигладаг вэ?

... хүний тоо

албан тушаал ....

4.Та компьютерээр мэдээлэлд боловсруулалт хийдэг үү? T Y M

Ямар мэдээлэл СТ мэдээллийг..

Ямар зорилгоор төвд дамжуулах, орон нутагт өгөх гаргах

5

5.Танаас өөр ямар хүн ашигладаг вэ?

Хүн Ямар мэдээлэл Ямар зорилгоор

....

....

Д. СУРГАЛТ

1.Та компьютерыг хэрхэн ашиглаж сурсан бэ? 9

1. Дамжаагаар 99
2. Найз нөхөд танилаараа заалгасан
3. Ном сурах бичиг ашиглаж сурсан 9
4. Өөрийн оролдлогоор 1

2.Танд цаашид компьютерын сургалт хэрэгтэй юу? 1

Тийм бол чухам юу сурахыг хүсч байна вэ? бичнэ үү Өрших үеийн пр-хангамж SW T/Y/M 7

3.Танай байгууллагад компьютерын сургалт явуулж байсан уу? 2

рэрэв сургалт явуулсан бол хамрагдсан хүний тоо .. T/Y/M 9

ямар хэлбэрээр явуулсан бич 99

4.Танай байгууллагад компьютерын сургалт явуулах шаардлагатай юу? T/Y/M 1

тухайлбал бич ....

ямар нэгэн төлөвлөгөө/зорилго бий юу? T/Y/M 9

бичнэ үү Анхан шатны байгууллагуудын ... мэдээ өгөх LEARN PEOPLE DOWNLEVEL TO USE COMP 1

Е. ХЭРЭГЛЭЭНИЙ ПРОГРАММ ХАНГАМЖ

1:Танай байгууллага хэрэглээний ямар программ ашигладаг вэ? 9

1. ЭМЯ болон төвөөс боловсруулсан
2. Компани пүүсийн боловсруулсан
3. Олон улсын стандарт программууд

Ямар функц үүрэг гүйцэтгэдэг бич MAKE REPORT Мэдээлэл ... ...

Ямар хэл дээр бичигдсэн Монгол, Англи, Орос, Бусад (зур)

Эдгээр программыг хэрэглэх явцад	ЭМЯ Төв	Компани Пүүс	Стандарт програм	
1.Хэрэгцээг тань хангадаг уу?	T/Y/M	T/Y/M	T/Y/M	1 9 9
2.Хэрэглэхэд хялбар байдаг уу?	T/Y/M	T/Y/M	T/Y/M	1 9 9
3.Танд сургалт хэрэгтэй юу?	T/Y/M	T/Y/M	T/Y/M	2 9 9
4.Бэрхшээлтэй үед тусламж авч чаддаг уу?	T/Y/M	T/Y/M	T/Y/M	1 9 9
5.Үүнийг сайжруулах шаардлагатай гэж боддог уу?	T/Y/M	T/Y/M	......	1 9 9

Ё. ХАРИЛЦАА ХОЛБОО

Та холбооны ямар хэрэгслийг ажилдаа ашигладаг вэ?

1.Удирдах дээд шатны байгууллагатай Аймгийн төв/УБ (зур)

1. Утас T/Y/M 1
2. Факс T/Y/M 99
3. Шуудан T/Y/M 1
4. Замын хүнд дайдаг T/Y/M 99
5. Бие хүнээр T/Y/M 99
6. Модем болон И-Мэйл T/Y/M 1
7. Бусад 2

2.Танд төв рүү холбоо барихад бэрхшээлтэй байдаг уу? T/Y/M 99

хэрэв бэрхшээлтэй байдаг бол: 99

1. Утас найдваргүй 99
2. Унаа ховор 99
3. Шуудангийн үйлчилгээ тааруу
4. Шуудангаар явуулахад үнэтэй
5. Бусад

3.Доод шатны байгууллагатай (Сумтай)

1. Утас T/Y/M 1
2. Шуудан T/Y/M 1
3. Замын хүнд дайдаг T/Y/M 1
4. Бие хүнээр T/Y/M 99
5. Бусад 99

4.Танд сум руу холбоо барихад бэрхшээлтэй байдаг уу? T/Y/M 1

хэрэв бэрхшээлтэй байдаг бол: 1

1. Утас найдваргүй
2. Унаа ховор
3. Шуудангийн үйлчилгээ тааруу
4. Шуудангаар явуулахад үнэтэй
5. Бусад 99

Ж.МЭДЭЭЛЛИЙН ТОГТОЛЦОО

1.Та сарын статистикийн мэдээг сумдаас яаж авдаг вэ?

1. Утсаар 1
2. бие хүнээр 1
3. замын хүнээр 1
4. шуудангаар 1
5. бусад 1

2.Та сарын статистикийн мэдээг цагт нь авч чаддаг уу? Т/Ү/М 2

3.Дээрхи мэдээллийг та компьютерт оруулдаг уу? Т/Ү/М

хэрэв тийм бол

1. Хүлээж авангуутаа оруулдаг 3
2. Ер нь оруулдаг

4.Та сарын мэдээг компьютер ашиглаж хэвлэдэг үү? Т/Ү/М 1

хэрэв ашигладаг бол

1. Текст боловсруулах программ (BRIEF г.м) 1
2. Зориулалтын хэрэглээний программ 1
3. Хүснэгт боловсруулах программ (SC4 г.м)/бусад 1

5.Та сарын мэдээг боловсруулахдаа юу ашигладаг вэ?

1. Гараар боддог
2. Сампин
3. Тооны машин 2
4. Компьютер (ямар программ хэрэглэдэг,ямар функц гүйцэттэдэг (бич) калькулятор, төвлөрсөн боловсруулалт болон стандарт (б/нэгэн, word, excel)
5. Бусад . . . .

6.Та анхан шатны маягт (АШМ)-ыг сумдаас яаж авдаг вэ?

1. Бие хүнээр 1
2. Замын хүнээр 9
3. Шуудангаар 1
4. Бусад . . . . .

7.Та АШМ-ыг сардаа хүлээн авч чаддаг уу вэ? Т Ү М 2

8.Та АШМ-ыг компьютерт оруулдаг уу? Т Ү М 4

хэрэв тийм бол

1. Хүлээж авангуутаа оруулдаг
2. Ер нь оруулдаг

9.Та эдгээр маягтуудаас ямар нэгэн статистик боловсруулалт хийдэг үү? Т/Ү М 1

боловсруулалт хийдэг бол

1. Гараар боддог
2. Сампин
3. Тооны машин 1
4. Компьютер (ямар программ хэрэглэдэг,ямар функц гүйцэттэдэг (бич) . . . .
5. Бусад . . . .

10.Та сумдаас авдаг бусад маягтыг компьютерт оруулж боловсруулалт хийдэг үү? Т Ү М 9

хэрэв тийм бол ямар маягт . . . .

ашигладаг программ,функц 9

11.Та дээрх маягтанд боловсруулалт/дүн шинжилгээ (компьютер хэрэглэлгүй) хийдэг үү? Т Ү М 1

хэрэв тийм бол

1. Гараар боддог
2. Сампин
3. Тооны машин 1
4. Бусад

3. МЭДЭЭЛЛИЙН УРСГАЛ, ХАРИУ МЭДЭЭЛЭЛ

1.Сарын мэдээ боловсруулахдаа компьютерыг ашигладаг уу?
Т/Y/M

2.Үүнийгээ хаашаа ямар хугацаанд илгээдэг вэ?

1.Төв (ЭМЯ)	Т/Y/M	сардаа/жилдээ/тогтмол бус
2.Аймгийн удирдлага	Т/Y/M	сардаа/жилдээ/тогтмол бус
3.Ерөнхий эмч/Нэгдсэн эмнэлэг	Т/Y/M	сардаа/жилдээ/тогтмол бус
4.Халдвартын хяналтын алба	Т/Y/M	сардаа/жилдээ/тогтмол бус
5.Сумын тамгийн газар	Т/Y/M	сардаа/жилдээ/тогтмол бус

6.Бусад бичнэ үү ....

3.Та хариу мэдээлэл авдаг уу? Т/Y/M

хэрэв тийм бол

1.Төвөөс (ЭМЯ)	Т/Y/M	сардаа/жилдээ/тогтмол бус бичгээр/уулзах үед/ярилцлага/утсаар
2.Аймгаас	Т/Y/M	сардаа/жилдээ/тогтмол бус бичгээр/уулзах үед/ярилцлага/утсаар
3.Сумаас	Т/Y/M	сардаа/жилдээ/тогтмол бус бичгээр/уулзах үед/ярилцлага/утсаар

4.Мэдээ тайлангаа ямар хэлбэрээр хоорондоо дамжуулдаг вэ?

1. Дискээр (боловсруулсан файл)	Т/Y/M
2. Дискээр (боловсруулаагүй файл)	Т/Y/M
3. Компьютерээр хэвлэсэн байдлаар	Т/Y/M
4. Компьютерээр боловсруулж хэвлэсэн байдлаар	Т/Y/M
5. Гараар бичсэн байдлаар	Т/Y/M

II. ӨӨРСДИЙН ХЭРЭГЛЭЭНИЙ ПРОГРАММ

1.Та (танай байгууллагад) хэрэглээний ямар нэгэн программ хийсэн үү? Т/Y/M

1.Ямар асуудлыг шийдвэрлэсэн вэ? бичнэ үү... Зеркийн ... ... авах ...

2.Ямар программ хангамж хэрэглэсэн (SC4/DBASE г.м) ... ...

3.Хэн энэ программыг зохиосон..............................

2.Танай байгууллагад өөрсдийн хэрэглээний программ хэрэгтэй юу? Т/Y/M

3.Компьютерийг өөр ямар зорилгоор ашиглахыг хүсч байна вэ?

....

4.Танай байгууллагад программ зохиогч шаардлагатай юу? Т/Y/M

5.Танай байгууллагад шинэ программууд нэмж хэрэгтэй юу? Т/Y/M

6.Таны гаргасан мэдээлэл,дүн шинжилгээнд танд ямар нэгэн шаардлага тавьдаг уу? Т/Y/M

Хаанаас Аймгаас
Сумаас

Чухам ямар шаардлага (бичнэ үү) ....

Байнга шаарддаг уу? 1.үргэлж
2.сар болгон
3.жилдээ
4.тогтмол биш

II. ТАНЫ САНАЛ

Компьютерыг өөрийн ажилдаа илүү үр дүнтэй ашиглахад юу чухал гэж та бодож байна.
Бичнэ үү

- Шинэ тэр ашиглагдах бүх программ хангамжуудыг
- Байгууллагын сүлжээ компьютерийн бүрт ашиглах боломжтой гэж үзэж. Түүнээс тэр төв газар болон ... курс ... хэрэгтэй байх, ... хэрэг ... сайн бүртгэлтэй.

ТАНД ИХ БАЯРЛАЛАА

training

Learn New SW

Recommendations to the Ministry of health in Mongolia based on our survey June - September, 1996

Jørn Braa, Ch. Nermunkh

The present health information system is purely a *reporting* system. This system should be redesigned so it could also gather for use and analysis of information at Sum and Aimak level. Data should be analysed and used at the level where it is collected. Health workers at peripheral levels must become part of all parts of the information system: (1) collection, (2) analysis and (3) use of information, and not only the data collection part.

To ensure that the new system responds to local needs it is crucial that local health workers become actively involved and real participants in the process of redesigning the health information system. Participation is also needed in order to create a sense of "ownership" towards the information among health workers at peripheral level, crucial in ensuring the quality of the system.

Analysis and use of data at the level where it is collected is the best way to ensure the quality of the data that are reported up to central level. Thus the reporting parts of the information system will be improved by an increased focus on local level. By improving the system at Sum and Aimak level the system will "automatically" be improved also at the central level. The quality on central level relies upon commitment at local level.

- The statistical feltsher in the Sums holds a key role both in the information system and in primary health care delivery. This crucial *double* role should be acknowledged and their *job description and responsibilities should be changed*:

1. The statistical feltshers should become part of the Sum management team and be given increased responsibility over primary health care delivery.
2. The statistical feltshers should become responsible for analysis and use of information at Sum level and to train and involve staff in information usage. Today the statistical feltsher is only responsible for reporting into the Aimak information system.
3. In each Sum the statistical feltsher should be responsible for compiling and regularly updating a health/demographic profile of the Sum divided into bags. The profile should include age groups, nutritional status and appropriate health and health service indicators. This Sum profile should be displayed on the wall in the Sum hospital using maps, graphs etc. so that health workers, patients and the wider community become involved.

- The *responsibilities and job description of the Aimak Information Offices should be changed* so that they become responsible also for the *use* of information at Sum level. At present they are only responsible for the collecting and *reporting* of data from the Sum level into the Aimak information system.
- The *Aimak information offices should be responsible for training of statistical feltshers and for developing tools for information collection and analysis appropriate for Sum level.* The entire Aimak information system should be redirected towards use at Aimak and Sum levels. The computer should be used to provide the Sum level with information.
- There should be created a *career path for statistical feltshers and physicians* working with information and computers. We saw many cases where skilled information people went to other jobs not related to information and there was no incentives to develop a career within the information area.

- *Training programs* in information management, analysis and use should be developed for statistical feltshers and physicians.
- *Health information should be included in the curriculum* at the health worker college where the feltshers are trained. Today there is little or no training in analysis and use of information in health management and primary health care.
- *Guidelines for how to develop the information system* at Sum and Aimak level should be developed. This should include a minimum set of indicators to be calculated and tools for data collection and analysis.
- *Establish pilots*. The above recommendations imply many changes and new concepts and a degree of trial and error will always be necessary and the interventions should be tested in carefully selected pilot sites. Experience shows that pilots enable certain district - Aimaks and Sums - to take the lead and ensure that the results are achieved, enabling spread to other district as soon as possible.
- The different *vertical programs and institutions should be integrated in the information system at Aimak level*. This could be accomplished by establishing routines for reporting into the Aimak information system as well as routines for feedback and use.
- *The National Institute of Health have to co-ordinate this process*, provide software and guidelines. Guidelines should include practical examples and tools on how a health / demographic profile of a Sum and of an Aimak should be made and updated and a selection of indicators and appropriate tools should be provided.
- In all Aimaks we visited apart from one (Tov Aimak) the use of computer was sub-optimal due to lack of training, appropriate software and experience in using the computer. None of the computer users had any training in computer use as part of their education. On these background it is necessary to *increase training in computer use and support activities for the computer based systems*. In addition to training in Ulaanbaatar on-the-job-training in the Aimaks should be prioritised because this is the only way the users particular and context bound problems may be addressed. One of the computer experts from the centre should visit each Aimak and help them solve their problems and train them.

SURVEY OF HEALTH INFORMATION USAGE AT PERIPHERAL LEVELS IN MONGOLIA - Aimaks and Sums	1. Total # 307	2. Statist feltsher SUM 67	3. Phys. Mng. SUM 30	4. Mid level SUM 50	5. Total SUM 147	6. Total NOT SUM 160
1. Do you collect, keep or receive data / information (within 9 specific areas)?	91	92	100	98	96	88
2. Do you analyse & use data at your level?	70	56	70	62	61	78
3. For this - do you use the following (*Total*)	*52*	*45*	*46*	*48*	*46*	*43*
A) Tables/ reports /statistics ?	14	10	10	6	9	6
B) (Including) Graphs/Pies etc?	18	19	13	20	18	17
C) (Including) Indicators ?	20	16	23	22	19	20
4. Do you get feedback from those you report to (level(s) above)?	70	86	70	68	76	64
5. How often (Total answered)	70	80	69	70	66	67
A)Monthly	34	37	33	28	25	35
B)Annually	16	23	10	16	18	15
C) Irregularly	20	20	26	26	23	17
6. In what form (total answers.)	69	85	65	74	77	60
A) Written only	45	50	46	46	48	41
B)Written And supervision	16	26	13	18	21	11
C)Supervision only	8	9	6	10	8	8
7. Do you have a job description?	80	76	90	78	79	81
8. Does it specify information handling?	67	73	60	64	67	66
9. Do you have written guidelines						
A) On data collection /use?	43	50	36	46	46	41
B) Other (specific) procedures?	48	52	80	58	59	37
10. Have you had training in						
A) use of information /data analysis	28	35	36	36	34	22
B) use of computer	10	3	6	0	2	16
11. Is it an action plan for your institution?	83	77	93	88	84	83
12. Who writes it?						
A) Head of institution	43	35	30	6	41	44
B) Participate myself	20	20	43	16	23	16
13. Do you use local data to draw up the plan?	63	68	76	62	68	59
14. Do you have personal targets? Please specify	35	19	66	26	31	38
15. Please specify other targets for the institution	31	31	50	28	34	29
16. Do you use indicators to see if targets are met'	32	28	63	22	40	30
17. Give example of information / target	10	5	30	6	10	9
18. What do you understand by coverage? (reasonable answers)	25	26	53	18	29	20
19. Do you use 'coverage' to assess services?	62	62	71	44	49	55
20. Do you know these 8 service coverage indicators (6 or more right answers)?	30	34	57	34	36	25
21. Do you know your target population (6 groups - 6 right answw)	38	58	46	50	53	25
22. Do you know these indicators						
Infant mortality rate	12	19	23	14	18	6
child mortality rate	11	15	23	10	15	9
maternal mortality rate	13	16	23	12	13	11
fertility rate	8	2	23	8	8	9
unemployment rate	8	6	13	4	8	9

SURVEY OF COMPUTER USAGE AT PERIPHERIAL LEVELS IN MONGOLIA - Aimaks	Health 57 % (# 42)			Others 43% (#32)			Total 100% (#74)		
1. Sex									
Number of women	85 (34)			66 (21)			76 (55)		
Number of men	15 (6)			34 (11)			23 (17)		
Unknown	(2)			(0)			(2)		
2. Years of service									
Less than 5 years	7 (3)			47 (15)			24 (18)		
Between 5 and 10 years	19 (8)			15 (59			16 (12)		
Between 10 and 15 years	19 (8)			15 (5)			16 (12)		
More than 15 years	55 (23)			22 (7)			40 (30)		
3. PROBLEMS	Yes	no	Not	yes	no	Not	yes	no	not
Is the equipment in order now?	71	18	12	56	28	15	65	22	13
4. Periods of malfunction before?	31	45	24	47	41	12	38	43	19
5. Is lack of training a problem?	69	24	7	47	34	19	60	28	12
6. Is English in SW & manuals a problem?	64	21	14	69	22	9	66	22	12
7. Is lack of access to the PC a problem?	50	26	24	41	37	2	46	31	23
8. Is it difficult to get repairs & maintenance?	69	21	10	56	19	25	64	20	16
9. When you have (small) problems: Is it a company in the Aimak providing service & maintenance?	0	58	42	0	83	17	0	70	30
10. Get help from other computer using organisations in the Aimak?	33 (14)			31 (10)			32 (24)		
11. Do you get help from friends in the Aimak?	33 (14)			41 (13)			37 (27)		
12. Get help from centre/head office in UB?	20			16			36		
13. When you have serious problems? Do you get help from head office/centre in UB?	43 (18)			47 (15)			45 (33)		
14. How long time does it take to get spare parts, e.g. a keyboard?	1 week	2-8 w.		1 week	2-8 w.		1 week	2-8 w.	
	45	17		41	25		43	20	
15. How many other organisations using computers do you know (# tick in list)	<3	3-7	not	<3	3-7	not	<3	3-7	not
	3	25	14	2	24	6	5	49	20
16. Are you collaborating regarding computers with some of these?	Yes	no	not	Yes	no	not	Yes	no	not
	36	26	38	59	25	16	47	26	27
17. How do you collaborate?	yes	not		yes	not		yes	not	
Get new SW and games?	2	98		16	84		86	92	
Get help when problems?	24	76		50	50		35	65	
18. Is it 'popular' to work with computers?	Yes	no	dnt	yes	no	dnt	yes	no	dnt
	71	9	20	75	9	12	73	9	12
19. Is working with PC seen as improving career opportunities?	HEALTH			OTHERS			TOTAL		
YES	26 (11)			18 (6)			23 (17)		
NO	44 (19)			50 (16)			47 (35)		
Don't Know	13 (6)			16 (5)			15 (11)		
Not answered	13 (6)			16 (5)			15 (11)		
20. Is working with PC seen as	Yes	no	dnt	yes	no	dnt	yes	no	dnt
Typical for managers & 'high position'?	50	24	26	40	44	16	47	32	20
Typical for 'low position'?	45	26	29	40	44	16	43	34	23
21. How much do you use the PC?									
More than three days a week	12 (5)			25 (8)			18 (13)		
Every week	50 (21)			53 (17)			51 (38)		

Every month	14 (6)	9 (3)	12 (9)
Irregularly	21 (9)	12 (4)	18 (13)
22. For what do you use the PC?			
Enter data	90 (38)	66 (21)	80 (59)
analyse data	26 (11)	44 (14)	34 (25)
make reports	81 (34)	75 (24)	78 (58)
make graphs	26 (11)	38 (12)	31 (23)
word processing	45 (19)	59 (19)	51 (38)
financial programs	21 (9)	47 (15)	32 (24)
23. How many are regular users?			
1	12 (5)	16 (5)	14 (10)
2-3	71 (30)	47 (15)	61 (45)
4 and more	14	31 (10)	22 (16)
Not answered	2 (1)	6 (2)	4 (3)
24. How many computers?			
1			67 (50)
2-3			23 (17)
5,6 and 10(1)			5 (3)
Not answered			4 (3)
25. The newest computer (September 1996)			
286			28 (21)
386			23 (17)
486			39 (29)
586 (pentium)			8 (6)
Not answer			1 (6)
26. What positions have the users			
only clerks	24 (10)	19 (6)	22 (16)
only managers	12 (5)	28 (9)	19 (14)
both groups	57 (24)	31 (10)	46 (34)
not answered	7 (3)	22 (7)	13 (10)
27. Are you using information processed by the computer?			
Yes	40 (17)	38 (12)	39 (29)
No	38 (16)	28 (9)	34 (25)
Not answered	21 (9)	34 (11)	27 (20)
28. What kind of information? (open)			
Reports, analysis and statistics	14 (6)	31 (10)	22 (16)
Produce numbers and sheets	17 (7)	19 (6)	18 (13)
Not answered	69 (29)	50 (16)	60 (45)
29. Have you been trained in PC use?			
On training course	62 (26)	36 (12)	51 (38)
Trained by colleagues	24 (10)	44 (14)	32 (24)
by your self	36 (15)	41 (13)	38 (28)
30. Do you need training ?	yes / not	yes / not	yes / not
	95 / 5	97 / 3	96 / 4
31. Specify your training needs (open)			
windows & other SW	21	19 (6)	20 (15)
SW in general	24 (10)	28 (9)	26 (19)
Specific SW, not incl windows	5 (2)	9 (3)	7 (5)
programming	5 (2)	13 (4)	8 (6)
use of computer	7 (3)	0	4 (39
analysis of data	5 (2)	0	3 (2)
Use of information	2 (1)	0	1 (1)
not answered	31 (13)	31 (10)	31 (23)
32. Is it need for training in your	Yes / no / not	yes / no / not	yes / no / not
institution?	69 / 7 / 24	84 / 3 / 13	76 / 5 / 19
Has it been organised training?	12 / 74 / 14	31 / 66 / 3	20 / 70 / 9
Is it a plan for training?	33 / 7 / 60	44 / 9 / 47	38 / 8 / 54
33. Has it been organised training in yo	Yes / no / not	yes / no / not	yes / no / not

institution?	12	74	14	31	66	3	20	70	9
34. Who have developed your SW used for health inf. and statistics?									
Head office/centre in UB	93 (39)			56 (18)			77 (57)		
Private company in Mongolia	0			16 (5)			7 (5)		
International application sw	7 (3)			53 (17)			27 (20)		
35. Language in interaction									
Mongolian	45 (19)			25 (8)			37 (27)		
English	12 (5)			25 (8)			18 (13)		
Both (more than one app. in use)	14 (6)			38 (12)			24 (18)		
Russian	0			0			0		
36. Is your 'UB' (from Ulaanbaatar, centre) SW serving your needs?	64 (27)			44 (14)			55 (41)		
Do you need training on 'UB' sw?	76 (32)			50 (16)			65 (48)		
Do you need training on int. sw?	9 (4)			41 (13)			23 (17)		
37. Do you get support on the 'UB' SW?	48 (20)	33 (14)		28 (9)	10(4)		37 (27)	24 (18)	
38. Does the 'UB' SW need to be adjusted to local needs ?	76 (32)			34 (11)			58 (43)		
39. Do you use computer to produce your monthly statistics?	yes 71	no 12	not 17	yes 75	no 9	not 16	yes 73	no 11	not 16
40. HOW?									
Text processing	21 (9)			28 (9)			24 (18)		
Spread sheet	28 (12)			44 (14)			35 (26)		
Special user pgm/ applications	48 (20)			50 (16)			49 (36)		
41. How are you calculating the stats									
By hand/calculator	38 (16)			9 (3)			26 (19)		
By the computer application	17 (7)			41 (13)			27 (20)		
Both hand and computer	33 (14)			28 (9)			31 (23)		
Not answered	12 (5)			22 (7)			15 (11)		
42. Are you reporting monthly /regular									
To the centre - up-level/UB	60 (25)			56 (18)			58 (43)		
To your own level - Aimak	50 (21)			25 (8)			(not comp.able)		
To level below - Sum	24 (10)			9 (3)			(not comp.able)		
43. Do you get feedback/reactions fron those you are reporting to	Month	annual Irreg.		Month	annual irreg.		Month	ann./ irreg.	
From centre	38	7		44	3		41	5	
From Aimak	2	2		3	0		(not comp.)		
From Sum	0	5		3	0				
44. How do you report to centre									
Disc /electronically	33			53			42		
Reports produced by computer	26			47			35		
Forms written by hand	21			6			15		
45. Have you developed (small) user programs your self?	Yes 36	no 26	not 38	yes 34	no 25	not 41	yes 35	no 26	not 39
46. What software did you use									
database software	12 (5)			9 (3)			11 (8)		
spreadsheet	10 (4)			6 (2)			8 (6)		
both	7 (3)			10 (4)			9 (7)		
'word'/ text processing	2 (1)			3 (1)			3 (2)		
47. Do you need some particular local user programs?	Yes 69	no/not 31		yes 48	no/not 29		yes 66	no/not 34	
48. Do you need a trained programmer?	yes 50	no 22	not 33	yes 38	no 9	not 31	yes 50	no 14	not 36