Challenges in building user competence in Health Information Systems.

A case study from Trivandrum health sector, Kerala

Steinar Johansen
Acknowledgments

There are several people I would like to thank when finishing this thesis. Thanks to Jørn Braa who gave me the idea of the possibility to join the implementation project. Thanks to Sundeep Sahay who supported me to go to Kerala and for advices and conversations about my thesis. Thanks to Jyotsna Sahay for discussions and conversations and for her achievements to make the staying in India an exiting and good experience. Thanks to Lohn Lewis for information about Kerala, and to Barath in HISP India team for helping with screenshots.

Also, I would like to thank my fellow students. During courses and study at the university, a network of relationships is established among fellow students. As we are passengers in the same boat or in the same community of students, mutual interests in helping each other becomes a natural thing. This synergy should not be underestimated.

I am also thankfull to Lars Groth. In a busy schedule he took his time to read and discuss my thesis.

Last, but not least I will thank my adviser, Jens Kaasbøll. There is a possibility that this thesis never had been finished without his support. I apprechiate his interest in my project, his calmness, his attention, his helpfullness, his positive attitude and the good conversations during the period. Thank you!
© Steinar Johansen

2012

Title: Challenges in building user competence in Health Information Systems. A case study from Trivandrum health sector, Kerala.

Steinar

http://www.duo.uio.no/

Print: Reprosentralen, Universitetet i Oslo
Abstract

To strengthen and further develop health information in Kerala, the state decided to implement a robust Health Management Information System (HMIS) and to switch to electronic reporting from facility level up to state level. The software application to use is called District Health Information System (DHIS2) and is developed by Health Information System Project (HISP), a global action research project. The change represented a large scale implementation and was a challenge with respect to capacity building and training to make the new system up and go. To overcome the challenges, a two year scaling period was decided and 10-12,000 health staff was given initial training in two or three days to learn the new routines. The thesis evaluates the user learning and capacity building in the first part of the period in Trivandrum district with the following research questions:

1) What were the results of the training and support? How did the results compare to the aims?
2) Why did these results come about concerning project activities and how did social, political and cultural elements influence competence building?
3) How do these results compare with other experiences?

To be able to answer these questions I used triangulation in the methodology, observations and conversations at training courses, interviews and group interview, fieldtrips and questionnaires.

Findings related were:

1. The course was too short for most of the participants. They did not learn how to operate the software, but they learned about it.
2. Causes: Many of the attendants were not IT literate from before and found the exercises difficult. The length of the training day was too long. The time gap from training course to work place practice was too long. Gender and age played a role.
3. Most of the respondents were positive to the implementation, but for the majority, perceived usefulness rested in the benefit of easier reporting and reduced workload for their own job, not quality of data and information for action in the health service management.

In a similar action research project from Zanzibar they found that a combination of initial training followed up by in-service support gave positive results.
Key words: Implementation, Health Information, Organizational learning, User learning, Super users, Communities of practice, Kerala,
## Contents

1. **Introduction** ........................................................................................................ 1
   1.1 Challenges in building competence .................................................................. 1
   1.2 Health Information System Project (HISP) ...................................................... 2
   1.3 The case in Kerala ............................................................................................. 3
      1.3.1 It started in Andhra Pradesh ....................................................................... 3
      1.3.2 Kerala ......................................................................................................... 4
      1.3.3 Project Aims ............................................................................................... 7
   1.4 Research Question .............................................................................................. 9
      1.4.1 Structure of the thesis .................................................................................. 10
2. **Theory** .................................................................................................................. 11
   2.1 Foundations ....................................................................................................... 11
   2.2 Communities of Practice (CoP) ......................................................................... 12
   2.3 Super users ....................................................................................................... 15
   2.4 Training Styles ................................................................................................... 18
   2.5 Competence and Levels of Mastery .................................................................... 19
      2.5.1 Subject Matter Areas ................................................................................ 19
      2.5.2 Levels of Mastery ..................................................................................... 20
   2.6 Technology Acceptance Model .......................................................................... 22
      2.6.1 Micro motives and individual preferences ................................................ 23
   2.7 Experiences from Zanzibar ................................................................................ 25
3. **Methodology** ....................................................................................................... 28
   3.1 Background ....................................................................................................... 28
   3.2 Research Methods ............................................................................................. 28
      3.2.1 Participatory Action Research ................................................................. 29
      3.2.2 Case Study ................................................................................................. 30
   3.3 Research Approach ............................................................................................ 31
      3.3.1 Doing fieldwork in foreign countries ........................................................ 33
      3.3.2 Language and culture ............................................................................... 34
   3.4 Data Collection Methods .................................................................................... 35
      3.4.1 Observation ............................................................................................... 35
      3.4.2 In the breaks ............................................................................................. 36
3.4.3 Interviews/Conversations .................................................................37
3.4.4 Group Interview ............................................................................37
3.4.5 Questionnaires ..............................................................................38
3.4.6 Limitations in Questionnaires ........................................................39
3.4.7 Field Trips .....................................................................................40
3.4.8 Document Analysis .......................................................................40
3.5 Evaluation .......................................................................................40

4 Research Context ................................................................................43
4.1 India/Kerala .....................................................................................43
  4.1.1 Global Culture and Technology ..................................................44
4.2 Administrative divisions in Trivandrum District .............................46
  4.2.1 Standards ....................................................................................47
4.3 Structure of Health Sector in Kerala ..............................................48

5 Empirical Findings ............................................................................51
5.1 The training sessions .....................................................................51
  5.1.1 The participants .........................................................................52
  5.1.2 Three days training schedule .......................................................53
  5.1.3 The First Training Course ............................................................55
  5.1.4 Second Training Course ...............................................................60
  5.1.5 Group Interview .........................................................................60
5.2 Questionnaires ................................................................................62
  5.2.1 “Yes” and “No” ..........................................................................62
  5.2.2 Open ended questions ..................................................................65
5.3 Use of DHIS in clinics .....................................................................69
  5.3.1 Field Trip at a Block Hospital, CHC ...........................................69
  5.3.2 Field Trip at a Sub center, PHC ....................................................71
5.4 Conversation with Facilitators .......................................................73

6 Analysis and discussion ...................................................................76
6.1 Subject Matter Areas in HIS ............................................................76
6.2 The Training......................................................................................78
  6.2.1 Time squeeze ..............................................................................80
6.3 Benefits ...........................................................................................80
  6.3.1 Perceived usefulness and benefits ..............................................84
6.3.2 Preferences, “critical mass” and “instigators” ........................................ 88
6.4 Delays ........................................................................................................... 89
6.5 Support ......................................................................................................... 91
  6.5.1 Zanzibar/Trivandrum .............................................................................. 92
6.6 Communities ............................................................................................... 93
7 Conclusion ....................................................................................................... 97
Register ............................................................................................................. 104
References ......................................................................................................... 105
Appendix ........................................................................................................... 109

List of figures:

Figure 2.1 Community interactions ...................................................................... 15
Figure 3.1 Old HISP ........................................................................................... 32
Figure 3.2 New HISP .......................................................................................... 32
Figure 3.3 Answer from the questionnaire. ............................................................ 34
Figure 3.2 Evaluation model from Mahapatra and Lai, 2005 .............................. 41
Figure 4.1 Map of Kerala. Fra Hafsal 2006 ............................................................. 43
Figure 4.2 Commercials, politics, religion ............................................................ 45
Figure 4.3 Administrative divisions and Panchayats .............................................. 47
Figure 4.3 Flow of data in rural health ................................................................. 48
Figure 5.1 Two colleagues may help each other .................................................... 51
Figure 5.2 Health professions ............................................................................. 53
Figure 5.3 Data entry ............................................................................................ 56
Figure 5.4 Validation error ................................................................................... 57
Figure 5.5 Classroom training at Palayam ............................................................. 59
Figure 5.6 Information overload ......................................................................... 69
Figure 5.7 Sub Center, Vizhinjam ....................................................................... 71
Figure 5.8 Mother record card ............................................................................ 72
Figure 5.9 Childs record card ............................................................................. 73
Figure 6.1 Adapted from Davis (1989) ................................................................. 86
Figure 6.2 Adapted from Davis (1989) ................................................................. 87
Figure 6.1 the interaction between IT and health communities in Trivandrum .... 96
List of tables:

Table 3.1 Interview list........................................................................................................ 32
Table 3.2 Table of evaluation.................................................................................................. 36
Table 4.1 Information from Rural Health Statistic Bulletin 2010......................................... 45
Table 6.1 Result from first course........................................................................................ 56
Table 6.2 Result from second course..................................................................................... 57
Table 6.3 Result from third course......................................................................................... 58
Table 6.4 Result from forth course.......................................................................................... 58
Table 6.1 Perceived usefulness Cat 1 and Cat 2................................................................. 78
1 Introduction

Through my study at the TOOL program (Technology, Organization and Learning), topics from these three fields have been combined and I have learned a deeper understanding of the complexity existing between organizational change when implementing new technology and how such changes influence people within them.

1.1 Challenges in building competence

Developing countries face great challenges related to health and environmental problems. To face this the Alma Ata declaration from 1978 pointed out a global vision of a primary health care approach in developing countries by setting the parole: “Health for all by 2000”. This visionary goal implied equal access to basic health services in all countries. Key roles to achieve correct and relevant information was delegated to development of health information systems (HIS) (T. Lippeveld, Sauerborn, & Bodart, 2000). A Health Information system is “an integrated effort to collect, process, report and use health information and knowledge to influence policy-making, program action and research” (AbouZahr & Boerma, 2005). The goal can be seen as a standardized way to build and maintain efficient health care services, evidence based and with an action-led approach. Some years have passed since Alma Ata and a great number of articles from research in this field have contributed with experiences to the process. A great number of articles tend to conclude that it has proved difficult both to reach the vision and to implement a robust health information system in developing countries. To be able to attack health challenges it is likely that a strong, robust HIS is a benefit. But a prerequisite to build a robust HIS is the existence of competence among the people who are using the system. Efforts of building competence in developing countries are not an easy task, due to complex relations, not only concerning technical issues, but also when considering social, cultural and political aspects. Braa and Nermunk held that introducing HIS in DC is more difficult and complex than in developed countries because of current state of knowledge, lack of technical competent personnel, less availability of tools and infrastructure, lack of financial resources and constraints imposed by the social and political context (Jørn Braa & Nermunkh, 2000). Health information systems also tends to be fragmented due to poor infrastructure, huge distances and lack of integration between facilities in remote areas, no coordination or overview of key data, resistance to change and the donors. Because of
scarce technical and financial resources DCs must rely upon donors. Driven by demands of accountability donors tend to implement their own data platform which respond to donor requirements, not necessarily to the need of the country decision makers. This situation leads to overlaps of information, gaps and lack of standard definitions for data. Combined with a centralized bureaucracy this is a problem. Mosse and Sahay (2001) argue that health care in developing countries are mostly run by bureaucratic organizations in which information is likely to take on a meaning on its own, separate from its actual use. Heeks (1999) are questioning the problem by asking "Why health care information systems succeed or fail" and explains the success or failure of health information systems with respect to a gap between design of the system and reality. He argues that the greater the gap between current realities and the design conceptions of a new health information system, the greater the risk for failure. And the larger the amount of organizational change that takes place, the larger is the chance for the system to fail (Heeks, Mundy, & Salazar, 1999). Kaasbøll et al. (2010) held that information systems often fail due to low competence among the users, and argue that no study is known to provide a systematic account of the user competence needed (Jens Kaasbøll, Chawani, Hamre, & Sandvand, 2010).

1.2 Health Information System Project (HISP)

This thesis is part of Health Information System Project (HISP) which is an ongoing global action research project. The HISP vision described on their web page is:

“to support the development of excellent and sustainable health information system that enables all health care workers to use their own information to improve the coverage and quality of health services within our communities.”(HISP)

A basic idea is that research should lead to change, and change should be part of the research process itself. HISP started out in South Africa in 1996-98. A need to limit Essential Data Set for health care led to development of the first electronic version of the software District Health Information System (DHIS). The aim was to establish a sustainable computer based Health Information System to improve health care by providing health personnel and managers correct data concerning their actual health situation. The intention was that information use on this background will improve management, decision making and quality in health delivery. Implementation of a computer based information system in this context is not limited only to technical terms about functioning and reporting. A transfer of
consciousness towards understanding why use of Health Information Systems is an important contribution in developing countries is relevant.

The two first HISP nodes outside South Africa appeared in Mozambique and India. Today implementation of DHIS software and HISP activities is a global effort in numerous developing countries in Africa and Asia and is recognized by world health organization (WHO) (HISP).

1.3 The case in Kerala.

1.3.1 It started in Andhra Pradesh
Lack of access to information, uncoordinated vertical programs, reporting systems with excessive data requirements and a variety of data formats tend to create overlapping, with the result of inconsistent data of poor quality (T Lippeveld, 2001). This was the situation in health services in India as well as in many developing countries. In India there was a need to reduce and integrate indicators and data sets required from the states by the federal level (S. K. Puri, Byrne, Nhampossa, & Quraishy, 2004). To get better overview a revision process took place starting as a pilot project in 2000 in Andhra Pradesh. The state was chosen because of its interest in introducing e-governance based reforms under leadership of a former pro-technology Chief Minister. Besides, his Special secretary supported HISP and its visions. On the contrary, the commissioner of Family and welfare was skeptical since HISP was seen to bypass her authority (Lewis, 2005). This example stresses the importance of politics when trying to implement HIS in developing countries. Based on the pilot project in 2001 where 1200 data elements had been reduced to 400 and reports restructured and reduced to 10 (S. Puri, 2007) these reports where implemented in 9 PHCs in Kuppam constituency in Chittor district. The progress of these experiences led, in 2004 to a Memorandum of Understanding (MoU) between HISP and the State Government to implement DHIS (District Health Information System) open source software and to establish new data procedures in all states in AP.
1.3.2 Kerala

The HISP Kerala team is part of HISP India and has funding and cooperation with University of Oslo (UiO). HISP India is a multi-disciplinary organization consisting of people from public health, informatics, computer science, developing, and technical implementation. The HISP initiative in Kerala started in 2004 when HISP staff and University of Oslo (UiO) approached Health Department for permission to initiate the HISP implementation (Hafsal, 2006). The health secretary recognized the HISP achievement to improve the governments’ own HIS, especially their focus on local capacity building (S. K. Puri, Sahay, & Lewis, 2009). Permission was obtained and in 2005 HISP started to explore the possibility to initiate computerized HIS. A pilot project was launched with no financial funding from the state. Vizhinjam CHC, south of the capitol Trivandrum (Thiruvananthapuram in Malayalam), was chosen to be the pilot site. HISP conducted a detailed study of the information flow and the stakeholders involved, from grassroots to district up to state level. Besides state level health programs, various forms related to national health programs which continued to run in parallel involved extreme amounts of redundancy and duplication with the result of heavy workload of health staff. A key recommendation from the situation analyses was to shift focus from individual data collection to datasets comprising of groups of similar data. (S. Puri, 2007) HISP Kerala introduced new data sets on all levels and reduced the number of data elements drastically and ordered all collected data to be part of an indicator, thus being meaningful information.

According to Hafsal (2006), a computer with a standalone version of DHIS1.4 was installed in the administrative office of Vizhinjam CHC in 2005. The staff had no computer experience and was not too enthusiastic about the computer. Due to lack of experience there was a period with computer training before the DHIS1.4 software was introduced. Mostly, it was administrative staff who was involved in the training (Hafsal, 2006). In January 2006 a training seminar was arranged for all 19 medical doctors in Trivandrum district. Only 9 of them did attend. Theoretical topics in the DHIS seminar were basic HMIS concepts, use of software, data quality, use of indicators and GIS and maps (Hafsal, 2006).
At the time of the fieldwork it was, according to Hafsal (2006), the DHIS version 1.3 which was in use in India. This was a standalone version based on Windows operating system with MS Access as its database. It was license based and due to the cost of licenses, an open source solution would be preferable. The development of DHIS2, based on Free and Open Source Software (FOSS) and cross platform independent was prepared, but it was assumed that it would take time to finish it. Due to many delays of finishing DHIS2 the government in Kerala was eager to get the computerized system up and go and decided to develop a web based version of DHIS1.4. But during fall 2005, progress was made in Oslo with development of DHIS2 to find portals for connecting to different modules.

The pilot study which started in one CHC (see above) was extended to 19 similar clinics and coincided with the release of the first version of DHIS2 in 2006. Global HISP provided the clinics with computers. In the second phase of the training seminars, it was the first version of DHIS2 that was used, not the former 1.4 version. The experiences from usage in these seminars gave insights to the software developers to improve the software further. The first version was quite unstable, but was gradually improved. Frequent patches were released to rectify the bugs, but with the absence of web based deployment in the 19 clinics it was a challenge because of geographical distances between the clinics (S. K. Puri et al., 2009).

All the way the HISP solutions were forced to compete with the bureaucratic state agency of HIS and prove the advantages of the HISP system. During the evaluation of the HISP and state agencies, HISP could draw on the National Rural Health Mission reform process which aimed at moving HIS outwards to the community, not upwards in the bureaucracy. Secondly it was argued that the HISP solution was about 90% cheaper than the competing top down formulation. And third, the free and open source approach was in line with the ruling Left Party’s ICT policy (S. K. Puri et al., 2009). On base of the evaluation, HISP was asked to scale up the activity to 102 facilities in Trivandrum. The state government decided to invest in the HISP implementation which enabled HISP Kerala to hire facilitators and coordinators for training of health workers in the use of DHIS. In 2008 a Memorandum of Understanding (MoU) was signed between HISP and the Minister of Secretary of Health and welfare in Kerala. This document initiates the implementation of DHIS2 in all 14 districts in Kerala (S. K. Puri et al., 2009). It is from this point the data collection of this thesis took place.
**Facilitators**

Facilitators will play an important role in the project. They are key persons in the kick-off period and were responsible for the transfer of the process in the districts like education and training of trainers to ensure necessary scaling of the process. Their main concern is HMIS at facility level to keep data quality at expected level in management work and reporting. As they are IT people they did installations and tried to fix computer problems in the facilities when necessary. The facilitators are young, ambitious people with IT education recruited and educated from technical studies on bachelor and master level. They are hired by HISP because of their technical competence, which is needed. If they fail, there was a possibility that training and capacity building and the implementation process which should take place would fail as well. There was not enough competence in the districts to solve these tasks. On this background HISP Kerala decided to send out facilitators to the districts, thus covering the whole state, and the relied on this strategy to succeed with the implementation in the 14 districts.

**District coordinators**

From my experience the trainers at the training courses usually were HISP District Coordinators or consultants from National Rural Health Mission (NRHM). I was told there were three District Coordinators in Trivandrum at the time of my staying. The district area were divided between them and in the area of their responsibility they had a role as a link between project activities, facilities and HISP. They were teachers at the training courses and responsible for the logistical part of the training as well. They were not health educated, but IT engineers on bachelor level, mostly. One of them told me she was a B-tech graduate in Information Technology. They represent an organic part of the HISP (Health Information System Project) organization in Trivandrum during the scaling process. The DHIS software has been developed inside the global HISP organization. District Coordinators were given training by HISP in the DHIS software and they knew the HMIS concepts well before they started practicing as teachers. The role between facilitators and district coordinators could be a bit blurred from time to time and sometimes they overlapped.
1.3.3 Project Aims

The HISP coordinator in Kerala stressed the importance of targeting three competence areas to ensure that users moved from merely collecting data for reporting to a consciousness of converting data into information for better decision making and better health services. Accordingly three competence areas were focused:

- Concepts of health information and health information systems
- Operational use of DHIS to address lack of computer literacy
- HMIS (Health Management Information System). Information for action.

In this context health information means information which is used by the health information system (HIS). The information in the system consists of raw data or elements counted and collected by field workers and say something about the number of the actual case. A group of elements forms data sets. Indicators are variables calculated from the elements. Usually they are calculated in per cent or per thousand of a target population. Indicators are preferable for analyses.

A system consists of different parts or bodies which are meant to cooperate due to mutual interests. In literature there are several contributions defining what a HIS is about. (AbouZahr & Boerma, 2005) suggest “an integrated effort to collect, process, report and use health information and knowledge to influence policy-making, program action and research”. From my impression this statement corresponds with the HISP Kerala aims. That was what they hoped to achieve. DHIS is a flexible tool to operate aggregated data, to be used both for health workers and management in a HIS. HMIS is a health management system. Processed and analysed data are transformed to useful information in the decision process to make better health services for the population on local and national level.

The process of implementing DHIS2 in all states with a new structure concerning datasets and indicators became a big challenge because many people were involved and competence and training were seriously needed. To cope with the challenge to be able to switch over to online reporting, a two year training project was launched to scale the system. The period this thesis investigates takes place from January to April. HISP was given the responsibility to carry out
the initial training in collaboration with National Rural Health Mission. Resources were allocated by the state and project costs were tied essentially to training.

The National Rural Health Mission in Kerala describes the process in this way:

“The State is implementing a robust Health Management Information System (HMIS) as reporting and analyzing a variety of data is of vital importance in Health care. Accurate and timely information, in a web based platform, is required both by the Government of India and the State. The HMIS, developed by HISP India, a not-for-profit NGO, on Free & Open Source Software (FOSS) in accordance with the State IT Policy, now links 1,200 plus health facilities in the State including all PHCs, CHCs, District Hospitals, Government Hospitals, General Hospitals, W & C Hospitals, Medical Colleges, Taluk Hospitals and Specialty hospitals to collect and process data from all institutions up to peripheral Sub Centers and even Private health facilities. Approximately 10,000 Health staff belonging to Health department was given initial training under the programme to switch over to online reporting. From April '09 onwards, the State started generating data in the new system.”

(”Description of online reporting process,” 2011)

Scaling for two years

* First year aim. According to HISP Kerala, “trying and training” of operational use of the DHIS were focused the first year. An aim was to learn basic computer use and to learn about health information and the concepts of data sets, elements and indicators. More than 500 facilities and between 10-12000 personnel were covered by the initial training in Kerala. The aim included establishment of 2 facilitators in every of the 14 districts. They were responsible for training of other trainers and transfer of competence in the implementation process and to keep contact with facilities. Each facilitator was responsible to follow up facilities at least once a week. A practical aim within April the first year was the switching over to monthly electronic reporting using DHIS2 to report from PHCs to higher levels, which implied computers, software and competence to know how this could be done.
* Second year aim. The second year of the project aimed at establishing routines in use of information on a higher level. The number of facilitators was increased from 2 to 4 in every district. Training in computer labs and IT centers were moved to in-service training in the facilities which saved time and money and gave synergy to learning potentials. Olfman, Boström and Sein (2003) identified four dimensions of IT learning in 16 organizations in USA. The third dimension concludes that the stronger the training unit is integrated with the business unit, the better for the outcome (Sein, Bostrom, & Olfman, 1998).

1.4 Research Question

When studying information systems it is possible to investigate in several ways. One approach can be from the perspective of a programmer, what source code is needed to apply the expected functioning? Another approach can be to survey the design or customization, how it looks like and how the different parts work together. A third possible approach is to explore the perspective of the user of the system. Do the users perceive the usefulness and ease of use of the system? If they do they will probably learn it and use it. If some people see the usefulness, it is possible that others will follow, and with facilitating conditions the process may scale. Concerning Health Information Systems user participation is a crucial matter in developing countries, because it affects the life of many people.

The three perspectives mentioned cannot be seen in isolation, but must be seen as an organic whole. Thus, to have success in building a robust HIS, competence building in all fields must be highlighted. Due to my interest, my background and not to forget the field I was given chance to study in Trivandrum, Kerala, this thesis will address the user perspective, limited to the period of my field work. The key attributes that affect user acceptance in DHIS2 are discussed by (Mehmeti, 2011). In this thesis I am discussing the user learning of the system. From literature it is well known that there are great challenges in making Health Information Systems not to fail in developing countries (J Braa, Monteiro, & Sahay, 2004; Heeks et al., 1999) Further, little research is known to bring a systematic account on what kind of user competence is needed to prevent information systems to fail (Jens Kaasbøll et al., 2010). A motivation for my thesis is to contribute to increase this understanding.
Research questions:

1) What were the results of the training and support? How did the results compare to the aims?

2) Why did these results come about concerning project activities and how did social, political and cultural elements influence competence building?

3) How do these results compare with other experiences?

1.4.1 Structure of the thesis

Chapter 2 – Theory. In this chapter I will give a review of literature on learning at organizational and individual levels and results from a similar study in Zanzibar.

Chapter 3 – Methodology. The chapter outlines the background for the research in the thesis, the research approach and what research methods that were used.

Chapter 4 – Research context. Here some details about India and Kerala are presented which might be both of interest and of importance to understand the context in which the thesis takes place.

Chapter 5 – Empirical findings. The findings of my case study are presented in this chapter. I present the actors involved and results from field trips, training courses, interviews and questionnaire.

Chapter 6 – Analysis and discussion. This chapter analyses and discusses my empirical findings with respect to the theoretical content in chapter two.

Chapter 7 – Conclusion. In the last chapter I return to the research question, summarize the discussion and give some concluding remarks.
2 Theory

2.1 Foundations

From literature the question on “How to create knowledge and how to strengthen Health Information Systems in developing countries?” has been discussed. Lungo (2008) uses (Heeks, 2002) Gap Theory and find it useful to connect it to Actor Network Theory (Latour, 2005) when discussing “Design-Reality Gaps in Open Source Information Systems Development” in Tanzania (Lungo, 2008). In the Gap Theory Heeks argue that the greater the gap between design and reality in HIS, the greater the chance for failure. Actor Network Theory (ANT) recognizes the role played by both human and non-human actors in the network. Lungo addresses Walsham and Sahay (2006) arguing that ANT is a useful theory due to its explicit way of conceptualizing technology as one of the actors (Walsham & Sahay, 2006). Kimaro (2006) uses Information Infrastructure (II) theory to conceptualize HIS as a Health Information Infrastructure (Honest Christopher Kimaro, 2006). Information Infrastructures (II) have developed from ANT as a result of the way IT has developed by interacting with multiple organizations and systems on global basis, e.g. the internet. Hanseth (2002) argues that these networked, institutional systems are different from traditional IS in many respects. They are more than pure technology since they cannot live in isolation and are better conceptualized as socio-technical networks (Hanseth, 2002). The traditional view of seeing application design merely as a technical issue has been criticized. Social informatics identifies the importance of social aspects of computer technology. Kling (2007) argue that application design ideas based on technical considerations alone will not be successful (Kling, 2007). Nicholson and Sahay (2004) argue the importance of seeing knowledge in context, seaming less of time, space and cultural boundaries and Walsham et al. (1988) argue that IS are social systems with human-centered approaches (Nicholson & Sahay, 2004; Walsham, Symons, & Waema, 1988). When it comes to learning in organizations, (Lave & Wenger, 1991; Wenger, 1998) emphasizes that knowledge held by individuals and communities become embedded in social learning systems like the work place. In this thesis user learning in a HIS context is investigated and I find it relevant and useful to emphasize the notion of social aspects in information systems since humans are social beings and learning is a social phenomenon. Science, Technology and organizations will be of no interest ever without considering the human relation to the issue.
In the following I will review the theoretical framework which I find relevant for the thesis. From participation on the training courses I experienced how the users learned and adapted the technology. From field trips, questionnaires and interviews/conversations I experienced, to a certain extent, if they were able to adapt the learning to the work place situation. Since their attitude were positive to the new technology it was important for me to find out the preferences for their arguments. Training takes place both inside and outside the work place. When it takes place outside, it is a challenge to transfer what happened at a course to the work place situation.

2.2 Communities of Practice (CoP)

Communities of practice address learning at work. To understand learning in the implementation process it is of interest to understand the relationship between IT and health and what they represented. To adapt new technology super users seem to play an important role to increase the level of competence among peers. Subsequently the question, how to identify super user in communities should be of interest.

CoPs can be understood as groups of people with a common agenda and interest for what they do or learn by each other. They improve by regular interaction and by building an area for potential learning through negotiations of meanings, which can be seen as the engine in a CoP (Wenger, 1998). According to Wenger (1998) this happens through three elements: domain, community and practice. In the domain area the common ground of knowledge is created. The area inspires people to participate, guides their learning and gives meaning to the action. The next area, community, creates mutual engagement and binds members together into a social entity by encouraging a willingness to share ideas. The last area practice represents the communal resources (routines, vocabulary, sensibilities) that members have developed over time. While the domain area can be seen as the area providing general interest for the community, practice area can be seen as the area providing specific focus on its core knowledge. When a newcomer meets with a CoP he is the one who has to adapt and accept the common ground and the ruling routines already existing in the group, not the opposite. According to Wenger CoPs are everywhere. Not only at the work place. “We belong to them at work, at school, at home, in our hobbies. Some have a name, some don’t. We are core members of some and we belong to others more peripherally” (Wenger, 1998). E.g., by being member of a band, we may just come to rehearsals to hang around with the group for the
evening. CoP can be formal organization units as well as informal. In business settings there is an interest to benefit from capturing tacit knowledge from communities and share knowledge which is not easily articulated.

When CoPs are hidden assets within an organization, their appearance are not easily recognized. What kind of groups can we imagine those to be? Examples of informal groups can be groups organized by the trade union or a sales department in a company if they have routines or work practices which are unknown to the rest of the organization.

When two or more CoPs exist, we consider three aspects of interaction: *Boundary interactions, boundary objects and brokers*. Boundary interactions take place when members from different CoPs participate in common activities, like teachers in schools or informatics and health student participating at a health information course at IFI, or the interaction between an IT specialist and the user in a support situation. Boundary objects are intermingled among the CoPs and make sense in more than one of them, like sharing a teaching plan for a school, HMIS in a HIS context, or IT in the support context.

Brokers are the last aspect of the three, but may be the least peripheral as they can introduce information from one CoP to another. Brokers have knowledge from more than one community and usually they are member of both or more than both communities. Brokers come and go between the Cops and are well known with the culture, the people etc. and subsequently they will be able to communicate knowledge back to their own communities (Wenger, 1998). In this way they can take the role as instigators of change across the boundaries. The knowledge in the interaction between communities can be shared. According to Wenger the most favourable situation is to have some knowledge from both communities. If a broker has too much knowledge from one community, the tension between the communities will be too strong and unbalanced. The border area is the area which overlap between the communities. It is in this area the interaction between CoPs takes place and in which potential learning is possible (See figure 2.1). If the broker is too far away from the border area the learning potential will be too weak.

To be able to create an area for potential learning, communication between CoPs is important. In an essay from GIS development/land management applications in India, Puri (2007) discuss the importance of building knowledge alliances across CoPs, referring not merely to the material characteristics of technology, but also to the local context and indigenous
knowledge involved in it. By using two key concepts from CoP, boundary objects and participation, he wants to focus the understanding of the multiplicity of knowledge systems and to suggest possible approaches to creation of knowledge alliances (S. Puri, 2007). In this context multiplicity of knowledge systems must be understood as the local contexts and indigenous knowledge in which the creation of communication is embedded. Puri argues that in one CoP boundary objects may have connotations and meanings different than in another community. He uses an example with development of a user interface to show that from the perspective of a user the interface is seen as ease of usage, while a system designer may view it from a technical perspective. Despite the different perspectives the interface provides communication through which the designer will be able to understand users’ requirements. Puri distinguishes between three attributes imbued in boundary objects: Technology, which goes into the construction of the boundary object. Content, which represent the knowledge embedded in it. Practices, how the knowledge inscribed in the boundary object is utilized (S. Puri, 2007). By using this three step conceptualization it is easier to link the different perceptions of the CoPs meeting with the boundary objects.

The second key concept Puri discuss is participation. How participation is defined will influence the communication between CoPs and how the learning potential will look like. One step is to bring together relevant communities to make them share knowledge through boundary interactions. Puri gives an example from a case dealing with GIS implementation. Three CoPs were brought together; scientists, communities and government departments, each of them with a separate knowledge system. A villager from the community representing the indigenous knowledge argued that they had much better knowledge about the area than the engineers because they had local experience. The villagers started to draw a resource map of the actual area. The map became a boundary object and the inherited knowledge of it was shared among members of the three CoPs. The resource map helped to demystify the complicated GIS technology and led to a synthesis of the CoPs respective knowledge domains (S. Puri, 2007).
In recent years the role of super users as brokers between users and IT has been widely and increasingly discussed. In his master thesis (Almnes, 2001) describe experiences in creating super users in context with “How to improve user support and information flow?” His research is taken from health sector in a municipality outside Oslo. In a summary of his findings Almnes describe some key factors to increase super usability.

"The selection of super users, and why they are needed." Almnes argue that a general course to learn software not necessarily will highlight the problems and questions a user is fighting with. To achieve this understanding super user should be identified among the users. Almnes stresses the importance that the super user is chosen among his peers, and not among the managers. This is to ensure that the user’s problems and work routines are understood the right way. Other reasons for not choosing managers as super users are manager’s lack of availability and time, and the fact that an employee is not comfortable if he must expose weaknesses to his boss. At a work place it is commonly known if a person has a special ability to find solutions on work related problems or grasp new technology. Work mates tend
to turn to him to get help when they are stuck. A super user should have the ability to want to help his work mates and he should be regarded as a sociable person or a person with social antennas with some social intelligence. If not so, people will not be interested in consulting him.

**Responsibility.** Super users should have direct access to or have influence over resources necessary to support his workmates in their work tasks with the software as it is the super user who knows what specific means are necessary vice versa the user.

**Training of super users.** The super user should be given the same training as other users, but since he is expected to be a “horse head” in front of them he need more and deeper knowledge than other users he is supposed to help. Almnes argues that super users also need some pedagogical training to ease the transfer of training to the user without losing the spoken jargon established among the users. External support sometimes brings with them their own technical jargon which is unfamiliar and a hindrance at the work place they are sent to.

**User support.** To ensure that the user will be able to transfer learning to workplace situation, the super user should be involved in the planning before the user learning starts. The transfer is challenging for the user, but since the super user have participated both in planning and the accomplishment of the course he is prepared to see what the problems will be for the user. And, on the contrary, the threshold for the user to question the super user is not too high since the user has participated together with the super user in the training.

**Organising the super users.** At larger work places where the need for super users is more than one, Almnes argue that the super users should be organized and their experiences should be shared and available for the other super users. Super users should have the possibility to meet and discuss challenges. This will ensure that a problem solved by one super user do not have to be taken up again by another because he did not know. When there are several super they may become a community of super users and a leader should exist to super wise the situation and the needs among them. Super users should be provided with refreshment training to prevent that they are falling behind in competence. Almnes state that if this happens, their role as super users will be changed and workmates will turn to other possible sources for help.

**Communication/Motivation.** In organizations an ability to communicate is crucial if they want to profit from experiences. Almnes stresses the importance of open communication and that it is possible to reach. The role played by the super user in the communication process is unique
as he is in the middle of the employees. This aspect of his role should be used so that the request from the users is taken into account towards a computer department or those in charge of the software and hardware. By using the network of super users, management may communicate quickly towards the organization or part of it. When systems updates occur or tools are replaced, the users need to be informed and trained in the altered functionality. The super users could then naturally take on this obligation, and provide in-service training sessions locally if needed. When changes are necessary the super user can be a factor who triggers motivation and point at potential usefulness for the changes. Almnes argue that this must not be done in a manner that accuses the super user of being an errand person for managers (Almnes, 2001).

Above, the role of the broker between CoPs is discussed. It is possible to see that the super user may take that role as well as it is likely that he is member of more than one community. Possibly he is member of a community of super users as well as with a community among his peers. It is likely that he negotiates with an IT department or IT specialists and with the management. As he moves across several communities he can take the role as a broker between them and instigate communication and participation which leads to change.

In another survey Karuppan (2008), held that overlearning is a proven and popular method of strengthening learning (Karuppan & Karuppan, 2008). As the super user is a resource for other users of technology, his competence should be a horsehead in front of them. In that sense he needs overlearning, opposite to the need of the users he is meant to help. Thus, it is important, for not losing this synergy, to target and not underestimate the super users need for refresher training.

Karuppan and Karuppan argue that lack of practice triggers forgetting and the longer the period from training to practice the more will be forgotten. When introducing new technology they conclude: “With multiple unforeseen circumstances, the anticipated go-live date is usually postponed, and novices have ample opportunities to forget what they have just learned” (Karuppan & Karuppan, 2008). This view may be valid, not only in the context of user learning in Health Information systems, but in general terms when new technology is introduced.
2.4 Training Styles

Learning is a need humans must overcome in multiple situations. Training styles concern the possibilities for transfer of competence from courses to work. First we must find out how things are working, e.g. a new ticket machine at the bus, balancing on a bike or how to turn a computer safely on and off. After finding out how, repetition or training is needed to strengthen what we found out, otherwise there is a chance we forget it the next time. When learning skills, two different basic styles of training are possible. One of them is imitation. By observing, or imitating a person’s doing or repeat what a teacher tells you to, it is possible to learn something. The trainer demonstrates how to carry out various tasks with a projector, and the students try to mimic the trainer in doing these tasks (Jens Kaasbøll, 2011). You may learn how to do a task, but knowing how does not necessarily include knowing why things happen. And, according to Kaasbøll, a situation with many details imitated in one viewing is very limited due to the capacity of our short term memory.

Another approach is the conceptual-practical training style based on the research of (Gagné & Briggs, 1974). In their theory they have proposed a nine step model for training to maximize transfer of skills and understanding. The model separates five capabilities, intellectual skill, cognitive strategy, information, attitude and motor skill. The last one is of less interest in this context. From research it is known that conceptual understanding will enhance transfer of competence from course to work place or between concepts (Bransford, 2000), and that improved understanding will help users to remember longer during periods when they are not using the software (Karuppan & Karuppan, 2008). A typical training session according to the conceptual model would start by a general introduction of the topic, and a presentation of the relevant concepts for what is being taught. Then, at least half the time should be spent on practical exercises, where students follow a detailed instruction sheet to learn the specific tasks. While performing these tasks, the trainer can assess the student's performance (Jens Kaasbøll, 2011). Of these two styles of training, it is the conceptual-practical training that is recommended. While repeat after me trains the user in doing very specific tasks, conceptual-practical training gives a better understanding of the concepts behind the tasks, and the reason for doing the task as instructed. This makes it more likely that the students will actually use the skills they have acquired – it increases the chance of transfer (Jens Kaasbøll, 2011)
2.5 Competence and Levels of Mastery

This part concerns users IT competence and the competence aims. Competence is not uniform. There are different competences for different kind of tasks. To solve a task related to information you need information literacy. But in IT, the turnover of new software versions, solutions and technology is quick. Due to this, standard definitions of information literacy do not cover competence needs in information systems precisely enough and do not include information technology. (Leu Jr., Kinzer, Coiro, & Cammack, 2004) argues that a more specific definition of information literacy is needed when discussing IT. Leu et al. suggest naming them „new literacies“, because they add new demands to traditional literacy. The way information is presented is different in a computer than in a book. To be able to handle the rapid changes in IT you need to know about the subject matter areas connected to the specific area, which makes a person IT literate. In IT this will imply a need for competence in information, information technology and in the tasks to be solved, which constitutes these areas specific subject matters.

2.5.1 Subject Matter Areas

Users of an information system need competence about the area or domain presented in the information system. The subject matter areas for the Kerala project are presented in the project aim above (See section 1.3.3). In general terms the three areas can be defined like this:

- *Information*. How is the domain presented?
- *Information technology*. Knowledge about the functionality of the system
- *Tasks* in the work practice of the system

In this thesis we are investigating user learning of software (DHIS2) in an implementation process to improve health services. By using the software it is possible to collect, analyse, validate and present aggregate data in a health information system Then a user of the system need knowledge on what kind of data is relevant to be collected, how and where to collect them and why the specific data should be collected. This is knowledge health workers possibly may know with or without software and computer. With competence in using those tools collected data will be more accurate, and it will be easier and faster to analyse them. Then the software will become an advantage in their activities. The expected outcome, what you want to achieve by using the information system, will hopefully be better health management and health services for people in general which is useful in this context.
2.5.2 Levels of Mastery

When the subject matter areas are defined it will bring us further to what level of mastery a person reaches. Levels of mastery are presented in a three level model for externalisation of IT concepts (Stamatova & Kaasbøll, 2007). “Skills can be carried out perfectly without explaining how we were doing it” (Jens Kaasbøll, 2011). Thus, skills represent the first level. The next level in the model is referred to as functional understanding. On this level you are able to carry out an action, but also to tell what you expect to happen when doing it. The last level is referred to as conceptual. On this level you understand the concept as an object on its own, and you will have the ability to explain it to another person and understand how it connects with other concepts. Skills are often tacit knowledge or competence. The conceptual level implies explicit competence. Because the levels of mastery are higher on conceptual level we want tacit competence to become explicit.

From knowledge management literature several contributions have been made to identify tacit and explicit knowledge in organizations and the interaction between them. Among the two concepts it is tacit knowledge which is most focused because it is difficult to define and to explain to another person by verbalising it or writing it down. A competent health worker who has knowledge about the health situation in his area makes the knowledge explicit when he presents and explains it to other health people at a meeting. A person may not be aware of his knowledge or how it can be useful to others. To some extent it can be compared with intuition; you have a notion of how to, but you are not able to explain why. A bicyclist does not reflect upon why he does not fall off the cycle. If the same person would like to teach his son how to balance on a cycle there is a chance that the father will not be able to explain exactly what balancing a bicycle is about. The same outcome is likely in cross country skiing because of the complexity in movements. To succeed in balancing a cycle or learning cross country skiing, practice in close interaction with others who are able is necessary. In such a social and practical context it is possible to both capture and transmit tacit knowledge. And in practical, work related knowledge at the work place a community of practice should be a relevant area for the capture and transmission of tacit knowledge.

Nonakas dynamic theory of organizational knowledge creation (Nonaka, 1994) is one of the well-known theories of the transformation from tacit to explicit knowledge. In the theory Nonaka present the SECI model. SECI stands for socialisation, externalization, combination and internalization. As it is impossible to see an organization without individuals, Nonaka
present the four steps, seen as a turn in a spiral, as steps in an individual’s knowledge creation. A second turn in the spiral will evaluate to a higher level than the first which means that the amount of knowledge has increased correspondingly. The first step, socialisation is recognized by interactions between individuals, presumably under quiet circumstances. Nonaka stress the importance of shared experiences. Without them it is extremely difficult to share each other’s thinking processes because they are recognized in embedded motions and nuanced contexts (Nonaka, 1994). Nonaka also argues that tacit knowledge can be acquired without language and refers to apprentice work and craftsmanship. This view is supported by Lave and Wenger and the Dreyfus model of skill acquisition (Dreyfus & Dreyfus, 1986; Lave & Wenger, 1991).

In the second mode, combination, we are in the explicit area which involves use of social processes to combine different bodies of explicit knowledge held by individuals. Here the point is that explicit knowledge can create new explicit knowledge by transmission of a combination of explicit knowledge’s (Nonaka, 1994).

The third and fourth mode relates to patterns involving both tacit and explicit knowledge and is a prospect of seeing them through a process of mutual interaction (Nonaka, 1994). Nonaka makes a two-step solution to this. What he calls externalization is a conversion of tacit knowledge into explicit knowledge. The model for externalization of IT concepts mentioned above is a specialization of Nonaka’s process. What he calls internalization goes the opposite way. New explicit knowledge creates more tacit knowledge, but as we have come to a higher level the challenge is to capture and convert the new tacit knowledge to be explicit. The outcome of the process should be increased knowledge continuously for every turn in the spiral. The circumstances in the process of dynamic knowledge creation might be turbulent. Nonaka argues that it is possible; by different means of actions e.g. metaphors, analogies and models to make tacit knowledge explicit (Nonaka, 1994).

The theory of active knowledge creation is important in context with the roles of brokers and super users in CoPs. In the interaction between CoPs, brokers and super users meet with each other’s in meetings, conferences and as acquaintances. The interaction between brokers in a CoP may be similar to the contact points described in “combination” from the Nonaka model, where explicit knowledge creates new explicit knowledge and sometimes new knowledge emerge from the process. What is explicit for the members in one CoP might be tacit for
members in another and vice versa. Brokers and super users inherit the roles that enable them to instigate mutual transmission of knowledge.

## 2.6 Technology Acceptance Model

How is it possible to predict acceptance of computer software? In context with my research the issue addresses the question: Will the health personnel start using DHIS? One well documented connection is The Technology Acceptance Model (TAM). In a study of use of an electronic mail system in a company it was found that perceived usefulness was a stronger motivation factor for acceptance of the mail system than how easy it was to use it (Davis, 1989). Later on, two more factors concerning social and facilitating conditions, have been added to the model (Venkatesh, Morris, Davis, & Davis, 2003). If your colleagues use it, or if you are told to use it by a superior, this will be a social factor and influence acceptance. The last factor added to the model was about the effect of facilitating conditions, e.g. to find out the extent of possibility for health workers to train with a computer at the clinic. Each of the four factors will influence to acceptance of technology, but according to Davis perceived usefulness is the strongest factor, and stronger than perceived ease of use. In Davies study it is peoples subjective preferences towards performance in the time the technology is used which matter, “…and do not necessarily reflect objective reality” (Davis, 1989). The subjective preferences recognized with the benefits of usefulness are so strong that even if software objectively would improve performance, it is likely that the system will not be used if the user does not recognize the usefulness (Davis, 1989).

Another study by Gallivan et al. (2005) investigated Co-workers’ influence on IT usage in the work place (Gallivan, Spitler, & Koufaris, 2005). The study was carried out in a non-profit organization in USA. 80% of the respondents were women with university degree. In this research they found no support for the amount of user training or perceived usefulness at all, but they found a very strong support for the influence of co-workers’ IT uses. This study contradicts the findings in the technology acceptance model.

Health staff is users of DHIS but they cannot do this in isolation. They are dependent of other health staff to register or fill in data in the system. Otherwise it is meaningless to use it, and it will probably not be used. In this context the Gallivan study makes sense. The study also found that the coworkers' perception of the quality of training was more important than the
quantity of training. If a coworker was satisfied with the quality of performed training, that would influence his or hers use of IT.

2.6.1 Micro motives and individual preferences

In the preface to his book Micro MOTIVES and MACRO behavior, Thomas Schelling argues how rational individuals make choices, when the better choice among two or several possibilities depends on what choices others will make or are making. “He calls it interdependent decisions” (Schelling, 1978). From his experiences in life he discusses and reflects upon multiple examples in the book. One of the known stories is the story of pedestrians crossing the street against the light and the cars keep coming. It starts with a few nimble pedestrians crossing against the light. When seeing this, a few more seems ready to follow, but hesitate not willing to venture ahead without enough safety in numbers to cross. People look restlessly left and right, not on the traffic but to watch the other pedestrians. At some point several appear to decide that the crossing flow is large enough to be safe and join the flow. As their crossing enlarge the flow, it makes it safe enough for a few more who were still hesitating and they now join in. Since the crossing surge now has become a crowd, even the nervous and timid, which had never started crossing against the light on their own, joins in. At this point the cars have resigned and stopped (Schelling, 1978)

To understand the psychology behind, Schelling uses the concept “critical mass” and he argues that in some cases it is not the number itself, but the effect of the number that matters (Schelling, 1978). Opposite to physical and chemical reactions, it is typically the case in social reactions that “critical number” or cross over points will differ from one person to another. Some people will dress formally if enough people do to keep them from being conspicuous. Others will dress formally only if so many do that he will be conspicuous not to dress formally.

In another essay “Threshold Models of Collective behavior” Mark Granovetter study individual preferences “in situations where outcomes do not seem intuitively consistent with the underlying individual preferences” (Granovetter, 1978). While Schelling uses the concept “critical mass”, critical number and cross over points to illustrate the phenomena, Granovetter refers to threshold models, threshold points and individual preferences. Threshold models treat binary decisions where the alternatives are one of two, as deciding to use an application or not to use it. A further requirement is that the assessment on costs and benefits from an
actor to take a choice depends on how many others who make which choices. To discuss the theory, Granovetter establishes a riot situation as a colorful metaphor. He argues that different individuals require different levels of safety and they will vary in consideration of benefits and costs before entering the riot. The threshold for joining is defined as the proportion of the group he will have to see join the riot before he is joining himself. Among a group of 100 with thresholds from 0 to 100, it is likely that a “radical” will have a low threshold to join while “conservatives” will have high thresholds. The benefits are negative to the conservative and since they are respectable citizens, the consequences of being arrested are high. With the radical on the contrary it is opposite. The benefit of rioting are high and since they are not afraid of being arrested the cost are low. Granovetter held that if some of them are sufficiently radical to have a threshold of “0”, they will join by any means and will become the instigators of the riot. Granovetter held that it is not necessary to classify a person politically since “the threshold is simply the point where the perceived benefit to an individual of doing the thing in question exceeds the perceived cost” (Granovetter, 1978). It cannot be taken for granted that two persons with the same threshold will be politically identical since a threshold is a result of the combination of benefits and costs.

Both Schelling and Granovetter use the term “equilibrium” which represents the points where nobody in the group will join or most of the group will join, in relation to expected number of attendance. Granovetter discuss some issues which affects the stability of equilibrium. Social structure and effect of friendship is one of them. In absence of social structure an individual with threshold 50% in terms of reaction to strangers will not be activated. If the person knows 20 of the crowd and 15 have joined the riot, each friend must be counted twice according to Granovetter. A perceived proportion of rioters in the previous time period exceed the person’s threshold and he will join (Granovetter, 1978). Being surprised about the result Granovetter found that the largest effect occur when people know ¼ of the rest of the group, which he consider a moderate level of friendship. Granovetter concludes that it makes little difference when threshold distributions have stable equilibria, but when they are unstable; the effects of social structure may overwhelm those of individual preferences (Granovetter 1978).

When discussing scaling of user competence in large information systems which is part of the issue in this thesis I find it fruitful to draw on the theories above. I found that my informants were positive to the implementation and use of the software, DHIS2. The technology acceptance model (TAM) helped to find which factors that influenced perceived usefulness
the most in my findings. The Gallivan survey found that coworkers IT use was an important factor to influence others’ use of IT at the work place. Both the theory of Schelling and Granovetter support the Gallivan survey at this point. In a large scaling process as in the Kerala project they contribute with questioning how many must join before others to come after, which is a combination of “critical mass”, the manifold of different individual preferences and the configuration of benefits and costs when joining. The last theory is also of interest to focus on brokers and super users as “instigators” to move a process to start.

2.7 Experiences from Zanzibar

From literature several contributions have been provided to address the challenges when ICT based HIS is initiated in developing countries. In a paper from Tanzania, Kimaro (2006) points to the need for human resource capacity building (Honest Christopher Kimaro, 2006). He argues that use of ICT is very low due to lack of ICT literacy as one of the reasons. A study from health sector in Mozambique by Braa et al. (2001) supports this view. They found that only few had basic ICT skills and understanding of how to interpret health data, and the actual use of ICT was low (Jørn Braa et al., 2001). When the gap between ICT capability and the requirement to the system is too big the chances to have success in building a sustainable HIS is less favorable. Kimaro (2006) argues that capacity building goes beyond development of basic, technical skills and is a continuous process where both people and organizations develop their abilities individually and collectively to perform activities, deal with problems and manage to set goals (Honest Christopher Kimaro, 2006). An important part of these goals is to find out what user competence is needed and in what way shall it be built to make HIS more sustainable and successful?

A study from Zanzibar aimed to find ways to change practice in organizations through questioning how to carry out training and support in a way that users changed their practice subsequently (Ngoma, Kaasbøll, & Aanestad, 2008). An integrated HMIS for monthly reporting had been installed. Reports were computer based on district and national level, but paper based at the facility level. Health workers were observed not to be able to use the newly installed, computer based system. Experiences when introducing initial training to learn the system had not given the desired skill level among users, and due to little resources no more training had been provided. In Zanzibar an action research group was established and training objectives were formulated in collaboration with the health workers. The research took place
in three districts in Zanzibar, representing 12 facilities. The training was organized in interactive group sessions and support at the workplace. One two hour training session outside the workplace, then support visits at the workplace monthly for each next three months. Health staff who participated in the training session would be trainer to their colleagues who were not able to attend the course and thus transfer the style of training to each of their facility. May be a start in the process to identify super users as well? Group discussions to involve everyone, with exercises to be given to the health workers after training sessions were planned. On the monthly support visits the clinics were given feedback on their achievements on data quality compared to other clinics. When mistakes occurred the health staff got eager to do better next time. An exercise was performed in order to evaluate necessary knowledge and skills. Only half of the sessions ran smoothly, while the other half had problems. When separating facilities with good attendance from the ones with less attendance, useful data was measured to 94% for the good ones compared to 83% for those with less good attendance. For those with no attendance at all at the initial training both inaccuracy and incompleteness had increased. Completeness and accuracy were also measured during the three month in 10 facilities which did not receive any training. Here the result was only a slight improvement of 1% compared to the facilities that received training. In the latter improvements were remarkable.

The situation at the district offices showed as well that previous training was not sufficient. They needed both computer literacy training and HMIS training. For the district offices a two week course was prepared, but only a few people showed up. The management cancelled appointments and the schedule was rearranged several times and postponed. After several attempts some training was arranged. According to Kirkpatrick’s evaluation framework (see chapter 3.5) the participants reaction towards the training were positive. At level 2 they were able to run the HMIS and transfer the information in their monthly and quarterly reports which represent level three. They started to quality check, meaning analyzing data sent to them from the facilities, but they were not able to use this in managerial work to make changes in the outcome of health management (level 4) as they did not have the culture of analyzing the data and use it for decision making (medical officer). What they usually did was to send the report further to the zone office. The findings in this research conclude that initial, interactive training in a small group of colleagues should be followed up by regular support visits by the trainer at the workplace. The best results were found at facilities were attendance among health workers were good in both initial-, and support sessions. The responsibility for
this kind of training and support should be embedded in the normal supervision provided by
managers. But if there is no culture for it, room for it or if competence does not exist, it is not
likely that we will see any organizational change.
3 Methodology

3.1 Background

In this part I will present the research methods I have used and the research approach, including some challenges and difficulties. The background for my thesis was information from members of the Global Infrastructure group at IFI, University of Oslo who encouraged me to apply for the project going on in Kerala, India, where implementation of the new version of DHIS2 was about to start at that moment. According to National Rural Health Mission (NRHM), more than 10 000 people belonging to government health staff should be given initial training to be able to switch over to electronic reporting from PHC level upwards ("Description of online reporting process," 2011). The functioning was expected up and running within the limit of the project, two years. For me the project became an opportunity and made it possible to focus on the implementation of the software and the training process. In accordance with my background as a student at the TOOL program (Technology, Organization and Learning) the two possible perspectives were both suitable. Before travelling to Kerala the exact focus was not decided. However, it was important for me to get there as soon as possible, because the project was running and the limit for the initial training terminated April first year.

3.2 Research Methods

Traditionally, research is divided between qualitative research methods (when studying social phenomena) and quantitative research methods (when studying any sciences). What kind of method you choose depends on what you are going to study and the difference in the specific quality of data will be of importance for your choice. Sigmund Grønmo (1996) held that data which is possible to express in pure numbers or entities (many/few, more/less and so forth) are quantitative data. Data which is not expressed in this way he held as qualitative (Grønmo, 1996). When seeing this view in context of social phenomena it is possible to see both qualitative and quantitative aspects of social issues. E.g. opinions from several persons when interviewing them, may contribute to more (both qualitative and quantitative) information than from one single person. More information is more reliable than less information. Thus, for the researcher it might be of interest to count numbers of specific opinions? Describing
case study Yin (2009) argues that data should not be limited to a single source of evidence and held that most of the better case studies rely on a variety of sources (Yin, 2009). Even though a qualitative research method is chosen as the basic method, it is possible to strengthen the research project using a quantitative method inside a qualitative project and vice versa. Yin is pointing at triangulation of sources. It is possible to triangulate methods as well.

In my project I intend to investigate user learning and the learning process when implementing new software in a Health Information System. In order to do this I need knowledge of the project activities, to understand the social context in which health workers live and work and how social, political and cultural elements influence on the learning process. Pure quantitative approaches will not provide relevant answers to these questions. Due to that, I have chosen to use an interpretive qualitative research approach as the basic method. Nevertheless, in addition to data sources like individual-, and group interviews, observation, conversations, field trips, document analysis, I have used questionnaires as a semi-quantitative method.

Besides grounded theory and ethnographic research, action research and case study are two well-known qualitative research concepts. I have declared this thesis part of an on-going action research project called HISP. The basic research strategy adapted by HISP is action research. This does not imply that all research projects connected to HISP is action research by definition. Some are, but more likewise, the sum of achievements and contributions from master students and PhD research are parts of the AR process in HISP in general terms.

3.2.1 Participatory Action Research

Because HISP take action research as their basic research approach I will explain the concept briefly. Greenwood and Levin (2007) held that action research is a balance between three basic elements and argue that if one of the elements is absent, the process is not action research (Greenwood & Levin, 1998). The three elements described as statements by Greenwood and Levin are action (because AR aims to alter the initial situation of the group, organization or community), research (because AR is one of the most powerful ways to generate new research knowledge) and participation (because everyone involved takes some responsibility to promote social analysis and democratic social change). The statement indicates that action research is more like a social research strategy rather than a research method. (Baskerville, 1999) has discussed the variety of forms within action research
approaches. He held that a survey in the literature finds widespread agreement on four common characteristics.

1. Action and change orientated
2. Problem focus
3. “organic” process, sometimes iterative stages
4. Collaboration among participants

Opposite to traditional social research where focus is limited to a part of a process (e.g. sociology), the focus in action research will be on the interaction of the whole process, which implies involvement from all participants. In some way the participant feature is relevant to compare with Actor Network Theory (ANT) where different participants in a network are defined (Latour, 2005). The researchers are actively participating with the researched to solve real life problems. Research should lead to change, and action for change should be part of the research process itself (Easterby-Smith, Thorpe, & Lowe, 1991). From experiences in this process practical and theoretical knowledge will emerge and the consciousness of the problem will evolve. The collaborative features will make the researcher and the researched gain experiences from the process. The researcher will not underestimate the experiences from local context, but learn from it. The involvement in the participation is close and the role of local stakeholders may become that of a co-researcher. When seeing this in context of the subject matter areas (information, domain, IT and tasks) when implementing health information systems in developing countries it seems like a suitable strategy. Greenwood and Levin describe participation as a strong value of democracy, because “these people together establish the AR agenda, generate the knowledge necessary to transform the situation, and put the result to work…” (Greenwood & Levin, 1998).

3.2.2 Case Study

In my project I have used case study to describe the development in user learning in an implementation process of the DHIS2 software in Trivandrum. My research approach can be held as ethnographical as well, due to my role as an observer at the training courses, partly that of a passive observer, partly that of participant observation. Yin (2007) argues that evidence from case studies may come from direct observation and participant observation, interviews, documents etc. which implies that the borderline between different research
approaches may become blurred from time to time. Rather than using a strict set of rules to examine a limited number of data, case study involve an in-depth examination of an event or a case in its natural setting, meaning the research often need to go over a period of time. In this way it is possible for the researcher to gain a deeper understanding of the case, why things turned out the way they did and what implications the findings will have for the future. In my project I was following 4 training courses and did two field trips over a period of 9 weeks to find evidence for my research questions.

What I have found is not “the truth”, but “a truth”. Metaphorically a research project can be seen as the frog in a well. The frog will see just a part of the sky from below, as the researcher in a research project. But the more research looking at the same, the more of “the truth” will be revealed, hopefully.

### 3.3 Research Approach

My field work in Trivandrum, India lasted from end of January to Easter 2009. When I arrived in Trivandrum, I had no detailed overview of the project and the activities connected to it. The HISP Kerala office is situated in Trivandrum. I was informed to take contact with the main coordinator in Kerala at the HISP office, and I did. The HISP team was quite busy at the time, preparing courses for initial training of thousands of health staff. Due to that, the organization was in expansion. Facilitators and district coordinators were employed and trained to cover the need as teachers and organizers in the implementation process. At the same time, when the training courses started in computer labs around the city, HISP Kerala was about to move to new office locations.
Figure 3.1 Old HISP

Figure 3.2 New HISP
As a whole, the logistics were a challenge. For me it was a need to ask questions to get information. In between the activities, I had conversations with people at the office and the HISP coordinator. I was informed about the goals, project plans for the two year period, and things I else needed to know. At the time another master student from the University of Oslo was also staying at the office, doing his field work for his master degree. He had been in Trivandrum for two month and could help with information. But I was quite dependant of the office for my own activity, as they had the schedule for the training sessions. At the first session I had no ideas of what to expect and prepared questions in accordance with what I could imagine I needed to know. There was nothing to compare to. It was a situation of see and learn. I wrote down as much as possible, and immediately after coming back I transcribed and interpreted the notes on fresh memory. I discussed the content with the HISP coordinator and from this background I prepared for the next session. The main link for data collection came to be the training sessions in Trivandrum, where I met teachers and health staff. And the courses made it possible to arrange for further appointments with them.

3.3.1 Doing fieldwork in foreign countries

It was not easy to get the right bus at my first field trip. Vellanadu is a village approx. 30 km. outside the centre of Trivandrum. We went to a bus station near the Railway. There were many buses and impossible for us to read their destinations in Malayalam. At the ticket/Information office we asked for help. They understood our question but it was not easy to get a straight answer to which bus was the right one. They suggested bus 6 or 8. Finding bus no.6 it was obviously not the right one. The driver in bus 8 did not recognize Vellanadu as a destination either. After asking several people without getting an answer, we found another office on the area. They told us that the bus we were looking for was not going from this bus station, but from Eastfort, The Main Bus Terminal in Trivandrum. At Eastfort a bus employee pointed out the right bus. Happy to be on the right way we started out only to reach the first substation we had just left near the Railway station! Nobody was able to tell us that we could just walk 20 meter outside the area and wait for it! The reason for telling this story is a reminder of how things you are not prepared for comes in your way. This is a lesson to take in consideration when doing fieldwork in foreign countries. We were sorry for the delay because the people we had an appointment with were expecting us.
3.3.2 Language and culture

Most health workers, young people and people with education usually understand English in India. But it is not always easy to communicate in English because their English are often strongly influenced by the Indian language. Once I did an interview with a girl who had applied for a job in HISP. She misunderstood my question at first and I asked the question again. Indian educated girls are talking very fast and they often go faster and faster during the conversation. This one did and when she started to talk again it was hard to follow her. On the other hand she did not understand my English well either. The “Indian English” is sometimes very special to catch for European ears. They think in their own language and adapt it to English. The way they build up sentences, intonation and expression on words can be very unfamiliar. When this is connected with high speed accelerated through the conversation it can be difficult, resulting in mutual misunderstandings. Having conversation with a group was even more challenging. When a question was put forward, more than one person eagerly wanted to answer the question. This was a good thing, telling about motivation for participating in the conversation.

It was not only in oral conversation challenges occurred. Also when I tried to read their writings difficulties occurred. E.g., I have used much time to interpret the written answerers in the questionnaires. An example is shown below. The answer starts in English and continues in Malayalam. The HISP coordinator made me aware of the possible language problem. Most people speak English in Kerala and I decided to take this as a challenge. If I listen carefully I will manage to understand the content of what they say, was my attitude. She hesitated on that and said I soon could experience the opposite. At the beach I asked a person if he was able to translate this answer for me (See figure 3.3). The content means “Take the report again one time more, and then check it. Then send”.

Figure 3.3 Answer from the questionnaire.
During an interview with facilitators a girl titled me “sir” all the time. The same happened when talking to female teachers and district coordinators at the training sessions. Was it an expression of respect for my age, since I was older than them, or was it related to a submissive attitude towards men? Since I am not used to be titled “sir”, this was different for me and I was not comfortable with it. My position was a student who wanted to ask them some questions, but when titled “sir” I felt like some kind of heavy authority they were put in front of.

An impression which came to me during conversations in India was a tendency to avoid admitting problems. It seems the Indians do not like to admit them. The phrase “no problem” was often heard, even if you could imagine that there was a problem. I went to a travel agency to book a trip. A sign outside the agency told me they accepted all credit cards. When I insisted to pay with a card it was not possible. “We are not ready for that yet”, I was told, “but this was no problem”. Only to go to the nearest bank I was told, take out the money, return and pay in cash. Because the amount of money was above the limit for withdrawals I had to do this operation twice. There was a problem for me indeed, but the friendly Indian did not see it that way, since he had constructed a solution for me.

### 3.4 Data Collection Methods

Yin (2007) describes three principles of data collection methods. In the first principle he describes the rationale for using multiple sources of evidence which he calls triangulation. He argues that “any case study finding or conclusion is likely to be more convincing and accurate if it is based on several different sources of information, following a corroboratory mode” (Yin, 2009). To start with I had no specific overview of possible collection methods to use, but as my research developed I ended up by using several collection methods, thus using the concept of triangulation to collect my sources of evidence.

#### 3.4.1 Observation

At the training courses my role was a mix between a passive observer and participate observation. The courses lasted for three days. The participants consisted of 25-35 health staff who shared one computer two by two. Besides learning basic computer concepts, they tried to
solve specific tasks related to validation rules, reporting etc. relevant concepts in the new DHIS2 software. My presence was announced by the teachers, but the teachers were busy running around helping people with the tasks. A role as a passive observer was awkward because being white and coming from Norway; I attracted attention and some curiosity. Some of the people wanted to talk to me and ask questions, while others felt embarrassed when I tried to talk to them and slid away. From my experience it was a difference concerning gender. It was easier to get in contact with the men than the women. And sometimes language was a barrier. In the middle of the day it was very hot inside the buildings. Even though the Indians are used to the climate, they got tired and concentration dropped. I observed some of them just fell asleep in their chairs. People who were curious about me was a good thing because it gave me a chance for further conversations, an interview, or a possibility for a field trip to their facility later on. My observations lasted for 1.5-3 hours. Mostly I observed the last part of the day because I needed to cope with transportation.

3.4.2 In the breaks

In the breaks tea and cakes where served and it was easier to mingle and get acquainted. They opened up, told me where they came from, their profession and their opinions about the course. Sometimes they gathered around me and asked questions about Norway, what was the income level etc. It happened their eagerness was so intense they forgot the time and the teachers had to get them back to their places to continue the training. In the breaks it was room for learning more about health situation in Kerala as well. Concerning polio the last case was registered in 2000, a medical officer told me. This means they have beaten polio in Kerala. There is support for people who are struck by the disease, but I did not get any details about that. But there were many beggars with polio according to my own experience. “HIV is on a low acceptable rate”, he said. He held that diseases which are increasing rapidly in Kerala are heart diseases and diabetes. These are welfare diseases due to lifestyle, equal to trends in western countries. Young people in Kerala are eating less traditional food; they have less physical activity and eat unhealthy fast food containing fat and sugar. This is a trend they have measured, he explained.
3.4.3 Interviews/Conversations

Structured and planned interviews were not easy to obtain. The question: “I would like to interview you. Can we meet on Wednesday at two o’clock?” never happened like that. It was more like when making an appointment, I had to be open for everything to happen without being in control of the outcome. In this way the interviews were semi-structured and open ended. People I made appointments with usually saw it as a social event. When talking about interviews in this thesis most of them are conversations which I was conscious about with some questions prepared in beforehand, tried to follow them up during the conversation and structured the result afterwards. When theory about the interview situation meets real life, the output often becomes something else, was my experience. (See interview questions. Appendix)

3.4.4 Group Interview

To start with, my intention was to make interviews during the training courses, but this was not easy to organize. I needed help from the trainers but they were busy helping the trainees. To me the trainers were attentive, polite and helpful, but they could not stop the training for an interview. They wanted interviews to be part of the breaks. But nothing was organized in the breaks, it was up to me. I talked to a lot of people in the breaks. In that sense I did several group interviews, but I was a bit anxious not to have an organized interview. To do interviews after the sessions in the afternoon was no option, because the participants lived in villages outside Trivandrum and they were in need to go home after courses. Women should get children from kindergarten and cook dinner to their families. I explained my need to the teachers and they organized a group interview for me in an extended break the next day. This was a positive experience because the group of 12 was motivated, with a gendered mix between different health staff professions from different facilities. The problem was to discipline the group when more than one person wanted to answer a question. And it was hard sometimes to grasp the content of what they were saying, even though they spoke in English. The interview ended up with them curiously turning the situation around asking me questions about what my opinions were about the matters discussed.
Because Kerala has a tropical climate with monsoon, the contrasts are great through the seasons. Due to that the Keralites are, as the Norwegians, very concerned about the weather. They were interested in how the weather was in Norway, and did I like Indian food? What was my opinion about Kerala? I had many conversations and chats. Below, (table 3.1) I present a list of interviews I interpreted and wrote down:

<table>
<thead>
<tr>
<th>Place</th>
<th>Profession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vellanadu</td>
<td>- Health Inspector</td>
</tr>
<tr>
<td></td>
<td>- Medical officer</td>
</tr>
<tr>
<td>HISP office</td>
<td>3 Facilitators</td>
</tr>
<tr>
<td>HISP office</td>
<td>HISP coordinator</td>
</tr>
<tr>
<td>Palayam</td>
<td>12 health staff, group interview</td>
</tr>
<tr>
<td>Vizhinjam</td>
<td>Health Inspector</td>
</tr>
<tr>
<td>Palayam</td>
<td>District coordinator</td>
</tr>
</tbody>
</table>

Table 3.1 Interview list

### 3.4.5 Questionnaires

After having experienced the first training session I was anxious not to be able to collect enough data. And I was afraid of running out of time. When I realized the problem of organizing interviews during the courses, I looked for alternatives. Using questionnaires as a semi-quantitative method should increase the possibility to obtain more information, and perhaps different information since this was done anonymously? And I could then concentrate on other issues in interviews/conversations. I discussed the experiences from the first questionnaire form with the HISP coordinator and modified it to a second edition after the discussion. I handed out questionnaires among the participants in three different training sessions. In the first two sessions the forms consisted of eight similar questions (form 1). The questionnaire was modified in the third session (form 2). Two more questions were added, and some of them were altered. 78 informants from three different courses answered the forms. (See Questions for Questionnaire in appendix 3)
If you want to print out a document from a file you may go to a print shop somewhere and pay for the prints pr. copy. The first questionnaire, I printed out at the old HISP office. The modified version I hoped to be able to print out in the new office and take it to a training session the same day. But there was a misunderstanding. There were no people present at the office that day. I did not get in and had no key to enter. In the building, which was under construction by the time, only two companies had moved in, HISP and an advertisement firm. Knocking on the door to the other office I told I was in need to print out some papers and asked if they had a printer, which they did not have. They understood the importance of the matter and one of the employees offered to scooter me to a print shop. After printing out, a tri-wheeler took me to the training center far away to the other side of the city. I reached just in time to hand out the questionnaire to the participants, but I missed most of the course that day.

3.4.6 Limitations in Questionnaires

The situation in which the questionnaires were produced and handled was not optimal. The idea of using questionnaires was more or less done on the spot with time pressure when I wrote and produced them. The questionnaires were handed out and answered in a break or at the end of the session. This was done in a hurry and gave little room for deeper reflections from my informants when time matters. From the returns of the papers I recognized that some informants answered exactly the same. Possibly some people sitting beside each other and had copied answers? I expected the hand out situation to become a bit turbulent. Because of the possibility of not getting answers, I consciously reduced the number of questions to ten, half of them “yes” and “no” questions. And the rest open ended. Experiences with modifying the first form are mixed. When introducing two different forms confusion and ambiguity may appear when analyzing and comparing the answerers and the work load for the researcher gets bigger. Many health workers took part in this initial training in Kerala. 78 people are not much in this context. All though, I hope my findings have shed some light on how these people experienced their participation.
3.4.7 Field Trips

I did two trips to villages outside Trivandrum. I visited a sub center and a school nursery outside Vizhinjam, and a block hospital in Vellanadu. For both visits appointments and invitations were made through contact in training courses. In Vizhinjam I experienced the functioning of a sub center and a school nursery among the population. When the Health Inspector had showed me around in the sub center and the nursery, he insisted in taking me to his home.

Besides seeing the block hospital in Vellanadu I looked forward to talk to the Health Inspector and the Medical Officer and take a look at their computer installation and the software. We were short of time but immediately after arriving we picked up the MO with the hospital car and we were taken to a lunch place quite a distance from the hospital. This was a nice experience and the first time I eat a hot meal on banana leaves using my right hand as a fork. It took me about 2 hours, but it was impossible to deny such hospitality.

3.4.8 Document Analysis

At the HISP Kerala office I was given a chance to read the HMIS toolkit and data entry forms which are important documents in the training process. I have also visited the official website from National Rural Health Mission (NRHM) which has been a good source for information.

3.5 Evaluation

A framework for evaluation of end user training is Kirkpatrick’s four steps model (Kirkpatrick, 1996). The first level evaluates reaction to training or satisfaction of the trainee. The second level evaluates what skill and knowledge the trainees have learned. On level three skill transfers evaluate the ability to apply what the trainees have learned in a work place situation. The fourth level evaluates changes on organizational goals and organizational performance. Later on Kirkpatrick’s framework has been developed and modified with an additional level including evaluation of the usefulness of IT based tools and presentation of training materials. Subsequently a two dimensional scope defining both what to be evaluated and who is doing the evaluation have been added to the framework (Mahapatra & Lai, 2005). The framework is shown in figure 3.2. In this thesis I find it most relevant to use the basic four levels in Kirkpatrick framework. The most difficult levels to evaluate in an academic
context are skill transfer and organizational effect. The last one is difficult to measure, and the first one needs a possibility to follow up over time at the work place.

Figure 3.2 Evaluation model from Mahapatra and Lai, 2005

In the first level in the Kirkpatrick model, reaction to the training, the teacher requested the trainees to give feedback to the content of the course. On my own I had the opportunity to ask them and in the questionnaire they were invited to give their opinion. In group interviews it was possible to evaluate reactions as up to ten people could give their opinions in one setting.

At level two it was possible to evaluate by observing how they managed to solve exercises and if they were able to operate the computer during exercises. Sometimes I actively offered to help to start a conversation and get a better understanding of what they had learned. Sometimes they turned to me to get me involved in their problems. I could recognize a different attitude between men and women. The women were more reluctant towards contact with me than men, who opened up easily. The levels of the trainees were different, the need for help was absolute and the teachers were busy helping around. Those who did not get help became passive, got stuck and dropped off. Sitting two or three together were good both for learning and for the social setting, but they had no written material to use as help when stuck.
Level three was possible to evaluate when visiting facilities at field trips. By observing if they used the computer and software and asking questions, it was possible in some way to see if there had been any transfer from course learning to practical use at the workplace. At this point we must take into account that the software was not installed in all facilities and in some places the computer did not work. The outcome of evaluation in level three was therefore limited. But chances were used, when they occurred, to ask health workers about use of computers at their work place, if they had tried electronic reporting with the new software, who were responsible for the use etc. At the HISP office I discussed my experiences with the Kerala coordinator and I got feedback from her to adjust questions and research approaches.

The last level, organizational change was not easy to evaluate, since I did not stay long enough. Nevertheless, on mail I asked a health inspector how they practiced the new software and I received this answer: “hi stain here v r happy .wr r u knows here the winter and also happy to mail u.the HISp PROJECT is updated and all r sending reports thru it” Table 3.2 shows my evaluation activity.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Observation</th>
<th>Interviews</th>
<th>Conversation</th>
<th>Questionnaire</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td></td>
<td>Group interview</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Level 2</td>
<td>Passive/Active</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td>Field trips</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 4</td>
<td></td>
<td></td>
<td>X</td>
<td>Email/Evaluation report</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.2 Table of evaluation
4 Research Context

4.1 India/Kerala

The population in India is the second largest in the world counting more than 1.200 millions of people (Census 2011). Besides China, India is one of the fastest growing economies in the world today.

In Kerala the population counts 32 million people with an area of 38,863 square km. Literacy rate in Kerala is the highest in India, 94.5% (compered to India as a whole 74%), and life expectancy is at 77 years (Census 2011, India), which is close to the USA, 78 years (Census 2008, USA). The official language in Kerala is Malayalam, a Tamil language. Tamil is the last living classical Indian language, and is one of 22 official Indian languages. An Indian, who speaks Sanskrit, will not understand another Indian who speaks Malayalam. Thus, English has become a language Indians turn to when communicating between themselves.

Even though Kerala is one of the most prosperous states in India, there are challenges. Southern India, in which Kerala is a part, was badly struck by the tsunami in 2004. Many fishermen are living with their families along these shallow shores of the south-west coast. I visited some areas south of Vizhinjam two times and experienced the need for improved health services and livelihood among a population in poverty. Kerala and West Bengal are two states in India with a traditional awareness of left side politics. Kerala was the first state in India, actually in the world as well, were a communist government was elected in democratic elections. The year was 1957. The Left Democratic Front (LDF), an alliance lead by Communist Party has more or less been in power since. Their most important opponent,
The United Democratic Front (UDF), is led by The Congress Party. Participation in politics and elections is run locally by the 991 Panchayats in Kerala (see Panchayats below). Kerala is one of the most prosperous states in India with concern to health-, and public services, life expectancy, infant mortality rate, literacy rate, education etc. and is close to standards in developed countries when it comes to life indicators. In a study, Moni Nag (1989) discusses Kerala and West Bengal, both states with leftist governments (Nag, 1989). Nag question why the two states seem more successful by means of distribution than other states in India. One of his answers is conscious political priorities and the strategy chosen by the governments to stimulate for political participation. Important factors are implementation of land reforms, introduction of minimum wages in agriculture and industry and regulation of working conditions. Kerala have a long tradition with strong trade unions.

The dominant religion is Hinduism, next to Islam and Christianity. The three religions have their accepted place in society. One reason might be a quality with Hinduism. Instead of rejecting an alien, a Hindu will try to define the stranger in view of his religion by englobement (Dumont, 1980). Another possible reason can be the role of the Communist Party. As they have sought to abolish the caste system, it is not as strict as in the rest of India and may partly explain the reason for a high percentage of women in employment in Kerala (S. K. Puri et al., 2009). Even though the influence of the communist party has been strong, Kerala is not a totalitarian state. In practical policy the political conditions is likely to compare with radical social democracy adapting the historical, social and religious traditions of the country. Kerala has become a fusion balanced between politics, religions and capitalism were different stakeholders cooperate to a great extent. The support given by the authorities to HISP Kerala achievements should be seen in this context. When I was travelling in Kerala it was impossible not to recognize the colorful traits of political activism. Banners, slogans and posters of political leaders were seen in many places, side by side with religious symbols and commercial advertisements. According to Nag (1989) the successful distribution in society in Kerala has developed positively over years because of, not in spite of the strategy chosen by the Communist party and the left wing alliance (Nag, 1989).

4.1.1 Global Culture and Technology

Not only is the economy growing fast in India. New technology is also growing fast as the global culture is taking root everywhere. But it seems that India has been able to incorporate
the modern without rejecting the old. The use of Internet, computers and mobiles are rapidly increasing, especially among young urban people. India had an estimated more than 45 million active Internet users in 2008 with the majority in urban areas representing a growth on 13% from the year before. Though, this growth was less than expected (Ramachandran, 2009). The Hindu reports that computer owning households had increased substantially the same year with 36%, but it was great differences between English speaking urban population and rural population. People who used the Internet sometimes, but not regularly were asked what the most important obstacles to increase the use were. Nearly half of the users in the survey answered that there was no need to use it or they did not know how it could be useful to them (Ramachandran, 2009).

The government in Kerala give priority at providing computers in schools. Under the slogan “One Laptop per School” more than 4000 schools across the state were provided with a laptop each in 2009 to improve infrastructure for computer education. This also included printers, scanners, video cameras and generators. Most of the schools were provided with high speed broadband internet connection and multimedia projectors (Correspondent, 2009).
4.2 Administrative divisions in Trivandrum District

Administrative divisions in India are nested in a hierarchy of country subdivisions. The system might be different and a bit difficult to understand when coming from Europe. India consists of 28 states. Each state is divided into districts. In Kerala there are 14 districts. For planning purpose and health, district is divided into three levels: Taluks, blocks and villages. Because India is a vast country it is not uncommon to recognize different local titles for the same level of division, e.g. taluks are frequently referred to as talukas, mandals or tehsils in some states. In this thesis I will use the expression taluk when needed. Nevertheless, it is of importance to get an overview of the hierarchical structure to understand where the health system is situated, where health staff comes from and how health is organized. Trivandrum district consists of 4 taluks (Trivandrum, Nedumangadu, Chirayinkeezhu, and Neyyayyinkara). A taluk is a smaller part of the district, similar to a county (but not exactly). A city or town serves as its headquarters. Possible additional towns may exist, and a number of villages. A taluk may consist of one or more blocks governed through the panchayat raj system. Blocks are referred to as Block Panchayats and the total number is 12 (Figure 4.3).

Panchayats are a linked village system of self-governing units with local representatives in urban areas. Panchayats are not a physical entity with geographical borderlines like a city or taluk, but a democratic, legal, self-governing institution, playing an important role in infrastructure and wellbeing of the people. In Norway the nearest similar institution might be the community board. Panchayats have long traditions and exists on three levels: village, block and district. Gram (meaning village) is the basic unit of administration on village level. On block or taluk level it is called Panchayat samiti and has the function as a link between block and district level. On district level panchayat is called Zilla (district) Parishad, meaning District Council. Some of the functions related to Zilla Panchayat (district level) can be provision of Primary Health Centres, hospitals in villages, vaccination drives and family welfare campaigns, among several other activities (Ministry of Panchayati Raj). An example: For an interview I visited a block hospital situated in the village Vellanad (population: 26,760) within the taluk Nedumangad which comprises 28 villages and one municipality headquarter (urban administrative division) with the same name as the taluk, Nedumangad.
4.2.1 Standards

Indian Public Health Standards (IPHS) is a set of standards to improve quality in health care delivery under National Rural Health Mission (NRHM), a program run by the ministry of health under government of India “to improve the availability of and access to quality health care by people, especially for those residing in rural areas, the poor, women and children.” (NRHM)

The quality of services is not uniform in India, due to various reasons. In view of a rapidly expanding health care system, standards and upgrades are being introduced in hospitals and facilities in order to improve and ensure the same quality of health services to the population. IPHS Guidelines describe standards as means in which it is possible to describe levels of quality in health care organizations in a way they are expected to meet, with response to clients’ needs. The guidelines argue that standards are a main driver for continuous improvements because standards will make it possible to assess health care delivery with the set standards. (IPHS:) (IPHS Guidelines 2010)
4.3 Structure of Health Sector in Kerala

The Sub Center (SC). First contact point between primary health care and community. They are often situated in remote areas. There are 420 SCs in Kerala. Each of them is covering a population from 3-5000 individuals. Their activity is preventive and outreached. The main focus is Ante Natal Check-up (ANC), immunization, Family planning (sterilization, supply to children etc...) Staff: Auxiliary Nurse Midwife (ANM) or Junior Public Health Nurse (JPHN). And usually there is a male health worker. (Multi-Purpose Health worker) or Junior Health Inspector(JHI) This is the ideal according to Indian Public Health Standard, but staff may change from place to place due to existing resources.

Primary Health Care (PHC). There are 62 in Kerala. Activity is preventive and curative services. This PHC covers populations of every 20,000 population in “hilly, tribal and...
backward areas”, and “every 30,000 population in the plains” (IPHS Guidelines 2010). Guidelines refer to health planners who have visualized PHC with its SCs as the proper infrastructure to provide health services to the rural population. Health staff: 15. Among them, a medical officer (MO, doctor), a male and a female health assistant, a pharmacist, a lab technician and supporting staff. A PHC is the referral unit to 6 sub centers.

Community Health Care (CHC). There are 25 block hospitals administrated by the taluks. The CHC, a 30 bed hospital, is a bigger hospital than the PHC and provides more specialized medical treatment like surgery and emergency cases. CHCs are established when a need for upgrading of PHC on block level occurs, conversion of taluk hospitals to CHC, or if it simply is a need for a new hospital of this kind. CHC covers a population from every 80-120,000 individuals. Staff in a CHC: 25 Medical officers (MO, doctors), Programme Manager, Public Health Nurse. Specialists: Anaesthetist, Surgery, Gynaecology, Obstetrics and supporting staff. (NRHM, 2010)

District. There are 14 districts in Kerala. They represent a middle level link connection between state and lower levels in the district. District Management Officer (DMO) also known as Chief Management Officer(CMO) is in charge of the health and family welfare programs in the district and responsible for implementation of the programs according to policies described at higher levels. The district is first contact point from local health system towards higher level. Thus, one might describe role of the district as facilitating both upwards and downwards.
<table>
<thead>
<tr>
<th>Health structure, Kerala</th>
<th>Primary Health Care</th>
<th>Secondary Health Care</th>
<th>Tertiary Health Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilities</td>
<td>Sub Centre, 4575. Report to PHC PHC, 813. Reports to CHC</td>
<td>CHC, 233</td>
<td>Regional hospitals Medical Hospitals Ayurveda and Homeopathy hospitals</td>
</tr>
<tr>
<td>Where</td>
<td>Rural</td>
<td>Villages, smaller towns Communities</td>
<td>Towns, Cities</td>
</tr>
<tr>
<td>District</td>
<td>Taluk, Blocks, Panchayat</td>
<td>Taluk, Blocks, Panchayat</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Treatment</td>
<td>Focus on preventive treatment</td>
<td>More specialized</td>
<td>Specialized. When not possible to treat on primary or secondary level</td>
</tr>
<tr>
<td>Coverage of population</td>
<td>From every 3-5000. SC From every 20-30 000 PHC</td>
<td>From every 80 000-120 000</td>
<td>Numerous</td>
</tr>
<tr>
<td>Staff</td>
<td>SC, Auxiliary Nurse Midwife (ANM) or Junior Public Health Nurse (JPHN). And a male, (Multipurpose health worker) PHC: Medical Officer + 14 health and support staff</td>
<td>Medical officers: 4 Health and support staff: 21 which is a minimum staff pattern according to IPHS.</td>
<td>Hospital standard</td>
</tr>
</tbody>
</table>

Table 4.1 Information from Rural Health Statistic Bulletin 2010
5 Empirical Findings

In this section I will present the findings from my research. I start with a presentation of the participants in the courses and continue with the content and impressions from courses were I participated. In one of the sessions I did a group interview with 12 health persons from different levels and units, but from same taluk (See section 4.2). I distributed a questionnaire in three of the courses and present the result of the answers. Next I present findings and impressions from field trips and in the end of the chapter I present a conversation with three facilitators at the HISP office in Trivandrum.

![Image of two colleagues working together]

Figure 5.1 Two colleagues may help each other

5.1 The training sessions

The training courses took place in computer labs and IT centers throughout Trivandrum and were organized as classroom teaching with batches of 25-30 people, two people sharing one computer. This was a good thing because the two people (probably colleagues) could help each other with the tasks and talk together in a supportive way. The design of the courses is presented in section 5.1.2 and 5.1.3. Some of the content and exercises in the courses was complicated for novices and some previous knowledge of health information and operational
use of computer was needed to be able to follow the exercises. With the amount of people participating on the initial training the level of competence was diverse among the participants. Even though some previous knowledge was needed, it was not expected and a session with teaching in operational use of computer was part of the courses.

5.1.1 The participants

The participants in these courses were health staff on different levels. There are many titles (shortcuts) related to health personnel in India, a bit confusing and unfamiliar to start with. I asked a health inspector after a training course if he could explain the different titles of the professions and what it meant.

JPHN means Junior Public Health Nurse. She is female and work with Junior Health Inspector (JHI). Then comes Health Inspector (HI) and Lady Health Inspector (LHI) “All were there”, he said. The first two, Junior Public Health Nurse and Junior Health Inspector are grass root level health workers attached to basic health units like Sub enters. Their main focus is Ante Natal Care and pregnancy, Mother and Child Health (MCH) and Reproductive and Child Health (RCH). They are visiting houses and collect data. Their activities are preventive and service providing, not treatment. The other participants were connected to PHC and CHC levels. In addition to the personnel mentioned there are two supervisors in the CHC. Lady Health Supervisor (LHS) is in charge of the Lady Health Inspector in the PHC The Health Supervisor (HS) is in charge of Health Inspector in the PHC. They were all health personnel, with health inspectors and health supervisors administratively on the management side. In addition there are medical doctors and block coordinators who are responsibility for management on block level. The professions can be listed like in figure 5.2:
### Figure 5.2 Health professions

<table>
<thead>
<tr>
<th>Professions</th>
<th>Facility</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junior Public Health Nurse (JPHN)</td>
<td>Sub Centre(SC)</td>
<td>Mother and child health. Visits. Data collection and reporting. Preventive</td>
</tr>
<tr>
<td>Junior Health Inspector (JHI)</td>
<td>Sub Centre(SC)</td>
<td>Communicable diseases. Sanitation. Multipurpose tasks</td>
</tr>
<tr>
<td>Lady Health Inspector (LHI)</td>
<td>PHC</td>
<td>Supervisor for JPHN</td>
</tr>
<tr>
<td>Health Inspector (HI)</td>
<td>PHC</td>
<td>Data reporting from PHC. Supervisor for JHI</td>
</tr>
<tr>
<td>Lady Health Supervisor (LHS)</td>
<td>CHC</td>
<td>Supervisor for LHI</td>
</tr>
<tr>
<td>Health Supervisor (HS)</td>
<td>CHC</td>
<td>Supervisor for HI</td>
</tr>
<tr>
<td>Accredited Social Health Activist, (ASHA)</td>
<td>Sub Centre(SC)</td>
<td>Initiated by NRHM. Piece payed for visiting patients. Reports to JPHN and JHI</td>
</tr>
<tr>
<td>Medical Officer (MO) Doctor</td>
<td>PHC</td>
<td>Medical responsibility at PHC. Reports to DMO</td>
</tr>
<tr>
<td>District Medical Officer (DMO)</td>
<td>District level</td>
<td>Medical responsibility In district</td>
</tr>
</tbody>
</table>

#### 5.1.2 Three days training schedule

One of the coordinators, working as a teacher at the courses gave me this overview of a three days training schedule:

**Normal 3 day Schedule contains**

1. Slide Presentations (8 slides)
2. DHIS 2 software session
3. Exercise (for evaluating the participants)
4. Feedback collection from the participants
This is the actual schedule, she explained, but from the participants feedback they are not interested with theory session (Slide presentation), because they are health staff, they know everything about health related topics. She said:

“I completed 3 trainings. From the first participants’ feedback, I reduced the slide presentation by 2slides (HISP, NRHM (National Rural Health Mission) goals, HMIS (current & new)). They are very eager to know new things. Most of them are elder (old people); they don't know anything about computer operation and so.” (Coordinator)

First she started slide presentation of DHIS2 software training. The second part gave feedback to basic awareness to computer in operating MS Word and MS Excel. Then for 3rd batch she gave a lesson on the following and started the practical training:

1. Start the system (computer)
2. Shut down the System
3. What s desktop
4. What s pointer
5. Minimize/maximize close button
6. How to open a folder
7. Copy, paste
8. How to insert a pen drive, open the document, copying data to pen drive

"then I start software session (3rd batch training I mainly focus on software training, not slide presentation, only 2 slides I showed (HISP,NRHM slides and HMIS slides First day itself they are fully satisfied because they got something new. On 3rd day I got better feedback.” (Coordinator)

Normally the feedback form contains of three sections. A feedback form in this context represent level 1 in Kirkpatrick’s evaluation model, reaction to training (See section 3.5).

1. Unsatisfied
2. Average
Finally, she said that one participant gave her feedback to add a column named "EXCELLENT" in the feedback form. This feedback indicates they are “totally satisfied in this training. After that they copy the entire software for practicing”. By this remark I think she wanted to impress me a bit, telling me how clever she was as a trainer.

5.1.3 The First Training Course

Content of course as it was formulated:
1. Data Entry
2. Validation rule. Import formats.
4. Reports.

The software

In this part I will give a brief presentation of the software and give some examples of tasks learned at the courses. DHIS software is a tool for health workers and health managers to improve health routines and decision making. The first version was developed by Health Information System Project (HISP) in South Africa in the project period between 1996 and 1998 based on the development of an Essential Data Set for Primary Health Care (HISP). The software is used to collect, analyse, validate, aggregate and present statistical health data. It is a system for aggregated data, not patient data. The DHIS2 version is open source software licensed under Berkeley Source Distribution (BSD/UNIX). The software does not involve paying for prohibitive licenses and can be used at no costs. This is important in developing countries where resources are limited. The software has been called a generic tool because it allows the user to design the contents of a specific information system without need for programming, e.g. the platform is multi language, that is, the software is presented in the language for the specific country and not only in English. The former versions, DHIS 1.3 and 1.4 was based on Microsoft technology and was not web enabled. They were standalone applications, only possible to run on windows operating systems using Microsoft Access as database. DHIS2 is cross platform independent.

During the time from the pilot project in 2005 (See section 1.4) data elements have been drastically reduced and thus it has been much easier to register collected data. Data entry is
the module for entering captured data into the system. At the left side of the screen it is an organization unit tree. It is easy to select one of them for entering of a particular org unit. All clinics and facilities are listed in a hierarchical system and they are easy to find.

![Data Entry Interface](image)

**Figure 5.3 Data entry**

By selecting datasets and which period available for registration from the dropdown menu a data entry form will appear with all data elements that belong to the dataset (See figure). A combination of org unit, dataset, and period is possible to change if needed. It is important to quality check data. Data quality can be defined as the gap between actual and measured data. The smaller the gap is the better is the accuracy (Heywood & Rohde, 2002). One way is to check whether entered data falls within or without the expected range of values, usually minimum and maximum values are used identified in beforehand through discussions among health staff that uses and collects the data. Another way is to run validation rules. Clicking on "validation rule" entered data will be identified for violations. It is also possible to create a new validation rule by giving a statement like “the number of birth deliveries must be equal to less than the sum of live birth and still birth”. By running validation a list of validation rule names will appear. Left and right side values’ description will appear and in Data Entry the
result of the validation report give a description if the value has passed the validation. (See figure).

![Data Entry](image)

Figure 5.4 Validation error

1. Day
Two teachers and 30 health personnel from CHC and sub centers in Vellanadu block in district of Trivandrum were present. A health inspector told me a computer was installed at the CHC where he was working and they had software to train on. This was a relevant question for me to ask, as I knew that the goal for switch over to electronic reporting was April and this was February. To make this possible, both training and implementation of computers and software should be in line.

The teachers told me they gathered everybody for class teaching in the morning, and did training throughout the day. The teachers went through the exercises and the subject for the actual day. My impression is that there was not enough time for the two teachers to reach the need for help to all the people during the exercises. The situation seemed a bit unorganized. I
was thinking it could be an idea to do the tasks in smaller parts, each step carefully on the blackboard first, then practice, and then evaluate in parts, “what have we done, what have we learned?” May be too much information was presented at the start of the day? If so, there is a possibility of not being able to use the information and you easily forget the content of it. There were no instruction sheets and the participants were not used to handle computers. Then the exercises turned out to be complicated tasks for the participants.

The levels of computer knowledge seemed very different. The young people were quicker with basic functions like copy and paste. Some of the elderly had problems with where to put the cursor, drop-down menus etc. One of the participants was trying to calculate validation rules in an exercise by the computer, but it turned out wrong and he did not understand why. The reason was that he was not concentrating on the values he was entering. The result was that the weight on a new born child became 3 grams instead of 3000. When this was told to them they understood and they laughed about it.

2. Day
We came to the course after lunch. The attendants were doing reports in DHIS2. They seemed satisfied with the course, but a health inspector argued for extension of the course with two more days. That would have fulfilled a need amongst the participants was his opinion. I was invited to his CHC the week after. He was the head of the block, through him it was possible to study the facility and also visit sub centers. Unfortunately I was not able to visit this CHC more than once.
The health inspector argued that his people are motivated for the new system (DHIS2 and electronic reporting), for them there is not an alternative to stick with the old system, he said. They saw the advantages and benefits of the new software. But many of the people including himself have no or little experience with computers. “He had passed 40”, he said. 40 years was an age limit several people I talked to did use as an ultimate age to be able to handle computers and new technology! He pointed that this will be different with the new generations. “They are growing up with electronic equipment, both in school and elsewhere. Computers are not a threat for them. But he himself had decided to take the challenge to climb over the fence and learn this.”
5.1.4 Second Training Course

People on this session came from a block hospital. It was the same course content as in the first course. One of the teachers was a consultant in NRHM (national rural health mission). The second trainer was a HISP coordinator from Trivandrum. Among the participants were health workers from sub centers, 2 medical officers (doctors) and 9 health inspectors. They told me that every PHC in their block had a computer installed, but not the new software. They expected the software to be installed within a month, meaning during April. I was told that in a block hospital not far away they had started to use the software and it was possible to visit the hospital during the day to talk to some people and see how this was practiced. An appointment was arranged by one of the coordinators to take a trip to the place. On our way to this place the coordinator made a phone call and then it became clear that they did not use the software after all. We turned around back to the training center. The coordinator said there were some people at the course who did work at the hospital we had hoped to visit and she suggested I could talk to them. But when it came to concrete questioning, the actual person exposed reservation to talk about it because she had used it only little, and made excuses because she could not say much about it. She confirmed they had done double reporting, using both software and paper forms. But since the software was not in real use yet, they had stopped to use it as it meant double work to them, and a heavier workload.

5.1.5 Group Interview

37 people participated at this course. This was a big group because the limit of these courses is 30. There were representations from two taluks in Trivandrum. At this point I had found out it could be a good idea to work out a question form to the participants of the training courses. My presence was expected, but the teachers were anxious about too much time being lost in interruptions and questions. In accordance with that the coordinators suggested an interview group to be gathered in the lunch break. In the middle of the day the two coordinators efficiently organized an ad hoc group of 12 people with a broad representation of the participants at the course.

I asked a health manager from one of the taluks if a computer and the software were implemented within their places? A computer was installed. They said the software was installed and that they were using it. This was a misunderstanding. It was not DHIS2, the new,
but an earlier version DHIS1.4. After a discussion they confirmed that DHIS2 should be installed later, after this training (See section 1.3.2).

I asked them what they considered the biggest challenges from the course experiences: “Computer training“, most of them answered. Then a discussion started. To be given the possibility to train was important they said. “This training is not enough. We need more time for training. How to operate and how to implement is the problem we are facing here.” About ownership and administration routines they said: “It is the supervisor who is responsible. Everybody who operates the computer knows the password”. They did not see this as a problem.

They felt unsecure about managing the computer and repeated again, “this will not work without more training” They must be given an opportunity to practice and gradually grasp it. In one of the places the computer was not working, and they need help to fix it. Elderly people (They meant over 30 - 40) have more difficulties than younger people.

A women health worker argued: “Married women over 30-40 have to make food and look after their children and have much to do at home. It is even more difficult for them to find time to train and practice on a computer than for the men. There is no time for it for us”

They expressed that many of them did not know how to turn a computer on and off. The computer section in this course was too short and the teaching went along too fast, they argued. They wanted an in-line course for learning the computer and then software training. Five days had been better. Some of them suggested refreshment training after half a year.

Resources were discussed with HISP after this course. They saw the need for more training or a longer training period, but it was no resources available for that at the moment. The training program was collaborated between HISP and the government which had tied the project costs and no more time were allocated to the training. The same was the matter with the instruction sheets. I was wondering why instruction sheets were not handed out on the courses. The reason was lack of resources because paper was expensive. A few copies were shared among them. In a developed country piles of paper are everywhere and you do not reflect upon lack of paper as a problem. In this context it was different.
5.2 Questionnaires

Form 1 was handed out to 54 health staff on two different training courses. Form 2 (Table 3) is a modified version and was handed out to 21 respondents in a third course. The first three tables give the result of the answers in percent of total number of the actual course. In the fourth table answers from similar questions are merged and represents answers from the total of respondents in all three courses. By this presentation it should be easy to discover differences and trends in the material. First I present the tables with the result from “yes” and “no” questions. In a second part I present the result from the open ended questions.

5.2.1 “Yes” and “No”

<table>
<thead>
<tr>
<th>1) Result of questionnaire from first course:</th>
<th>Yes%</th>
<th>No%</th>
<th>No answer %</th>
<th>N</th>
<th>Total of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Have you used a computer before participating on this course?</td>
<td>58</td>
<td>42</td>
<td>0</td>
<td>100%</td>
<td>24</td>
</tr>
<tr>
<td>2) If yes, do you feel comfortable using a computer?</td>
<td>71</td>
<td>25</td>
<td>4</td>
<td>100%</td>
<td>24</td>
</tr>
<tr>
<td>3) Do you have the possibility to use a computer at home?</td>
<td>33</td>
<td>67</td>
<td>0</td>
<td>100%</td>
<td>24</td>
</tr>
<tr>
<td>4) If not, do you have a possibility elsewhere?</td>
<td>79</td>
<td>5</td>
<td>16</td>
<td>100%</td>
<td>24</td>
</tr>
<tr>
<td>5) Do you consider DHIS software difficult to learn/use?</td>
<td>21</td>
<td>79</td>
<td>0</td>
<td>100%</td>
<td>24</td>
</tr>
<tr>
<td>6) Will implementation and training better quality of health work at your place?</td>
<td>70</td>
<td>17</td>
<td>13</td>
<td>100%</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 6.1 Result from first course
## II) Result of questionnaire from second course:

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes%</th>
<th>No%</th>
<th>No answer %</th>
<th>N</th>
<th>Total of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Have you used a computer before participating on this course?</td>
<td>73</td>
<td>27</td>
<td>0</td>
<td>100%</td>
<td>30</td>
</tr>
<tr>
<td>2) If yes, do you feel comfortable using a computer?</td>
<td>70</td>
<td>3</td>
<td>27</td>
<td>100%</td>
<td>30</td>
</tr>
<tr>
<td>3) Do you have the possibility to use a computer at home?</td>
<td>70</td>
<td>30</td>
<td>0</td>
<td>100%</td>
<td>30</td>
</tr>
<tr>
<td>4) If not, do you have a possibility elsewhere?</td>
<td>20</td>
<td>20</td>
<td>60</td>
<td>100%</td>
<td>30</td>
</tr>
<tr>
<td>5) Do you consider DHS software difficult to learn/use?</td>
<td>33</td>
<td>67</td>
<td>0</td>
<td>100%</td>
<td>30</td>
</tr>
<tr>
<td>6) Will implementation and training better quality of health work at your place?</td>
<td>73</td>
<td>0</td>
<td>27</td>
<td>100%</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 6.2 Result from second course

## III) Result of questionnaire from third course with modified question:

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes %</th>
<th>No %</th>
<th>No answer</th>
<th>N</th>
<th>Total of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Have you used a computer before participating on this course?</td>
<td>85</td>
<td>14</td>
<td>0</td>
<td>100%</td>
<td>21</td>
</tr>
<tr>
<td>2) Do you consider it difficult to use a computer?</td>
<td>5</td>
<td>90</td>
<td>5</td>
<td>100%</td>
<td>21</td>
</tr>
<tr>
<td>3) Do you have the possibility to use a computer at home?</td>
<td>48</td>
<td>52</td>
<td>0</td>
<td>100%</td>
<td>21</td>
</tr>
<tr>
<td>4) Do you have good possibilities to train with the computer at the PHC?</td>
<td>62</td>
<td>38</td>
<td>0</td>
<td>100%</td>
<td>21</td>
</tr>
<tr>
<td>5) Do you consider DHIS2 software difficult to learn?</td>
<td>10</td>
<td>90</td>
<td>0</td>
<td>100%</td>
<td>21</td>
</tr>
<tr>
<td>6) Will you be able to manage computer and software after this course?</td>
<td>81</td>
<td>19</td>
<td>0</td>
<td>100%</td>
<td>21</td>
</tr>
<tr>
<td>7) Do you have a personal aim for this training with software and computer</td>
<td>48</td>
<td>48</td>
<td>4</td>
<td>100%</td>
<td>21</td>
</tr>
<tr>
<td>9) Do you think the DHIS software covers your needs in your work?</td>
<td>67</td>
<td>29</td>
<td>4</td>
<td>100%</td>
<td>21</td>
</tr>
</tbody>
</table>

Table 6.3 Result from third course
Comments to responses

From the design of the course I experienced there was a need for previous knowledge which not all the participants had. Thus, it was of interest to find out if many of them had used a computer before attending the course. I found that a majority, 72% of 75 respondents, had been using a computer before attending. What was meant by use is not clear. It could be everything from touching a computer to making budgets for their family on a spread sheet.

If they had used a computer before attending I wanted to find out if they were comfortable with the use. A majority answered they were comfortable with it, but 8 people who had not used a computer before attending, kept answering the second question whether they were comfortable with the use or not.

Almost half of them had the possibility to use a computer at home, but it differed a lot. In the first course only 33% had the possibility to use a computer at home, while in the second course 70% had the possibility at home. It is not possible to say if the last were more computer literate than the first, because that was not measured. The attendants on the second course were numerous with a number of 30 people. Among them was a group of younger female health. They have used computers at school and they are more comfortable with new electronic devices. They were collaborating in groups of two and three and my impression is
that they were successful and more independent than others during the exercises. I discussed
the finding with a health inspector. He confirmed that the finding seemed right to him. Many
people had a computer at home, but he was skeptical to their ability to use it. In one session
19 out of 24 answered they had the possibility to train with a computer elsewhere than home
or at the work place. While only 6 out of 30 respondents confirmed to that in another session.

Almost half of the respondents confirmed that it was possible to use and train on a computer
at their office, CHC or PHC. The differences between courses were remarkable. In one course
only 20% confirmed to the possibility, while in the first course 79% confirmed to the
possibility.

In question 5 they were asked if the DHIS2 software was difficult to learn and use. A majority
answered “no”, but in the first course (table 1), 46% more of the respondents first answered
“yes” to the question and then changed the answer to “no”. The corrected number is given in
table 1.

My intention in question 7 (table 3) was to find out if some of the participants had reflected
upon how the training could be successful to them. The way I formulated it (if they had
personal aims for the training) was not precise enough, owing to the time limit when I
produced the questionnaire. (See section 3.4.5) The respondents understood it the way if they
had aims to use it for their own personal purposes. Half of them answered “no” adding
comments like “No personal aim- quite official!”. Quite as many answered “yes” and
commented “For official use and proper reporting”.

5.2.2 Open ended questions

Duration of training

If they would be able to manage computer and software after the course, was asked in
question 6 in modified version (table 3). The question must be seen in context with question 8
and 10 in “Training to comprehend” below in this section. A great majority of the
respondents answered positive to the question. Health staff from this course came from the
area were the pilot started in 2005 (See section 1.3.2) and may have been used to earlier
versions of the software.
Arguments in answerers:

- 12 answered duration of training was too short. - "Training period is very limit”
- "Three days training is not enough to understand everything”.
- “Extended up one month. The method of training program is good, it can refer a book or CD”
- It should have been one week at least.
- “I felt difficult because the computer class was gone in a very speed way”

Better quality at your own workplace

78% of the respondent’s believed that the implementation and training would improve quality of health work and that the software would cover their need in their work. The arguments and benefits are presented in Section 5.2.2 below.

In question 7 they were asked if the implementation of the software and the training process will improve quality of health work at their own place, or the opposite. In the first course four answered “no” and one answered this was “not better than traditional reporting system.” (Paper based). In course 2, 8 did not answer the question. Some answered with longer duration of training. Many arguments were used for improvements on their own workplace.

Arguments in answerers:

- Reports restored.
- Reduces paperwork.
- Accurate reports.
- Software helps to improve fieldwork. Data preparation becomes easy, longer training period? Reduces human errors. Less reporting forms. Lower work load. Upgrade teaching facility. Longer training duration, at least one month we can absorb the basic.
- “Because we can save lot of time. Reports will be accurate and up to date and we can get the earlier reports easily”
- Correct reporting and comparative study of all sub centers of PHC. And also rectify the mistakes of field work and improve the field work.
- This software helps in reducing human errors.
- It will reduce the work load by minimizing number of reporting forms
- **Self-assessment of the progress will be easy**
- **Good monitoring will help to improve the quality of work”**
- **Easy to operate and handle, Analyses, Comparison, better routine work, better quality, better data-reporting, -consolidation, -handling. Better data collection, -accurate and promptly.**
- “We can easily calculate the reports. Take the report again one time more, then check it, then send. ”

In form 2 this issue was asked in question 8. Five of the twenty one wanted computers in the sub centers. 12 of them, 57% answered they wanted support of a qualified/trained person to improve the standard by training.

**Training to comprehend**

The last question, Question 8 in form 1 was about any possible personal goal for the training and how much training was needed to independently switch over to electronic reporting. 14 wanted more training and more training programs periodically. 11 did not answer.

Arguments in answers:

1. Course
   - “Refreshing between 6 month and one year. ”
   - *Two weeks.*
   - *One month*
   - “I Don`t know the computer.”
   - “This is first time many of the people using the computer”

2. Course
   - “Using a computer for the reports without taking photostats from outside?”
   - “I need minimum 1 month for using electronic reporting system independently”
   - “I need maximum training before using electronic report system independently”
   - “Minimum one week”
   - “Two weeks training a month after this course.”
- Personal aim: to learn the system. Help co-workers”.
- At least one week. Need one month training to do it independently.
- Two weeks. Maximum training. Minimum one week
- “To attain all the knowledge needed. To help my co-workers to overcome the digital divide. For me one week will be the minimum period”

DHIS and your needs

In question 9, form2 I asked if they think DHIS2 covers their needs as health workers. 14 answered yes. If not, what is missing?

Arguments from answers:
- Does not cover all needs in one work.
- Does not include items which are used regularly in PHC reporting?
- Need to add diary report for mate also
- Include pages for practical use and data in our institution!
- Missing male workers. Job reporting system

Result from question 10, Modified form. On how much training before they could operate independently:

In this question they were asked how much training they needed to be able to use the electronic report system independently. Most of them (except one) answered they needed training on a scale between one week and six month to be able to operate independently. It seems that this finding contradicts the result from question 5 in table 3.

- 3 answered 1 week
- 5 answered 2 weeks
- 2 answered 1 month
- 7 answered 3 month
- 3 answered 6 month
5.3 Use of DHIS in clinics

5.3.1 Field Trip at a Block Hospital, CHC

At a training session I met a health inspector and a health officer who was leader of the block CHC (Community Health Centre) hospital at Vellanadu. They had installed a computer system and was about to implement the new DHIS2 software. The health inspector had participated at the training course to learn computer use and the new software and he invited us to visit the hospital to see how it was working. They took us to a room with a computer and a printer. We started the computer to open the DHIS2 software. But the Windows system expected a username and password. They had forgotten what it was. The first suggestions did not work. More people gathered and several suggestions for the right password were tried without success. After a while they said that an installation had been done on the computer and that the password had been changed at that point. The installation was dealt with by people from an IT company. They had left without leaving the new password they said because a new version of the operating system was to be installed at the 21. of March, a month later. Then we tried to open the DHIS2 software through different user. But, as a standard you also need a username and a password to open the DHIS software at the facility. But they had forgotten this password as well, because nobody had written it down! Several suggestions were tried again without success.

Figure 5.6 Information overload
I had brought with me my computer with the installation files to the DHIS2 software. To help them to a version they could practice on we tried to install my software. But Windows did not allow us to since we were users not admins (and we did not know the password either). The result was that they could neither use, nor train on the system until the IT company returned in middle of March many weeks later. Concerning training the medical officer had been to a course in January, a five days HMIS course for managers and medical officers. He was positive about the course and said 5 days was good enough. But he argued that there was a problem when the time from learning to practice was too long because you forget what you have learned and had to learn it again. This was the situation now. I called the health inspector in middle of March to ask if the operating system had been reinstalled and if the computer was running. He confirmed that. From that point of view this was a lucky story.
Sub centers are the most peripheral contact point between the community and the rural primary health system, often situated in remote areas with limited resources. I met a Junior Health Inspector who took me to the sub center in which he worked and had responsibility. The center is administratively under the PHC (primary health care center). A review meeting takes place in the sub center every month and they report collected data monthly to their PHC unit. Here collected data will be consolidated and analyzed by superiors before being passed upwards in the health system. He told me that their main focus is Ante Natal Care (mothers’ condition during pregnancy). They had some regular service he explained. Every week they have service for checking pregnant women in the community. “The women are taking that”, he said. They treated as much as possible and helped with medicines if it was available, “but this did not cover the need”, there was a limitation. Lack of resources made it impossible to provide for the actual need. “Some sort of time there will be no money for it”, he said. He also showed me a school nursery for children less than six years run by the Family Welfare Center (FWC). The children stayed there for the day while their parents were at work. Some of the
women working there I had met earlier during training course in Trivandrum. It seems to me that the nursery school had grown out from local needs and initiative and can be held as a decentralized effort to strengthen infrastructure among the population.

Basic activities in sub centers are collection of raw data among the population using different collection tools like patient record cards, tally sheets etc. Sub centers are not in possession of computers, the collection is done manually or by mobile phones. The data collected should be essential for the environment they are used. When collecting, it is important to ensure quality because inaccuracy and errors will influence the process further on and may cause great damage and wrong decisions and affect both quality and use negatively. Health workers receive little or no training in data collection methods and, if the data collected are not relevant to them, they will not use the data they are collecting. (T Lippeveld, 2001). Usually there is a lack of feedback on collected data. This situation easily leads to poor motivation. The Health Inspector held that most of the people were positive to the software. “They can manage in one or two month.” was his opinion. He does not think it is practical to use it daily, but weekly and monthly. He was sceptical to install computers in sub centres. “Not a practical one”. “Sub centers can report by phone or sms.” He sees no problem to use the system in the future.

Figure 5.8 Mother record card
In Vizhinjam there was a mother CHC with two PHCs below. “All three have computers, but they have trouble with the computer in Mukkola. It does not work properly. Company is coming to fix it.” But he did not know when. He wanted local support and believed this could be realized in the future. But this was not the situation today. If problems occur with computers, they had to rely on service from an IT-company, which takes time!

5.4 Conversation with Facilitators

Their education as they reported to me:

- First male informant: BA in Computer science and Master in computer applications.
- Second male informant: Engineer diploma in instrumentation, BA in computer application and engineering in computer science.
- Female informant: Data Engineer in Information Technology and computer science.
Since last autumn they have been in a training program for their work as facilitators. Not to learn computer handling, they are experts on that, but to learn the DHIS software and what it is based upon, The Health Management Information System principles (HMIS) and concepts. The strength concerning these young people is their speed in learning and their competence in computer based technologies. A drawback on the other hand might be their age, lack of experiences in life and background. They have to cooperate with health workers around the state, many of them older than themselves and with different cultural heritage. The facilitators have their educational background from high schools and universities in the cities, and the gap concerning age between them and health staff they will work together with might be hindrances to them if they did not take into account other people’s problems and needs in a socio-cultural context. Their attitudes and what they are based on is important. The HISP Kerala coordinator told they had discussed the necessity of a conscious attitude a lot since the job as facilitator is not in first place a technical one, but that of a socio-cultural. To achieve and ensure this part, this was stressed in the training sessions last autumn, she said.

At the HISP office in Trivandrum I was given the opportunity to interview a girl and two boys who, at the time, were hired by HISP to work as facilitators. At the office they studied the DHIS software and learned the HMIS principles for their practice in the districts. I asked what their motivation was by applying for this job since they easily could pick a good job and a career elsewhere in society. The girl seemed a bit unsecure about defining herself in the situation of the question. May be she misunderstood my question or she had not thoroughly thought about it? First she answered “more efficiency in health sector” as a reason. Then she added “she wanted to use her education to teach people who did not know computers.” That was meaningful to her and part of her motivation. Then she explained she had friends who worked in HISP. They had told her “this is an easy job and I could manage it, no problem! Take it as a challenge, no problem!” (The girl). I hesitated a bit about the answer. This remarque could be understood the way that because she thought she could handle it easily, that was part of her motivation. Or the opposite, the job was suitable for her because she was competent. The second male informant replied that in private business ”there was a lot of pressure, and after two or three month they leave to that job. Compare to that, here will be better”. Did he expect less pressure working as a facilitator in HISP? The third male informant gave a more reflective explanation. He started to say:
“What I have heard from them (HISP) is that this is a job where you put in more exposure to different aspects.” He compared it with IT development “where the person will be put to a specific work, doing the same work day in and day out. He might get more have done and get much experience in that area, but not exposures to different aspects like checking infrastructures, material and training which is required, go to many places, meeting different people and different levels of education”

He respected that HISP was a non-profit aimed organization and was very proud of being part of the entire movement HISP had become to be! He meant this contributed to the country as a whole as well as to India in the future.

I asked if they had prepared some methods or could imagine something they should be especially aware of in their new practice? The third informant immediately replied “patience”, and the two others gave their consent to that.

“First we have to start with patience. Then we have to imagine how they are willing to catch up with the technical term. The whole idea is to computerize a manual process. We need to give them mapping ideas of what they are doing now and what we are trying to impart.”

Different considerations which must be taken in account was discussed among them, one of them was age. The female informant argued that it could be hard getting acquainted with mouse and key board above the age of 30! They were uniform to the view that the users should be familiar with any change and room must be given to the users to adapt and accommodate with the changes
6 Analysis and Discussion

6.1 Subject Matter Areas in HIS

The problem which my thesis wants to investigate is user learning in an IT implementation process. The HISP Kerala team aimed at three subject matter areas during the project period, mentioned in the start of this thesis:

- Concepts of health information and health information systems
- Operational use of DHIS2
- HMIS (Health Management Information System).

What did health workers learn from the three areas during the period I am investigating? Systematic, computer based HMIS using DHIS as a tool is a concept developed by HISP. As long as health information systems have existed, so have health management. But it was a new approach to address health management as a system with defined goals. This was not rooted in the consciousness of health managers. Likewise, it is not likely that health workers in general did reflect upon the meaning of health information system and what it meant to be part of it. Due to different backgrounds and competencies and busy work schedules, the time to devote themselves to HMIS was limited. The intention from HISP Kerala was that HMIS would be part of the daily practice at the end of the implementation phase (Kerala coordinator, 200?). The training courses took place in the first part of the two year implementation process. 2 or 3 days of training hardly gave enough room to overcome how to operate a computer in the first place, learn DHIS2 software, in addition to concepts of information-, and management systems. From my findings it was operational use of computer and DHIS software which became focus in the courses. But the interplay when learning DHIS, and the social context when colleagues and health workers meet and collaborate, may possibly have contributed to increase the understanding later on. My findings show that many health workers have a strong focus on collecting and reporting and a positive attitude towards the implementation process. The positive attitude is based on the benefits they will get by easing their daily strive. If there is less consciousness about why you collect and report, a possibility of missing the task of sight is a danger. In the training courses and user learning process the HISP Kerala team wanted to focus not only on collecting for reporting, but to
ensure that users moved to a consciousness of converting data into information for better decision making, or health management (HMIS)

At the sessions it was not possible to survey all the attendants closely. From my impression most of them were able to follow the tasks on skill level when being instructed what to do. But the challenges in how to operate the computer was big enough and they seemed not able to concentrate on reflections upon what they expected to happen next. Another interesting observation was differences between the work places reflected in the answers in the questionnaire. All facilities from PHC and upwards had PC installed with possibility to train on the computer. In one course with people from Vizhinjam the coordinator told me she visited the actual facility at their work place and gave support and help when she had the chance to. The answers from this batch of health people gave the impression that their level of mastery was higher because their possibility to train and use computers perhaps was better structured than in other places. Vizhinjam CHC, a place south of Trivandrum was the target for the pilot project started by HISP in 2005 (See section 1.3.2 and 5.1.3). They had participated in earlier implementations. They were the first facility to have a computer and DHIS1.3 software installed. And they had been given training in use of the earlier versions (S. K. Puri et al., 2009). Due to that experience, they were traditionally more used to computerization than other facilities which came after. How many of the group who had attended the pilot project in 2005 is unknown. From this group many did not consider DHIS2 software difficult to learn and a majority considered they would be able to manage computer and software after this course. But on the last question, when questioning how long they considered it necessary to train before they could use the software independently without considering the traditional paper forms, the answers were very diverse, from one week to six month. (See section 5.2.1). Probably those who answered one week were closer to a conceptual level than those answering six month? Perhaps they knew the computer better and had a stronger user platform. About half of the health staff had a computer at home. When I discussed this with a Junior Health Inspector his assertion was that “I think it is right that many people have a computer at their home, but many don’t know how to operate them”. Considering their answers, I see a contradiction as most of them answered that DHIS2 was easy to learn and use, and that they were able to manage computer and software after this course. If the second of the two questions was understood by them in general terms, not in context with DHIS2, this may explain the result. Or maybe they wanted to give a positive impression of their capacity, and avoided to admit that this was problematic?
When investigating how well functioning a group like this is in relation to levels of mastery it is not enough to examine the level, but also how many who fit each of the three levels. An aim is to move as many as possible of the total group toward the conceptual level.

**6.2 The Training**

The concept of a three day training schedule was sent to me with comments by one of the district coordinators who attended as a teacher at the courses. At the first course I was observing, the DHIS2 software session contained validation rules and import formats, data quality, analyzing and reports. To be able to work with this session you need to know some operational use of the computer. Then training in operational use on computers must come first and is then connected to the DHIS2 software session (See section 5.1.2). Two different styles of training can be used. One approach is repeat-after-me, also named “parrot style” because it resembles how a parrot is learning by repeating over and over again. The second approach is the conceptual-practical training (See section 2.4)

In the first batch of training the teacher started with a slide presentation considering a general introduction of the topics and a presentation of what was being taught for the day. That is in line with the practical-conceptual method. But then she said she reduced the slide presentation with two slides after feedback from the participants. The reduced slides were health (HMIS) slides. She argues that the participants are health staff and “know everything about health related topics” (teacher) which is not obvious and was not confirmed. Besides, they were elderly people and not so interested in theory sessions (the slide presentation). They were eager to know new things like learning the computer, not the things they already know about (health). An important thing pointed out in the project was that operational use of DHIS2 software not should be a technical one, but it should “lend itself on a robust HMIS”. Even though it is obvious that the participants knew health from their daily work, it is not obvious that they knew the HMIS principles and how the DHIS software robustly could lend upon that.

The second batch mentioned was DHIS2 software session. To be able to go further to batch three, exercises in DHIS2, it is necessary to know basic use of the computer. In this session repeat after me or “parrot style” might be an appropriate training style since they should do specific tasks on the computer like start and shut down the system, copy paste, how to open a
folder etc. In tasks like this it is possible for the participants to follow the teachers modeling. When doing DHIS2 exercises the conceptual-practical concept is preferred because you need to concentrate both on the functionalities of the computers’ operating system and the DHIS2 software and make them work together. The combination of tasks makes the complexity more challenging. In fact it is two complex concepts you have to know about. If you are a computer illiterate person you easily drop out when coming to DHIS2 software part. Then people get frustrated and give up, which was my experience from time to time. An introduction course to learn the computer, and then another course to learn DHIS2 would have been an advantage. But it is much more costly and resources are scarce in developing countries. We could hardly expect that to happen. The participants in the three day course, are described as elderly, in this context meaning above 40, “they don’t know nothing about computer operation and so” (teacher). It seems to me that this course practically became a learning the computer course rather than a learning the DHIS2 course. It had to because the attendants did not know the computer.

Concepts of health information, HIS, and HMIS are difficult to discuss in this context, since the teacher did not mention it any further. But concerning operational use of computers and DHIS2 it is possible to say, the way it is described, that the level probably was not above skill level.

In the courses in which I attended it was a mix between the two training styles. Since people were sitting two by two they could cooperate, but there was not an instruction sheet to each pair of people. When a problem arouse they had to call out for help from the teachers who told them what to do, until the next problem arise. Thus the situation grew a bit turbulent when more and more people needed help with the exercises, and the teachers ran faster and faster for helping.

According to the framework in Kirkpatrick’s evaluation model the experiences touch level 1 and 2 in the framework (Kirkpatrick, 1996). Level one evaluates the trainee’s reaction to the training focusing on how design, relevance in their work, course content can motivate trainees for the learning. In the three day schedule mentioned above the trainer explained that she distributed a request to get feedback from the trainees. From what she said it seems that the response to the content of the course was positive. Especially it was positive in the part dealing with the operational use of the computer. In this thesis I have discussed that many in the courses were not computer literate and they expressed frustration because “the computer
class was gone in a very speed way” (From questionnaire) Another informant argued that they needed more training “because this is the first time many of the people using computer first time.” In some courses evaluation is not done immediately after the course with a risk that trainees will forget important positive or negative details. To introduce a request to fill out a written feedback directly after the course, as was done in the case above, is positive and will give the teacher fruitful directions to enhance part of the teaching as well. But if this was done as routine in the other sessions is not possible to say. Level two evaluates skill acquisition or what the trainee has learned at the course. I never experienced this level to be evaluated and the teacher from the course discussed above did not say something about it. I will imagine this was very different, depending on what mastery level the attendant were on. It is likely that some of the persons who were offered the obligation as super users were able to use DHIS2 in some extent, while others only had a notion of a new vocabulary from the courses. HISP Kerala realized that three days of training was too limited for the persons who were identified as potential super users at the courses. Thus, additional training was organized with them by the facilitators.

6.2.1 Time squeeze

From literature it is known that health workers in developing countries have a hard work load and are striving to fulfill them from day to day (Lewis, 2005). From the pilot project in Andhra Pradesh, Lewis (2005) explains that training was organized at the facilities because the health staff was much occupied during the day. Work place training became a solution in which it was possible to combine work and training. A female health worker who participated in a group interview in Trivandrum explained in frustration that they had so much to do in their daily work; there was no time for training. She said this was even worse for women than for men, because women also have to take care of the children, and after work they must cook for the family, and what is left of the day then?

6.3 Benefits

Both our informants in Vellanadu, health inspector and medical officer, expressed positive attitudes concerning benefits of using a computer and implementation of the new software. They looked forward to reduced paperwork with the reports and better quality as it would be possible to validate collected data. Compared to the paper based system they expected routine
work to go faster with the computer based system. They had attended a five days management course last year. Their second course was the three days course in Trivandrum, (where I got acquainted with them), to learn operational use of computer and DHIS2 software together with health workers from different levels.

The two persons belonged to management at the facility and were responsible for the activities connected to that position, including computer and software administration. At the time, they did not use the computer. Here is to add, that they had forgotten the password both to the DHIS2 software and to their operating system. In the meantime they had to rely on the existing paper based HMIS which they knew well and probably were comfortable with. But due to the piles of paper at their office, the paper based system seemed very unwieldy. Their hands were full with daily routines, and they did not feel very anxious about the computer problem. They expected external support from an IT company to take that responsibility. The impression was even if they were responsible for the computer equipment; there was no surplus to mobilize eagerness and curiosity to start working with the computer equipment, even though it was physically present. With a heavy work schedule it is convenient to avoid the problem. If you do not feel competent, the person will not be comfortable to try and avoidance may be a possible outcome.

The HISP vision is to support the development of a sustainable Health Information System (HIS) in developing countries. To make this vision come true a Health Management Information System has been established with the DHIS software as a tool to collect, analyze, validate, aggregate and present statistical health data. HIS consists of health staff and professional health workers, individuals who collect health data and turn it into useful information in the system. On the organizational side there are managers who are operating within a health management structure. The two bodies, the individual and the organizational parts depend on each other with common goals, better health services for the community. The word system implies a connected whole. Due to AbouZahr & Boerma (2005) most country health information systems lack such cohesion because of administrative, economic, legal or donor pressures (AbouZahr & Boerma, 2005). Further on they argue that the health information system is part of both the health system and the wider statistical system. This may cause a competition between the interests of the individual health worker and the interest of the management in the organization health staff is part of. The attitude towards what tasks or priorities the two parts consider important might be different. On the organizational side
managers have the responsibility to facilitate for the health staff to make them able to carry out their work which involves a huge range of tasks concerning human- and other resources. Managers are responsible for infrastructure and a functioning logistical system. They are responsible for appropriate collection tools for the health staff and how they shall be used. To analyze, process and validate raw data, create reports and send to higher levels, present and interpret information, make decisions and put them into life in the community. The individual health worker is responsible for collecting raw data in the community by means of the tools provided by the management, and send monthly reports to their PHC. They also need the competence to develop a set of indicators based on their priority activities. In India it is usual that field teams (health workers) operate in remote areas. They must travel a lot and survey the health situation among the population related to the priority indicators. Indicators will help them to measure the effect of their health efforts and detect changes in health conditions. The description above is an ideal picture. From literature we know that the real situation is different from the theory of how situation is expected to be. Earlier in this thesis I have discussed the challenges in introducing HIS in developing countries (Jørn Braa & Nermunkh, 2000), (Heeks et al., 1999; Jens Kaasbøll et al., 2010)). In his doctoral thesis Kimaro (2006, p.194) investigate HIS challenges in Tanzania. He argues that “…the local trainees perceived the DHIS as just a tool to store data (data repository tool) rather than to generate usable outputs because the district authorities never asked for processed information for decision making” (H. C. Kimaro, 2006). Both for the individual health worker and health management on the organizational side the workload is hard and the challenges are big. The prospect of efficiency will trigger both individuals and management in an organization, if you recognize the benefit in saving time, and ease your work load. In an organization it will be possible to get reports out of the way in a hurry with a possible consequence that what you did not see you do not know? Possibly, any means that will help to enhance the situation for the individual health worker and management will be welcomed as a benefit.

In Vellanadu, the managers, as mentioned above, were positive to the implementation of DHIS2 and argued for the benefits due to less paperwork, speed and better quality. When I had interviews and conversations with health workers, they were positive to the changes. Not all of them explained why, but possibilities with data analyses were mentioned. From answers in the questionnaire a majority of health workers were positive and there were many arguments for the benefits, only four persons from one training session were negative. On questions if implementation of the software and the training process will improve quality of
health work at their work place and if the software covers the need in their work, 53 of the persons who did answer were positive to the possibility (Q7 in form1 and Q9 in form2). In addition many of them gave arguments. In this context yes and no answers are of less interest. Their arguments are much more interesting as it tells us something about why they see the implementation as a benefit.

From the questionnaire I have found two groups of arguments which can be held as typical for two different attitudes when arguing with benefits. Answers like

- “reduces paper work”
- “we can save lot of time”
- “It will reduce the work load by minimizing number of reporting forms”,
- “Using a computer for the reports without taking photostats from outside”

indicate the benefit of seeing the software mainly as a tool for reporting, which can be done more efficiently with the new software compared to the existing paper based system. Reduced paper work and time saved is good for most people in their work and today we expect that benefit when new software is introduced. But individual benefits were not the main focus for introducing DHIS2.

- “The software helps in reducing human errors” and
- “Rectify the mistakes of field work and improves the field work”,

These arguments indicate a different attitude. The latter type point in the direction of health management and decision making. Reduction of human errors will improve data quality which is important for health management and decision making. When using the paper based system, it is difficult to detect inconsistencies and mistakes in reports due to double counting, incorrect grouping of data, wrong-, and missing values etc. Detecting mistakes, errors and inconstancies in a paper based system; require human skills. In DHIS2 it is possible to run validation of data collected in the system. The electronic validation makes it possible and easier to detect some errors and mistakes quickly when validating and processing collection targets. If health staff learns how to run the system, improved field work may be the result, followed by improved data quality, accurate decision making and better health services.
For the further discussion I will establish two categories. Cat1 highlight benefits for reporting. Cat2 highlight benefits for decision making. Sometimes I needed to make use of some interpretation to decide what category to put them in as their content could have elements from both categories. “Yes” answers have not been considered here since they do not give any argument. Some of the arguments were copies, meaning people who were seated beside each other had copied exactly the same answer. Nevertheless, it is not fair to take away the possibility that the argument really represented their personal opinion.

<table>
<thead>
<tr>
<th>Training sessions</th>
<th>Cat1: Benefit for reporting</th>
<th>Cat2: Benefit for decision making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Session 2</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Session 3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Tot</strong></td>
<td><strong>27</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

Table 6.1 Perceived usefulness of Cat1 and Cat 2. Absolute numbers

Between 10 and 12 000 health workers were mobilized in the scaling up period in Kerala and participated on training courses on initiative by the state. If we held that my estimate is representative for health workers in Kerala, it leads to an indication that most of them were positive to the benefits of DHIS2 and the implementation. The expected benefits were due to less paperwork, easier reporting and reduced work load for the majority of the informants.

### 6.3.1 Perceived usefulness and benefits

Above, I argue what I see as two different attitudes in the implementation of the new software. Both attitudes describe benefits, roughly divided in benefits for reporting and benefits for decision making. In both cases the arguments are the subjective answers of the users. In first case they argue with a possible prospect of reduced workload and easier reporting and tasks. In the second case the prospect is less human error and to rectify mistakes and improve health management. Benefits and usefulness is not exactly the same. I held that standing in front of software and new technology, benefits are the prospects and expectations a person reflect upon due to his own preferences. Usefulness is what a person experience when using the technology. Thus, when usefulness fulfills your prospects and expectations, it
will be an important source to motivate for use of the technology. In this way, the prospect of benefits and perceived usefulness are linked together. The statements in the answers must be seen as expectations of the performance of the software from what the informants perceived at the training courses.

In the TAM study (See section 2.4). Davis presents 14 initial items (Davis, 1989). Below is the statement he presents to assess the semantic content of the items. How do the statements from the questionnaire correspond with the items? In my assertion I see a similarity between cat1 and item 5, 6 and 13 in table 1 which correspond with “Saves me time”; “Work more quickly” and “Makes Job Easier” Saving time to reduce workload and to get the tasks done more quickly are typical with cat1 attitudes. While item 2, and 11 “control over work”, and “Quality of work” are typical with cat2 attitudes, focusing on control over collection mistakes and human errors to improve data quality. To accomplish this DHIS2 will be critical to their job (item 7). Some of the items can be typical for both categories, e.g. item 13, “Makes Job Easier”. But then it depends on what the person mean by makes job easier. If the person mean easier to evaluate wrong data it is a cat2 attitude. If he means easier to complete a report it is a cat1 one attitude. Further, my assertion is that item 1, 3 and 13 are similar both with cat1 and cat2, corresponding with “Job Difficult Without”, “Job Performance” and “Makes Job Easier” (table 1). It is likely that item 10 and 12, effectiveness and productivity also correspond with both cat1 and cat2, but from the answers it is unclear.

As we started with benefits, my assertion was that a HIS consists of two bodies, individual health workers and health management on the organizational side. The two bodies depend on each other. But, as their role in the system are different, it is likely that the preferences from the two bodies standing in front of change, implementation of DHIS2 and online reporting, might become different. Both parts favor the benefits, but arguments in cat1 answers tend to favor the benefits for the individuals, as arguments in cat2 answers tend to favor benefits for managerial responsibility or the organizational perspective. What items the persons who represent each of the two categories perceive as useful, might be different according to their positions. May be it is not enough to ask “What is the strongest factor?” We also need to know what the strongest item inside a factor is. In the first table I grouped the arguments in cat1 and cat2 attitudes. My next step was to try to identify the strongest item in the perceived usefulness factor (see table 6.1). I found that the strongest item was item 13, makes job easier. I have interpreted the arguments as close to the text in the questionnaire as possible.
Perceived usefulness:

<table>
<thead>
<tr>
<th>Num.</th>
<th>Item</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Job Difficult Without</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Control Over Work</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Job Performance</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Addresses My needs</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Saves Me Time</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Work More quickly</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Critical to My Job</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Accomplish More Work</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Cut Unproductive Time</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Effectiveness</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Quality of Work</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>Increase Productivity</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Makes Job Easier</td>
<td>18</td>
</tr>
<tr>
<td>14</td>
<td>Useful (for both categories)</td>
<td>X</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>37</td>
</tr>
</tbody>
</table>

When it comes to perceived ease of use, it is not easy to find similarities between items and categories or answers in questionnaire, since the software at this point was not learned by routine or used at the workplace. It is possible to imagine similarity between items 4 which correspond with “Dependence on manual (when using the software)”. 5 of the answers in the questionnaire claimed a book or CD to support them in the further training. Perhaps it was a result of feeling both confused and frustrated while learning the software? It is possible to see a similarity between item 11(understandable) since 58 people in the questionnaire answered "no" to the question if they considered the DHIS2 software difficult to learn and use. It is also possible to see a similarity between item 12, “ease of remembering” and some answers arguing that it was a benefit to be able to save the reports without having to take photostats. This argument can be interpreted both as “usefulness” as it “makes the job easier”, “increase productivity” (12), are more effective (10) saves time (5), and “ease of remembering".
Perceived ease of use:

<table>
<thead>
<tr>
<th>Item</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Confusing</td>
<td></td>
</tr>
<tr>
<td>2  Error Prone</td>
<td></td>
</tr>
<tr>
<td>3  Frustrating</td>
<td></td>
</tr>
<tr>
<td>4  Dependence on Manual</td>
<td>X</td>
</tr>
<tr>
<td>5  Mental Effort</td>
<td></td>
</tr>
<tr>
<td>6  Error Recovery</td>
<td></td>
</tr>
<tr>
<td>7  Rigid and inflexible</td>
<td></td>
</tr>
<tr>
<td>8  Controllable</td>
<td></td>
</tr>
<tr>
<td>9  Unexpected Behaviour</td>
<td>X</td>
</tr>
<tr>
<td>10 Cumbersome</td>
<td>X</td>
</tr>
<tr>
<td>11 Understandable</td>
<td></td>
</tr>
<tr>
<td>12 Ease of remembering</td>
<td>X</td>
</tr>
<tr>
<td>13 Provides Guidance</td>
<td></td>
</tr>
<tr>
<td>14 Ease of use</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6.2 Adapted from Davis (1989)

Due to my findings, how can we say that the two next factors, social influence and facilitating conditions, did contribute to acceptance of the software? In the questionnaire 39 out of 75 people answered they had an opportunity to use a computer at home. Of the 36 who did not have a computer, 25 persons answered they had an opportunity at their work place (PHC, CHC etc.). In an interview, a health inspector confirmed it was good opportunities to use and train with computer for health staff at his PHC. How many who really did is not possible to say. And how the possibilities in other facilities were, depends on the circumstances from place to place. In the facilities which succeeded in building a culture for using a computer and train on the software, a social influence would probably occur. It is to say as well, that it was an external pressure to get started since the state expected to switch over to online reporting in April. At the courses groups of people were represented from the different organization units, both managers and health staff. It is possible that the external pressure from the state implied in the situation, exposed social pressure from managers towards health staff to participate and use the new software. It is also possible that health staff participating at the same courses influenced each other and their peers as they experienced benefits with the software during courses. Concerning facilitating conditions every facility from PHC upwards had computer
installed. But in some places the computer did not work and they needed help from external support to fix the problem, and not all facilities had the software installed yet either. In one facility, they had started to use DHIS2 for electronic reports, but since they still had to do the paper based reports they had stopped using the software as it meant double work for the staff. In this context the staff perceived the use of the software not very useful and they stopped using it.

6.3.2 Preferences, “critical mass” and “instigators”

According to Granovetter the threshold model treats binary decisions, a choice between one of two. If the perceived benefits to an individual exceeds his perceived cost, that will influence him to participate (Granovetter, 1978). The individual preferences related to benefits and costs are different among different persons. The pedestrians crossing against the light in the example from Schelling is routed in the same consideration of benefit and cost influenced by the number who joins in. The first people who cross over feel safe enough to pay the cost to cross. In the pedestrian example they represent the “instigators”.

The technology acceptance model only states that expectations of different kinds of benefits will perceive a notion of usefulness and lead to acceptance of use of technology. It does not say anything about any configuration between benefits and cost or the number of attendants. The Gallivan survey does not support perceived usefulness, but held that coworkers’ use of technology is the strongest factor to influence/trigger others at the work place to accept use of technology. In this context the coworker who starts to use new technology may take the role as an instigator.

When new technology is developed, there is sometimes a challenge to get people to use it. Groupware is only useful if a high percentage of a group use it and a “critical mass” of users is essential (Grudin, 1994). A “critical mass” is the point where enough people have adopted technology in a number that makes it self-sustaining and creates further growth. The number of critical mass is not provided in a lapse of a moment. It starts with a few who are curious enough to try the new devices. In this context the first to try are instigators for the adaption of the technology similar to the first pedestrians to cross the street against the light in the example above. For developers of technology it is important to capture the individual preferences linked to the first users. If the preferences are identified it should be possible to reach “critical mass” faster.
A groupware application opposite to a single ware application is expected to provide a collective benefit. According to Grudin individuals benefit from groupware, but some people are usually required to enter or process information that the application requires (Grudin, 1994). The DHIS software used in the implementation process in Kerala can be considered groupware and health workers are required to enter and process information through it. If nobody does, and information is not timely and of poor quality it will be of less meaning for health staff to use the system and further growth will not be created. In Trivandrum the HISP coordinator argued that during the training courses people were identified to take the role as super users (Igira, Kaasbøll, Lagebo, Sahay, & Williamson, 2010). It is likely to imagine that some of these first identified super users took the role as “instigators” in their facilities or blocks. When some followed a few more increased their interest and joined in. When using the technology acceptance model I found that a majority were in favor of using the DHIS because they saw a benefit in reduced work load and easier reporting. The synergy to this positive attitude is the possibility, over time to increase knowledge and move it to a conceptual level of understanding of health concepts. The “instigators”, brokers and super users move between the communities and have a role that may influence people to join.

The combination of instigators triggering others and the perceived usefulness for reduced work load creates a situation where both types of factors influence in favor of adopting the DHIS.

6.4 Delays

In Trivandrum the training courses started in the beginning of the year. The first course which I attended was February 9. The last was on March 18. The switch over to electronic reporting was supposed to be April. From first course in February, at least two month would pass before the obligation from health authorities to send online reports started. In some facilities the
software was not installed and there were problems with computers. It is reasonable to assume that circumstances were not optimal for training at the work place when health staff returned from training courses, even though there were differences. In the questionnaire and in the interviews, informants made complaints about the length of the courses. Three days were not enough. “The time was too limited “were arguments in the questionnaire. In a group interview, I asked what they thought was the biggest challenge. “Laptop training (PC), this training is not enough” was the answer. They needed the opportunity to practice and “gradually grasp it”, they argued. If we take as our stand that people who participated in the courses learned something, on different levels of mastery and understanding, is it possible to say something about the value of the contribution when they returned from the courses to their work places? In literature this has not been studied carefully yet, but Karuppan and Karuppan (2007), held that “A time lapse of more than a week or two between training and implementation can be a significant lapse in employee performance.” (Karuppan & Karuppan, 2008) (See section 2.3). This is supported by practical experiences. The Government Computing News (GCN) which is the technology authority for government in USA refers in a survey to find out what works well and what doesn’t when training employees for new systems and software (Finnegan, 1996b). Experiences from managers in this survey suggest it is best to have the system up and run before training starts. Then the users will have a general feel for it in advance. If that is not practical, the system or software should be installed immediately when employees return from training. Further on the managers experienced that a lapse of a week or two, the information taught at the course was forgotten. And what you learn at course should be relevant to the tasks you do at work, otherwise “it is not a lot of benefit to it” (Finnegan, 1996b). A logistics superintendent for the Air Force Reserve in Milwaukee held that “I found one of the biggest issues that drive people crazy is that there is not somebody to turn to when you have a question” (Finnegan, 1996b). From my experiences so far, the possibility to train with the software at the work place when returning from training courses was different from place to place. From my questionnaire 25 persons who did not have a computer at home, answered they had an opportunity to practice at their work place. But answering that they have the opportunity is different from using the opportunity. And, as was told above, in some facilities the software was not installed, and in others the computer did not work. According to the GCN experiences, they held that if the chance to practice what is learned at the course is not possible within a couple of weeks you forget what you learned and will not be able to adapt it in practical use when necessary. Karuppan and Karuppan
(2007) simply state that “lack of practice triggers forgetting”. The timing concerning training course vs. work place tasks are difficult. It is a great chance that the time from training course to work place practice will not fit within a couple of weeks, due to many reasons, e.g. lack of facilitating conditions.

6.5 Support

If the statement above is acceptable, then the problem should be addressed by many as a challenge. A facilitating condition which may be a crucial element to ease and adjust the situation will be establishment of super users and advanced users who achieve the competence and ability to transfer knowledge to others. Because super users and advanced users are someone you know, probably a colleague, the influence will be a social factor as well, according to Technology Acceptance Model (TAM). The synergy of establishing super users may replace the difficulties in making training courses and work place practice fit because of too long time from course to work place. GCN also made some experiences in training from different computer programs and recommend effective formulas from practical experiences. A chief of information systems, Billy Brown, stress the importance of continuous training. He said they established a task force with the most computer literate persons from each office. They received training from his headquarters and then shared information with the rest of the office. This was successful and his opinion was that it worked out very well as “every office had someone who was computer literate and was able to pick up on what we were teaching fairly easily.” A computer specialist at an aviation administration said that “she looked for people with an interest in computers and urged them to help co-workers.” Sharing knowledge is inexpensive and effective.

At one of the courses I asked the group what kind of means or actions they considered necessary to make the digitalization process in healthcare a success at their place? 15 out of 21 answered they wanted support or help at their work place. (This question was not asked in the other groups.) In Vellanadu, when I visited the place, they wanted support and help and from what I experienced, they also needed it. In general terms we think of support in IT as help with installation of computer equipment or help to fix problems we have not enough competence to solve on our own. Support can be local or external. The answers from my informants changed between “Support”, “help” and “support and help”. In this context I interpret the answers the way that they wanted support when their computer devices broke
down, but a stronger preference was help at the work place or “somebody to turn to” when it was needed (See section 2.3). In the questionnaire this group also have answered they needed additional training from one week to six month to operate the software independently (See section 5.2), which strengthen the view that they wanted work place learning. During the first year of the project, HISP Kerala realized the need to build “master trainers” and “HMIS champions”. At the training courses health staff who had the potential to become a super user because of their interest and ability to understand and communicate were identified and asked to take further training with the facilitators (Igira et al., 2010). Thus, providing overlearning to super users (Karuppan & Karuppan, 2008). During the second year of the project, the system with master trainers made it possible to initiate training in the health facilities. The Kerala coordinator addresses some reasons for the transition. The costs of hiring computer labs and training centers were high. Health staff did not have to be taken out of their work and busy schedules. And finally, “workplace learning made visible concrete outcomes to users” (Igira et al., 2010). It seems that the remark confirm an experience that it was difficult to transfer learning from the training session to the work place situation. In 2-3 days the courses was filled with too much to learn for an average health worker. Below I will discuss differences and similarities Between the Kerala project and the Zanzibar experiences.

6.5.1 Zanzibar/Trivandrum

The two projects are similar in the way that an integrated HMIS with monthly electronic reporting was introduced and that health workers had not reached the desired skill level in the initial training. The aim with both projects was not only to learn operational use to run the system, but learning should also lead to change in the outcome of health management, “HMIS for planning and monitoring of service delivery” (Igira et al., 2010). Though, the dimension of the projects was quite different. In Zanzibar three districts with 12 clinics were selected. In Kerala the activities involved all 14 districts with many stakeholders. Due to the amount of people the training was organized in much larger groups than in Zanzibar. As the time limit to switch over to online reporting was not far away, it is likely that the project in Kerala was pressed on time. To secure how to manage to start the online reporting in numerous facilities it became urgent to identify super users/master trainers and HMIS champions as soon as possible. Due to the amount of people and clinics, it was important to recruit them locally since teachers or external support did not exist in that scale. Identified super users were trained by facilitators who were not health people, but IT educated who had learned about
health information and HMIS. The take-off for the online reporting became a situation of learning by doing, and from the experiences made in the process, actions were taken subsequently. While in Zanzibar (see chapter 2) the actions where planned in beforehand and the initial training was integrated with in-service support. I have not found this to be the case in Kerala. During the second year, in-service in the facilities was initiated. The system with super users had been established, and the number of facilitators was increased from 2 to 4 each district, which was planned and possibly gave the facilities better room for training at work. With the external training it was expensive to hire computer labs, health staff had to be taken out of work and one may question the effect of the training when returning to the workplace, which I have discussed above in the thesis. Those arguments might have been compelling factors for the transfer from training outside workplace to in-service training. In the questionnaire I found at one training session that 15 out of 21 health staff wanted training with help or regularly refreshment at the work place. This attitude may indicate that health workers prefer in-service training and motivation for this kind of training are high. At the district level monthly analysis and data quality checks using DHIS were introduced according to Kerala coordinator. They request facilities to make corrections and provide justifications on inaccurate and incomplete data reported to them. The picture is similar to Zanzibar at district level. But to evaluate at level 4 according to the Kirkpatrick framework, organizational change is needed. At Zanzibar they were not able to use data analysis to perform organizational change at district level.

6.6 Communities

To understand how learning takes place between people in an organization, it may be of help to use the framework of Wenger (1998), Communities of Practice (See section 2.2). Wenger held that communities are everywhere in society and most of us are member of at least one community, not necessarily at the workplace only. The Actor Network Theory (ANT), another perspective, argues that society and technology can be seen as networks where both human and non-human actants play a part (Latour, 2005). In the process of training described in this thesis which is a social process it will be more of interest to try to identify the communities that formed the process and the members representing them. Who were the brokers and what influenced the area for potential learning? The participants at the courses
were health staff and managers responsible for administration and health services. The minimum staff pattern according to Indian Public Health Statistics (IPHS), are 2 persons in sub centers, 15 in PHC and 25 in CHC (Directorate General of Health Services, 2006; WHO). Some of the personnel are support staff. A chauffeur probably does not need training in how to use DHIS2 because he will not be responsible for reporting and analyses of health data. The facilities are numerous and so are the total numbers of health workers. The management is responsible for reporting. The role of block coordinators has traditionally been block management and tasks connected to that. Today the role of block coordinators have changed towards responsibility connected to data reporting and collection of data and training of people on block level and must be considered part of management. The facilities form communities with common domain and practice in health. Inside them it is likely that more communities can be identified between health workers, support staff and the sub centers vs. their PHC.

The HISP organization in Kerala forms a different community. They represent IT that knows about health information and health management. HISP has developed DHIS2 and the health management system possible to be ran by the software. They have competence on conceptual level on how this can be done. The facilitators are IT educated specialists hired by HISP. The second year they will count 56, four in each of the 14 districts in Kerala. They are widespread all over the state, but might as well form a community as they have a common agenda. They are responsible to get the HMIS up and go at the facilities in the districts, and they help with training. They will have regular contact with the clinics and report to HISP Kerala. The district coordinators are IT people as well but on a lower level. While the facilitators have their focus on facility level, DCs coordinates the HISP activity in the district. They are responsible for training courses and have some contact with the clinics. It is not clear to see if their common agenda is strong enough to form a community or if they have some contact points between the districts which make a relationship between them.

In a study of health management information systems Kaasbøll et al. (2010) pointed out domain, technology and management practices as the three subject matter areas. Corresponding to these areas four practices were identified:
• Users. In the case we are discussing health workers at the facilities who have health as primary domain of work.

• Information officers. They are not IT professionals, but use IT as their main tool and are experts on information in their field and potentially they often develop into super users

• Computer specialists and IT companies.

• Super users

Inside the health facilities IT departments and computer specialists will hardly be recognized. IT companies play an important role as vendors towards HISP and the facilities. Since technical support and installation is outsourced, the HISP office and the clinics became strongly dependent on IT companies. My findings confirm that dependency. If something wrong happened with a computer, the facility was stuck and they had to use the IT vendors as a lifeline for support. The implementation process was large scale with many stakeholders. Due to that it is possible to see the IT vendors and companies as communities. Wenger held that boundary interactions takes place when members of different communities participate in common activities (Wenger, 1998). The training courses are a relevant example of boundary interaction where people from different communities participate in common activity. According to Wenger, boundary objects are intermingled among the communities and make sense in more than one of them. In this context it is represented by the software they were supposed to learn. The last aspect is brokers. They come and go between the communities and know them well. Thus a broker is able to communicate knowledge back to his own community. But who were the brokers between the IT and the users? The facilitators and their IT competence are on conceptual level. To be able to work in the districts they must know about the clinics and learn their practice and culture. A facilitator put it like this: “First we have to start with patience. Then we have to imagine how they are willing to catch up with the technical term. The whole idea is to computerize a manual process”. The approach of the facilitator must be supportive towards the clinic and the health staff. The activity forms a boundary interaction between the clinics and the facilitators, with HMIS as a boundary object. The facilitator takes the experiences back to HISP so they can be adjusted and give better training and support. Between the IT Company and a clinic it is possible to identify brokers if the IT person is not a new one from time to next. The IT person will be acquainted with the
management, the users of the system and the condition of the system itself. The users of the system have "somebody to turn to" who can help with a problem. The role of a block coordinator is also possible to identify as a broker role. In the block he is a person with good overview. It is likely that he knows several communities in his area and that he will be involved in contact with IT Companies as well. He will move among the communities and exchange experiences. As he has taken upon the role of health reporting and training, he can play the role of a super user as well. The broker roles I have identified and discussed above show how potential learning can take place when communities meet. See figure 6.1.

![Diagram](image)

**Figure 6.1** the interaction between IT and health communities in Trivandrum.
7 Conclusion

The research in this thesis has aimed at evaluating user learning among health workers when implementing new software in a HIS in Kerala. From literature it is known that it is a challenge in making HIS not to fail in developing countries and little research is known to bring a clear understanding of what kind of user competence is needed to make HIS a success. By following the training process among health workers the achievement in this thesis have been to find what are the most important factors influencing success and failure in building competence in a user learning process. This aim is deduced from the following research questions:

1) What were the results of the training and support? How did the results compare to the aims?

On base of a memorandum of understanding from 2008 between the Health Department and HISP India, an initiative was taken to scale up to online reporting using DHIS2 in all 14 districts in Kerala. A result was that health staff belonging to Health department was given initial training to be able to switch over to online reporting. HISP Kerala was given the responsibility to carry out the training which took place in training centers and computer labs. Because of the great number of people this was a large scale project. It was expensive because people were taken out of their jobs and computer labs had to be paid for. In the implementation process the content of training aimed to go beyond merely learning of DHIS. The competence areas indicate the aim:

- Concepts of health information and health information systems
- Operational use of DHIS to address lack of computer literacy
- HMIS (Health Management Information System). Information for action.

From answers in the questionnaire a majority answered that they needed more training than given at the course to operate the electronic reporting independently after the course. They needed refreshment training differing from one week up to several months depending on who gave the answer. Then, one may conclude that most attendants did not learn using the software, but they learned about the software. As they had been given the chance to try operational use and had been acquainted with the concepts the chances to recognize and pick
it up more easily in their work practices at the workplace was present. From my finding their 
attitude was positive to the implementation, and during the courses they experienced potential 
benefits with use of the software. They learned that by using the software they saved time, it 
was easier to report, reduced their workload and made their job easier. Some also got the 
notion of better quality on data. We must take in account as well that the competence level 
and ability to understand IT concepts was different among them. In a group of 30 people it 
differ a lot, illustrated by answers from two persons in the questionnaire; one estimated the 
need for refreshment training to a week vs. the other person who answered the need was six 
month. This observation evaluates on level 2 in the Kirkpatrick framework.

In field trips I had the chance to observe if the attendants were able to practice what they had 
learned in a work place situation, which evaluates on level three in the Kirkpatrick 
framework. At a block hospital they had a computer and software installed but the manager 
who was responsible for the equipment had forgotten the password both to computer and 
software. It seemed that the manager was the only person who had access to the system. 
Hence, the system was not in use until external support came to help. It is not unlikely that 
among the employees it could have been possible to find people with capacity to share the 
responsibility, but as far as I could see no other persons had access to the system. If one or 
two others had been given the trust to share the responsibility, the problem could have been 
solved locally. It is to say that this was not a problem in all places. In a group interview it was 
reported that everybody who used the system knew about username and password even 
though it was the supervisor who had the responsibility. They were comfortable with the 
situation.

From the pilot project taken up by HISP in 2005 in one facility, implementation was extended 
to 19 CHCs. Managers and Medical Officers (MO) was given initial training (See section 
1.3.2). Hence, there existed an environment with experience from implementation and 
competence in computer and software use at facility level in Trivandrum District. An 
important difference from the former implementations to the last one was the extension to all 
14 states in Kerala and the switch-over to online reporting up to state level with a radically 
modified software version. This time all health staff was given initial training. I will hold as 
positive, the democratic attitude that made health workers from different levels able to 
participate, not only medical officers and management. During the first year super users and 
master trainers were identified at the sessions.
2. Why did these results come about concerning project activities and how did social, political and cultural elements influence competence building?

Many of the attendants were not IT literate before the training. The computer training was important for them, but in frustration they argued that the computer part was too limited. This attitude seemed quite massive from my findings. A user who touches the computer for the first time at a course, drop off easily when it comes to tasks which the user finds complicated. At the courses there was not an instruction sheet to everybody according to a conceptual training style (Gagné & Briggs, 1974). Lack of instruction sheets resulted in reduced possibility to progress in exercises by themselves and they got heavily dependent on the teachers who had to run faster and faster during the day to help with the tasks.

The length of the training sessions is another aspect. In a study from Zanzibar the initial training outside workplace was two hour sessions. In the GCN surveillance they found that too long sessions will reduce the chances to grasp what happened during the day (Finnegan, 1996a). In Trivandrum the sessions lasted a whole working day. In the heat in the afternoon people got tired and less concentrated and it was tempting to take a nap if stuck and not able to follow. This observation evaluates on level one in the Kirkpatrick Framework.

When it comes to the possibility to train, when returning to the facility; it depends on existence of installed software to work on. In many facilities the new software was not installed and users had to wait for weeks before they could practice what they had learned. In some places the computer did not work. Karuppan and Karuppan (2008) and the GCN surveillance (Finnegan, 1996c) argue that a couple of weeks was enough to forget what you learned at a course due to the time gap (Karuppan & Karuppan, 2008).

Gender and age are aspects which seem to influence competence building. Due to the policy of the left wing government, women’s position is better in Kerala than in many other states in India. Nevertheless, training is even harder for female health workers, as they take care of the children and must cook for the family after coming from work. The government in Kerala is doing heavy efforts to introduce IT in schools and universities. Young people are used to computers from school, but a person on 40 has not taken part in the computerization process in the school system. They are considered old in an IT context. It seems there is an age gap
existing on this level and a challenge when scaling new technology. Seen from the perspective of developed countries electronic devices are cheap in India, but for an Indian it will not be felt like that as the income level is low. Among my respondents 52% of them reported to have a computer at home. One of them replied to me “That is right. Many have a computer, but most of them don’t know how to use it”.

3. How do these results compare with other experiences?

Health information systems and HMIS were concepts more or less unknown to most health workers. During the training process, HISP wanted to bring the focus from collecting data for reporting to a consciousness of converting data into information for better decision making and better health services. From my findings it seems that this was too ambitious to overcome in three days. Many argued that they were not so interested in the health part since they were health staff and knew health. They expressed that operational use to be able to do tasks in DHIS was what they needed for their work and they felt “this had gone in a very speed way”. I found that the participants responded positive to the implementation and the software. They argued with the benefit in using it.

-Information for action or information for reporting?

According to Technology Acceptance Model Davies (1989) perceived usefulness is the strongest factor for acceptance of new technology. From the answers in the questionnaire I analyzed the arguments for benefits using Davis’ items in the table. I made two categories targeting different attitudes of usefulness. Category one addressed arguments similar to “software is a benefit for reporting”. Category two addressed arguments similar to: “software is a benefit for health management and for decision making”. I found that 90% of the arguments belonged to category one (See section 6.3.1). It is also important to know what item is the strongest inside a factor. The strongest item from the perceived usefulness table was “Makes job easier” (See section 6.3.1). The number of informants is few, though it indicates that health workers accept use of the software because they expect a benefit in report work as it makes their job easier. It also indicates that benefits users expect from new technology can be addressed by different sets of attitudes.
Perceived usefulness or Co-workers’ influence

The technology acceptance model (TAM) has for long been accepted as a well-documented model and perceived usefulness has been accepted as the strongest factor for user acceptance. (See section 2.6). The finding in the Gallivan et al. study contradicts the technology acceptance model (Davis 1989). They found that coworkers’ usage and perceived quality of training was the most important factors. From the empirical material in my research I can hardly see that it is possible to come to the same conclusion as in the Gallivan et al. study. But it is possible to see that coworkers’ IT use influence other users. The implementation of DHIS is meaningless if not seen in a social context. On different levels health workers use information from the system and enter information into the system. In this way users of the system will be influenced by what other users or coworkers who use the system do. This has also to do with quality. If coworkers use the system to generate poor data the information that is created will be poor as well and the decisions that is taken on base of the information. In a study from Kerala it was pointed to data manipulation by field workers due to pressure on them to achieve their targets from higher level (S. K. Puri et al., 2009). In the end it is the people who are targets for the decisions that will suffer. The facilities are communities in the district with an interaction between them. Decentralization can be a result of online reporting and the new software and increase the interaction between facilities. It is likely that the focus on use of the system will increase as well. At the courses health staff meet coworkers from own community and from other communities and thus were influenced in mutual experiences concerning the software as a boundary object. When returning to the facilities the experiences may influence the interactions further on.

The contradictions in the research in this area point to the fact that it is very difficult to measure exactly what is the strongest influence for user acceptance in general terms. The different views also trigger the need for more research on this issue.

In-service support.

In this thesis it has been possible to evaluate on three levels in the Kirkpatrick framework. Level four was not possible to measure since I did not stay there long enough. The action research study from Zanzibar, Ngoma et.al. (2008) discuss experiences from user training to
in-service support. The Zanzibar project was able to describe changes in organizational performance as they had the opportunity to evaluate on all four levels. The research from Zanzibar found that a combination of initial training followed up by support visits at the workplace monthly for each next three months gave results. Health staff in Zanzibar who participated at the initial training sessions took the role as trainer to their peers. Potentially, the role as a trainer was a way to build and identify super users. When data was measured at clinics with good attendance both at initial- and follow up training, the result showed that useful data had increased distinctively. In Trivandrum external training sessions were transferred to in-facility training after the first year. During the first year super users were identified, but in-facility training was not initiated, neither support visits regularly at the workplace. The comparison address differences in the time gap in the scaling process from the two projects.

**Final reflections and future research**

From my experiences some final reflections about future research could be of interest, and I could raise the question: What would I have done next time or in a second research project to follow up the scaling process? I think it would have been of interest to visit some of the clinics from which health staff participated at the courses and see if it was possible to evaluate on fourth level in the Kirkpatrick framework. Fourth level evaluates if there has been any organizational change after the initial training. It would have been possible to do this by comparing the amount of useful data from the period of my staying with the increase of useful data after the two year period of initial training. By doing this evaluation it would have been possible to evaluate if any measures had been taken to strengthen health management and increase consciousness about HMIS principles and concepts (see section 1.3.3).

It would also be of interest to find out in what way the initial training had improved health workers’ ability to apply what they had learned in a workplace situation and what was the health workers opinion about it afterwards? The initial training was an expensive large scale project. The second year the training moved to in-facility training and a system of super users were built. If the initial training had been much more limited and the in-facility training had started earlier and in a bigger scale, had it been possible to say if an altered strategy would have influenced the result in a different way? I had no chance to find out in what way super users were organized and how they worked among their peers in the facilities which are of importance and of interest to find out in future research.
In the beginning of this thesis (Section 1.4) Kaasbøll et al. (2010) held that little research is known to make a systematic account on what kind of user competence is needed to prevent information systems to fail. In this thesis I have discussed some of the problems related to my findings. As I see the contributions in literature from this field a bit fragmented, it would be of help if future research aimed at giving an overview of what is working and what is not when competence building takes place in developing countries.
References


Correspondent, S. (2009, February 8). 4.071 schools to get a laptop each, IT, The Hindu.


Lungo, J. H. (2008). *Design-reality gaps in open source information systems development: an action research study of education and healthcare systems in Tanzania*. (nr. 808), [Department of Informatics], Faculty of Mathematics and Natural Sciences, University of Oslo, [Oslo].


Appendix

Appendix 1:

Questions for preparation to the first training session:

Meeting with block coordinators in connection with training on Monday February 9.2009

Some questions:

- What is a block coordinator? CHC Block is a unit in the district.

- (Hvilke kategorier er under opplæring her?) From CHCs and Sub centers in the same block.

- Do you expect health workers who participate in training to stay along for a long time or is it common that they change work and new one must be trained all over again?

- How long will the training last? (The courses last for three days usually)

- Is this training sufficient enough? He said no. They would have needed another two days to learn it properly.

- Concerning DHIS, what do they experience as the most important difference in their work before and now?

- What are their expectations of the new system? Do they experience this difficult to learn? Evt. What is experienced as difficult and problematic? Communication problems? Treats?

Does the new DHIS software fulfil the expectations of what is needed in their work?

- If they could choose, would they have stayed with the old system and improved it or is this the only way to go?

- What do the users see as goals for themselves?

(May be it is an idea to ask both the users and the coordinators the same question.)
Appendix 2

Questionnaire 1:

Hello!

My name is Steinar. I am coming from the University in Oslo/Norway. I am writing a master thesis about learning in the implementation process of the software you are trying to adapt. I am happy if you will help me with this and answer the questions below. This is confidential, no names mentioned. Only for statistical use in my thesis. Just make an X after your answer or explain in short terms. Use another sheet if you need to.

Thank you!

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you used a computer before participating in this course?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, do you feel comfortable with using a computer?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have the possibility to use a computer at home?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If not, do you have a possibility elsewhere? In which place?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you consider the DHIS2 software difficult to learn?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, what is difficult in your opinion?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Do you think the implementation of the software and the training process will better quality of health work at your place, or the opposite? If better, can you explain in what way?
Do you have any personal goals for the training? Using your imagination, how much training do you think is needed before you will use the electronic report system independently without considering the traditional paper forms?

Appendix 3

1) Modified questionnaire for training session:

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Have you used a computer before participating in this course?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Do you consider it difficult to use a computer?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Do you have the possibility to use a computer at home?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Do you have a good possibilities to train with a computer at the PHC?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Do you consider the DHIS2 software difficult to learn and use?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, explain the difficulties if you want.</td>
<td></td>
</tr>
<tr>
<td>6) Will you be able to manage computer and software after this course?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Do you have a personal aim for this training (computer and software)? Can you explain?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8) In general, what kind of means or actions do you consider necessary to make the electronification process in healthcare a success at your place? (support and help etc..)

9) Do you think the DHIS2 software covers your needs in your work? If not what is missing?
10) Using your imagination, how much training do you think is needed for yourself before you are able to use the electronic report system independently without considering the traditional paper forms?