The critical issues affecting the introduction of Health Management Information Systems in developing countries in Africa

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"*Change is hard because people overestimate the value of what they have, and underestimate the value of what they may gain by giving that up*."

— James Belasco and Ralph Stayer
Flight of the Buffalo (1994)

Management summary

In the countries of Tanzania, Mali, Zambia and Uganda information systems are being introduced in hospitals in the form of health management information systems. But with a lack of relevant research done in these countries about the introduction of technologies like information systems there is not much to go by. This research will therefore be done in support of the belief that a convincing and operational framework for assessing health system performance is vital for the work of governments, development agencies and multilateral institutions.

The international Institute for Communication and Development (IICD) works in 9 countries in Africa and Latin America. IICD has since 1998 been supporting partner organizations with the introduction of Information and Communication Technologies (ICT) for development and poverty alleviation, amongst others in the health sector. For the past years they have been supporting projects in Mali, Tanzania, Uganda and Zambia implementing systems into healthcare.

IICD sees the importance of a decentralized system for health information management and wants to take stock of the achievements of projects that have been implementing information systems, gather experiences and lessons learnt and identify challenges for introducing and using information system (IS) in healthcare.

This is why together with IICD this research wants to identify the issues that have to be considered when implementing information systems in the form of a health management information system in hospitals on the district level in the countries supported by IICD. This, in support of the belief, that a convincing and operational framework for assessing health system performance is vital for the work of governments, development agencies and multilateral institutions.

According to the definition in this research a health management information system (HMIS) is designed to integrate data collection, processing, reporting, and use for the improvement of patient health services, effectiveness and efficiency through better management of patient data at all levels of implementation. The output of an HMIS may vary according to the level on which it is being implemented. A HMIS consists of two subsystems: a patient management information system and a hospital management information system (see figure 1).These systems incorporate all the patient data and hospital data with the use of information processing tools consisting of computer systems based on various hardware platforms and software products offered by (several) vendors.

The factors found which influence the introduction of a health management system were in this research categorized into a framework based on van Irsel(?), Kuhn et al.(2001), Kiu kim (1990), Gladwin et al. (2003), Berndt (2001) and Chetley et al. (2006) and own interpretation and consist of the factors: objectives, planning and strategy, stakeholders roles and responsibilities, social and cultural aspects, technology, human capacity development, participation and awareness and financial aspects and sustainability. This research however also recognizes that even though an attempt was made to categorize the different factors and their issues it is almost impossible to do so due to issues and factors which may overlap each other.

A framework was then developed into a tool to help identify the issues and their corresponding factors in the documents available at IICD. The tool can also be used to assists the project manager when implementing a new information system in a hospital. The use of phases in the framework helps to categorize a project and to analyze the projects which have already been implemented. The phases help to discern the different issues and factors which are of importance to the phase at hand.

By then analyzing the documents and interviews held at IICD and based on the management and evaluation (M&E) data the critical issues affecting the introduction of a heath management information system (HMIS) in the countries of Mali, Uganda, Zambia and Tanzania were then analyzed.

From the findings this research concludes that the most critical issues affecting the introduction of an HMIS in the countries of Uganda and Tanzania can be attributed to:

Stakeholders' roles and responsibilities

Because the project is dependant upon the stakeholders for implementation and use of the project, the needs of these parties and their roles have to be explicitly documented and have to be taken into consideration when designing and implementing the HMIS.

Social and cultural aspects

The established roles tend to be very hierarchical divided; the HMIS brings change to this which is not appreciated by all the people involved. It is crucial to give doctors and medical staff the recognition for their important role in the organization.

Technology

These problems concern a lack of standardization, electrical power and backup of the system. A good backup for the systems is a problem in all the cases leaving computers prone to viruses. There is also a need for alternative ways to produce electricity: shortage of energy hinders continuous activities and delays the implementation of projects many times. The lack of money hinders the introduction of alternative ways to produce power.

Human capacity development

Overall lack of computer literacy and brain drain on local level is a critical issue because most of the people - especially in rural areas - have never used a computer. Training as a part of capacity development is also an element of awareness. From the analysis can be concluded that even though the training being received is of good quality, not enough time is given to training. Data misinterpretation due to the lack of the right capacity is a problem which is experienced in all developing countries. Training should be a continuous process to change people from what they are used to, to new technology because it is very hard to let go of previous institutionalized practices.

Participation and awareness

Many stakeholders are not aware of the goal of the system because of the modular introduction of the system not all stakeholders are being involved. Consistent awareness raising in the form of better information and training will help them to better accept the system. Continuous education also helps people to understand how the system works better.

Financial aspects and sustainability

In all the cases analyzed no long term financial plans were available in the documentations. Clear analysis of the costs is still needed at the beginning of the projects to indicate the budget needed for a project, because costs often turned out to be much higher then expected. Running short of money from the donors is a common problem and can jeopardize the entire project because this has also an effect on the sustainability of the entire system.

Based on these findings this research therefore recommends the following actions to be taken for the cases which are now in implementation and for future projects which may encounter the same problems:

- Make a clear definition of the new roles and responsibilities.
- Use standards for software on the national level for better data and information exchange.
- Use of alternative forms of power supplies like solar panels should be exploited and encouraged.
- Invest more time in the trainings for the data interpretation and management (2 to 3 weeks) and more on the job training.
- Increase participation and awareness by showing the personal benefits that such a system may bring to them and to the hospital they are working at.
- Use long term financial planning to reduce insecurities especially for after the main donor is gone.
- Finally, it takes time to change the way people work, so give people the time to get used to these systems.

Preface

This is my final thesis written for the program Business Information Systems from March until September of 2007.
This research would like to thank the following people for all their wisdom, patience and help…..

Frans Neuman and Judith Veldhuizen who were my mentors at IICD,

All the country managers at IICD and project managers abroad who did not hesitate to assist and who helped make this possible,

All the consultants who were approached and who were eager to share their knowledge and experiences,

Toon Abcouwer my mentor at university,

And everybody else who contributed to this research in one way or another, you know who you are ….

This will be the cherry on top, celebrating an ending and a whole new beginning.

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1 Introduction

1.1 Background

The health system in developing countries has changed drastically in the last few years from a centralized system with hierarchical reporting to a decentralized system. Health systems in a centralized system only used to focus on morbidity and mortality reporting from individual health units to the district and national level (Gladwin et al., 2003). With the introduction of a decentralized system there has been significant change, emphasized by the Ministry of Health (MOH), through the implementation of health management information systems (HMIS) which emphasize the use of information at the point of collection. Through decentralization more freedom and responsibilities are given to each point of care meaning that more skills are demanded of primary health care managers, concerning the data and information handling at all levels of a health care system on a global level (Gladwin et al. 2000).

To provide optimal care, healthcare institutions need timely patient information from various sources at the point-of-care, and need a comprehensive, complete and fully functional system to fulfil all these needs. One way to achieve this is through the use of ICT in health care. ICT is defined in this research as a tool that facilitates communication, the processing and transmission of information and the sharing of knowledge by electronic means. This encompasses the full range of electronic digital and analogue ICT, from radio and television to telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the Internet, but excludes the non-electronic technologies. However this does not lessen the importance of non-electronic technologies such as paper-based text for sharing information and knowledge or communicating about health (WHO, 2004).

The introduction of information systems in healthcare knows of failures and successes. What has become apparent is that the introduction of such a system many times fails because of issues related to the organization itself. Kuhn et al. (2001) allocate the success rate of a project as being 80 percent dependent on the development of the social and political interaction skills of the developer and 20 percent or less on the implementation of the hardware and software technology. In developing countries this means that issues like the national and organizational culture play a big role. Another issue is the loss of individual benefits like extra income. The introduction of technology would also mean that illegal money making and fraud would become visible. These are some of the issues that play a role in developing countries which have a big impact on the successful introduction of information systems in hospitals in these countries.

The World Health Organization (WHO) identified the district-oriented health information systems as a priority and noted that ‘weakness of information support is acknowledged by most member states as a persistent obstacle to vigorous and objective management’. Efforts made to strengthen national information systems have often produced little improvement and have sometimes made the problems worse (Gladwin et al. 2003). This is why there is a need in low income countries for research on the development of practical health information systems to guide policy and management decisions and for improvement of the existing systems. This will be essential to achieve the new health information system on all levels.

The International Institute for Communication and Development (IICD) works in 9 countries in Africa and Latin America and has since 1998 been supporting partner organizations with the introduction of Information and Communication Technologies (ICT) for development and poverty alleviation, amongst others in the health sector. For the past years they have been supporting projects in Mali, Tanzania, Uganda and Zambia implementing systems into healthcare.

IICD also sees the importance of a decentralized system for health information management and wants to take stock of the achievements of projects that have been implementing information systems, gather experiences and lessons learnt and identify challenges for introducing and using IS in healthcare.

There is also still much confusion in literature about the definition which should be used for the HMIS abbreviation. What it stands for and how and when it should be used properly seems to be an international problem. Starting with a clear definition of the HMIS will also be a goal of this research. Therefore meaningful, comparable information on health system performance and the key factors that explain these variations can strengthen the scientific foundations of health policy at the international and national levels.

This is why together with IICD this research is hoping to find a suitable definition for an HMIS and identify the issues that have to be considered when implementing information systems in hospitals on the district level in the countries supported by the IICD where HMIS are being implemented. This, in support of the belief, that a convincing and operational framework for assessing health system performance is vital for the work of governments, development agencies and multilateral institutions.

1.2 Research question

This research is a qualitative desk research based on multiple case studies of projects which have been implementing health management information systems at IICD. It is a qualitative research in which existing literature, documentation and interviews will be used. The analysis has to lead to recommendations for improvement of existing activities and support the development of future health information system projects. The problem statement in this research is:

What are the critical issues affecting the introduction of a health management information system in hospitals on the district level in Zambia, Uganda, Mali, and Tanzania?

Some of the sub questions through which this thesis will try to find an answer are:

- What is a Health management information system?
- How does the introduction of an HMIS affect a hospital?
- Which issues and factors influence the successful integration of an HMIS in existing work process in hospitals?

1.3 Research relevance

In the countries of Tanzania, Mali, Zambia and Uganda information systems are being introduced in hospitals in the form of health management information systems. But with a lack of relevant research done in these countries about the introduction of technologies like information systems there is not much to go by. This research will therefore be done in support of the belief that a convincing and operational framework for assessing health system performance is vital for the work of governments, development agencies and multilateral institutions.

This research will also introduce a framework that assesses these issues to add to research that will help in the introduction of health management information systems on a more international level. Through this research organizations will gain insight in the issues that may arise with the introduction of IS in developing countries. This will benefit new organizations who want to introduce such a system in their organization and help existing ones by making recommendations for improvement.

The structure of this thesis will now be shortly described. This thesis will continue in chapter 2 with explaining what an HMIS is. In chapter 3 the issues will be described and 4 the method used are described. In chapter 4 an analysis will be made of HMIS projects being implemented in developing countries. The results of the documents, interview and management and evaluation (M&E) analysis will be discussed in chapter 5 through 9. Finally in chapter 10 the conclusion followed by the recommendations and further research.

Health Management Information Systems (HMIS)

Like any other system based on ICT the introduction of HMIS has an affect on the entire organization, and the organization in this case being an entire hospital.
In this research we will be looking at this influence based on the socio-technical approach. In this approach used by Winter et al. (2001, 2003) and Haux et al. (2004) "*a hospital information system is defined as a subsystem of a hospital, which comprises all information processing actions as well as the associated human or technical actors in their respective information processing role*."
A socio technical system therefore is a system where humans and machines carry out specific actions following established rules.

So when introducing systems to maximize communication in a hospital you have two things to consider: a human part and a machine or technical part. Successful implementation is dependant on how these two parts of a hospital to handle change. Realizing that technology is the enabler and not the driver should put more emphasis on the importance of people working in these newer information system forms.

This chapter will start by introducing the concept and definition of a health management information system. The analysis will be done by first describing the use of ICT in health care (2.1) then introducing the definitions used for information systems in health care based on literature findings (2.2) and then finally defining the HMIS (2.3) based on these findings and concluding with the research's own interpretation and final view of the definition of an HMIS (2.4).

1.4 ICT in healthcare

To provide optimal care, healthcare institutions need timely patient information from various sources at the point-of-care, and need a comprehensive, complete and fully functional system to fulfil all these needs. And one way to achieve this is through the use of ICT in health care (WHO 2003).

ICT is defined in this research as a tool that facilitates communication, the processing and transmission of information and the sharing of knowledge by electronic means. This encompasses the full range of electronic digital and analogue ICT, from radio and television to telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the Internet, but excludes the non-electronic technologies. However this does not lessen the importance of non-electronic technologies such as paper-based text for sharing information and knowledge or communicating about health (WHO, 2004).

The use of ICT into existing health systems according to Chetley et al. (2006) has helped to improve the delivery of health care in a number of ways. These include the use of telemedicine to improve diagnosis and enhance patient care, improvements in the continuing professional development of health workers and better sharing of research findings through e-health, and the use of health systems as an effort to extend the reach and coverage of health care to make an impact on specific conditions.

Telemedicine

Telemedicine is considered a powerful tool for improving health care delivery which has been successfully implemented in pilot projects in many countries. It can improve diagnosis and treatment of specific conditions dramatically but has proven to be very costly. Telemedicine is an implementation which requires high bandwidth and sophisticated remote equipment and has only proven practical in cases where money is not an issue or as an alternative to high-cost air transportation and lodging. Used wisely, however, telemedicine can be a cost-effective method that richer countries can employ to aid capacity building in the health care systems of poorer countries (Chetley et al 2006). In Africa, for example, the use of telemedicine has helped people in rural areas by saving money and time for travelling and long queuing lines. Clinical staff can now sent patient information by email to specialists in the cities and symptoms can now be analyzed a day ahead from a distance.

E-health

E-health is the use of emerging information and communication technology, especially the Internet, to improve or enable health and healthcare. This includes both clinical and non-clinical sectors and includes equally individual and population health-oriented tools. E-health is the organization and delivery of health services and information using the Internet and related technologies. This can be used to improve health care locally, regionally, and worldwide by using information and communication technology (Chetley et al 2006).

E-health has helped isolated health workers involved in primary health care who have little or no access to up to date information and opportunities to exchange experience with colleagues. Making use of new technologies and better use of existing technologies is beginning to improve this situation. Using personal digital assistants (PDA) have enabled health workers in remote settings to gain access to information, capture, store and share important health data, and link to the experience of other colleagues to improve their practice and the outcomes for their patients.

Health systems

Health systems consist of all activities whose purpose is to promote, restore or maintain health. This includes, but is not limited to, the preventive, curative and palliative health services provided by a health care system (Chetley et al 2006). Healthcare systems differ from all other systems due to the complex collection of data types used. In health care, for example, the automation of patient records must deal with a variety of data requirements and specification problems due to things like the complexity of the medical vocabulary, the codification of biomedical findings, and the classification of health conditions and interventions. The difficulty lies in the fact that this

classification can include a huge number of possible combinations. In South Africa health systems, in the form of, for example, district health management systems (DHMIS) help to gather data systematically which can be used to identify public health issues. It enabled all the public clinics to collect information on national health indicators.

ICT is the basis for the development and operation of information systems and enables the creation and application of knowledge. This consists of different levels of sophistication and complexity of information systems, within the health care system for: patient records, tracking of disease prevalence, monitoring drug supplies, maintaining ordering systems for supplies, and billing procedures therefore all benefit from the use of ICT. (Chetley et al 2006).

1.5 Types of information systems in healthcare

The aim of a health information system is to improve the ability to collect, store and analyze accurate health data, service delivery efficiency, improve data accuracy, effectiveness of intervention, increase accountability and learn about trends. The objective of the system is to record information on health events and check the quality of services at different levels of health care. Few countries in the world today have effective and comprehensive systems in place to gather this data. These information systems used in health care, however, lack an unambiguous description of what an HMIS stands for. To give a few examples of the names being used to define these systems: the health management information systems (HMIS), hospital management information systems (HMIS), hospital information systems (HIS), hospital system(HS), health management system and these are only a few of what have been found. The confusion seems to lie in knowing the difference between a hospital and a health management system.

Hospital information systems

According to the found literature a hospital information management system or hospital information system or clinical information system is used in hospitals to assist the overall management of the health care facility through information about diseases and information about patient care (Kusabi et al. (?); Haux et al. (2004); Winter et al. (2001, 2003)) in terms of record keeping of patient information, accounting, HR management, asset management, stock management and knowledge management.
The task of a hospital information system is to support patient care and associated administration by providing

- Information, primarily about patients, in a way that it is correct, pertinent and up to date, accessible to the right persons at the right location in a usable format. It must be correctly collected, stored, processed, and documented;
- Knowledge, primarily about diseases—but also for example about drug actions and adverse effects-to support diagnosis and therapy;
- Information about the quality of patient care and hospital performance and costs. (Kusabi et al.(?); Haux et al. (2004); Winter et al. (2001, 2003))

Health information systems

Health Information systems or health management information systems are according to the literature systems used to collect, analyze, retain, retrieve and evaluate health information (Haux et al. (2004); Tan (2002)). The Who (2005) article on “Issues in health information’’ adds to this definition by stating that a health management information system incorporates all the data needed by policy makers, clinicians and health service users to improve and protect population health.
The goal of a Health Management Information System is to check quality by comparing perceptions of services delivered with the expected standards and to provide timely and accurate information leading to better health care planning and improved diagnosis and more patients getting access to health services for an entire country (Haux et al. (2004); Tan (2002)).

A health information system usually describes one of these several separate subsystems containing data (WHO, 2005):

- Disease surveillance and outbreak notification.
- Data generated through household surveys.
- Registration of vital events and censuses (births, deaths and causes of death).
- Data collection based on patient and service records and reporting from community health workers, health workers and health facilities.
- Programme-specific monitoring and evaluation (for example for TB, HIV/AIDS, and EPI).
- Administration and resource management (including budget, personnel, and supplies).

The function of a health information system is to bring together data from all these different subsystems, to share and disseminate them to the many different audiences for health information, and to ensure that health information is used rationally, effectively and efficiently to improve health action. A strong health information system is an essential component of sound programme development and implementation, and is a requirement for strategic decision making, providing the basis upon which improved health outcomes depend.

The difference between hospital information systems and health information systems has been defined by Haux et al. (2004). He states that such complexes or systems of processing data, information and knowledge in health care environments are called health information systems. The first difference is the level where the system is being implemented. A health management information system being on the national level shows that hospital information systems are just one instance or subsystem of health information systems. The aim of health information systems was and is as simple as relevant: to contribute to a high quality, efficient patient care. This aim is primarily centred towards the patient and towards medical and nursing care, the administrative and management tasks are then needed to support such care.

1.6 Defining an HMIS

The cases described at IICD as well as in other literature still seem very unclear of what HMIS or other abbreviations used stand for. Looking at the IICD cases in the countries of Mali, Uganda, Tanzania and Zambia can be concluded that there are several different definitions being used in these countries to describe information systems being used in healthcare. In Mali they seem to use HIMS which stands for hospital information management system. In Ugandan HMIS stands for health management information systems, in Tanzanian HMIS stands for health management information system as well as hospital management system and finally in Zambia they use health management information system also. When it comes to defining the goal and purpose of these systems these re in all cases the same being a system that helps to collect and generate data and information on patients, costs, performance of personnel, reporting etc.

Due to the lack of a clear definition this research will define an HMIS based on Kusabi et al.(?), Haux et al.(2004), Winter et al. (2001.2003), Chetley et al (2006) and Tan (2002) as a health management information system. This is because each definition differs from the other on the basis of level of implementation, type or sort of data which is being collected and definition used by the organization itself.

In this definition the health management information system can be on a district or national level and consists of data for policy and strategy its main goal is to provide timely and accurate information leading to better health care planning and improved diagnosis and more patients getting access to health services for an entire country. A health management information system will consist of two subsystems which define an HMIS a hospital management information system and a patient management information system.
The patient management information system will therefore deal with all the information related to patients like:

- Patient data
- Patient billing
- Patient treatments
- Patient prescriptions

A hospital management information system will be used to manage clinical information of the hospital concerning financing and logistics:

- accounting,
- record keeping,
- HR management
- asset management
- stock management

1.7 Conclusion

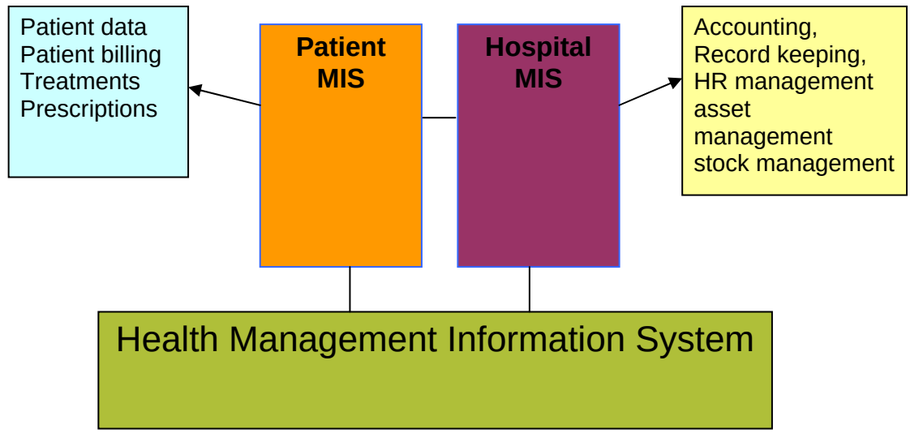

Figure 1: HMIS

A health management information system requires the monitoring of the health status of a population, by provision of services as the coverage and utility, drugs stocks and consumption patterns, equipment status and availability, finances, and personnel on a regular basis.
This research defines an HMIS as:

A system designed to integrate data collection, processing, reporting, and use for the improvement of patient health services, effectiveness and efficiency through better management of patient data at all levels of implementation. The output of the system varies according to the level of the data being gathered. A HMIS consists of two subsystems: a patient management information system and a hospital management information system (see figure 1).These systems incorporate all the patient data and hospital data with the use of information processing tools consisting of computer systems based on various hardware platforms and software products offered by (several) vendors.

Due to the extensiveness of including all these levels this research will only focus on cases where HMIS are being implemented on the district level.

2 Issues arising with the introduction of an HMIS

A hospital consists of various organizational units with differing tasks for various types of healthcare professionals. These units often tend to be in very different locations in a hospital. A good example would have to be the physician who sends a patient to a clinic who is then transferred to a hospital. Every time the patient moves to one place information about his condition is registered. This often leads to missing information and double registration due to the lack of cooperation between the different instances like the doctor, pharmacy, hospital and insurance. There is a visible gap between the information needed and the information exchanged. Critical patient information is often not available when and where needed and this makes the whole process take much longer.

One way to make this gap disappear is by providing intensive internal communication among organizational units and healthcare professionals as well as external communication (e.g. to insurance organizations, general practitioners, etc.). This suggests moving from healthcare to integrated care, meaning, the merging of hospitals and individual practices into larger integrated healthcare networks.
This is called a decentralized network of healthcare delivery by replacing hospitals as the only centres of care delivery (Bossert, 1998). The new hospital information systems have due to these changes taken in a much broader scope.

According to the article “Strengthening of health information systems Report” this is a report by the Secretariat of the WHO, the World health organization (WHO) has also acknowledged the need for better health care in developing countries. This organization focuses on combating poverty and hunger through better health. Introducing information systems into health care is one way they want to achieve better health. They set their own targets against which to measure progress in health and other dimensions of development. According to the WHO few systems in developing countries are effective because the available data often tend to be out of date therefore making trend assessment particularly difficult. And in these countries accurate health information is needed the most. This is why statistical, public health and biomedical knowledge and expertise are very much required.

According to the article the problem with this information is that it is haphazardly produced and used by institutions, such as health ministries, national statistics offices, ministries for labour, social welfare, planning and finance, the private sector, civil society, donors and development assistance agencies. With a vast majority of data producers health information systems have evolved following administrative, economic, legal or donor pressures and have been fragmented by the demands of disease-focused programs and the diversity of donor requirements and international initiatives.

This chapter describes issues which may arise due to the introduction of HMIS in organizations. It will start with a description of the varying factors which have been found in literature as contributing factors to the introduction of an information system based on ICT in an organization (chapter 3.1). In chapter 3.2 to 3.10 the issues that arise by the introduction of an HMIS which were found literature will be placed under one of these factors. The next chapter (3.11) shortly describes the phases which are important in a project and the different issues which depend on these phases. Then chapter (3.12) will then give an extensive overview of the way the issues are to be assessed while finishing with an overview of the stakeholders to consider (3.13) and a concluding chapter (3.14).

2.1 Factors contributing to the implementation of an HMIS

There are many factors contributing to the successful implementation of a health management information system. In this chapter a framework will be built based on the most important factors based on literature about implementations in Europe and the United States as well as in developing countries. Several authors have identified factors and issues contributing to the successful implementation of information systems based on ICT into a hospital. Based on van Irsel(?), Kuhn et al.(2001), Kiu kim (1990), Gladwin et al. (2003), Berndt (2001) and Chetley et al. (2006) a framework is created to help identify the factors affecting the introduction and success of HMIS in developing countries.

Realizing that technology in this case is an enabler and not a driver puts more emphasis on the importance of the people working in these newer information system forms and the impact these systems have on them and therefore the entire organization (Kuhn et al. 2001). According to Kuhn et al. (2001) the success rate of a project is 80 percent dependent on the development of the social and political interaction skills of the developer and 20 percent or less on the implementation of the hardware and software technology suggest that there are many social and political issues affecting the introduction of an HMIS. The way this research looks at this problem is through the introduction of a framework based on the found factors and issues.

The question which is considered here is: which factors and issues influence successful integration of an HMIS in existing work process in hospitals?

The difference between the researchers on which the framework is based lies in the fact that Van Irsel (?) and Kuhn et al. (2001) base their research on hospitals in Europe and the united states while Chetley et al (2006), Berndt (2001), Berg (2001) and Gladwin et al. (2003) draw from the experience of IS use in both the North and developing countries, but with a focus on applicability in developing countries to identify the most effective and relevant uses of ICT in the health sector.

The factors chosen to be incorporated into the developed framework for this research are, as said before, a combination of the different views found in literature and based on the idea by Van Irsel (?) and Kuhn et al (2001) that an organization can be seen as an open system which can be influenced by different factors from inside as well as outside the organization.

Each factor consists of several issues which need to be addressed for successful implementation of an information system based on ICT into an organization. Each factor has its own issues which have been categorized for this research as belonging to that particular factor. The found issues which were most alike have been incorporated underneath one heading, as a factor, for the developed framework in this research. Based on this idea the following factors are chosen:

1. Objectives
2. Planning and strategy
3. Stakeholders' roles and responsibilities
4. Social and cultural aspects
5. Technology
6. Human capacity development
7. Participation and awareness
8. Financial aspects, sustainability

2.1.1 Objectives

An effective approach to setting up information systems is to explicitly identify the objectives of the system and determine the expected results (Gladwin et al. 2003). This will help to give the implementation a certain direction and clear objectives to follow through.

So, whether at an organizational or institutional level (a hospital, a university medical school, a health centre) or at a national level (within the health ministry or across the health system), determining the core objectives in terms both of health service provision and information capabilities are important requirements for introducing ICT successfully.

Issues: Core objectives and determining expected goals explicitly

2.1.2 Planning and strategy

Planning and strategizing is an important way to map out possible directions that the information system will be used for on the short and longer term (Gladwin et al. 2003). Processes in Healthcare are important and optimal adaptation of IS to workflow in health care institutions is required. HMIS improvement should focus upon utilizing information as well as data collection and processing.

During planning and strategy always make explicit strategies to support the informational management approach and put support strategies in place. In health care, however, the 'core business process' consists of highly knowledge-intensive, professional work, typified by a complexity that defies the predictability and standardization required for simple reengineering.

Moreover, the professionals ultimately responsible for this process are powerful actors in the organization, and cannot be simply told to change their work patterns by senior management.

Attempting to impose more controls to weed out surprises is a sure route to disaster; unexpected problems should be taken as instances to learn from and adapt to rather than as obstacles to overcome (Berg, 2001).

Issues: Vision, strategy and national plans

2.1.3 Stakeholders' roles and responsibilities

The stakeholders are the human part of the organization and many times pursue different objectives, concerns, priorities and constraints. According to Rogers et al. (2002) stakeholders are all the people or organizations that will be affected by the system and who have a direct or indirect influence on the system requirements. This can be: the development team itself, the managers, recipients of the products output, direct users and their managers, people who may lose their jobs etc. The view of the introduction of the process of an HMIS includes most of all a handling of the stakeholders and working together of the different groups to get to a single point of view. These different goals are an issue that make data management in health care organizations a challenging undertaking (Berndt (2001); Chetley et al. (2006); Gladwin et al. (2001))

The successful implementation of ICT and health programmes requires complex balancing of the competing views and concerns of the different stakeholders. Some clinicians will view new technology with suspicion, fearing its challenge to their professional autonomy and status. Patients will often seize on the potential benefits (particularly in making care accessible where care would otherwise not be available) but will also hold legitimate concerns about the security and confidentiality of any electronically held patient data. IT specialists may seek to use cutting edge technology where existing tried and tested technology would be more than adequate to deliver real improvements in patient care. Policy makers may require convincing that the initial investment costs in the new technology will bring the benefits promised. All these differing views and concerns need to be addressed at the outset of any intervention involving ICT (Chetley et al. (2006); (Gladwin et al. (2001)).

Based on the framework by Winter et al. (2001, 2003) the following stakeholders and their interest and roles can be distinguished in an HMIS (see figure 2):

- Top management: interested in seamless and cost-effective operation of the hospital. They approve the plans, probably together with the funding institutions, which are primarily interested in the financial consequences.
- Funding institutions: are primarily interested in the financial consequences
- Employees, e.g. physicians, nurses, administrative staff: eliciting the requirements for own use
- Clinical, administrative, and service departments: eliciting the requirements for own use
- Information management department (IM department): will usually create and maintain proposals for the plans. They are interested in clearly defined requirements for their work reflecting tactical management issues, which cannot be done without effective backing from the top management.
- Consultants: help creating or updating plans, but can also is effective in negotiations for the project approval.
- Hardware and software vendors: constructing or maintaining components of hospital information systems.

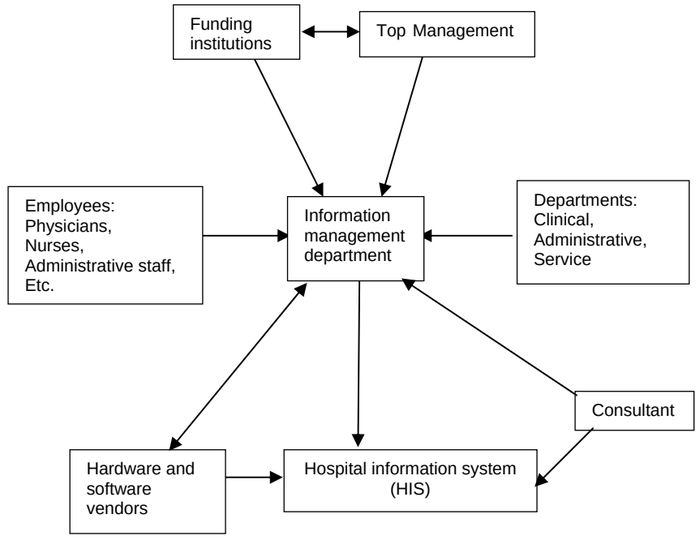

Figure 2: Stakeholders and the information flow

Defining the different roles at each level within the organization and involving these stakeholders as much as possible in the planning, development and use of the system that is going to be implemented will help make the system more successful. The stakeholders consist of:

1. User: These are the people who are going to be working directly with the HMIS as the end users. Their job will be to interact with the system by entering, analyzing and interpreting data in the HMIS.
2. Hospital: when referred to in text the meaning is all the users plus the patients and the clinics outside the hospital.
3. Stakeholder: Stakeholders are all the people and organizations who are involved in the project during development and implementation of the HMIS. In this figure they have been defined as the

Because the stakeholders determine in the end whether the HMIS being implemented is going to work or not it is important to define all the stakeholders involved when referred to in the developed HMIS framework. Each type of stakeholder is defined by the dotted line circling certain areas.

The reason for this is because there was a lack of a clear definition about who was meant when spoken of stakeholders in the different literature. Stakeholders is such a broad definition that it is was necessary to define these in a more abstract way. So, when referring to the hospital it would be clear that a reference is being made about all the users who are the doctors and nurses, data analyst, district MOH, patients and all the clinics which fall under a certain hospital (see figure 3). When literature implies changes occurring in the hospital it will be clear who the different people involved in the change are, this will make it easier to know who is meant by the stakeholders involved.

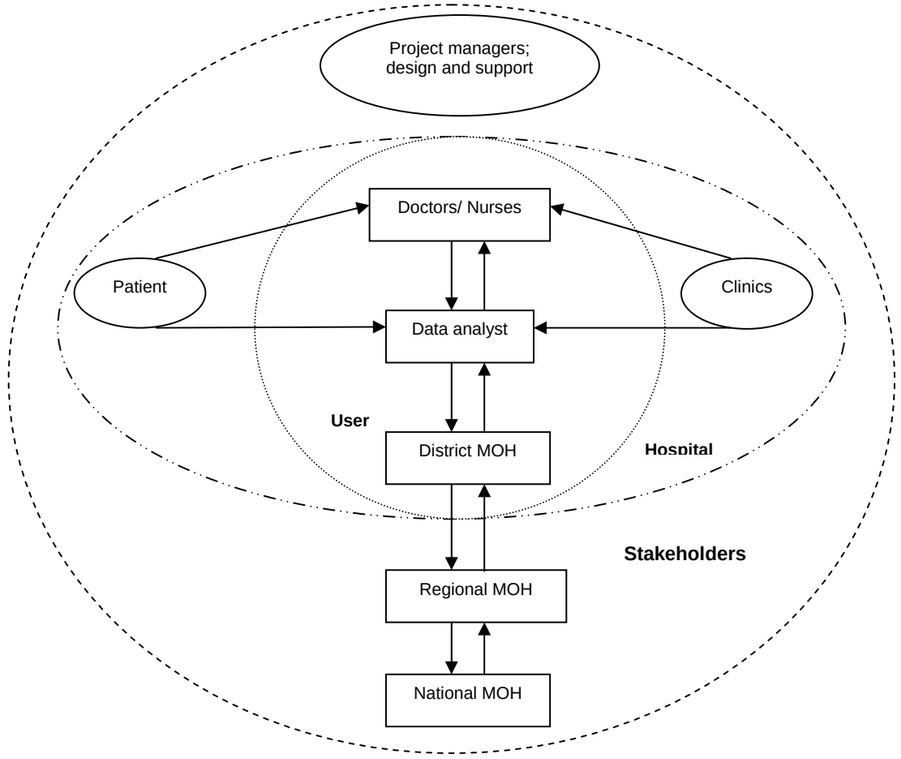

Figure 3: Overview of stakeholders

A proper assessment of whom the stakeholders are, their roles and responsibilities and the policies for these roles and responsibilities is the primary means of maintaining oversight and accountability in a loosely coupled organizational structure. It is important to monitor and record what is going on, take steps to ensure compliance with agreed policies, and to provide for corrective action in cases where the rules have been ignored or misconstrued.

Issues:
Proper needs, roles and responsibilities assessment of the stakeholders' involved
Policies for the roles and responsibilities of the people involved

2.1.4 Social and cultural aspects

Social issues to consider are personal agendas, changes in status and power and other political issues. Political issues, for example, tend to be isolated systems that operate independently throughout the organization like the conflict between the inherent values of clinicians and administrators mentioned in the factor above. The strategic use of an IS can only take place after the political issues have been solved between clinicians and administrators and integration has occurred.

Cultural issues need to be addressed in terms of appropriate and relevant content. Another aspect of culture is the need to examine and challenge the cultural inhibitions and barriers within society and institutions that prevent effective use of ICT. This includes a commitment to transform the rules and regulations surrounding telecommunication and broadcast systems. It also means increasing political will to ensure that government procedures are more transparent and that information sharing cultures are encouraged (Kiu Kim (1990); Gladwin et al. (2001).

These issues should all be considered when designing, adopting and implementing IS. Therefore conflicts between existing organizational culture and changes needed need to be carefully negotiated by assessing the possible benefits and stresses when introducing the HMIS (Chetley et al. 2006).

Issues: Commitment to change rules, regulations, ensures transparency and information sharing cultures.

2.1.5 Technology

Technology as a factor which consists in this research of the sub-factors hardware, software and connectivity with their own matching issues.

Hardware

The hardware needed should be identified before the introduction of the system. This means that at the start of the project an assessment should be made about the hardware already available and the hardware which is still needed for full introduction of the system.

Software

One of the major concerns with IS, is the fact that users often claim that they are not user friendly and lack intuitive data input. Because of the way in which data is put into a system reflects the individual's practice style. The interface design and structure of the data need therefore to conform to each other. The other issue is that it depends on the technology being used. Flexibility and adaptability is also a challenge when introducing such a system. Here looking for the right terminology for input is also a concern (Kuhn et al. 2001).
Software content issues include the lack of local content creation, the language used and the relevance of content to the local situation. Appropriate language is frequently neglected in ICT programmes and little content is available in local languages for health programmes (Chetley et al. 2006).
Another concern of any health organization in the integration of health information systems is the fact that healthcare institutions need timely patient information from various sources at the point-of- care. This means buying a fully functional system fulfilling all their needs from one vendor. This suggests working with standards for better data integration (Kuhn et al. 2001).

Connectivity

With connectivity you have to deal with things like the lack of an enabling telecom policy and regulatory environment; access to electricity, solar power options, back-ups, insufficient infrastructure, connectivity access and high costs. The better these things are functioning the greater the chance for successful implementation. Embedded in this are issues around broadcasting rights and regulations controlling the media which also concern the social and cultural aspects and governance (Chetley et al. 2006).

The actual integration of isolated systems is an important issue for the success of an information system. The use of simpler systems fitted better with the clinical work processes should also add to better solutions. Service and maintenance not only of the hardware but of all technology being used should also be considered when introducing the system. The availability of a good backup for failing hardware and software should also be considered when implementing an HMIS. There should also be a combination of old and new ICT in creative and innovative ways, no single technology will be suitable for all situations.

Issues:
Information and telecommunications infrastructures
Focus on simplicity, integration and standardization, user friendliness and sustainability

2.1.6 Human capacity development

While capacity to adapt information to ensure that it is culturally appropriate and relevant is a major challenge, so too is the capacity to use ICT effectively. A skilled ICT work force is an essential ingredient for the effective use of ICT in healthcare. Systems professionals, services providers and project team leaders with high skill levels and experience in an organization are important components of success. It is therefore very important to identify the skills present in the organization and the skills which still need to be trained (Chetley et al. 2006).

Training is also an important part of capacity development. If the intended training approach is not undertaken there will be a lack of understanding of changes needed to accompany the innovation. HMIS data collection, processing and information use assumes a certain level of general education and specialist training amongst health workers, which is often not available, especially in smaller health units in developing countries. Too few HMIS training for health unit personnel to grasp new skills, such as data processing, compiling graphs and statistics will then lead to unsuccessful skills and a lack of the right capacity. This is why workers' skills should always be aligned with the HMIS (Gladwin et al. (2003); Chetley et al. (2006)).

Investing in capacity development and training in technological, communication and content development of skills will ensure more successful implementation of an HMIS. Making opportunities available to see the HMIS in practice or a clearly reported trial should accompany innovation introduction (training).
Teaching skills should also be an integral part of supervisor's training to be able to help them teach and manage others. Strategies to overcome lack of skills amongst less well-educated health workers need to be developed during the planning and strategy (Gladwin et al. 2003).

Issues:
Computer illiteracy
Limited experience in medical informatics

2.1.7 Participation and awareness

The lack of participation and awareness also leads to unsuccessful introduction of the HMIS. This can be attributed to the lack of capacity and training available in the organization but also with the social and cultural issues affecting the organization. This often tends to lead to a lack of understanding of changes needed to accompany the innovation and stakeholders not willing to participate into this process.
For maximum success an ICT project requires all participants to participate and view the innovation as adding value to existing systems; if the people using the system do not like, want, or support it, it will likely fail. There should be a mutual understanding of the meaning of the HMIS before the introduction of the system by the project managers. The project managers should then introduce this meaning to other people before or during awareness raising and training of the system (Gladwin et al. 2003).

Sharing learning and experiences should be encouraged to improve understanding of the different ways people learn, communicate and use information by developing links with others doing the similar ICT interventions. This is also important to get people participating in the use of the system, this is not something people are used to and changing in the way people view this is needed by awareness raising and training.

Issue: Information, participation and awareness about ICT applications

2.1.8 Financial aspects and sustainability

Generally, there is little investment in ICT for health in most developing countries. The picture is one of fragmentation, with many different varieties of ICT being acquired from different donors. Invariably, there is no national health information and IT infrastructure to underpin the delivery of health care. It is very important to make a realistic financial plan for all the costs in the system before the introduction of the HMIS (Gladwin et al. 2003).
Sustainability is very important when considering the introduction of an HMIS in an organization, especially in local hospitals in developing countries. Being able to continue supporting the system financially on the long run is an important issue to consider. Plans for sustainability should be clearly expressed ensuring that capital investments and costs are identified up front as well as ICT, capacity and infrastructure requirements. Monitoring and evaluation is also part of the sustainability failure to adopt a particular IM strategy may signal inappropriateness. Also by encouraging partnerships between stakeholders on local, national, regional and international level sustainability can grow (Gladwin et al. 2003).

Issue: Resources to meet costs and sustain the system

2.2 The implementation process

First of all the introduction of the HMIS into a hospital is seen as the implementation of a project and each project consists of a few phases. These phases are partly based on Checkland (1999). The whole process should be tackled as mentioned before according to the following steps which are used in all project situations. Figure 4 (pyramid) depicts the amount of time needed against the phase the project is in.

Phase 1

The planning phase starts before the introduction of the system, and consists of the planning and a formal pre-implementation process. This will be defined in the framework as phase 1. This phase consists of defining and planning of the factors and issues and consists of the following steps when entering a situation:

- Asses the current situation
- Determine goals and strategy
- Determine needed change for each factor

Phase 2

The implementation phase can be considered as the actual implementing part of the project. This happens after phase 1 and is defined as phase 2 in the framework. This phase consists of actually implementing the plans which had been made in phase 1 and occasionally going back to revise phase 1 if needed.

1. Implement needed change
2. Go back to phase 1 if needed to asses the implemented change

Phase 3

Post-implementation happens after the implementation phase. In this phase sustainability becomes important and is dependant on the planning in phase 1 and sustains the implemented system from phase 2. In the last phase of a project it is important to check the sustainability of a project and is therefore dependant on how the project was planned and if the implementation was completed.

- Determine sustainability for implemented change in phase 2
- Return to phase 1 to check if goals have been reached
- Or return to phase 2 to check if implementation was completed
- Repeat phase 1 after project time has been achieved

The planning phase, as can be seen in the pyramid shown in fig. 4, takes the most time when introducing an HMIS into a hospital. This suggest that when information systems are being implemented this is a very crucial part and can be seen in the framework. The framework can then to be used in the planning of the introduction of a system in a hospital an assessment plan implying all the needed changes and concerns in an organization.

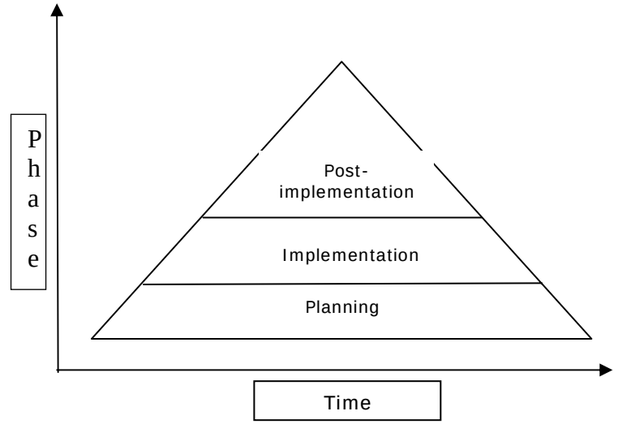

Figure 4: time /phase overview

2.3 The developed framework

The found factors and their issues in literature will be used for integration into the framework developed for this research, which will be used also to analyze the documents and interviews of the cases at IICD.

The framework is depicted as a matrix where horizontally the framework shows the different phases the project can be in and vertically the factors which have a positive correlation with the introduction of an HMIS. The rows then show the different phases the project is in, and the columns depict the factors and their issues concerned per phase.

The chosen phases for the framework are phase1, phase 2 and phase 3 as explained in chapter 3.1.1. For the framework in this research the issues encountered were rephrased into questions. This way while analyzing the documentation and the interviews by coding the issues can be traced back to their corresponding factor. Each issue in question form can then be coupled per phase.

	Phase 1: Planning	**Phase 2: Implementation**	**Phase 3: After implementation**
Objectives	Define objectives	Check objectives	Monitor objective
Planning and strategy	Define planning and strategy	Implement strategy	Monitor strategy
Stakeholders roles and responsibilities	Responsibilities and Communication flow	Register and check roles and responsibilities	Monitor and check roles and responsibilities
Social and cultural aspects	Identify participation	Check participation	Monitor participation
Technology	Identify: Tools; Connectivity; Design	Implement technology needed	Maintenance
Human capacity development	Identify capacities; Develop needed Training	Give training	Achieve long term sustainability
Participation and awareness	Identify needed participa-tion and awareness	Do Awareness raising Get participation	Monitor participation
Financial aspects, sustainability	Identify financial input	Guard input and output	Monitor input and output

Table 1: issues per phase

For example, for the factor strategy and planning the following questions are asked in phase 1 as being critical for this phase:

1. Has the planning for the implementation of the HMIS been developed?
2. If YES, is a document of this planning available?
3. What type of planning is it?(year/months)
4. Where is the planning document stored?

For phase 2 the following question is asked:

5. Is the planning for the HMIS being monitored and implemented?

And for phase 3:

- Is there a long term monitoring and evaluation process in place for the HMIS?

Factor	Phase 1: Planning	Phase 2: Implementation	Phase 3: After implementation
Planning and strategy	1. Has the planning for the implementation of the HMIS been developed? 2. If YES, is a document of this planning available? 3. What type of planning is it?(year/months) 4. Where is the planning document stored?	1. Is the planning for the HMIS being monitored and implemented?	1 Is there a long term monitoring and evaluation process in place for the HMIS?

Table 2: example of tool based on the framework

The full version of the framework can be found in annex framework, the way this tool is to work is by walking through each phase separately depending on the level of implementation the project is in. The walkthrough consists of each phase and the issues that should be considered here. By using this framework depending on the phase the project is in and the positive correlation between the issues and the HMIS each phase the project is in and issue at hand can be assessed with the use of this framework.

2.4 Conclusion

By splitting the research area into 9 types of factors this research has tried to split the factors affecting an organization into several areas for research. Even though these factors are analyzed separately this research recognizes that it is impossible to analyze all these factors separately because the factors and their issues do overlap. This can also be seen in literature which has been found because the factors and issues have the tendency to refer to each other, or be seen in some cases as part of other factors. The definition of the different issues for each factor was based on the literature and has been for most part successful, because of the pertaining overlap there are some issues where there is still doubt about the factor under which they belong so placement has been a personal choice.

The factors and their issues found can be shortly summarized to the following points of attention and have a positive correlation with the implementation and integration of an HMIS into an organization:

Factor	Issue
Objectives	Objectives, goals
Planning and strategy	Vision, strategy and national plans
Stakeholders roles and responsibilities	Needs, roles and responsibilities, policies

Social and cultural aspects	Rules, regulations, transparency and information sharing cultures
Technology	ICT infrastructures; standardization, integration, user friendliness and sustainability
Human capacity development	Computer illiteracy; Limited experience in medical informatics
Participation and awareness	Information, participation and awareness
Financial aspects and sustainability	Resources and system sustainability

Table 3 : overview of factors and issues

A stakeholder's overview has also been defined to help when using the framework. This was due to the use of stakeholders as too broad a definition in the literature. This definition of the stakeholder helps to distinguish the different users, hospital and other stakeholders involved in the projects when referred to.

The framework based on van Irsel(?), Kuhn et al.(2001), Kiu kim (1990), Gladwin et al. (2003), Berndt (2001) and Chetley et al. (2006) was developed into a tool to help identify the issues and their corresponding factors in the documents available at IICD. The more times a "yes'' is answered to a question the better the project has been analyzed by the project manager and the corresponding issues taken care of.

The tool assists *the project manager* when implementing a new information system in a hospital. The use of these phases in the framework helps to categorize a project and to analyze the projects which have already been implemented. The phases help to discern the different issues and factors which are of importance to the phase at hand. This way depending on the phase the project is in, the project manager can strategize about the next steps to take. Further explanation about the use of the framework is given in chapter 4.

3 Methodology

This research is a qualitative research based on multiple case studies (Yin, (1994); Hutjes et al. (1992)) where the focus for data analysis is on available documents, findings in the literature, and interviews based on projects done by IICD in the countries Zambia, Uganda, Mali and Tanzania. An exploratory research was conducted where the framework and questions were defined from the start. This has been be done by case analysis through open interviews and questionnaires, available documents and the literature findings.

This research focuses on the HMIS cases which have been implemented or are being implemented by IICD in hospitals in these countries on the district level. The district level was chosen because this is the level which has been experiencing the most pressure because of decentralization. This level is the central level below the national level where most of the clinics have to send their information before they are sent to the national level (see also: definitions).

3.1 Case study

To execute this research the case study was chosen as research method. Multiple case studies were used to strengthen the results by replicating pattern matching, thus increasing confidence in the robustness of theory. The reason for choosing the case study is based on the assumption that what this research is trying to find are the more intrinsic aspects of organizations and trying to make general assumptions of these findings (Yin, (1994; 2003); Hutjes et al. (1992)).

First the theoretical propositions and then the evidence was analyzed based on the developed framework and tool. An exploratory research was conducted where the framework and questions had been defined from the start. Triangulation was then used to analyze the data on several levels to assure its reliability through:

- The use of the developed tool from the literature for analysis of the project documents available at IICD
- Interviews and questionnaires taken with country managers and project managers and directors and external consultants
- M&E documentation of the projects

For analysis of the documents and interviews the developed tool was used as a classification method for the factors which had to be identified. Coding was then used to identify these factors in the interviews as well as in the documents. The coding schemes developed with use of the framework were then used to code the interviews and the documents. When coding the abbreviation N.I. was used to represent factors which had not been identified yet and could be considered as a new finding.

Other materials which were used:

1. Camcorder/voice recorder to record/ tape interviews
2. Telephone to hold interviews with interviewees abroad

3.2 The cases

The project documentation analyzed consisted of health cases implementing projects that coincide with the definition of HMIS according to this research and needed to be projects which were being implemented in the countries of Zambia, Mali, Tanzania, or Uganda. The projects which were chosen for analysis were based on the following criteria:

1. They have to fit the description of HMIS as defined in chapter 2, meaning that a) the HMIS *consists of two subsystems*: a patient management information system and a hospital management information system and b) it is computer based working with software in the form of an information system.
2. The projects were being implemented by IICD in Zambia, Uganda, Mali or Tanzania

After analysis of the projects based on the criteria mentioned the amount of projects that were going to be analyzed were in total three cases in which were being implemented in Uganda and Tanzania. In Mali and Zambia there were no projects that fully met the selection criteria. However, in both countries there were other health projects being implemented and project proposals are being formulated and approved during the writing of this research. For these reasons three of the first appointed cases could no longer be used for analysis.

By evaluating the differences between the projects concerning the goals etc basic differences may be found which could explain further differences between the factors encountered when implementing the systems in the varying countries. This will be combined with the other data gathered to make conclusions about the projects being implemented.

With these minor setbacks it was decided to bring in consultants and people who have had expertise in the implementation of health systems in developing countries to help give more value to the research by testing the findings against these experiences. The people that were chosen for this were consultants who have all had some years of experience with the implementation of an HMIS. One technical manager who also had some years experience as a consultant and technician and has worked together with IICD at implementing some of these systems was also asked for his view (see 4.3 for further reading).

The documents which were analyzed were all the documentation found online and in the database archives at IICD. A description of the chosen projects used for analysis can be found in table: Overview of IICD projects for Uganda and Tanzania.

Country	Uganda	Zambia	Mali	Tanzania	Tanzania	Tanzania
Total projects	1	0	0	2		
Project name	UCMB			D-HMIS (1)	Health facility management (2)	
Phase	Implementation			Implementation	Implementation	Stopped after formulation
Level of implementation	National level			District level and facility level	Facility level	
Summary	Health Management Information System (HMIS) is being implemented in over 27 hospitals throughout Uganda. In addition to the emphasis of the MOH on information produced by OP departments of health units UCMB has insisted on the submission of monthly In-patients department reports and about the use of quarterly assessment reports very useful in assessing the health units' performance against the national HSSP targets and indicators. The system is computer based and is being implemented with the use of excel sheets as data sheet.	Project proposal in formulation and awaiting approval and during this writing	Project proposal in formulation awaiting approval	The use of ICT (websites, online databases, virtual 'community of practise' for health practitioners) to improve the performance of health facilities (from health centres to hospitals) in Mwanza, Arusha and Moshi, as well as health management at the district level. It is also helping to improve the collection of health data for the national Health Management Information System (HMIS).	Computerization of routine processes carried out by health facilities to help make them more efficient by customising the national Health Management Information System (HMIS) so that it can be used in 26 health facilities administered by the project owner, ECLT.	Project proposal in formulation awaiting approval
Goals	The use of ICT in the form of health systems to improve access to information and communication between the health institutions; Timely feed back by soliciting changes in the management process of the HMIS; Improved monitoring tools; Appropriate human capacity at the technical and managerial level; Recognised and acknowledged role of HMIS in the Health Sector.			To use ICT in improving the ability to collect, store and analyse accurate health data at the district level to increase service delivery efficiency, increase data accuracy and effectiveness of intervention, increase accountability and better learn health trends in the district.	The project objective is to improve the management of health facilities and to that end develop an HMIS system, which is user friendly and is producing all the reports that administration and MOH need. Install the necessary hardware at each of the health facilities; Train and motivate staff to use and maintain the HMIS system; Assure roll-out to 26 health facilities (with support in the form of an introduction package, a set of guidelines, user-training, ICT support and back-up service).	
Contact	CM:Arjan de Jager PM: Andrea Mandeli			CM: Nic Moens PD: Richard Mbwambo	Nic Moens PD:Dr. Mauri Niemi	

	amandelli@ucmb.co.ug PD: Danielle Giusti			Joep Ibambasi Email: Ibambasij2004@yahoo.com	Email: mniemi@elct.or.tz Director, Managed Health Care Programme, Dr. Peter Kopwe Email: pkopwe@elct.or.tz	
Project Budget in euros	129.000 + 77.100			121.700 the total funding sought from IICD $ 156.293	Not available	
Information availability	Project document available online at www.IICD.com, title: "Cordaid-IICD Health Programme Uganda". Quarterly reports are also available online and in the archives/IICD database (private)			Quarterly reports are also available online and in the archives/IICD database (private)	Not available	
Hardware and software used	Internet connectivity Use of Excel and Access templates based on the MOH HMIS template The adopted software is an adopted version of the MOH system used in Uganda			The installation of computers, servers, and software. Software is called NPK and is locally made based on the MOH template Internet Connectivity:	The chosen software is the care2x software which is going to be used to implement the HMIs at facility level.	
Formulation date	12/1/2003			5/1/2005	5/1/2005	
Implementation date	10/1/2004			12/1/20005	2/1/2006	
Second contract date	11/1/2006					
Independent continuation date				31/12/2008		
Total amount of hospitals	27 hospitals 230 facilities			6 hospitals 2 dispensaries	26 health facilities	

Table 4: Overview of IICD projects

CM= Country manager, the person in charge of the project at IICD
PM= Project manager, the person in charge of the project residing in the stated country

3.3 Coding

The code sheet for the documents and interviews was chosen based on the developed tool and consists of the factors which have been found. When coding the documents, the question number, which had been answered, was also added to the coding. So depending on which of the questions had been answered from the developed tools questions a number was added to coding. For example: if in the document or interview you find a sentence depicting an answer to the factors objectives in phase 1 question 1 then you code this with “O 1.1”. if you find an answer to the factor objectives in phase 3 for question 5 then you code this with “O 3.5”.(see also the developed framework for more details see coding table 2)

Factors	Code
Objectives	O
Planning and strategy	PS
Stakeholders roles and responsibilities	SR
Social and cultural aspects	SC
Technology	T
Human capacity development	HCD
Participation and awareness	PA
Governance	G
Financial aspects, sustainability	FA
Not identified (yet)	N.I.

Table 5: Coding table

The results of the interviews and document analysis were placed into four different tables:

- Table consisting of the document analysis based on the tool
- Table of the analysis of the interviews with project managers and country managers
- Table of the analysis of the interviews with the consultants
- General data from the projects depicting general information

These will then be placed and analyzed based on the found information on the projects. For the full coding see annex: framework coding

For analysis of the documents, interviews and the different questions belonging to a phase and factor where coded. The coding consists of a number and the corresponding factor code. The number can then be traced back to the answer to the question referred to in the document analyzed. A coding example can be found in the coding example table.

Factors	Phase 1: Planning	code	Phase 2: Implementation	code
Objectives	5. Has the objective of the HMIS been identified? 6. Has the goal of the HMIS been identified? 7. Is the objective of the HMIS consistent with the objective of the MOH ?	O 1. 1 O 1. 2 O 1. 3	2. Is the HMIS still being implemented? 3. If 1 is NO or partly, please explain why 4. Is the objective of the HMIS still consistent with the objective of the MOH and regional MOH?	O 2. 1 O 2. 2 O 2. 3

Table 6: Coding example table documentation and interviews

3.4 Documents analysis

The developed tool was used to analyze the different documents available at IICD about the projects which are being implemented concerning HMIS. The tool can be seen as a framework of factors which influence the introduction of the HMIS. This tool as said before is based on the findings in the literature.

By using the developed tool information which was not available in the documentation then became clear. When information was not found in the according documents the missing information was added and tested through the use of semi structured open interviews and questionnaires.

The analysis consisted of analyzing the project in three different phases; each phase representing the project planning, implementation and sustainability. The phases of the project that should be run through were dependant of the status of the project.

Example: a project which is in the independent continuation phase should be analyzed per factor from phase 1 through 3.
Phase 1 Planning: this is before the introduction of the system consisting of the planning.
Phase 2 Implementation: this is during the actual implementation of the system, implementation
Phase 3 After-implementation: this is after the project implementation phase where sustainability of what has been implemented is being tested.
Each factor per phase consisted of several questions which helped to identify which parts of the project have been completed and which parts should be reconsidered.
Example: start with the column phase 1 and answer for the factor 'objectives' questions 1 through 3. After this question was answered please keep to the same column and answer for planning and strategy question 5 to 8 and so forth until the last question has been answered. Depending on the phase of the project you can then move on to the next phases and go through the same process.

The choice was given, per question, between the categories: "yes", "no" or "partly" for each question per phase of the project. Yes, no and partly are seen here as established elements that can be used in the analysis of the documentation based on the developed tool. The more times a yes is appointed to a document the more information are available about the project. A "yes" also means that these factors have been handled according to the framework which has been designed. The more "yes" answered in a project the better the project coincides with the found factors in the literature. The factors to which an answer could not be found in the documents were then referred to the interviews.

Documents coding

The abbreviations used for coding in the documents analysis are:

1. The codes shown in coding table 2
2. T1= Tanzania project DHMIS
3. T2= Tanzania project health information systems
4. U= Uganda project UCMB
5. Yes= Y
6. No=N
7. Partly= P

On the data evaluation sheet all the answers of individual projects were entered into a table where all the answers were coded as followed: yes is Y no is N and partly is P. This will then be entered into the data sheet where columns stand for the case and where the rows are divided into categories and their matching variables for the project analysis.

3.5 Interviews

The developed tool could not be used during the interviews because of the structured way in which it is designed. The framework questions however worked well as open questions for the interviews and because it still was a semi structured and reasonably open interview in the end most of the questions were answered because of the open form. This analysis will be a qualitative analysis in which the answers given will be sentences instead of codes. Through analysis of these sentences then further conclusions due to differences in answers can be drawn. This is valid for both interviews with project managers and country managers, as well as with the consultants.

The interviewees for the open interviews and questionnaires were chosen based on their availability through IICD and their experiences with HMIS in Africa and other developing countries. Contact with the respondents was made through emails, face to face meetings and by telephone. In the emails a short introduction was given about the research and the respondents were then asked whether they were willing to participate in the research by doing an interview or filling in a questionnaire.

Each interviewee had their own questions based on the analysis of the documents found. The questions which still needed an answer were then asked in an open question form. Most interviews consisted of questions which were then relevant to the interviewee.
The chosen interviewees were:

1. The country managers
2. Project managers or project directors
3. External consultants

The country managers are the main people involved with all the projects of the countries being researched in this paper. The reason why these country managers were chosen is due to the fact that they are present at IICD and have a broad view over all the projects being run at the moment and have the responsibility for these projects as long as they are sponsored by IICD.

The project manager or the project director is responsible for overall implementation and management of the project. They have to ensure connectivity manage the entire team, manages the finances resources, maintain and report progress to the donors. Sometimes you also have a technical manager who's job is to assist the project manager in formulating plans, budgets and ensuring that operations proceed according to plan. Both of them therefore have a clear view of the project which is being implemented.

External consultants were also asked to analyze projects conducted by them by using the developed tool. The reason for choosing external consultants was because these are people who have extensive experience with HMIS and the introduction of these systems into hospitals in Africa. They are from the HISP project, ETC crystal consultants, Afyapro, and an external IICD contact who has been working for a long time with these systems in Africa (see for more information the definitions).

Interview analysis

For the projects in Tanzania and Uganda interviews were held with all country managers at IICD and the appointed project managers in each country. Due to the fact that for the countries Zambia and Mali there are no running projects only the country managers were interviewed and their own personal view of the project asked. There no being a project to base their answers on they were asked to answer in a way that they think that certain problems could evolve over time during the introduction of a heath management information system.

The interviews were fully typed for analysis. Coding based on the developed tool was then used to identify the factors in the interviews. The interview itself was divided into 4 parts consisting of:

- Part 1: personal profile. In this part the interviewee needs to fill in information about him or her and the organization and project being addressed.
- Part 2: stakeholder identification. In this part the various stakeholders are identified
- Part 3: project analysis in phases. In part 3 the project will be analyzed per phase consisting of standard options and some open questions
- Part 4: open questions. This part has open questions to ask for some personal views from the interviewee.

A complete overview of all the interviews can be found in appendix? As said before the questions used in the interviews were mainly based on information which could not be found in the document analysis and at the same time also confirming the answers found in these documents. After the document analysis it became clear that there were particular factors which had to be further analysed. The questions in the interviews were largely based on information which was not available or clear from the documents found about the project implementation. These questions were based on some or all of the following factors:

1. Social and cultural aspects
2. Technology
3. Human capacity development
4. Participation and awareness

Still, being a rather open interview, information about other factors were also found and incorporated into the results for analysis. Not all countries are mentioned in the results this is because these factors have already been clearly defined in the document analysis.

3.6 M&E

The other source of evidence was collected based on the health M&E documents about the impact of ICT on health projects. This was used to sustain the findings from the interviews and the other documentation used in this research. The data was available but not always specifically for the analysis of the HMIS projects in particular.

The monitoring and evaluation results are based on research done by the M&E team at IICD. This is part of the sustainability factor of the system the M&E results signal the appropriateness of a certain strategy and whether this needs to be adjusted or not.

The monitoring and evaluation (M&E) system in the varying countries works with one permanent local facilitator as M&E partner per country. These partners are specialized in evaluating development initiatives in their respective countries. Their role is to collect and analyze data, facilitate Focus Group Meetings and capture the lessons learned in Learning Reports.

The M&E data will be used for data triangulation from which it will be possible to draw general conclusion concerning the issues affecting Tanzania, Uganda, Mali and Zambia.

3.7 Conclusion

There are different issues contributing to the implementation of information systems which are not dependant of a geographical location for introduction. However, in developing countries there are some issues which are very particular to these places. Some of these issues like electrical power and computer illiteracy have been known to be commonly found in these countries. These however are not a problem for developed countries like Europe and the United States (Gladwin et al. 2003), so what are these issues affecting the introduction of the system in these countries?

By analyzing the documents and interviews held at IICD and based on the M&E data the critical issues affecting the introduction of an HMIS in the countries of Mali, Uganda, Zambia and Tanzania are analyzed. First the results for the documents will be given where each factor is analyzed separately, then the interviews analysis and finally the M&E data. In the last chapter an overview will be given of new factors and findings which were encountered during the results analysis.

The next chapters will describe the results per analyzed data type based on the developed framework and with help of the developed tool.

4 IICD documentation results

These results are based on the analysis of the documentation found at IICD on the website and in the archives in the organization (the documents which were analyzed can are found in the reference list named 'IICD documentation''). The analysis was done based on the factors and issues found in analyzed literature (for an extensive overview of the results this research refers to the annexes).
These factors and issues in analyzed literature contributing to the implementation of an HMIS are:

Factor	Issues
Objectives	Objectives, goals
Planning and strategy	Vision, strategy and national plans
Stakeholders roles and responsibilities	Needs, roles and responsibilities, policies
Social and cultural aspects	Rules, regulations, transparency and information sharing cultures
Technology	ICT infrastructures; standardization, integration, user friendliness and sustainability
Human capacity development	Computer illiteracy; Limited experience in medical informatics
Participation and awareness	Information, participation and awareness
Financial aspects and sustainability	Resources and system sustainability

Table 6: overview of factors and issues

All in all, from the documents results was found that about 67% of the factors in the documents of all IICD projects were answered with a "yes", 22% was a "no" and the remaining 11% was appointed to "partly". This means that more then half of the issues had been documented in the documentation, which should suggest that these issues have been recognized and treated in the cases.

	Yes	No	Partly
T1	22	5	2
T2	19	4	4
U	23	12	4
Total	64	21	10

Figure 5: overview of all documents results

However when looking at each country separately this also suggests that the issues answered with "yes'' in the documents of Tanzania the DHMIS case about 29% of the 78 questions could be answered, for the health facility case 34% and for Uganda UCMB case about 50% of all questions were answered with use of the documentation. Suggesting that the Ugandan projects are from all cases the best documented and that less then half of the other cases issues were documented.

The second results from the analysis show that most of the information available in document form is based on information needed in phase 1 and 2. This makes sense due to the fact that all cases are in the implementation phase at this point in the project.

T1	Yes	No	Partly
O 14	4	0	0
PS 6	2	1	0
SR 9	3	1	0
SC 8	1	1	1
T 13	6	1	1
HCD 7	4	1	0
PA 11	2	0	0
FA 6	0	0	0
TOTAL	22	5	2

Figure 6: overview of Tanzania documents results

The issues which had been best documented in all the cases were:

1. The objectives: meaning that the indicators have all been well defined in the planning phase.
2. The planning and strategy has also been clearly defined in the documents where the strategy for the implementation is described.
3. The technology: the use and type of technology has been clearly described in the project documentation and is available for everyone.
4. Human capacity development: capacity development activities have been formulated in the planning phase and trainings have been implemented.

The results suggest that with more than half of the issues found in the documentation that the tool does help to identify these issues more practically. With the objectives, planning and strategy, technology and capacity development being the best documented factors.

4.1 Objectives

The objectives analysis showed some rather interesting results when it came to the different projects being implemented. **In all analyzed cases the objectives and goals were clearly defined** (Gladwin et al. 2003) in the project planning. They all focused on introducing an HMIS in hospitals on facility (clinical) level and the very of reports on time to the MOH.

All the projects have a common goal for the system which is, to improve data and information management in the different health centres with the use of data produced for internal evaluation and data up keeping of the patient information.

In the implementation phase **the objectives are being met in all cases**. This can be found in the documents stating for example that "*During the implementation period in Uganda the percentage of hospitals submitting complete HMIS in time moved from 49% to 90%".* This information shows that the objective of delivering the needed information on time is being reached according to the documentation. The quarterly reports from Uganda also support this indicating that *"there has been improved use of data and information management for planning, monitoring and decision-making processes*".

Another way to support these findings is this sentence stating that: "*The digitization of data is now taken care of by the hospitals themselves which is in line with the objective to make UCMB a leaner organization. After digitizing the data and checking its completeness, the hospitals then forward the data via email to UCMB head quarters, resulting in a timely delivery of the data needed for lobbying purposes*."

After analysis of the documentation the results show that in all cases the objectives and goals have been clearly defined. The objectives of the system to introduce ICT to help support data digitization and delivery of the MOH data on time are also being reached.

4.2 Planning and strategy

The planning and strategy findings show for the question whether the planning for the implementation has been developed (Gladwin et al. 2003) the following result:
In Uganda over the past years **the documents show two strategic plans** have been defined; the second building further on the first one. Objectives have been clear and in-line with

the long term vision. Monitoring and two evaluations have provided opportunities to learn and adjust where needed. It also showed that initial objectives were sound but too far fetched, requiring an adjustment in the following plans.
For Tanzania also in both cases **the project planning and strategy has been defined and documented**. However in Tanzania for the health management information system this documentation was only partly found.
When it comes to the national plans **all three cases are in line with the strategy of the MOH** matching with the wishes of the government.

The **strategic approach to the introduction of the systems differs.** It is curious to see that in Tanzania, they used the top down approach for the health management information system. "*The whole system will function on a top down system inherently this not being one of the best choices but as a starting point.*'' The implementation started on the national level and went from there to lower district and facilities. **In all other cases the system was implemented using the bottom up approach**. Literature states however that all changes brought on with a top down approach will not be accepted completely by the people on the lower levels and could be a problem for the introduction of such a system (Berg 2001).

When looking at the type of implementation they all start implementing on a small scale and if successful then move on to more implementations in an area. By taking these small steps changes can be made if needed before implementation on a larger scale.
"*Uganda: The project emphasized the need to make small steps. For example data collection and transformation went through the following phases in a period of three years:*
• From hard-copy forms which had to be filled in manually to standardise Excel sheets which could be filled in using a computer;
• From sending these Excel forms by normal mail to sending it by email (forms as attachments);
• A system which made it possible to link and analyze the HMIS output with a cost-based financial system;
• From sending Excel forms by email (as attachment) to filling in on-line forms.''

When looking at the type of implementation they all start implementing on a small scale and if successful move on to more implementations in an area. The cases used different approaches when it came to implementing the system. In Tanzania they used for the health management system the top down approach while in the other cases they used the bottom up approach. The documentation states very clearly that the implementations of the system are all consistent with the strategy of the MOH.

4.3 Stakeholders roles and responsibilities

In Tanzania for the DHMIS case there has been **a clear analysis of the different stakeholders and their roles and responsibilities** ((Chetley et al. (2006); (Gladwin et al. (2001)).

There has also been a clear description of the responsibilities of the stakeholders in the form of job descriptions. For example: "*Project Manager Description of job: Overall in charge of the project implementation and management; Ensure that all aspects of HIMS, LAN and connectivity are in good working order; Will manage and lead the team in organizational matters as well as motivation and commitment ……*''.

In the health facility project and the UCMB project the shift in responsibilities has also been experienced but how, is not clear, **making the new roles and responsibilities clear is still a concern**. "*Currently in Uganda there is no clear indication of which kind of curriculum a "records assistant" or a "record officer" should have*.''

There was a **clear lack of proper needs, roles and responsibilities assessment of the stakeholders' involved; lack of policies for the roles and responsibilities of the people involved.** Changing the way people work still seems to be a problem. **Making the new roles and responsibilities clear is still needed.** "*Currently in Uganda there is no clear indication of which kind of curriculum a "records assistant" or a "record officer" should have*.''

These different goals for each stakeholder are an issue that make data management in health care organizations a challenging undertaking and not defining them clearly could be a problem (Berndt (2001); Chetley et al. (2006); Gladwin et al. (2001)).

In all the case documentation analyzed there was a **clear lack of proper needs, roles and responsibilities assessment of the stakeholders' involved; lack of policies for the roles and responsibilities of the people involved.** There have been some attempts in the Tanzania to define these issues but a complete view of roles and responsibilities could not be found.

4.4 Social and cultural aspects

There were no clear references found in the documents about the social and cultural aspects which play a role when implementing an HMIS on the district level.

4.5 Technology

In Uganda **there is no lack of standards** (Gladwin et al. 2003) **because they are** implementing one type of software on all levels in the country. The software uses a combination of Visual Basics and C++ for interface and any ODBC compliant database at the backend. The database of choice is open source MySQL. The solution runs primarily on a windows platform but the developers are also in the process of developing a Linux compatible version which can easily be transferred to use on the facility (clinic) level.

In Tanzania there **is a lack of standards** because there are 2 types of HMIS software being used: Afyapro and Care2x.
Afyapro is locally made software. It is a system where change is introduced planned in phases into the hospital. This project also focuses more on customization on the entire level working towards a more general approach and is being implemented on the district level in several hospitals.
The Care2x system is more flexible software and not proprietary like Afyapro. However Care2x provides no technical support and is dependant on a community of developer's, and dependant on regular updates, therefore regular system changes. The project will keep the source code open and free so that everybody who is interested will get it free of costs. This is why they want Care2x to be the national system used. Wider user base and developer base makes this software stronger and cheaper in this region with less resources.

User involvement is in the case of the Care2x software very high because the system is being implemented locally and customized to the hospitals needs, it is based completely on user preferences. Afyapro on the other hand is pretty standard and has less user involvement in the development, only in the implementation.

Unreliable power supply ((Gladwin et al. (2003); Chetley et al. (2006)) is a problem for all projects. Especially when occurring in the beginning of a project this can hinder implementation. This **was a problem which was perceived in all the studied cases and affected all projects in the same** way by delaying implementation according to the documentation.

Application of HMIS **to basic and user-friendly software** like Excel has made the system easily usable in Uganda. There is also a direct possibility to use this tool right at the Health Facility levels instead of only on higher levels. In the project raw data from 27 hospitals up-country are transformed using Excel and Access templates, developed on the basis of the Ministry of Health (MoH) HMIS template, into information. In a next step this information is transformed via statistical analysis in a "usable" form for management decision-making. The **software interface remains impressively simple for the end user and is customizable** so that the user is only able to view options relevant to him or herself.

In Uganda the routine data collection system is not yet well established; **back-up installation and upkeep of antivirus programs is still a problem** leaving the computers prone to viruses.

When it comes to electrical power all the cases experience this as a problem affecting the implementation of the system. In one of the cases there is still a lack of standards but which is now going to be developed. A good backup for the systems is a problem in all the cases leaving computers prone to viruses. When it comes to user friendliness in Ugandan documentation the system seemed to be the most users friendly and easier to keep up.

4.6 Human capacity development

"*Along with short trainings on ICT use to familiarize end users, formal training of records assistants and officers has been offered.*" **In all cases basic computer trainings are given** where mostly new skills are acquired in data management and ICT.

In Tanzania this is offered once before installation of the HMIS and twice after. The purpose is to bring the intended users of the HMIS to the competency level that is required to use the HMIS. The course will cover basic PC theory, use of standard PC software and general maintenance and usage ethics training.

According to documentation there are 3 sessions through the year, each running for a week, and involve approximately 5 participants consisting of first of all formal training on how to use the HMIS. This is provided by the software vendor and it is a standard training course for the end users of the system. This includes the data entry people, the department heads and the facility manager. It is a formal classroom environment and it lasts 5 days with 4 hours per day. And second a non-formal training. It is a period of time where the vendor watches the users start to use the system and assists them when needed. The vendor also 'coaches' the users into altering the method they have been used to for years to this new automated electronic system. **With this the users are meant to feel more secure during the initial period knowing that professional help is nearby and will give them the motivation to use the system more confidently** (Chetley et al. 2006). These sessions will last for four weeks after system installation and the formal training offered above.

Training is given in all the cases to the stakeholders however in Tanzania training is more extensive then in Uganda. This is because in Uganda there was not much found in the documentation about these trainings which at the time could not be filled properly.

4.7 Participation and awareness

There is a clear awareness raising plan for all the projects being implemented in the countries. "*In the DHMIS case there will be an awareness raising session on the ability and potentials of HMIS used in facilities and at the district level. The purpose of these sessions is to showcase the ongoing project to non-project partners for their consideration and continued support for the project*."

4.8 Financial aspects and sustainability

Tanzania: "*Apart from initial equipment cost, no additional costs are planned for. It is assumed that all equipment and services procured will carry a warranty of at least 12 months*." A long term planning financially for all the cases is missing. In the other projects also the planning was not completed and would only be given for the initial costs and even so was in many cases not complete (Gladwin et al. 2003).

No long term financial plans are available for the cases in the documentations. There has **been no explicit mentioning of sustainability** in the documentation.

This table shows the critical issues summarized which still need to be addressed according to the results for the cases analyzed at IICD.

Factor	Critical issue	Not a critical issue
Objectives		X
Planning and strategy		X
Stakeholders roles and responsibilities	X	
Social and cultural aspects		X
Technology	X	
Human capacity development		X
Participation and awareness		X
Financial aspects and sustainability	X	

Table 7: documents results

5 Interviews results

The interviews were based on findings in the documentation; they confirm, reject or add to these findings. These interviews were held with the project managers and country managers and the analysis is based on the same factors and issues as in chapter 5. The analysis was done based on the factors and issues found in analyzed literature (for an extensive overview of the results this research refers to the annexes).

5.1 Objectives

To show that the **objectives and goals are being achieved** when looking at the interview data, in both Tanzania and Uganda monthly reports are being delivered to the Ministry of Health on time and internally the system is time saving because the data is well kept and as a result patient data can be easily processed.

All goals and objectives are being reached which confirm the findings in the documentation.

5.2 Planning and strategy

One slogan which has come back in all interviews is the incorporation of the Ministry of Health (MoH) strategy into the projects. "*Always consider the MOH strategy when implementing systems like HMIS*." Another quote to sustain this finding: "*The government also wants to introduce ICT, now we are working together and are trying to solve problems together*."

However there is still a long term planning missing for what to do after IICD has left the project. This has also been found in the statement made by one of the interviewees saying that: "*the biggest concern is what is going to happen when IICD leaves."*

As found before in the documentation they do work with short term planning starting small. "W*e start implementing the system in only a few hospitals, when the pilot is successful that is when we move on to the next implementation."*

There is a lack of long term planning availability making it difficult to know how the projects are going to be implemented when IICD is gone, but the short term planning with small scale introduction seems to be working for the introduction of the system. In Zambia and Mali they also agree they are going to use this approach even though the system has not been implemented yet the interviews suggest that they have also chosen to start small on the district level where people are already interested in the system and move from here to other implementations on a bigger scale.

Strategy vision and national plans are clearly defined in all cases. Even in the cases which have not been implemented yet (during the time of this writing) in Mali and Tanzania. However, for the long term there is still a lack of planning in all cases.

5.3 Stakeholders roles and responsibilities

Defining the different roles at each level within the organization and **involving these stakeholders as much as possible** in the planning, development and use of the system that is going to be implemented will help make the system more successful (Chetley et al. 2006).

The interview findings show that **in all the cases this is a concern and the biggest stakeholder is seen as the MOH.** They show that by including the MOH from the start into the projects particular needs and wishes from them can be better included into the HMIS.

There also seems to be a **high degree of dependency from other project implementers/partners, especially "technical" partners, which was not foreseen.** This can be attributed according to the interviewee **to the lack of technical capacity** within the hospital, both for the development and the use of the systems. The support for the systems is therefore often provided by external consultants and help desks which are financed by IICD who's needs and responsibilities also need to be considered.

During the analysis it became very clear through the interviews that there has been **a shift in the work processes**. Because of the HMIS **people's roles and responsibilities have changed, however it is unclear in what way it has changed and what the new roles are.** The interviews also support this by one of the interviewees stating that: *"Changing the way people work is still a problem. Their new roles and responsibilities need to be clear.''*

The introduction of an HMIS means that the stakeholder's roles and responsibilities are bound to change. Which is clearly found back in the interviews **the exact way in which they change however has not been clearly stated**. However there is great attention given to the fact that they are changing due to the implementation of the projects. The different stakeholders consisting of: users, the different clinics and external stakeholders will all be affected. The needs of these parties and their roles need to be explicitly documented and need to be taken into consideration when designing and implementing the HMIS.

5.4 Social and cultural aspects

"From my point of view each stakeholder is positively affected by the introduction of an HMIS. I also believe that there will always be people in every group who are negatively affected depending on the objective of the system, if the objective were to properly control the pharmacy stock then those who were happy with the stock not being properly in control will be affected."

The shift in roles and responsibilities often conflicts with established social and cultural traditions (Kiu kim (1990); Gladwin et al. (2001)). All the benefits and stresses have been identified; the social and cultural issues which still need to be addressed have been identified by the interviewees. Findings also stated that "*the culture of information is slowly picking up, routine data collection are in place and used and the use of evidence based decision making is becoming part of the organization management", s*tating a positive result for the systems in implementation.

The benefits and stresses found in the different countries influencing the social and cultural aspects also influence the introduction of an HMIS. The results show the most interesting findings that were made per country in the interviews when discussing these issues. A **proper assessment of all the benefits and stresses** has been found in the interviews. These stresses found also emphasize the social and cultural aspects which still need to be tackled because they are seen as a stress points by the interviewees.

In Tanzania the social and cultural issues concern:

- Corruption: there should be better control of the data therefore less corruption because of better overview of finances
- Transparency: doctors don't like to be looked at, there is a fear of private information being exposed and therefore less informal rewards and better control. *For example more control of councils dividing the budgets.*
- Politics: personnel is deliberately kept unaware to avoid confrontations
- Automation brings fear to people of losing their jobs
- Working together is a problem.
- Do not have a workflow based culture.

Uganda

1. There is no culture of sharing: developing a culture towards the use of data and information for sound decision making processes still needs to be addressed.

Zambia

1. Transparency: opposition from doctors and nurses because of a better control over personal gains through private business. In Zambia about 50 percent of their time is spent on receiving patients and getting paid for private accounts.
2. The culture of rather paying people then having to pay for connectivity.
3. There is a need of incentives to feed the system more personal benefits make the system use more appealing.
4. Privacy: the sharing of patient information, you have to be very careful about who has access to the database.
5. Involvement from the MOH who states that health information should stay within the country and also the server.

Mali

- Culture of respect and admiration.
- Corruption: personal gain is no longer possible.
- Already has a culture of decentralization.
- MOH hesitant of introduction of not proven technology.
- Negative long term perspectives can be seen as a problem.
- MOH hesitant of introduction of not proven technology.
- Culture of moving to other countries when finishing schooling.
- Personal gain: the influence of people who work between the different levels can use the system for personal gain.
- Regional level manipulates data very often.

The **shift in roles and responsibilities often conflicts with established social and cultural traditions**. The established roles tend to be very hierarchical divided; the HMIS brings change in this which is not appreciated by all the people involved. All the benefits and stresses have been identified, the social and cultural issues which still need to be addressed have been identified by the interviewees. Findings also stated that the culture of information is slowly picking up, routine data collection are in place and used and the use of evidence based decision making is becoming part of the organization management, a positive result of the systems in implementation.

5.5 Technology

Findings in the interviews showed that people would lose motivation to use the computer because **of bad connectivity**; they frequently stated returning to the old ways of manual data registering because of this. **Problems are worse in rural areas** where now alternative power supplies in the form of solar panels are being used. These alternatives however, are still very expensive and budgets need to be sought or other alternative ways of supplying energy. "*The use of alternative power like generators and solar panels in rural areas help to give the needed energy either as a backup or as a permanent power supply. The costs should be weight against the benefits supporting the needed alternative.*"

The **software being used for the system is a concern** (Gladwin et al. 2003).
A national standard is still to be created to enable a better network connection of all hospitals with each other for improved information exchange. In addition, **backup for the hardware of the systems which are being used is not available**. One of the interviewees stated that "*If one server would break down, or a computer would become unusable, there is no backup for the system and work will have to stop*." **Sustainability of the system is an issue** because of the high costs of hardware. Cheaper alternatives will have to be sought.

The interviews supported the findings already made in the documents analysis about the use of standards in Tanzania and Uganda with the accompanying foreseen problem. The interviewees stated that the differences between the two systems in Tanzania should be supported to avoid lock in. The main difference between them being that one is workflow based and the other is not. For care2x the system is more of a pilot and there is documentation of lessons learnt. The process based system of care2x also brings problems sometimes because it is not a loose fitted system but workflow based meaning that if one person did not do his job the whole system can not continue, Afyapro does not have this problem.

The same problems concerning **a lack of standardization, electrical power, backup and user friendliness**, as found in the documentation, were also found in the interviews. Electrical power is the biggest concern in rural areas.

5.6 Human capacity development

Overall lack of computer literacy is often a problem because most of the people - especially in rural areas - have never used a computer. The research showed that **the computer is often seen as something for the privileged or people of higher status in a hospital, and if used it was often not to its full potential**. People were used to doing everything manually and were not trained in the use of information systems based on ICT.

Brain drain on local level is also a problem as it is very difficult to get people to work in rural areas. This is because working conditions in rural areas are much tougher then in the cities,

though the living costs are much lower. People who have had training and work with the HMIS are often promised higher salaries because of the lack of people with this knowledge in other hospitals especially in the cities. **This is different compared to brain drain in Europe and the United States where it is on an international and less national level.**

What should also be considered is training aimed at data collection and analysis. Even though much time is now being spent on the training of basic computer skills, there is a **lack of training to handle the data produced by the system and to understand the goal of the system** Gladwin et al. (2003); Chetley et al. (2006)). Quote: *"The weakest link is always the moment of data collection." There is a tendency to over relay on computer based applications while people are still in need of more training."* Furthermore, **no plan for continuous learning** has been developed in the projects. This however is done by some of the participants out of own interest, which is a positive development.

Overall lack of computer literacy and brain drain on local level is also a problem because most of the people - especially in rural areas - have never used a computer. Training as a part of capacity development is also an element of awareness. From the analysis can be concluded that even though the training being received is of good quality, **not enough time is given to training**.

5.7 Participation and awareness

By **making people aware of revenues** – like, use of HMIS may result in higher salaries because of improved efficiency - their interest can be triggered and motivation to use the system may rise. As the quote from one of the interviewees show: *"There has been a tremendous change through the introduction of awareness sessions, teaching and educating people on how the system works."* For maximum success an ICT project requires all participants to participate and view the innovation as adding value to existing systems; if the people using the system do not like, want, or support it, it will likely fail (Gladwin et al. 2003).

All stakeholders should be made aware of the system; however, **many stakeholders are not aware of the goal of the system;** one of the reasons for this can also be found in the interviews stating that: "*Modular introduction of the system leads to not all stakeholders being involved."* More time should be spent at making the users aware of the possibilities and added value of the system. Other stakeholders like the government are more aware of this and their interest seems to be growing as a result of the reports processed by the system being handed in on time (see also factors objectives and strategy and planning).

There is also a cultural fear of the people due to lack of information about the computers. People still think that computers are only for scientists or that they are there to take over their jobs. Through consistent awareness raising in the form of better information and through training will help them to better accept the system.

All stakeholders should be made aware of the system; however, **many stakeholders are still not aware of the goal of the system;** one of the reasons for this can also be found in the interviews stating that because of the modular introduction of the system not all stakeholders are being involved. More time should be spent therefore at making all stakeholders aware of the possibilities and added value of the system. **There is also a cultural fear of the people due to lack of information about the computers**. Consistent awareness raising in the form of better information and training will help them to better accept the system.

5.8 Financial aspects, sustainability

Sustainability issues also arise as a **lack of long term planning for the projects**. Several stakeholders are concerned about the sustainability as for many projects **it is not yet clear how the project is going to be funded when IICD is gone**.

More money is required for salaries of ICT personnel in hospitals. As ICT staff is not seen as direct hospital staff, many hospitals do not include their salaries in their budgets. These people are essential to support the systems and therewith for the sustainability. Hospitals should be made more aware of their roles and responsibilities to understand why they have to pay their salaries.

Clear analysis of the costs is needed at the beginning of the projects to indicate the budget needed for a project. As the M&E and the interviews indicate that if the other items have not been budgeted for from the very beginning, a health facility entering an ICT project might fail to continue after an initial start. For example in Tanzania costs often turned out to be much higher then expected: *"Hardware costs are higher here and it is also the case in many places. The price for computers, UPS, printers etc are still very high and hence our projects have failed to provide computers to all the departments within the health facility. What we are doing is to partially computerize some departments and leave others in manual work."*

Clear analysis of the costs is needed at the beginning of the projects to indicate the budget needed for a project, because costs often turned out to be much higher then expected. Sustainability issues also arise as a result of the lack of long term planning for the projects. Several stakeholders are concerned about the sustainability as for many projects it is not yet clear how the project is going to be funded when IICD is gone. More money is also required for salaries of ICT personnel in hospitals which at this point are not really seen as paid personnel in hospitals jeopardizing sustainability of the system when IICD is gone.

This table shows the critical issues summarized which still need to be addressed according to the results of the interviews for the cases analyzed at IICD.

Factor	Critical issue	Not a critical issue
Objectives		X
Planning and strategy		X
Stakeholders roles and responsibilities	X	
Social and cultural aspects		X
Technology	X	
Human capacity development	X	
Participation and awareness	X	
Financial aspects and sustainability	X	

Table 8: interview results

6 M&E results

These results are based on the M&E documents at IICD. Here also the analysis was done based on the factors and issues found in analyzed literature as shown in chapter 5.

A definition to consider is impact on health, this is also called sector impact and measures amongst others whether the project has resulted into more customized patient records and better health care and awareness among project users on the possibilities of using ICT to improve health care.

6.1 Objectives

According to the M&E data in Tanzania 84% of participants stated they had achieved the goals by participating in this project as evidenced by well kept and easily accessed patients' and other records; successful computer training of project people; use of computer daily as a tool and change from manual to computer system facilitating fast daily, weekly and monthly activities. Suggesting that the goals for the system were being reached according to more than half of the participants and the more physical results like availability of data.

6.2 Planning and strategy

Reference is made in the sustainability referring to right cost planning in the planning and strategy of the system.

6.3 Stakeholders roles and responsibilities

No clear references were made about the roles and responsibilities.

6.4 Social and cultural aspects

Experiences have learnt that it is better to start with only one topic in one hospital and to build upon that further and expand in the longer run. It is also crucial to **give doctors and medical staff the recognition for their important role** in the organization this was the case in all the cases. This is interpreted in this research as the importance of the social and cultural aspects influencing the introduction of such a system. **Change management is complex and must be done carefully, step by step.**

6.5 Technology

No explicit references have been made in the M&E about the used technology.
One finding is however the problem of electrical power delaying the projects.

6.6 Human capacity development

The M&E indicated that in cases where people indicated that their goals were not achieved, they would like to have received more on-the-job training or possibilities to practice. Practicing is sometimes not possible due to a lack of infrastructure and/or internet connectivity in their institutions.

6.7 Participation and awareness

According to the M&E data about 50.9 % and 59% respectively of the users in Uganda and Tanzania state that they are aware of the HMIS being implemented. This is a considerably **low level of awareness**; however, according to a comparison of Monitoring & Evaluation data for other projects this is actually quite high, because the HMIS projects have only been in implementation for a rather short period. In the projects the **lack of awareness** was seen in the fact that people often did not turn up for trainings and a **lack of interest** in the use of the system by doctors and sometimes nurses.

6.8 Financial aspects, sustainability

At the start, **unless a very clear analysis has been made, the costs are not clear**. If the other **items have not been budgeted for from the very beginning, a health**

facility entering an ICT project might fail to continue after an initial start. The experiences in Mali have shown that it is also crucial to make sure that if Internet connection costs are budgeted for they should include all services that need an Internet connection, including MIS, telemedicine, CME, etc...

This table shows the critical issues summarized which still need to be addressed according to the results of the M&E data for the cases analyzed at IICD.

Factor	Critical issue	Not a critical issue
Objectives		X
Planning and strategy		X
Stakeholders roles and responsibilities		X
Social and cultural aspects		X
Technology		X
Human capacity development	X	
Participation and awareness	X	
Financial aspects and sustainability	X	

Table 9: M&E results

7 Interview consultants results

These results are based on the interviews held with consultants who work or who have worked and have experience with health management information systems. Their experiences and encountered issues have been analyzed to be compared to the findings in the documentation and analysis at IICD to decide which of the found issues can be labelled as general issues or issues particularly encountered in these cases based on a more practical view. These results will also be used in the recommendation for the critical issues.

The analysis was done based on the factors and issues found in analyzed literature as shown in chapter 5 and also based on individual questions (for an extensive overview of the results this research refers to the annexes).

7.1 Objectives

No clear references have been made about the objectives by the consultants.

7.2 Planning and strategy

In the planning phase and development of the strategy you should always check in the organization where the HMIS is being implemented: the existing system, competence, supervision competence and the short comings. According to one of the interviewees: "*The way to implement the system is by using the bottom up approach and starting by introducing HMIS one department after another*.''

This is exactly how it is being implemented in the cases at IICD, except in Uganda where the system had been implemented from the top down.

7.3 Stakeholders roles and responsibilities

When considering the stakeholders and their roles and responsibilities you should **start by identifying the information flow in the planning phase**, as stated in literature **their roles and responsibilities**.

The interviewees also stated that in their experience one of the issues which need to be tackled is **the right adjustment of the needs of the management with needs of the situation and population where the health management information system is being implemented.** Realize for example that it is the manager's role to persuade employee for accurate data entry. Management decisions should be based on user involvement and wishes of the population

The experience is also that **there is a general lack of stakeholder involvement.** This is because of the changes in roles and responsibilities which may change. "*You know what you have, but not what you get, therefore it is better not to change."*

Decentralization is seen as a form of empowerment to the lower layers. Therefore you should include users in the planning and implementation of the system. User involvement is particularly needed when:

- Deciding who is responsible
- Deciding who to train
- Checking responsibilities of each user

This confirms the findings in literature about the roles and responsibilities being clear and also **stressing the involvement of the user** in the planning and implementation of the system which is not being done completely in the cases at IICD.

7.4 Social and cultural aspects

A phenomenon that has been experienced in developing countries which may explain the issues with the use of the systems is according to one of the consultants **because there is no real personal interest in statistics in developing countries.** One of the suggestions from the consultants is the use of reward systems and secondary reward systems which is much more appreciated and more easily integrated into the existing culture.

When it comes to benefits and stresses, the benefits still seem to be experienced more by **the hospital owners through increased revenues and reports availability**.

According to one of the consultants it was noticeable that: *changes will always threaten the status of a person s quite similar in all countries in Africa*, confirming that **they still consider information as a powerful thing in all African countries**.

The HMIS has helped to improve the means of communication between various health care levels and between health workers on the same level in a country where information and knowledge still equals power.
However **changing the way people are used to work and changing working relationships is still an issue.**

Things like corruption are still an issue people may experience reduced income due to proper stock control, redundancy or move to other departments.
" *These problems often have to do with health workers and managers not being used to change too much their ways of doing things and the introduction of technology which makes everything more rigorous and transparent.*''

Political issues like the government policy being too complicated to implement or old fashioned are also problem. **How the system is received also differs per country this is more politically based**. "*How the system is received locally differs because the bureaucratic culture of Francophone and Anglophone countries differs*.''

Through user participation in every stage of the HMIS introduction and a combination of users from various health care levels better participation can be achieved. One of the suggestions from the consultants is the use of reward systems and secondary reward systems which is much more appreciated and more easily integrated into the existing culture.

7.5 Technology

Problems encountered are based on **connectivity, double work due to manual work and lack of adequate back up,** according to the consultants all the same problems which are being tackled at IICD.

7.6 Human capacity development

There is a **general lack of right capacity in developing countries especially for statistical analysis.** There is a need for training for managers and data enterers.

By **conducting on-job/onsite training while in the working setting** areas requiring more training can be identified in which to better train users. However one of the consultants also states that the reason why this is not being properly done is due to the lack of funds.

7.7 Participation and awareness

The consultants stated the following issues which according to them still need to be tackled concerning the participation and awareness:

6. Lack of awareness of importance of right numbers in data analysis.
7. Lack of personal benefits from statistics.
8. Lack of awareness for the use of healthcare
9. Lack of involvement of the MOH in the system
10. Lack of employee involvement

The users also **need to be informed about the coming changes in their work routine** so that they can participate and feel they are part of the change process from the beginning of the project. **Conducting awareness workshops from the start of the project is very important**. "*Because without awareness there is no commitment to change, and therefore no change*.''

A good quote to explain the need of participation and awareness by using action research as a method:
"*In all phases it is very important to have users involved. But typically you need to produce some results before people see how they can benefit from a system and before you can find the good way of participation. Users will become increasingly involved as the project develops.*
It is sometimes therefore acceptable and natural not to have much participation in the beginning apart from the formal interest. People are interested but you have to show them that your approach can make changes. There are millions of meetings and workshops in Africa you have to show more action and less talk.''

All stakeholders should participate because they all play a role in building and using the HMIS. This is also needed to build local ownership of the HMIS. Conducting awareness workshops from the start of the project will help them understand the changes needed. Producing results is the best way to then get people to start and keep participating in the project.

7.8 Financial aspects and sustainability

After the implementation there is a need for good governance of the system which will lead to sustainability as long as most of the factors during the implementation phase are considered.

8 Opportunities encountered

As a result of the interviews this chapter will summarize all the positive opportunities and new findings which have been found in the interviews. These results show the opportunities which are experienced because of the introduction of an HMIS according to the interviewees and it also summarize the new factors which have been found.

8.1 Positive opportunities encountered

- **Positive interest from the government in the system being implemented:** During implementation positive interest from the government in the system being implemented in the private hospitals in Tanzania. "*Because the information is being delivered complete and on time. Since we have produced the data they like it and also want to use it in the other hospitals*."
- **Working and solving problems together with the government:** Government working together and trying to solve problems together with private hospitals and public private partnership.
- **Introduction and use of local area networks** to make it easier to share information cost effectively and without needing internet connection for all the computers.
- **System standardization:** Working towards one system standardized for Tanzania through working together intensively with all the hospitals where the open source version of the system is being implemented through knowledge sharing and avoiding reinventing the wheel all over again.
- **Better allocation**: better management on district and national level lead to more efficient allocation of staff and medicine due to the available numbers and data. Leading to better healthcare quality and right capacity use.
- **Financial benefits**: better allocation leads to financial benefits.
- **Predictability**: because of HMIS decision makers are now able to predict and act better on epidemics thanks to the available information and a more professional approach to health care. The whole community can benefit from this because of preventive measures which can then be taken from advanced. This also leads to an improvement of data collection, analysis and reporting routines, tools and procedures.
- **Adaptability**: Application of HMIS to basic and user-friendly software like Excel
- **System use**: Possibility to use this tool right at Health Facility levels
- **Financial aid:** hospitals being able to deliver data on time will be able to get better financial aid based on the available information.
- **Capacity building**: Building health workers' capacity both in public health issues and HMIS issues. Development of training modules and curricula for Health Records Officers (totally absent in the Ugandan panorama)
- **Interest**: there is an increased interest into computers.

8.2 New factors

There are issues which have been found and labelled as not identified during the data analysis. These are issues which contribute negatively to the implementation of HMIS which had not been clearly identified in the developed framework.

External political factors

According to the results there might be **a political will aiming at hiding information** from the Non Government Sector, this is a sensitivity which can be connected to the idea that in the private sector things always look more effective and efficient. Councils still decide how to divide the budgets and where the money is supposed to go. There is also a tendency of governments being very old fashioned and holding on to rules and d policies which tend to negatively influence the introduction of the HMIS. An **increase in collaboration** between public and private partnerships, hospitals and centres, process and structures and practical collaborations could help this.

Focus of the national system

Another problem **is the focus of the national system** for the entire system. There is too big a focus on things like aids because the donors only want this information. But in practice there are

many other diseases and information needed but because of the stressing on HIV other information might go for granted.

These are all factors which can not be controlled by the hospitals where the HMIS is being introduced. By involving the government into the projects from the beginning of the project as a potential stakeholder most of these problems can be possibly avoided. The reason for this is, that the more involved the government is, the more they can realize and see the potential of a health system. This way their willingness to participate and change the policies will increase.

8.3 Factors to consider per phase

Another finding which has been made is a categorization of factors which contribute to the different phases used in the developed tool according to the consultants which were interviewed and based on their experience they were asked to categorize each factor to importance per phase.

According to the interviewees the following factors should be considered during **the planning:**
Objectives, Planning and strategy, Stakeholders roles and responsibilities, Social and cultural aspects and Participation and awareness.
All these factors prepare the implementation phase through building awareness of the need for change and involve key stakeholders' who play a big role in identifying the system's requirements.
In this phase it is also important to prepare for the costs of implementation. Understand the user requirements, conduct awareness workshops and start with
basic computer trainings.

During the implementation:

Objectives, Planning and strategy, stakeholders roles and responsibilities, Social and cultural aspects, Technology, Human capacity development, Participation and awareness, Financial aspects and sustainability.
Considering these factors during the implementation phase will build ownership from within the organization and its stakeholders and thus build the roots for the system's sustainability after end of the project.

During the final phase:

Sustainability and roles and responsibilities should be considered after the implementation of the system. These two should be made very clear to help sustain the project which is being implemented.

It is very interesting to see that the developed tool also coincides with the suggestions which have been made about the factors which need to be considered in each phase according to the interviewees. This shows again that the tool can be used to analyze and help project managers and other project implementers when planning, implementing and running the introduction of an HMIS into hospitals in developing countries in Africa.

9 Conclusion

After defining an HMIS it became clear that only in the countries of Tanzania and Uganda there were projects being implemented which could be used for this research. By then building a framework to recognize the issues contributing to the introduction of an HMIS a tool was build with which to analyze the documentation and interviews held at IICD and with external consultants.

Through this analysis some of the positive aspects which have been found were given in the results it is by any means good to see that that the objectives and goals are being reached. Even though the planning and strategies being used may differ they are all still achieving the goals set for each project. There is a proven positive interest from the government in the system being implemented. And it is becoming increasingly more common for the hospitals to work and solve problems together with the government.

In Tanzania they are even working towards one standardized system through knowledge sharing and therefore avoiding reinventing the wheel all over again.
The introduction of the system itself has also helped for better allocation, financial benefits and better predictability of epidemics. All in all this has led to better financial aid for hospitals based on the available information, capacity building for the health workers and an overall increased interest in computers which was not there before.

Also the discovery of new factors like the external political factors and the focus of the national systems are some findings which contribute to this research. These are however factors which can not be controlled by the hospitals where the HMIS is being introduced. But, by involving the government into the projects from the beginning of the project as a potential stakeholder most of these problems can be possibly avoided. The reason for this is, that the more involved the government is, the more they can realize and see the potential of a health system. This way their willingness to participate and change the policies will increase.

9.1 The critical issues affecting the introduction of an HMIS

So, what are the critical issues affecting the introduction of a health management information systems in hospitals on the district level in Zambia, Uganda, Mali, and Tanzania?

After analyzing the results based on the analysis of the documentation and the interviews the following factors and issues have been found as the most critical issues affecting the introduction of the HMIS projects at this moment in Uganda and Tanzania. First all the factors will be summarized in a table and then the critical issues which still need to be tackled will be explained. These issues can not be completely separated from each other because they do overlap as will become apparent in the conclusion. Table 10 shows an overview of the critical factors with their issues affecting the introduction of an HMIS.

Factor	Critical issue	Not a critical issue
Objectives		X
Planning and strategy		X
Stakeholders roles and responsibilities	X	
Social and cultural aspects	X	
Technology	X	
Human capacity development	X	
Participation and awareness	X	
Financial aspects and sustainability	X	

Table 10: the critical factors and issues.

9.1.1 Stakeholders' roles and responsibilities

The introduction of an HMIS means that **the stakeholder's roles and responsibilities are bound to change.** Which is clearly found back in the interviews and the documents. The exact way in which they change has not been clearly stated. Because the project is dependant upon these stakeholders for implementation and use of the system, the needs of these parties and their roles have to be explicitly documented and taken into consideration when designing and implementing the HMIS.

9.1.2 Social and cultural aspects

The **shift in roles and responsibilities often conflicts with established social and cultural traditions**. The established roles tend to be very hierarchical divided; the HMIS brings change to this which is not appreciated by all the people involved. It is crucial to give doctors and medical staff the recognition for their important role in the organization so they realize that their importance will not change and keep feeling appreciated.

9.1.3 Technology

The same problems concerning **a lack of standardization, electrical power, backup and user friendliness**, as found in the documentation, were also found in the interviews. **A good backup for the systems** is a problem in all the cases leaving computers prone to viruses. There is also a **need for alternative ways to produce electricity:** shortage of energy hinders continuous activities and delays the implementation of projects. **The lack of money** hinders **the introduction of alternative ways to produce power**. **System standardization** is also a problem because better collaboration is needed between the project team and the users and other hospitals to achieve a standard system.

9.1.4 Human capacity development

Overall lack of computer literacy and brain drain on local level is also a problem because most of the people - especially in rural areas - have never used a computer. Training as a part of capacity development is also an element of awareness. From the analysis can be concluded that even though the training being received is of good quality, **not enough time is given to**

training. Data misinterpretation due to the due the lack of right capacity is a problem which is experienced through out all the developing countries. The M&E also indicated the people asked would have liked to have received more on-the-job training or possibilities to practice. Practicing was sometimes not possible due to a lack of infrastructure or internet connectivity in their institutions.

Training should be a continuous process to change people from what they are used to, to new technology because it is very hard to let go of previous institutionalized practices.

9.1.5 Participation and awareness

Many stakeholders are still not aware of the goal of the system; one of the reasons for this can also be found in the interviews and in the M&E data is that because of the modular introduction of the system not all stakeholders are being involved. More time should be spent therefore at making all stakeholders aware of the possibilities and added value of the system. In the projects the **lack of awareness** was seen in the fact that people often did not turn up for trainings and a **lack of interest** in the use of the system by doctors and sometimes nurses.
There is also a cultural fear of the people due to lack of information about the computers. Consistent awareness raising in the form of better information and training will help them to accept the system. **Continuous education** also helps people to understand how the system works better.

9.1.6 Financial aspects and sustainability

In all the data analyzed no long term financial plans were available for the cases in the documentations. Clear analysis of the costs is needed at the beginning of the projects to indicate the budget needed for a project, because costs often turned out to be much higher then expected. **Sustainability issues** also arise as a result of the lack of long term planning for the projects.
Several stakeholders are concerned about the sustainability as for many projects it is not yet clear how the project is going to be funded when IICD is gone. More money is also required for salaries of ICT personnel in hospitals which at this point are not really seen as paid personnel in hospitals jeopardizing sustainability of the system when IICD is gone.
Running short of money from the donors is a common problem and can jeopardize the entire project because this has also an effect on the sustainability of the entire system.

9.2 Validity

Internal validity

Through the use of triangulation in the form of documentation (projects documentation, M&E data), archival records and interviews the internal validity of this research is increased because of the use of multiple sources to support the findings. By interviewing consultants who have also been working with health information systems the findings in the cases could also be tested by comparing their views with the findings.

External validity

The framework was used to test the external validity of the findings to other literature written on the subject. By the use of the multiple case study method and applying the framework to different cases the external validity of the research has also increased.

9.3 Reliability

The use of documentation already available over a longer time span has helped with the reliability of the found data. Most of the documentation can be found on the IICD site and are easily retrievable. Some of the documentation used was drafts and only available in the archives of IICD, however most of these documents are awaiting publication and will soon be available online.

The use of interviews also increased the reliability of the findings in the documents by confirming the findings in the documentation. By focusing on the factors as targets information could be gathered fairly well. The only disadvantage to interviews is that sometimes the interviewee did not understand the questions and would give the answer he would think the interviewer wanted to hear.

10 Recommendations

These recommendations are done for the found critical issues affecting the introduction of an HMIS found in this research. It should also be mentioned that these issues do overlap and that the issues do influence each other and that recommendations will affect other factors too.

Stakeholders roles and responsibilities & social and cultural aspects

By better defining the new roles and responsibilities, the goal and added value of the system, people will understand what their new roles will be and that their status will not change. This will help them cope better with the social and cultural aspects which tend to change because of a shift in responsibilities. For example the doctors and the data enterers relationship which changes. This will make it clear that the sharing of information does not mean a loss of power. Hospitals should be made more aware of the roles and responsibilities of the technical staff to understand why they have to be considered as staff.

A clear definition of the new roles and responsibilities is advised.

Technology

When it comes to the technology all the projects seem to have the same problems concerning power supply, especially in the rural areas where the use of alternative power supplies is advised. The use of different standards could be a problem for Tanzania in the future when it comes to combining this different software together. However the idea of a system which is not workflow based is very much applauded; by using a second platform which aggregates all the data these two software types can still be joined together.

An overall standard is advised on the national level for better data and information exchange. Especially in rural areas the use of alternative power supplies like solar panels should be exploited and encouraged.

Human capacity development

The human capacity development trainings are of good quality but more time should be given for people to get more used to the system especially when it comes to data interpretation. More time given to training should help people to learn to work better with the system.

Investing more time in the trainings for the data interpretation and management (2 to 3 weeks) and more on the job training is advised.

Participation and awareness

Through participation and awareness people will understand the goal of the system better and will have less problems accepting the system once they know what it is for, and how it can be useful for themselves and the hospital. The more personal benefits they see in the system the more willing they will be to use the system.

To increase participation and awareness people can should be shown the personal benefits that such a system may bring to them and to the hospital they are working at.

Financial aspects and sustainability

There is no clear analysis of the costs which are needed for implementation of the system. Therefore costs tend not to be clear from the start and more funding is often needed. Also long term planning for the projects is a problem because there is no guarantee of what is going to happen to the project once IICD is gone. This often makes people insecure about if what they are doing is going to continue when IICD is gone.

To reduce insecurities, long term financial planning is advised especially for when IICD leaves.

Overall recommendation

It is very interesting to see that the factors and their issues in the framework were also found to be of negative influence in the cases at IICD. This shows that the developed framework does help to analyze the issues and factors negatively affecting the implementation of an HMIS into an organization.

This model however can be seen as a bottom up exercise generalizing from empirical cases (Berg, 1999). Therefore it can be applied to HMIS being implemented on the district level in developing countries but should be considered more carefully when used for more “developed’’ countries.

It is also important to check whether other projects have already been done in the country and see if they were successful. If so then it is a matter of copying the system if possible instead of having to invent the wheel all over again. Looking into own databases is also a way of checking if projects of the same type have already been implemented successfully. Better cooperation between IICD and other organizations which are also implementing such a system is also advised this would especially help to avoid reinventing the wheel all over again.

Because the stakeholders involved vary per project and organization it is recommended to analyze the shift in roles and responsibilities and the possible effect that it might have on the introduction of the HMIS for each different project in implementation separately.

Finally, it takes time to change the way people work, so give people the time to get used to these systems.

11 Further research

This research has taken a rather broad perspective on the factors and issues affecting the introduction of an HMIS. For further research is recommended to choose a few factors and to analyze this factor in a much deeper way then has already been analyzed.

For further research this paper also recommends to try and find out the direct relationship between the factors in the findings. The question that would then need to be answered is if the different factors correlate with each other and what this relationship would be like. Therefore giving a more researched view on the different factors and issues in the study and being able to sustain the chosen categorization.

In the beginning of the project it seemed that defining all the stakeholders separately would be a very good decision. However during the research this was no longer of use because the different stakeholders were never clearly defined in the analysis. For further research it could be used as a way of analyzing the different stakeholders per phase more extensively.

The final suggestion for further research would be the developed tool. This could be a powerful tool as a guideline for implementation of information systems in organizations. Therefore further analysis and use of this tool by also adding the factors advised by the consultants as of importance per phase can also be something for further analysis.

“When implementing any kind of project maybe we should start by considering not only what we can take away but also what we can give back.”
- Olaf Erz-

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13 Definitions

ICT
Information and communication technology, the combination of techniques, practices and devices concerned with collecting, storing, processing and distributing data or information.

Data
This is a formal representation from which information is constructed via processing or interpretation.

Information
This is defined as data which has been processed so it has meaning to the person receiving it.

Knowledge
Knowledge is the internalization of information, data, and experience. Which can be tacit present within the mind, behaviour and perceptions of individual members of the organization, or explicit which is the formal, recorded, or systematic knowledge in the form of procedures, rules, organizational archives, principles, etc., and can easily be accessed, transmitted, or stored in computer files or hard copy.

IICD
International Institute for Communication and Development

Staff
These are the doctors, nurses and administration working in health care.

Literature
All the papers used which were written by other researchers describing an HMIS.

Documentation
All the written case information found at IICD

Local level hospital:
This is a local hospital situated in a district, surrounded by supporting clinics. This looks much like a satellite organization with a centre and surrounding posts.

District level hospitals:
These are hospitals in different areas in a country which can be compared to a town or city with all its clinics. Example: physician, eye clinic, women's clinic etc.

Regional level
This level can be compared to a province and is on the level above the cities with all the hospitals in it. This is compared to a province in the Netherlands.

National level
This level can be compared to an entire country and consists of all the districts and provinces

Health centres:
All the centres in a local area concerned with national health which can range from dental clinics, maternity wards to physician wards.

Referral level:
This is the last level of treatment and is when the doctor has referred the patient to a certain hospital for further treatment

HMIS:
Health management information system

MIS:
Management information system

Information system:
A system that provides information to support the decision making process at each level of an organization.

System
This is a collection of components working together to achieve a common objective.

WHO
World Health Organization

Stakeholders
These are all the people and organizations involved in and who have a direct or indirect influence on the system requirements.

Factors
All the issues divided under one heading or factor that should be considered when introducing an information system that can be associated with the subjects involved in the introduction of an information system.

Dispensary
This is where the patient goes to for the first visit when symptoms/ complaints first arise.

Health centre
This is where a patient gets his medication for a particular treatment

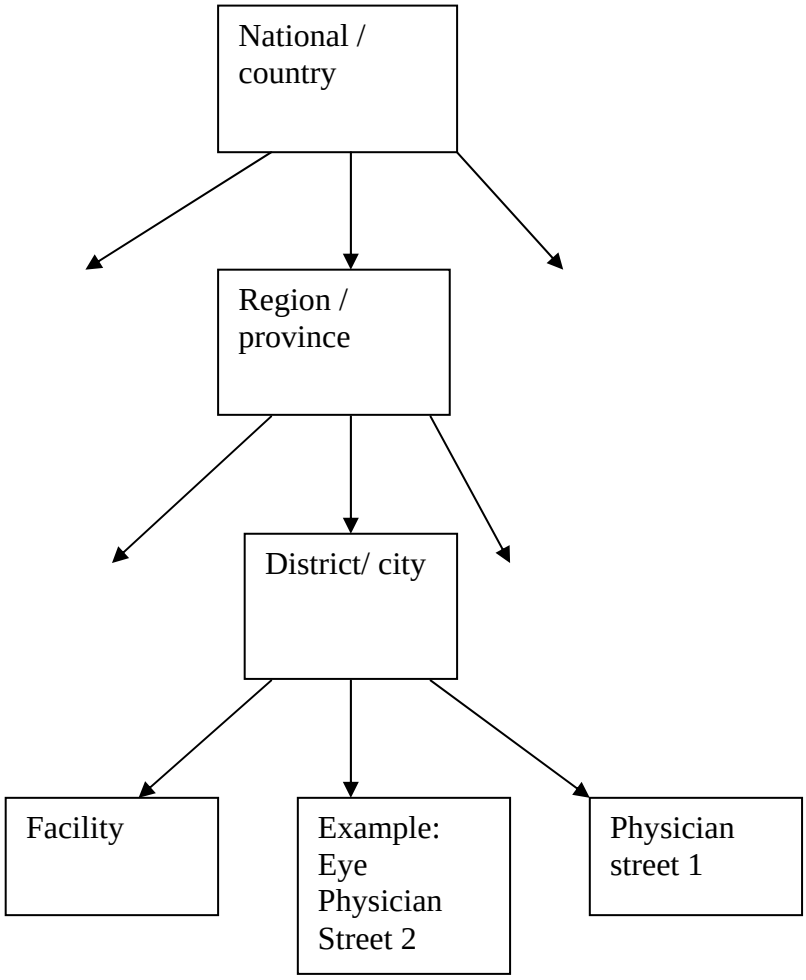
Hospital
This is the level where the patient is referred to in case of the need for an operation or a different kind of treatment that could not be given on the former levels.

Facility
This is a clinic or centre which is usually part of a hospital which is on a higher level. this can be seen as one of the satellite centres of a hospital.

ETC Crystal
ETC Crystal is a public health consultancy group that promotes equitable and robust health systems which are responsive to local needs in low and middle-income countries. They assist governments, NGOs, development agencies and private enterprises to ensure a good connection between policy and practice in public health and in the domain of HIV/AIDS (www.etc-crystal.org).

Afyapro
Andruw Muga, is consultant and software developer, his contribution is asked of based on the fact that Afyapro has been developed in cooperation of IICD and NPK technologies. This system is also being used in many hospitals at the moment and has also been implemented by IICD in Tanzania for the DHMIS project.

HISP
Jørn Braa is the co-chair in charge of relations with non-governmental and governmental organizations. He is associate professor at the Department of Informatics, University of Oslo. He is the coordinator of the Health Information Systems Program (HISP) and BEANISH. Jorn Braa has been involved in Health Information Systems research and development in many countries in Africa, Asia and Latin America over the last 15 years (http://www.witfor2007.org/commission/health/co-chairs).


National / country
Region / province
District/ city
Facility
Example: Eye Physician Street 2
Physician street 1

Annexes

	Phase 1: Planning	Please Choose: Yes/ No/Partly	Phase 2: Implementation	Please Choose: Yes/ No/Partly	Phase 3: After implementation	Please Choose: Yes/ No/Partly
Objectives	8. Has the objective[i] of the HMIS been identified? 9. Has the goal[ii] of the HMIS been identified? 10. Is the objective of the HMIS consistent with the objective of the MOH[iii] ?	O Y O N O P O Y O N O P O Y O N O P	5. Is the HMIS still being implemented? 6. If 1 is NO or partly, please explain why 7. Is the objective of the HMIS still consistent with the objective of the MOH and regional MOH?	O Y O N O P …… …… O Y O N O P	2 Is the HMIS still being implemented? 3 If NO, please explain why 4 Has the objective been achieved? 5 If NO, please explain why 6 Has the goal of the HMIS been identified? 7 If NO, please explain why 8 Have the targets for the HMIS been identified? 9 If NO, please explain why	O Y O N O P …… O Y O N O P …… O Y O N O P …… O Y O N O P ……

	Phase 1: Planning	Please Choose: Yes/ No/Partly	Phase 2: Implementation	Please Choose: Yes/ No/Partly	Phase 3: After implementation	Please Choose: Yes/ No/Partly
Planning and strategy	11. Has the planning for the implementation of the HMIS been developed? 12. If YES, is a document of this planning available? 13. What type of planning is it?(year/months) 14. Where is the planning document stored?	O Y O N O P O Y O N O P …… …… …… ……	8. Is the planning for the HMIS being monitored and implemented?	O Y O N O P	10 Is there a long term monitoring and evaluation process in place for the HMIS?	O Y O N O P
Stakeholders roles and	15. Have the stakeholders[iv] been identified? 16. Have their individual needs or wishes been identified? 17. Has the information flow been identified? 18. Has the information flow been recorded?	O Y O N O P O Y O N O P O Y O N O P O Y O N O P	9. Are stakeholders' roles and responsibilities still being fulfilled? 10. If 5 is NO, Has there been a shift in the stakeholders' roles and responsibilities? 11. If 5 is YES, have the new roles and responsibilities been recorded?	O Y O N O P O Y O N O P O Y O N O P	11 Are stakeholders' roles and responsibilities still being fulfilled? 12 If 10 is NO, please repeat phase2	O Y O N O P

responsibilities						
	Phase 1: Planning	**Please Choose: Yes/ No/Partly**	**Phase 2: Implementation**	**Please Choose: Yes/ No/Partly**	**Phase 3: After implementation**	**Please Choose: Yes/ No/Partly**

Social and cultural aspects	19. Does the entire hospital/ facility participate in the implementation and deployment of the HMIS? 20. If NO, please describe who and why they are not willing to participate 21. Have possible benefits and stresses (or the hospital[v]) been analyzed? 22. Please identify the possible benefits and stresses of the system	O Y O N O P ………………… ………………… O Y O N O P ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… …………………	12. Does the entire hospital participate in the implementation and deployment of the HMIS? 13. If NO, please describe who and why they are not willing to participate	O Y O N O P ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… ………………… …………………	13 Does the entire hospital participate in the implementation and deployment of the HMIS? 14 If NO, please describe who and why they are not willing to participate	O Y O N O P …………………… ……………… …………………… ……………… …………………… ……………… …………………… ……………… …………………… ……………… …………………… ……………… …………………… ……………… …………………… ……………… …………………… ………………

Technology	23. Have the hardware and software to be used for the HMIS been identified? 24. Is there internet connection available? 25. What is the type and speed of the internet connection? 26. Is the internet connection reliable? 27. Is there reliable electrical power for general connectivity of the hardware available? 28. Is the software for the HMIS being designed with involvement from the user[vi]? 29. Is the HMIS user friendly? 30. Have the software and hardware policies and procedures concerning the hardware and software been established? 31. Is there a feedback mechanism in place for further development of the software for the HMIS?	O Y O N O P O Y O N O P …… ……	14. Are the software and hardware policies being implemented? 15. Has the software been implemented? 16. Has the equipment been fully installed?	O Y O N O P O Y O N O P	15 Are the software, hardware and power being maintained?	O Y O N O P

	Phase 1: Planning	Please Choose: Yes/ No/Partly	Phase 2: Implementation	Please Choose: Yes/ No/Partly	Phase 3: After implementation	Please Choose: Yes/ No/Partly
Human capacity development	32. Have the users of the system been identified? 33. Have the required skills of each user been identified? 34. Is there a training designed for the development of skills?	O Y O N O P O Y O N O P O Y O N O P	17. Are users being trained in relevant skills? 18. Are the users with the needed skills concerning the HMIS still present? 19. IF 13 is NO, have substitutes been found?	O Y O N O P O Y O N O P O Y O N O P	16 Is there a plan for continuous learning?	O Y O N O P
Participation and	35. Is there an awareness raising plan for the use of the HMIS in place? 36. Is the entire hospital aware of the goal of the HMIS? 37. Are stakeholders, involved and affected by the project, aware of the goal of the HMIS? 38. Do all stakeholders participate in the implementation and deployment of the HMIS? 39. If NO, please describe who and why they are not willing to participate	O Y O N O P O Y O N O P O Y O N O P O Y O N O P	20. Is the awareness raising being implemented? 21. Do all stakeholders participate in the implementation and deployment of the HMIS? 22. Do health workers feel more aware of the value of ICT? 23. If NO, please describe who and why they are not willing to participate	O Y O N O P O Y O N O P	17 Does the hospital participate in the implementation and deployment of the HMIS? 18 If NO, please describe who and why they are not willing to participate	O Y O N O P ....

awareness		…… ……				
	Phase 1: Planning	**Please Choose: Yes/ No/Partly**	**Phase 2: Implementation**	**Please Choose: Yes/ No/Partly**	**Phase 3: After implementation**	**Please Choose: Yes/ No/Partly**
Governance	40. Have the responsibilities and policies concerning each stakeholder been identified?	O Y O N O P	24. Is the decision and responsibilities mechanism for the stakeholders still in place?	O Y O N O P	19 Is the decision and responsibilities mechanism still in place?	O Y O N O P
Financial aspects	41. Is a financial plan for sustainability of the HMIS in place? 42. What is the start budget of the HMIS?	O Y O N O P …… ……	25. Is the financial output being guarded by the institution and government? 26. Is it within the budget?	O Y O N O P O Y O N O P	19. Was the financial plan within budget? If no, how much over budget?	

Annex: Framework coding

Factors	Phase 1: Planning	code	Phase 2: Implementation	code	Phase 3: After implementation	code
Objectives	43. Has the objective of the HMIS been identified? 44. Has the goal of the HMIS been identified? 45. Is the objective of the HMIS consistent with the objective of the MOH ?	O 1. 1 O 1. 2 O 1. 3	27. Is the HMIS still being implemented? 28. If 1 is NO or partly, please explain why 29. Is the objective of the HMIS still consistent with the objective of the MOH and regional MOH?	O 2. 1 O 2. 2 O 2. 3	20 Is the HMIS still being implemented? 21 If NO, please explain why 22 Has the objective been achieved? 23 If NO, please explain why 24 Has the goal of the HMIS been identified? 25 If NO, please explain why 26 Have the targets for the HMIS been identified? 27 If NO, please explain why	O 3.1 O 3.2 O 3.3 O 3.4 O 3.5 O 3.6 O 3.7 O 3.8
Planning and strategy	46. Has the planning for the implementation of the HMIS been developed? 47. If YES, is a document of this planning available? 48. What type of planning is it?(year/months) 49. Where is the planning document stored?	PS 1.4 PS 1.5 PS 1.6 PS 1.7	30. Is the planning for the HMIS being monitored and implemented?	PS 2.4	28 Is there a long term monitoring and evaluation process in place for the HMIS?	PS 3.9
Stakeholders roles and responsibilities	50. Have the stakeholders been identified? 51. Have their individual needs or wishes been identified? 52. Has the information flow been identified? 53. Has the information flow been recorded?	SR 1.8 SR 1.9 SR 1.10 SR1.11	31. Are stakeholders' roles and responsibilities still being fulfilled? 32. If 5 is NO, Has there been a shift in the stakeholders' roles and responsibilities? 33. If 5 is YES, have the new roles and responsibilities been recorded?	SR 2.5 SR 2.6 SR2.7	29 Are stakeholders' roles and responsibilities still being fulfilled? 30 If 10 is NO, please repeat phase2	SR 3.10 SR 3.11

Social and cultural aspects	54. Does the entire hospital/ facility participate in the implementation and deployment of the HMIS? 55. If NO, please describe who and why they are not willing to participate 56. Have possible benefits and stresses (or the hospital) been analyzed? 57. Please identify the possible benefits and stresses of the system	SC 1.12 SC 1.13 SC 1.14 SC1.15	34. Does the entire hospital participate in the implementation and deployment of the HMIS? 35. If NO, please describe who and why they are not willing to participate	SC 2.8 SC 2.9	31 Does the entire hospital participate in the implementation and deployment of the HMIS? 32 If NO, please describe who and why they are not willing to participate	SC 3.12 SC 3.13
Technology	58. Have the hardware and software to be used for the HMIS been identified? 59. Is there internet connection available? 60. What is the type and speed of the internet connection? 61. Is the internet connection reliable? 62. Is there reliable electrical power for general connectivity of the hardware available? 63. Is the software for the HMIS being designed with involvement from the user? 64. Is the HMIS user friendly? 65. Have the software and hardware policies and procedures concerning the hardware and software been established? 66. Is there a feedback mechanism in place for further development of the software for the HMIS?	T 1.16 T 1.17 T 1.18 T 1.19 T 1.20 T 1.21 T 1.22 T 1.23 T 1.24	36. Are the software and hardware policies being implemented? 37. Has the software been implemented? 38. Has the equipment been fully installed?	T 2.10 T 2.11 T 2.12	33 Are the software, hardware and power being maintained?	T 3.14

Human capacity development	67. Have the users of the system been identified? 68. Have the required skills of each user been identified? 69. Is there a training designed for the development of skills?	HCD 1.25 HCD 1.26 HCD 1.27	39. Are users being trained in relevant skills? 40. Are the users with the needed skills concerning the HMIS still present? 41. IF 13 is NO, have substitutes been found?	HCD 2.13 HCD 2.14 HCD 2.15	34 Is there a plan for continuous learning?	HCD 3.15
Participation and awareness	70. Is there an awareness raising plan for the use of the HMIS in place? 71. Is the entire hospital aware of the goal of the HMIS? 72. Are stakeholders, involved and affected by the project, aware of the goal of the HMIS? 73. Do all stakeholders participate in the implementation and deployment of the HMIS? 74. If NO, please describe who and why they are not willing to participate	PA 1.28 PA 1.29 PA 1.30 PA 1.31 PA 1.32	42. Is the awareness raising being implemented? 43. Do all stakeholders participate in the implementation and deployment of the HMIS? 44. Do health workers feel more aware of the value of ICT? 45. If NO, please describe who and why they are not willing to participate	PA 2.16 PA 2.17 PA 2.18 PA 2.19	35 Does the hospital participate in the implementation and deployment of the HMIS? 36 If NO, please describe who and why they are not willing to participate	PA 3.16 PA 3.17
Governance	75. Have the responsibilities and policies concerning each stakeholder been identified?	G 1.33	46. Is the decision and responsibilities mechanism for the stakeholders still in place?	G 2.20	37 Is the decision and responsibilities mechanism still in place?	G 3.18
Financial aspects	76. Is a financial plan for sustainability of the HMIS in place? 77. What is the start budget of the HMIS?	FA 1.34 FA 1.35	47. Is the financial output being guarded by the institution and government? 48. Is it within the budget?	FA 2.21 FA 2.22	19. Was the financial plan within budget? 20. If no, how much over budget?	FA 3.19 FA 3.20

Table: factor coding

Annex: Project information

	Tanzania DHMIS	Tanzania Health facility	Uganda UCMB
	The critical issues affecting the introduction of an HMIS		information and data management for continuous medical education
Project name?	District health management IS	health facility information system	
What is the level of implementation?	District level	Facility level	National level
If more then one please continue in same column			
What is the status of the project?	Implementation	Implementation	Second contract (bridge funding)
Formulation date	5-2-2005	5-1-2005	?-9-2003
Implementation date	5-6-2005	2-1-2006	11-12-2004
Second contract (bridge funding) date			31-7-2006
End date	n/a	n/a	n/a
What is the total budget?(in euros)	€ 121.000,00		€ 190.000,00
Organization name			UCMB
In which country is the project implemented?	Tanzania	Tanzania	Uganda
In what area is the institution?	Rural area	Provincial or district area	Rural area
If more then one please continue in same column	Provincial or district area		Provincial or district area
			Capital city
What is your position in the institution?	Other	Other	
If "other" please enter here:	not relevant	not relevant	
Who are the stakeholders in the project?	Top management	Top management	Top management
If more then one please continue in same column	Funding institutions	Funding institutions	Funding institutions
	Training institutions	Doctors	Training institutions
	Doctors	Nurses	Doctors
	Nurses	Consultants	Hardware vendors
	Consultants	Hardware vendors	Software vendors
	Software vendors	Government	Government
	Government	Patients	Data administrator
	Patients	Data administrator	
	Data administrator		
If stakeholder is other please enter here:			
Who are the users of the system?	Doctors	Doctors	Doctors
	Data administrator	Data administrator	Data administrator
	Other	Other	Other
If "other" please enter here:	department heads, facility managers.	laboratory personnel, pharmacy personnel.	private not for profit hospitals

T1	Yes	No	Partly
O	4	0	0
PS	2	1	0
SR	3	1	0
SC	1	1	1
T	6	1	1
HCD	4	1	0
PA	2	0	0
G	0	0	0
FA	0	0	0
TOTAL	22	5	2

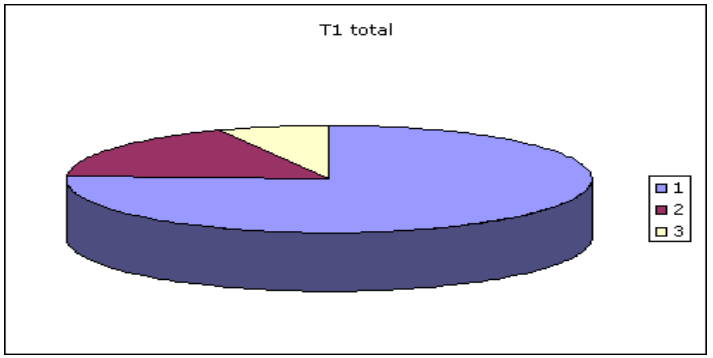


Table documents analysis Tanzania

	Yes	No	Partly
T1	22	5	2
T2	19	4	4
U	24	11	4
Total	65	20	10

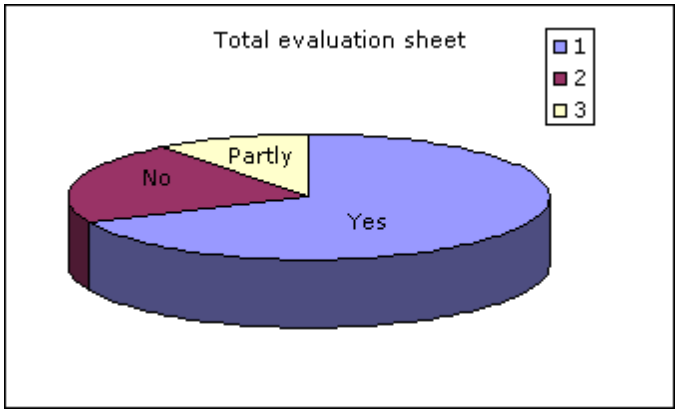


Table documents analysis all cases together

U	Yes	No	Partly
O	3	0	1
PS	3	0	1
SR	3	1	0
SC	0	2	0
T	5	6	1
HCD	3	2	0
PA	4	0	0
G	1	0	1
FA	2	0	0
TOTAL	24	11	4

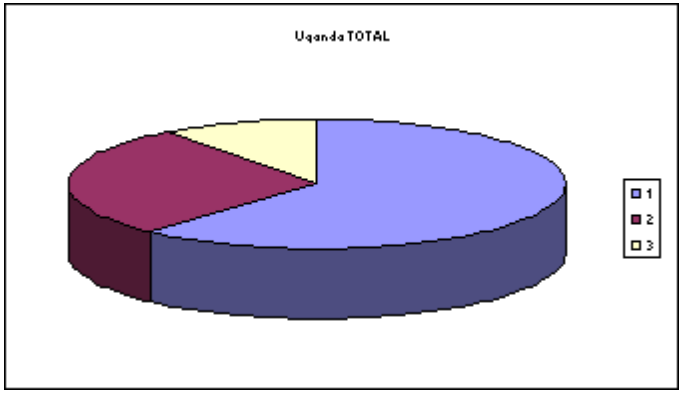
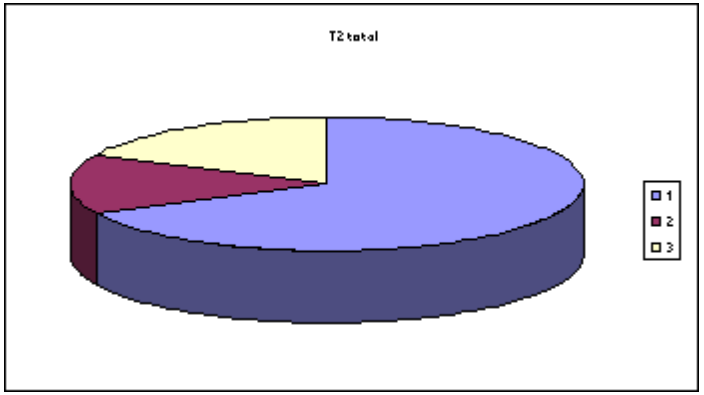


Table documents analysis Uganda

T2	Yes	No	Partly
O	5	0	0
PS	0	1	1
SR	2	2	0
SC	2	0	0
T	5	1	2
HCD	3	0	0
PA	0	0	0
G	2	0	1
FA	0	0	1
TOTAL	19	4	5

Table documents analysis Tanzania



Annex: table with consultants results

Factors	C1	C2	C3
O 1. 1			
O 1. 2	The right adjustment of the needs of the management with needs of the situation and population		
O 1. 3			
O 2. 1		Objectives, Planning and strategy, stakeholders roles and responsibilities, Social and cultural aspects, Technology Human capacity development, Participation and awareness, Governance and Financial aspects: Considering these factors during the implementation phase will build ownership from within the organization and its stakeholders and thus build the roots for the system's sustainability after end of the project.	
O 2. 2			
O 2. 3			
O 3.1			
O 3.2			
O 3.3			
O 3.4			
O 3.5			
O 3.6			
O 3.7			
O 3.8			

G 1.33	Keep responsibilities clear.		
G 2.20			
G 3.18			
Factors	**C1**	**C2**	**C3**
PS 1.4	In the planning always check: Check the system, check competence, check supervision competence Check short coming	Objectives, Planning and strategy, Stakeholders roles and responsibilities, Social and cultural aspects and Participation and awareness. All these factors prepare the implementation phase through building awareness of the need for change involve key stakeholders' who play a big role in identifying the system's requirements. Prepare for the costs of implementation	a. BOTTOM UP APPROACH i. ii. Understand their requirements Conduct awareness workshops iii. Basic computer trainings iv. Give enough time for people to get used to computers\ v. Introduce HMIS one department after another
PS 1.5			Introduce HMIS one department after another
PS 1.6			
PS 1.7			
PS 2.4			
PS 3.9		Governance and sustainability. These two factors depend on each other – after the implementation there is a need for good governance of the system which will lead to sustainability as long as most of the factors during the implementation phase were considered.	

Factors	**C1**	**C2**	**C3**
SR 1.8	Check the: information flow		
SR 1.9	Manager's role is to persuade employee for accurate data entry.		
SR 1.10	Decentralization as a form of empowerment to the lower layers		

SR1.11	User involvement needed when: Deciding who is responsible Deciding who to train		
SR 2.5	Check responsibilities of each user		
SR 2.6			
SR2.7			
SR 3.10	Management decisions are based on user involvement and wishes of the population		
SR 3.11	Change in output from input to output based.		

Factors	C1	C2	C3
SC 1.12	The data enterers is the one most prone and stressed by the introduction of such a system Much of the system still manual. No real personal interest in statistics. Lack of stakeholder involvement Less reporting from private hospitals.	Benefits: Improving means of communication between various health care levels and between health workers in the same level Stresses: Changing the way people are used to work – changing working relationships	Benefits: Mainly Hospital owners, Increased revenue, reports availability much easy Stresses: Reduced income due to proper stock control, redundancy or moved to another departments Politics: When government policy is too complicated to implement or old fashioned Negative attitude towards computers, most people things computers are for computer scientists
SC 1.13	Using rewards systems And secondary reward systems Benefits: Better view of real situation Better budgeting of money Better monitoring. Better decision making.		
SC 1.14			From my point of view, each stakeholder group is positively affected by the introduction of HMIS. Either I also believe there exist within every stakeholder group a number of people who will be negatively affected depending on a number of factors.

			These factors are based on what the objective of such HMIS system is, for example if the HMIS objective was proper pharmacy stock control then for those who were happy with the stock not in proper shape will be negatively affected.
SC1.15			
SC 2.8		Through user participation in every stage of the HMIS introduction – combination of users from various health care levels better participation can be achieved.	
SC 2.9			
SC 3.12			
SC 3.13			

Factors	C1	C2	C3
T 1.16	Check the software being used Check the manual input		
T 1.17	Problems: No Connectivity Double work due to manual work Lack of adequate back up		
T 1.18			
T 1.19			No, internet connectivity is still not available or a problem in the implementation of the DHMIS project.
T 1.20			There is reliable power supply available.
T 1.21		Yes – users play a big role in identifying the HMIS' requirements	Understand their requirements
T 1.22	The system output is top down decided and not users dependable. The input should be considered with the users.	Yes	The HMIS is user friendly and made with involvement from users.
T 1.23			Software and hardware policies and procedures have also already been

			identified.
T 1.24	Check user feedback	Yes, also use of action research helps to achieve this.	There is also a feedback mechanism in place for further development of the software.
T 2.10			
T 2.11			
T 2.12	No reliable back-up available.		There is no reliable back-up in place for the hardware and software in use.
T 3.14			HIGHER COSTS OF ICT HARDWARE, projects become too expensive.

Factors	C1	C2	C3
HCD 1.25	Check: human capacity make people computer literate buy the right software and hardware	Problem is that most users are computer illiterate.	Yes, users were identified based on based on the departments affected by HMIS.
HCD 1.26	Check feasibility of the data enterers Better working together of managers and data enters		
HCD 1.27			Basic computer trainings
HCD 2.13	General lack of right capacity in developing countries especially for statistical analysis. Need for training for managers and data enterers.	Conducting on-job/onsite training because while in the working setting you can identify major areas requiring training, helps to better train users.	
HCD 2.14			
HCD 2.15			Yes, but funds could be a problem
HCD 3.15		yes	

Factors	C1	C2	C3
PA 1.28	Lack of awareness of importance of right numbers. Lack of personal benefits from statistics. Lack of awareness for the use of healthcare Involvement of the MOH in the system Lack of employee involvement	There is an awareness raising plan in place. Yes Because its users need to be informed about the coming changes in their work routine so that they can participate and feel they are part of the change process from the beginning of the project	Conduct awareness workshops
PA 1.29			Yes, about 60%.
PA 1.30			
PA 1.31		All stakeholders should be informed Because they all play a role in building and using the HMIS. Yes all need to participate. (The same reason as above – build local ownership of the HMIS)	
PA 1.32			
PA 2.16			
PA 2.17			
PA 2.18			
PA 2.19			
PA 3.16			
PA 3.17			

Factors	C1	C2	C3
FA 1.34	Lack of money for generators		
FA 2.21			
FA 2.22			

FA 3.19			
FA 3.20			
FA 1.35			
N.I.	No personal benefit from right statistics as employee. Private hospitals should get more involved for more accurate view of numbers. Local brain drain. Lack of feedback to employees and decision makers.		Give enough time for people to get used to computers\ Conduct change management and awareness raising workshops for better system integration. **funds could be a problem.** Most users are computer illiterate; they need enough time to familiarize themselves with this new technology to them.

[i] The overall objective: this is the objective of the HMIS and should be seen as an objective to be achieved on the long term (long term).

[ii] The goal: is the short term objective to be reached per phase and a step towards reaching the overall objective (short term)

[iii] MOH: Ministry of health

[iv] Stakeholders: all the people and organizations who are involved in the project during development and implementation of the HMIS.

[v] Hospital: all the people in the district hospital who may be affected by the introduction of an HMIS, see also figure 1.

[vi] Users: These are the people who are going to be working directly with the HMIS as the end users. Their job will be to interact with the system by entering, analyzing and interpreting data in the HMIS.