Mobile Supported e-Government Systems

– Analysis of the Education Management Information System (EMIS) in Tanzania

Gudrun Wicander
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Abstract

e-Government systems are considered by both governments and international organisations to improve administration and management. In Tanzania, an e-government system for education administration, EMIS, is partly implemented but shows several limitations. Statistical data is collected but the process is resource demanding and much of the collected data are never put into the system, and therefore remain inaccessible from this electronic system.

The overall aim of this study is to propose an approach to designing more efficient e-government systems within the education sector. The focus is on public schools. The more specific aim of the present study is to:

- explore more efficient data transfer (faster, more reliable, and potentially less resource demanding) by using mobile telephone technology, especially SMS, as a means for statistical data collection for Tanzanian education management.

The study is guided by an overall research approach that comprises systems theory and a socio-technical view. This research is performed as a case study, inspired by the ethnographic method and comprises field studies in East Africa. A multi-technique approach is used for empirical data gathering, including literature study, interviews, and direct observations. The analytical process is performed by developing and applying three analytical models:

- **XIF** - the eXtended Sustainable ICT Framework
- **Triple A** - Access, Attitude, Awareness
- **Seven Aspects** – an Approach Towards Success

The contributions of this thesis are as follows. A mobile supported SMS-based statistical data collection process employing a blended digital solution is proposed. Likely effects of such a system would be `better` data e.g. less transmission errors, which provides for `better` administration, `better` decision-making, and also provides for transparency. Moreover, it is very likely that the proposed system is significantly less resource demanding than the present system.

The three analytical models that are developed specifically for this study have generic characters and can be used during the implementation process of other e-government solutions. The most important part of the contribution is not the technological solution per se; it is the process that foregoes the actual implementation. The proposal departs specifically from the Tanzanian educational context but has implications for e-government systems solutions and information systems implementation in developing countries in general.

Finally, three overall reflections are made based on the major observations of the research findings: the Double 'e' Dilemma, on the problem of prioritising electronics before electricity, the Mobiles to Avoid Mobility paradox, highlighting connectivity before mobility, and the opportunity to use the SMS to Combat Corruption weapon.
For
Dagmar, my dear Mother
Susanne, my beloved colleague who passed away before we had finished our project
Theresa and Johanna, my wonderful daughters
As a child, I dreamt about being an explorer. All explorers are driven by curiosity. A geographical explorer goes to the edge of the world to find what’s there and brings back something unseen. An intellectual explorer goes to the edge of knowledge to find what’s there and brings back something unknown. The search at the edge of knowledge leads to the discovery of new knowledge to be used for filling an empty space of scientific silence.

Acting as a researcher and an explorer, you are a translator, understanding the reality as observed, interpreting this understanding in order to explain the world around us. We get to discover the world, to discover knowledge, and to discover the process of research – ‘to reshape the truth into a truer entirety’.

But why do we explore and research? The researcher is perhaps naïve in thinking that she can change the world, that it is somehow possible to influence reality, but for me, this is essential. I carry with me a wish and a desire to change. I explore in order to gain the knowledge needed to bring about a change, no matter how small.

With knowledge comes responsibility: the responsibility to use knowledge to create a better world. Knowledge is power and with power comes duty for the good. As a researcher, there is no greater weapon of knowledge than the pen – it is indeed mightier than the sword.

I have realised that it isn’t easy being an explorer and a researcher. You have to have a flaming passion for the issue at hand, and at the same time keep a cool distance to the research so as to not influence the results.

This particular research belongs to the field of ICT4D, which implies a sociopolitical agenda. ICT4D is not about ICT! ICT in itself is more of a tool, a tool that facilitates communication. ICT4D is about enabling people to make informed decisions; it is about development.

Now I have been given the opportunity to act as the explorer I dreamt of as a child and it has been just as exciting as I thought when I was five!

*You must be the change you wish to see in the world*

(M. Gandhi)

Karlstad in October 2011

Gudrun Wicander
Acknowledgement

Many people have accompanied me during this journey of adventures. Travelling together makes a journey more fun, more creative and more challenging. This experience has given me the opportunity to meet people from many places; generous people that have guided me, supported me, and encouraged me. Many people deserve my greatest gratitude for having made this thesis, this research, this journey, this adventure, this discovery possible.

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Thanks to my landladies in Port Elisabeth, Kathmandu, Kampala, Dar es Salaam, Grahamstown, Iringa, Bhaktapur, and Essaouira. A special thanks to Mamma Dagmar in Hammarsebo, Anna-Lena in Mossby, Marie and Henrik at Donsö, Rosa at Hamburgö, Gita at Riad Gita in Marrakech, Francesco Pipino at Camillo 19 in Oria, and Lisbet and Jan at Zanzibar.

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<th>Full Form</th>
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<tbody>
<tr>
<td>BEDC</td>
<td>Basic Education Development Committee</td>
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<td>BEST</td>
<td>Basic Education Statistics in Tanzania</td>
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<td>BNF</td>
<td>Batchelor and Norrish Framework</td>
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<tr>
<td>C2C</td>
<td>Computer-to-Computer</td>
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<tr>
<td>CC</td>
<td>Carbon Copy</td>
</tr>
<tr>
<td>COSTECH</td>
<td>Tanzania Commission for Science and Technology</td>
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<td>CST</td>
<td>Critical Systems Thinking</td>
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<tr>
<td>DC</td>
<td>Developing country</td>
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<td>DEO</td>
<td>District Education Office</td>
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<td>DIRA</td>
<td>Diocese of Iringa</td>
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<tr>
<td>DO</td>
<td>District education Officer</td>
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<tr>
<td>ECT</td>
<td>Education Coordinating Team</td>
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<td>EMIS</td>
<td>Education Management Information System</td>
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<td>ET</td>
<td>EMIS Team</td>
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<tr>
<td>ETHICS</td>
<td>Effective Technical and Human Implementation of Computer Systems</td>
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<td>ESMIS</td>
<td>Education Sector MIS</td>
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<tr>
<td>FYI</td>
<td>For Your Information</td>
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<tr>
<td>G2G</td>
<td>Government-to-Government</td>
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<td>GAID</td>
<td>Global Alliance for ICT for Development</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GIS</td>
<td>Geographic Information System</td>
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<td>GPRS</td>
<td>General Packet Radio Service</td>
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<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>GSM</td>
<td>Global System for Mobile communications, originally Groupe Spécial Mobile</td>
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<tr>
<td>HDI</td>
<td>Human Development Index</td>
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<tr>
<td>HDR</td>
<td>Human Development report</td>
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<td>HIC</td>
<td>High-Income Countries</td>
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<tr>
<td>HIS</td>
<td>Health Information System</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>HMIS</td>
<td>Health Management Information System</td>
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<td>HR</td>
<td>Human Resources</td>
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<td>HT</td>
<td>Head Teacher</td>
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<td>ID</td>
<td>Identity</td>
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<td>IC</td>
<td>Industrialised Country</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
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<td>ICT4D</td>
<td>ICT for Development</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>REO</td>
<td>Regional Education Office</td>
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<td>RO</td>
<td>Regional education Officer</td>
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<td>SA</td>
<td>Systems Approach</td>
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<td>SADAV</td>
<td>Swedish Agency for Development Evaluation</td>
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<td>SC</td>
<td>School Committee</td>
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<td>SEMA</td>
<td>School Education Management Application</td>
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<td>SLF</td>
<td>Sustainability Livelihood Framework</td>
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<tr>
<td>Sida</td>
<td>Swedish international development cooperation agency</td>
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<td>SIF</td>
<td>Sustainable ICT Framework</td>
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<tr>
<td>SIM</td>
<td>Subscriber Identity Module</td>
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<tr>
<td>SIMBA</td>
<td>Sustainable ICT – a Model for Benchmarking Activities</td>
</tr>
<tr>
<td>SIS</td>
<td>Strategic Information System</td>
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<td>SME</td>
<td>Small and Medium-sized Enterprise</td>
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<td>SMS</td>
<td>Short Message Service</td>
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<tr>
<td>SPIDER</td>
<td>Swedish Program for ICT in Developing Regions</td>
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<tr>
<td>SSA</td>
<td>Sub Saharan Africa</td>
</tr>
<tr>
<td>TAM</td>
<td>Technology Acceptance Model</td>
</tr>
<tr>
<td>TANESCO</td>
<td>Tanzania Electric Supply Company Limited</td>
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<tr>
<td>TCRA</td>
<td>Tanzania Communications Regulatory Authority</td>
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<tr>
<td>TSbs</td>
<td>Tanzanian Shillings</td>
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<tr>
<td>TTCL</td>
<td>Tanzania Telecommunication Company Limited</td>
</tr>
<tr>
<td>UIS</td>
<td>UNESCO Institute of Statistics</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNCTAD</td>
<td>United Nations Conference of Trade and Development</td>
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<tr>
<td>UNDESA</td>
<td>United Nations Department of Economics and Social Affairs</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
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<tr>
<td>VAT</td>
<td>Value Added Tax</td>
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<tr>
<td>WEO</td>
<td>Ward Education Office</td>
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<tr>
<td>WC</td>
<td>Ward education Coordinator</td>
</tr>
<tr>
<td>WIFI</td>
<td>Wireless fidelity</td>
</tr>
<tr>
<td>WITFOR</td>
<td>World IT FORum</td>
</tr>
<tr>
<td>WMTE</td>
<td>Wireless and Mobile Technologies in Education</td>
</tr>
<tr>
<td>WSIS</td>
<td>World Summit on the Information Society</td>
</tr>
<tr>
<td>XIF</td>
<td>eXtended Sustainable ICT Framework</td>
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1 Introduction

This thesis proposes taking mobile telephony into consideration as a complementary technology in an e-government system. More specifically, this thesis elaborates on the opportunities to use mobile phones including SMS (Short Message Service) for the support of administration and management of the primary education sector in Tanzania.

1.1 Background

In the context of the eight Millennium Development Goals\(^1\) (MDG) formulated by the United Nations (UN), education as such is one of the basic services with primary education as the first target for initiatives in developing countries\(^2\). However, several challenges are present such as scarcity of financial resources and infrastructure, combined with ineffective government structures and mismanagement, which are among the critical constraints to reach MDG II, i.e. the second MDG, which includes primary education for all.

There is attention being placed on how ICT\(^3\) (Information and Communication Technology) in general can bring about transformation in the developing world (Madon 2009). The World Bank (2007a) emphasises that e-government can contribute with more effective and efficient government management.

- Government solutions can enhance transparency and accountability through improved quality of data; ‘better’ data results in ‘better’ decisions and ‘better’ actions. Improvements of data can be reached in many ways, e.g. more frequent data capture, faster delivery of data, and fewer data transmission errors.

- Government systems are introduced by the public sector in many developing countries but there are several examples of failed e-government attempts in the literature.

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\(^2\) The classification of countries into ‘developing countries’ is both complex, political and controversial (Sundén & Wicander 2006:57-64, esp. 59). ‘Developing countries’ or the ‘developing world’ constitute over 70 per cent of the world population. ‘Developing countries’ does not define a homogenous group nor is it even a common defined concept. There are different assessments of development (ibid), following different classifications of nations. (See World Bank 2008; UNCTAD 2008 for classifications). The terms ‘developing countries’ (DC) and ‘developing regions/world’ will be used in this thesis as the terms are used in the literature of development in general. In addition, the terms ‘developed countries’ and ‘industrialised countries’ (IC) will be used for the same reason. As such, the designation of all terms is intended for convenience and does not imply a judgment about the stage reached by a particular country in the development process.

\(^3\) The term ICT encompasses diverse technologies such as computing, networking, hardware, software, telecommunications infrastructure (landline, mobile, wireless devices and broadband fibre networks), and broadcasting devices.
The implementation of MDG II in Tanzania has brought with it a huge increase in pupil numbers, which has influenced the quality of primary education. The education sector faces several problems such as economic cuts, shortage of qualified teachers, classrooms, and educational materials (Sida 2007b). A result of these problems is a decrease in enrolment and an increase in drop-outs and repeaters, indicating a retention problem due to over-crowding and under training (ibid).

Accurate statistical data is needed as there is a need to monitor enrolment numbers at a local and national level with the strategic implications of these data needed to manage and finance the school system as it governs capitation grants distributed to primary schools each year.

ICT can be used in the education sector in many different ways and can bring improvements such as performing more and better education, including distance education (Andersson 2010) and facilitating administration and management. ICT makes it possible to handle huge amounts of data and to make these data available and transparent.

The Education Management Information System (EMIS\(^4\)) is an e-government system in the education sector in Tanzania for processing statistical data collected in the primary schools (Ministry of Education and Vocational Training 2007).

EMIS has been implemented in most district offices, but a problem when operating the system is that many districts are not well computerised and the Internet is not available everywhere (Uimonen p.c. 2007).

EMIS has shown several shortages and weaknesses and has shown to be resource consuming and at the same time not providing high data quality. The collection of school statistics is performed annually using an extensive paper-based form. This entails problems for the dissemination and collection of the form, which is done by postal service or by delivering it in person. Moreover, entering the data from Tanzania’s 15,000 primary schools into EMIS is a time-consuming task.

For a long time, focus for ICT in developing countries has been on increasing the population’s access to landline telephones and to computers, and later on also to the Internet.

Mobile technology is the fastest growing communication technology in history and is fundamentally changing the way we communicate. This holds true all over the world (see Wicander 2010 and Svensson & Wicander 2010 for reports on M4D – Mobile for Development). Mobile phones are now the

\(^4\) EMIS can also be an acronym for Environmental Management Information System
primary form of telecommunication in developing countries. They play the same role as landline phone networks did in Europe and North America in the 20th century (Mendes et al. 2007).

Mobile technology is now considered an opportunity for enhanced rollout of ICT. In many developing countries, mobile technology is currently the only option available for rural areas. Because of its relatively low cost, ease of use, and accessibility, mobile technology might be the solution for digital connectivity in rural areas.

SMS is a widespread and accepted way of communication (Wicander 2010). Arguments in favour of SMS can be found in terms of its cost, speed, and accuracy (Traxler 2006, 2007).

Mobile technology is rapidly changing the delivery of services in a broad range of fields such as education and government (UNDESA 2007). There is a spreading recognition that mobile technology brings opportunities for increased efficiency. The potential of mobile technology is expressed by Traxler (2007:1) as: “In developing countries, mobile, nomadic and handheld technologies have the capacity to gather, store, deliver and enhance information in ways that are completely different from countries where mains electricity, computer hardware and Internet connectivity are stable, reliable, cheap and abundant.”

Additionally, Madon presents mobile technology as providing “…revolutionary opportunities for promoting social and economic development…”; and “…making processes more open” (2009:22). Therefore, mobile technology should be taken into consideration as a vital part in an e-government system. It is a novel but potentially appropriate technology – it “recognises the economic boundaries and limitations of poverty” as Schumacher once put it (1973:158).

To set the stage for this study, there are nearly 15,000 primary schools in Tanzania, most of them in rural areas, serving approximately 10,000,000 pupils. A head teacher at one of these rural primary schools faces the reality that there is:

- No electricity
- No landline phones
- No computer
- No Internet
- Poor public transport
- Poor conditional road network
- Poor postal service

…but the head teacher has a mobile phone.
The fact that most rural primary schools in Tanzania lack access to computers and the Internet as well as landline phones, coupled with the dramatic growth of mobile phone access through most of Tanzania, creates an opportunity for the use of the mobile network in EMIS, and the collection of statistical data via SMS.

The major focus of this study is to investigate the prerequisites for the present EMIS to be blended with mobile phones, in particular the SMS service. The blended solution discussed in the present study focuses on the possibility of connectivity between institutions within the education sector, from the rural primary school up to the Ministry of Education and Vocational Training (MoEVT) using the mobile network. The mobile network permits sending SMSes between mobile phones and – with the right hardware and software equipment – other devices such as computers. SMS can thus be used to interact with automated systems for services and for accessing information.

A computerised information system blended with mobile devices can be considered to be more appropriate than an Internet-based system in this context.

Hence, there is a potential role for mobiles including SMS in the education sector and also for blended technologies for EMIS, i.e. an EMIS that does not necessarily rely on computers (parts of the present day process for collecting statistical data are not computer-based as will be described in Chapters 2 and 6.1, and thus the entire system is already blended).

There are many studies performed on mobile phone usage in developing countries (see Wicander 2010 for an overview of studies). However, there is a lack of studies looking into the details concerning mobiles as administrative tools in the education sector.

1.2 Research Scope

This section covers the research problem, the aim and the research questions.

Research Problem

e-Government systems are introduced by the public sector in developing countries to improve efficiency, effectiveness, and transparency (World Bank 2007a). However, there are several examples of failed e-government activities in the literature (Heeks 2002a).

The education sector in Tanzania faces several challenges and there is a need for improved administration and management. For instance, enrolment figures are crucial to manage and finance education because they govern
capitation grants distributed to primary schools each year. Thus, such data are critical to schools, pupils, parents and teachers.

ICT can provide support for an improved administration. EMIS can be a part of this ICT, but EMIS presently faces challenges such as a low level of access to computers and the Internet at the district and school levels. In fact, presently EMIS is resource demanding and has problems with data quality and with data transfer as the collection of statistical data is slow, potentially error prone, complex, and without well-developed feedback.

Research Aim
The overall aim of this study is to propose an approach to designing more efficient e-government systems within the education sector. The focus is on public schools as there are presently no private players able to provide primary education for all, and thus no similar management problems to investigate outside the public sphere. If in the future NGOs and foundations were to be given governmental commissions to run thousands of schools each, the results of the present study, despite its e-governmental tint, should be of interest as such organisations would then have to face the problem of scale that the government presently has to deal with.

Considering that mobile technology is now generally regarded an opportunity for enhanced roll out of ICT in developing countries, and that SMS can be a tool for effective and efficient administration of the education sector, the more specific aim of the present study is to:

- explore more efficient data transfer (faster, more reliable, and potentially less resource demanding) by using mobile telephone technology, especially SMS, as a means for statistical data collection for Tanzanian education management.

In effect, the aim is to analyse mobile support in the form of SMS for the Tanzanian Education Managements Information System, EMIS. This calls for some specific research questions that should be addressed.

Research Questions
The research questions that this study is meant to answer are:

- Can mobile phones effectively constitute a part of a blended EMIS?
  - How can the widespread use of SMS be utilised?
  - What would such a blended EMIS look like?

Before setting out to answering these questions, there is a need to evaluate the present EMIS.
Research questions about the present EMIS:

- How is statistical data currently collected?
  - What are the strengths and the weaknesses of the process?

Research questions for the outline of the proposed EMIS, the blended EMIS:

- What are the existing supporting and hampering structures that would influence the implementation of an SMS-based system?
  - What ‘critical’ issues need to be considered?
- What would the consequences of an implementation be outside the system?

1.3 Research Design

This research takes place at an interface between development studies, mobile technology and e-government systems, since implementing mobile solutions in developing countries must address several social, cultural and organisational issues. The study is guided by an overall research approach that comprises systems theory, a socio-technical view, and a critical perspective.

This research is performed as a case study and as such it describes a new phenomenon, where the ‘border’ for the new phenomenon is not clear, in a natural and small setting, on-site, close to the data sources. An understanding of the current state of the specific situation in a community gives a more stable base to create realistic changes for achieving a better state in the future, argues Nilsson et al. (2011; with reference to Nilsson et al. 1999). “At best we take care of some past experiences when analysing the present situation. From a systems approach perspective it is essential to get a deeper understanding of the situation of yesterday and today as a solid base for proposing appropriate social changes for the near future.” (ibid.) The present study is inspired by the ethnographic method and comprises field studies during all together six months in East Africa. It illustrates in descriptive detail the context to gain understanding and develop new knowledge about an undocumented research area.

It is a multi-technique study comprising literature study, interviews, and observations, including different tools to collect data such as several questionnaires. Several data sources were used, both primary and secondary sources, such as empirical data collected in Tanzania together with reports form several MIS (Management Information Systems) projects in developing countries.

This study is performed in two phases that match the two sets of research questions derived above from the overall research question.
The first phase, Phase I, is mainly descriptive. It builds on interviews with respondents from different areas, all with different knowledge and experience from Tanzania. Phase I has mainly a top-down approach and perspective, as most of the respondents are ‘experts’ in different areas. Questions posed to the respondents covered topics involving physical infrastructure (e.g. ICT), education system and administration of educational statistics including EMIS. The first phase was performed during 2006-2008, including a field study in Dar es Salaam, Tanzania in October-November 2007.

The first phase focused on describing the present EMIS and the statistical data collection process within the education sector, including identifying strengths and weaknesses. The outcome was also an overall picture of Tanzania including the ICT situation, in particular the mobile situation, together with a description of the education sector. Additionally, a working report on ‘M4D’ – Mobile for Development’ was produced. This report maps mobile phone usage for development purposes (see Wicander 2010).

The second phase, Phase II, is explorative and apply a more bottom-up approach as it aim to take a user perspective. It builds on interviews with head teachers in primary schools.

Phase II was performed during 2008-2010, including a field study in the Iringa Region, located in the Southern Highlands of Tanzania, during spring 2009. A rural area was preferred for this study as the challenges, obstacles, bottle necks, and problems concerning data and information transfer were presumed to be more frequent and also of a more severe character.

In the Iringa region, 24 primary schools were selected for interviews. Finally, 20 in-depth interviews were performed and in total 217 questions were asked to each respondent i.e. 20 head teachers, making a total of 4340 answers, which constitute the main empirical basis for the analysis.

The second phase focused on exploring the use of mobile telephony in general among head teachers in primary schools in the Iringa Region, and describing the prerequisites and conditions, including beliefs and attitudes of use of mobile telephony including SMS as a tool for the administration of the education sector. The outcome of Phase II was also a description of a hypothetical statistical data collection process according to the aim for the study as a whole.

The proposed solution has been developed during an iterative process including literature studies and qualitative analysis of both primary and secondary data.
The research data is analysed using a systems approach. The systems approach contributes with a general systemic view and with a terminology – a set of terms and concepts derived from systems theory (Appendix 4:0 Keywords in Systems Theory). A systems approach is generally applicable and offers a broad view for the understanding of change processes and to understand the complexity involved.

The analytical process in this study has been divided into four different steps. The first step is an analysis of the present EMIS, mainly emanating from data in Phase I. The second step consisted of the analysis of the usage pattern and profile of mobile phones among head teachers, both private and work-related use. The analysis emanated from data in Phase II. The third is an analysis of head teachers’ views on a hypothetical SMS-based data collection system. This analysis is based on data from Phase II. In the fourth and last step, I return back to EMIS, but with a future perspective on supporting vs. hampering structures, discussing if and how the mobile can effectively be used and adapted as an administrative tool in the education sector.

The analytical process comprises several models that are developed for this study as will be explained in the next section (the models are described more in detail in Chapter 4).

1.4 Contributions

The contribution of this thesis is an elaborate discussion around supporting and hampering structures concerning a proposal for an extended EMIS with mobile technology for ‘better’ statistical data collection, understood as effective and efficient data collection. The proposal consists of an SMS-based statistical data collection process employing a blended digital solution. The most important part of the contribution is not the technological solution per se; it is the process that foregoes the actual implementation.

The proposal departs specifically from the Tanzanian educational context but has implications for e-government systems solutions and IS implementation in developing countries in general.

Contributions of this research are mainly four constructions:

- A future EMIS including examples of identified hinders and suggested solutions. Pre-capture should not be neglected when discussing a digital information system.
- A model for system analysis (XIF, fully described in Appendix 4:4)
- A model for analysis on individual level (Triple A, Appendix 4:5)
• An analysis framework on a process level for e-government system implementation (Seven Aspects Towards Success, section 3.6)

Furthermore, additional contributions consist of a demonstration of:
• how to evaluate from multiple perspectives the potential for mobiles and SMS as an administrative tool in (e-)government activities
• a regionally relevant system proposal (in the Iringa Region in Tanzania)
• an empirical case study that puts the local context in focus and demonstrates the conditions for data collection
• a manageable way of addressing problems related to statistical educational data needed to administrate primary schools
• an alternative approach to ICT-based information systems and IS development

1.5 Outline

The thesis is structured in the following way:

Chapter 1 presents the background and the identified research problem. It also states the aim and the research questions. The chapter ends with a brief introduction to the research design and a summary of the contributions of this study.

Chapter 2 consists of a context description, an overall picture of Tanzania and its society focusing on the education sector. Additionally, an overall picture of the ICT situation in Tanzania and in particular the mobile situation is presented. The systems theoretical rationale for this chapter is to give an extended background to the research setting thereby providing an understanding for the complexity that surrounds the research topic and for the challenges that are present in this particular context.

Chapter 3 consists of a literature review covering works on e-government including e-administration and m-government with a focus on developing countries. The reason for this broad presentation is to give a foundation to the analytical framework for e-government implementation in a developing country context. Failures are costly in general but even more costly in this particular context. It is a generic framework that is applicable to more than the education sector. The rationale is to draw on prior experience including described failures and challenges from related fields and also to contribute with a list of essential aspects worth considering in e-government implementation processes. In order to consider the low-resource setting for this kind of context, an efficient solution that draws on prior experience is important.
Chapter 4 presents methodological issues including the research approach, the methods and analytical models used in the study: these have already been hinted at in section 1.3. Compared to Chapter 3, this chapter is more focused on circumstances pertaining to the educational sector than e-government in general as the investigation has been designed to answer some specific research questions in order to meet a specific aim as declared in section 1.2 above. The complexity of the subject of this study has been tackled by a systems approach.

Chapter 5 presents the empirical findings from the field studies. The first section focuses on presenting EMIS and its environment and gives a rather detailed description of the statistical data collection process. This is followed by a presentation of empirical data from the second phase, where the presentation is guided by the different questionnaires used; each questionnaire has its own subsection.

Chapter 6 analyses the field data and presents an answer to the overall research questions, including a discussion of the blended ICT solution. After an analysis of the present EMIS and some overall reflections on the present statistical data collection process, the chapter moves on to evaluate the interviewed head teachers’ mobile usage pattern and their views on a tentative mobile-supported data collection procedure.

The main part of this chapter is then devoted to a thorough discussion of the proposed system, EMIS of Tomorrow. The outline of the proposed mobile supported system is followed by a discussion where the empirical data are related to other national and international studies. This discussion is summarised in a list of supporting structures with added identified hampering structures that must be considered when implementing the proposed type of system. The proposed EMIS is further discussed raising possible implications, consequences and effects, both positive and negative. The chapter ends by moving to a more generic level, taking the framework developed in Chapter 3 into consideration by discussing how this model can be applied when implementing the mobile supported system.

Chapter 7 highlights in a concise way the many the contributions of this study. As should be obvious from section 1.4 above, there are both practical as well as theoretical contributions. In order to make it easier to find relevant passages in the text, this chapter refers back to the preceding chapters and individual sections, as well as to the appendices, where the reader can find the full discussion and/or presentation leading up to the results highlighted in the chapter.
2 Context Description of Tanzania

This chapter gives a brief context description of Tanzania serving as an extended background to the research setting. The chapter includes a presentation of findings from statistical sources and various official Swedish and Tanzanian documents. Information is also provided by several informants and respondents as part of the outcome of the first phase of this study, including the first field study performed in Tanzania in October – November 2007.

The chapter looks at demographical data and socio-economic issues, as well as e-government issues. The following sections present the overall ICT situation: the communication ecosystem in Tanzania, including statistics and disseminations on mobile telephony. The final sections of this chapter deal with the primary education sector in some depth.

2.1 Demographical data

In 1964, the United Republic of Tanzania was formed by a union of two sovereign states, Tanganyika and Zanzibar.

Tanzania is located on the east coast of Africa5 with borders to Kenya and Uganda to the North, Rwanda, Burundi and The Democratic Republic of the Congo to the West and Zambia, Malawi and Mozambique to the South as shown in Figure 2.1.1.

Tanzania is divided into four zones (Lakes, Northern, Coast, Southern Highlands), 26 regions, and 121 districts. There are large regional differences concerning levels of income and health in Tanzania (Ministry for Foreign Affairs 2006).

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5 Africa consists of 54 nations, five (5) climate zones, and approx. 800 million people.
Figure 2.1.1 Map of Tanzania (World Factbook 2007a)

Population
The total population is estimated at 42.7 million for 2011 (World Factbook 2007b). The major city is Dar es Salaam with an estimated population of 3 million and the capital is Dodoma (MCT 2005). Rural residents account for 77 per cent of the population (Andersson et al. 2006). Tanzanian households consist on average of almost five persons. Women in Tanzania have an average of 5.7 children during their lifetime. The level of education is strongly related to the age of the mother at first birth, as well as the number of children, the child mortality rate and child health. Almost 45 per cent of the population is under the age of 15 (HDR 2005). Life expectancy for males and females is 44 years and 46 years respectively (UNCTAD 2005).

Languages
Official languages are Swahili and English (UNCTAD 2005). The number of local languages is 121 and approximately 30 per cent of the population speaks English (Jensen p.c. 2006).

2.2 Socio-economic Conditions
Tanzania is one of the poorest countries in the world, according to the Human Development Report 2006, where it is ranked 162 out of a total of 177 countries (HDR 2006). Tanzania is also one of Africa’s poorest countries with approximately 90 per cent earning less than 2 USD a day (UIS/UNESCO 2007). Tanzania belongs to the group of so-called ‘Least Developed Countries’
(LDC), according to UNs terminology\(^6\), which constitutes 50 states, 11 per cent of the world’s population, and 0.6 per cent of the world GDP (UNCTAD 2005).

**Economy**
The currency in Tanzania is Tanzania shillings (Tshs). GDP per capita was 287 USD in 2003 (HDR 2005), far below the 935 USD level for LIC (Low Income Countries) (World Bank 2008). The agriculture sector constituted 45 per cent of the GDP in 2003, with approximately 80 per cent of the total labour force (UNCTAD 2005).

Included in the state budget is the official aid that constitutes in total approximately 1.8 billion USD (Ministry for Foreign Affairs 2006), which is approximately 40 per cent of the budget. Official aid constitutes approximately 16 per cent of the GDP. Tanzania is one favourite among donors - a so-called ‘donor darling’ - and there are 22 multilateral and 25 bilateral donors in Tanzania (ibid).

**Public Health**
Almost 45 per cent of the population is considered undernourished (UNCTAD 2005). Malaria, tuberculosis, amoeba dysentery and diphtheria are common diseases (Landguiden). HIV is the leading cause of mortality among adults (UNCTAD 2005). There are two physicians per 100 000 people in Tanzania (HDR 2005).

2.3 e-Government and Governance
Tanzania received an e-government ranking of 137 out of 184 countries, according to the UN’s Global E-Government Survey 2010, with an e-index of 0.293 compared to the world average of 0.441.\(^7\)

The President’s Office published an e-government strategy in 2009 that begins by stating that e-government in Tanzania has been “…ad hoc and uncoordinated” (2009:iii). Further, it recognises ICT as a tool for improving the public administration: “…to be an effective tool to modernize the complex administration of governments” and it stresses the importance of flexibility, openness and pragmatism and the need for collaborations between government

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\(^6\) Three criteria’s are used: low income, weak human assets, and economic vulnerability. For more information see UNCTAD 2005

\(^7\) The e-Government Development Index is a composite index comprising the Web measure index, the Telecommunication Infrastructure index and the Human Capital index.
An analysis of the e-government readiness in Tanzania was undertaken before the formulation of the strategy looking into eight factors: institutional arrangements, human resources, budgetary resources, inter-agency communication flows, national infrastructure, ICT capacity levels, ICT related policies, and public private partnerships. The result conclude that there is a “…need for a holistic approach to e-Government implementation in Tanzania” together with a participatory design process to avoid wastage of resources. The guiding principle is identified as ‘Serikali sikivu – inayowezeshwa na Teknolojia’ – Kiswahili for ‘Effective Government – Enabled by Technology’. The following issues were identified as compelling according to the strategy (ibid:14-15):

- Lack of a coherent policy, legal and institutional framework for e-government
- Uncertainties in e-readiness for e-government
- Outdated service delivery infrastructure and fragmented delivery channels
- Silo-based e-government initiatives
- Absence of bilingual local content in e-government
- Sustainability of ICT adoption in the public service
- Low awareness of e-government opportunities
- Lack of adequate expertise in ICT human resources
- Attitude and cultural challenges in the use of ICT
- Low robustness and low security of ICT infrastructure
- Lack of integrated information systems
- Lack of a framework to leverage private sector resources and community participation

The e-government strategy mentioned the following six critical factors (ibid:41): political will, support and commitment; availability of HR capacity; institutional and legal framework; financial resources; commitment by all actors; and sustainable infrastructure. Risk factors are donor dependency; lack of political will; resistance to change; problems with privacy and security; and technological obsolescence.

Further, governance compromises traditions and institutions that affect how authority in a country is implemented. According to the World Bank Institute, governance includes the process by which governments are selected,
monitored and replaced; the capacity of the government to effectively formulate and implement sound policies, and the respect of citizens and the state for the institutions that govern economic and social interactions among them.

The importance of good governance is emphasised for economic development. Studies that focus on the correlation between institutional quality and long term growth have found strong causal impact on per capita incomes worldwide.

The World Bank Institute has developed a database with six aggregate governance indicators that are based on several hundred individual variables measuring perceptions of governance, drawn from some 30 separate data sources constructed by several different organizations (Global Monitoring Report 2006).

One of the aggregate indicators is the indicator Control of corruption. This measures the extent of corruption, conventionally defined as the exercise of public power for private gain. It is based on scores of variables from polls of experts and surveys. KK (Kaufmann and Kraay) Control of Corruption governance scores lie between –2.5 and 2.5, with higher scores corresponding to better outcomes. In 2004, Tanzania had –0.57 (ibid).

Another corruption index is Transparency International's Corruption Perceptions Index (CPI) score, which shows a country’s ranking by perceptions of the degree of public-sector corruption as seen by business people and country analysts. CPI ranges between 10 (highly clean) and 0 (highly corrupt). Tanzania had 2.9 in 2005 and 2.6 in 2009 and ranked 126 out of 180 in 2009.8

2.4 Infrastructure Backbones

Electricity enables access to modern educational media and communication in schools which links energy to achieve MDG II (Uisso 2006). Energy is inadequate, unreliable, scarce, costly and not easily available in most parts of Tanzania. Tanzania faces severe power problems both in rural areas as well as in the main city. Even in the major city, Dar es Salaam, long power-rationing periods occur (Sheriff 2007). In 2000, 9 per cent of the population had access to electricity (UNCTAD 2005). A further analysis of the figure shows that 2 per cent of the rural population and 39 per cent of urban populations had access to electricity (Andersson et al. 2006).

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Many areas in Tanzania do not have grid power and alternative solutions need to be considered both for environmental as well as for socio-economic reasons. Various programs to improve rural electricity have been tried with limited success. Biomass meets 96 per cent of the energy needs in rural areas (Uisso 2006).

According to Vodafone (2005) lack of electricity did not constitute barriers to access. Many vendors and users have installed solar systems to run their facilities (Sheriff 2007).

Concerning the road system, most mains roads are gravel roads with only minor parts being paved. During the rainy season, rural areas in southern and central Tanzania are not accessible at all (Landguiden).

2.5 The Communication Ecosystem of ICT

The Tanzanian government decided to forbid the use of computers and television in 1974. But this was changed in 1984 and since then the country has been playing catch-up in its use and adoption of ICT, according to Hare (2007). Hare also mentions that in 2003, a national ICT policy was adopted that identifies the expansion of infrastructure as key in the development and use of ICT in the country. The policy also stresses the strategic input of ICT in education. A liberalisation of the telecommunication sector was decided upon in 2005. Hare points out that the Tanzania Telecommunication Company Limited (TTCL) suddenly had competition in data and voice service provision and several providers could be licensed.9

As an overall statement about the institutional and political conditions today, Tanzania is considered to be liberal concerning ICT regulations and the Tanzania Commission Regulatory Authority (TCRA) is stated as a best case with a lot of other countries are looking at TCRA and what they have done (Jensen p.c. 2006).

ITU’s, i.e. The International Telecommunication Union’s, ICT Development Index compares developments in ICT. The Index combines 11 indicators into a single measure that can be used as a benchmarking tool globally, nationally, and regionally. These are related to ICT access, use and skills, such as households with a computer, the number of Internet users, and literacy levels. Tanzania was ranked 145 out of 154 counties in 2007.

9 For a list of providers, see Tanzania Communications Regulatory Authority, Market Information at http://www.tcra.go.tz/Market%20information.htm)
The ICT Ecosystem by Type of Infrastructure

- **Landline**

Statistics show a declining number of landlines from 2001 and onward (MCT 2005), with 4 telephone mainlines per 1000 people in 2003 (HDR 2005). The number of total fixed telephone lines was 138,227 in 2006 (Hare 2007). According to Vodafone (2005), 28 per cent of the population had access to a landline. Jensen (p.c. 2007) mentions an even lower figure of 18 per cent. Less than 10 per cent of Tanzanian households own a fixed telephone (TDHS 2005). In Tanzania, it took five years for mobile subscriptions to outnumber landlines compared to 15 years in the UK (ibid).

- **Public phones**

There are slightly more than 4000 installed public pay phones in 2004. There were fewer public payphones (706) in the Southern Highlands zone in December 2004, compared to the Coastal zone (1744). Approximately 45 per cent of the public payphones used Smart Cards, with the lowest share, approximately 10 per cent, for the Southern Highlands zone (MCT 2005). Public payphones could be stated as ‘rare’ and today public access is gained through entrepreneurs selling wireless airtime on mobile phones.

- **Internet**

The Internet was used for the first time in Tanzania in 1989 (Sheriff 2007). In 2003, the percentage of Internet users was 0.7 per cent (HDR 2005). That number increased to approximately 1 per cent in 2007 according to Jensen (p.c. 2007). The total number of Internet users was 333,000 in 2005 (Hare 2007:6). There are 23 licensed ISP (Internet Service Providers) (MCT 2005). The bandwidth price in Tanzania is approximately 3000 USD per MB, based on quantity purchase, compared to the bandwidth price in HIC (High Income Countries) of approximately 300 USD per MB (Sheriff 2007). There is a lack of Internet bandwidth through broadband terrestrial cable in East Africa, as the region is without access to the global fibre pipeline. The available solution is satellite communication, which is considered expensive and with a limited bandwidth (ibid:42). The deployment of the EASSy (East African Sub-Marine System), a fibre optic cable which will link East Africa to the global network via South Africa and Djibouti, is expected to lower the bandwidth prices (ibid). In fact, the fibre optic cable that connects Tanzania with the rest of the world was launched by President Jakaya Kikwete on July 23, 2009.

- **Radio**

Approximately 60 per cent of Tanzanian households, with an average of five persons, own a radio (TDHS 2005), which makes it the largest communication
medium in Tanzania. There were 47 licensed radio stations in 2006 (Hare 2007:6). The use of radio can be seen as an example of an operational mode of sharing (Wicander 2010).

- Television

Approximately 6 per cent of Tanzanian households own a television (MCT 2005) and there were 29 licensed television stations in 2006 (Hare 2007:6). The use of TV can be seen as a further example of the operational mode of sharing.

- Postal service

In general, physical addresses do not exist but many people have post boxes (Jensen p.c. 2006). There were 32 licensed postal operators in 2004 with a total number of 437 post offices (MCT 2005). This is equivalent to 1 post office per 87 000 people, compared to for instance Sweden, which has 9 million people and 1600 post offices plus 380 post offices for company customers, which corresponds to 1 office per 4500 people, according to the national post office web site (www.posten.se 06.02.2009).

2.6 Mobile Telephony

This section highlights some figures specific to mobile telephony in Tanzania. These figures are collected in Wicander (2010). (As mobile telephony is a very dynamic field some facts and figures presented here may be dated).

Growth

In Tanzania, the growth of mobile telephony has been almost 1600 per cent between 2002 and 2008, though starting from a very low level of 1.3 per cent with a forecasted market penetration/mobile density of 20.6 per cent in 2008 (Wireless Intelligence 2007). In 2003, there were 25 mobile subscribers per 1000 people (HDR 2005).

The annual number of subscribers in Tanzania grows at an average rate of 47 per cent (TCRA 2007a), which is a bit lower than the general subscriber growth rates in Africa of 50 per cent per year (Heeks & Jagun 2007a).

Penetration

Tanzania has a lower market penetration compared to Africa as a whole: 20.6 per cent compared to 27.9 per cent (Wireless Intelligence 2007). However, in Tanzania, according to Vodafone (2005), 97 per cent of the people surveyed had access to a mobile phone, which could imply extensive use of the operational model of sharing. The figure highlights that there are several meanings when using the term ‘access.’
Of 195 countries, i.e. national economies that are ranked by 2006 mobile phone penetration by UNCTAD (2008), Tanzania is ranked 120. This could be compared to the ranking in the Human Development Report 2006 where the country is ranked 162 out of a total of 177 countries. Tanzania could be considered as unexpectedly well ‘developed’ concerning mobile communication.

Subscriptions
In 2006, the communication and transport sector grew by 7.5 per cent compared to 6.4 per cent in 2005. The increased growth can be attributed to the increased number of mobile phone subscribers (PWC 2006). Mobile subscribers have 98 per cent of telephony with fixed-lines making up the other 2 per cent (TCRA 2007a). Statistics of telephone subscribers in Tanzania show that 7.7 million Tanzanians owned mobile telephone lines by the end of September 2007 (ibid). This is an increase of about 12 per cent from June 2007, which is equivalent to 48 per cent on an annual basis (ibid). The total forecasted number of subscribers for the first quarter of 2008 was 8.2 million (Wireless Intelligence 2007). However, the majority of the population of Tanzania, approximately 80 per cent, did not have a telephone subscription, according to the 2007 TCRA report (TCRA 2007a).

Operators and Tariffs
There is one fixed-line operator, the state owned TTCL (Tanzania Telecommunication Company LTD). There are several operators on the Tanzanian national mobile market who offer voice and data service including SMS, MMS and GPRS. There were seven mobile telephone operators in 2007 with Vodacom as the largest in market share (48 %) and Celtel coming in second with 29 per cent (TCRA 2007b).

In June 2009, the prepaid tariffs by e.g. Vodacome ranged from 0,5 – 1 Tsh per second for special ‘programs,’ i.e. you need a membership and you have to buy a new voucher each day. The ordinary prepaid tariffs were approximately 350-400 Tsh per minute.

In June 2009, the local tariff for national SMS ranged from 50 to 58 Tshs per SMS. In 2007, the largest operator in East Africa (Kenya, Tanzania and Uganda), Celtel, charged approximately 0.212 USD for one minute of voice time compared with 0.036 USD for an SMS (Mendes et al. 2007). These pricing

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10 In June 2007: 1700 Tshs ~1 Euro and 1200 Tshs ~1 USD
conditions have helped foster a culture of SMS in much of Africa (ibid), including Tanzania.

The cost of a new mobile phone in Tanzania is approximately 30 USD for the cheapest model, while a second-hand could be bought for approximately 10 USD (Nielsen p.c. 2007).

The growth in excise duty collections of mobile phone airtime is 90 per cent (from 12.2 billion TShs to 23.2 billion TShs) during nine months 2006-2007. If VAT at 20 per cent is factored in, this makes for gross VAT and excise collections of around 94 billion TShs, which, on a 12 month basis, would equate to around 125 billion TShs.

Hence, increased mobile use creates an income source for the government with a positive impact for the national economy.

2.7 The Education Sector

The education sector in Tanzania comprises three levels: primary, secondary and tertiary level. Tanzania follows a 7-4-2-3 system of education. Primary schooling takes seven years, followed by four years of secondary, two years of high school (advanced level), and three years of first degree university studies (Hare 2007).

The literacy rate among adults is approximately 70 per cent (Sida 2007). Approximately 50 per cent of the adult population has completed primary school compared to approximately 10 per cent for secondary school (TDHS 2005). Swahili is the main language at primary school, while it is English in secondary school (Jensen p.c. 2006) as well as in the tertiary level. Local languages (121 different ones) are spoken at the pre-school level.

2.7.1 Organisation and Administration of the Education Sector

The education sector in Tanzania is formalised and the education administration is divided into 26 regions, which is further sub-divided into 121 districts, approximately 2500 wards, and approximately 14 700 primary schools. The education sector in Tanzania can be characterised as complex and multilayered (Frankenberg p.c. 2007; Persson p.c. 2007).

The ministry headquarters at the Ministry of Education and Vocational Training (MoEVT) in Dar es Salaam constitutes approximately 450 employees at different departments, e.g. Primary education, Secondary education, Policy and Planning, Physical Planning and Maintenance department.

The education sector is organised and administrated on five levels (Persson p.c. 2007) - on a central government level at MoEVT headed by the
Minister of Education; on a regional level with a Regional Education Office headed by a Regional Education Officer; on a local government level – district level - with a District Education Office headed by a District Education Officer. Additionally on a local level a Ward Education Office headed by a Ward Education Coordinator and at village level (mtaa in Kiswahili) the primary school headed by a Head teacher and the School Committee.

Other institutions within the education sector are the National Examination Council of Tanzania and the Agency for Development of Education Management.

The Education Sector Development Programme points out that successful management and administration of education systems require effective use of ICT tools (Ministry of Education and Culture 2004).

2.7.2 Economy in the Education Sector

Education expenditures accounted for 2.8 per cent of the GDP in 2002 and 11 per cent of total public expenditure (HDR 2005).

Budget

The state budget allocated in 2006 approximately 910 million USD (18 per cent of the total budget) for the education sector. The primary subsectors’ share of the allocated budget is approximately 56 per cent (Ministry of Education and Vocational Training 2006).

Included in the education sector budget is the official aid, which constitutes 234 million USD, which is equivalent to 13 per cent of the total official aid to Tanzania (Ministry for Foreign Affairs 2006). The official aid share of the budget allocated for the education sector constitutes approximately 26 per cent. The education sector has the most donors in numbers: 15-30 international donors contribute to the education sector development (ibid).

The education sector has top priority according to the Budget Guidelines for Budget 2007/08 with increased allocation to MoEVT (Frankenberg p.c. 2007). Frankenberg (ibid.) describes the planning and budget process as follows: the process is both bottom-up and top-down. The bottom-up process goes from village level to district level, whereas the top-down process consists of the central government ministry official budget prepared by MoF and approved by Parliament. The two processes are not connected or reconciled, which creates confusion and lack of implementation. It also creates uncertainty about timing and the amount of disbursements that districts can expect. There is an unrealistic budget as well as deviations in execution.
Funding and Financial Flow

There are three main flows of financial resources and two sub-flows within the education sector (Frankenberg p.c. 2007):

- Capitation grant (~10 USD per pupil annually)
- Development grant
- Capacity building grant

The capitation grant is divided into a cash allotment and a book allotment. The development grant finances the construction of e.g. toilets, classrooms, desks, and water tanks (URT 2006). The district councils transfer the cash allotment of the capitation grant and the development grant directly to the school accounts, whereas the book allotment of the capitation grant and the capacity building grant are administered at the district council level. The district council is supposed to procure and transfer books to the schools and to train school committee members. (Frankenberg p.c. 2007)

The system of capitation grants is based on enrolment figures (Persson p.c. 2007). The capitation grants main financial flows come from: the MoEVT, Prime Minister’s Office – Regional Administration and Local Government (PMO-RALG), and from the Ministry of Finance (MoF) via the Education Block Grant at the district councils or regional secretaries. Other ministries such as the Ministry of Higher Education, Science, and Technology and the Ministry of Community Development, Gender and Children are also involved in funding the education sector at the central government level (Frankenberg p.c. 2007). This makes the funding process complex and difficult to survey and control.

Adding to this are funds from other institutions such as Tanzania Social Action Fund, Local Government Capital Development Grants, off-budget donors, NGO projects and the Constituency Development Fund that go into the local budget at district council or regional secretariats or directly to the schools (Frankenberg p.c. 2007).

2.7.3 ICT in the Education Sector

The Ministry of Education and Vocational Training (MoEVT) points out that successful management and administration of education systems requires effective use of ICT tools (Education Sector Development Programme 2004). The document Information and Communication Technology Policy for Basic Education (MoEVT 2007) states that MoEVT “will ensure that all educational institutions are linked together in a secure network for administrative purposes (e.g. EMIS) with access to the Internet for teaching and learning and professional
development” (Statement No. 6.4.5.). Further, the document mentions mobile technology as a part of ICT in education.

But there is not always an understanding for ICT as a ‘development tool’. There is a lack of policies, strategies, master plans, holistic views, awareness, coordination and funding according to Jensen (p.c. 2007). For example, ICT equipment in schools is underused due to lack of knowledge among teachers. ICT in schools in Tanzania are mostly confined to administration (Hare 2007). Additionally, the education sector does not use mobile phones in a systematic way in order to facilitate administration (p.c. 2007).

Teachers are considered early adopters of mobiles according to Traxler (2006), but the experience from Jensen (p.c. 2007) is that teachers are seen as late adopters on ICT in their occupation with the difficulties accepting the new technology.

The World Bank (2007b) and its initiative infoDev has supported a ‘Survey of ICT in Education in Africa’ consisting of several country resorts. There are several ICT in education initiatives and projects at the national level in Tanzania listed in the report including an EMIS. The first initiative was taken in 2002 by the ministry together with a Dutch NGO, the International Institute for Communications Development (IICD). A forum comprised of ICT in education stakeholders has formulated a programme to adopt EMIS at both the school and ministry levels.

The report from Tanzania (Hare 2007) points out that ICT education projects tend to precede the policy and strategic phases with the effect of uncoordinated and duplicated efforts. Hare (2007:8) provides a list of factors and their enabling ‘helps’ and constraining ‘hinders’ features for ICT in education in Tanzania:

- **Policy framework and implementation**
  - Helps: A new policy will guide the implementation and give the ministry leadership
  - Hinders: Lack of policy hinders the uptake of ICT in education and limits active promotions at the ministry
  - Hinders: Lack of a policy framework, which has hampered the implementation of ICT and the promotion of ICT in education at the ministry.

- **Infrastructure and cost of bandwidth**
  - Hinders: Cost of bandwidth and lack of national network for many rural schools
• Language of the Internet
  o Helps: Kiswahili content and open source software
  o Hinders: Language is a major inhibitor for ICT use as Kiswahili is the common language and English is taught in secondary school

• Electricity
  o Hinders: The absence of a national electricity grid at rural schools coupled with breakdowns and load shedding is a major constraint - most schools are out of the national electricity grid. Major breakdowns and load shedding has also increased the cost of ICT infrastructure

• Tutor technicians
  o Hinders: A new area with need for pre-service and in-service training

• New technologies
  o Helps: New technologies lower the cost of entry and ownership of ICTs in schools including different wireless and mobile solutions. Also the wide network coverage is an enabling feature for ICT in education.

There are several ICT in education projects implemented on a national level e.g. EMIS to produce and manage educational data and information (see Hare 2007 for a list). EMIS are applied to fulfil the reporting requirements of higher institutional levels such as MoEVT. The EMIS is expected to collect, process, utilise, and disseminate education data. As an example, increased enrolment in the education sector requires management systems that allow transparency to track budgets (URT 2006).

EMIS is implemented by the MoEVT with computers and printers provided at ministry headquarters, and at some regional and districts offices. Computer training has taken place for regional education officers, and district education officers (Hare 2007:7) (see also http://www.moe.go.tz/ict4e).

2.7.4 The Primary Education Development Programme (PEDP)

Since 2002, the Tanzanian government has been implementing the Primary Education Development Programme (PEDP) in an effort to realise the MDG II: to achieve universal primary education and the Education for All-target (URT 2004). The objectives for PEDP are to achieve enrolment expansion, improve the quality of teaching and learning processes, build capacity and strengthen institutional arrangements (ibid).
The implementation of the PEDP is facilitated by e.g. different programmes aimed at the decentralisation of decision-making and the management of resources, the streamlining of the civil service for efficiency and effectiveness and for the streamlining of resource mobilisation and effective utilisation (URT 2006). The introduction of EMIS can be seen as a contribution to the objectives for PEDP to strengthen institutional arrangements that support the planning and delivery of educational services (ibid).

According to URT (2006), during the first phase of PEDP, between 2001-2006, there has been an increase in:

- enrolment
  - from approximately five million pupils in 2001 to approximately eight million pupils in 2006
  - GER (Gross Enrolment Rate) went from 84 per cent in 2001 to 112.7 per cent in 2006\(^{11}\)
  - NER (Net Enrolment Rate) went from 65.5 per cent in 2001 to 96.1 per cent in 2006
- number of schools
  - 11 873 in 2001 to 14 700 in 2006
- transition rate from primary to secondary school
  - 22.4 per cent in 2001 to 49.3 per cent in 2006

The government introduced capitation grants and development grants and abolished school fees and enrolment-related contributions to ensure free primary school to all children.

### 2.7.5 Problems and Challenges with PEDP

PEDP has been a major success in increasing enrollment rates: pupil numbers increased from 4.8 million to more than 6 million in the first two years. However, the increased number has added pressure for more resources at the primary school level (URT 2006). According to PEDP II (ibid), the first phase of the programme focused on enrolment expansion with little attention to quality aspects such as retention and financing gaps due to unfulfilled commitments. Officially, primary education is free, but there are still several ‘fees’ for parents to pay that are determined locally: school uniform, practicing books (Frankenberg p.c. 2007).

A Sida report (2007b) mentions economic cuts, inefficiency, and a shortage of qualified teachers, classrooms and educational materials in the

\(^{11}\) GER over 100% is explained by the fact that there are several repeaters in the system
The pupil/teacher ratio in primary school was 56 in 2007 (UIS/UNESCO 2007) and which indicates overcrowdedness and under-training. A result of the problems mentioned above is a decrease in enrolment, and an increase in drop-outs indicating a retention problem. There are also growing cases of repeaters. The repeaters can be verified by e.g. GER over 100 per cent as mentioned above.

The completion rate varies among different sources from 40-54 per cent. According to Sida (2007b), four out of ten children complete their primary education, while data from UIS/UNESCO (2007) shows that 54 per cent of children complete a full course of primary education. Approximately 50 per cent of the adult population has completed primary school and approximately 10 per cent of the population has completed secondary school (TDHS 2005).

There is an opinion that enrolment is prioritised over quality because capitation grants are based on enrolment figures. Enrolment is not the same as attendance. There is a risk that the system puts focus on inputs instead of learning outcomes. Further, the audits do not examine the performance, so there might be an incitement to “over-register” enrolment figures.

Increased enrolment also requires management systems that allow transparency to e.g. track budgets, which is indicated by Traxler in findings from Kenya in 2006 and 2007. There is a need to monitor and manage school enrolment numbers at a local and national level, with the strategic implications of accurate and timely school enrolment data needed to manage and finance the school system (Traxler 2007:4).

This is in line with the objectives for PEDP mentioned above: strengthening institutional arrangements that support the planning and delivery of educational services.

According to the Primary Education Development Programme (URT 2006), because there is a lack of access to information and proper feedback as well as delayed feedback on the information provided by the different institutions, there is a need for accurate and timely data and information to effectively plan and manage a quality education system. There is a need to ensure appropriate collection, flow and use of education data and information for the education sector (ibid).

Also included in this overarching objective is a so-called IEC (Information, Education and Communication) strategy to ensure that correct and relevant data and information reaches the intended recipients, while getting systematic feedback from the same. Objectives are, among others, to improve information flow in and out of the MoEVT, and to strengthen links within the
basic education system as well as to monitor income and expenditure in accessing education services (URT 2006).

Capacity building and strengthening institutional arrangements includes governance, management training, and internal efficiency as well as monitoring and evaluation including EMIS (URT 2006).

A number of different ministries and other institutions have the responsibility of collecting, processing, and administrating data and information within the education sector according to URT 2006:

- **MoEVT:**
  - Collect and communicate education data and information to all system levels, supporting education institutions, and interested stakeholders via e.g. BEST (Basic Education Statistics in Tanzania)
  - Receive education data and information from all system levels and stakeholders via e.g. EMIS

- **PMO-RALG Education Coordinating Team (ECT):**
  - Communicate education data and information to all system levels and stakeholders
  - Produce regular financial and physical reports to the Treasury and MoEVT
  - Receive education data and information from all system levels and stakeholders

- **MoF (Ministry of Finance):**
  - Ensure timely auditing of PEDP funds

- **BEDC (Basic Education Development Committee):**
  - Effectively collect, communicate and receive educational data and information among basic education stakeholders

- **Government, donors and other funding agencies:**
  - Effectively communicate data and information to the sector ministries and to others relevant stakeholders in a transparent manner

- **NSA (Non State Actors):**
  - Effectively collect and communicate educational data and information to and from all education stakeholders

The list above indicates a complex information system with several actors and activities. One part of the overall information system is the sub-system EMIS, the Education Management Information Systems.
3 e-Government – Experiences and Challenges

The use of mobile and other wireless devices to support the administration of education can be stated as an interface between IS development, e-government including m-government and e-administration. The inclusion of this chapter is based on the fact that this thesis studies information systems and a particular e-government system. This chapter gives a review on these areas, which will be repeatedly referred to in the following chapters.

The chapter opens with a short introduction to the e-government research field. This introduction serves to positioning the study.

Section 3.2 discusses e-government systems and solutions as information systems. The section briefly introduces Information Systems (IS) research and the constituents of an information system. It further elaborates on e-government systems as information systems followed by a discussion about the importance of ‘information’ as a critical resource for the development of society. Following is a sub-section on different views of ‘technology’.

The third section, 3.3, gives an introduction to e-government. It elaborates on what e-government is, how to define it, why it is interesting, what it promises. Most of the literature focuses on ‘developing country’ (DC) situations, either by discussing ‘development and e-government’, or by having been performed in a DC context.

The next section, 3.4, looks more in detail at e-administration. It starts with a brief presentation of e-administration in general followed by a sub-section on e-administration in the education sector including EMIS. Failures especially related to e-administration are then discussed with three specific examples from Ghana.

The fifth section, 3.5, focuses on m-government. m-Government can be seen as a subset to e-government, using different wireless technologies. The section gives a brief introduction to the ‘new’ field of m-government, including promised benefits and met challenges. Following are two sub-sections on mobile technology in the education sector with one focusing on administration. The section ends with an example of an SMS application tested in Kenya for school administration.

With an ambition to add to existing approaches in order to find a multidimensional model for e-government systems implementation in developing countries, an outline called ‘Seven Aspects – An Approach Towards Success’ is presented in the last subsection, 3.6.
3.1 e-Government Research

e-Government research combines different disciplines e.g. Information Systems, Computer Science, Economics, and Political Science to explore and study ‘electronic services delivered by government agencies and institutions’ and focusing on different domains such as education, health, and infrastructure. Research topics include technical, organisational, social, and economic issues.

Different types of sector-specific MIS (Management Information Systems), i.e. types of ICT applications deployed in the public sector, are often prominent in studies performed in developing countries such as GIS, HIS, SIS\(^{12}\) for e.g. data gathering with the intended impact of effective performance and improved decision-making (World Bank 2007a). This study has EMIS as its focus; a sector-specific MIS of the education sector.

e-Government research can be regarded as a rather new research field\(^{13}\). In 2005, e-government research was considered by Grönlund and Horan (2005) as an immature field with unclear definitions and an undeveloped multidisciplinary character, but as a potentially fruitful research field. This still seems to hold. According to Heeks and Bailur (2007:243, 248), the research field is characterised by “...confused positivism...dominated by over-optimistic, a-theoretical work that has done little to accumulate either knowledge or practical guidance...lack of clarity and lack of rigor...ignoring the evidence of the widespread cost of failure...”. Further, Yildiz (2007:646) adds that the research is an “...oversimplification of the e-government processes within complex political and institutional environments...”.

e-Government research issues can be associated with different generic perspectives and aspects, for instance Grönlund and Horan (2005) mention:

- government in a systems perspective - “all government agencies together rather than individual organisations or subsets of government organisations” (2005:724)
- social and societal aspects - the use of ICT for social and economic development in developing countries

\(^{12}\) GIS = Geographic Information System
HIS = Health Information System
SIS = Strategic Information System
\(^{13}\) e-Government research, activities and projects in developing countries - the research and most of the activities are sponsored by the World Bank and the UN (Grönlund & Horan 2005). A global and political focus on e-Government can be mentioned from WSIS (World Summit on the Information Society – (http://www.itu.int/wsis) and WITFOR (World IT FORum) with the UN and UNESCO as sponsors; a ‘global macro-trend’. At WSIS 2005, it was decided that by 2015, all public centres and governments should have an online system of administration (http://www.itu.int/wsis).
Two theoretical perspectives, including their related frameworks, are presented by Lanzara (2009). In the first perspective, ICT is regarded as an analogue or functional equivalent of a traditional institution exemplified with expressions such as “...does what the institution did ...works as an institution...” (ibid:13). The “...technological artefacts enforce certain practices that become institutionalised along the recurrent use of the artefact.... The technical artefact ...tells us what to do and how to do it...” (ibid).

In the second perspective “...institutions become more technical...as they have to adapt to the possibilities and constraints brought about by new technologies.” (ibid.) This is exemplified as “institutional codes, practices and administrative procedures need to be functionally simplified (or reduced) in order for the technology to be able to manipulate and sustain them.” (ibid.). These lines of thought provoke a reaction as they both assume a technological determinism.

A socio-technical approach on the other hand, emphasises a continuous and mutual interaction of the technology and the organisation or institution. This approach is advocated by several authors e.g. Madon 2009; Yildiz 2007; Garson 1999.

Yildiz (2007:655) argues that “understanding the processes through which e-government end-products (government information and services) are determined saves us from unnecessarily focusing on the artefacts (...use of certain technologies)”. This understanding will help us to recognise key players and the consequences of inclusion and exclusion of certain actors.

Yildiz continues that a focus on technology and technological artefacts makes it difficult to understand that “... the main issue is to make government work better, faster, more convenient to use for its stakeholders and provide administrative and democratic channels that were not possible to open with the old technological tools”. This view on the technological artefact in e-government is in line with Andersen and Henriksen (2006), as they take on a reflective and critical view on ICT. They favour a view with a focus on core processes and related activities.

Two main streams of literature on e-government systems in developing countries can be identified according to De’ (2009), with one stream focusing on effectiveness of the delivery of government services (e.g. Bhatnagar 2003, 2004; Rao et al. 2004). This stream assumes that e-government systems are needed and the stream includes the objectives of analysing why a system has failed or succeeded, measuring the failure or success, and suggesting what to learn from this.
The other stream is more reflexive and critical and acknowledges the complexities involved with implementing an e-government system. Technology is assumed to both introduce change and to be shaped by change. This encompasses a notion of duality where technology is both influencing and influenced.

For instance, Madon14(2009) addresses critical issues related to governance and development which she states are fundamental when implementing e-government projects, in her case rural India, that can be interpreted to be generally applicable to a rural developing context. Whereas much research focuses on effectiveness and efficiency e.g. in public agencies, she has adopted an approach that is grounded in the conditions of rural poor people. Her critique against e-government projects in developing countries include public service institutions focusing on measuring public sector performance e.g. benchmarking of efficiency in service provision and cross-country performance.

Selinger (2009) claims in a critical view that developing country policies for technology integration in e.g. the education sector are reminiscent of the Western models. Selinger proposes instead that a critical examination of every new context should be made, and she raises questions about what ICT are used for and how ICTs are deployed.

Additionally, with a critical viewpoint, Sein and Harindranath (2004) state that ICT is too often treated as a monolithic and homogenous entity, which in itself generates a limited focus; they also criticise a focus where ICT is seen as a ‘panacea’ for developing countries. Sein and Harindranath (ibid) argue that ICTs need to be examined in more detail, and that there is a need to conceptualise the many perceptions of ICT and the manifold impact of ICT in society as information and knowledge are always grounded in a local context. There is also a need for disaggregation of ICT since ICT is not one single entity; instead it includes several parts, e.g. several technologies.

This introduction to the e-government research field creates a foundation for positioning this study, which starts by a socio-technical and pragmatic perspective, combining a functionalistic view with a critical view. The study has the ambition to be reflective and critical to existing and suggested information systems, which includes the duality of technology as well as looking into why a system or solution has failed and what to learn from this.

14 Shirin Madon wrote her doctoral thesis 20 years ago on computer-based information systems in rural development administration in India – this must make her one of the first on e-government for development
3.2 e-Government Systems as Information Systems

This section discusses e-government systems and solutions as information systems. The section briefly introduces Information Systems (IS) research and the constituents of an information system. It further elaborates on e-government systems as information systems, followed by a discussion about the importance of ‘information’ as a critical resource for the development of society both on an individual level as well as on an aggregated level. Following is a sub-section on different views on ‘technology’. (Some parts of this section have appeared in Sundén and Wicander 2006).

3.2.1 The Field of Information Systems

The research dealing with information systems is both diverse and pluralistic. The field of Information Systems\(^\text{15}\) concerns a broad area including development, use and implications of ICT. It deals with technical, human and organisational issues, and studies human interaction with information systems in different operations, focusing on developing knowledge of the use of ICT in society.

Research in information systems focuses on understanding the underlying processes of change. Of importance here is the institutional background within which an ICT project is implemented. Such an organisational background has shown to influence the process by which resources allocated for an ICT project leads to a successful or unsuccessful system (Avgerou & Madon 2004).

In Table 3.2.1 ‘Eras of Information Systems History’ below, a brief summary of Information Systems history is given. The different eras are highlighted together with their related trends, purposes, key issues, and constraints (Sundén & Wicander 2006).

\(^{15}\) There are several different but related concepts regarding the field of Information Systems (Davis 2003). Information Systems (IS), the Academic field of IS (AIS), Management of IS (MIS), and Information Management are all used as synonyms. Over time, there has been a trend to employ the simple term, IS (ibid). Information Systems, with capital initials and an ‘s’ at the end, is used to name the research field for the academic discipline, while an information system with lower-case letters together with the acronym IS refers to the object of this research field.
The constraints facing e-government solutions in developing countries can be seen as a ‘summary’ of the different ‘eras’. The different ‘eras’ that the Information Systems history in the industrialised world is divided into can be seen as snapshots of the present status in developing countries. This indicates the level of complexity that faces developing countries when implementing e-government solutions and also suggests that ‘leapfrogging’ is not as easy as it might sound. (Leapfrogging is the idea that countries and societies can jump over one or more generations of technology and that developing countries can thus move more rapidly to ‘effective’ ICT use.)

### 3.2.2 Information System Constituents

An information system can be stated to consist of several elements. There is a need for a systemic and contextual view of technology to be able to understand the role of ICT. This is shown in a systemic model of Wilson and Heeks (2000:413) see Figure 3.2.1.
In this model, the central element is ‘information’. However, there is a distinction and relation between ‘data’ and ‘information’ even if several authors use them interchangeably. Data are possibly processed but yet uninterpreted, while ‘information’ is interpreted data, or as Davenport and Prusak put it, information is ‘contextualized, categorized, calculated, corrected and condensed’ data (1998). A formal definition of information including data is the infological equation by Langefors (1973/1978:248): $I = i(D, S, t)$. Information ($I$) is a function of an interpretation ($i$) of data ($D$), the receiving structures ($S$), and time available ($t$). The receiving structures ($S$) are related to a person and her/his prior knowledge, frame of reference, understanding, education, experience, skill and language.

The second element in the systemic model is Information and Communication Technology (ICT), the technology. The term ICT can be defined as “…the artificial resources we use to develop, implement, operate, use, maintain, and manage an information system” (Weber 2003:325). According to Weber, these artificial resources can be classified as hardware and software. ICT can be divided into non-digital based and digital based or, in line with Wilson and Heeks (2000), into ‘other technologies’ and ‘new ICT’. The

![Systemic Model of an Information System](image-url)
former includes old ICT, e.g. fixed telephones, books as well as ‘the bush telegraphs’, while the latter is synonymous to what we today label ‘new’ ICT.

A further division of ICT is into three stages – old, new, and converging (see e.g. Hall & Preston 1988; Göransson & Söderberg 2003). Converging includes several more functions than what each ICT covered when they were introduced; several more media types are integrated into one platform (Wicander 2010), which creates an opportunity for developing countries (UNCTAD 2008).

The third element is ‘information system’. The term ‘information system’ has been used and defined broadly within different interests. Langefors simplified this to ‘information systems handle data to provide information’ (1973/1978:195). Further, a number of authors stress the importance of defining an information system as a social system (Walsham et al. 1990; Land 1994; Avison 1997).

Walsham et al. (1990) give the concept a broad definition, since they define an information system as a social system that has both some technical aspects and some social, political, and communicative aspects involved. This definition is similar to Land’s (1994), when he considers information systems to be essentially social systems having ICT as one aspect. With this follows a diminished focus on the technological aspect. A difference is that Land takes ICT for granted as the technical aspect. Avison (1997), on the other hand, does not take new ICT for granted in his definition: “An information system is a human activity (social) system which may or may not involve computer systems” (1997:115). This is in line with Dahlbom (2003) when he declares that in information systems, technology is not the essence, even if an efficient management depends on information facilitated by ‘modern’ information technology. Lee (2003:315) goes further as he declares that “…an information system is an organization enabled by information technology”.

In other words, some authors do not link the definition of information systems to ICT at all, while others consider ICT as implied in the concept of information systems. Lee (2003) declares that even in the past, when the information technology was not electronic or digital, there were information systems. This conception of an information system involves a return to some basic ideas in the IS discipline (ibid:315). This is in line with Weber (2003:325), who believes information systems, rather than ICT, will be the source of the

16 The complete definition: “By information system we mean here: A system of information sets needed for decision and signaling in a larger system (of which it is a subsystem) containing subsystems for collecting, storing, processing, distributing information sets.” (Langefors 1973/1978:195)
phenomena that allow us to build theories that establish the identity of the IS discipline. The above discussion coincides with the systemic model by Wilson and Heeks (2000:413) where their information system is built up of two main elements: people and processes, which can be understood as a social system.

Further, as the fourth element in their model, Wilson and Heeks highlight the influence from the surrounding environment including several influencing factors and institutions. These factors range from human and social factors to political and institutional factors as well as economic ones.

In a systemic view, an information system can be described as being about people undertaking processes of activities using different types of ICT with the purpose of transmitting data and information in support of human purposes. Hence, an information system can refer to a system for handling data and for information transfer. An information system is used, and can also be studied, in different contexts and within different organisations. Following this, an information system must be seen in a wide perspective, and as a social system for data and information transfer within an organisation taking into account new ICT as well as old ICT.

But at the same time, it is important not to forget the ‘IT artefact’ as Orlikowski and Iacono (2001) label ICT. They stress the interdependence between technology and the social context including its history and culture. The authors offer five premises about ICT: it is not neutral or universal; it is embedded in time, place, discourse and community; it is made up of a multiplicity of components; it is neither fixed nor independent; and it is dynamic and conditional – it has a dual notion in several aspects. Hence, to study an information system, one needs not only to study the ICT per se including its components in its embeddedness in time and place, but to remember ICT can be both digital and non-digital as well as manual; an information system can be labelled ‘blended’ i.e. a mix of digital and non-digital as well as a mix of different digital technologies.

ICT can be viewed from two perspectives: technological determinism, where technology is an autonomous force that is external and that controls (determines, shapes) people and society; or a perspective where people and society control the technology. A third perspective is to view ‘technology’ as neutral. Technology is in this study to be understood as both the artefact itself as well as the artefact in use. Artefacts in use influence people and society but the influence also works the other way around; there is a duality of these ‘forces’ - both sides are influencing and influenced, in line with the Orlikowski and Iacono view. I want to advocate a complementary perspective related to
the two perspectives: something ought to be done because it is possible to do it, not indiscriminately but when there are clear benefits involved, e.g. if there is a certain technology that can serve society without draining resources from other urgent matters, one has a moral duty to consider it.

The traditional view of information systems has progressed significantly since the early information systems developed under the technology-centric view: the hardware and its user. (See e.g. Sundén & Wicander 2006 for an account of this.) There is a growing acceptance that it is not solely the technical issues that are the major factors in their successful development and use, but that the non-technical human and social factors are equally relevant. These combine with technologies to create the informed contexts in which information systems are developed and operate, effectively or otherwise.

Within the Information Systems field, the socio-technical movement (Mumford 1983; 2000) can be seen to provide insights into this complex relationship between the technological artefacts and the social aspects in which they are situated (Agerou et. al. 2004). As such, they may be understood independently of the actors that produced them in the first place, yet intimately situated within their contemporary contexts. In doing so, these technologies and their functionality may be seen to combine with humans and their actions to constitute an informed ‘socio-technical ensemble’. How such an ensemble may be ‘effectively’ created and maintained is the subject of this thesis.

As stated above the Information Systems field can be characterised as diverse. The diversity could be expressed as the two missions for the field of Information Systems, according to Markus (2000). The first mission is concerned with value aspects and focuses on the process by which the ICT investments can add value. This mission is closely connected with usage. If the information system is not used by the intended users in the intended way, there will be no added value.

The second mission concerns the construction of ICT infrastructure. This focuses on how to structure and build with the purpose of best supporting an application. The second mission is a prerequisite for the other or as Markus puts it: “…a robust infrastructure is an essential precondition for achieving sustained value from IT applications” (1999:196).

However, in this study it will be stressed that there are several prerequisites for a working infrastructure. In industrialised countries, the basic infrastructures are there and are well functioning, but in developing countries this cannot be taken for granted. In other words, infrastructure is a necessary
but not sufficient precondition for added value from an information system in a developing country context; there are several other resources that are needed.

The view of e-government systems as information systems presented in section 3.2 emanates mainly from Heeks (2006). His understanding of e-government, drawing on contingency philosophy, is shortly expressed with 'e-government is about use of ICT by the public sector'. E-government systems are not just ICT; they are also information systems and ICT is not only about digital ICT, it is also about non-digital as well as manual ICT, as Heeks points out. The systemic model by Wilson and Heeks (2000) presented above is further developed and adapted to e-government by Heeks, by e.g. adding an organisational level. He identifies several structures and 20 separate factors embedded in the public sector organisation and the embracing environment.

In his systemic model, Heeks (2006) indicates that information systems are socio-technical systems. An information system can be defined as a socio-technical system including both 'people' and 'technology', which are labelled 'soft' or 'hard'. Further, a 'soft' approach can be characterised by terms such as 'subjective, qualitative, human, systemic and holistic', while a 'hard' approach can be characterised as "objective, quantitative, technical, reductionist" (ibid). According to Heeks, the 'soft' side is more often related to failures than the 'hard' side. Socio-technical systems can be handled by a socio-technical approach also labelled 'hybrid', i.e. a mix of a soft and a hard approach – a blended approach (ibid).

### 3.2.3 Information – a Critical Resource

Information is a critical resource, while at the same time it is a primary resource in 'all' activities. Information is a resource that can be used by individuals for individual benefits, but also for benefits on an aggregated level contributing to change and the development of society. From a systems perspective, a social system has the capacity to exchange information with the environment and by that to create change and development. For the survival of the system, it is important to be in constant contact with the environment.

Seen in an historical perspective, information has been an important ingredient for development in the Western world as well as in developing countries. Several authors (Lerner 1958; Rostow 1960; Fuglesang 1973; Ngwainmbi 1995) have pointed to the importance of information and communication and they all see this as a prerequisite for both economic and social development. Ngwainmbi (1995) describes development as a continuous process that demands information in constant circulation between politicians,
decision-makers, project leaders, and receivers. Ngwainmbi mentions political awareness and engagement, increasing equality, better public health, and diminished famine as examples of positive effects from better information and communication.

The importance of information and ICT has given rise to a theory, the New Growth Theory, that attempts to explain the process of development and growth through endogenous forces such as human capital, knowledge ‘spill over’, and ICT (Sengupta 1998).

The importance of information is stated by Castells in his trilogy “The Information Age. Economy, Society and Culture” (1996; 1997; 1998) about the network society. Castells pointed to the growing amount and growing importance of information work, speaking about the ‘information revolution’ and an Information Society.17

Gaining access to essential information through ICT is also about benefiting from the information: to put data into action, change depends on availability of data and information. With a systemic approach, this can be illustrated with an action chain, in accordance with Wilson and Heeks (2000:415), see Figure 3.2.2, the Five A’s model.

![Five A's Model](image)

**Figure 3.2.2** The Five A’s Model (adapted from Wilson and Heeks, 2000:415)

Today, information can be regarded as commercial goods necessary and with profound implications for development in general, and for the development process in developing countries in particular. Information ‘economics’ is discussed by Coiera (2000), who characterises information by high production cost, low reproduction and low transportation cost, together with the distinct characteristic that information is not consumed or worn out; information is a ‘non-exhaustible’ component. The usage of information does not in itself reduce its present or future availability as Meier noted already in 1980.

But in a developing country context, this has to be viewed a bit differently. Wilson and Heeks (2000:414) present different main roles that ICT can have in developing countries. In one role, ICT is an information processing technology, with the motivation that all organisations need to process

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information that arises from both inside and outside the organisation. ICT can, in this process, act as both a capital-saving as well as a labour-saving technology (Meier 1980; Göransson & Söderberg 2003). ICT can e.g. offer alternatives to travel and facilitate a more efficient use of transport resources (Göransson & Söderberg 2003). As labour-saving, ICT could be related to better management, organisation, and work procedures (Meier 1980). Meier (1980) also mentions a risk with this process, as it tends to aggravate the underutilisation of labour. Meier points to the fact that most developing countries have a so-called ‘dual economy’, which consists of a minor modern commercial industrial sector along with a major traditional agricultural sector.

Indeed, Wilson and Heeks (2000) state that given the relatively high ICT costs and the low labour costs in developing countries, ICT can easily raise, rather than lower, processing costs. Inefficient information systems can be incredibly demanding on resources and thereby may take away resources from organisations who already lack resources and who could spend their resources in better ways.

It is important to choose the most efficient means to mediate information, whether it is digital or non-digital, manual or non-manual, and not just replace ‘old’ ICT with ‘new’ ICT. Instead, it is imperative to integrate them into a ‘hybrid’ that utilises both the technological, economic and cultural strengths (Ngwainmbi 1995) and to be aware of that effectiveness and efficiency is not only about ‘ICT’.

Another role for ICT is as a communication technology. All organisations, regardless of size, have a significant need for both receiving and sending information. This can be seen as the main potential area for ICT applications for developing countries as ICT ‘normally’ lowers communication costs substantially, according to Wilson and Heeks (2000). This view is in line with Ngwainmbi (1995), since he states that ICT can be seen as a tool for fast and reliable communication. ICT can provide options to travel, and can encourage more efficient usage of the transport resources available.

It is important to mention that the problem in many developing countries is related to the concept of ‘asymmetric information’ introduced by the Economy Nobel Prize winners of 2001, George Akerlof, Michael Spence and Joseph Stiglitz. Asymmetric information is a matter of uneven distribution of information. The issue of asymmetric information has high relevance in developing countries due to inefficient information systems, (de Vylder 2002), lack of resources and lack of relevant data.
The relationship between asymmetric information, corruption and ‘bad’ governance is discussed for instance by Kristiansen (2004:11) and Reinikka and Svensson (2004). Reinikka and Svensson show from the education sector in Uganda that the central government’s policy regarding the capitation grant was not well-known to parents or to the local PTA (Parents and Teachers Association). Little information was available to the public, including the PTA, about the spending items protected within the budget system. Hence, local officials and politicians could take advantage of an information gap; the information asymmetry resulted in extensive corruption.

An ‘Information Society’ implies two things: the creation of information and the control of information. The power, capacity and capability to create new information are dependent on the access to data and ‘old’ information. Thus, both information and communication are resources with clear connections to development.

3.2.4 Technology – a Troublesome Facilitator

Technology is a vital part of most human activities and can be defined as: “…a purposeful, practical activity that involves the application of knowledge by organisations of human beings and their interaction with hardware” (Wilson & Heeks 2000:403).

There is an overall belief that developing countries have a great advantage as modern technology is accessible and does not have to be reinvented, so-called leapfrogging. This belief includes skipping certain technological stages and this view could be related to the view expressed by Rostow in 1960.

There is also critique against this positive point of view of ICT and development. Wilson and Heeks (2000) argue that ICT, like any other new generic technology, is often mentioned in wide statements about what it can do for development. There is an overall belief that poor countries must gain from adopting new technology. Great claims are being made for the role of ICT in poverty alleviation and development in general. These claims should be considered with caution; not only may the benefits be exaggerated, but ICT development also takes away resources that may be better placed elsewhere.

There has been tension between ‘technology-as-solution’ and ‘technology-as-problem’ views for decades. During the 1950s and 1960s, technology was represented as the solution to and goal of development. Development was the same as technology and technology was the same as development. This view has its roots in the industrialisation era and modernisation is the dominant goal (see Sundén and Wicander 2006 for a discussion on modernisation).
However, in the 1970s there was a reaction against this view and technology started to be seen more as a problem. Several authors questioned the association of technology with progress. Schumacher expressed his criticism in ‘Small is Beautiful – A study of economics as if people mattered’ (1973). This contribution can be seen as a call to action for technology with a ‘human face’ and he defined this as “…making available to them a technology that recognises the economic boundaries and limitations of poverty…” (Schumacher 1973:158). This different approach to technology was also expressed by others and concepts like ‘alternative technology’ and ‘appropriate technology’ were formulated.

During the 1980s, another approach was emerging that explained technology as a social process (Wilson & Heeks 2000). Technology was seen as embedded in social, cultural and economic relations in the particular society. This approach views technology as both reflecting and influencing the society that produces it and technology is seen as only one among others that shapes a society. When technology is transferred from one society to another, it also reflects social values, institutional forms and the culture of the former society. In other words, one has to take into account the social, cultural and economic contexts in which it is to operate. At the same time, the consequences of technological development are not necessarily negative, even if it disrupts cultural norms (ibid).

Wilson and Heeks (2000) point to a more ‘systemic’ view that has evolved in which one can never exert total control over technology. Technology development can be managed if one recognises its embeddedness in other relations such as economic, social and cultural relations. This approach views action for development as taking place within a system of inter-related arenas, such as social, economic, cultural and technological, where action in one has impact on the others (ibid); i.e. a dual notion of technology both influencing and influenced. A summary of the views on technology and development is shown in Table 3.2.2 below.

| Table 3.2.2 Views on Technology and Development (Sundén & Wicander 2006:77) |
|---------------------------|---------------------------|---------------------------|---------------------------|
| 50-70                     | 70-80                     | 80-90                     | 90-                       |
| Technology as solution -  | Technology as problem -   | Technology as social      | Technology as system      |
| ‘Neutral’ instrument for   | ‘Call for technology with a human face’ | process -                | - Action in one arena     |
| accelerated development    | ...a critical view         | Take account of the social, cultural and economic contexts | ...a systemic view        |
|                           |                           |                           |                           |
3.2.5 Summing up

This section has discussed e-government solutions as information systems. In a systemic view, an information system is about people undertaking processes of activities using different types of ICT with the purpose of transmitting data and information in support of human and social purposes. Hence, an information system can refer to a system for handling data and for information transfer. An information system is a social system for data and information transfer including new ICT as well as old ICT existing in context.

Furthermore, research in information systems focuses on understanding the underlying processes of change. Of importance here is the institutional background within which an ICT project is implemented. Such an organisational and institutional background has shown to influence the process by which resources allocated for an ICT project leads to a successful or unsuccessful system (Avgerou & Madon 2004) – which in itself is not binary. Following these observations an information system must be considered in a wide perspective due to the complexity inherent in its functioning.

The importance of information as a critical resource for development is recognised by several authors. The capacity to act is dependent on information but the lack of information is profound. Moreover, even if there is information, not everyone involved has access to relevant and complete data, nor the possibility to assess the data or apply and adapt the data into information. Additionally, information is held in both in formal IS as well as in informal IS.

Furthermore, technology is in this study to be understood as both the artefact itself as well as the artefact in use. In this section, it has been observed that the artefact in use influence people and society but also that technological structures and social structures are influenced by each other. In doing so, these technologies and their functionality may be seen to combine with humans and their actions to constitute an informed socio-technical ensemble (Bijker & Law 1995), in which the parts mutually shape each other.

This section also brought up the belief that developing countries have a great advantage because modern technology is accessible and does not have to be reinvented, a fact which allows for so-called leapfrogging: skipping certain technological stages. When looking at the lack of infrastructure, it was concluded that there is no simple, general potential for leap-frogging.

Moreover, infrastructure is a necessary but not sufficient precondition for added value from an information system in a developing country context. As stated above, the context needs to be considered including social aspects. There are several other resources that are needed for an IS in a developing country.
context. It was also noted that inefficient information systems can be incredibly demanding on resources and thereby taking away resources from organisations who already lack resources and who could spend their resources in better ways.

3.3 e-Government

e-Government systems and solutions is a phenomenon related to administration and management of the education sector. This introduction to the phenomenon e-government elaborates on what e-government is, how to define it, what it promises, and why it often fails and finally looks at some general models.

3.3.1 What is e-Government and e-Governance?

e-Government is a relatively new phenomenon, both the activity itself and the term for it, which emerged in the 1990s (Grönlund & Horan 2005), and is associated with the adoption of computers, digital networks and the Internet.

One dimension of e-government, e-administration, consists internal activities and has a longer history, dating back to the introduction of computers, making the introduction of ‘e’ in government more about a long evolutionary chain rather than a sudden revolution.

Today, e-government is often concerned with services to citizens, i.e. external activities, but all definitions, according to Grönlund and Horan (2005), go beyond this and include organisational change and the role of government.

There are several definitions of e-government (see Grönlund & Horan 2005) all related to ‘ICT-based innovations in public services’ and e-government can be broadly defined as “all use of information technology in the public sector” (Heeks 2006:1-5).

Guida and Crow describe e-government as “the delivery of services via network technologies to citizens, businesses and government agencies...” (2009:282). This encompasses both the front-office, i.e. external, and the back-office, i.e. internal, use of ICT to support processes such as the provision of data and information. E-Government includes several managerial issues from high-level strategies and politics to the technicalities of data flow and process mapping (Heeks 2006).

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18 Electronic Government, Digital Government, Electronic Governance are synonymous with electronic government being the most commonly used (Grönlund & Horan 2005), and e-government as the most cited term (Andersen & Henriksen 2006).

19 The terms ‘public sector’ and ‘government’ are used interchangeably as well as ‘public agency’ and ‘public sector organisation’.
In general, e-government refers to a government's use of ICTs to exchange data, information and services with citizens, businesses, civil society, and other arms of government. In other words, to pass information and services from the government, to the government and/or within the government, the latter being synonymous to e-administration, internal activities, back-office or government-to-government (G2G).

There is some confusion between the terms and concepts ‘e-government’ and ‘e-governance’. Grönlund and Horan discuss e-government vs. e-governance and conclude that “…government is about certain specific activities with a short-term perspective, governance is about processes and outcome in the long run” (2005:719). They state that e-government is more about ‘what’ and e-governance is more about ‘why’ and ‘how’; e-government is more about the administrative sphere and e-governance more about the political sphere and the civil society, but that ‘governance’ is related to all three spheres.

E-Governance consists of a bureaucratic and a political element according to Madon (2009). While any governance obviously has a political element, the bureaucratic element in e-governance could need an explanation: the bureaucratic element refers to “…simplifying procedures and work flow within the administration through the adoption of management techniques and procedures” (ibid:33).

A wider definition of e-governance from a UNESCO report (Jensen 2002) states that ICTs are used to “…promote more efficient and effective government, facilitate more accessible government services, allowing greater public access to information, and making government more accountable to citizens.”

Grönlund and Horan (2005) point out that related to the definitions are also a set of different social, political and economic values, and several contextual and societal aspects. E-Governance is implicitly ‘good’ and/or ‘benign’ and an exercise of power in a positive sense to help citizens. But government and governance can also be seen as an exercise of power in a negative sense to extract resources from citizens and the prefix ‘e’ is more about how it is delivered.

The term ‘e-government’ is used in this study, but in line with the definitions of e-government that include ‘governance’ i.e. the role of government in society, interpreted as ‘better government’, including e.g. reduced corruption (Grönlund & Horan 2005) is implied. The definition of ‘e-government’ in this study includes the different social, political and economic values, together with a concern of contextual and societal aspects, since using a
too-narrow definition of e-government and e-governance, as Grönlund and Horan (2005) state, can bring with it a too-narrow focus with the risk of sub-optimising.

3.3.2 What does e-Government Promise?

Proponents of e-government have promised advantages, benefits, positive effects and impact, and opportunities. e-Government has been claimed to have several internal effects and benefits (Yildiz 2007; Guida and Crow 2009) such as inter-connectivity, inter-activity, and decentralisation, with improved and convenient intra-governmental services and back-office process automation, together with better inter-agency relationships, inter-operability, and better data transfer and data sharing with greater accuracy.

This section discuss the following questions: Aside from theses promises, what are the motivating factors for implementing e-government solutions in developing countries? What are the opportunities for developing countries?

In recent years, an increasing number of projects have been launched in developing countries under the label of ‘e-government’, and several governments have identified this as a key policy priority according to World Bank. Investments in ICT are made to create the underlying infrastructure and also to build applications that utilise the computing power and connectivity (World Bank 2007a).

The World Bank declares that ICT offers the public sector in developing countries an opportunity for change and it has become the norm rather than the exception to utilise ICT in a broad range of public sector operations in contemporary governments (ibid.). The success of some projects in improving the delivery of services has reinforced the idea of ICT for development.

Motivating factors to implement e-government solutions in developing countries are either top-down from the bureaucracy, perceived as the need to e.g. reduce costs and improve services or bottom-up and demand-driven from the users e.g. to improve quality of service (Guida & Crow 2009).

According to Guida and Crow (2009), ICT can address two key challenges for governments in developing countries: how to develop a public sector that is more efficient and responsive to development challenges; and how to prepare the public sector to participate in the ‘global ICT revolution’.

But governments in developing countries are also under national and international pressure to “...participate in a global digital information sharing” (Kazooba 2010).
The main objectives of technology use in government have ‘always’ been to enhance the managerial effectiveness of public administration in order to increase government productivity (Yildiz 2007). ICT is stated to have played an important role in public sector initiatives and has been mainly about improving the efficiency of government and of bureaucracies (Grönlund 2002; Madon 2009) due to, inter alia, that ICT is considered inexpensive (Yildiz 2007; Guida & Crow 2009).

E-Government is stated to have the potential to deliver information and services faster and cheaper i.e. a functionalistic view that focuses on productivity; to improve performance and collaboration (Lee et al. 2005). Cost savings in the form of reduced internal transaction costs, is also mentioned (Heeks & Bailur 2007; Yildiz 2007; Guida & Crow 2009). An example is an e-government project in Uganda which is reported as a success and positive effects have been mentioned such as less need to travel including lowered cost for accommodation, less paper work, and reduced stationary costs (Kazooba 2010).

E-Government is also about doing ‘things’ better and the important role to enhance the quality of data and information for decision-making is mentioned by several authors (Andersen & Henriksen 2006; Heeks & Bailur 2007; Madon 2009) for transparency and accountability (Yildiz 2007) i.e. data quality resulted in ‘better’ decisions and ‘better’ actions.

E-Government solution promises could be related to effectiveness and efficiency i.e. to do the right things and do them in a right way through:

• cost reduction
• improved quality of services
• increased quantity of service

There are also reports of more efficient reporting procedures releasing staff for more ‘value-added tasks’ (Madon 2009). Walsham (in Foreword to Madon 2009) stresses that ICT is not only about efficiency and effectiveness but also about opportunities for personal development and capacity building.

Layne and Lee (2001) focus more on the system and they state that e-government is about a change in the public sector’s organisational structure; an internal change with an effect on system efficiency.

In contrast to these optimistic views of e-government, there are authors that question the promises. Heeks and Bailur (2007:248) claim that the positive effects and impacts can be related to an optimistic technology view. Dé (2008) states that views of ‘technology determinism’ and ‘leap-frogging to modernism’ are dominant in the rhetoric.
However, Lee et al. (2005) recommend that regardless of a nation’s state of e-government efforts, e-government solutions should be implemented since ICT provides new opportunities such as mobile communications to enhance the efficiency of governments operations. Additionally it is suggested that ICTs make more difference in rural areas than in urban (Mitra 2006 in Selinger 2009), which can be assumed to count for e-government systems.

### 3.3.3 Failures and Challenges

While an increasing number of governments are investing in ICT, evidence to date on the outcomes of ICT investments in the public sector has not been fully established, according to Madon (2009). This is particularly valid for ICT investment projects in developing countries, some of which are financed by development institutions such as the World Bank (World Bank 2007).

Many ICT projects have been launched in different developing countries that were initially dubbed "success stories," but which eventually failed to make any significant impact (World Bank 2007). In the context of developing countries, many projects launched have not led to any significant improvement in the delivery of government services (Heeks 2002a). In other words, even if e-government systems and solutions promise a lot for developing countries as seen in the last section, Heeks (2002a; 2006) states that most e-government projects fail; or are ‘difficult to implement, hard to manage, often fail(s)’. A failure rate of more than 50 per cent is widely cited in this context (Heeks 2003). Evidence of failed projects has drawn attention to the level of risk involved in the implementation of e-government services. Additionally, the links between ‘better’ technology and ‘better’ government and governance, and development are not fully clear according to Madon (2009).

In a paper from 2002(b), Heeks discusses e-government in Africa stating that there are a growing number of e-government projects delivering ‘efficiency and effectiveness’. But Heeks states that it is an “...imported concept based on imported design” (2002b:97). The diffusion is slow, mostly with failures. Failures are due to several challenges described by Heeks as a lack of “e-readiness for e-government” and large “design-reality gaps”.

Walsham et al. express a similar view of a lack of reality and contextual awareness in this critical way: “The designers and sponsors of the various technology applications (HIS, GIS, SIS ...) often have overly simple expectations regarding the role of ICTs in development objectives. These naive

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20 ‘Failure’ is not an absolute phenomenon. An outcome can be divided into several categories as discussed in Sundén and Wicander (2006); it is too simplistic and reductionist to measure the outcome as ‘success’ or ‘failure’.
expectations often underplay the role the social and institutional conditions in major development projects, leading to unintended consequences and, sometimes, failure” (2007:322).

Selinger (2009:217) talks about a “technology dissonance” in developing countries, which includes the fact that culturally relevant models are different with the consequence that a technology-based model from one context is difficult to replicate in another context, in line with the ‘design-reality’ gap that both Walsham and Heeks talk about.

So what are the factors and issues included in ‘lack of e-readiness’? E-government presents a number of challenges and there are several ‘critical’ factors and issues when implementing e-government systems and solutions described in the literature. Challenges concerning e-government in developing countries can be discussed both in terms of what the public sector is doing and how it is doing it. Important factors and issues range from political and economic models to inequities of financial, human and technical capital (Guida & Crow 2009:316).

In this present study, these factors and challenges are tentatively and broadly placed into seven categories (physical, financial, human, social, institutional, political, immaterial) using the analytical framework XIF (the eXtended Sustainable ICT Framework), which will be explained in Chapter 4.

Factors and challenges related to physical resources include fundamental, ubiquitous infrastructures, the availability and nature of different technology solutions, and appropriate ICT (Heeks 2002b; Lee et al. 2005; Selinger 2009; Guida & Crow 2009). Factors and challenges related to financial resources include financial capacity and affordability of access, sufficient counterpart funding and technology cost in developing countries (Guida & Crow 2009; Selinger 2009).

These factors are integrated into what Selinger (2009:217) calls the “technology dissonance” in developing countries, including the availability and nature of different technology solutions and cost; e.g. lack of access together with higher costs in Africa compared to Western countries. Additionally, Heeks (2002b) argues that cost-cutting goals are questionable in a developing country context, where wage costs are relatively low and the opportunity costs are relatively higher due to a limited availability of resources.

e-Government literature presents a number of institutional and organisational challenges including human and social issues. The organisation culture is a challenge (Lee et al. 2005) and included in organisation culture are attitudes towards ICT. Structural obstacles in organisations also exist where
normative rules and institutional structures of the bureaucracy constrain and channel the design of ICT (Avgerou 2002). Also attitudes towards actual usage of ICT are essential and e.g. the perception of being successful creates self-confidence (Furuholt 2009). Further, good administrative processes (Lee et al. 2005) and inter-operability between departments (Layne & Lee 2001) are important while organisational complexity (Braa et al. 2007) with too many ‘components’ can create coordination problems (Guida & Crow 2009): coordination failure between central and local governments can occur (ibid). Also problematic are the lack of institutional capacity (ibid) and the lack of top management engagement (Furuholt 2009) as well as top-down approaches that do not account for user needs (Guida & Crow 2009). Unclear responsibilities of stakeholders and the vested interest of various stakeholders (ibid) with different agendas that might be at play (Furuholt 2009) create problems. Additional problems are created by a lack of human resources (Guida & Crow 2009) including the availability of basic knowledge and e-literacy i.e. knowledge barriers (Furuholt 2009). It is not only about training for all involved (ibid) and the lack of adequately trained personnel; it is also about the lack of resources to train personnel (Kumara & Best 2006). On a governmental level, it is about government leadership (Lee et al. 2005) including the lack of government commitment from those responsible and also about changing government priorities (Guida & Crow 2009). Involvement for all stakeholders from the beginning (Kumara & Best 2006; Furuholt 2009) including involvement of the local stakeholders in the entire process (Macome 2003) is mentioned as well as motivational encouragement for all involved (Furuholt 2009) including engaged public employees (Lee et al. 2005). Lack of job-related benefits (Furuholt 2009) with low utilisation of newly developed systems (Guida & Crow 2009) and government employees’ unwillingness to share information (ibid) is also mentioned.

An example from Uganda illustrates the diverse challenges that an e-government implementation can meet; an example of contextual complexity. A district project was implemented in 2001 in four districts in Uganda by the Ministry of Local Government to improve communication between different government levels within a district and the central government in Kampala (Kazooba 2010). Communication was a major problem in the area due to poor telephone lines and a poor network of roads i.e. infrastructural problems (ibid). The project was also meant to reduce poor delivery of public services, due to inefficient record-keeping of a variety of paper-based data and information, including statistical data (ibid).
Several challenges are mentioned (Kazooba 2010):

- Insufficient electricity in the districts
- Insufficient Internet connections
- Not all departments are connected – only two out of five
- Limited ICT skills
- Inadequate training
- Crucial staff was not involved
- District authorities have not budgeted for the project
- Limited funding – donors withdraw funding too early

Another example from Botswana is a study by Ojedokun and Moahi (2009) concerning the impact of ICT on productivity. Data from two public corporations in Botswana, energy and water, show no significant statistical evidence that ICT is positively linked to improvement on productivity. ICT is used in the billing process in two ways; a handheld device is used for capturing data, and this data is later uploaded to a computer for bill processing. Findings from the study show that productivity depends on a combination of workplace factors (organisational and institutional) in the billing process including (Ojedokun & Moahi 2009):

- The degree of supervision
- Lack of supervision due to work-overload
- Computers are used for other official and non-official activities
- Delays in correcting computer breakdowns
- Lack of motivation among both meter readers and supervisors
- Significant absence among meter readers
- Meter reading is labour-intensive and creates stress

Additionally, Ojedokun and Moahi indicate that ICT can constitute a source of stress for employees e.g. to learn computer skills, and by “…thinking their job has become less secure and less interesting” (2009:50).

Boateng et al. (2009) stress workplace practices and process; i.e. institutional and social factors and state that ICT alone is an insufficient predictor of productivity improvement at public sector agencies. Instead e.g. workplace practices influence and govern the usage of ICT.

Political and policy issues and factors present a further challenge as reported in the literature (Layne & Lee 2001; Furuholt 2009; Guida & Crow 2009) e.g. lack of or a weak supportive regulatory environment and legal framework (Guida & Crow 2009).
e-Government challenges and the role of political leadership in a rural district in Indonesia is discussed by Furuholt (2009). He contends that strong political leadership is one of the most important success criteria for e-government projects in general and in developing countries in particular. Strong leadership is even more crucial to being able to generate progress over time and to help manage e-government implementation when there are limited resources available. Heeks (2002b) stresses ‘e-champions’ as a critical factor.

Kumara and Best (2006) report from an e-government project in rural India which failed after one year due to lack of both local political and administrative support, i.e. lack of political and institutional resources on a local level. A lack of sustained and effective public leadership, commitment and institutionalisation shows the need for institutionalisation of an e-government project instead of letting it be dependent on individual(s) and their initiative. The need for institutionalisation includes the involvement of all stakeholders on all levels, from the highest level down to the local level. Kumara and Best (2006) describe that the government at the highest level supported the project but that local representatives were never deeply involved and even if they were aware of the project they did not recognise it as serious or they shifted to other regions. The project also caused a perceived shift in existing power relations and some local officials found the project a threat to their role, authority and influence in the local community.

Srinivasan (2004) also reported weakened support from local government and she related this to lack of institutionalisation, and a top-down approach. Support from local officers remained only as long as the ‘champions’ were active.

Another example of an e-government failure, related to institutional issues, is a HMIS (Health Management Information System) in Ecuador, described in Heeks (2006:23), where he concludes that the main factor in the failure was a top-down centralised approach, based on the needs and agendas of the senior officers at the Ministry of Public Health. The HMIS was implemented but it was only partially used or not used at all and finally abandoned.

The role of e-government systems, i.e. transparency and accountability, and the possibility to reduce corruption is discussed by De’ (2007), with case studies from India. The study shows that even if e-government solutions were implemented, manual processes existed simultaneously: a legal online and an illegal manual version of land certificates. De’ concludes that the existing conditions in which an e-government solution is implemented will determine its
effect on corruption such as pre-existing relations between officials and citizens, and the existing laws. Further Kumara and Best (2006) assume that a diminished opportunity for corruption related to the loss of control was a major reason for opposition from local officers. In other words, local public officers find motivation to resist an e-government project if the project undermines their opportunities for corruption. Heeks (2002b) also stresses the importance of empowerment of local communities for engaging themselves.

There are also pessimists about the capacity of government, stressing that it is naive to expect technology to transform government organisations in developing countries that are “...inherently conservative, hierarchical and bureaucratic.” (Norris 2002 in Guida & Crow 2009:284). Guida and Crow (2009:316) stress that an “... insular institutional culture of government predetermine the effectiveness of e-government strategies.” According to Lee et al. (2005), it is evident that e-government practise in a country mirrors the ICT policy, strategy and diffusion in that country. This is in line with Heeks’ (2002b) idea that e-government ‘readiness’ relates to the ability of taking dynamic strategies for ICT development, and better understanding the context of strategic planning.

Lee et al. (2005) argue that e-government can be understood in terms of how ICT are shaped between rules of technology and law, and between organising principles of bureaucracy and society. A study from India concluded that through e-government systems, the state reinvents itself as a “...powerful centralised force...”; an e-State (De’ 2008) since the e-government systems are used to centralise control to higher levels in the bureaucracy.

### 3.3.4 Scalability, Scarcity, and Sustainability

Three ‘overarching’ challenges in developing countries mentioned in the literature are scalability, scarcity, and sustainability - all related to lack of resources.

**Scalability** is identified as a challenge in developing countries (Walsham et al. 2007; Braa et al. 2007). Starting up a project and reaching success is a challenge in developing countries, but to scale it up presents an huge challenge due to, inter alia, high complexity, and lack of resources including lack of infrastructure (Walsham et al. 2007). Scale is about the number of users and the geographical area i.e. scale can be defined as the scope of an IS and scaling as the “...expansion of the system in scope and size” (Braa et al. 2007:384), but scaling in one direction can hinder scaling in another direction. Scalability is affected by the gap between available and required resources.
Scarcity of ‘all’ resources is a challenge mentioned for developing countries in general (Guida & Crow 2009:316). Discussions on scarcity often reveal a gap between urban and rural areas. Here, the inequities and uneven distribution of resources between urban and rural areas is in focus. There is a lack of contextual awareness, which includes the urban-rural gap, as well as a lack of awareness about the sometimes huge intra-national gap between more prosperous urban areas and disadvantaged rural areas.

There is a need to take account of the specific circumstances and challenges of rural communities, including the education sector, when implementing an e-government system. All of the problems, challenges and gaps are more profoundly and acutely experienced in rural areas where most people live. Extremes of availability exist between urban and rural areas with regards to components in the infrastructures such as ICT, electricity and roads. Rural areas have relatively low mobile penetration and more poor people, which makes it difficult to reach a critical mass of users (Mendes et al. 2007), which is a prerequisite to widespread acquisition and usage of mobile phones. Concerning financial and economic issues, the ability to pay (purchasing power) is lower in rural areas but at the same time, the willingness to pay is higher in rural areas (Furuholt 2009).

In order to understand the extent of the rural – urban gap in India, Mathur (2004:123) uses the metaphor of a snake “...with its head in the twenty-first century and tail in the nineteenth.” An example of a ‘physical’ gap is mentioned from Indonesia, where teledensity was as high as 25 per cent in urban areas compared to 0.2 per cent in rural areas (Idris 2004). An example of an ‘accessibility’ gap related to languages can be shown in Sri Lanka, where the majority of government websites only offer content in English, while most people in rural areas speak Sinhala and Tamil (Wattegama 2004). This heterogeneity demands “...robust, flexible, and scalable approaches...” (Braa et al. 2007:395).

Several of the access barriers in developing countries can be stated to have the most impact in a rural context, as the poorest part of the population and the biggest lack of infrastructure, both electricity and telecommunications, as well as mobile services, are found in rural areas (Shanmugavelan & Wariock 2004; Donner 2008). “The potential of balancing deep divides in resources is inherent in ICT”, says Bradley (2010:5) but in the present study the difference between different ICTs are emphasized; cf. the discussion on disaggregation of ICT in section 3.1.
Sustainability is identified as a ‘huge’ challenge in the literature concerning e-government solutions in developing countries (Sander et al. 2005; Braa et al. 2007; Madon 2009). Sustainability is determined by a gap between provided and needed funding.

Sander et al. (2005) identify problems with economic sustainability in donor-funded projects related to long-term funding and undertaking. Donors withdraw funding too early; funding is mostly provided over a fixed period and then the project is considered completed according to Kazooba (2010). Donor-funded projects also exclude long-term operating costs, which are not seen as ‘mission critical’, such as hardware and software maintenance costs, telephone and Internet charges; consumable such as papers, printer cartridges, spares, back-up media; higher salaries required for the retention of technical staff, ongoing staff training. All operating costs must be planned for and covered in the initial planning as this is essential in a context “...where even the cost of paper for printing is frequently regarded as a significant item” (Sander et al. 2005:137).

Sustainability is about long-term undertaking, including issues such as ‘realistic’ long-term plans for maintenance and usage and financial planning that covers implementation, operating costs and long-term financial support (Sander et al. 2005; Braa et al. 2007; Madon 2009).

In sum, these three overarching challenges relate to three gaps:

- Scalability involves a gap between available and needed resources
- Scarcity involves a gap between urban and rural areas
- Sustainability involves a gap between provided and needed funding

### 3.3.5 General Models

Different models have been developed to meet the challenges encountered by public administrators when implementing e-government solutions.

One of the first models, and also one of the most cited, is the ‘four stage model’ by Layne and Lee (2001). Other models are the Public Sector Process Rebuilding maturity model by Andersen and Henriksen (2006); a model by Guida and Crow (2009); a model from the World Bank (2003); and the UN-ASPA model (2002).

21 Other models are the Public Sector Process Rebuilding maturity model by Andersen and Henriksen (2006); a model by Guida and Crow (2009); a model from the World Bank (2003), and the UN-ASPA model (2002).
different governmental levels with improved efficiency and effectiveness as the outcome. According to Layne and Lee (2001), vertical integration is about the ‘transformation’ of government services including changes in the government processes themselves.

The full benefits can be reached when organisational changes accompany technological changes e.g. national databases that are connected to different government agencies/departments/ministries (sharing a database among agencies within the same functional walls but across different levels of government) (Lee et al. 2005). This requires that different levels of government become less proprietary about their information according to Layne and Lee (2001). Boundaries at different levels become less distinguishable and an employee at one level becomes more integrated with employees at other levels. Challenges mentioned for this vertical integration are technological issues as well as organisational ones.

A model presented in Madon (2009) includes three stages of growth continuum in a developing country context: (1) e-administration, (2) e-service, and (3) e-participation. Here e-administration is focused while the other two stages are not relevant to the discussion at present. e-Administration is about the use of ICT to improve internal efficiency through the automation of back-office functions and the introduction of different management information systems (MIS) to support them. e-Administration systems, e.g. an EMIS, can be used as an effective monitoring system to provide local relevant information to policy-makers.

e-Government projects in developing countries are generally categorised as e-administration, i.e. belonging to the first stage of the maturity model. In a World Bank report from 2007, with 73 ICT projects in the public sector, many were categorised as e-administration and were concerned with MIS for different public sectors (Madon 2009).

Models in themselves imply evolution, a growth continuum, a linear path, and/or technological determinism. Higher stages/levels in the model imply maturity, development and advancement. e-Government can be seen as an evolutionary phenomenon according to Layne & Lee (2001); a never-ending process where the levels can be seen as “…discrete points in a continuous process in the organisation” (Andersen & Henriksen 2006:239).

But all models represent a risk for oversimplification and Yildiz (2007) states that the models mentioned, with their stage approach, are unsatisfactory, since e-government development does not follow a chronological order. e-Government progress does not necessarily follow a linear path, according to
Lee et al. (2005): a government can reach the different stages in a different order or take them in a different order and skip over certain stages. A government can also implement the different stages in parallel i.e. the different phases can occur simultaneously (Andersen & Henriksen 2006). Focus can also be placed more on one level and Lee et al. (2005) state that in most countries, the most advanced e-government solutions can be seen on a national level, while local governments are at a more early state. A further critique about stage models or maturity models according to Andersen and Henriksen (2006) is that they include a normative value as they often pose maturity versus immaturity.

But the models leave out a majority of the countries in the world, the so-called developing countries, as Yildiz states, since the models are not applicable to those countries; there is a focus gap as models are lacking for developing countries. Or as Selinger (2009:217) puts it when she talks about the “technology dissonance” in developing countries, a technology-based model from one context is difficult to replicate in another context.

At the same time, it is argued by Yildiz (2007:652) that “...developing countries have a much faster learning curve; they can perform the requirements of all stages almost simultaneously” but this can be called into question when considering all the challenges and failures described in the literature and to which some will be referred in a coming section.

3.3.6 Summing up

The term ‘e-government’ in this study includes ‘governance’, that is the role of government in society is included, interpreted as ‘better government’, e.g. reduced corruption. The use of ‘e-government’ in this study also includes different values such as social, political and economic, together with a concern of contextual and societal aspects. In line with this, an inclusive definition of e-government includes four aims - e-government is about building efficient and effective government systems and institutions to achieve transparency and accountability.

e-Government projects are a way to address the ‘digital divide’ and several projects are supported by donor organisations and aid agencies, but sometimes under pressure. Proponents of e-government have promised advantages, benefits, positive effects and impact, and opportunities. It can be established that many e-government systems and solutions in developing countries have not met the expectations. It can also be concluded that the types of models widely used to describe e-government might not be suitable in developing country contexts.
e-Government presents a number of challenges and there are several ‘critical’ factors and issues when implementing e-government systems and solutions that are described in the literature. The most troublesome challenges seem to be of human, social, institutional and political character and several reports mention this. Walsham et al. (2007:322) state that social and institutional conditions are often underplayed. According to Guida and Crow (2009), most e-government projects in developing countries fail due to human-related factors, not technical ones. This is in line with Kumara and Best (2006), who noted that among their list of failure factors ‘technology’ were not included. Sander et al. (2005) also reported experiences from Ghana, where ‘technology’ was not a factor in the failure of e-government projects.

Some ‘learning points’ of Madon’s research in India, which are in line with ‘findings’ from Walsham and Sahay (1999), are the crucial importance of the state in ensuring broader social objectives and the vital role of frontline workers ensuring the project is implemented appropriately.

There is a need for an information system to be firmly embedded in the organisational processes and it needs to be supported by the main stakeholders. There is also a need for a top-level commitment but not for top-level control, or a centralised top-down approach.

Challenges are also about dealing with unrealistic ambitions in an overoptimistic technological view consisting of simple and naive expectations while considering problems of high complexity. Unless the complexity is noticed, as Lee et al. (2005:104) put it, “…the existing bureaucracy and ineffective processes …[will] only be exacerbated by …ICT”. On the other hand, facing these challenges does not mean giving up. An interesting view, attitude, or ‘approach’, to these challenges is expressed in Furuholt (2009:7): “Our infrastructure is limited. Our budget is limited. But, we believe that it does not mean that we cannot cope with the limitation.”

There are three overarching challenges that need consideration: scalability, scarcity, and sustainability, which involve availability of resources and funding in a low-resource setting. Finally, below is a list of short statements about e-government in developing countries to summarise the field, inspired by Heeks (2006):

- Is a rapidly growing phenomenon; it is a hype
- Has an increasing impact on the work in the public sector
- Absorbs an increasing proportion of the public sector budget
- ‘Overpromises’ as a solution to many public sector problems
- Difficult to implement, hard to manage, often fails
3.4 e-Administration

This section starts with a brief presentation of e-administration followed by a sub-section on e-administration in the education sector including EMIS. EMIS is an information system for management and administration of the education sector, which can be labelled as an e-government application. Failures especially related to e-administration are then discussed and this discussion is exemplified with three specific examples from Ghana.

3.4.1 e-Administration in General

e-Administration is often the first step, the first stage, and also the most common e-government activity in developing countries. e-Administration can be categorised as a back-office or Government-to-Government (G2G) activity, since it has its focus on processes within the government administrative sphere: internal administration where the actors are other government agencies and their employees.

e-Administration can be described as "enabling government agencies at different levels to work more easily together" (Lee et al. 2005:101). e-Administration is about applications designed to improve internal efficiency and effectiveness through administrative simplification and better management capacity (Madon 2009). e-Administration aims at cutting process costs, managing process performance, making strategic connections to government and creating empowerment (Heeks 2002b:99). It is about improving G2G processes, improving the internal workings, public administration, and the bureaucratic procedures and processes of the public sector.

And as for e-government projects in general, there is a belief in its ‘promises’ for developing countries expressed by Henderson (2007) as e-administration projects in developing countries hold "...significant developmental implications ...using information technology to improve the functioning of the bureaucracy in its role of planning and administering...".

e-Administration is, inter alia, about introducing different management information systems (MIS). MIS is a database system in which ‘raw’ data is stored and processed. Guida and Crow (2009) group applications into front-office and back-office categories, where back-office applications can be understood as enabling “government agencies to coordinate inter-agency information flows and achieve process efficiencies” (Guida & Crow 2009:291). Applications often require a combination of several software systems into one distributed system. Integrated data processing applications, such as MIS, link
different agencies and their data ‘silos’ via intranet, and the Internet - for the user, it looks like one unified system.

Many governments in developing countries start using ICT to improve efficiency and overall performance through the automation of back-office functions, and the introduction of management information systems for effective performance monitoring and improved decision-making (World Bank 2007) i.e. the process of introducing ICT often starts with manual processes being supported or replaced by automated processes (Fenenga & de Jager 2007).

The importance of the ‘content’ i.e. the data and information in the information system is stressed in the literature. e-Administration is ‘characterised’ by communication, coordination, and standardisation of data (Yildiz 2007). e-Administration solves problems, e.g. lack of mobility of data, which locks the government with in-comparable, in-transparent, and in-accessible data (Braa et al. 2007). Improved data integration and coordination of MIS are key issues for information systems development (ibid).

When building e-government in Africa, data quality is stressed and discussed by Heeks (2006). Data quality constitutes the base for improved decisions and can be improved by e.g. different types of rewards and/or punishment.

Data quality is reached through an improved collection process of data, which can include fewer data transmission errors, more frequent data capture and faster delivery of data i.e. data is more up to date.

Data quality can be ‘measured’ through several indicators such as completeness (the degree to which all the data required by users is present in the e-government system), accuracy (the level of errors/incorrect data within the overall system), relevance (the degree to which data is necessary in order to complete particular user decisions and actions), timeliness (the degree to which data can be delivered by the e-government system within a required timeframe) and appropriateness of presentation (the degree to which data produced by the e-government system is accessible and intelligible to the recipient) (Heeks 2006:73).

Fenenga and de Jager (2007) report experience from the implementation of an HMIS (Health Management Information System) in Uganda. Initially, paper forms were used and filled in manually and sent by ordinary mail, which was cumbersome, labour intensive, gave inaccurate data, caused backlogs of 3-6 months and resulted in data getting lost in transport. Digitisation of data moving from paper forms to on-line forms via e-mail resulted in timely delivery
of data and work was done faster. The quality of data improved, together with the possibility to link to central MIS, which enabled informed decision-making according to Fenenga and de Jager (2007).

In sum, e-administration is about applications such as MIS designed to improve internal efficiency and effectiveness for improved decisions via improved data quality. The promises and accomplishments of e-administration are to make data comparable, transparent, and accessible through coordinated inter-agency data flow and an integrated data process. Key issues are interoperability, communication, coordination, and standardisation of data.

3.4.2 e-Administration in the Education Sector

Promises are also heard in the education sector. Educational management is stated as one key area for ICT by GAID (Global Alliance for ICT for Development). Advancements within ICT have brought significant chances, possibilities and opportunities to the field of education 22, according to the GAID report (2009). The GAID report mentions that management and governance can be improved through ICT by supporting administrative processes in schools and thereby making ICT serve as an incentive for leaders and staff at all levels to institutionalise its use.

An education information management system, an EMIS, can assist teachers at schools as well as at the administrative level. The focus of an EMIS is to provide administrative support to schools, including the management of statistical reporting as well as auditing and reporting functionality. One key objective is to improve data management and the use of information in order to improve the overall management. The outcome of EMIS is ‘better’ data, and the impact of EMIS is ‘better’ decisions, which will give ‘better’ education, which is dependent on ‘better’ management and administration and in which ICT plays a role (Selinger 2009).

Two reports from South Africa are described below to exemplify the use of EMIS. From the educator sector in South Africa, Badcock-Walters et al. (2002) state in a report that ‘conventional’ EMIS, when they are functional, only capture annual or bi-annual ‘snapshots’ of the system and seldom provide analysis of the data soon enough to guide the management to react. Due to the failure of centralised EMIS systems, they ask for a new, more regular data gathering system, which captures and monitors key indicators. This system needs to be closer to the education service delivery, and return ‘value-added’

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management information to those gathering the data. This also includes the need to empower local institutions and district managers with the information necessary to better manage the system. The authors suggest a district-level EMIS to capture a limited number of data for both teachers and pupils on a monthly basis. An important aspect of the system is that it allows managers and planners to instantly access data from a given school and respond accordingly, according to Badcock-Walters et al. The system would reveal alarming trends and levels of fluctuations unseen in the annual school census.

A report from South Africa by Peltzer (2005) describes the national EMIS, which was used to find data about enrolment, attrition and mortality. The report points to problems with data inaccuracies and data inconsistency. The study finds that even if the number of school-aged children has grown, enrolment figures have declined. This is stated to be an effect of, inter alia, an improved system of data collection due to enhanced provincial EMIS, which has led to more rigorous and decentralised data verification, which may have reduced the over-reporting of enrolment that occurred in some schools. Over-reporting is related to the link between resource provision and teacher numbers, which depends on stated enrolment figures according to Peltzer.

In sum, the promises and accomplishments of e-Administration in the education sector through an EMIS is about improving data management in order to improve the overall management of the sector. On a local level, problems with data inaccuracies and inconsistencies in enrolment can be solved by an improved system for data collection, including a more rigorous, regular and decentralised data verification, which allows managers at the local level to respond and act ‘instantly’, resulting in the empowerment of local institutions.

3.4.3 Failures and Challenges in e-Administration

In spite of the promises mentioned in previous sub-sections, some failures have been reported. Failures especially related to e-administration and to different MIS are discussed below. Two studies from India, a report from African countries together with a study from Pakistan are used as examples of failures in e-administration.

In India, e-administration was introduced in the late 1980s, but several general problem and challenges have been encountered. One early, and most cited, study on GIS for district-level administration in India by Walsham and Sahay (1999) shows that there is a need for acceptance of the more traditional prescriptions to make an e-government project like theirs to become successful. The authors see the GIS implementation as a failure. Problems and challenges
mentioned are lack of political support, lack of adequate training and lack of financial resources, among others (ibid). An overall reason for the failure mentioned by the authors is that “...India is not a map-based culture...” and to change that will take years as this approach is so embedded in social attitudes and structure. Success would require “...a more fundamental and widespread change of attitude and work practice...” (ibid:56). The authors give the general conclusion that “...the creation and maintenance of a relatively stable set of key actors with aligned interests related to the GIS technology had not been fully achieved in any of the districts ...and in many cases such a situation could be considered far away.” (ibid:55-56). In other words, failures are mainly related to human and institutional factors, in line with the discussion in the previous section.

Madon’s experiences from India (2009) show that ten years later, the same main issues were identified, which hampered the usage of the system she studied. The MIS was underutilised and the implementation of MIS resulted in no significant impact on public sector reform according to Madon. She presents several reasons that are directly or indirectly related to ‘information systems and data’. Lack of financial and human resources lead to the existence of inadequate systems of data handling as well as a lack of micro-level data. Lack of political will to decentralise data and decision-making powers to local agencies leading to the centrally defined data reporting formats did not correspond to the local physical and financial reporting requirements, which led to reports continuing to be prepared manually. Further, there is a poor capacity within the local administration for the analysis and use of data. Additionally, challenges can be cultural factors such as status and hierarchy within the administration as well as the allegiances of public officials to social ties within the community.

Braa et al. (2007) share their experience for implementation of information systems in the health care sector (HMIS) from African countries: South-Africa, Mozambique, Ethiopia, and Botswana. The authors discuss that the health care sector in a country consists of several institutions managed by partly overlapping institutions organised into geographic areas and according to vertical programme and services, which can be relevant for other governmental sectors as well in developing countries. The reality is often, according to Braa et al., that each programme and/or service has their own vertical and uncoordinated systems; fragmented and uncoordinated organisational structures all maintaining their own MIS. This lack of integration and coordination results in the same data being collected and reported several times while other data are not collected and reported at all. Further inconsistencies in
definitions and procedures result in excessive data of poor quality and poor use of collected data. Braa et al. also mention that this fragmentation is aggravated by donors who create new HMIS that are not integrated with the existing HMIS.

In a study from the North West Frontier Province in Pakistan, Komatsu (2009) looks at local education administration. There is a worldwide trend of enhancing efficiency and effectiveness of education administration with the goal to promote education in developing countries, especially primary education. In a decentralisation reform in 2000 in Pakistan, the district governments were designated as the core of basic education administration. The reform was expected to increase productive efficiency but this was not fulfilled according to Komatsu, as there were several constraints and challenges. Power cuts, local politicians’ and administrative elites’ lack competence and interest in public education management, private social obligations such as funerals, and mobilisation by the district government to prepare for local elections, increased the procedural complexity in communication between different layers of administration together with lack of multi-linguistic competency, including national, official, and local languages, that is required of local education officers.

Concerning the communication patterns between layers in the education sector, Komatsu describes that district education offices communicate with lower-tier offices and school heads via telephone and letters, while official directives are sent by messengers hired by the office. Communication between district education offices, school management committees and PTAs is imperative in education development, according to Komatsu, requiring legal, political and attitudinal adjustments at different levels of administration, according to Komatsu.

Summing up, challenges related to information systems and data mentioned in the literature are in general inappropriate systems (Walsham & Sahay 1999), maturity of the information system (Heeks 2002b), embeddedness of information systems in the organisation structures (Braa et al. 2004) as well as the general issue of quality data (Lee et al. 2005) and data quality.

The report from African countries regarding MIS shows that the key issue is structural weakness, including fragmented organisational structures, which can be exacerbated by donors who install their own MIS (Braa et al. 2007). Walsham and Sahay (1999) stress the importance of cooperation and collaboration between central government agencies, including policies on the issues of data coordination and sharing, as duplication of efforts to collect,
store and use data are expensive and a major waste of resources and a loss of synergy.

Access to data and analysis of data would benefit developing countries and ICT can contribute to achieve this, but ICT must not be seen as a goal in itself, but as a tool to improve administration by better use and management of data.

Administrative capacity is deficient in most developing countries and also constrained by “...poorly articulated demands for information coming from higher levels of the bureaucracy” (Madon 2009:39). This is also noted by Komatsu (2009) in Pakistan, with regards to the education sector, where local politicians and administrative elites lack competence and interest in public education management.

Capacity problems have several causes such as lack of knowledge, skills and experience together with structural weaknesses in organisational and institutional arrangements (Selinger 2009). Madon concludes that “…focus on improving local administrative capacity through ICT was short lived with lack of clarity about how e-administration projects and the bureaucracy impact each other in reciprocal ways” (2009:55).

3.4.4 Three White Elephants - EMIS, PMIS and HMIS

This section describes three examples of e-Administration failures. All three were donor-funded projects in Ghana and ended in failure, becoming so-called ‘white elephants’ as the unofficial pejorative term is for an externally funded failed project in a developing country.

Many governments, international aid agencies and donors, both bilateral and multilateral, see ICT as a way to improve management and to disseminate data and information effectively. But governments in developing countries are under a lot of national and international pressure to “...participate in a global digital information sharing” (Kazooba 2010). Braa et al. (2007) also mention that donors cause fragmentation as they create new MIS that are not integrated with the existing MIS. In spite of the good intentions, many attempts fail. The failures are costly as they cause a waste of scarce resources including funds and highly trained and skilled local staff, which could have been used for other productive purposes (Sander et al. 2005).

Sander et al. (2005) discuss three cases from Ghana where different aid agencies funded the implementation of different MIS, but which all three ended up in failure. The three cases concern the implementation of three different MIS at three different departments: EMIS (Education Management
Information System), PMIS (Personnel Management Information System), and HMIS (Health Management Information System).

The three MIS will be presented below including a short background followed by a list of post-implementation observations made by Sander et al. (2005).

**The EMIS Story**

The education sector in Ghana comprises some 700 schools and 6000 teachers with several formally unqualified teachers and gender inequality in teacher deployment. It comprises resource constraints in terms of computers, network, and administrative arrangements including inefficient and poorly resourced management.

Extensive statistic data and reports at all levels including analyses by age, gender, grade, school type existed but accurate statistical data and data control systems were non-existent. Additionally, the data entry system was unsystematic with three separate databases. Data collection was a critical part of the existing EMIS due to an annual exercise and was the source of the majority of the data with a 14-page form covering detailed enrolment figures and establishment facilities. Each year different methods were used for issuing, collecting and validating data. Training was provided for head teachers each year but they saw no benefits for them or their school so they lacked motivation and delegated the tasks to untrained staff with the consequence that the forms required extensive validation before data entry. No satisfactory and cost-effective approach had proved successful in terms of speed, completeness and accuracy. A donor supported the education sector in Ghana through provision of an EMIS.

Post-implementation observations show that the management was not prepared to devote resources to the EMIS and the EMIS team was either moved away or they left the department. Recruitment of replacement staff was not possible due to lack of competent candidates and management reluctance. Equipment maintenance deteriorated due to limited ability and capacity of organisation minimal funding and adequate technical staff was missing. Additionally, severe power supply problems were reported, which hampered the use of EMIS.

**The PMIS Story**

The background to the implementation of an updated PMIS was that the staff travelled around visiting every civil servant with a questionnaire for data input
into PMIS. A donor-funded updated PMIS was implemented with the intention of ‘good governance’.

Post-implementation observations show that PMIS was designed and installed, but it was never fully used by the staff who ‘...viewed the data it held with suspicion.’(ibid:138). There was a lack of confidence in the PMIS capability among management and staff. Paper-based data were regarded as accurate and PMIS data was regarded as unreliable, operational procedures were not changed and data was held both in a paper-based filing system and in a digital system. No training and explanation was given to the staff about databases (how to use them, what benefits there are, what type of data is used in PMIS). Explaining the need for operating procedures and persuading the PMIS staff to adopt was not ‘...less straight forward.’ (ibid:138). In addition, the staff that needed the data did not have computers. There were discrepancies between the paper system and PMIS and serious data discrepancies were discovered within the paper-based system. A fire causing the loss of a large amount of paper-based data did demonstrate the added value of disaster recovery planning and management procedures. But all documentation about design and implementation was missing.

The HMIS Story
The background for HMIS was an increasing demand for accurate health information on which to make analyses and the World Bank and African Development Bank financed an HMIS.

Post-implementation observations show that full accountability of the medical supplies was not wanted by the personnel and that there was a lack of high-level support, appreciation and consensus for ICT activities including HMIS which illustrated an inability of donors to assess needs. Furthermore, inadequate and/or insufficient equipment was installed and basic technical infrastructure such as power and water was inadequate. There was a lack of in-country ICT development expertise as multi-national companies recruited the available staff together, and inadequate basic education of personnel with basic analytical skills was missing. Financial constraints such as high expenses of acquiring legal software and lack of donor responsibility hampered the use of HMIS.

Sander et al. (2005) identify challenges and key issues related to the implementation of these MIS in Ghana and propose a set of guidelines, in order to achieve benefits from ICT schemes in developing countries in general, here categorised as ‘internal’ and ‘external’ challenges.
• **Internal Challenges and Key Issues**

ICT awareness is a key issue as the beneficiaries are unaware of how MIS can be usefully employed in their daily work. Before implementation, the beneficiaries, including management staff and users, must understand and agree that the implementation will benefit their work. Further, the overall decentralisation ‘hype’ made it vital to include local divisional offices and staff, building local capacity and awareness and a need for an inter-departmental MIS group for inter-departmental communication and cooperation.

From the outset, all stakeholders, including donors, implementers, management, and final users must be aware of the fact that the users have to adjust and adapt their working procedures if benefits are to be achieved – all must commit to change. “The nature of the changes to working-procedures must be evaluated, understood, and agreed by all stakeholders before the scheme is implemented.” (Sanders et al. 2005:137) – it is about Change awareness.

The authors stress that before an implementation, the beneficiaries, including management staff and users, must undergo sensitisation and training.

• **External Challenges and Key Issues**

Contextual awareness is a key issue, since the aid agencies do not understand the operational (human and physical) environment in which the MIS are intended to operate. This includes understanding underlying structures as well as identifying differences between various local contexts - cultural and contextual differences. Also, to ensure project applicability, there needs to be an understanding of the real and practical needs of the recipient i.e. local requirements. Because many failures in developing countries can be related to a lack of reality and contextual awareness (Heeks 2002b; Walsham et al. 2007), there is a need for a gradual sensitisation process as “(T)echnology is not simply a matter of computers it is also a state of mind – an entirely new way of thinking.” (Sanders et al. 2005:154) There is a need for a realistic and achievable project scope and time-scale including phased implementation – step-by-step with clear and achievable goals and easily quantifiable indicators. As Sander report points out, “using the ‘big bang’ is a recipe for disaster” (ibid:156).

Financial awareness is another key issue, since long-term financial support i.e. economic sustainability is a problem. Funding is provided over a fixed period to cover implementation and then the project is considered completed. Donor-funded projects, as mentioned before, exclude running costs and long-term operating costs, which are not seen as ‘mission critical’, such as hardware and software maintenance costs, telephone and Internet charges; consumables such as paper, printer cartridges, spares, and back-up media; higher salaries
required for the retention of technical staff, on-going staff training. All on-going costs must be planned for and covered in the initial planning – this is essential in a context where even the cost of paper for printing is a significant item as Sander and his co-writers notice.

Infrastructural awareness is an additional key issue in terms of physical infrastructure problems such as inconsistency and/or unavailability of electricity and telecommunication (e.g. telephones at the departments were frequently cut off due to non-payment of bills). There is a need to identify the ICT state at the department through an initial assessment of computer resources as well as to identify needed infrastructure such as power supply.

Summarising, the MIS-projects failed mainly due to two ‘fundamental’ causes – ‘external’ and ‘internal’. The internal issues can be labelled ICT awareness and Change awareness and the external issues Contextual awareness, Financial awareness and Infrastructural awareness.

3.4.5 Summing up

e-Administration is the first and also the most common e-government activity in developing countries, likely because administrative capacity is deficient in most developing countries. e-Administration in general is about applications such as MIS designed to improve internal efficiency and effectiveness for improved decisions.

The promises of e-administration in general are to make data comparable, transparent, and accessible through coordinated inter-agency data flow and an integrated data process making inter-operability, communication, coordination, and standardisation of data key issues.

The promises of e-administration in the education sector through an EMIS can provide administrative support and improve data management in order to improve the overall management of the sector. On a local level, problems with data inaccuracies and inconsistencies on enrolment can be solved by an improved system for data collection, including a more rigorous, regular and decentralised data verification system which allows managers at a local level to respond and act ‘instantly’ resulting in the empowerment of local institutions.

But in spite of the good intentions, many attempts fail and failures of different MIS are reported from several countries. Interestingly, technology is not the main factor in the success or failure of MIS implementation. Instead, the key issues are political, institutional, and human resources in line with
‘findings’ in section 3.3.3 and these issues are related to changes of attitude and structure, which can take years (Walsham & Sahay 1999).

Access to data and analysis of data would benefit developing countries and ICT can contribute to achieve this. ICT must not be seen as a goal in itself, but as a tool to improve administration by better use and management of data. As mentioned above, administrative capacity is deficient in most developing countries but Madon concludes that “…focus on improving local administrative capacity through ICT was short lived…” (2009:55).

Sander et al. (2005) state that donor-funded MIS-projects are failures mainly due to two ‘fundamental’ causes – one ‘external’ and one ‘internal. In other words, the failure of aid agencies to understand the context in which ‘their’ ICT is to operate, i.e. a design-reality gap, as well as the failure of aid recipients to understand the benefits of ICT for ‘their’ work i.e. lack of e-readiness.

3.5 m-Government

m-Government can be seen as a subset to e-government, using different wireless technologies. The section gives a brief introduction to the ‘new’ field of m-government, including promised benefits and met challenges. Following are two sub-sections on mobile technology in the education sector with one section focusing on administration. The section ends with an example of an SMS application tested in Kenya for school administration. (For an introduction to M4D – Mobile for Development see Wicander 2010) .

3.5.1 Introduction

m-Government is a rather ‘new’ research field. In 2003, the first academic paper on m-government was published (Kuschchu 2006). In 2004, the first e-government web portal in Europe using mobile technology was launched in Bremen, Germany. Also in 2004, the Italian government used SMS to communicate with their citizens caught by the tsunami in Thailand. In 2005, the first conferences about m-government were held (www.icmg.mgovernment.org).

e-Government refers to the use of ICT, and m-government can be seen as a subset using different wireless technologies. Generically, m-technology refers to technology that is mobile, wireless and portable and these terms are used interchangeably in the literature. m-Technology is hence more than mobile

23 A review of m-government initiatives can be found in Karan and Khoo (2008). For m-government initiatives in Africa see e.g. Maumbe et al. (2006:214-218)
phones and examples of other mobile devices are laptop computers, Personal Digital Assistants (PDAs) and Global Positioning Systems (GPS).

m-Government can be defined as “...a strategy and its implementation involving the utilization of all kinds of wireless and mobile technology, services, applications, and devices for improving benefits to the parties involved in e-government including citizens, businesses, and all government units.” (Kuschchu & Kuschchu 2003 in Kuschchu 2006:1-2)

Mobile devices can be used with a variety of wireless communications technologies such as GSM (Global System for M-technology) and GPRS (General Packet Radio Service) - data services that allow Internet access for mobile phones and PDAs; Wireless fidelity (WIFI) – a type of wireless local area network technology wherein networks use an array of receiver transmitter towers built by public or private service providers; and Bluetooth - connects mobile devices wirelessly over short distances using radio waves (UNDESA 2007).

The issue of ‘mobility’ is discussed by Kuschchu (2006) and Sharples et al. (2007). m-Government focuses on the mobility of the technology (Kuschchu 2006; Sharples et al. 2007). But focus could also be placed on the mobility of the user augmented by personal and public technology (Sharples et al. 2007). The extent of mobility in the target segment is set as an important factor by Chang and Kannan (2002) for the successful adoption of m-technology. m-Government is not only about the mobility of the citizens; wireless applications may also enable greater mobilisation of the government officials (Kuschchu 2006). Hence, mobility of technology and user emerges as characterising m-technology.

3.5.2 Promised Benefits, Effects, and Impact

Within ICTs in general, mobile technology is a fast growing segment. It could be considered as showing potential in transforming e-government. m-Government emerges as the new big wave in the process of ICT use in the public sector, according to Kuschchu (2006). Even if the Internet is dominant in e-government solutions, newer mobile technologies are vital as well (Andersen & Henriksen 2006). GAID (2009) states that new mobile platforms need to be fully exploited in a developing country context together with appropriate and relevant content for the local situation.

Differentiating factors i.e. advantages compared to other ICT, according to Kuschchu, are that m-technology gives more convenient accessibility and availability, better precision and personalisation in targeting users and delivering
By providing access, mobile phones can offer a valuable means of delivering e-government services according to Guida and Crow (2009). The benefits of remote delivery of government services and information can be extended to those who are unable or unwilling to access public services through the Internet or simply prefer to use mobile devices (UNDESA 2007). m-Government may become the key method for reaching rural areas (Kuschchu 2006:7).

Kuschchu and Borucki (2004) see government efforts to implement m-government as either an upgrade to applications and services, complementary to other e-government efforts or as innovative efforts that create new benefits, exploiting the characteristics of mobile technology and m-government applications.

Mobile communication provides opportunities for governments to improve and enhance their services, according to Kuschchu et al. (2006) and enhance the efficiency of governments’ operations (Lee et al. 2005). The adoption of mobile technologies by government organisations is stated to have benefits on the internal workings of the public sector such as better functions, increased productivity, cost savings and operational savings (Kuschchu et al. 2006) by reducing processing time, eliminating long bureaucratic procedures, and reforming organisation structure, i.e. efficiency and effectiveness of internal functions and processes (Kiki et al. 2005).

It is important to understand the effects of mobile technology on government administration. From an administrative perspective, m-technology includes a potential to develop and transform government systems, utilising the opportunities that m-technology brings with it to ‘tie’ mobile devices to centrally located information and/or applications platforms (UNDESA 2007). Kuschchu et al. (2006) present potential effects of mobile technologies with impact on organisational structure (e.g. reduction in the number of people performing the job and flattened structure with fewer hierarchical levels), civil workers (e.g. need for new skills - how to use the new device and how to enter information, adjusted job description, reduced personal communication - face-to-face replaced by human-to-machine, feeling of being monitored and tracked), and business processes (e.g. more integrated approach for gathering, updating and processing data, a single shared platform; an integrated database) that are of interest for an e-government solution in general (Kuschchu et al. 2006:145).

Key pressures for the transition from e-government to m-government include pressure to meet increased expectations, pressure towards adoption of
new technologies and towards further improving e-government efforts, together with pressure for increased governmental efficiency and effectiveness (Kuschchu et al. 2006:137; see also Kuschchu 2006:7). For developing countries, they mention the pressure for supporting economic development, especially for rural areas of developing countries.

Driving forces for changes into m-government are an increasing mobile infrastructure and mobile device penetration, the evolution of mobile technologies, standards, and protocols towards faster and more sophisticated applications together with the adoption of mobile applications and services by individuals and organisations (Kuschchu (2006:7) and Kuschchu et al. (2006:137).

Rapid penetration of mobile telephony in Africa provides an opportunity for m-government solutions in this context. Expectations on better, more effective and efficient public administration, together with high costs and poor infrastructure, especially in rural areas concerning the Internet, have made mobile technologies be seen as a complement and/or substitute. m-Government seems to be the next logical mode of governmental services in Africa according to Maumbé et al. (2006).

Kuschchu (2006:3-4) mentions different types of government applications and services and gives some examples from Asia: information release e.g. SMS flood warning systems in Malaysia; information collection e.g. garbage collection schedules via SMS in the Philippines; and information exchange e.g. reporting crime via SMS in the Philippines.

There are several m-government applications applied in Africa in different fields e.g. the collection of health data and dissemination of information in Ghana, Uganda, Kenya (Castells et al. 2007), and many widely applied services in different fields such as health, education, and security in South Africa (Maumbé et al. 2006).

There are also several examples of m–governance activities in Africa (Castells et al. 2007). Communication via SMS can be used to send political news to a newspaper, i.e. citizen journalism, which is common in East Africa (Hellström 2009). SMS can also be used to receive political news. Coordination activities using mobile technology and SMS for election monitoring have been used for instance in Senegal in 2006 and in Zimbabwe in 2008. In Nigeria in 2007, FrontlineSMS24 was used and organised 10 000 SMS (Banks 2007). Voter registration has been used in Kenya in 2007 as well as in Ghana (Castells et al. 2007).

24 FrontlineSMS see www.kiwanja.net
Another example of m-governance is collective actions through campaign and mobilisation, which can be done using voice calls or SMS; either as SMS chain letters or bulk SMS. A successful SMS chain letter campaign was the so-called ‘People Power 2’, which led to the removal of President Estrada in the Philippines.

It is important to be aware of the fact that mobiles can be used both for information and for disinformation, both for (citizen) sousveillance and (state) surveillance. Who is watching whom, asks Hellström (2009) from Uganda, where a person with two mobiles working at a state institution explained that one mobile was official and one was ‘tapped’. Some governments wish to control and monopolise the flow of data and information. This can be done by registering all SIM cards and subscriptions thereby monitoring people and locate mobiles.

3.5.3 Challenges Met and Success Factors

Castells et al. (2007) argue that the public sector has not sufficiently utilised mobile technology and the potential is far from being fully realised. Castells et al. continue that the public sector plays a central role in shaping the technology for the needs of public services. Governments in developing countries can stimulate growth in the overall ICT sector by adding demand for electronic services such as m-Government (Hesselmark 2007).

However, there are different challenges for implementing m-government that a government has to respond to such as political, cultural, structural, social, legal, and administrative (Kiki et al. 2005). Challenges for m-government according to Kuschchu (2006:8-9) and Chang and Kannan (2002) are about developing wireless and mobile networks and related infrastructure – both physical infrastructure (e.g. technology, equipment, network) and soft infrastructure (e.g. institutional arrangements, software); promoting mobile penetration and increasing accessibility (success depends on the number of users but also on information needs); protecting privacy and providing security for the data and information; regulating and developing legal aspects of mobile applications and the use of the services (including the responsibilities of the data holders i.e. the government – in some countries the law does not recognise mobile documents and files); and technology readiness of the target segment.

Bulk SMS refers to an institution or organisation sending or receiving a large volume of SMS.

See Bakari (2007) for security issues in Tanzania. Obstacles for increased mobile services are discussed e.g. in an UNCTAD report (2006) as problem related and linked to security and privacy of transmitting personal and financial data.
Concerning networks, Guida and Crow (2009:291) state that e-government relies on a “…readily available supply of connectivity infrastructure …to be useful on any scale …a fast, reliable ICT backbone is a critical part of any e-government strategy…” But problems noted, without any examples given, are that the implementation of some services on a national scale could be problematic, since the systems could not handle the resulting influx of data (Mendes et al. 2007). There is a common perception that e-government services including m-government need additional data transmission infrastructures and that the mobile network does not have enough capacity (Hesselmark 2007). However, Hesselmark (2007) claims that there is a great potential transmission capacity that could be added incrementally by upgrades in the existing mobile network. This allows for flexibility and the opportunity to adjust to the traffic loads.

General success factors for m-government, focusing on organisational factors and competences, as listed by Capra et al. (2006), are: decentralisation, focus on individuals, bottom-up involvement processes, leadership of individuals, presence of non-formal and informal learning methods and focus on both hard and soft skills.

### 3.5.4 Mobile Technologies in the Education Sector

Research in the field of education through m-technologies has progressed since early 2000. Two European initiatives worth mentioning are The First IEEE International Workshop in Wireless and Mobile Technologies in Education (WMTE), which was held in Växjö, Sweden in 2002 and MLEARN 2002, the first European workshop on mobile and contextual learning, held at the University of Birmingham, UK. Two special issues on the same topic have been published by the Journal of Computer Assisted Learning 2003 and 2005. A third initiative worth mentioning is e-Learning Africa.27

The introductory conferences and special issues show an interaction between new ‘ecologies’ of ICT and education. Most of the research of this topic focuses on learning inside and outside of the classroom, in a Western context. A minor part has a management and/or administrative purpose and even fewer parts have a developing country context.

But, given the rapid and extended growth of mobile phone usage in developing countries, some innovative uses of mobile phones in education are

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found in this context. Power and Sankale (2009:124) stress that the interest in mobile telephones in education arises from an interaction between the MDG II challenges to provide education for all, the failures of many ICT projects in developing countries and the revolution of mobiles in Africa.

‘Promises’ are made both by mobile producers and UN agencies. Education is a presumptive major service area for mobile services in developing countries according to Nokia (2006), where the mobile could grant affordable access to education in remote areas, nomadic communities, and displaced communities. Mobile phones are predicted to be the next transformative device in the field of education (GAID 2009).

Further, the mobile is shown in research reports on education in Tanzania as a resource due to its portability, simplicity and affordability (Stone et al. 2003; Donner 2008).

Hoppe et al. (2003) state that in modern education “…mobile and handheld devices offer the possibility to move from the fixed computer allowing interaction with several different devices and making data and information accessible through wireless connections with a server. The technology offers new opportunities for individuals who require a mobile solution.” Further, Hoppe et al. state that modern educations “… converge in their high valuation of active, productive, creative, and collaborative…” methods. Drozdova et al. (2009) also discuss converged technologies and state that these are characterised by high flexibility, high granularity, data rate evolution towards broadband communication, mobile and fixed connections, nomadism and mobility, together with multi-service, multi-protocol, multi-access. As an example of a converged solution, Drozdova et al. mention an integrated system supporting the administration of education at University of Zilina, including data about students, teachers and timetables. GAID (2009) states that trends towards convergence and new mobile platforms need to be fully exploited in a developing country context together with appropriate and relevant content for the local situation.

But reported negative effects of m-technology include a sense of isolation (Hoppe et al. 2003) and an increased individual isolation (Zembylas 2009). One case described a situation where PDAs were distributed to medical students to access web-based information, however the PDAs were not used for the...

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28A compendium focusing on mobile technology applications in the areas of health and learning from UNDESA (United Nations Department of Economics and Social Affairs 2007) presents 85 examples of m-Health applications together with 46 examples of m-Learning applications including school administration. All the school administration applications are from Europe and the United States.
intended purposes; instead they were used for communication and social purposes (Hoppe et al. 2003).

### 3.5.5 m-Administration in the Education Sector

New mechanisms for strengthening the administration in the education sector using mobile technology are being developed and there is talk about m-administration – yet another of all ‘m’-neologisms. Examples are classroom response systems, participatory simulations, collaborative data gathering, and structuring documents (Hoppe et al. 2003). Below, some examples are presented of using ‘blended solutions’ to support administrative communication in the education sector together with studies from Bangladesh on data collection using m-technology including SMS and a UN-report including several African countries.

Naismith (2007) reports on a study from the UK using SMS to support administrative communication in education. The author states that there is a need to integrate SMS into education, both among students and staff, in order to be effective in education. StudyLink, an email to text message (SMS) service was tested, and the administrative staff integrated the service into their current means of communication with success, but with some difficulties in composing appropriate SMS. Results from the study show that the administrative staff considered the StudyLink service easy to use and integrate with their normal working practices. StudyLink was a way to ‘ensure’ that information was delivered, as students do not check their email so often, making SMS more reliable than email. StudyLink was thus an effective tool for communicating with students, as it joined two activity systems – receiving emails and receiving SMS. SMS use among students is more interactive than email, it is expressive e.g. jokes and instrumental e.g. easier to coordinate work, according to Naismith (2007).

Moving to a developing country context, Nix et al. (2007) describe distance education for a Post-Graduate Diploma in Education at the faculty of Education at University of Pretoria, South Africa in 2002. All of the students were full-time employed teachers in rural schools in South Africa. None of the hundreds of students had email or access to the Internet; post took 5-15 days; but all had a mobile phone. The university used mobile phones to administrate their paper-based distance education programmes achieving almost immediate communication by using SMS via two-way technology. To overcome the limitation of 160 characters, a number of messages were combined into one long message. Mobile phone support entailed sending bulk, pre-planned SMS
for general administrative support to all students, specific administrative support to selected groups/students, together with motivational support to all students. According to the authors, the advantages and success were significant and students responded en masse and almost immediately to the information provided. By providing a simple, effective, and low-cost two-way SMS reply mechanism, the need for the user to make return calls, which incurs cost and ties up resources, was reduced. According to Nix et al., the solution is simple as the recipient simply replies to the message; accessible as the replies are delivered back to the desktop account from which the message was sent; and flexible as the system provides options to redirect the replies to email, mobile pagers, or a web-based account.

A study from Kenya describes how mobile devices can support educational administration (Traxler 2006:3). In part, the project develops pilot systems to gather national schools’ enrolment data through large-scale targeted managed messaging (SMS) in the education sector (Traxler 2007). This project will be described in more detail in the next sub-section. Another report from Kenya shows that mobiles enable contact and communication between parents, students and teachers as “…most of the teachers now have mobiles” (Nielsen p.c. 2008) and support and enable up-to-date educational information about exams, enrolment criteria, fees, admission dates and provide an efficient tool for the collegiums to attend home-visits, as well as to disseminate information about seminars and meetings. Within the education sector in South Africa, grade reports and feedback for example are applied i.e. students have been informed via SMS that the exam results are ready for collection (Maumbe et al. 2006).

An anthropological study on communication and the impact of mobile phones in Jamaica by Miller and Horst (2006) includes the impact of mobiles on education and on schooling. An interview with a head-teacher of a rural primary school, without any telecommunication, gives details about the effect of a mobile phone. Before the mobile, it had been a problem to deliver messages to the parents, both written and verbal, and information about fees, and meetings was most successfully passed at the local church, which was the nearest local public address facility. With a mobile phone and a list of phone numbers to parents, connectivity is reached and the ‘message problem’ is ‘solved’. But according to the study, the cost for the phone use comes from the head-teachers’ personal salary.

An example from the Philippines, given by Mendes et al. (2007), is information dissemination via applications that allow the user to send bulk SMS
to mobiles via computers and the Internet – a service that allows quick dissemination to a large number of people: the Department of Education can provide the general public with announcements on e.g. test schedules, holidays, and cancellation of classes.

In an UN-report from GAID (2009:13), it is mentioned that in Zimbabwe, Zambia, Ghana, and Tanzania, PDAs have been tested as a tool for monitoring the evaluation of ICTE projects and found that the method was “...extremely time efficient”, explaining that data can be calculated within hours instead of weeks and transmitted directly through the Internet to the headquarters. PDAs improve the quality of the surveys and the procedure and improve the reliability of the outcome through more consistent data collection. The report continues that the cost of this technology might seem high at the beginning, “...but one needs to take into consideration that the cost of paper is eliminated and that the devise is re-usable, enabling the user to change and create new surveys on the go. Through devices such as this one, stakeholders can carefully monitor progress to ensure that projects remain productive and sustainable for use by many generations in the future.”

A case study from Bangladesh (Pouzezvara & Khan 2007) used smartphones to determine if the mobile phone is a suitable mode to reach rural and remote teachers and whether it is a suitable mode for education administration. As a background, it is mentioned that many government offices have computers but they are underused. EMIS is introduced but there are problems with data input and utilisation, and EMIS is mostly used for teacher payments. Further, there is a lack of staff to enter data into the computers.

Noted benefits using mobile phones are convenience (not having to leave school), opportunities for on-going conversation, modern and exciting approach, increased face-to-face interaction (between teachers and school administrators at school level) together with a fostering of collegiality (due to the need to work together and to provide feedback). Mentioned advantages of SMS vs. voice are teacher can ask quick questions outside school hours, easy to send announcements to the whole group, short assessments can be completed and cost savings. Challenges, experiences, recommendations and lessons learnt (Pouzezvara & Khan 2007:37ff):

- The study overestimated the need for sophisticated technology, when in fact the real value of the phones was in their simplest use “...—one-on-one conversations between trainer and trainee, and among trainees in different schools.” (ibid:37)
  - Use a simpler and low-cost model
• Better management of the phones
  o Provide a way to ensure the phones are recharged as necessary
  o Ensure that teachers have access to the phones at all times and take responsibility for the phones after school hours if phones must be shared
  o Consider using the teachers’ own personal phones by finding a way for reimbursement

• In terms of accessories
  o Provision of spare batteries would have prevented the downtime caused by shortage of electricity for frequent recharging
  o Being able to attach an external speaker would be beneficial for group interaction with the trainer or with another school
  o Adding local printers would be worthwhile, so that documents sent through the phones could be printed at the school level.
  “However, although such technology does exist (phone-to-printer), it would not be practical in this setting due to the lack of electricity.” (ibid:39)

• Head teachers were critical to success
  o “They took it very seriously as a professional development opportunity for the whole school, and it was only on their initiative that all of the teachers came together on a regular basis.” (ibid:38)

• There was a language problem affecting SMS, since messages only could be written in English or other languages using Latin alphabet.

• The study assumed too much prior phone experience for the users, based on the overall availability of phones and phone service in Bangladesh.

• There was a steep learning curve between simple phone communication, for the use of advanced phone features, even by experienced mobile phone users, including having structured conversations or multiparty conversations with a loudspeaker.

• “Also, the design of the school-based, in-service training was such that a great deal was learned just by discussion and debate among teachers in the school, application of the techniques in the classroom, feedback from colleagues, and then more discussion and debate.” (ibid:37)
  o Improve the programme by providing more effective training and developing a manual
Even if there are severe technological issues to consider, the main issue and challenge is not about technology; it is of social, human and institutional character and these issues seem to be dominant when implementing e-government systems and solutions.

### 3.5.6 SEMA – School Education Management Application

This sub-section describes a national project for SMS-mediated school administration and management implemented in Kenya during 2006-2007, the so-called SEMA (School Education Management Application) project. In part, the project developed a pilot system to gather national schools’ enrolment data through large-scale targeted managed SMS connected to an EMIS (Traxler 2007). The project is described in more detail as the background shows several similarities with Tanzania concerning the education sector. There are several reports on the SEMA project (e.g. Traxler 2006; Traxler 2007; Power & Sankale 2007; Power & Sankale 2009), which will be referred to and cited in this sub-section.

The background of the project was, inter alia, that there was a need to monitor and manage school enrolment numbers at a local and national level in Kenya with the strategic implications of accurate and timely school enrolment data needed to manage and finance the school system (Traxler 2007:4). Primary schools provide regular statistical returns and these in return play a vital role in national planning and in the allocation of resources to individual schools. There are annual, termly and monthly returns from head teachers using paper-based, large, complex, repetitive and ambiguous ‘instruments’ in the form of questionnaires (Traxler 2006). The returns are transmitted by letter-post, courier, or by phone conversation, which is slow, expensive and error-prone (ibid). “The slow return of these instruments from remote rural areas was further delaying the process by perhaps nine months, making intervention to prevent error or fraud difficult” (Traxler 2007:4). Additionally, most of the returns are never used, only stored (Traxler 2006). “Currently data analysis is often non-existent because of the central data entry overhead involved in transferring un-standardised paper-based returns to a computer system. The state of the computer infrastructure would mean large-scale analysis would still be vastly problematic even if data were entered.” (ibid:9)

Further, in policies and programmes on a national level in Kenya, including Ministry of Education, it is stated that ICT is needed “to develop the

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29 During the project, enrolment figures were captured in 12 districts with ~8000 users and ~250 000 SMS sent during the period 2006-2007 (Traxler 2007).
skills today which will be needed tomorrow” and but that there is an inadequate number and capacity of computers and lack of access to the Internet (Power & Sankale 2007).

The overall objective of the main programme was to enhance communication within the education system to address a potential isolation in rural areas and to increase the sense of community among rural schools. The main programme used a blended delivery approach consisting of video and audio i.e. mobile phones and radio (Power & Sankale 2007).

Additional objectives of the SEMA project were to offer cost-effective support to administration in primary schools, to monitor and manage school enrolment numbers at a local and national level, and to improve the efficiency, speed, accuracy, storage and analysis of data and improve education data collection for EMIS (Traxler 2006:10; Power & Sankale 2007:5; Traxler 2007).

Implementing an improved EMIS included capturing a handful of headline figures such as enrolment figures by year, gender, class or stream with result of accurate, timely and up-to-date school enrolment data that would provide central government with management information to support planning, monitor schools for local and national attendance and enrolment problems, and allocate per-capita funding for the school (Traxler 2006).

Prerequisites and Potentials for SEMA
According to Traxler (2006), the SEMA project has potential for addressing problems associated with the statistical educational data needed to manage and finance the education system. SEMA can be described as an administrative tool that uses bulk, managed SMS in the collection of school enrolment data (Traxler 2007). SEMA includes an application and a back-office database connected to two mobile operators. The mobile phones were the core communication platform for SEMA because it was seen as particularly appropriate and ‘pro-poor’; the technology is robust, appropriate and socially inclusive and the technology is relevant, feasible, inexpensive and technically adequate (Traxler 2006; 2007).

It is stated that the use of mobile phones can solve issues of connectivity and lack of a wired infrastructure (Power & Sankale 2007). This statement is supported by advantages such as lively and energetic mobile phone networks and high levels of mobile phone ownership, acceptance and usage (Traxler 2007).

Concerning aspects of ICT attitudes, access and usage, teachers identified ICTs as appropriate technologies and teachers can be classified as early
adopters when it comes to using mobile phones for communications, information and, more recently, access to a range of services (Traxler 2007). Additionally 80 per cent of teachers have mobile phones (Power & Sankale 2007).

SEMA project used a ubiquitous technology well known to the teachers, instead of introducing a new technology, including training and technical support. The mobile phone is ‘ideal’ for the purpose (Power & Sankale 2007) or as Traxler expresses it:

“In developing countries, mobile, nomadic and handheld technologies have the capacity to gather, store, deliver and enhance information in ways that are completely different from countries where mains electricity, computer hardware and internet connectivity are stable, reliable, cheap and abundant.” (Traxler 2007:1).

SMS could provide solutions to data gathering since mobile phones could be used and the standard SMS format could be sent by the head teacher to a specified phone number (Traxler 2007:5). It is also possible to write and send targeted bulk SMS from a mobile as well as to receive them (Traxler 2006:4). This functionality could be supported by conventional data processing technologies, able to deliver routine management reports as emails or as presentations available via secure access on the Internet (Traxler 2007:5).

Furthermore, SMS can be written and sent from a conventional computer, for example a networked desktop PC or wireless-enabled laptop PC, using an interface of a standard office email client such as Eudora or Outlook.

Some more stated arguments in favour of SMS are: cheaper way of communication i.e. less cost30 (less postage costs including post room and clerical costs and less phone use), increased speed, increased accuracy of data and communication, more personal communication, potential for immediate response together with the possibility of accessed anywhere, any time – i.e. flexibility (Traxler 2006:12; Power & Sankale 2007:5; Traxler 2007).

This opens up possibilities for using mobile phones and SMS to enhance, supplement and support administration. The use of SMS for collecting data has enabled the collection of data from several schools, thereby condensing a process that previously took up to a year into a matter of weeks, which has resulted in an enhanced quality of data available for the ministry. SMS can also be used to deliver a ‘whistle-blowing’ service for parents and pupils (Traxler 2006:13).

30 Example from Kenya: cost 3 min call: 38 vs. cost letter: 12 vs. cost SMS: 1.7.
These differences also speaks against other mobile solutions than SMS such as touch tone, speech recognition and also MMS-based solutions (cf. Parikh et al. 2006)
Traxler (2007) described the SEMA system as:

- a free system including messaging privileges and visibility to authorised users
- a system that uses an individual short-code determined by place in the educational system
- a system that uses a limited and predefined syntax, each type starting with a keyword
- a system that could automatically validate the data, that is, check for anything obviously defective
- a system that could message the sender in case of queries
- a system that could send out reminders to head teachers of late returns
- a system that could be monitored centrally from MoEST

Challenges and Constraints to SEMA

The project has also experienced several challenges and constraints (Traxler 2007:5; Power & Sankale 2007:6-7; Power & Sankale 2009). Major issues when implementing the SMS-based system included:

- Economic Issues

The SEMA project included sending free SMS for the involved teachers and schools through central funding. This is critical and in contrast to many donor initiatives, where the initial cost is covered by the donor but the maintenance cost is left to the schools. This cost can be substantial and a significant barrier to a continuation of a project.

The costs for SEMA included capital costs which was stated as “…negligible, unlike other ICT interventions, teachers buy or already own the necessary hardware” (Traxler 2006:9) and running costs, which were stated as minimal since SMS text messages can be bought in bulk at a considerable discount, a fact administrators and educators were unaware of.

Identified overheads were setting up the system including capturing and entering all the teachers’ details (Traxler 2007:5). It would be very expensive to register all the teachers and to capture and maintain this huge volume of data manually. All teachers received one extra sheet of paper in their initial mailing. This piece of paper asked them to send an SMS to a specified number in a specified format, giving their details. These details would be transferred automatically to a database (a searchable address-book) that would then

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31 A limited and predefined syntax, each type starting with a keyword
Registration Syntax: register, location code, job role, name, age, gender.
underpin subsequent targeted SMS broadcasts and enable messages to be sent by district, by role etc.

- Technology and Infrastructure Issues - Network Coverage & Power

Challenges in Kenya related to the SEMA project dealt with network coverage and power. Network coverage and telecommunication infrastructure is limited, inadequate, incomplete and unreliable in rural areas (SMS is not delivered and teachers have to go to ‘hot spots’) (Power & Sankale 2007:6; Traxler 2007; Power & Sankale 2009). The problem related to access to connectivity should be guided by media selection linked with the availability of infrastructure (Power & Sankale 2007:6-7).

There is also the issue of a lack of power supply, with 60-99 per cent rural schools without electricity (Power & Sankale 2007:6; Traxler 2007; Power & Sankale 2009).

Additionally, as the teachers were using their own mobiles, there were several different brands and models and with some there was a problem locating some of the special characters required for the SEMA messages such as the hash key (Power & Sankale 2007:6; Power & Sankale 2009).

- Policy Issues

Some of the challenges in Kenya were related to policy issues where policies and policy makers support innovations ICT in education. A suggested solution by Power and Sankale (2007:6-7) was to implement sensitisation programmes for policy makers.

- Social issues including Gender and Private Use

Some issues of social character were identified by the scholars, including gender issues: some female teachers experienced problems, difficulties and challenges in the possibility and freedom of using the SEMA system with husbands wanting to own/control the mobile phone (Power & Sankale 2007:6; Power & Sankale 2009). Additionally, the use of the system for private purposes occurred, with some teachers trying to use the free SMS possibility to send private SMS (Power & Sankale 2007:6; Power & Sankale 2009).

- Organisational Issues

SMS needs cautious organisation at a local level considering constraints such as acceptance, attitude and awareness according to several authors (Traxler 2007; Power & Sankale 2007:6; Power & Sankale 2009). Further, there is a strong case for discussion and interaction between policy makers, budget holders, technical experts and teaching professionals to create and sustain the necessary synergy (Traxler 2006:12). There were problems of acceptance for users in
understanding the system’s role and intended use (Traxler 2007), as well as a negative attitude toward the use of SMS (Power & Sankale 2007:6; Power & Sankale 2009). There is often an insufficient awareness of the exact nature of opportunities and challenges among the various different groups of potential stakeholders (Traxler 2006:12), where administrators are unaware of the fact that SMS text messages can be bought in bulk at a considerable discount and that SMS text messages can be written and sent from a conventional computer.

**Training Issues**

Training via a cascade system involved several challenges such as using a specially formatted SMS that had a syntax designed for the application, where users must be trained in the syntax and use it precisely (Power & Sankale 2007:6; Power & Sankale 2009). The cascade training model resulted in the training material being interpreted in different ways that were contrary to the original purposes (Power & Sankale 2007:6; Power & Sankale 2009).

**Validation Issues**

User activation was done through a cascade system with a ‘super user’, a system that uses an individual short-code determined by place in the educational system. Teachers’ identification was done through phone number, district, name and status. The details categorise the teachers and define the different target groups for targeted bulk SMS. It was possible to validate the schools since each school has a unique MoEST (Ministry of Education) ID, a unique numeric school identification comprised of 7 + 3 digits (Traxler 2007:5). A terse, coded/fixed format compressing a week’s data into one message aided validation (ibid), which is a vital contribution that any computer-based system, including one based on SMS messaging, would make (ibid). But using the terse fixed-format for gathering schools’ enrolment data resulted in problems. Many messages contained erroneous data or data in wrong format. There were also many duplicates.

Finally, there were also problems in getting users onto the system rather than problems in using it (Traxler 2006:6).

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32 The composition of this is all numeric (Traxler 2007:5)

- Province 1 digit [1 … 8]
- District 2 digits [01 … 99]
- Division 2 digits [01 … 99]
- Zone 2 digits [01 … 99]

followed by an individual school code, namely

- ECDE 3 digits [001 … 199] or
- Primary " [200 … 299] or
- Secondary " [300 … 399]
Additional Obstacles for Rural Schools

The most disadvantaged teachers in rural areas experienced the most difficulties and challenges in the possibility and freedom of using the SEMA system, including lack of infrastructure (Power & Sankale 2007:6; Power & Sankale 2009).

In summary, the SEMA project aimed to explore how large-scale SMS can be used to improve data collection from schools, including the number of pupils enrolled in each year, and in every school, providing the Ministry of Education with more up to date and reliable data for decision making within the ministry (Power & Sankale 2009:131) as a 'rapid, reliable and cheaper' alternative (Power & Sankale 2007). Several advantages and benefits with both m-technology and SMS can be noticed from the SEMA project in Kenya but also several challenges of mainly institutional and social character most profound in rural areas.

3.5.7 Summing up

m-Government can be seen as a subset of e-government using different wireless technologies. m-Government is about strategy and implementation of m-technology to improve e-government solutions at, inter alia, government agencies. m-Government emerges as the new big wave in the process of ICT use in the public sector including m-administration.

Given the rapid and extended growth of mobile phones in developing countries, some innovative uses of mobile phones in education are found in this context that create new benefits, exploiting the characteristics of mobile technology and m-government applications. Several keywords emerge that characterise m-technology with potential opportunities for developing countries and rural areas in particular for e-government solutions: accessibility, affordability (e.g. less expensive), availability, connectivity, convenience, flexibility, mobility (of technology and user), simplicity (e.g. ‘easy’ to use), personal, portable (i.e. easy to carry) and precision.

m-Government may become the key method for reaching rural areas (Kuschchu 2006:7; Kuschchu et al. 2006:137), where teachers experience isolation, lack of access to teaching material, and poor management and support (Power et al. 2009). A tentative objective for the SMS-based system in Kenya was to address this potential isolation in rural areas and findings show that the SMS project in Kenya has reduced the potential isolation and increased the sense of community amongst rural schools (Traxler 2007).
However, at the same time, one reported negative effect of mobile technologies in education is a sense of isolation (Hoppe et al. 2003) i.e. ICTs can contribute to increased individual isolation (Zembylas 2009).

Furthermore, poor infrastructure, together with high costs, especially in rural areas with regards to the Internet, has suggested that m-technologies are a complement and/or substitute in order to integrate and share. The main insight from the SEMA project is the blended approach. This is expressed by Traxler: “The dominant model for delivering computer-based and network-based IS shares much of this technology and there is thus the possibility of IS that is based around the mobile phone blended with IS that is based around the computer.” (2006:4). Arguments for using m-technology and SMS, according to Traxler (2007) are that they be used as components of blended technology that can catalyse, reinforce and complement other ICT and that have the potential for increased roles and functions across the education sector and that they should thereby be an integral part of communications support for the education sector.

I argue that ‘connectivity’ is the most important issue in a developing country context, where there is a lack of ‘virtually all’ communication infrastructure; the technology offers opportunities for institutions and individuals that have never had ‘connectivity’.

Experiences using m-technology in the education sector indicate that ‘connectivity’ seems to be the main contribution. Three areas seem to emerge within m-administration in the education sector, which indicate that connectivity is a main issue: communication with students, parents and teachers and administrators; information dissemination, distribution, exchange, release e.g. up-to dated information quick and cheap via bulk SMS; and data collection.

But it is important to be aware of the fact that m-technology can be used both for information and for disinformation. m-Technology can be used both for observation and increased control, as well as for empowerment and transparency – surveillance and sousveillance. Potential threats such as isolation, misuse, and economic issues are also noticed. There is a need to consider the potentially negative effects on organisational structure, civil workers and the business process.

Experience from mobile applications is that there is an overcomplicated view of the technology and a simplistic view of the social practices surrounding the applications. Hoppe et al. (2003) conclude that the social practices are critical to success. They discuss that in a reductionist, delivery-oriented view, the goal for m-technology is to optimise the quality of service in terms of time
and space, but in a wider view, m-technology allows for exploratory activities including data collection and retrieving information of various types, and if combined with wireless transmission, the activities can be continuously monitored and coordinated between places. This latter view puts the technology in the background and focuses on the task and the interpersonal relations i.e. stakeholders’ roles, types of activities, and physical settings (ibid). The conclusion is that design and development of m-technology “...requires a socio-historical conceptualisation of the information and communication infrastructure in relation to the social and technical networks.” (Hoppe et al. 2003:257).

Being driven by technical initiatives, with a narrow focus on the quality of mobile technologies themselves, does not capture the potential variety and emergent aspects of m-government. Moving from the focus on technology broadens the perspectives and dimensions of m-government. It gives a more comprehensive picture and adds to the complexity of m-government. This complexity includes m-technology in a physical, institutional, political, and human view. A multidimensional view of m-technology contributes to a better understanding of the important values that m-government can provide.

3.6 Seven Aspects – an Approach Towards Success

This section discusses e-government systems and solutions in general including e-administration and m-government together with m-administration in the education sector. e-Government systems and solutions are of interest for developing countries as access to data and information at all levels is critical and generic for development. e-Government ‘promises’ to deliver services not only faster and cheaper but also better as gauged by effectiveness, efficiency, transparency, and accountability.

A growing number of e-government solutions have shown ‘efficiency and effectiveness’ in e.g. Africa, but many failures are obvious. There are several causes that are interrelated, which indicate a high level of complexity and imply several challenges. There are several resources needed for an e-government solution but public sectors in developing countries suffer from a general lack of resources.

Failures are due to lack of resources but they also cause waste of resources. e-Government systems and solutions can be very resource demanding and by that they may take away resources from organisations who already lack resources and who could spend their resources in better ways. Failures are costly as they cause a waste of scarce resources including funds and
highly trained and skilled local staff (Walsham & Sahay 1999), which could have been used for other, more productive purposes. Heeks (2002b:105) argues that the opportunity costs are relatively higher in developing countries due to a limited availability of resources. The effect of the general scarcity of resources means that the impact of failures is greater in developing countries than in industrialised countries. For instance, when discussing the administration of education, Komatsu (2009) says that: “(g)iven the financial constraints..., it is all the more important for the local government to make the best use of its resources by increasing the efficiency and effectiveness of the education administration.”

E-Government presents a number of challenges and there are several critical factors and issues when implementing e-government systems and solutions according to the literature. Important factors and issues range from political and economic models to inequities of financial and technical capital. Some factors are considered as more ‘important’ than others; notably, the main issues are not about technology and economy - it is of social, human and institutional character.

But factor models are criticised and it is argued by Madon (2009) that they focus mainly on macro-levels or that they are too abstract, focusing only on high-level aggregate numbers, disregarding the extent of the infrastructure in place, network coverage or number of applications available. Nor do the reports and studies mention any order and weighting; most factors are not ranked or weighted.

Examples of micro-perspective and identification of factors on an individual level are found in Furuholt (2009) and Guida and Crow (2009) with focus on a user perspective and economic factors on an individual level.

Further, Madon criticises ‘pure’ factor models for being normative and prescriptive and not taking the actual context into consideration.

The issue of failed e-government systems is a complex phenomenon. Complexity is related to the several elements that an e-government system consists of, including several influencing environmental factors as well as contextual issues. Further, it has been established above that the challenges and constraints facing e-government solutions in developing countries of today can be seen as a ‘summary’ of the different eras constraining IS implementation in

33 However, in some discussions of e-Government, one gets the impression that e-solutions targeting effectiveness and efficiency are seen as ‘simple’ functionalism. In contrast, I argue that an efficient and effective governmental administration has profound implications for developing countries in particular: efficiency and effectiveness of systems are quite essential for a poor country where there is a lack of resources.
the industrialised world. This indicates the level of complexity that faces developing countries when implementing e-government solutions.

Additionally we can establish that there is a risk that being driven by technical initiatives, with a narrow focus on the technology itself, does not capture the variety and the different aspects of e-government. Moving away from a focus on technology broadens the perspectives and dimensions of e-government. It gives a more comprehensive picture but also adds to the complexity of e-government. This complexity includes e-government in a physical, financial, institutional, political, social, and human dimension.

Following these observations, it is taken for granted that an e-government system must be considered in a wide perspective due to the complexity inherent in its functioning. The intention with this section is to highlight the complex reality, which constitutes the framework for the implementation of an e-government solution in a developing country – contextual complexity.

Another way to discuss failures and describe challenges is to talk about 'gaps'. There are several gaps stressed in the literature related to e-government solutions, which implies several challenges. There are not only gaps but also noted overlaps with the consequence of waste of resources.

E-government solutions is a way to address the digital divide but the digital divide itself consists of several gaps that have to be identified. The digital divide often refers to a gap of 'have vs. have not ICT' but there is also a gap within 'the haves' about having but not using ICT. In Tanzania for example, Furuholt (2009) talks about an assimilation gap: a gap between acquisition and actual deployment of the equipment. Some officials are most concerned with having the technology but are not utilising it (ibid), the symbolic value of ICT. An example of this is from schools in South Africa, where computers were installed. Results showed that on a technical level, the project was successful, but at the same time, 75 per cent of the teachers could not give any example of how they had used the computers in their teaching (Power et al. 2009:98). In addition, and to further complicate the have vs. have-not analysis, ICTs have a symbolic representation as a bridge, not only over the digital divide, but also between rich and poor, isolated rural and more connected communities (Power et al. 2009) and this 'symbolic representation' was expressed among the teachers in the study from South Africa and “...central to their desire to have computers in their schools...” (Power et al. 2009:96). The symbolic value of ICT is mentioned by other authors (Furuholt 2009; Power et al. 2009). But at the same time, Power et al. (2009:98) stress that ICT must not be seen as a goal in itself;
as a symbolic representation of quality in the education sector. This brings a need for disaggregation of the ICT artefact.

Concerning models for implementing e-government solutions, the models leave out a majority of the countries in the world, the so-called developing countries; there is a focus gap as models are lacking for developing countries. Walsham et al. (2007:322) express a similar view of a lack of reality and contextual awareness. Or as Selinger (2009:217) puts it when she talks about the “technology dissonance” in developing countries, where a technology-based model from one context is difficult to replicate to another context in line with the design-reality gap that both Walsham and Heeks (2002b) talk about. Examples of design-reality gaps are the Ghana cases with projects that are supported by donor organisations and aid agencies who have an external perspective vs. an inside perspective i.e. there is a clear perspective gap.

There are also gaps related to the usage of e-government systems in developing countries described in the literature between captured/stored data (not used) vs. used data and captured/stored (useless) vs. useful data. Related to this gap is the issue of asymmetric information discussed earlier. Concluding, there are gaps related to implementation of e-government systems in developing countries described in the literature between:

• promises vs. impact
• investment vs. outcome
• expectations vs. achievability
• design vs. reality

These gaps need to be considered when discussing failures and challenges.

As established above, e-government systems and solutions in developing countries are mainly described as failures and there are several challenges to meet. Several authors have proposed different models and strategies to reach success and avoid or tackle failure of e-government solutions, but these models might not be suitable in a developing country context. Korpela et al. (2000) argue for the use of approaches appropriate to the severely constrained conditions found in an African context, especially in rural areas. A multidimensional view of e-government contributes to a better understanding of the important values that e-government can provide and how to prevent failures. 34

With an ambition to add to existing approaches in order to find a multidimensional model, I have designed a combined approach for e-

34 How to reach success and tackle failures concerning IS/ICT projects in general are discussed in Sundén and Wicander (2006:114-133)
government systems implementation, the ‘Seven Aspects – An Approach Towards Success’ presented below. Success is here to be understood as both avoiding failure as this consumes resources and also ensuring a long-term survival of the system and solution.

The seven aspects are:

- a Socio-Technical aspect
- a Contextual aspect
- a Slow Time aspect
- a Small Step-by-Step aspect
- a Capacity and Quality aspect
- a Max-Min Macro-Micro aspect
- a Coordination and Consistency aspect

The seven aspects are presented in an order moving from an overarching and structural level ‘down’ to a data level but it is important to point out that the seven aspects are not mutually exclusive; they are overlapping.

3.6.1 Socio-Technical Aspect

A socio-technical approach emerges from an interest in management and information systems to study the impact of technology on effectiveness and productivity (Mumford 1983), but in a wider view includes a social perspective. Positive impact such as cost savings and improvements in quality can be related to technology i.e. ICT, in an optimistic technology view, but Heeks and Bailur state that the positive impact of ICT has socio-technical causes i.e. is a “…result of human agency shaped by social context” (2007:248).

A socio-technical approach is proposed by Walsham et al.: “IS do not have a simple deterministic impact on development. Like other instances of IS being applied to complex social issues, outcomes are not determined only by the technology. Social influences are crucially important to the trajectory of any technology-based project” (2007:322).

Heeks (2002a) recommends a socio-technical approach developed from soft systems ideas with the adaptation of the e-government solution to the context including technological, organisational (including values, perceptions, and assumptions of key stakeholders) and social situation specific factors. It is organisational change, skills and technology that together make the success (Grönlund & Horan 2005).

In order to prevent failure, a socio-technical approach is promoted by Silva and Hirschheim (2007), as they state that to understand the process of
implementation of an e-government solution such as a strategic information systems (SIS) in Guatemala, there is a need, except from technical aspects, to include structure and social dynamics of an organisation such as core values and beliefs, distribution of power, and mechanism of control systems. There is a need to understand that e-government solutions will have to be embedded in relatively rigid organisational structures (Silva & Hirschheim 2007). But it is also imperative to consider that power distances are both expected and accepted in many cultures (Furuholht 2009) both at political as well as at institutional levels.

In a more technology focused way, Guida and Crow state that “(T)he technical variables, as well as human and environmental variables, must be effectively harmonised to realise the full potential presented by technology. This harmonisation of the purely technical with the vastly more fluid and complex human and environmental factors is the realm of e-governance” (2009:296).

Madon (2009) on the other hand states that improving systems of governance is foremost a social activity, not a technological one, but that this is not recognised in policies. Instead, policies suggest governance supported by ICT in order to improve efficiency and effectiveness of government, and solutions are instrumentally focused in techno-managerial terms with goals as short-term cost reduction and time benefits as mentioned above.

Summarising, e-government can be stated as a socio-technical challenge with factors such as organisational change, skills, policies and technology that together make the success; success is a function of social and technical factors.

3.6.2 Contextual Aspect

There is critique against models for being normative and prescriptive and not taking the actual context into consideration. Several authors, including Braa et al. (2007), Furuholht (2009), and Madon (2009) have addressed the need for a contextual approach with some authors focusing on ‘wider’ and ‘broader’ context while others focus on ‘local’ context. At the same time one needs to view these terms as relative terms.

Madon (2009) states that technology-based projects, such as e-government systems, aimed at ‘development’ must be studied in a wider contextual perspective, including the historical processes of development and governance in the specific context. This is something that is missing in current ICT4D (ICT for Development) research according to Walsham (in Foreword to Madon 2009). The need for e-government solutions must be discussed in a broader context including vision as necessity in developing countries.
Walsham et al. (2007) declare that there is a need to involve cultural transfer and mutual learning when bringing a technology to a new context, including local adaptation and cultivation of IS and they state that it is naive to think that globalisation is synonymous with cultural homogeneity. “Applying IS to development requires an understanding of the local meanings, existing work practices, and in institutional contexts, as well as a willingness to engage with the dynamics of socio-technical change over time” (Walsham et al. 2007:322). The specific features of the local context are crucial as to how and whether an IS can be implemented successfully (Walsham et al. 2007). Rodrik argues that “the secret of economic growth lies in institutional innovations that are country specific and that come out of local knowledge and experimentation” (in Madon 2009:163). Wagner et al. (2005) states that local strategies are most effective as no technology is culture-neutral.

Contextual particularities of the local situation are considered as central (Walsham & Sahay 1999; Puri 2007); it is about understanding and valuing local practices (Bada (2002). In a study from India (De’ 2009), the caste structure is discussed and how it determines e-government introduction. e-Government implementation can confront existing cultures (Walsham & Sahay 1999) and can be actively resisted (Silva & Hirschheim 2007).

The importance of context is stated by Prakash and De’ in their study of computerisation of land records in India. They state that the focus should be on “…technologies, which build on local technological traditions, blending with and enhancing local cultures in the process…” (Prakash & De’ 2007:268).

It is also argued by Macome (2003) in a study from Mozambique, that in this study the local context is crucial in the implementation of an IS and that the local stakeholders need to be involved in the entire process. Korpela et al. (2000) also argue for use of approaches appropriate to the local culture.

Additionally, different countries show different implementing strategies; some a bottom-up strategy e.g. South Africa, while some favour a top-down strategy e.g. Botswana concerning HMIS according to Braa et al. (2007).

The second aspect out of the seven can be summarised as a ‘Contextual Aspect that involves a wider and broader perspective of the local context’.

3.6.3 Slow Time Aspect

It is obvious that time is an important aspect in the implementation, adoption, and use of e-government systems. Time is mentioned both explicitly and implicitly in several reports about e-government.
Time can be seen as both ‘is’ and ‘as’ a resource. Time is a resource that needs consideration – it is something that can be used; something takes time, consumes time: time is required to implement an e-government system. Time as a resource is discussed in Sundén and Wicander (2006), where people save resources as they save time using ICT instead of going by bus. ICT is a tool for faster communication and by that save resources (Sundén & Wicander 2006:81).

Heeks (2002b) talks about a design-reality gap and related to this gap is ‘time’. There is a need for a ‘design’ that is even more related to time, which takes into consideration that there are different aspects, concepts, dimensions, perspectives, terms, and tools of time. There is a need for an approach that considers a time perspective more explicitly when implementing an e-government system in developing countries.

As an answer to this, a ‘slow time aspect’ is introduced. It builds on theories by Heeks (2002b), Rogers (2003), and empirical findings from Furuholt (2009), Grönlund et al. (2008) and others. Time is a huge issue and my intention here is to make some reflections about time related to e-government in a developing country context under the following headlines:

• Success and Failure as a Function of Time
• Measure and Describe Time
• Dimensions of Time
• Adoption – a Process over Time
• Changes of Attitude takes Time

Success and Failure as a Function of Time
There are several examples that relate both success and failure to ‘time’. Success and failure are expressed by ‘time’; measured, described, evaluated, and /or estimated in ‘time’ terms. But, success and ‘failure’ are not absolute phenomena. The notions of success and failure need to be related to a time perspective; it is too simplistic and reductionistic to measure the outcome as ‘success’ or ‘failure’, as discussed in Sundén and Wicander (2006:114-133).

An example of a report that relates ‘success’ to ‘time’ is Sundén and Wicander (2006:118) who talk about ‘success’ being about the planning of time, coordination and co-operation of time and that ‘success’ is measured using time as an indicator as e.g. ‘on-time’ (Sundén & Wicander 2006:115). Further, e-government solutions are stated to have the potential to deliver information and services faster i.e. a functionalistic view that focuses on productivity; the rationality for the adoption of ICT is increased efficiency of public
administration. This is expressed by Madon (2009) where e-government solutions are instrumentally focused with goals as short-term cost reduction and time benefits.

An example of a report that relates failure to time is Sundén and Wicander (2006:117-118) who mention that, in the literature, a failed project is defined as e.g. ‘over-time’, or ‘time overruns’. Heeks et al (1999) talks about a ‘sustainability failure’, which is defined as “...succeeds initially but fails later” (in Sundén and Wicander 2006:117). In a paper from 2002(b), Heeks discusses e-government in Africa and states that diffusion is slow with mainly failures due to several challenges and a ‘slow’ uptake is defined as a failure in Grönlund et al. (2006).

**Measure and Describe Time**

Time is measured with different tools such as a watch and calendar and can be measured in hours, days, months, years. Time can also be measured with different activities e.g. holidays, vacations. Time can also be measured in relation to the nature e.g. seasons.

Further we can describe an activity or a process by using time terms e.g. we can describe ‘development’ with a metaphor related to a time perspective. For instance, Mathur mentions in a report from Harvard University that India is described as a snake “...with its head in the twenty-first century and tail in the nineteenth” (2004:123).

We use different terms to describe time such as slow, fast, quick; i.e. we describe time with different terms, which we have given in relation to time. But what is ‘slow’ – who defines and measures, how can we define and measure and in relation to what?

Sander et al. (2005) talk about a realistic time-scale, and Braa et al. (2007) about realistic long-term plans but what is realistic; whose reality do we refer to?

Time is relative; even if we measure time with the same tool and describe with the same terms we perceive, experience and interpret time differently e.g. one hour can be perceived as both slow and fast.

**Dimensions of Time**

There are several dimensions of time that co-operate such as:

- **Point of time** – when e.g. when is the best point of time
- **Duration** – how long time is something going on e.g. long-term
- **Chronological order** – in which order (before /after)
- **Time interval** – how often i.e. frequency
- **Simultaneity**
Adoption – a Process over Time

Time is a main component to consider in the adoption process. Rogers (2003) describes in his ‘diffusion of innovation’ theory that adoption is a process over time and that the meaning of an innovation is “...gradually worked out through a process of social construction.” (Sundén & Wicander 2006:86). The adoption of ICT is expressed by Furuholt (2009:47) as a process that will “...evolve and materialize gradually over time.” and that implementation must be understood, not from a point in time but over time.

A time dimension is involved in the decision process by which an individual passes from first knowledge of an innovation through to its adoption or rejection. This decision process can be described with Langefors’ (1973/1978:248) infological equation – i.e. the interpretation of data into information is a function of time (Sundén & Wicander 2006:102).

The time period for a diffusion process depends on many factors and preconditions such as the compatibility with values, beliefs, and past experiences of individuals in the social system (Sundén & Wicander 2006:94), including work practices and the local environment.

Time is involved in the diffusion of innovations when it concerns e.g. the rate of adoption, which is the relative speed an innovation is adopted by members of a social system. Most innovations have an S-shaped rate of adoption on a group level when the number of individuals adopting a new idea is plotted on a cumulative frequency basis over time. The adoption of an innovation is hence a function of time with adopter categories such as early adopters, and late majority, where, for a majority, adoption is a long time process (Rogers 2003).

The fact that adoption is a slow process leads to many organisations and individuals wanting to speed up the rate of the diffusion of a new technology by using a change agent, but it is crucial that a change agent is able to put him or her in the role of the users (Sundén & Wicander 2006). Concerning change agents, Furuholt (2009) contends that strong political leadership is one of the most important success criteria for e-government projects in general and in developing countries in particular. Strong leadership is even more crucial to generate progress over time and to help manage e-government implementation when there are limited resources available. Hence, political leadership can be stated as a change agent.

But the adoption process might not be continuous; it can be an ‘interrupted’ process. Furuholt talks about an assimilation gap to consider: a gap between acquisition and actual deployment of the equipment, where some
officials are most concerned with having the technology but not of utilising it (Furuholt 2009).

Change of Attitude – to Technology, to Processes, to Time – Takes Time

Rogers points to a ‘pro-innovation bias’ of the diffusion of innovation theory including that it is implied that an innovation “...should be diffused more rapidly...” (2003:476). But in reality, the diffusion of innovations is in most cases a slow process according to Rogers (2003) and the time period between a technology becoming available to it being widely adopted is often long, and the adoption is slower higher up in a hierarchy.

One early and most cited study on GIS for district-level administration in India by Walsham and Sahay expresses that for this process to be a success would require “...a more fundamental and widespread change of attitude and work practice...” (1999:56). But to change that will take years, as this approach is extremely embedded in social attitudes and structure.

Madon’s experiences from India (2009) show that ten years later, the same issues were identified, which hampered the usage of the system she studied, which indicates that changing attitudes and structures is a slow process. Madon (2009) argues that capacity building should involve informal aspects such as altering mindsets, behaviours, and trust.

As Sander et al. (2005) express it, “... technology is not simply a matter of computers it is also a state of mind – an entirely new way of thinking.”

Furuholt (2009) reports from a project in Tanzania designed to introduce information technology into a management college, which showed little progress over the ten-year period from 1991 to 2001. He states that change of attitude is a long-term process including the concept of time and planning for the future.

There is therefore a need to consider attitude to time, which can be seen as an underlying structure that influences, governs and controls decisions. In order to understand underlying structures - cultural and contextual differences – there is a need for a gradual sensitisation process (Sander et al. 2005).

Additionally, there is a time gap to consider, as shown in Furuholt (2009), where a change in mindset is shown between the attitude to ICT and e-government in 1999 and in 2009. Furuholt concludes that different occurrences have changed the attitude to ICT. New factors include outside pressure, the obvious personal benefits, and an awakening management.

Social structures take time to change, which is also discussed by Grönlund et al. (2008). They introduce a hierarchy of different challenges for implementing ICT in developing countries based on ‘time’. Different challenges
can be met at different times: i.e. it takes a different amount of time to meet different challenges. Technical challenges can be done in a short time and organisational challenges can be made “relatively quickly” but social and cultural challenges are the most complicated with the “longest timeline” as structures and processes that have been practiced for a long time are rigid to change.

Grönlund et al. (2008) conclude that meeting challenges requires long-term engagement and endurance, which has to be considered, since many ICT4D projects have a domain technical focus together with short-term investments, i.e. they are ‘pro-innovation biased’. The diffusion of technology is a social process more than a technical matter (Sundén & Wicander 2006:101).

The Slow Time aspect favours a time awareness based on a cultural and contextual understanding. There is a need to understand that time is a relative concept based on different ways to perceive, experience and interpret time. Adoption is about a process over time where changes of attitude and structures as social constructions take a long time. This has to be considered when planning for implementing an e-government solution.

3.6.4 Small Step-by-Step Aspect

This aspect is about ‘change’ and the pace and extent of change. Several authors have highlighted the issue of change (Heeks 2002b; Sander et al. 2005; Braa et al. 2007).

Heeks discusses the degree of change that an e-government system introduces and argues that “…the greater the degree of change, the greater the risk of failure” (2002b:105). Further, Yngström (1996) divides adaptation, which can be related to degree of change, into functional and structural - functional changes appear in the short run; it is more about small adjustments, while structural changes appear in the long run. Functional changes are ‘easier’ and smaller while structural changes are larger changes; it is more about adaptation.

Sander et al. (2005) favour a phased implementation: step-by-step with clear and achievable goals and easily quantifiable indicators – as cited before, “using the ‘big bang’ is a recipe for disaster” (ibid:156). They motivate their view as being about understanding underlying structures, and cultural and contextual differences, including a technological culture gap – there is a need for a gradual sensitisation process.

Braa et al. (2007) address a need for change that can adapt to a changing and complex context. Their approach is about being “…sensitive to the local
context, to allow change to occur through small steps...” (Braa et al. 2007:382). They suggest “radical changes through small steps”; changes that are appropriate and synchronic with ‘radical’ in the sense of new ways of doing things (2007:399).

This fourth aspect can be described as Small steps in a Step-by-Step manner.

### 3.6.5 Capacity and Quality Aspect

This aspect builds mainly on studies done by Madon. Capacity building is discussed as a pervasive means to reach development e.g. the MDG (Millennium Development Goals), according to Madon (2009) and related to improving management in organisations. Administrative capacity is deficient in most developing countries and constrained by “...poorly articulated demands for information coming from higher levels of the bureaucracy” (ibid 2009:39).

Capacity problems have several causes such as lack of knowledge, skills and experience together with structural weaknesses in organisational and institutional arrangements and levels (Selinger 2009).

Capacity development involves both individual and organisational levels (Fenenga & de Jager 2007). According to the World Bank (2006), in their Fast Track Initiative (FTI), capacity building and development in the education sector for instance means developing skills, organisation and institutions at all levels. Capacity building is central for ICT in education (Unwin 2005a).

Madon (2009) argues that capacity building should involve both informal aspects such as altering mindsets, behaviour, and trust together with more formal aspects of organisational and institutional change such as structure, and skill development. Furthermore, effective bureaucracy requires different types of capacity from administrators such as technical and managerial skills, adaptation and learning (ibid). Additionally, capacity building should be context-sensitive and a long-term undertaking.

Madon (2009:58) also suggests an e-government model that focuses on quality and builds on the e-government system’s quality, together with the data, information and service quality. The model includes added value to three key actors: government, users, and society.

Data quality constitutes the base for improved decisions and can be improved by different types of rewards and/or punishment (Heeks 2006). Data quality is reached through an improved data collection process. Data quality can be ‘measured’ through several indicators such as completeness, accuracy, relevance, timeliness, and appropriateness of presentation (Heeks 2006:73).
The Capacity and Quality Aspect, is about developing skills, organisation and institutions at all levels together with systems, service, data and information quality with added value to government, users and society.

### 3.6.6 Max-Min Macro-Micro Aspect

The max-min aspect concerns the amount of captured data. An example of a so-called maximalist approach can be taken from Botswana in Braa et al. (2007) where the strategy is to include all stakeholders, capture all data across all programs into the shared data warehouse – it is ‘nice to have data’. A risk with the maximalist approach is that a huge amount of data is collected but only a small portion is used meaningfully – there is a need for a discussion of useless vs. useful data. On the other hand, a minimalist approach is about deciding upon a set of essential data – ‘need to have data’.

The macro-micro approach is inspired by Madon (2009). In order to improve the understanding of development, e-government and governance there is a need to trace macro-level political and socio-economic factors as well as micro-level social systems, such as existing ways of local administration (ibid). Macro-level factors include national culture, leadership, organisational capacity, and regulatory environment (ibid). On a micro-level, factors include local information sources, interaction and political struggle, and political support from local institutions (ibid). Interfacing the macro-and micro levels are formal and informal local government and governance structures comprising administrative, social and political systems (ibid).

The Max-Min Macro-Micro aspect, concerns both a data level as well a structure level and advocates a discussion about ‘useless’ vs. ‘useful’ data together with the need to identify factors on both macro and micro levels in formal and informal local structures.

### 3.6.7 Coordination and Consistency Aspect

This aspect is mainly a product of Braa et al (2007) and their experiences from HMIS implementation in developing countries.

Braa et al (2007) argue that the health care sector in a country consists of several institutions managed by partly overlapping institutions organised into geographic areas and according to vertical programmes and services. This constitution can be relevant for other governmental sectors as well.

Braa et al. (2007) suggest two strategies to success: focus on data and information instead of technology, and build gateways between technically ‘incompatible’ subsystems. In other words, the focus needs to be on ‘content
not container’ or ‘message not messenger’. According to Braa et al., the challenge to success is developing workable data standards i.e. a uniform set of data elements together with an interface between paper-based systems and computer-based systems, so-called gateways. The authors suggest standards on two levels; on a service delivery level for data collection and communication and on a technical level for software.

Several authors stress the need for the integration of data and the coordination of MIS (Braa et al. 2007; Yildiz 2007; Guida & Crow 2009). An agreed set of standards for sharing information is crucial for data to be exchanged between systems, while allowing each system to process data independently (Guida & Crow 2009) i.e. the coordination of data so information can be searched and shared across the organisation.

Walsham and Sahay (1999) mention the importance of cooperation and collaboration between central government agencies, including policies on the issues of data coordination and sharing. Experience from an HMIS in Uganda is reported by Fenenga and de Jager (2007). The authors claim that steps to strengthen a culture of use of data and information and of data and information exchange has to be developed. In order to do that, the authors suggest deciding who to report to, using standardised forms, ensuring regularity in reporting e.g. on a monthly or quarterly basis, conducting data and information reviews on a regular basis and ensuring feed-back (Fenenga & de Jager 2007).

The minister of Environment and Forests in India at the time commented upon the issue of data sharing: “...This is what is popularly referred to as an information superhighway. An information highway is perhaps the only kind of highway which can be built without attracting the provisions of the Forest Conservation Act for diversion of forest land and cutting trees!” (Walsham & Sahay 1999:57).

The strategy of using a gateway, defined by Braa et al. as “… a piece of software that links together different sub-infrastructures into an integrated one…” (2007:397), that then acts as a translator of data between different levels and subsystems was proven important by Braa et al. (2007). In a developing country context, a paper-based system must coexist with a computer-based system for several years in advance (ibid).

A gateway includes different procedures e.g. analysing data, producing different reports, feedback. Gateways, according to Braa et al (2007), also include objects that link and translate between different levels and also between incompatible electronic infrastructures. They called such gateways hybrids because they were composed of humans, procedures, computers and software.
“An appropriate blend of standards and gateways allows infrastructures to evolve by maintaining order at the edge of chaos.” (Braa et al. 2007:398)

Braa et al. (2007) mention three types of gateways: paper-to-paper (P2P), paper-to-computer (P2C) and computer-to-computer (C2C). They state that the use of gateways is related to the level in the hierarchy and the types of gateways are related to the uneven distribution of resources between urban and rural areas and the types of gateways that are needed will vary depending on availability of infrastructure.

The last out of the seven aspects is about ‘Coordination and Consistency of Data through Cooperation and Collaboration’.

3.6.8 Summing up the Seven Aspects of e-Government Systems Implementation

The seven aspects here presented are thus:

- a Socio-Technical aspect
- a Contextual aspect
- a Slow Time aspect
- a Small Step-by-Step aspect
- a Capacity and Quality aspect
- a Max-Min Macro-Micro aspect
- a Coordination and Consistency aspect

Summarising the first aspect, the Socio-Technical aspect, e-government can be stated as a socio-technical challenge with factors such as organisational change, skills and technology that together make the success; success is therefore a function of social and technical factors in line with a socio-technical approach.

The second aspect out of the seven can be summarised as Contextual aspect and involves a wider and broader perspective of the local context.

The third aspect, the Slow Time aspect, favours a time awareness based on a cultural and contextual understanding. There is a need to understand that time is a relative concept based on different ways to perceive, experience and interpret time. Adoption is about a process over time depending on changes of attitude and structures as social constructions taking a long time. This has to be considered when planning for implementing an e-government solution.

The fourth aspect can be described as Small Steps in a Step-by-Step manner.
The fifth aspect; the Capacity and Quality aspect, is about developing skills, organisation and institutions at all levels together with systems, service, data and information quality with values to both government, users and society.

The Max-Min Macro-Micro aspect advocates a discussion about useless vs. useful data together with the need to identify factors on both macro and micro level in both formal and informal local structures.

The last out of the seven aspects is about ‘Coordination and Consistency of data through Cooperation and Collaboration’.
4 Methodology and Research Design

This chapter discusses methodological considerations and describes the research process. First, an account is given of the general research approach and perspectives. This is followed by a presentation of the chosen research methods and a description of the field studies performed in Tanzania. Then, the applied analytical framework is presented.

4.1 Research Approach and Perspectives

Included in methodological considerations are approaches and perspectives for the conducted research.

Performing research in ICT4D implies an interest in development issues. ICT4D can be stated to include a political, philosophic and ethical point of departure as well as a critical and emancipatory standpoint. Furthermore, the concept of ‘sustainability’ is important to consider in any ICT4D work and in order to deliver a sustainable ICT solution, it is advisable to ‘build on what you have’, ‘use what you can get’ and ‘focus on what you can do’. For instance, a mobile is an ICT tool that is available in most developing countries – even in rural areas. A lack of fixed telephony creates an opportunity for mobile solutions: ‘exploiting’ the fact that ‘everyone’ owns a mobile phone in a pragmatic way.

This also highlights the concept of ‘contextualisation,’ which has been very prominent in this research design. Contextualisation entails having a local problem and local resources as a starting point, having a bottom-up perspective, and considering the local communication patterns regarding information transfer.

This research has a decidedly practical orientation. Practice oriented research focuses on what people do and their socially situated actions (Schultze 2000). It implies being problem oriented and giving suggestions for solving a problem that exists in ‘reality’. The research results can support concrete development by supporting existing practice and by being supported by existing practice. This is important when taking into account the magnitude of failures when implementing e-government solutions in developing countries, which can be related to a lack of knowledge and understanding about the actual context.

In Europe, IS academics often rely on interpretative studies advocating greater pluralism, more diversity, greater use of methods that allow researchers a possibility for interpretation, and adoption of theoretical perspectives that are not founded on a rational and mechanistic view of the world (Benbasat &
Scandinavian research can be seen as a separate tradition or as an additional tradition, included in the European tradition. The Scandinavian tradition, to which I belong, can be characterised with six key ‘P’ words: participatory, plural, pragmatic, philosophic, anti-positivistic and practical according to Sundén and Wicander (2006:112).

Underlying all of the above is a systems approach. The subject of this study needs an approach favouring holism and multidisciplinarity and these features are included in a systems approach.

The systems approach is based on systems thinking and systems theory. Systems thinking, introduced by Checkland (1981), and systems theory are concerned with ‘the whole’ (Langefors 1995).

Systems thinking can be defined as: “a discipline for seeing wholes...a framework for seeing interrelationships rather than things, for seeing patterns of change rather than snapshots.” (Senge 1990 in Öquist 2003:13)

Systems thinking includes a philosophical standpoint, an epistemological view, and a common language. Systems thinking states common principles in the structure and in the operation of all systems. It views the world as interacting systems and to study this interaction, systems thinkers use multiple perspectives, including a general language i.e. a common vocabulary and set of concepts. Systems thinking is generally applicable and can be used as an analytical tool in different settings of e.g. an education organisation.

It is imperative to understand that systems thinking is not objective as different observers can apply different perspectives of a phenomenon and by that conceptualise it differently (Ackoff 1971). Systems thinking includes different perspectives such as soft, hard and critical, which is further elaborated on below.

Systems theory can be said to have its origin in the observations of similar phenomenon existing in many different sciences. It is a basic theory, which deals with general properties of systems on an abstract level. Its foundation is the assumption that all kinds of systems have some characteristics in common.

The ‘modern’ systems theory includes chaos theory, evolution, fluctuation, and is influenced by Ilya Prigogine (Belgian Nobel prize winner 1973 in chemistry) for his theory on dissipative structures (Ackoff 1981). The main idea is that small deviations/divergences, a ‘kick’ in a system, can cause powerful effects and constitute a totally new structure within a system. Systems that are far from balance are the most susceptible for a ‘kick’ (ibid).

Adopting a systems approach means applying a perspective in which both problems and solutions are multi-dimensional, where things can never be
treated as isolated elements, but as a totality. Furthermore, to emphasise a systems approach is to stress that it is the combined effect of the parts that is important i.e. its synergetic effect.

A systems approach offers a broad view for understanding a context. Applying a systems approach can help place change processes in their wider contexts and help understand the complexity involved, by offering ways to view the complexity in terms of different parts with relationships among the parts (Mårtensson 2003). Systems approach is about applying knowledge to a context, where parts in a system have little or no ‘awareness’ of the complexity of the whole system of which it is a part.

A systems approach makes it possible to define and investigate systems and their phenomena free from any biases other than that of the concept itself (Yngström 1996). As this research could be considered multidisciplinary, a systems approach is chosen with its aspiration to provide a universal theory, including a general scientific language in order to promote communication across disciplinary borders.

Systems approach is one way to analyse change and problems in an organisation. A systems approach to changes and problems “…focuses on systems taken as a whole, not on their parts taken separately” (Ackoff 1971:661). There is a need to look at the whole system and the performance of the whole system even if a change occurs only in one part of the system, since some properties of the system only can be looked at from a holistic view and these properties derive from the relationships between different parts of the system (Ackoff 1971).

Systems approach (SA) can be considered to have the following characteristics according to Yngström (1996) and Schoderbek et al. (1990): SA emphasises the whole; SA studies open systems; SA explicitly defines the environment; SA considers changing and learning goals; SA considers many hierarchies; SA considers adaptive and changing systems states.

These characteristics imply high complexity and indeed many systems are multidisciplinary, dynamic, human, social and open, such as ICT projects. Systems approach is one way to understand the complexity of introducing and implementing an information system such as an e-government system in a developing country context.

From an ontological view, a phenomenon is a system, something that exists in reality e.g. an information system. Checkland (1988) uses the concept ‘hard system thinking’ for this ontological view. With hard system thinking, problems are solved using systematic methods (Yngström 1996).
From an epistemological systems view, a phenomenon can be studied as a system (Checkland 1981). In this view, a system is an abstraction, an epistemological device that can be used to identify, investigate, and describe some of the problems in the world in order to make it easier to understand and to facilitate analysis. The basic idea of a ‘system’ is as a tool to describe the world, as a way to understand the world, to structure one’s thinking about the world. Dahlbom and Mathiassen (1993:54) explain their epistemological view in this way: “Systems thinking is a way we have to deal with a world that is diverse and constantly changing”

Thinking in abstractions is in accordance with the systems approach. In other words, it is a way to look upon reality as a system and systems are used to make perspectives explicit. A system can be seen as an abstraction of reality and abstraction is one way to deal with complexity for the human mind. It is a way of looking at reality in parts, which is the only way to be able to understand reality. Or, as Langefors (1995) puts it: “Complexity is the property of being a thing that can only be perceived piecewise”.

An important means for dealing with complex systems is to simplify the structure by reducing the linkages between the systems’ parts (Langefors 1995). A system could also be divided into subsystems, as a way of illustrating the relation between the size and the complexity of the system: reduce complexity in order to be able to study it. Langefors (1973) explains that every system is subject to influence from its environment, is a subsystem of some larger system, and that every system part is potentially a system; “…a system is a system of systems” (Langefors 1995:39).

The epistemological view can be labelled ‘soft system thinking’ (Checkland 1988). The emergence of the soft system thinking was a reaction to the inadequate approach within ‘hard system thinking’ of tackling problems within social systems: from the ‘hard’ view, a phenomenon is a system. Soft system thinking is an approach to problem solving that copes with situations in which objectives are unclear with multiple legal viewpoints of problem situations and by that are themselves the problems (Checkland 1989). Synonymous to soft systems thinking is systemic thinking (Yngström 1996:22) and problems within soft systems thinking are solved by using systemic methods. The two types of thinking are complementary to each other and do not present a dichotomy (Checkland 1989; Avison & Fitzgerald 1995).

Soft system thinking is considered advisable for multi-perspective problems and uses systemic methods for problem solving and changes. Systemic methods include interpretative, participative, and emancipatory
methods with a focus on social and user aspects. In this study, soft system thinking is complemented with systematic methods.

There is not one ‘systems approach,’ but many different variations (Schoderbek et al. 1990). Systems approaches can be classified into four different categories: functionalist, interpretative, emancipatory, and postmodern (Jackson 2000). The different systems approaches have different backgrounds, slightly different theoretical foundations and content.

One part of the analysis in this study, the analysis of EMIS and the statistical data collection process, has been inspired mainly from a functionalist approach. A system in the functionalistic paradigm is ‘hard’ with an identifiable existence and it is possible to construct a model of the system (Jackson 2000). A functionalistic socio-technical system view fits a problem context that is defined as ‘a complex system with pluralist participants’ (ibid:359).

A second part of the analysis in this study, the analysis of the head teachers’ mobile usage pattern, is related more to an interpretative approach. A system in the interpretative paradigm is ‘soft’ and can be understood by the views of the human beings that construct them (Jackson 2000). An interpretative system view fits a problem context that can be defined as ‘a simple system with pluralist participants’ (ibid:359).

Jackson (2000) introduces Critical Systems Thinking (CST), which can be seen as a coherent framework that unites these four different systems approaches. Critical Systems Thinking encourages pluralism and multi-methodology use, favouring multi-disciplinarity. It is argued by Jackson that CST can be used “…to promote successful intervention in complex organizational and societal problem situations” (2000:355). The basis for CST can be stated to include: critical, social and ethical awareness, human emancipation and improvement, together with coherent pluralism. Or, put another way with nine e-words, “…efficiency, efficacy, effectiveness, ethicality, elegance, empowerment, emancipation, exception and emotion” (Jackson 2000:424).

The overall approach of this study was inspired and influenced by Critical Systems Thinking, which promotes research and change in order “…to accept that any research on human or social systems will inevitably change them and to make a virtue of this fact” (Jackson 2000:15). A critical perspective and point of departure can be stated to question society and is concerned with criticising existing social systems. Critical research attempts to evaluate and transform the social reality (Chua 1986; Orlikowski & Baroudi 1991). Habermas (1984; 1987) suggests that ICT, which are designed to increase organisational effectiveness,
must also increase human understanding and emancipate people from undesirable social and physical constraints, distorted communication and misapplied power. This study applies a systems perspective with a social aspect of social and economic development, including a critical perspective to be understood as a wish to change (Walsham 2005:112).

Earlier, the systems theories received critique; see for example The Rise of Systems theory by Robert Lilienfeld (1978). Systems theory has been criticised for being reductionistic and atomistic (Langefors 1995), and, according to Lundahl (1989/1994), the use of systems theories within development studies has not given any outcome. Considering the complexity related to e-government research in developing countries, the use of a systems approach is a way to handle this issue.

Finally this study is guided by a socio-technical approach. The socio-technical school is inspired by systems thinking where the human and the machine, the social and the technical, are bound together in an entirety. The main idea of the socio-technical school is that the social and technical subsystems cannot be regarded as isolated systems. A socio-technical system has both a technical and a social dimension that each need attention and which have to collaborate (Mumford 2000). Hence, we have to consider the relationships between them (Andersen & Sorsveen 2003). This advocates putting human needs before technological possibilities, to emanate from a need assessment, a demand-driven approach, but to be aware that ‘need’ is not the same as demand; need is a relative term locally defined.

In every social situation, a problem and its treatment are important parts of the situation and cannot be extracted from the social situation. The problem must be seen as a phenomenon of something e.g. a lack of computers and the Internet cannot only be treated as a technological problem.

A complex systems need to be divided and abstracted in order to facilitate an analysis. In line with the socio-technical view, a system can broadly be divided into two subsystems: a social and a technical subsystem. The technical system covers different technical aspects e.g. different types of ICT, whereas the social system includes every human aspect that may be of interest (Andersen & Sorsveen 2003); it is a human activity system existing in space and time showing the different actors, their activities, responsibilities, economic matters, and time aspects. Furthermore, a social system is the result of interaction between human beings and artefacts such as computers and mobiles, representing the technical system.
The different systems must be well-suited to each other in order to function in an optimal way. In other words, it is not sufficient that a system is technically functioning: it must also be socially accepted. The solution is to produce a system that combines technical efficiency with sensitivity to organisational and human needs (Mumford & Weir 1979). Accordingly, adopting a socio-technical systems perspective helps to avoid a purely technological approach. A socio-technical approach emphasises a continuous and mutual interaction of the technology and the organisation or institution. This understanding helps us to recognise actors and consequences of inclusion and exclusion of certain actors.

According to Mumford (2000), the socio-technical school has a technical non-deterministic approach with objectives and goals primarily of a social character (Mumford & Weir 1979), emphasising that human needs must not be forgotten when technical systems are introduced. This is in accordance with Lejk and Deeks (1998), as they state that the technical aspects of the system must be evaluated with an active involvement from the human community that will operate it and that the analysis must be focused on human relations and actions.

The socio-technical tradition has formulated two main prerequisites to reach its social goals. The first and most important prerequisite is the attitude among the ‘experts’ including researchers. The ‘experts’ must look upon their task from a social perspective. The second prerequisite is to let the users participate in the process. In order to guarantee that the users’ needs are given enough consideration, one must specify user-oriented and usage-oriented constraints first, and introduce technical constraints as late as possible (Langefors 1973).

There is also some critique against the socio-technical approach. It is viewed as management-oriented, considering organisations as value-neutral and positivistic in their world-view (Kensing & Blomberg 1998). Further, not everyone has the possibility to decide which technique should be developed, with the consequence that technique development and technological progress is a matter of power and of the social structures within an organisation, community or nation (ibid).

4.2 Research Methods

This is an explorative and descriptive study. Methodologically, it can be described as mainly qualitative with some quantitative elements. There are some issues that are essential for the decision to use qualitative approaches. One
determining factor for such a decision mentioned by Trauth (2001) is the degree of uncertainty surrounding the phenomena. Further, qualitative data have an important feature, which is that “they focus on naturally occurring, ordinary events in natural settings, so that they have a strong handle on what ‘real life’ is like” (Miles & Huberman 1994:10). Maxwell’s (1996) advantages with qualitative research concern the practical purpose with a study, as well as generating results and developing fundamental knowledge that is needed to be able to solve problems within a specific context. In other words, generating results that are understandable and beneficial for the people being studied. Bearing this in mind this, I consider it advantageous to adopt a qualitative approach, added to which it is an accepted practice to perform qualitative studies within the IS paradigm to underpin the design of new systems.

Additionally, this research is inspired by the ethnographic method, which is sensitive to social situations and conditions. It is descriptive and interpretative and illustrates in descriptive details the context in order to gain understanding and develop new knowledge about an undocumented research area. It involves an extended period of time in a culture one is unfamiliar with, close to the respondents and their context (Schultze 2000). This thesis comprises field studies during six months in East Africa. Practical experiences from the field studies are presented in a descriptive field diary of the research process in line with an ethnographic study (Schultze 2000:7). As is obvious it has been necessary to apply what Robson (1993/2002) calls a ‘flexible design’. (See Appendices 4:1 and 4:2 for field diaries.)

An interpretative study has the intention of understanding the context of an IS and also creating an understanding of how the context shapes the IS and vice versa (Walsham 1995). The present study describes how an organisation and administration is structured, how the information system is organised, and how the collection of statistical data is organised, and gives an overview of how these subsystems shape each other. An interpretative study is influenced and biased by one’s personal understanding, knowledge and experience of a phenomenon.

Additionally, this research is performed as a case study and as such it describes a new phenomenon, where the ‘border’ for the new phenomenon is not clear, in a natural and small setting on-site, close to the data sources. The case is described from a holistic view: broadly and tentative, in an iterative process with the aim to understand this new phenomenon. Case studies are open for flexibility (Eisenhardt 1989) and an unstructured research design led by the actual situation and research setting. It includes several data collection
techniques and several data sources (Benbasat et al. 1987) to get as much depth as possible and to validate the data (Yin 1994/2003). It has an explorative character, investigating and counting on empirical data from this new phenomenon emanating in rich descriptions.

A case study is sensitive to the context, since it is the activities and values of people in the specific context that are to be studied. It is creative and idea generating including adventure and new experiences, which makes it suitable for research dealing with practical problems suggesting solutions.

4.2.1 Data Collection Techniques

This is a multi-technique study comprised of a literature study, interviews, and direct observations, including different tools to collect data such as questionnaires, together with several data sources.

The literature study included research papers, reports, government documents, and official statistics.

Since this study looks for views, opinions, attitudes, perceptions, interviews were performed. Informal interviews (verbal) were conducted with informants (experts) in both Sweden and Tanzania and formal interviews were performed with respondents in Tanzania. Different questionnaires were used for the formal interviews and, due to language barriers, both verbal and written techniques were used. The interviews addressed issues such as background and demographic questions, opinion and value questions about ICT, and experience and behaviours questions about ICT.

Observations were used to verify data from other sources: they complement data from other sources as a second data collecting method. Yin (2003) claims that making a field visit to a research site can create the opportunity for direct observations. Observations made it possible to gain access to the complex nature of actions and the social world of the respondents. Hence, I could collect data based on behaviours and environmental conditions, such as infrastructural conditions in rural areas and the working conditions at the EMIS office at the Ministry of Education and Vocational Training (MoEVT). The observations were mostly made in connection with the interviews, and the data were collected in a diary and by photographing.

The primary data collection combined different data sources such as:

- Data from official statistics
- Data from official governmental documents
• Data from informants (experts) and respondents (citations are used to stress the actual wording to reduce interpretation errors)

Secondary data sources included:
• Research publications (e.g. conference papers, journal papers)
• Reports from aid organisations (e.g. the UN, Sida)
• Reports from the industry (e.g. Ericsson, Nokia, Vodacom)

4.3 Phase I

This study was performed in two phases. The first phase was mainly descriptive. It builds on several interviews - unstructured, not bounded, un-standardised - with informants from different areas, all with different knowledge and experience from Tanzania. These informants included employees from Sida, the Swedish embassy, and Ministry of Education and Vocational Training (MoEVT) including administrators and managers of EMIS. Phase I has mainly a top-down approach and perspective as most of the informants are 'experts' in some way.

Phase I consisted of three sub-phases performed during 2006-2008:
• Informant interviews
• Field study including Informant interviews
• Literature study

The informant interviews were performed in Sweden during 2006-2007 and in Tanzania during 2007. The informants belonged to three groups of ‘experts’: researchers, consultants, and employees on governmental level. The expert group contributed with general knowledge of ICT implementation in developing countries together with specific knowledge of Tanzania on ICT and the education sector.

The field study was performed in Dar es Salaam, Tanzania during October – November 2007 at the Ministry of Education and Vocational Training (MoEVT) at the office of the EMIS team. The literature study was performed as a desktop study on a continuous basis during 2006-2008 at Karlstad University.

Data sources for Phase I included primary data from informants and secondary data included statistical sources, different official documents and archival records, both Swedish and Tanzanian, related to Tanzania, the education sector in Tanzania and the ICT situation in Tanzania. The archival records had the form of maps of local geographic characteristics, census
records, and organizational charts. Observations mainly at MoEVT were also a source of input for the first phase.

Phase I focused on the present EMIS describing the statistical data collection process within the education sector including identifying weaknesses as well as strengths regarding the statistical data statistical process in order to answer the research questions about the present EMIS:

• How is statistical data currently collected?
  ○ What are the strengths and the weaknesses of the process?
Outcome of Phase I:

• an overall picture of Tanzania including the ICT situation in particular the mobile situation together with a description of the education sector – presented in Chapter 2
• a description of the statistical data collection process – presented in section 6.1
• an analysis of the strengths and the weaknesses of the statistical data collection process – presented in section 6.1.4
• a working report on M4D - a mapping of mobile phone usage for development purposes (see Wicander 2010)

4.4 Phase II

The second phase could be labeled mainly explorative. It builds on interviews with head teachers in primary schools. The interviews were structured, standardised, and bounded, supplemented with open questions. A questionnaire about the local organization of the primary education was given to a selected number of regional education officers and district education officers.

Phase II has mainly a bottom-up approach and perspective, since the respondents are ‘end-users’. The idea is to catch the multitude of user views. The goal is to chart the conditions for mobile phones usage in primary schools by interviewing head teachers. Head teachers as respondents were selected, as they are the person in charge at each local primary school and the one who is responsible for the collection of statistical data, i.e. they are the primary source of school data. The interviews involved making the participants understand what is tentatively discussed, as well as making it possible for them to have an influence on the future design (thus following the first steps of a systems approach (Langefors 1995). As explained earlier, the focus placed on mobile telephony vs. other ICT is due to the mobile’s high penetration in developing countries in general, including Tanzania, also reaching out to rural areas. The
focus placed on machine readability vs. calling person-to-person (cf. section 3.5.6 why SMS was chosen among the techniques allowing machine readability).

A complementary round of interviews was performed at a district education office (DEO) level. This DEO study aimed at identifying attitudes towards work-related use of mobile phones among employees at district education offices. The study was conducted with employees of two district education offices in the Iringa region: the Iringa Municipal district and the Iringa Rural district, both of which are included in the head teacher study. Data was collected through interviews, four individual and one group, and questionnaires with 12 respondents. XIF (see section 4.5.2) was used as a framework when the data collection was designed.

Phase II consisted of two sub-phases performed during 2008-2010:

- Field study
- Literature study

The field study was performed in Tanzania during spring 2009 in Iringa in the Southern Highlands of Tanzania. The literature study was performed as a desktop study on a continuous basis during 2008-2010 at Karlstad University.

Data sources for Phase II were primarily the questionnaires and interviews, and secondarily statistical sources, different official documents and archival records related to the education sector, and the ICT situation in particular in the selected region in Tanzania. The archival records had the form of maps of local geographic characteristics, census records, and organisational charts. Observations, mainly at primary schools, were also a source of input for the second phase.

Phase II focused on exploring the use of mobile telephony in general among head teachers in primary schools in rural areas and identifying the prerequisites and conditions of use of mobile telephony including SMS as a tool for the administration of the education sector in order to answer the research questions for the outline of the proposed EMIS:

- How can the widespread use of SMS be utilised?
- What would such a blended EMIS look like?

Outcome of Phase II:

- a rather detailed picture of the mobile situation at school level for the Iringa region – presented in section 6.2
- a description of the beliefs and attitudes concerning SMS among head teachers – presented in section 6.3
- a description of a hypothetical statistical data collection process according to the aim for the study as a whole – presented in section 6.4
4.4.1 Research Setting and Selection Process

There are a total of 26 regions, 121 districts, and nearly 15,000 primary schools with approximately 10,000,000 pupils enrolled in Tanzania. Phase II was performed in the Iringa region in the Southern Highlands of Tanzania during spring 2009. A rural area was preferred for this study because the challenges, obstacles, bottle necks, and problems concerning data and information transfer were presumed to be more frequent and also of a more severe character. In addition, one can assume that the effects of working ICT would be greater in rural areas because of the scarcity of resources in such areas, even if the present study does not include any implementation to test effects. The Iringa region was selected due to newly established research contacts between Tumaini University and Karlstad University.

There are 1000 primary schools in the Iringa region, divided into eight districts. Three districts were selected for interviews: Iringa Municipal (Urban) – District IM; Iringa Rural – District IR; and Kilolo district – District KD; with a total of 232 primary schools. The selection process was guided by mobile network coverage and this information was provided by a key informant at Tumaini University together with the regional education officer.

Available resources such as time, money, car, and driver allowed for at most 25 in-depth interviews. From the three districts, 24 primary schools were selected with help from key informants at the district education office who had knowledge about the local mobile network coverage and the availability by car. A proportional method was used since the aim was to investigate rural Tanzania in general, not specifically the rural municipal areas (the latter would of course have been much easier).

Four primary schools in Iringa Municipal (Urban) district were selected from a list of 42 primary schools, as these primary schools could be considered to have full mobile coverage. All four head teachers at these schools were available and participated.

In Iringa Rural district, primary schools along the three main roads - Mbeya road, Morogoro road, and Ruaha road - were selected. Of the 144 primary schools in the district, 17 schools were initially selected, including three alternates. Alternate schools were selected due to long transport to the initially selected. Of these 17 schools, five were closed at our visit35 and at one school, the head teacher was absent. In the end, there were 11 primary schools visited and head teachers interviewed in Iringa Rural district.

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35 Wednesday afternoon is cleaning day and the school is closed, but we were not informed about this in advance.
In Kilolo district, out of a total of 46 primary schools\textsuperscript{36}, six schools were chosen including one alternate. Of these six schools, one was closed at our visit. In the end, there were five primary schools visited in Kilolo district. In sum, 20 head teachers participated in Phase II, representing 20 primary schools.

\textbf{4.4.2 The Questionnaire}

Implementing mobile solutions must address several issues such as social, cultural and organisational factors. When deciding upon specific questions for the questionnaire, the XIF framework acted as guideline with its pre-defined set of issues.

The framework guided my knowledge of the prerequisites and conditions for the research, and was also used to analyse the environmental factors. The connection between XIF and a specific question can be traced in the questionnaire as each subcategory and factor in XIF has its own code, which is shown in the left margin next to each question. However, not all questions have their origins in XIF, since XIF is a generic framework.

The questionnaire was a tool to find out the selected respondents’ views, opinions, and perceptions on issues related to mobile telephony using \textit{how} and \textit{why} questions in order to get a deeper understanding for the phenomenon.

The questionnaire consisted of structured, standardised, bounded and unbounded questions. Some questions could be answered using several reply alternatives. In order to capture data that was not covered by the questions, every sub-section of the questionnaire ended with an open question: Would you like to add anything?

The attitude questions were answered using only one alternative as the reply alternatives were designed to be mutually exclusive. The attitude questions had an even number of alternatives (6), to avoid the usual pattern of taking the one in the middle. To get a more reliable answer, most of the attitude questions were divided into three parts:

- Does the respondent have an opinion in this matter?
- What direction is the opinion?
- How strong is the opinion?

Additionally, the questions were formulated to be easy to understand i.e. asked in a ‘simple’ everyday language. They offered fixed alternatives as far as possible and were written with as neutral a wording as possible i.e. not biased, not

\textsuperscript{36} Note that the initial information about the number of primary schools in the Kilolo district, i.e. 46, given from the district education office does not match the information in the questionnaire section A3 i.e. 96.
valuing, and not leading. The questionnaire started with the most important questions, with fixed alternatives and not so complicated and complex issues. (Appendix 4:3 presents the complete questionnaire.) The questionnaire consisted of three different sections:

- Background (A) – The background data is not part of the answer to the research questions but was used to relate the other data to the context.
- Mobile telephony (B)
- Collection of statistical data (C)

Section A: ‘Background’ consisted of five sub-sections:

- National (A1)  
  Served only as a guide for the search for background data.
- Regional (A2) – 35 questions  
  This questionnaire concerning the Iringa Region was personally delivered to the Regional Education Office and answered by the employees at the office without my presence and picked up by my driver two days later.
- District (A3) – 33 questions  
  This questionnaire concerning the three selected districts in the Iringa Region was personally delivered to the District Education Offices and answered by the employees at the office without my presence and picked up by my driver two days later. Contact details were collected to make it possible to check up on answers.
- School (A4) – 37 questions  
  This questionnaire covers background data of the 20 primary schools represented in Phase II. It was answered by the head teacher in interviews. Each school was given a number to provide anonymity for the respondents.
- Teacher (A5) – 9 questions  
  This questionnaire covers background data of the 20 head teachers that were interviewed.

Section B: ‘Mobile telephony’ consisted of one section – 93 questions. This questionnaire covers data concerning mobile telephony. In total, 93 questions were posed to each head teacher.
Section C: ‘Collection of Statistical Data’ consisted of two sub-sections:

- **Collection of statistical data via mail (C1)** – 26 questions
  This questionnaire covers data concerning the collection of statistical data via ordinary mail. In total, 26 questions were posed to each head teacher.

- **Collection of statistical data via SMS (C2)** – 51 questions
  This questionnaire covers data concerning the collection of statistical data via SMS. In total, 51 questions were posed to each head teacher.

The questionnaire for the officers consisted of Regional (A2) and District (A3). The questionnaire for the head teachers consisted of: Background – school (A4) and teacher (A5) level – 46 questions; Mobile telephony – 93 questions; Collection of statistical data via mail (C1) and via SMS (C2) – 77 questions. In total, 217 questions were posed to each respondent i.e. 20 head teachers, making a total of 4340 answers, which constitute the main empirical basis for the analysis in Chapter 6.

The standardised questions make it easier to compare and compile the answers. All of the answers were compiled by an independent person in order to make the process as neutral as possible. (All compiled data have been published in a working paper, Wicander 2011.) When compiling the answers, the numbering of section B was changed slightly so the 93 questions were compiled into 83 answers. When compiling the answers from section C2, the 51 questions were divided into 53 answers.

The final version of the questionnaire was written in Tanzania to increase the validity of the questions due to insight into the local society and the local conditions. The questionnaire was tested at Tumaini University with one senior researcher, one junior researcher and a group of students, all of them formerly teachers. The researchers were European, while the students were Tanzanians. They were asked to check language, understanding, relevance, knowledge level, ‘asking the right thing in a correct way’, i.e. to check if the questions were adapted to the target group and to the context.

During the interviews, reliability was ‘tested’ by asking the same question but in varying ways and also asking ‘Why’ or ‘Why not’. In order to get a high percentage of answers, the respondents were ‘forced’ to answer all the questions by using the alternative ‘Don’t know’.

My ambition during the interviews was to act as an ‘observer’ not influencing the answers from the respondents, but, obviously, the wording of the questions about an hypothetical SMS-based system might have influenced
the answers on that particular part of the questionnaire. The respondents might have been lead to think in a certain way rather than "freely" consider such a system. The risk that they completely misunderstood the questions is, on the other hand, very small as I was present and explained whenever a respondent was in doubt of the interpretation or showed signs of misinterpretation.

A word concerning generalisation may be in place. The limited number of respondents does not allow generalising the proportions of the collected opinions to all head teachers in Tanzania. Rather, it is the ‘process’ leading up to the proposal in the final section of the analysis that is replicable to another context, not the suggested solution in detail and definitively not the statistics on ‘rural’ head teachers’ views and experiences with mobile phones even if some results would justify to shorten future investigations on certain points.

4.4.3 Interview Setting

This study used a combined interview technique: an oral and written technique. It used an extensive questionnaire, but chose to ask the questions orally due to language barriers. The oral form during the interview was helpful to explain difficult issues, to avoid misunderstandings, and to persuade the respondent to fill in the questionnaire fully, and to have control over the situation so no one interfered with the respondent and influenced the answers.

The interviews were performed during an unlimited period of time, to give the respondents a possibility to express their own thoughts and to add comments. Each respondent was interviewed one at a time with the same procedure for everyone: interviewed in their own environment, without a tape recorder, with an interpreter, asking all the questions in the same way, wording and order, following the form and writing down all the answers in the questionnaire.

I distributed the questionnaire myself to the respondents and I decided to be present in case of questions to get a higher percentage of answers. During the first interview, I noticed that some of the questions demanded further explanations both in English and in Kiswahili. Instead of letting the respondents read and fill in the questionnaire by herself/himself, I read out the questions and also wrote down the answers. I sat next to the respondents so we both looked at the form together. This also made it possible for the respondents to read the question by herself/himself if my pronunciation was unclear. The driver also acted as an interpreter, as some of the responders were not fluent in English. The driver was introduced into the research issue and
into the questionnaire. He was present at all interviews and assisted me when needed.

All of the interviews were performed at the head teacher’s office of each primary school except one, which was performed at the house of the head teacher. All interviews opened up with a presentation of myself, my background and my research, as well as letters of recommendation from Tumaini University, Karlstad University and the district education officer. Then followed a presentation of the visited primary school, the employees and the pupils.

As there was an extensive questionnaire with a total of more than 200 questions, I decided to start with something quite familiar: the use of mobile phones (Questionnaire B), moving on to the most complex part on the collection of statistical data (Questionnaire C), finishing with Questionnaire A, the most simple form and questions, when all parties (myself, the driver and the respondent) were getting tired.

In order to make the atmosphere less formal and to provide a relaxed and non-stressful situation, I tried to be quite informal and to be encouraging, as the questionnaire was extensive and sometimes felt exhausting. As an example, one of my questions, the one about ‘number of wives’, always generated good laughs as well as the questions about ‘beeping’.

I decided to promise the respondents anonymity in order to have them be more honest and give straightforward answers. This anonymity does not apply to me as researcher, so that I am able to check and confirm responses. Neither are the respondents anonymous to their superiors, the district education officer, as there was a need for an introduction letter.

4.5 Analytical Process

The analytical process includes procedures and techniques to categorise, classify and interpret the data (Strauss & Corbin 1998). This study has a descriptive and explorative character and it needs an approach that can handle the complexity of the research issue. The research data is analysed using systems thinking and a systems approach. The system approach contributes with a general systemic view and with terminology derived from systems theory.

In every social situation, a problem – the diagnosis – and its treatment are important parts of the situation and cannot be extracted from the social situation; they have to be internalised and also need to be studied on a higher level of abstraction. The problem must be seen as a phenomenon of something: lack of computers and the Internet cannot be seen only as a technological problem. Instead, the social conditions need consideration and a socio-technical
approach is therefore applied to this study. These approaches guide the analytical process, focusing on effectiveness of delivery of government services, including a sort of technology deterministic view that assumes that e-government systems are needed and includes the objective of analysing why a system has failed or succeeded, measuring the failure or success, and suggesting what can be learned from this.

The analytical process in this study has been divided in four different steps:

- The first step was an analysis of the present EMIS, mainly emanating from data in Phase I, but also from Phase II questionnaire C1. This ‘step’ is presented in section 6.1.
- The second step consisted of the analysis of the usage pattern and profile of mobile phones among head teachers, both private and work-related use. The analysis emanated from data in Phase II, questionnaire B and is presented in section 6.2.
- The third was an analysis of head teachers’ views on a hypothetical SMS-based data collection system. This analysis was based on data from questionnaire C2. This step is presented in section 6.3.
- In the fourth and last step, I returned back to EMIS, but with a future perspective on supporting vs. hampering structures, discussing if and how the mobile can effectively be used and adapted as an administrative tool in the education sector. This fourth analysis starts from the 20 head teachers’ individual perceptions but the identified structures are presented on an aggregated level and on a group level. The data are discussed on school, district, regional and national levels, and are also related to an international context. In line with a systems approach, the analysis relates the data to e-government solutions in developing countries in general and to mobile solutions for e-government in particular, as well as to MIS solutions in developing countries in general and to EMIS solutions in particular. This fourth step is presented in section 6.4.

4.5.1 Description Models

The analytical process comprises two description models; a change model adapted from Leavitt (1965) and a process model adapted from Heeks (2006). These models are general, descriptive analytical models.

Complex systems need to be divided and abstracted in order to facilitate an analysis. In line with a systems approach and a socio-technical view, EMIS is divided in the analysis into two subsystems – a social and a technical subsystem.
The social subsystem includes human aspects of interest, e.g. responsibilities and economic matters, and the technical subsystem covers technical aspects including different technical devices, e.g. different types of ICT, both ‘old’ and ‘new’ ICT.

A model from Harold Leavitt (1965) is often used to illustrate a socio-technical view. Leavitt’s model can be regarded as a dependency model applied to organisations. According to Leavitt, an organisation can be constituted of four different systems with connections to each other: task, structure, technology, and people. People can be divided into different groups: users, experts, and management. The four different systems are all mutually dependent on each other and mutually influencing each other. The model illustrates the mutual dependency between the subsystems when a change is implemented. A change within one of the subsystems will result in a retaliatory change within the other subsystems. In other words, an organisation can be seen in a holistic way and composed of different systems that alternately influence each other.

Leavitt explains what the introduction of ICT can imply:
“…the introduction of new technological tools – computers, for example – may cause changes in structure (e.g. the communication system ...), changes in actors (their numbers, skills, attitudes and activities), and changes in performance or even definitions of task, since some tasks may now become feasible of accomplishment for the first time, and others may become unnecessary…Clearly, most efforts to effect change, whether they begin with people, technology, structure, or task, soon must deal with the others…”
(Leavitt 1965:1145)

In this study, Leavitt’s categorisation is used when describing the present EMIS in section 6.1, as well as the proposed EMIS in section 6.4. In this study ‘activities’ and ‘actors’ are used instead of ‘task’ and ‘people’, and ‘organisation structure’ rather than merely ‘structure’ as the latter word is used for many other purposes here. It is imperative that the subsystems are bound together in an entirety, as the Leavitt model indicates; see the adaptation in Figure 4.5.1. I call the model the Change Model because I use it for analysing the changes between the present EMIS and proposed EMIS. Two dimensions are added in Chapter 6, namely time and space: the time dimension include issues such as when and how long, whereas the space dimension includes issues such as roads and climate.
Additionally, the description of EMIS and the statistical data collection build on Heeks’ process view (2006). Heeks’ (2006:6) model includes eight different tasks. I suggest an additional task that precedes these eight, a ‘pre-capture’ task, which has shown to be relevant when analysing EMIS within the education sector in Tanzania. Also, I have summarised the different tasks in Heeks’ model after ‘capture’ (input, processing, store, output, decision, action, communication) into a ‘post-capture’ subprocess, which here includes three activities (submission, data processing, feedback). For an illustration of this process, see Figure 4.5.2.

**Figure 4.5.1** Change Model (adapted from Leavitt 1965)

**Figure 4.5.2** Three-stage Data Capture Process Model
Hence, the description of the data collection process in this study comprises three main subprocesses:

• Pre-capture - distributing the data forms
• Capture - gathering the ‘raw’ data
• Post-capture - submission, data processing, feedback

These subprocesses are thus divided into five activities when analysing the present EMIS in section 6.1. Later on however, when the proposed system is described in section 6.4.1, eight activities are used. Still, this eight activities can be classified within the five just listed.

The statistical data collection process can be viewed as a sequence of activities. The interface between the different organisational levels represents these activities. The statistical data collection is mainly a cyclical process e.g. head teachers are sources of data and also recipients of information via an annual report. The MoEVT is the recipient of data and the sender of information in the form of the annual report.

4.5.2 Analytical Models

The analytical process comprises three analytical tools (framework, model, approach), namely XIF, Triple A, and, from Chapter 3, the “Seven Aspects – an Approach Towards Success”. These three analytical models are developed specifically for this study.

XIF - the eXtended Sustainable ICT Framework

One of the applied analytical tools is XIF: the eXtended Sustainable ICT Framework, which emanates from SIF: the Sustainable ICT Framework, developed by Sundén and Wicander (2006). XIF is a generic framework for analysing factors influencing sustainable ICT use with focus on rural areas in developing countries. XIF was used as a guide for developing the questionnaire for this study, as well as a tool for the analysis.

XIF is used to describe and explain the empirical data and to analyse if the necessary factors for a sustainable mobile solution are present; a ‘should’ situation. The point of departure for XIF is that there is a need for different resources or capitals to start, run, support and maintain an ICT activity. These capitals are needed on different levels: individual, local, regional, national, international i.e. micro, meso and macro levels. Environmental and contextual factors can be studied using XIF as a guideline and analytical framework stating necessary but not necessarily sufficient resources. This comment might seem
obvious, but when thinking of the failures of ICT and IS and MIS projects in developing countries, there is still a need to look into these issues.

Aside from a resource dimension, a time (e.g. how long) and a space dimension is needed as well – the space dimension is here understood as ’rural’ areas; it implies a rural setting.
See Appendix 4:4 for a description of XIF.

**Triple A – Access, Attitude, Awareness**
The data is also analysed on a micro level, using the conceptual model Triple A. Triple A is used to analyse the usage pattern of mobile phones, both private use and work-related use, among head teachers on an individual level, including their personal, subjective understanding, views, opinions and perceptions.

The Triple A model consists of three ‘A’ concepts: Access, Attitude, Awareness, which can be defined with terms that are central on an individual level: Access (economy, equipment, infrastructure, ownership and usage), Attitudes (complexity, norms and values, self esteem and self confidence, trust, and usefulness) and Awareness (experience, knowledge and skill).

The three ‘A’ concepts are related to each other in a systemic way; as a system with mutual interdependency and mutual influence between them. The Triple A model is developed in order to capture both social and technical aspects i.e. socio-technical aspects in a user perspective, including both ‘hard’ and ‘soft’ structures, but has its main focus on ‘soft’ issues.

- Human and social aspects and structures (soft) via attitude and awareness
- Technical aspects and structures (hard) via access
See Appendix 4:5 for a description of Triple A.

**Seven Aspects – an Approach Towards Success**
Additionally, the proposed solution is analysed using an approach for e-government solutions in developing countries as described in Chapter 3. The approach involves a multidimensional view and consists of seven aspects to consider in an e-government system implementation. The approach emanates from the contextual complexity that is related to implementation of an e-government system in a developing country context.
5 Empirical Data

This chapter covers the empirical data from the two phases including the field studies. It includes empirical data from the first phase of this study, including the field study performed in Tanzania in October – November 2007. The chapter also covers empirical data from the second phase of this study including the field study performed in Tanzania in June 2009, where head teachers were interviewed and the minor field study in spring 2009 where information from employees at two district offices were collected.

5.1 Phase I

This section covers major parts of the empirical data of the first field study performed in Tanzania in October – November 2007. The section starts with information about EMIS, the Education Management Information System and ends with a description of the statistical data collection process.

5.1.1 The Education Management Information System

EMIS, the Education Management Information System, is a computerised system for managing and administrating the Tanzanian education sector. According to the Information and Communication Technology Policy for Basic Education (MoEVT 2007), EMIS is a system for collecting, processing, utilising, organising, storing and disseminating education data and information with the intention to serve educators at all levels in the education sector (URT 2006; MoEVT 2007).

EMIS is coordinated from the MoEVT and its Physical Planning and Maintenance department together with the department for Policy and Planning from the Monitoring and Evaluation Section.

The EMIS team includes four statisticians, one economist, and one head of the unit. Two principal education officers are also connected to the unit. In charge is the head of Physical Planning and Maintenance under the Permanent Secretary.

The costs for EMIS 2006/2007 were projected to be approx. 1.0 – 1.3 Million Tshs (URT 2006:40-42).

EMIS has four main purposes (URT 2006):

- Administration of schools (students, teachers, registers, budget)
- Administration of the education system (equipment, planning)
- Communication (to reduce the amount of paper reports)
- Document handling
The focus of the system is to provide administrative support to schools, including the management of statistical reporting as well as auditing and reporting functionality. The key objective is to improve data management and the use of information in order to improve the overall management of the education sector. The computerised EMIS has been implemented in most district offices, but the Internet is still lacking in most districts (ET p.c. 2007).

According to Finne (p.c. 2007), the actual EMIS includes a user interface and a central database for storing data and the actual EMIS is only a part of the planned EMIS. A selected number of data are presented once a year in the so-called BEST (Basic Education Statistics in Tanzania) report.

EMIS deals with pre-primary, primary, and secondary school statistics. There is also a parallel EMIS for higher education (Uimonen p.c. 2007). Those EMIS are not integrated today but there are plans with UNESCO for an ESMIS (Education Sector MIS) for the whole education sector (ibid).

The link between EMIS and higher institutional levels is non-existent due to an insufficiently recognised role. There is no integration with other MIS such as the IFMIS (Integrated Financial Management Information System), and there is a lack of technical as well as managerial human capacity in order to implement an integrated MIS (ET p.c. 2007).

On a local level, there are plans for EMIS functionality to be integrated with the existing system. There is a need for a well-integrated interface that allows EMIS to integrate with other school management systems (Uimonen p.c. 2007).

### 5.1.2 Statistical Data Collection Process

EMIS is used for the collection of statistical data within the education sector. MoEVT (Ministry of Education and Vocational Training) together with the EMIS team are responsible for collecting educational statistical data. A decentralisation process to MoLG (Ministry of Local Government) is ongoing (ET p.c. 2007). There is also an ongoing collaboration with UNESCO and its Institute of Statistics (UIS) (ibid).

The instrument for collecting statistical educational data at the primary school level is a standard statistical questionnaire including ten groups of questions (see Appendix 5:1). The 10-page questionnaire, the paper-based form that provides the basic data, is distributed annually in February to the 14 700 primary schools. The formulation of the questionnaire is decided by the EMIS team together with the stakeholders (e.g. UNESCO) once a year. The questionnaires are distributed by members of the EMIS team who travel in
The questionnaire is filled in manually by the head teacher at each primary school. It is then submitted to the Ward Education Coordinator who checks and verifies that the form is correctly filled in. The Ward Education Coordinator brings the questionnaires to the District Education Officer where all the forms from the district primary schools are summarised manually by the district education officer and then the summary is sent by ordinary mail or handed over in person to the MoEVT for further data processing by the EMIS team. The instrument for the district summary includes the same ten groups of questions except the first, which in the district summary, focuses on the entire district including data about district, region, number of government and non-government schools, religious affiliation, and location i.e. urban or rural (see Appendix 5:2). The original questionnaires are stored at the district education office. The collection process is performed during April. The collection process is performed without delay due to threats of withdrawal of funding from the ministry. The collection is financed by each district education office (ET p.c. 2007).

The received data are processed by EMIS at the MoEVT in Dar es Salaam between April and October. The EMIS team types a selected amount of data manually into the data base but not all input data are processed (ET p.c. 2007): there are huge amounts of data that are not processed (Uimonen p.c. 2007). The most obvious problem with the data sheets is misunderstanding or incorrect answers concerning ages (ET p.c. 2007). According to Persson (p.c. 2007), the questionnaire is complicated.

The processed data are published in an annual report, BEST (Basic Education Statistics in Tanzania) (ET p.c. 2007).

Feedback is delivered to the district education offices in a district report (ET p.c. 2007). The DEO has a central role in the statistical data collection process (Smithmanis Dry p.c. 2007).

5.2 Phase II

This section covers empirical data from the second phase of this study, including the second field study which was performed in the Iringa region in the Southern Highlands of Tanzania during spring 2009. There are 1000
primary schools in the Iringa region divided into eight districts. Three districts were selected for this study: Iringa Municipal (Urban), Iringa Rural, and Kilolo district. From these three districts, 24 primary schools were selected. (For details about the selection process and other methodological issues see Chapter 4.)

From the selected 24 primary schools, four were excluded: three because they were closed at our visit and one because the head teacher was not available. Thus, 20 head teachers participated in Phase II.

In total, 217 questions were posed to each of the 20 head teachers, making a total of 4340 answers, which constitutes the empirical basis of the present study.

An additional field study, performed by two students at Karlstad University in March–May 2009 with me as expert advisor (giving the research questions and data collection instruments to use), is presented in brief in section 5.2.7, “DEO Study”. This study is complementary to the main study in Phase II and focuses on employees at district education offices in the Iringa Region37.

5.2.1 Regional and District Background Data – A2 and A3 Questionnaire

The Iringa Region, considered a rural area, is one of the 26 regions in Tanzania, divided into eight districts and located in the Southern Highlands. Answers to the questionnaire concerning the Iringa Region, A2, and A3 which concerned the three selected districts in the Iringa Region are summarised in Tables 5.2.1-5.2.4 together with national figures38.

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37 This study was conducted by Dahl & Lövgren and published at Department of Media and Communication, as a bachelor thesis.
38 Statistical processing of the data is usually not meaningful with less than 40 respondents (Ejvegård 2009), as one respondent gives a great effect in percentage. Instead it is better to communicate these data in a descriptive way, but at the same time to express data in percentage is an ‘easy/quick/efficient’ way to ‘high-light’ the findings.
| Table 5.2.1 Demographic and Infrastructure Data on National, Regional and District Level |
|--------------------------------------|-----------|-----------------|-----------------|-----------------|-----------------|
| **Demographic Data**                | Tanzania  | Iringa region   | Iringa Municipal district | Iringa Rural district | Kilolo district |
| Population                          | 37.6 million | 1.5 million | 135 000          | No data          | No data          |
| Average age (years)                 | 45        | 53             | No data          | 52              | No data          |
| GDP (Euro) *                        | 229/287 USD | 356/605 000Tshs | 115/196 000Tshs  | 171/290 000Tshs | No data          |
| **Physical Infrastructure Data**    |           |                |                  |                 |                 |
| Post offices                         | 437 (1 per 87 000 people) | 24 (1 per 62 120 people) | No data          | No data          | No data          |
| Banks                                | No data   | 4 banks 14 branch offices | No data          | No data          | No data          |
| Electricity (%)                     | 2 - rural areas resp. 39 - urban areas | No data          | No data          | No data          | No data          |
| Landline phones                      | 138 227 lines - 4 lines per 1,000 272 people per line (2006) | 2424 lines 613 people per line | No data          | No data          | No data          |
| Mobile phones (%)                    | 21        | No data        | No data          | No data          | No data          |
| Internet (%)                         | 1         | No data        | No data          | No data          | No data          |

*In June 2007: 1700 Tshs ~1 Euro and 1200 Tshs ~1 USD*
The staff at the District Education Office was asked to give their opinion on the physical infrastructure in their respective districts. See Table 5.2.2 for a presentation of these opinions.

### Table 5.2.2 Opinions about Physical Infrastructure on District Level

<table>
<thead>
<tr>
<th>Opinions about physical infrastructure</th>
<th>Iringa Municipal district</th>
<th>Iringa Rural District</th>
<th>Kilolo district</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads (approx. 8% tarmac roads)</td>
<td>“Passable”</td>
<td>“Good”</td>
<td>“Available”</td>
</tr>
<tr>
<td>Electricity</td>
<td>“Available”</td>
<td>“Poor”</td>
<td>“Available”</td>
</tr>
<tr>
<td>Postal service</td>
<td>“Good service”</td>
<td>“Poor”</td>
<td>“Available”</td>
</tr>
<tr>
<td>Bank service</td>
<td>“Good service”</td>
<td>“Worse”</td>
<td>“Available”</td>
</tr>
<tr>
<td>Public transportation</td>
<td>“Available”</td>
<td>“Fair”</td>
<td>“Non available”</td>
</tr>
<tr>
<td>Landline phone</td>
<td>“Available”</td>
<td>“Worse”</td>
<td>“Non available”</td>
</tr>
</tbody>
</table>

Understanding the general status of the physical infrastructure is necessary in order to estimate the relative advantage of electronically transferred messages as compared to physically transported documents. See Table 5.2.3 for physical infrastructure data in primary schools on regional and district levels.

### Table 5.2.3 Physical Infrastructure in Primary Schools on Regional and District Level

<table>
<thead>
<tr>
<th>Physical Infrastructure Data in Primary Schools</th>
<th>Iringa Region</th>
<th>Iringa Municipal district</th>
<th>Iringa Rural district</th>
<th>Kilolo district</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity (%)</td>
<td>4</td>
<td>45</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Landline phones (%)</td>
<td>2</td>
<td>14</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mobile phones (%)</td>
<td>70</td>
<td>100</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Computers (%)</td>
<td>1</td>
<td>86</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Internet (%)</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Data concerning education on national, regional and district levels are presented in Table 5.2.4.
### Table 5.2.4 Education Data on National, Regional and District Level

<table>
<thead>
<tr>
<th>Education Data on National, Regional and District level</th>
<th>Tanzania</th>
<th>Iringa region</th>
<th>Iringa Municipal district</th>
<th>Iringa Rural district</th>
<th>Kilofo District</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Primary schools</td>
<td>~15 000</td>
<td>1000</td>
<td>42</td>
<td>144</td>
<td>96</td>
</tr>
<tr>
<td>No. of Pupils</td>
<td>~10 000 000</td>
<td>382 000</td>
<td>22 430</td>
<td>63 610</td>
<td>50 937</td>
</tr>
<tr>
<td>No. of Pupils per school (average)</td>
<td>382</td>
<td>534</td>
<td>442</td>
<td>531</td>
<td></td>
</tr>
<tr>
<td>No. of Teachers</td>
<td>8512</td>
<td>758</td>
<td>1472</td>
<td>938</td>
<td></td>
</tr>
<tr>
<td>Female teachers (%)</td>
<td>51</td>
<td>76</td>
<td>52</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Pupil/teacher ratio (average)</td>
<td>56</td>
<td>45</td>
<td>30</td>
<td>43</td>
<td>54</td>
</tr>
<tr>
<td>No. of Head teachers</td>
<td>1000</td>
<td>42</td>
<td>144</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Female Head teacher (%)</td>
<td>12</td>
<td>36</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>GER – Gross Enrolment Ratio (%)</td>
<td>~113</td>
<td>98</td>
<td>98</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Drop-out rate (%)</td>
<td>17</td>
<td>12</td>
<td>9</td>
<td>0.4</td>
<td>3</td>
</tr>
<tr>
<td>Transition rate (%)</td>
<td>49</td>
<td>64</td>
<td>82</td>
<td>No data</td>
<td>46</td>
</tr>
<tr>
<td>No. of Administrative Staff</td>
<td>8 DEO</td>
<td>138 WEC</td>
<td>9 DEO</td>
<td>12 DEO</td>
<td>1 DEO</td>
</tr>
</tbody>
</table>

**Iringa Municipal District**

BEST 2006 shows a total GER of 106.6 per cent and a total NER of 87.5 per cent.

**Iringa Rural District**

BEST 2006 shows a total GER of 116 per cent and a total NER of 100 per cent.

**Kilofo District**

BEST 2006 shows a total GER of 115 per cent and a total NER of 98 per cent.
Finally, concerning identification numbers of the districts, wards and schools, two district education officers state there is an ID for the district, one that there is an ID for the ward, and two that there is an ID for the schools, a so-called school registration number.

5.2.2 Personal Background of Head Teachers – A5 Questionnaire

This section summarises general background data (A5) of the 20 head teachers from the three districts that were interviewed in this study. Below is a summary of the answers showing major trends. There is a list of the respondents but as they are promised anonymity this list is not published.

The group of respondents can be characterised in the following way:

- 15 male and 5 female head teachers
- Ages ranged in the group from 29 – 54
- Experience as head teacher varied from 3 months to up to 17 years but lay typically between 2 and 4 years
- Income per month was reported in the largest group (6) to be 400 000–427 000 Tshs per month (equivalent to 235 - 251 Euro in June 2009)
- All (20) of the respondents spoke Kiswahili, and 18 English.

5.2.3 Primary School Background Data – A4 Questionnaire

This section covers background data (A4) of the 20 primary schools presented in the study. Below is a summary of the answers showing major trends together with illustrative comments from the respondents. School, Pupil and Teacher Data of the selected schools:

- Total number of pupils: 13 277
- Number of pupils per school: 216 – 1429
- Total number of teachers: 355
- Number of teachers per school: 8 – 35
- Number of male teachers per school: 1 – 29
- Number of female teachers per school: 1 – 20
- GER (Gross Enrolment Ratio): 86 % – 100 %
- Drop-out rate: 0 % - 10 % “Three times a week there are free lunches → no drop-out.”
- Transition rate: 26 % – 100 %

On the question of how grants are paid/disbursed, 9 schools reported that the DO (District education Officer) makes a deposit into the school bank account
and 8 schools reported that the grants are transferred from the MoEVT (Ministry of Education and Vocational Training) in Dar es Salaam.

On the question on when grants are paid/disbursed, 8 report ‘quarterly’ i.e. 4 times a year; 7 schools report 3 times a year; 3 schools report 2 times a year; while 2 schools answer that it “depends on when the DO receives deposits”.

A majority of the schools (15) state that they get information in advance, i.e. before the grants are paid/disbursed, while 4 mention that they get information afterwards. The information is delivered mostly as a letter delivered by hand from the DO as mentioned by 10 schools, as a letter from the DO delivered by post stated by 5, at a meeting with the DO (2), via a call (1) or as a bank statement (1). One school mentions that there are regular HT-meetings (HT – Head Teacher) four times a year at the district office.

Distance to the DEO (District Education Office) ranged from 1 to 90 km. Time spent on travelling to DEO during both the dry and rainy season ranged from 10 minutes to up to 1 day. One respondent mentions that “Sometimes I have to spend the night there.” For transportation, mostly bus and dalla-dalla are used. The transportation fee ranges from 250 Tshs to up to 10 000 Tshs. One respondent mentions that the school pays the fee.

**Post and Bank Services**
The distance to the nearest post office ranges from 0.5 to 25 km. During the dry season, it takes from 5 minutes to up to 3 hours to reach the post office. During the rainy season, it can take a bit longer, as indicated by these figures: from 5 minutes to up to 5 hours.

A majority, 11, walk to the post office; the rest go by bike, by dalla-dalla (small buses privately owned), or by public bus. (Several options were mentioned by each respondent.) The fee for the transportation ranged from 250 Tshs to up to 1000 Tshs. A majority paid the fees themselves. The respondents stated that delivery time for a letter sent to Dar es Salaam ranged from 2 days up to 1 week. A majority (18) stated that the post service is reliable.

The distance to the nearest bank office ranges from 1.5 km to up to 90 km. During the dry season, it takes from 10 minutes to up to 1 day to reach the bank office. During the rainy season it can take a bit longer. Most of the respondents go by bus (8) or dalla-dalla (8), the rest by bike or on foot. One respondent mentions that there is no dalla-dalla at his place, while another one uses both bike and dalla-dalla. The fee ranges from 250 Tshs up to 10 000 Tshs.
The fee is paid by the school at 6 schools, and one respondent mentions that “Sometimes school pays, sometimes myself.”

Power supply
A majority (13) of the selected schools was not connected to the national power grid (TANESCO) although two (2) expected to get connected soon. These 13 schools stated that the distance to the power grid from the school ranged from 100 meters to up to 57 km. All 6 schools connected to the power grid mentioned that they had electricity 7-8 hours/day. The electricity service was stated as: ‘Regular’, ‘Sufficient’, and ‘Reliable’. The schools’ spending on power per year ranged from 100 000 Tshs to up to 700 000 Tshs for 1 school, but at this school the teachers were also connected and paid for their share. One (1) school mentioned that they used solar power for night lessons and charging of mobiles.

ICT equipment
None of the selected schools had either a landline or a mobile phone. A majority (18) of the head teachers answered that there were no computers at their schools but one (1) mentioned that a “computer will be delivered in August”. Of the two (2) schools with computers, one (1) stated that they used it for “typing – keeping data”, and the other one (1) “one new PC – haven’t used yet – write letters.” None of the schools had an Internet connection.

On the question ‘To what extent do you consider that mobile phones are a potential to the communication infrastructure (as a complement to fixed telephony and postal service)?’, a majority (15) answered ‘Very high’.

Concerning the document Information and Communication Technology Policy for Basic Education, less than half of the respondents were aware of this document and one respondent commented that: “Most don’t know.”

On the final open question ‘Would you like to add anything?’ the following comments were given:

“DEO have to supply school phones”
“More education about new technology. Updated curriculum. More technical equipment.”
“The main problem is lack of electricity.”
5.2.4 Mobile telephony – B Questionnaire

This section covers data concerning mobile telephony. Below is a summary of the answers showing major trends together with illustrative comments from the respondents.

Access and Usage

All 20 respondents used a mobile phone. The length of usage ranged from 1 year (since 2008) to up to 8 years (since 2001). A majority of the respondents stated that they could manage to use the mobile phone ‘well’. All 20 respondents had access to a mobile phone through owning one.

A majority mentioned that they had more than one SIM card. For most of the respondents, the reason for having more than one SIM card was related to the quality and/or availability of the network: e.g. “Celtel had no network here so I need another operator – Vodacom”, “Network differs depending on operator - bad network=switch card”. Economic reasons were also stated: “Depends on whom I will call; different friends have different SIM-cards”, “…to avoid expenses/ same operator as I call”.

Several functions were used among the respondents. The five most popular were ‘clock’, ‘calculator’, ‘calendar’, ‘alarm clock’ and ‘games’.

Several services were used among the respondents. All 20 respondents used the basic services, ‘call’ and ‘SMS’. Among other services, ‘beeping’ was the most popular.

Mentioned benefits to using a mobile phone were for the majority ‘easy to use’; ‘fast’ followed by ‘has a variety of services’ and is ‘cheap’.

Among disadvantages, ‘expensive’ was mentioned by a majority, followed by ‘health issues’ (radiation, noise). Others mentioned “Encourage thieves – they can come to carry out their act.”

Economy

The amount of money spent per month on the mobile phone for airtime ranged from 5000 Tshs to up to 45 000 Tshs. One respondent added that “5000 Tshs is official which is paid by the school.”

The amount of money spent per month on the mobile phone for charging ranged from 0 Tshs (at home) up to 5000 Tshs.

The amount of money spent per month on the mobile phone for reparations ranged from 0 Tshs to up to 10 000 Tshs.
Concerning other costs on their mobile phones, a majority answered that they did not know. One respondent added: “Changed battery many times – after a year.”

All 20 respondents used pre-paid cards, also called ‘vouchers’.

On the question concerning whether the benefits of the mobile phone justify the cost, all but one gave a positive answer.

Ownership
The period for ownership ranged from 1 year to up to 8 years, with a majority stating 3-4 years.

Concerning purposes for owning a mobile phone, a majority stated ‘Communication/ phone family and friends’.

Half of the group bought their mobile phone in a ‘regular store’ and the other half by a ‘street vendor’. One comment was: “Street vendor - not durable”.

A majority of the mobile phones were new with only one reported to be second-hand. The respondents paid between 25 000 Tshs and 350 000 Tshs for their mobile phone.

The most common brand was Nokia followed by Motorola and Ericsson. A majority state that their mobile phone is an original.

A majority owns one mobile phone, while a third owns two mobile phones. The reason for owning more than one phone was “Always be available”; “One phone/ SIM-card”; “Technical errors”; and “My wife has one”.

Calling
The frequency of making calls ranged from 6 times a week to up to 15 times a day. The main reason for making calls was ‘Relationship’, as answered by all of the respondents, together with work-related calls. Further responses included ‘Emergencies’; ‘Private businesses’; and ‘Substitute for transport’.

As for the receiver(s) of the call(s), the five most popular were ‘Family’; ‘Friends’; ‘Colleagues at my school’; ‘Colleagues at other schools’; and ‘Parents’.

The frequency of receiving calls ranged from 1 time a day to up to 20 times a day. The respondents received calls from ‘Family’; ‘Friends’; ‘Colleagues at other schools’; ‘Colleagues at my school’; and ‘DEO’.
Beeping

The frequency of beeping\(^{39}\) someone ranged from 1 time a month to up to more than 10 times a day. ‘I don’t beep’ was answered by 4 respondents.

The ones the respondents mostly beep were ‘Friends’; ‘Family’; ‘Colleagues at my school’; ‘Colleagues at other schools’; and ‘School board’. Comments: “You never beep DEO, WEC or Medical service”.

For the majority, the reason for beeping was ‘a shortage of airtime/ out of money/ no vouchers available’.

The frequency of receiving beeps ranged from 10 times a month to up to 20 times a day. Comment: “Younger sister and brother”

The five most cited contacts from whom the respondents received beeps were ‘Friends’; ‘Family’; ‘Colleagues at my school’; ‘Parents’; and ‘Private Businesses’.

SMS

All 20 respondents used SMS. The five most frequently mentioned reasons were ‘Cheap’; ‘Easy to use’; ‘Fast’; ‘Private’; and ‘Secure’.

Half of the group stated that they managed to use SMS ‘Well’. Concerning opinions about SMS, a majority expressed that ‘160 characters is too short’; followed by: ‘Difficult to make choices’; ‘Don’t get a receipt e.g. Message delivered’; ‘Expensive’; ‘Is delivered to the wrong person’; and ‘Language problems’.

The frequency of sending SMS ranged from 20 times a month to up to 15 times a day.

The respondents sent SMS to ‘Family’; ‘Friends’; ‘Colleagues at my school’; ‘Colleagues at other schools’; and ‘Parents’. Added comments were “I don’t send SMS to DEO”; “I don’t write to DEO and parents – I phone.”

The frequency of receiving SMS ranged from 3 times a week to up to 15 times a day.

The respondents received SMS from especially ‘Friends’; ‘Family’; ‘Colleagues at my school’; ‘Colleagues at other schools’; and ‘Parents’. Added comment: “Not from DEO.”

\(^{39}\) Beeping is synonymous with ‘missed-calling’ and ‘flashing’. Beeping is using one ring signal, also called ‘flashes’; the caller hangs up after one ring signal leaving intentional missed-calls

This use of ‘calling party pays’ is an example where users exchange a predefined message over the network without paying any tariff (Donner 2008). Because a missed-call is not charged, it allows low-income users to free-ride the established mobile infrastructure. It is the least costly form of digital communication. Beeping is an example of adaptation and appropriation of functionality (Donner 2007; Sey 2007; Donner 2008).
Access of Mobile Phones at School i.e. Work-related Access
All of the respondents answered that the staff at their school had access to mobile phones and a majority of the respondents stated that every teacher at their school owned at least one mobile phone. There were only 3 schools where not all of the teachers owned a mobile phone.

At a majority of the schools, there was no official list distributed from the district office with phone numbers to other schools. Added comment was “I’ve made my own”.

Usage of Mobile Phone at School i.e. Work-related Usage
A majority of the respondents made and received calls related to their work for the purpose of ‘Meetings/seminars/conferences’.

A majority of the respondents sent SMS related to their work for the purpose of ‘Meetings/seminars/conferences’. Added comments: “SMS instead of calling to reduce cost”; “Same purpose as calling but when out of money”.

A majority of the respondents received SMS related to their work for the purpose of ‘Meetings/seminars/conferences’.

The five most popular purposes for beeping related to work were: ‘Meetings’; ‘Emergency’; ‘Sports/activities’; ‘Official issues’; and ‘Examinations’. ‘Lack of money’ was also mentioned.

The five most common purposes for work-related beeps received were ‘Meetings’; ‘Emergency’; ‘Sports/activities’; ‘Problems/family problems’; ‘Official issues’; and ‘Examinations’. ‘No credit’ was also mentioned. Added comment: “They want to get in contact”.

A majority of the respondents stated that they pay themselves for the work-related use of a mobile phone (calls/ SMS/beeps). One respondent answered “Myself and school (by guessing)”.

Charging
For charging the batteries for their mobile phones, most respondents did that at home. Adding comments were: “Solar power – has my own, 600 000 Tsh.”, “Solar power – owns one, 800 000 Tsh. During rain season no solar power.”

Further, respondents used ‘Certain shops’ or charged the battery at ‘School’.

In meters/kilometers (km), the distance to the charging location ranged from 200 meters to up to 9 km. In time, it took from 5 minutes to up to 2 hours. Added comment was: “By foot, bike, car, dalla-dalla.”

The fee per time for charging was between 200 Tshs and 600 Tshs.
The frequency of charging ranged from 1 time a week up to 3 times a week.

For a majority of the respondents, it took 2-3 hours to fully charge the battery.

**Network Coverage**
All of the respondents reported network coverage at their schools. A majority rated the quality as ‘Good’; and ‘Very good’ with one comment “Near a cell phone tower”. Added comment was: “50 % of the time we are without coverage”.

All of the respondents reported network coverage at their home. A majority of the respondents used their private mobile phone for work-related calls/SMS/beeps at home.

**Climate Effects**
A majority of the respondents stated that the rainy season affected the network coverage. A comment was that “Thunderstorms interrupt coverage”. A majority of the respondents did not know or had no answer of how to handle this situation. Two respondents answered “Wait until rain stop”.

A majority of the respondents mentioned that ‘Rain’ had an effect on their mobiles e.g. “lost memory”. Other climate effects were ‘Dust’ and ‘Moisture’.

**Service**
Finding spare parts/accessories for the mobile was stated as ‘Easy’ or ‘Relatively hard’ by a majority including comments “Have to travel long way to Iringa, 45 km.”; “Pirate copy”.

Finding a repair service for the mobile was stated as ‘Easy’ or ‘Relatively easy’ by a majority, while the quality of the repair services was stated as ‘Good’ or ‘Relatively good’ by a majority including the comment “We don’t have original spare parts.”.

**Operator**
A majority of the respondents stated they used ‘Vodacom’ and/or ‘ZAIN (CELTEL)’.

The respondents chose these operators due to ‘Good coverage’; ‘Cheapest’; ‘Relatives and friends use’; ‘First in the area’; ‘On the air all the time’, including the comment “I want to be on air so I need two operators.”
A majority of the respondents stated they had ‘Good’ or ‘Relatively good’ experience concerning support from their operator(s).

Asking more in detail about their experience, a majority mentioned ‘Disconnected network’; and ‘Unavailable network’.

Asking about the frequencies of any of these experiences, a majority stated 1-3 times a month.

Repeating the question ‘To what extent do you consider that mobiles phones are a potential to the communication infrastructure (as a complement to fixed telephony and postal service)?’ a majority answered ‘Very high’ or ‘High’.

On the final open question ‘Would you like to add anything?’ the following comments were given:

“Expensive. Batteries are faked even if you buy an original charge daily.”

“Reduce the price of handsets. Reduce the price of airtime. Reduce the radiation – can affect the brain.”

“Users need to be educated about the good uses.”

5.2.5 Collection of Statistical Data via Mail – C1 Questionnaire

This section covers opinions concerning the collection of statistical data via ordinary mail. Below is a summary of the answers showing major trends together with illustrative comments from the respondents.

Present Situation

All respondents describe that their school receives and sends the statistical form by hand to and from DEO. One respondent mentions that “By hand is faster than post.”

A majority of the respondents state that they collect data about the number of pupils ‘Daily’.

Concerning advantages with the present system, most respondents answered “Good to know data”; “MoEVT will know the finance required”; and “Get the real number of pupils”. Added comments were: “Helps to know the number of drop-outs and number of dead and sick.”; “Helps them with capitalisation – the ministry sends the right amount of money.”

Concerning disadvantages/problems with the present system, the respondents mentioned ‘It takes time’; ‘Costly (transport, photo copies)’. One comment was: “Sometimes using a rented motorcycle”.

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On the question ‘What is missing in the present system?’, most respondents answered ‘Nothing is missing’. Added comment was: “Transport to WEC” adding “Because a letter takes 1 week in rural areas.”

A majority of the respondent spent 1-2 days filling in the statistical form but for some it took one week. A majority stated that filling in the statistical form affected their normal work and they mentioned that they were not able teach these days “I’m at my office, I cannot teach.”

A majority of the respondents state that they do not get any feedback from the Ministry of Education or the District Education Office and that they would like to have feedback. Mostly wanted was a ‘Letter of confirmation (deliverance succeeded/that data is correct or not)’. Added comment: “Sometimes I write about problems at my school, but I don’t get any answer/solution.”

The respondents that received feedback mentioned that the type of feedback they got was a ‘Confirmation from DEO’. The feedback is mostly delivered as a ‘Call/letter/letter by hand from DEO’. Most of the respondents in this group state that the feedback is ‘Sufficient/satisfactory’.

Safety Issues
A majority of the 20 respondents state that the risk is ‘Small’ or ‘Relatively small’ that the statistical form is lost on its way from school to the ministry. Added comment: “Sometimes DEO asks about the same data again!”

When asked to estimate the risk that the Ministry of Education receives statistical forms that have mistakes/wrong data, a majority stated ‘Small’, or ‘Relatively small’. Added comment: “The reporters can mislead some of the report”.

A majority stated that WEC do not change the statistical data. If it happens, it depends on ‘Small mistakes (spelling/miscounting)’ in most cases.

A majority stated that the DEOs do not change the statistical data. One respondent answered that “We don’t know as we don’t receive a report.”

On the final open question ‘Would you like to add anything?’ the following comments were given:

“If wrong number of children → wrong amount of money.”
“Good if the MoEV’T sends out the report which we write through the DEO’s.”
“The data should be used to analyse how much money is needed to give good education.”
“Receive feedback.”
5.2.6 Collection of Statistical Data via SMS – C2 Questionnaire

This section covers data concerning the collection of statistical data via SMS (C2). Below is a summary of the answers showing major trends together with illustrative comments from the respondents.

Administrative Tool
All of the respondents answered that they knew that mobile phones are used to administer education in some way/in general, and that they are used to administer education in some way at their particular school. A majority of the respondents stated that there is a need for/a good idea using mobile phones in the administration of education. Added comment: “It’s better with writings.”

A majority of the respondents have observed/noticed that mobile phones are used in other public services e.g. in ‘Medical service/hospitals’; ‘Agriculture’; and in ‘Police’.

Some suggested areas where mobile phones can be used in primary rural schools were e.g. to ‘Simplify communication/transportation’; and ‘Reduced expenses for transport, accommodation’. Added comments were: “Save expenses using mobile instead of personal visit”; “I can call beforehand. I save time because people can be prepared when I come”.

All of the respondents stated that mobile phones can be used to improve the communication between rural schools and the administration of education (WEC/DEO/MoEVT). Added comment was: “We are far, we get late reports – no landline, slow post service.”

Opportunity
On the question of how they think mobile phones could be used for collecting statistical data, a minority of the respondents answered ‘Through SMS’, however, a majority of the respondents was aware of the possibility of using SMS for data collection. Added comments included: “If DEO needs info I can call/ SMS”; “DEO ask for data and HT send it if it is needed quickly”; “Use SMS to send data to DEO”; “DEO send/receive data via SMS.”

On the question if the respondent knows whether regular phones, or computers or the Internet, are used for statistical data collection in any sector, half of the group answered ‘Yes’ and half answered ‘No’. Some respondents mentioned ‘DEO (use computers)’.

Half of the group answered that they did not know that mobile phones were used for statistical data collection in any public sector.
A majority of the respondents were not aware of the possibility of sending SMS directly into the computer system at the MoEVT. The stated opinion on the possibility/idea/suggestion to send statistical data via SMS directly to the computer system at the MoEVT was answered as ‘Good’ or ‘Very good’ by a majority. Added comment was: “Why? It is not possible to make a joint report in this way.”

A majority of the respondents mentioned ‘Faster/save time’ as an advantage, followed by ‘Cheaper (transport/papers)’. Added comments were: “If I want to get/send data it will be faster than letter”; “SMS = 54 Tshs compared to 10 000Tshs to DEO (one way).”

Mentioned disadvantages/problems/obstacles with using SMS for data collection was ‘Can’t correct after sending/no control of mistakes’ and ‘Keep data safe/can be stolen’. Added comments were: “Keeping data safe e.g. if the handset is lost the data is lost”; “The in-between officials don’t get the info (WEC, DEO).”; “If mistakes in my data WEC/DEO will not report”.

A majority of the respondents wanted ‘Confirmation (data received, correct or not)’ as feedback if mobile phones could be used for statistical data collection. When asked what type of feedback from the MoEVT they would want to get, a majority wanted this feedback as an SMS, while some respondents wanted a ‘Letter’ and/or a ‘Call’. Added comments: “A letter can be stored.”; “SMS stays in my phone and if I’m transferred the next HT will miss the info.”; “Letter of confirmation. Not SMS because I can lose my phone”.

Knowledge
When asked if they felt they had enough SMS knowledge/experience to use an SMS-based system/SMS for statistical data collection, a majority of the respondents answered to a ‘Moderate degree’, or ‘Not really’. A majority of the respondents answered that it would be ‘Very much’ or ‘Relatively much’ complex to use SMS for data collection.

A majority of the respondents stated they needed ‘Very much’ training to use an SMS-based system - a mobile and SMS for statistical data collection.

Participation
A majority of the respondents stated it to be ‘Very important’ to be involved in the planning of a new data collection system/an SMS-based system.
A majority of the respondents also stated that it is ‘Very important’ to know the reason behind a new system of using SMS as a new way of collecting statistical data.

A majority also stated it to be ‘Very important’ that the WEC and DEO support you in taking part in new way of collecting statistical data. The types of support mentioned were ‘Teaching/learning/training/seminars’; ‘Money for vouchers/pre-paid cards/reduced cost for SMS’; and ‘Mobile for the school’. Added comment was: “One mobile phone per school – also a computer if a mobile cannot print”.

Safety Issues
A majority of the respondents stated that they trusted the technology and found it reliable to send important data with SMS. Asking ‘Why?’ they answered e.g. ‘Good system/high quality’; ‘Fast’; ‘It’s the most modern technology’. A majority of the respondents thought it to be secure (i.e. data safety, data theft, data tampering) to send important data with SMS. A majority stated the reason to be ‘Nobody can change/steal the info’. Added comments were: “If I get the message the data is delivered I trust/I believe that.”; “No loss of data, nobody can change it but I can send to the wrong person.”; “It is my secret (no one can read it, change it, steal it’; “Someone can change/steal the info”; “The SMS can’t be lost/ destroyed on the way”; “Someone might delete your message if they don’t like it.”. One respondent answered “Between YES and NO. It can happen. There are human beings dealing with system.”

When asked to evaluate the risk of loss of data when using SMS, a majority answered ‘Low’ and ‘Relatively low’.

A majority of the respondents stated to a ‘Very high’ or ‘High’ extent that the information they receive via SMS was reliable. Added comment: “Cannot be changed.”

Support
A majority of the respondents answered ‘Not really’ or to a ‘Moderate degree’ on the question if they thought that there is local technical people or capacity or support to implement/introduce a new SMS-based system.

Concerning local technical people/capacity/support to train HT, half of the group thought there was such a capacity and the other half that there was none.
Concerning their opinion on if the district school system has enough money and resources to create a new SMS-based system, a majority stated ‘Not really’; and ‘Not at all’.

**Private Use**
A majority of the respondents could think of using their own private mobile for statistical data collection. The reasons they mentioned were: “It’s easy”; “It simplifies”; “Takes less time”; “To avoid the transport (avoid expenses)”; “Can keep the info secret”; “Info straight to MoEVT”; “No other alternative/no school phone”; “Possibility to store the data for the future”; and “If the minister wants me to”.

A comment from one of the respondents that didn’t want to use his/her private mobile: “Because it’s mine and I don’t want to use it for official use”.

A majority of the respondents needed support/favour for using their own private mobile for statistical data collection and mentioned as a reason ‘Private cost (vouchers, charging)’. Added comments were: “I don’t have enough money to use my own phone so that’s why I sometimes beep”; “Money talks!”; “Because I use my money to buy vouchers and to charge the phone.”.

A majority of the respondents mentioned ‘Airtime’ as support and some mentioned ‘Free SMS’; and ‘Recharging’. The respondent that did not ask for any support/favour stated that “The cost is affordable”.

Repeating, for the third time, the question “To what extent do you consider that mobile phones are a potential to the communication infrastructure (as a complement to fixed telephony and postal service)” a majority answered ‘Very high’ and ‘High’.

On the final open question ‘Would you like to add anything?’ the following comments were given:
“Certain data is difficult to use SMS for example graphs.”
“Other institutions have computers that can store data -> print.”
“Reduce cost for airtime.”

5.2.7 **DEO Study**
The study was conducted with employees of two district education offices in the Iringa Region: the Iringa Municipal district and the Iringa Rural district, both of which are included in the main study in Phase II. Data was collected through four individual and one group interviews, and questionnaires with 12 respondents.
All of the respondents owned and used a mobile phone on a regular, daily basis for work-related reasons. All of the respondents found it useful and appreciated it. The main opinions are listed below:

- Easy and convenient to use
- Makes work easier and more efficient
- Travel and visits can be reduced
- SMS most popular due to its lower cost
- SMS reduces uncertainty and misunderstandings
- Trust in technology
- Health risks from the device and masts (e.g. cancer and reduced brain capacity)
- Risk of exploding device
- Reluctant to use private device
- Paying her/himself for work-related use
- No access to office mobile phones
- Important information in a SMS cannot be signed
- SMS is stored and can be read by others
- The mobile can be stolen and SMS can be read by others
- Problems with instructions on the phone in English
6 Analysis

This chapter presents an analysis of the data from Phase I and Phase II. The aim and research questions guided the data collection in both phases and this will make the analysis of the collected data rather straightforward, even if the exposition will include a thorough investigation of possible “buts” that could threaten a system implementation.

As stated in Chapter 1, the more specific aim of the present study is to:

explore more efficient data transfer (faster, more reliable, and potentially less resource demanding) by using mobile telephony technology, especially SMS, as a means for statistical data collection for Tanzanian education management.

The present chapter starts by analysing data related to the present EMIS on a systems level, focusing on the statistical data collection process; section 6.1. This section answers the research question about how statistical data are collected presently and what are the strengths and the weaknesses of the present system. The description is based mainly on data from Phase I, but also from Phase II questionnaire C1.

An analysis on an individual level is then presented in section 6.2 regarding the usage patterns and user profiles of mobile phones among head teachers, including both private and work-related usage, based on data from Phase II, questionnaire B. This is followed in section 6.3 by an analysis of head teachers’ views on an SMS-based data collection system based on their answers to questionnaire C2. These analyses on an individual level provide the foundation in section 6.4 when the question of supporting and hampering structures is gauged. Section 6.4 also relates this to findings in other studies. The section returns to EMIS and a system level, by demonstrating how the mobile can be effectively used and adapted as an administrative tool in the education sector. The main research question is thus answered, and an outline is presented of what a blended EMIS could look like.

Further, section 6.4 also asks and discusses what the consequences of an implementation would be outside the system per se. Finally, the approach for e-governments systems implementation, as developed and described in section 3.6, is illustrated by the discussions in the various previous sections.

6.1 EMIS of Today – a System Analysis

This section presents an analysis of the present EMIS based on data from Phase I as well as the questionnaire C1 in Phase II. It is mainly an analysis of the statistical data collection process using systems theory, view and terminology,
together with a socio-technical approach. The analysis has mainly a descriptive character when discussing the statistical data collection process within the primary education sector, identifying strengths and weaknesses of the statistical data collection process in order to answer the research questions about the present EMIS:

- How is statistical data currently collected?
  - What are the strengths and the weaknesses of the process?

### 6.1.1 A System Description of the Education Sector

The education sector can be categorised and classified as an organisation and as a social system. The primary education sector can be seen as system within the supra-system, the entire education sector including secondary and tertiary education, in line with the saying ‘there is always a system within the system.’

A structural framework includes structural conditions and circumstances such as type of organisation, level of differentiation, as well as dimension and size. The structure and organisation of the education sector in Tanzania and particularly the primary education sector can be categorised as a governmental organisation, belonging to the public service sector.

The primary education system in Tanzania is structured and organised hierarchically, with the MoEVT at the ‘top’ and further differentiated into five levels, or subsystems serving approximately 10 million pupils. In Figure 6.1.1, the structure and organisation of the primary school sector in Tanzania is illustrated, including organisational levels, units, number of units, and head of units (except on central level).\(^{40}\)

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\(^{40}\) In official documents, the acronym DEO is used both for the unit and for the head of the unit. In this presentation, to avoid misunderstandings, I have chosen to use DO for the head of the unit and DEO for the unit.

**Head of Unit**
- RO = Regional education Officer
- DO = District education Officer
- WC = Ward education Coordinator
- HT = Head Teacher

**Unit**
- MoEVT = Ministry of Education and Vocational Training
- REO = Regional Education Office
- DEO = District Education Office
- WEO = Ward Education Office
- PS = Primary School
Figure 6.1.1 Structure and Organisation of the Primary Education Sector in Tanzania

Adding to this picture is the environment of the primary education sector. The environment contributes with structure and stability but also with certain limitations such as economic. Examples of relationship, action, dependency, integration and co-ordination with the environment and the primary education sector in Tanzania concerning economic issues can be found on various levels: internationally, e.g. different donors and organisations; nationally, e.g. budget allocation; and on a district level, e.g. the distribution of capitation grants. Finally, on the village level, there are NGOs, both local and international, which contribute economically and in kind.

EMIS is a MIS, one part of the overall information system. EMIS is a computerised system, a digital network aimed at connecting the (sub)systems in the primary education sector. The key objective of EMIS is to improve data management and the use of information in order to improve the management and administration of the education sector.

Data from Phase I show that the information system, i.e. the administration of data and information within the education sector, is a complex system with several subsystems and actors at the ministry and institutional levels as described in Chapter 2.

Two general types of data and information are transmitted in the primary education sector; data from the ‘outside’ e.g. budget allocation, and from the ‘inside’ e.g. statistical data. Data from the ‘inside’, internal data, is the focus of
this study. Internal data is necessary and increased internal data makes it possible to make the system more transparent.

The statistical data collection process is both directly and indirectly influenced and governed, by the condition of EMIS, of the education system, of the governmental system, together with national and international circumstances.

6.1.2 Essential Aspects of the Statistical Data Collection Process

The MoEVT (Ministry of Education and Vocational Training), including the EMIS Team, is responsible for collecting educational statistical data, but a decentralisation process to the MoLG (Ministry of Local Government) is ongoing (ET p.c. 2007). The DO has also a central role in the statistical data collection process (Smithmanis Dry p.c. 2007).

There are two parallel EMIS: one for the pre-primary, primary and secondary sub-sectors and one for the tertiary education sector. The EMIS considered here is the one for the pre-primary, primary and secondary subsectors. There are ongoing plans for an integrated EMIS: ESMIS (Education Sector Management Information System) but, according to data from Phase I, there is a lack of technical as well managerial human capacity in order to implement an integrated EMIS. EMIS includes a number of computers with an Internet connection, software, and a central database, physically located at the MoEVT, used on a central level for EMIS.

Further, EMIS is not integrated with other MIS either at the central level or the local level, neither is the central database connected to other ministries and institutions. Hence the central database is available only for EMIS and the EMIS Team. Additionally, the role of EMIS is not sufficiently recognised among the different stakeholders according to Finne (p.c. 2007).

Phase I shows that the EMIS is not fully implemented; EMIS is ‘only’ used for the collection and processing of statistical data. Furthermore, not all input data are processed due to work overload (ET p.c. 2007): there are huge amounts of data that are not processed (Uimonen p.c. 2007).

The EMIS Team includes a team of four statisticians, one economist, and one head of the unit; two principal education officers are also connected to the unit. In charge is the head of Physical Planning and Maintenance under the Permanent Secretary. The EMIS Team is physically located at the MoEVT in Dar es Salaam. The EMIS Team deals mainly with processing the data: the ‘decoding’ process of the collected data into BEST (Basic Education Statistics in Tanzania). The EMIS Team has formal basic education together with
education on a tertiary level in statistics and economics but no formal ICT Education.

The instrument for collecting statistical educational data is a standard paper form (see Appendix 5:1), including ten groups of questions. The paper form is available in Kiswahili and in English. The formulation of the statistical form is decided upon once a year by representatives from the MoEVT, including the EMIS Team, together with different stakeholders (e.g. UNESCO) as part of an ongoing collaboration with UNESCO and its Institute of Statistics (UIS) (ET p.c. 2007).

The statistical data collection process is here described in three main sub-processes: pre-capture, capture, post-capture, using the Three-stage Data Capture Process Model as mentioned in section 4.5.1. The data collection process is further divided into five activities:

Pre-capture:
- distribution (distributing the statistical data forms)

Capture:
- data capture (gathering the ‘raw’ data)

Post-capture:
- submission (entering the data into the database)
- data processing (altering the ‘raw’ data via e.g. calculation, classification)
- feedback (communicating processed data)

Pre-capture
The statistical form for primary schools, the instrument that provides the basic data, is distributed annually in February to the 14 700 primary schools. The statistical forms are distributed by the EMIS Team, who travel in person to the regional education offices in each of the 26 regions (ET p.c. 2007). The regional education officer distributes the statistical forms, by post or by hand, to the district education officers. District education officers in turn distribute the statistical forms by hand to the head teacher at each primary school.

Capture
The statistical form is filled in manually i.e. using PaP (Paper and Pen) by the head teacher at each primary school. The reference day for capturing the data is the 1st of March (ET p.c. 2007).
Post-capture

- Submission

The next step is to submit the statistical forms by hand to a ward education coordinator who checks and verifies manually that the form is correctly filled in. The ward education coordinator brings the statistical forms by hand to the district education officer as mentioned in phase I; or as findings from Phase II show, head teachers can bring the statistical forms by hand to the district education officer.

The statistical forms from the district primary schools are checked and summarised manually i.e. using PaP by the district education officer. The summary is sent by ordinary mail or handed over in person to the MoEVT for data processing by the EMIS Team. The original statistical form is kept at the district education office. The submission is performed during March-April. In order to avoid delayed submissions, the MoEVT threatens with withdrawal of capitation funds. The submission is financed by each district education office (ET p.c. 2007).

- Data Processing

The received data are processed by the EMIS Team at the MoEVT in Dar es Salaam between April and October. The EMIS Team types the data manually into the database, however not all data are typed and processed due to work overload. The district summaries are kept at MoEVT, and the results are published in an annual report, BEST.

- Feedback

Feedback is delivered to the district education offices in a district report (ET p.c. 2007). A majority of the head teachers do not get any feedback according to data from Phase II. When feedback is delivered, it is mostly delivered as a “Call/letter/letter by hand from DEO”.

6.1.3 A Socio-Technical Analysis of EMIS

The following description of the present EMIS is given in line with the Change Model as described in 4.5.1 – in section 6.4.1 this model will be used to describe the proposed EMIS.

Organisational Structure (Organisation Unit - Which): MoEVT, REO, DEO, WEO, PS

Actors (Who): EMIS Team, RO, DO, WC, HT
Activity (What and When): Statistical data collection divided into different sub-processes: pre-capture, capture and post-capture. The data collection process is further divided into five different activities: distribution, data capture, submission, data processing, and feedback.

Technology (How): The present system involves different types of technology, both digital and non-digital e.g. fixed computers and paper and pencil (PaP). Below, activities are listed along with who and which will be involved (both actors and organisation units). Finally, there is a list of the technologies showing the technical artefacts.

Pre-capture
- Distribution of Paper Form
- From MoEVT (EMIS Team) (February)
- To REO (RO) in person by car or by ordinary mail
  - To DEO (DO) in person by car or by ordinary mail
  - To PS (HT) in person by car

Capture
- Data Capture at PS (HT) manually by Paper and Pen (1 March)

Post Capture
- Submission of Paper Form (March - April)
- From PS (HT)
- To WEO (WC) in person by bus, by bike or on foot
  - To DEO (DO) in person by bus, by bike or on foot
  - To MoEVT (EMIS Team) by ordinary mail
- Data Processing (April – October) by EMIS Team at MoEVT
- Feedback (October and onward)

District Report
- From MoEVT (EMIS Team) via ordinary mail
- To DEO (DO)

BEST
- From MoEVT (EMIS Team) via ordinary mail
- To other ministries and organisations.
Below are listed the different technologies:

PS Level:
- PaP (Paper and Pen) – gathering the ‘raw’ data

WEO Level:
- PaP (Paper and Pen) – check and verify

DEO Level:
- PaP (Paper and Pen) – check and summarise

MoEvT Level:
- PC and Server (Database) – process and produce

Figure 6.1.2, depicting the statistical data collection process, is inspired by the rich picture technique showing the different actors and activities at each level. A rich picture is a graphical technique used to capture the ‘richness’ of a situation/problem. Rich pictures have been used by, inter alia, Checkland in his Soft Systems Methodology. It is a flexible notation and does not follow any specific syntax. Instead it contains pictures, symbols, figures, text – as much as considered needed to represent structures and processes related to the problem situation. A rich picture contributes to the understanding process – it adds to whatever other ways a problem is described.
Figure 6.1.2 The Present Statistical Data Collection Process
6.1.4 A Strength and Weakness Analysis of EMIS

The identified tentative strengths with the present EMIS, including the statistical data collection process, are listed in Table 6.1.1, and the identified tentative weaknesses with the present EMIS including the statistical data collection process are listed in Table 6.1.2.

Table 6.1.1 Strengths with ‘EMIS of Today’

<p>| • EMIS Team has higher education in statistics and economics |
| • Computers, Internet, software, and database available on central level |
| • Computers are available at the regional and districts levels |
| • An ICT Policy for Basic Education is available from the MoEVT |
| • A majority of HTs trust the post service |
| • A majority of HTs trust the present statistical data collection system |
| • A majority of HTs are satisfied with the present statistical data collection system |
| • An report, BEST (Basic Education Statistics in Tanzania) is published annually |</p>
<table>
<thead>
<tr>
<th>Table 6.1.2 Weaknesses with 'EMIS of Today'</th>
</tr>
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<tbody>
<tr>
<td>• EMIS is not fully implemented - EMIS is 'only' used for collection and process of statistical data</td>
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<tr>
<td>• The central database is not connected to other ministries and institutions and is available only for the EMIS team</td>
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<tr>
<td>• EMIS is not integrated with other MIS either at the central level or at the local level</td>
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<tr>
<td>• There is a lack of technical as well as managerial human capacity in order to implement an integrated EMIS</td>
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<td>• The role of EMIS is not sufficiently recognised among the different stakeholders</td>
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<tr>
<td>• EMIS team has no formal ICT education</td>
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<tr>
<td>• A majority of the HTs were not aware of the <em>ICT Policy for Basic Education</em></td>
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<tr>
<td>• Computers on regional and districts levels are not connected to the Internet</td>
</tr>
<tr>
<td>• The data collection form is distributed mainly by hand to REO, DEO and PS</td>
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<tr>
<td>• The data collection form is filled in manually</td>
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<tr>
<td>• The data collection form is complicated and extensive</td>
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<td>• Filling in the form is time consuming</td>
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<td>• The submission is performed during the rainy season - problems with gravel roads</td>
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<tr>
<td>• The data collection form is brought by hand by HT to WEO and to DEO</td>
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<tr>
<td>• Costly transport and photocopies</td>
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<tr>
<td>• Most HTs pay for the transport themselves</td>
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<td>• Public transportation is not available in all districts</td>
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<td>• All the forms from the district primary schools are summarised manually</td>
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<td>• The summary is sent by ordinary mail or handed over in person to the MoEVT</td>
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<tr>
<td>• Postal delivery is slow and with sometimes poor service</td>
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<tr>
<td>• The distribution and collection is financed by each district education office</td>
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<tr>
<td>• The district summaries are stored at the MoEVT</td>
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<tr>
<td>• Data are typed manually by the EMIS Team</td>
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<tr>
<td>• Huge amounts of statistical data are not typed and processed</td>
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<tr>
<td>• Time consuming process to find data that is not entered into the database</td>
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<tr>
<td>• A majority of HTs do not get feedback</td>
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</table>
6.1.5 Summary of the Present EMIS

The present EMIS and the statistical data collection process is discussed based on information from the EMIS Team and the empirical data from the selected districts in the Iringa region. The discussion emanates from the five activities in the statistical data collection process, which are condensed into three headlines: Distribution and Submission; Data Capture; and Data Processing and Feedback. The presentation builds on the tentative strengths of ‘EMIS of Today’ listed in Table 6.1.1 and the identified tentative weaknesses listed in Table 6.1.2. These are here discussed on a structural level using XIF as a guideline.

Distribution and Submission

The statistical data forms are distributed to the primary schools by the EMIS Team, the regional education officer and the district education officer mostly in person and by hand. The forms are later submitted by the head teacher at each primary school by hand to the ward education coordinator and then further to the DEO. Finally, the district education officer hands over the summary in person or sends it by post to the EMIS Team at the MoEVT.

It is reasonable to assume that the distribution and submission activities are resource-consuming and the context needs to be considered as resource-constrained in Tanzania, especially with regards to the education sector, which is heavily dependent on donor funding. These resource-consuming activities can be related to the local physical resources and infrastructure as well as to local and national institutional resources and structures i.e. the public sector and service structure, including public transport, post service and ICT supply, among other factors.

Travel in person is resource-consuming, taking into account time and cost for the involved actors. This is related to physical resources, physical infrastructure and the condition of the road network. The road network consists mainly of gravel roads, which, during the rainy season in April, are sometimes not passable. The head teachers mention that some of them need one day to hand in the forms, and one even mentioned that “Sometimes I have to spend the night there.”

The distribution and submission activities are also related to institutional resources and structures such as public transport. Public service, including public transport is not always available, making head teachers dependent on small private minibuses, called dalla-dalla, which were commonly used and a majority of the head teachers have to pay the travel costs by themselves.
Concerning costs, an additional cost is mentioned with regards to photocopies. Related to costs and the financial resources is that the distribution and submission is financed by each district education office, which presents a financial burden on an already constrained budget.

Another connection to institutional resources is the issue that the head teachers are absent from both teaching and administration tasks. The alternative costs need to be considered as:

- EMIS Team are highly educated in statistics and economics and their education and skills should be used for more ‘advanced’ activities as they are overloaded with statistical data
- Both RO and DO as professionals should be focused on more ‘advanced’ activities related to their professions, since the education system is ‘inefficient’
- HT as professionals should be used for more ‘advanced’ activities related to their education and skills, as the education system is ‘over-crowded and under-trained’

This driving around to gather data is an example of inefficient data transfer but at the same time it is important to be aware that these meetings can have other meanings (cf. the concept ‘management by walking around’).

Another issue with the distribution and submission activities is the public post system and service. The post system is not well distributed over the country, especially not in rural areas. The distance to the post office among the respondents was in time up to five hours, since the majority have to walk to the post office. If using dalla-dalla, the respondents paid the fees themselves when travelling to the post office, even in official errands. The service is considered poor and there is no post delivery so everyone has to bring their mail to the post office. Furthermore, the post service is slow and the respondents in the selected districts in Iringa region mention that “… a letter takes 1 week in rural areas.”

However, the respondents also found the service reliable and safe, despite the drawbacks of the system, i.e. the head teachers trusted the post service and considered the risk low that the statistical data form was lost on its way from school to the ministry. There were of course some exceptions expressed as: “Sometimes DO asks about the same data again!” In other words, there is a trust in the delivery structure but the fact that data are lost needs to be considered, i.e. data security is an issue.

Hence using the post system is a time and cost consuming activity.
Still another issue is related to physical resources: the ICT supply that is available to the public education sector, i.e. the public sector and service structure. REOs and DEOs have computers but in the Iringa Region, approximately one per cent of the primary schools have computers. Among the selected schools, a majority (90 per cent)\(^{41}\) had no computers at their schools.\(^{42}\) Although REOs and DEOs have computers, they are not connected to the Internet. Approximately one per cent of the Tanzanian population in 2007 used Internet. None of the selected schools had an Internet connection nor a fixed telephone or a mobile phone. Hence, there is lack of ICT hardware and ICT networks on both local and national levels.

A third issue also related to physical resources and physical infrastructure, is the national power grid. The access to electricity in the regional schools of four per cent is above the national average of two per cent for rural areas (cp. 39 per cent for urban areas). Among the selected schools, the majority was not connected to the national power grid. Hence there is severe lack of power, especially in rural areas both at the local level in the selected districts as well as at the national level in general.

Further, the ward education coordinator manually controls i.e. checks and verifies the statistical forms, which is meant as a data validity control but which in itself is an additional risk for data validity. All the statistical data forms from a district are summarised manually by the district education officer and the original forms, from the primary schools, with ‘raw’ data are stored at the district office. This presents an additional risk concerning the validity of the data.

It can be stated that other distribution channels than the present are not available and/or are less efficient and can be summarised in the following points:

- "By hand is faster than post"
- Computers available only on regional and district levels
- Few computers on PS level
- Internet is not available at all REO and DEO
- No Internet on PS level
- Electricity available at 2-4 per cent in rural areas

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\(^{41}\) Statistical processing of the data is usually not meaningful with less than 40 respondents (Ejvegård 2009), as one respondent gives a great effect in percentage. Instead it is better to communicate these data in a descriptive way, but at the same time to express data in percentage is an ‘easy/quick/efficient’ way to 'highlight' the findings.

\(^{42}\) The two (2) schools with computers used their computers for "typing and keeping data", and “write letters.”
Data Capture

The construction of the statistical data form is decided upon by representatives from the MoEVT, including the EMIS Team, together with different stakeholders e.g. UNESCO and its Institute of Statistics (UIS). The statistical form is considered complicated and extensive. This can be related to the institutional structure including the several stakeholders that have a need for an extensive amount of statistical data for international comparison. This can also be an effect of several donors ‘demanding’ input: i.e. the financial structure of the education sector guides the extension of the statistical form. Additionally, the planned decentralisation process to the MoLG (Ministry of Local Government) can raise the number of stakeholders, which can have implications on the construction of statistical data collection form.

One obvious problem with the complicated form is misunderstanding and incorrect answers concerning ages. This can be related to the high numbers of pupils in each grade (i.e. the high pupil/teacher ratio) together with the high numbers of repeaters, which makes it difficult for the teachers to keep track of the ages of all pupils. A complicated form also indicates a risk for data validation. At the same time, the head teachers grade the risk low that the MoEVT receives statistical data forms that have mistakes and/or wrong data.

Capturing the statistical data is a time consuming process due to the extensive form. The time spent to fill in the statistical form ranged from 1-2 days for a majority of the respondent to up to one week. A majority of the respondents stated that filling in the statistical form affected their normal work and they mentioned that they could not teach these days: “I’m at my office, I cannot teach.” An extensive form also risks compromising data validation.

Further, the statistical data form is filled in manually i.e. using the PaP method, which creates a risk for data validity in the form of risk for unreadability and misinterpretation when being validated by WC and DO.

Data Processing and Feedback

The received data are typed and processed by the EMIS Team at the MoEVT, and this manual process creates a risk for data validity. The EMIS Team is well equipped with physical resources such as ICT equipment, including several computers with relevant software, connected to the Internet, and a database.

But not all data are typed and processed due to work overload with the consequence that a lot of data is kept only in paper version, i.e. in the 121 district summaries. The work overload depends either on the staff being under-dimensioned, dealing with other activities and/or the amount of data being too
extensive. A consequence of the huge amounts of unprocessed data is that when there is a need for certain figures from the ministry that are not available in the database, the EMIS Team has to go through all the district summaries by spreading out all the statistical reports on the floor in the corridor and go through them one by one. This is a time consuming process to find data that is not entered into the database.

The EMIS Team can be assumed to be well qualified for their duties with higher education in statistics and economics, and although none has a formal ICT education, this might not be a problem since their assignments focus on statistical processing.

The processed data is published in an annual report, BEST (Basic Education Statistics in Tanzania), which gives a brief picture of the education sector status in Tanzania but that can be assumed to be a time and cost consuming production.

Feedback is delivered to the district education offices in a district report delivered by post, which also can be assumed to be a time and cost consuming activity.

But a majority of selected primary schools did not receive any feedback or confirmation, as fact that was perceived as unsatisfactory from the head teacher's point of view. In cases where feedback was given, it was distributed by letter or by hand but also as a phone call using private mobile phones.

**Overall Reflections on the Present EMIS**

This section ends with some overall reflections on the present EMIS and the statistical data collection process.

EMIS is about improving processes within the government. The key objective of the present EMIS is to improve data collection and the use of information in order to improve management and administration of the education sector.

Some drawbacks on a central level with the present EMIS is that EMIS is not fully implemented – it is 'only' used for collecting and processing statistical data. Furthermore, EMIS is not integrated with other MIS, neither is it connected to other ministries and institutions: the database is available only for the EMIS Team. According to systems thinking, a too ‘rigid’ control gives a system a closed character, including the risk that the only possibility of finding data and information is within the system and also with the risk that the data and information is never questioned. The present EMIS can, from a systems perspective, run the risk of turning into a closed system, due to lack of
transparency and isolation from other systems as well as from threats and punishment.

Internal data is necessary and increased internal data and information enables the system to become more transparent. At the same time, it is important that the system and the data flow are designed to avoid ‘information overload’. At present, there are several stakeholders involved in the system design, e.g. construction of the statistical data collection form, which results in the system receiving more data and even if the data is necessary and relevant, there is a need to handle this ‘information overload’. This is an example of the challenge highlighted in Chapter 3 about ‘nice to have data’ and ‘need to have data’.

These drawbacks are related to the fact that there is a lack of technical and managerial human resources to implement an integrated EMIS. Furthermore, the role of EMIS is not well understood and not sufficiently recognised among the different stakeholders. This can also be related to the complex institutional structure and to the lack of ICT awareness and leadership on both the political and administrative level.

There is a need for a well-integrated interface that allows the EMIS to integrate with other school management systems. EMIS needs to be firmly embedded in the organisational processes and needs to be politically and technically supported by the main stakeholders in the education sector.

However, at the same time on a primary school level, a majority of the head teachers had a positive attitude and did not miss anything with the present statistical data collection system. A majority of respondents mentioned different advantages with the present system such as: “Helps to know the number of drop-outs and number of dead and sick.”, “Helps them with capitalisation – the ministry sends the right amount of money.”

Concerning data quality and data validity, there is a low risk for incorrect answers accordingly to the head teachers: head teachers trust the present statistical data collection system and trust is central for the survival of a system. At the same time, data validity is risked due to several manual activities: data controls, data is filled in manually, summarised manually and typed by hand into the database by the EMIS Team. An additional risk for data validity is the extensive and complicated data form. Another issue related to data quality is data security. The delivery of the data forms in several steps via ordinary mail and/or by hand constitutes a risk for loss of data. The storage of the data forms at the DEO and the MoEVT is an additional risk for data security. Also the fact that the data is stored in different forms – paper and digital – needs
consideration. Concerning storage the original district summary paper forms are stored at MoEVT and only the typed data is stored in the database at MoEVT. This makes as indicated above data accessibility a problem.

The primary education system is structured and organised in a hierarchical order with MoEVT at the ‘top’. All hierarchical systems are by definition conservative and rigid, which is shown in the data collection process in several ways, but to a different degree on different levels. For example, on the WEO level, the collected data is checked and verified and on the DEO level the data is checked again and also summarised.

The higher up in hierarchy, the wider area of responsibility and power, the more abstract is the information being circulated; e.g. a policy document can be seen as information meant to influence. In *Information and Communication Technology Policy for Basic Education*, the MoEVT states that ICT, including the Internet, is an essential tool for the management and administration of the education sector. From an ICT implementation perspective, it is positive to have a specific policy for ICT in the education sector: it shows awareness and intention on this issue at the highest political level, but the same time, this policy is not well known at the school level, which might explain the low level of work-related ICT use among teachers. When dealing with a highly hierarchical culture, the effects of a policy need to be considered.

Additionally, the lack of feedback given to the primary school level is a concern. From a systems perspective, feedback is a key issue: it is the fundamental principle for self-regulation of the system. Information allows correction and revision in order to allow a system to survive in a constantly changing environment.

EMIS can be seen as a communication process with the MoEVT as the receiver of statistical data and interpreter of data into information e.g. BEST. Additionally, the MoEVT is the actor that can turn the information into action and is thereby the most important and influential actor in the communication process.

According to systems thinking, logical levels can be used to illustrate communication between parts of the system. Each level manages the next at the same time as the highest level manages all the levels. This becomes obvious in the statistical data collection process, where in the distribution and submission of statistical data, five logical levels are involved and the DEO has a central role.

It is imperative to keep separate the different logical levels from each other in a hierarchical system; to let local decisions be made within the logical
level and not let someone from a higher level make decisions on a lower logical level i.e. to disregard the local person in charge and to communicate between the levels.

When it comes to ICT equipment, i.e. physical hardware, it is apparent that ‘new’ ICT are available at some levels, but to fully use the ‘new’ ICT, there is a need for all levels to be connected, i.e. ‘new’ ICT need to be available on all levels and the users must know how to use it; from a systems perspective, it is the combined effect, the effect of the whole system that counts, i.e. its synergetic effects. But at the same time, in a resource-scarce setting, a blended solution must be considered.

The present EMIS is such a solution with a mix of ‘old’ and ‘new’ ICT; PaP together with computers. The EMIS of today can be labelled a blended system – mail, personal delivery, i.e. a mix of different data delivery tools, technical artefacts; both old and new ICT.

It can be stated that EMIS is an inefficient information system and as such it involves the problem of asymmetric information: an information gap, not everyone involved has access to relevant, complete, and correct data.

An inefficient information system is also about too much data, the issue of ‘information overload,’ which is an example of the maximalist approach presented in Chapter 3 – the ‘nice to have data’ attitude. There is a need to discuss captured data vs. used data and useful data vs. useless data.

An inefficient information system is a matter of both quality and quantity of data as well as the quantity of institutions involved in the data collection process. Adding to the picture of an inefficient information system is the fact that there are in total six different institutions involved, with responsibility for collection of data within the education sector. One of these is the MoEVT and the EMIS Team, but EMIS is not connected to the other five institutions. The collected statistical data is used inter alia as a basis for the budget process within the education sector. As mentioned in Chapter 2, there are in total ten different institutions involved in the funding process with no connection to EMIS.

The present EMIS and the actual status of EMIS in Tanzania have several challenges to meet. EMIS is inefficient and resource demanding and by that this may take away resources from an organisation that already lacks resources and that could spend its resources in better ways. But this is not unique for Tanzania – several examples of similar situations are described in Chapter 3.
6.2 Head Teachers’ Mobile Usage Pattern

This section describes the usage pattern of mobile phones among head teachers in the selected primary schools. It presents the identified usage and non-usage, including both private and work-related usage. Work-related usage can be defined in this group as official calls in an ‘unofficial’ way or as an ‘unofficial’ use of mobile phones for an official purpose.

The section is structured by the Triple A concepts: Access, Attitude, and Awareness. Findings from questionnaire B, comprised of 93 questions, and C2, comprised of 51 questions, are presented at the end of the section in Tables 6.2.1-6.2.3 including tentatively supporting factors and tentatively hampering factors. These factors are data evaluated according to the research questions and sorted under the Triple A concepts.

A fictive example of a typical head teacher profile and use pattern with regards to mobile phones is presented in the text below. Susanne is used as the name of this fictive head teacher and her characteristics are presented under the headlines Access, Attitude and Awareness in sections 6.2.1-6.2.3.

6.2.1 Access

The ‘access’ theme includes issues such as economy, equipment, infrastructure, ownership and usage related to mobile phone usage.

Susanne states that the main benefit for using a mobile is that it is a cheap way of communication. But she complains that “Inter-operator calls are too expensive – should be lower.” And because of this, she owns more than one SIM card.

Susanne states that a mobile phone is ‘easy to use’ and has used a mobile for almost 7 years. She has owned her own mobile for 3-4 years. But she is afraid of ‘health issues’ (radiation, noise): “Reduce the radiation – can affect the brain.”

All of the other teachers at her school own at least one mobile phone but there is no school mobile phone. There is no official list from the district office of phone numbers to other schools.

Susanne uses the basic services ‘call’ and ‘SMS’ every day, as well as ‘beeping’ when she is out of money. She uses her private mobile phone for work-related purposes and she does that also from home.

Susanne has network coverage at her home and good network coverage at her school with several operators available. She uses two operators and she has good experience of their support. But she has also experienced disconnected and unavailable networks and that the rainy season affected the network
coverage, so there are problems with both quality and quantity of network coverage at her school.

Susanne has a problem with charging the battery of her mobile phone, and at her school it is not possible at all due to the lack of a connection to the national power grid.

Susanne considers mobile phones as a very good complement to the ‘traditional’ communication of fixed telephone and postal service in her region.

6.2.2 Attitude

The ‘attitude’ theme includes issues such as complexity, norms and values, self-confidence, trust, and usefulness related to mobile phone usage. Attitude about different services (call, SMS, beeping) can be measured with frequency, reasons, level of manageability together with sender and receiver of calls, SMS and beeping.

Susanne states she can manage to use a mobile phone ‘well’ and that it is ‘easy to use’ including managing SMS, which indicates that she sees a mobile as ‘low-complex’ and also indicates a high level of self-confidence. A context-related ‘complexity’ is repair service, which she thinks is easy to find.

Susanne finds a mobile phone useful, stating it to be ‘fast’ and to have ‘a variety of services’. She makes both private calls and work-related calls. She makes calls and receives calls from the DO but it is not accepted practice to send SMS to the DO or to beep the DO. The most common reason for beeping is related to ‘meetings’.

Susanne finds SMS to be a useful service: it is ‘cheap’ and ‘private’. She uses it for private communication and also for work-related communication with both colleagues at her own school and at other schools as well as with parents. Additionally, she finds it useful to be able to use beeping when out of money.

However, the perceived ‘usefulness’ is influenced by ‘health issues’ such as radiation and noise and that “160 characters is too short”.

Susanne trusts the operator(s). The network coverage and the support is ‘good’ but she has also experienced disconnected networks. She trusts the quality of the repair, stating it as ‘good’ but at the same time she mentions that “We don’t have original spare parts.”

Susanne does not trust the technology completely as she says that she would want to “Reduce the radiation – can affect the brain.”
6.2.3 Awareness

The ‘awareness’ theme includes issues such as experience, knowledge, and skill related to mobile phone usage. Awareness about different services (call, SMS, beeping) can be measured with frequency, reasons, level of manageability together with sender and receiver of calls, SMS and beeping.

Susanne has almost seven years of experience of using a mobile phone. She has experience as head teacher of nearly four years and speaks, except from Kiswahili, English and her tribe language. But she has no formal ICT education and added a comment that “Users need to be educated about the good uses.”

Susanne considers herself as well skilled regarding managing a mobile phone stating it to be easy to use and can manage to use SMS very well but knows about colleagues that have language problems using SMS in English and find it ‘complicated to use’ especially SMS.

Having two SIM cards shows that she is well aware of the availability of networks, the different operators and also the business model used by the operators. She uses calls, SMS and beeping daily or almost daily. She make calls approximately five times a day and beeps up to six times a day.

Susanne uses her private mobile for work-related calls both at school and from home, to and from DO. She uses SMS related to statistical data collection but DO is not a receiver of SMS: “I don’t send SMS to DO.” Moreover she explains “I don’t write to DO and parents – I phone. And DO does not send SMS.”
Table 6.2.1 Access Factors – Tentative Supporting Factors

<table>
<thead>
<tr>
<th>Access – Economic Issues</th>
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</thead>
<tbody>
<tr>
<td>• Mentioned benefits to using a mobile phone were for the majority ‘cheap’. Added comment: “Postpone journey”; “Substitute for transport”.</td>
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<table>
<thead>
<tr>
<th>Access – Infrastructure Issues</th>
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<tbody>
<tr>
<td>• All of the respondents (20) reported network coverage at their home.</td>
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<tr>
<td>• Some (9) could charge the batteries at home</td>
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<table>
<thead>
<tr>
<th>Access – Work-related Infrastructure Issues</th>
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<tbody>
<tr>
<td>• All of the respondents (20) reported network coverage at their schools. A majority 60 per cent (12) rated the quality as ‘Good’.</td>
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<tr>
<th>Access - Ownership</th>
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<tr>
<td>• 75 per cent had used a mobile phone for 4-7 years.</td>
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<tr>
<td>• All 20 respondents had access to a mobile phone through owning one.</td>
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<tr>
<td>• Half of the respondents stated that they have owned a mobile phone for 3-4 years while a further 6 respondents had owned a mobile for 5-6 years.</td>
</tr>
<tr>
<td>• A majority of the respondents had used and experienced a mobile phone before buying one.</td>
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<tr>
<td>• The majority, 65 per cent (13) owns one mobile phone, while seven (7) or 35 per cent stated they own more than one phone and all (7) owned two mobile phones.</td>
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<tr>
<td>• One reason for owning more than one phone was “Always be available”</td>
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<tr>
<th>Access - Usage</th>
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<tbody>
<tr>
<td>• Mentioned benefits for using a mobile phone were for the majority ‘easy to use’, ‘fast’, ‘has a variety of services’, ‘private’ and ‘easy to access’</td>
</tr>
<tr>
<td>• Several services were used among the respondents. All 20 respondents used the basic services, ‘call’ and ‘SMS’. Among other services, ‘beeping’ was the most popular, used by 80 per cent of the respondents.</td>
</tr>
<tr>
<td>• Several functions were used among the respondents.</td>
</tr>
<tr>
<td>• To find repair service for your mobile was stated as ‘easy’ and ‘relatively easy’ by a majority (13)</td>
</tr>
<tr>
<td>• All (20) of the respondents spoke Kiswahili and 90 per cent of the respondents also spoke English.</td>
</tr>
<tr>
<td>• Several operators are available and two operators were used by a majority of the respondents</td>
</tr>
<tr>
<td>• A majority of the respondents (65) per cent stated they had ‘Good’ experience concerning support from their operator(s); 5 stated ‘Relatively good’, and 2 ‘Very good’.</td>
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</table>

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<thead>
<tr>
<th>Access – Work-related Ownership and Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All of the respondents (20) answered that the staff at their school had access to mobile phones and 85 per cent (17) of the respondents stated that every teacher at their school owned (at least) one mobile phone. On a regional level, 700 primary schools or 70 per cent have access to mobile phones.</td>
</tr>
<tr>
<td>• A majority, 95 per cent (19) of the respondents used their private mobile phone for work related calls/SMS/beeps at home.</td>
</tr>
<tr>
<td>• Concerning purposes for owning a mobile phone mentioned purposes included “Data keeping”</td>
</tr>
</tbody>
</table>
Access – Economy

- Among disadvantages, ‘expensive’ was mentioned by 95 per cent.
- Economic reasons were stated from 30 per cent (6) of respondents for owning more than one SIM card. “When I call to one operator the price is cheaper if I use the same.” But “Having more than one SIM card is also expensive.” “Inter-operator calls are too expensive – should be lower.”

Access – Equipment

- To find spare parts/accessories for the mobile was stated as ‘easy’ by 9 respondents; and ‘relatively hard’ by 5; including comments “Have to travel long way to Iringa, 45 km.”; “Pirate copy”.
- A majority of the respondents, 70 per cent (14), mentioned that they had more than one SIM card. The reason for having more than one SIM-card was for most of the respondents 35 per cent (7) related to the quality and/or availability of the network “Network differs depending on operator - bad network=switch card”.

Access – Work-related Equipment

- A majority (17) of the schools had no official list from the district of phone numbers to other schools.

Access – Infrastructure

- A majority of the respondents experienced some problems related to charging batteries.

Access – Work-related Infrastructure

- Problems with quality and availability of network coverage at selected schools.
- A majority, 65 per cent (13) of the selected primary schools was not connected to the national power grid (TANESCO) i.e. 35 per cent was connected.
- The regional average of connected schools of 0.4 per cent.
- 16 respondents could not charge the battery for their mobile phones at school.

Access – Usage

- Mentioned disadvantages: ‘health issues’ (radiation, noise) stated by 65 per cent. Added comment: “Reduce the radiation – can affect the brain.”
- Other disadvantages mentioned were ‘bad sound’ by 7; ‘bad coverage’ by 3 together with “Encourage thieves – they can come to carry out their act.”
- To find repair service for your mobile was stated as ‘relatively hard’ by 4 including the comment “Have to travel long way to Iringa, 45 km.”
- A majority of the respondents, 70 per cent, (14) mentioned that ‘Rain’ affected their mobiles. Further climate effects were ‘Dust’ and ‘Moisture’.
- A majority of the respondents (15) stated that the rainy season affected the network coverage.
- In total, there were 13 different tribe languages spoken within the respondent group.
- Concerning opinions about usage of SMS, 25 per cent mentioned ‘Language problems’.
- Among negative experiences related to operators, a majority (14) mentioned ‘Disconnected network’; and 10 mentioned ‘Unavailable network’.

Access – Work-related Ownership and Usage

- None of the selected schools had/owned a mobile school phone.
- A school mobile phone can encourage thieves.
Table 6.2.2 Attitude Factors – Tentative Supporting Factors

<table>
<thead>
<tr>
<th>Attitude – Complexity</th>
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<tbody>
<tr>
<td>• An opinion of low complexity among the respondents is shown, since a majority of the respondents, 12 (60 per cent) stated that they could manage to use a mobile phone ‘well’, while 5 answered ‘very well’, and 3 ‘relatively well’.</td>
</tr>
<tr>
<td>• An opinion of low complexity among the respondents is shown, since a majority (18) of the respondents managed to use SMS ‘well’ or ‘very well’.</td>
</tr>
<tr>
<td>• ‘Complexity’ factors related to the context that influence the actual use of mobile phones are for example finding spare parts/accessories for the mobile. This was stated as ‘easy’ by 9 respondents</td>
</tr>
<tr>
<td>• Another context-related ‘complexity’ factor is repair service. This was stated as ‘easy’ and ‘relatively easy’ by a majority (13)</td>
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<thead>
<tr>
<th>Attitude – Norms and Values</th>
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<tbody>
<tr>
<td>• Mobile phones are for the majority an accepted communication tool for several private issues</td>
</tr>
<tr>
<td>• It is an accepted norm among the respondents to use private property for work-related purposes.</td>
</tr>
<tr>
<td>• A majority of the respondents make calls to and receive calls from DEO i.e. to call is an accepted norm at both levels of the hierarchy.</td>
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<tr>
<th>Attitude – Self-confidence</th>
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<tbody>
<tr>
<td>• A majority of the respondents (12) stated that they could manage to use the mobile phone ‘well’, while 5 answered ‘very well’, which shows a high level of self-confidence. Comments such as ‘easy to use’ (17) indicate a high level of self-confidence.</td>
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<tr>
<td>• Half of the group (10) stated that they managed to use SMS ‘well’; ‘very well’ was stated by 8. A majority gave comments such as ‘easy to use’ (16).</td>
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<tr>
<th>Attitude – Trust</th>
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<tbody>
<tr>
<td>• A majority (12) rated the quality of network coverage at their schools as ‘good’, 5 as ‘very good’ and 3 as ‘Relatively good’.</td>
</tr>
<tr>
<td>• Concerning operators, a majority of the respondents (13) stated they had ‘good’ experience concerning support from their operator(s); 5 stated ‘relatively good’; and 2 ‘very good’. “To use mobiles are very expensive, but the service is good.”</td>
</tr>
<tr>
<td>• The quality of repair services was stated as ‘good’ or as ‘relatively good’ by a majority (16)</td>
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<tr>
<th>Attitude – Usefulness</th>
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<tbody>
<tr>
<td>• All respondents made both private calls and work-related calls for several different reasons, which can be interpreted as extensive perceived usefulness.</td>
</tr>
<tr>
<td>• ‘Usefulness’ is also expressed by the mentioned benefits to using a mobile phone, which were for the majority ‘fast’ (16); ‘has a variety of services’; ‘cheap’ (10); ‘private’ (9); ‘useful’ (6); and ‘flexible’ (3).</td>
</tr>
<tr>
<td>• All respondents sent and received SMS to and from ‘family’ (20) and ‘friends’ (20) i.e. SMS can be interpreted as useful for private communication.</td>
</tr>
<tr>
<td>• Concerning work-related SMS, a majority of the respondents sent SMS to and</td>
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</table>
received SMS from ‘colleagues at my school’, ‘colleagues at other schools’, ‘parents’, and ‘school board’ i.e. SMS can be interpreted as useful for work-related communication.

- Related to ‘usefulness’ are also the mentioned benefits to using SMS, which were for the majority ‘cheap’ (19); ‘fast’ (15); and ‘private’ (10).
- A majority of the respondents (16) used beeping and perceived it useful when ‘out of money’
- The most common reason for beeping was related to ‘meetings’
- The perceived usefulness is measured with the question concerning if the benefits of the mobile phone justify the cost, which was answered ‘to a moderate degree’ (7); ‘to a high degree’ (6); ‘yes absolutely’ (6)
Table 6.2.2 (cont.) Attitude Factors – Tentative Hampering Factors

<table>
<thead>
<tr>
<th>Attitude – Complexity</th>
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<tbody>
<tr>
<td>• 20 per cent of the respondents stated that a mobile was ‘complicated to use’.</td>
</tr>
<tr>
<td>• Several statements about SMS indicate ‘complexity’</td>
</tr>
<tr>
<td>• ‘Complexity’ factors related to the context that influence the actual use of mobile phones are for example finding spare parts/accessories for the mobile. “Have to travel long way to Iringa, 45 km.”; “Pirate copy”.</td>
</tr>
<tr>
<td>• Another context-related ‘complexity’ factor is repair service. This was stated as ‘Relatively hard’ by 4, including the comment “Have to travel long way to Iringa, 45 km”.</td>
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</table>

<table>
<thead>
<tr>
<th>Attitude – Norms and Values</th>
</tr>
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<tbody>
<tr>
<td>• SMS is not an accepted norm between different levels of the hierarchy</td>
</tr>
<tr>
<td>• Beeping is not an accepted norm between different levels of the hierarchy</td>
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</tbody>
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<thead>
<tr>
<th>Attitude – Self-confidence</th>
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<tbody>
<tr>
<td>• 20 per cent of the respondents stated that a mobile was ‘complicated to use’ together with “Users need to be educated about the good uses.”</td>
</tr>
<tr>
<td>• Opinions about SMS: ‘Difficult to make choices’ (7); ‘Difficult to read on the screen’ (4); ‘Difficult to make corrections’ (2); ‘Difficult to scroll’ (2).</td>
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<thead>
<tr>
<th>Attitude – Trust</th>
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<tbody>
<tr>
<td>• A lack of trust in the technology can be indicated by the statement ‘health issues’ (radiation, noise) as stated by 13. Added comment: “Reduce the radiation – can affect the brain.”</td>
</tr>
<tr>
<td>• A lack of trust for retailers such as ‘street vendors’ can be illustrated by one comment: “Street vendor - not durable”; “Batteries are faked even if you buy an original → charge daily.”</td>
</tr>
<tr>
<td>• Bad coverage – too far from mast”; “50 per cent of the time we are without coverage”</td>
</tr>
<tr>
<td>• A majority (14) mentioned ‘disconnected network’; and 10 mentioned ‘unavailable network’. Further answers were ‘unreliable support hotline’ “Closed offices are disturbing.”</td>
</tr>
<tr>
<td>• The trust of quality for repair services … “We don’t have original spare parts.”</td>
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<tr>
<th>Attitude – Usefulness</th>
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<tbody>
<tr>
<td>• Perceived ‘usefulness’ is also influenced by several disadvantages mentioned by the respondents, such as ‘expensive’ (19); ‘health issues’ (radiation, noise) (13).</td>
</tr>
</tbody>
</table>
| • The perceived ‘usefulness’ can be influenced by several negative opinions about SMS such as ‘160 characters is too short’ mentioned by a majority (15)
Table 6.2.3 Awareness Factors – Tentative Supporting Factors

<table>
<thead>
<tr>
<th>Awareness - Experience</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• All 20 respondents had experience of mobile phones.</td>
<td></td>
</tr>
<tr>
<td>• A majority, 75 per cent, had used a mobile phone for 4-7 years.</td>
<td></td>
</tr>
<tr>
<td>• 50 per cent (10) stated that they have owned a mobile phone for 3-4 years and 30 per cent (6) for 5-6 years.</td>
<td></td>
</tr>
</tbody>
</table>

Awareness – Knowledge (Basic and ICT)

<table>
<thead>
<tr>
<th>Awareness - Knowledge (Basic and ICT)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• All of the respondents had a formal basic education with experience as a head teacher of 2-4 years in the biggest group (8)</td>
<td></td>
</tr>
<tr>
<td>• All (20) of the respondents spoke Kiswahili and 90 per cent of the respondents also spoke English</td>
<td></td>
</tr>
</tbody>
</table>

Awareness - Skill

<table>
<thead>
<tr>
<th>Awareness - Skill</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• A majority of the respondents (60 per cent) stated that they could manage to use the mobile phone ‘well’, while 5 answered ‘very well’, and 3 ‘relatively well’; this view can be exemplified by the statement ‘easy to use’, from a majority of the respondents.</td>
<td></td>
</tr>
<tr>
<td>• A majority of the respondents, 70 per cent (14), mentioned that they had more than one SIM card, which can be seen as a sign of skill and awareness about networks, different operators and their economic models.</td>
<td></td>
</tr>
<tr>
<td>• Several services were used among the respondents. All 20 respondents used the basic services, ‘call’ and ‘SMS’. Among other services, ‘beeping’ was the most popular, used by 80 per cent of the respondents.</td>
<td></td>
</tr>
<tr>
<td>• All 20 respondents made and received calls with 50 per cent of the group making 1-5 calls a day.</td>
<td></td>
</tr>
<tr>
<td>• All 20 respondents used SMS with a majority (60 per cent) sending SMS daily.</td>
<td></td>
</tr>
<tr>
<td>• A majority of the group (18) respondents stated that they managed to use SMS ‘Well’, or ‘Very well’</td>
<td></td>
</tr>
<tr>
<td>• A majority of the respondents are used to beeping with 60 per cent beeping 1-6 times a day.</td>
<td></td>
</tr>
</tbody>
</table>

Work-related Awareness

<table>
<thead>
<tr>
<th>Work-related Awareness</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• All (20) of the respondents made work-related calls including calls related to statistical data collection</td>
<td></td>
</tr>
<tr>
<td>• A majority of the respondents made and received calls from e.g. DEO</td>
<td></td>
</tr>
<tr>
<td>• All (20) of the respondents used work-related calls including SMS related to statistical data collection</td>
<td></td>
</tr>
<tr>
<td>• A majority, 95 per cent (19) of the respondents used their private mobile phone for work related calls/SMS/beeps at home.</td>
<td></td>
</tr>
<tr>
<td>• Mobiles phones are seen as a potential to the communication infrastructure (as a complement to fixed telephony and postal service) among the majority (13) who answered ‘Very high’; and 6 answered ‘High’</td>
<td></td>
</tr>
</tbody>
</table>
Table 6.2.3 (cont.) Awareness Factors – Tentative Hampering Factors

<table>
<thead>
<tr>
<th>Awareness – Knowledge (Basic and ICT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The highest education level being ‘form four’ among the majority (14) in the group</td>
</tr>
<tr>
<td>• None of the respondents had a formal ICT education. Added comment: “Users need to be educated about the good uses.”</td>
</tr>
<tr>
<td>• In total, there were 13 different tribe languages spoken within the respondent group.</td>
</tr>
<tr>
<td>• Although nearly all of the respondents had a broad language knowledge, about usage of SMS 25 per cent mentioned ‘Language problems’.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Awareness - Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 20 per cent of the respondents stated that a mobile was ‘complicated to use’.</td>
</tr>
<tr>
<td>• Several negative opinions/disadvantages about SMS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work-related Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>• DEO is not accepted as receiver of SMS “I don’t send SMS to DEO” (3); “I don’t write to DEO and parents – I phone.”</td>
</tr>
<tr>
<td>• DEO do not send SMS; added comment: “Not from DEO.”</td>
</tr>
</tbody>
</table>
6.3 Head Teachers’ Views on an SMS-based Data Collection System

This section describes the head teachers’ views and opinions on a tentative SMS-based data collection system.

This section is also structured by the Triple A concepts: Access, Attitude, and Awareness. In this section, the fictive headmaster is called Peter to make it easier to refer to the two ‘typical’ headmaster expressions for the present paper-based data collection system (6.2) and a possible future SMS-based process (this section). Peter’s statements constitute a condensed form of the findings from questionnaire C2, comprised of 51 questions. The answers collected on these questions get a fuller presentation in Tables 6.3.1, 6.3.2, and 6.3.3, each table being divided into Tentative Supporting Factors and Tentative Hampering Factors (compare to tables in section 6.2).

6.3.1 Access

The ‘access’ theme includes issues such as economy, equipment, infrastructure, ownership, and usage related to an SMS-based data collection system. It may seem surprising that Access is included also in this analysis and not only in 6.2. However, certain aspects of access relates to a certain purpose (namely collecting statistical data by SMS).

Peter states that he is willing to use his own private mobile for statistical data collection. The reason he mentions is “No other alternative - no school phone”.

Peter states that the district school system does not have enough money and resources to create an SMS-based system including a lack of local technical capacity to implement the system and capacity to train head teachers.

For the stated purpose of usage, Peter considers mobile phones as a very good complement to the ‘traditional’ communication of fixed telephone and postal service in his region.

6.3.2 Attitude

The ‘attitude’ theme includes issues such as complexity, norms and values, self-confidence, trust, and usefulness related to an SMS-based data collection system.

Peter states that he trusts the technology and finds it reliable to send important data with SMS. Additionally, he considers it to be secure i.e. concerning data safety, data theft and data tampering, to send important data with SMS and he mentions that “Nobody can change or steal the info”; “Data
can be kept secret” and “Info goes straight to MoEVT”. He also considers data and information he receives via SMS to be reliable and he adds that “it cannot be changed”. He grades the risk for loss of data when using SMS as low. But at the same time he expresses some doubt about data security; “it can happen” as Peter says and continues that “There are human beings dealing with system, maybe the SMS can get lost on its way. Someone can change or steal the data or delete your message if they don’t like it”.

Peter declares that it is very important to know the reason behind a new system of collecting statistical data and he states it to be very important to be involved in the planning of a new system of collecting statistical data. Additionally he states leadership to be very important i.e. that the WC and DO support him taking part in new way of collecting statistical data.

Peter says that mobile phones can be used to improve the communication between rural schools and the administration of education and that there is a real need for using mobile phones in administration of education. He expresses the perceived usefulness with SMS for data collection as it is faster and saves time and that it is also cheaper because “SMS costs 54 Tshs compared to 10 000 Tshs to travel to DEO one way”. He also expresses some doubts about the possibility of storing the data for the future and some of his colleagues ask if it is “better with writings” as a sent SMS cannot be corrected after sending and also that there is no control of mistakes. Some colleagues comment that WC and DO do not get the data and if there are mistakes WC and DO will not report that.

Peter also indicates a low level of self-confidence as he estimates it to be very complex to use SMS for data collection.

6.3.3 Awareness

The ‘awareness’ theme includes issues such as experience, knowledge, and skill related to an SMS-based data collection system.

Peter is aware that mobile phones are used to administer education in some way in general and he is also aware that mobile phones are used to administer education in some way at his school. He has also noticed that mobile phones are used in other public services.

Peter is aware of the possibility to use SMS for data collection but he does not know how it could be done. He is not aware of the possibility to send SMS directly into the computer system at the Ministry but he finds the idea very good. He has some doubts though and comments that it is not possible to make a joint report in this way. Additionally he wants a confirmation SMS
(data received, correct or not) as feedback if mobile phones will be used for statistical data collection.

Peter states that he does not have enough SMS knowledge and experience to use SMS for statistical data collection and declares that he needs ‘very much’ training to use SMS for statistical data collection.

<table>
<thead>
<tr>
<th>Table 6.3.1 Access Factors – Tentative Supporting Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access – Economy - Equipment – Ownership – Usage</strong></td>
</tr>
<tr>
<td>- A majority, 90 per cent (18), of the respondents could think of using their own private mobile for statistical data collection. The reasons they mentioned were e.g.: “No other alternative/no school phone”</td>
</tr>
<tr>
<td>- A majority considers mobile phones as a potential to the communication infrastructure (as a complement to fixed telephony and postal service)</td>
</tr>
<tr>
<td>- Opinion on availability of local capacity to train HTs, ‘Absolutely’ and ‘High degree’ was answered by 45 per cent</td>
</tr>
<tr>
<td>- A majority of the respondents (75 per cent) also stated it ‘Very important’ to know the reason behind a new system of collecting statistical data</td>
</tr>
<tr>
<td>- A majority of the respondents (80 per cent) stated it ‘Very important’ to be involved in the planning of a new system of collecting statistical data</td>
</tr>
<tr>
<td>- A majority (60 per cent) stated it to be ‘Very important’ that the WEC and DEO supported taking part in new way of collecting statistical data i.e. leadership was considered important. Support mentioned was e.g. ‘training seminars’.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 6.3.1 (cont.) Access Factors – Tentative Hampering Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access – Economy - Equipment - Ownership - Usage</strong></td>
</tr>
<tr>
<td>- A majority stated that the district school system does not have enough money and resources to create a new SMS-based system.</td>
</tr>
<tr>
<td>- Concerning using private property, one respondent stated: “Because it’s mine and I don’t want to use it for official use.”</td>
</tr>
<tr>
<td>- A majority of the respondents indicated a lack of local technical capacity to implement an SMS-based system.</td>
</tr>
<tr>
<td>- Opinion on local capacity to train HTs: ‘Not really’ and ‘Not at all’ by 40 per cent.</td>
</tr>
</tbody>
</table>
### Table 6.3.2 Attitude Factors – Tentative Supporting Factors

#### Attitude - Trust
- A majority, 95 per cent (19) of the respondents stated that they trusted the technology and found it reliable to send important data with SMS.
- A majority of the respondents, 80 per cent (16), thought it to be secure (data safety, data theft and data tampering) to send important data with SMS.
- A majority, 55 per cent (11) stated the reason to be 'Nobody can change/steal the info'.
- A majority of the respondents stated that the information they receive via SMS was reliable. Added comment: “Cannot be changed.”
- A majority stated the risk for loss of data when using SMS as ‘Low’ or ‘Relatively low’.

#### Attitude - Usefulness
- All of the respondents (20) stated that mobile phones can be used to improve the communication between rural schools and the administration of education (WEC/DEO/MoEVT).
- A majority (19) of the respondents stated that there is a need for using mobile phones in administration of education.
- Perceived usefulness with SMS for data collection was expressed by a majority as ‘Faster/save time’ and ‘Cheaper (transport/papers)’ “SMS = 54 Tshs compared to 10 000Tshs to DEO (one way)” “Can keep the info secret”, “Info straight to MoEVT”, “Possibility to store the data for the future”.

### Table 6.3.2 (cont.) Attitude Factors – Tentative Hampering Factors

#### Attitude - Complexity
- A majority of the respondents (13), 65 per cent, answered that it would be ‘Very much’ or ‘Relatively much’ complex to use SMS for data collection.

#### Attitude - Self-confidence
- A majority of the respondents’ (13), 65 per cent answered that it would be ‘Very much’ or ‘Relatively much’ complex to use SMS for data collection which indicates a low level of self-confidence.

#### Attitude - Trust
- Some expressed doubt about data security: “It can happen. There are human beings dealing with system.”; “Someone can change/steal the info”; “The SMS can’t be lost/destroyed on the way”; “Someone might delete your message if they don’t like it.”

#### Attitude - Usefulness
- Someone stated about ‘SMS as data collector’: “It’s better with writings.”
- Mentioned disadvantages/problems/obstacles with using SMS for data collection was: ‘Can’t correct after sending/no control of mistakes’ (8, 40 per cent)
- Added comments were: ”Data can be stolen”; “Keeping data safe ex if the handset is lost the data is lost”; “The in-between officials don’t get the info (WC, DO),”; “If mistakes in my data WC/DO will not report”.
- A majority of the respondents wanted ‘Confirmation SMS (data received, correct or not)’ as feedback if mobile phones could be used for statistical data collection.
Table 6.3.3 Awareness Factors – Tentative Supporting Factors

<table>
<thead>
<tr>
<th>Awareness - Experience, Knowledge, and Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>- All of the respondents (20) answered that they knew that mobile phones are used to administer education in some way in general.</td>
</tr>
<tr>
<td>- All of the respondents (20) answered that mobile phones are used to administer education in any way at their school.</td>
</tr>
<tr>
<td>- A majority of the respondents (18) have observed/noticed that mobile phones are used in other public services.</td>
</tr>
<tr>
<td>- A majority (15) of the respondents were aware of the possibility to use SMS for data collection.</td>
</tr>
<tr>
<td>- A majority 90 per cent thought it to be ‘Good’ or ‘Very good’ to send statistical data via SMS directly to the computer system at the Ministry of Education.</td>
</tr>
</tbody>
</table>

Table 6.3.3 (cont.) Awareness Factors – Tentative Hampering Factors

<table>
<thead>
<tr>
<th>Awareness - Experience, Knowledge, and Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>- A majority did not know how mobile phones could be used for collecting statistical data.</td>
</tr>
<tr>
<td>- A majority of the respondents thought that they did not have enough SMS knowledge/experience to use SMS for statistical data collection.</td>
</tr>
<tr>
<td>- A majority of the respondents (17, 85 per cent) stated they needed ‘Very much’ or ‘Relatively much’ training to use SMS for statistical data collection.</td>
</tr>
<tr>
<td>- The majority of the respondents (17, 85 per cent) were not aware of the possibility of sending SMS directly into the computer system at the Ministry of Education.</td>
</tr>
<tr>
<td>- Added comments were: “Why? It is not possible to make a joint report in this way.”; “Certain data is difficult to use SMS ex. graphs (draft).”</td>
</tr>
</tbody>
</table>

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6.4 EMIS of Tomorrow – a Blended Digital System

This section returns to EMIS, but with a future perspective, discussing if and how mobile telephones can be used as an effective administrative tool in the education sector in a rural area in Tanzania in order to answer the main research question: Can mobile phones effectively constitute a part of a blended EMIS?

An underlying assumption of an ‘EMIS of Tomorrow’ is that in a developing country context, blended solutions must be considered. The present EMIS is ‘already’ a blended system with a mix of non-digital and digital technologies. The proposed EMIS is mainly a blended digital system, with a blend of several digital technologies with a minor non-digital part. A blended ICT solution is suggested here, which emanates from the local environment and context: what is already there and is being used. As Unwin and Day (2005) put it, ‘Don’t forget that ICT covers a wide variety of technologies – not just computers - it is very important that other technologies are not ignored.’

In this particular context, the education sector in the Iringa region in Tanzania, ‘computer hardware and Internet connectivity’ is scarce, but there is a wide adoption of mobile phones, used both for private and professional purposes. But the work-related usage of mobile phones is not organised, systematic or formalised. The proposed solution is meant to suggest a system that requires the introduction of a ‘new’ technology, i.e. mobile telephones, and to suggest using this ‘new’ technology in an organised, systematic and formalised way.

This section starts by presenting an outline of the proposed SMS-based system. This is followed in section 6.2 by a discussion relating the empirical data collected in this study to national data and national studies together with international studies mentioned in Chapter 3. This part of the analysis creates a foundation for a discussion about supporting and hampering structures; the latter are critical issues to be considered when introducing a new technological schema.

The next section, 6.3, focuses on the supporting and hampering structures and what resources are, tentatively, needed for the SMS-based systems in order to answer the research question:

- What are the existing supporting and hampering structures that would influence the implementation of an SMS-based system?
  - What ‘critical’ issues need to be considered?
Then follows a discussion of possible implications, consequences and effects of the SMS-based system, in section 6.4., including rich pictures that illustrate the challenges of the proposed EMIS for the different actors on ‘all’ levels. Additional remarks are made on challenges that would still remain since not everything can be solved with faster data collection in order to answer the research question:

- What would the consequences of an implementation be outside the system?

Section 6.4.5 briefly explains how the suggested approach from section 3.6 with seven aspects to consider in an e-government system implementation can be interpreted when planning for the implementation of an SMS system. Finally, the last section, 6.4.6, returns back to the research questions and points out in which sections the questions have been addressed.

### 6.4.1 Outline of an SMS-based Data Collection System

This section presents an outline of the proposed system, describing the organisational structure, actors, activities and technology of the proposed SMS-based system, with focus on the statistical data collection process: i.e. how an SMS-based system can be constructed. The structure of the SMS-based data collection system is inspired by the SEMA system in Kenya reported by Traxler (2006; 2007) among others.

First a couple of lines about ‘blended’. It can be stated to be synonymous with ‘hybrid’ and ‘mixed,’ both of which are often used in the literature. ‘Blended’ can also be related to terms such as composite, combination, convergence, complement, supplement, or integration.

A ‘blend’ must not be seen as a less advantageous alternative, a next best solution. Instead, it might be the most effective and efficient solution in a certain context. A ‘blend’ can also be understood as a middle way: “...a successful ‘third way’ between two unsuccessful extremes” (Heeks 2006) – a definition which also includes an incentive for blending. So the question is not if we should blend, but how to do it. Anything can be blended: technologies, techniques, applications, and methods.

Inherent to the concept ‘blended ICT’ is that it includes several technologies – manual and digital, ‘old’ and ‘new’, exploiting the diversity within the ICT ecosystem and taking advantage of different strengths and advantages to make the ‘best’ combination.

The idea is that different technologies can enhance data and information transfer through increased access, making the system faster and more flexible. A task such as statistical data collection can be completed in different ways
using different tools, i.e. the same final result can be reached in different ways, since a social system is characterised by equifinality and multifinality. From a systems perspective, it is the effect of the whole system that counts, the combined, synergetic effects. The strategy is to create synergy; to involve and utilise ‘new’ possibilities of interaction between different ICT devices, both old and new.

Blending is about finding complementarities between different technologies. It is also about adding new forms of technologies to supplement older forms, e.g. mobile phones become a substitute and a complement to the existing communication infrastructure particularly in rural areas.

The idea is that each technology has distinctive qualities and a blend of different technologies is ‘better’ than using only one; e.g. technology varies in cost of installation and maintenance, and the implied media can vary in cost of production and dissemination (Moore 2006:xxv). It follows that implementers and administrators have to decide upon which is the most cost-effective combination of media and technology for its particular purpose and one case is not like another.

However, it is important to remember is that a sustainable solution needs an underlying user perspective answering questions such as: Who wants a new solution? Is there a need and a demand? How do they want it? Are users ready for the solution? Is there capacity? Do users trust the technology?

The statistical data collection process can be viewed as a system with a sequence of activities. The data collection process, divided into three main sub-processes (pre-capture, capture, post-capture) is described using the Three-stage Data Capture Process Model presented in section 4.5. The proposed data collection process is further divided into eight different activities: seven dispatches of different kinds of SMS and one distribution of a report.

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43 A main source on blended solutions in the education sector is *The Handbook of Blended Learning – Global Perspectives Local Designs* (2006) (Eds. Bonk, C.J. and Moore, M.G.) John Wiley & Sons: New York. Moore (2006) defines ‘medium’ as “the form in which a message is communicated” e.g. SMS and ‘technology’ as “the vehicle that transports the medium”, as, for example, a mobile phone.
Pre-capture:
1. Request SMS

Capture:
2. Input SMS
3. Confirmation SMS
4. Correction SMS
5. New Input SMS
6. Verification SMS

Post-capture:
7. Completion SMS
8. Final report

In cases of error, SMS numbers 4, 5 and 6 are sent.

The feedback loop consists of several SMS messages, together with the final report, which is distributed via the Internet and ordinary mail in order to finalise the feedback loop.

Feedback SMS:
3. Confirmation SMS – Input Feedback
7. Completion SMS - Completion Feedback

Error Feedback: SMS 4 and 6
4. Correction SMS – Error Feedback
6. Verification SMS - New Input Feedback

The description of the proposed system is outlined according to the Change Model, which was presented in section 4.5.

Organisational Structure (Organisation Unit - Which): MoEvT, REO, DEO, WEO, PS

Actors (Who): EMIS Team, RO, DO, WC, HT

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44 In official documents, the acronym DEO is used both for the unit and for the head of the unit. In this presentation, to avoid misunderstandings, I have chosen to use DO for the head of the unit and DEO for the unit.

On the organisational level: - UNIT
MoEvT = Ministry of Education and Vocational Training
REO = Regional Education Office
DEO = District Education Office
WEO = Ward Education Office
PS = Primary School
**Activity** (*What and When*): Statistical data collection is divided into different sub-processes – pre-capture, capture and post-capture – and further divided into eight different activities: seven different SMSes together with the distribution of a report.

**Technology** (*How*): The proposed system requires the introduction of a ‘new’ technology, namely mobile telephones. The proposed system demands several types of technology, both digital and non-digital e.g. mobile phones, fixed computers and paper and pen (PaP).

The proposed system is facilitated by using predefined SMS formats and a short code. SMSes can be written and sent from a fixed computer via a server by using a standard office email client e.g. Outlook via the Internet or mobile networks. SMSes can also be received via a server using mobile networks.

Below the activities are described along with *who and which organisation units* will be involved. Finally, a list of technologies is presented according to the organisational structure. The structure of the proposed system is illustrated in Figure 6.4.1.

**Pre-capture**

- Request SMS - Automatic SMS from server at MoEVT (1 February)
- To PS (HT)
- with cc FYI
  - To PC or server at REO (RO), DEO (DO)
  - To WEO (WC)
  - To PC or server at other ministries e.g. MoF and org. e.g. UNESCO

**Capture**

- Input SMS - Predefined SMS format including the PS ID from mobiles at PS (March)
- To server at
  - MoEVT (EMIS Team)
- With cc FYI
  - To PC or server at REO (RO), DEO (DO)
  - To WEO (WC)
  - To PC or server at other ministries e.g. MoF and org. e.g. UNESCO
- Confirmation SMS - Automatic SMS from server at MoEVT (April) – ‘Thank you’
• To PS (HT)
• with cc FYI
  o To PC or server at REO (RO), DEO (DO)
  o To WEO (WC)
  o To PC or server at other ministries e.g. MoF and org. e.g. UNESCO

***IN CASE OF ERROR – SMS 4-6 ******
• Correction SMS - Automatic SMS from server at MoEVT – ‘Something is wrong’ (March)
• To PS (HT)
• with cc FYI
  o To PC or server at REO (RO), DEO (DO)
  o To WEO (WC)
  o To PC or server at other ministries e.g. MoF and org. e.g. UNESCO
• New Input SMS - Predefined SMS format including the PS ID from mobiles at PS (March)
• To server at
  o MoEVT (EMIS Team)
• With cc FYI
  o To PC or server at REO (RO), DEO (DO)
  o To WEO (WC)
  o To PC or server at other ministries e.g. MoF and org. e.g. UNESCO
• Verification SMS (feedback on new input) - Automatic SMS from server at MoEVT – ‘This is correct’ (April)
• To PS (HT)
• with cc FYI
  o To PC or server at REO (RO), DEO (DO)
  o To WEO (WC)
  o To PC or server at other ministries e.g. MoF and org. e.g. UNESCO

******************************************************************************

Post Capture
• Completion SMS - from server at MoEvT – Mission completed e.g. ‘Funding distributed’
• To PS (HT)
with cc FYI
  o To PC or server at REO (RO), DEO (DO)
  o To WEO (WC)
  o To PC or server at other ministries e.g. MoF

Final Report
  o To PC or server at REO (RO), DEO (DO)
  o To PS (HT) via ordinary mail

Technology
The proposed blended solution combines different technologies, e.g. mobile and fixed, digital and non-digital, via different gateways:
  • PaP → Mobile
  • Mobile → PC/Server
  • PC/Server → Mobile
  • PC/Server → Paper (Report)

Below the different technologies at different levels are listed:

PS Level:
  • PaP (Paper and Pen)
  • Mobile

WEO Level:
  • PaP
  • Mobile

DEO Level:
  • PaP
  • PC or Server
  • Mobile

REO Level:
  • PC or Server
  • Mobile

MoEVT Level:
  • PC or Server
Figure 6.4.1 Senders and Receivers of the Seven Types of SMS Messages
The analysis of the present EMIS and the statistical data collection process revealed several strengths and weaknesses as presented in section 6.1. Comments regarding those strengths and weaknesses are presented here, with the ambition to discover whether the proposed EMIS can compensate for the weaknesses. A premise is that the identified strengths should be utilised as supporting structures.

The proposed EMIS replaces the manual distribution and submission of the statistical data forms with SMS, which has the potential to tackle several problems such as:

- data security and data validity
- lack of Internet connections on regional and district levels
- lack of computers and fixed telephones on school level
- slow and poor post service
- costly, time-consuming, ‘complicated’ transports for several actors (HT, WC, DO, RO, EMIS Team) due to lack of public transportation and poor gravel roads during rainy seasons

The manual procedures of filling in the form at the school level, checking the data at the ward and district levels, summarising the forms at the district level, typing the data into the database at the ministry level and finding data that due to time constraints have not entered into the database, are replaced by an automatic process which will have positive effects on data validity.

The storage of data today at several different places and in several different forms is also an issue of data security and data accessibility. The delivery of data in several steps by several actors also constitutes a risk for data security.

A supporting structure for the proposed system is that computers, servers and the Internet are already available on a central level, with computers being available on the regional and districts levels. This makes it possible to store data at those levels automatically in databases via servers when receiving an SMS instead of keeping paper forms.

At the same time, a non-digital paper-based system must coexist with the digital system at some levels: PS and WEO, but hopefully with less paper with the SMS-based system.

Today, the data are collected annually in March-April. With an SMS-based system, (some of) these data could be collected more frequently if it is considered necessary to have more up-to-date data in order to facilitate management.
The proposed system also provides timeliness and reduces the stress and the risk for 'punishments' if the collected data is not delivered by the deadline.

A supporting structure in the present EMIS is the annual report, BEST (Basic Education Statistics in Tanzania), which acts as feedback together with the annual district report. But this feedback does not reach all actors. In the proposed EMIS, all actors involved can get ‘immediate’ feedback through an automatic SMS. This is central in a systems perspective. The production of BEST can be facilitated by updated and integrated databases. Feedback in the proposed systems also includes a loop of SMSes in case of error, which contributes to data validity.

The proposed system can contribute to ‘better data’ by the improved collection process of the data. Improvements can be many, e.g. more frequent data capture (data is up to date), faster delivery of data (again, data is up to date), fewer data transmission errors, less expensive data delivery, increased clarity through increased readability, reduced risk for misunderstandings, fewer links i.e. more direct communication.

6.4.2 Findings in Relation to Other Studies

This section relates the empirical data to national and international data and studies together as mentioned in Chapter 3. The findings from the field study among head teachers are supplemented with e.g. challenges within EMIS and experiences from m-government solutions in other countries.

The key issues below are categorised using the seven XIF resources as ‘labels’. Using XIF as a guideline has also the intention to give structure to the presentation, even if some subheadings do not follow the XIF sub-categorisation completely; some more inclusive subheadings are used to make the presentation in this section more condensed.

This part of the analysis creates a foundation for the discussion about supporting and hampering structures. The latter are critical issues to be considered and circumvented.

The seven resources in the XIF framework are Immaterial, Human, Social, Financial, Physical, Institutional, and Political.
I. Immaterial Resources and Key Issues

From a systems perspective, immaterial resources for e-government solutions can include issues such as languages, and content such as different types of data and information.45

- **Languages**

  The knowledge of languages is often seen as a resource for information systems development in a multi-lingual context, but at the same time a multi-lingual context also constitutes a challenge. In Pakistan, according to Komatsu (2009), one challenge to e-government projects is the lack of multi-linguistic competency required of local education officers, although many officers do not have such language proficiencies. This is also mentioned as a major inhibitor for ‘ICT in education’ in Tanzania, since Kiswahili is the common language but English is taught in secondary school (Hare 2007).

  Additionally the absence of bilingual content in e-government projects is mentioned as a challenge in the e-government strategy for Tanzania (President’s Office 2009). An example of a language challenge can be shown in Sri Lanka, where the majority of government websites offer content in English, while the majority of people in rural areas speak Sinhala and Tamil (Wattegama 2004). At the same time, a common trend over the world is to combine English with local languages, as seen with Tanglish in the Philippines.

  Additionally, SMS services are dependent on literacy and indigenous languages (Mendes et al. 2007). Among other challenges and barriers to SMS usage in Uganda, a lack of local languages on handsets posed a significant obstacle (Hellström 2009). Differences in language influence SMS interfaces as stated in several reports (Pornpanomchai et al. 2001; Lin & Sears 2007; Donner 2008). From Bangladesh, using SMS for education administration posed a problem because the message could only be written in English or using the Latin alphabet (Pouezvara & Khan 2007). For Tanzania it should be observed that Kiswahili uses characters from the Latin alphabet; ‘all’ mobile phones are prepared for the Latin alphabet.

  At the same time, it is important to be aware that ‘SMS literacy’ does not require full literacy, although it often involves its own vocabulary, which in itself requires ‘knowledge’ of a ‘new’ language. As de Bruijn et al. (2009:20) state, the “…orality both of Africa and of the mobile phone is overstated as new forms of literacy (i.e. text messages) are being employed…” The limited number of characters has improved the ability to synthesise and develop this new

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45 From an individual perspective, language skills can be alternatively categorised as a Human resource.
language: a “written orality”, based on symbols and abbreviations; it is more a code than a written language (Castells et al. 2007). A study was done using SMS service to support administrative communication in education in the UK, and the administrative staff integrated the service into their current means of communication with success, and although there were some difficulties in composing appropriate SMS, they found it to be more expressive (Naismith 2007). In the SEMA project in Kenya, a standardised SMS format, with a limited and predefined syntax, was used to simplify the composition of SMS (Traxler 2007). Some teachers, however, had problems identifying some of the special characters required for the SMS, as there was a need to use it precisely (Power & Sankale 2007; 2009), which resulted in error and duplicates (Traxler 2007).

In the study of Tanzania presented here, all of the respondents spoke Kiswahili and a majority also spoke English, but as head teachers at primary schools, their ‘working language’ was Kiswahili. In addition, there were 13 different tribe languages spoken within the respondent group. Hence, most of the respondents had a ‘good’ language knowledge i.e. had a bilingual competence. In spite of this language diversity and competency, when asked about SMS usage, 25 per cent of the respondents mentioned ‘Language problems,’ since English is most common in mobile applications. This opinion is also shared by the group of DEO respondents and this affected in a negative way their attitude to using mobile phones as administrative tools.

• Contact Data

Resource constraints in the form of administrative arrangements are mentioned in Ghana as a challenge when implementing MIS solutions (Sander et al. 2005). The importance of building gateways between different ‘incompatible’ subsystems within an e-government system is stressed by Braa et al. (2007). The existence, identification and registration of contact data can be seen as an interface between a paper-based subsystem and an ICT-based subsystem; as part of the overall information system and necessary to make the overall system function. The identification and registration of the head teachers’ phone numbers, including the registration of each school’s unique ID, is mentioned as a crucial part of the SEMA-project in Kenya (Traxler 2006).

The importance of phone numbers is mentioned by Wicander (2010): the phone number is the most ‘individual part’ of the mobile, the part that mediates connections, that reveals your identity when you call/SMS/beep, that you ‘keep’ with you all the time. The phone number may be more important in the mobile era than your identity number/personal number/birth data or physical
address in a developing country context. The importance of the list of phone numbers is shown in Jamaica, where communication problems between primary schools and parents were solved using mobile phones (Miller & Horst 2006).

However, it is important to be aware of the risk with registration of data and in this case registration of private ‘property’ and that this can be seen as surveillance, observation or increased control from the state, potentially creating the feeling of being monitored and tracked (Kuschchu et al. 2006). This has to be balanced against the importance of creating and strengthening a culture of data and information exchange. For example, GAID (2009) stresses the benefit of using mobile devices to be able to monitor progress in projects. It is mentioned that the SEMA system could be monitored centrally from ministry (Traxler 2007).

In this study, a majority of the schools had no official list, distributed from the district education office, of mobile phone numbers to head teachers at other schools. All schools have a unique school ID, which makes the registration process easier.
II. Human Resources and Key Issues

The importance of human resources, including experience, skills and knowledge among involved staffs for successful e-government solutions in developing countries, are stressed in several reports (e.g. Heeks 2002b; Heeks 2006:5-6; Guida & Crow 2009). In fact most e-government projects in developing countries fail due to human factors, not technical (Guida & Crow 2009).

Furthermore, effective e-government requires different types of capacity from administrators and users such as managerial skills, adaptation and learning (Madon 2009) as well as as competent candidates (Sander et al. 2005). Additionally, effective plans need to be put in place for the development of human capital including capacity development at individual level (Fenenga & de Jager 2007; Guida & Crow 2009).

- **Skill & Experience**

E-government presents a number of challenges for developing countries when implementing e-government projects. Effective e-government requires capacity from administrators such as technical skills (Madon 2009). Challenges mentioned from an e-government project in Uganda were, among others, limited ICT skills (Kazooba 2010). A lack of adequate ICT human resources together with a lack of expertise in ICT are identified as critical issues in the strategy for e-government in Tanzania (President's Office 2009).

Further, it can be stated that the users' mobile experience is essential for successful and effective mobile usage (Nokia 2006). In the SEMA project in Kenya, mobile phones were the core communication platform for the project because it was seen as particularly appropriate due to the high level of mobile phone usage (Traxler 2007; Power & Sankale 2009). The project engaged over 16 000 teachers over a short period of time, thanks to the use of a ubiquitous technology well known to the teachers, instead of introducing a new technology. However, when Power et al. (2009:96-97) made a study in South Africa they identified barriers to success for ‘ICT in education’ in rural schools including poor design with too much focus on the technical capacity.

The present study shows that all respondents had experience of mobile phones and a majority had used a mobile phone for 4 -7 years. Several services and functions were used among the respondents: all respondents used the basic services, voice and SMS or ‘call’ and text’, daily. Among other services, ‘beeping’ was the most popular, used by a majority of the respondents. That being said, a majority of the respondents thought that they did not have enough SMS experience to use SMS for statistical data collection and mentioned “Users need to be educated about the good uses”.
Important factors for e-government solutions include users being ready for e-government (Madon 2009); technological readiness can also include m-readiness – readiness for the successful adoption of the mobile (Chang & Kannan 2002). One part of this key factor in the implementation of MIS in developing countries is the use of user-friendly ICT tools (Fenenga & de Jager 2007).

In this study, a majority of the respondents stated that a mobile phone is ‘easy to use’. This opinion is also shared by the group of DEO respondents. This shows an opinion of low ‘complexity’ among the respondents, which is in line with the view expressed in Wicander (2010) that for an individual, a mobile is easy to use and a low level of skills is required in order to operate a handset.

At the same time, a mobile has more functions and is more complex to use than a traditional telephone (Mendes et al. 2007). The mobile phone is not monolithic: it is a complex artefact, (Fortunati 2005) and several features functions and attributes lay within the handset that are used in different ways by different users. A mobile can be seen as a multifunctional device in line with a ‘Swiss Army Knife’ (Jenkins 2006): a mobile phone is not just the handset; it is made of a ‘multiplicity of components’; ‘several products in one’: putting it on vibrate even turns it into a massage device.

- **Self-esteem & Self-confidence**

Key factors for e-government solutions in developing countries include attitudes of the staff (Heeks 2006:5-6). This includes both the attitude to ICT itself as a tool and also the attitude to one's own ICT competence. Self-esteem and self-confidence influence the use of mobile phones, which can be indicated by opinions about manageability. The perception of being successful creates self-confidence (Furuholt 2009). However, when identifying barriers to success for ICT in education in rural schools in South Africa, Power et al. (2009:96-97) discuss the issue of disempowering educators. If the technology is seen as the determining factor in ‘good’ education, this may then erode the agency of rural teachers.

In this study, a majority of the respondents stated that they could manage to use a mobile phone, including SMS, ‘well’, or ‘very well’, indicating a certain level of self-esteem and/or self-confidence. However, a number of the respondents stated a mobile phone as ‘complicated to use’ including SMS, illustrated with comments such as ‘Difficult to make choices’, ‘Difficult to read on the screen’, ‘Difficult to make corrections’, ‘Difficult to scroll’, which indicates a lower level of self-esteem and self-confidence for this activity. A
majority of the respondents also stated it ‘very much’ or ‘relatively much’ complex to use SMS for data collection.

- **Basic Knowledge & ICT Knowledge**
  
  Key factors for e-government solutions in developing countries include knowledge of the staff involved with the e-government systems (Heeks 2006:5-6). Availability of basic knowledge is a challenge (Furuholt 2009; Guida & Crow 2009) and one of the identified critical issues when implementing MIS in Ghana was inadequate basic education of personnel – basic analytical skills were missing, as the quality of the education system is stated as poor with several unqualified teachers (Sander et al. 2005). Furthermore, the levels of education and literacy noted by Nokia in India (2006) are essential for successful and effective mobile usage (Wicander 2010).

  Additionally, e-government presents a number of challenges for developing countries when implementing e-government projects, including issues such as availability of e-literacy (Furuholt 2009; Guida & Crow 2009). There is also evidence that schools and teachers do not use ICT in developing countries, according to Vrasidas et al. (2009:8). Experience from Tanzania shows that teachers are seen as late adopters of ICT in their occupation, i.e. they do not use the technology in their work due to lack of e-literacy (Jensen p.c. 2007). ICT in education demands a certain quality, with well-trained teachers being essential (Unwin 2005b).

  In this study, all of the respondents had formal basic education and with experience as a head teacher of 2-4 years in the largest group but none of the respondents had a formal ICT education.

  Sander et al. (2005) identified critical issues from MIS failures in Ghana, including a lack of in-country ICT development expertise. The lack of ICT expertise was due to multi-national companies recruiting the available staff (ibid). Post-implementation observations of the EMIS in Ghana was that equipment maintenance deteriorated due to the limited ability and capacity of the organisation and that adequate technical and operational staff was missing, since the EMIS team was either moved away or they left (ibid). Lack of staff to use the EMIS is also reported from Bangladesh (Pouzevara & Khan 2007). In the SEMA project in Kenya, it was initially stated that the resources, expertise, systems and technology to develop the SMS system all existed locally and cheaply (Traxler 2006:12), but later findings report on constraints such as access to resources, expertise, and equipment (Traxler 2007), which was also shown in Uganda with a lack of technical support by the main stakeholders (Fenenga & de Jager 2007).
Recommendations by Sander et al. (2005) from Ghana include identifying the ICT state at the department through an initial assessment of human resources.

In the study presented in this paper, a majority of the respondents indicated a lack of local skills and local technical capacity to implement an SMS-based system.

- **User Training**

The issue of training for the successful implementation of e-government in developing countries is stressed by several authors, including acquiring the necessary resources for the training (e.g. Kumara & Best 2006; Sander et al. 2005; Furuholt 2009). The lack of training has been mentioned in numerous studies in varying contexts, including India, Uganda and Ghana. In India, e-administration was introduced in the late 1980s, but several problems and challenges have been encountered, including a lack of adequate training (Walsham & Sahay 1999). Inadequate ICT training is also mentioned as a challenge from an e-government project in Uganda (Kazooba 2010). Experience from Ghana related to MIS shows that the important points include training of user staff (Sander et al. 2005). An identified hinder in Tanzania is that e-government is a new area with a need for pre-service and in-service training (Hare 2007). Tutor technicians are considered a critical factor for ‘ICT in education’ in Tanzania (ibid).

In the SEMA project in Kenya, mobile phones were the core communication platform for the project because it was seen as particularly appropriate (Power & Sankale 2009) and previously well-known to the teachers. Major issues when implementing the SMS-based system in Kenya included training (Traxler 2007:5), but the cascade-training model that was implemented resulted in that the training material could be interpreted in different ways that were contrary to the original purposes (Traxler 2007; Power & Sankale 2009). There were problems getting users onto the system rather than using it (Traxler 2007): “the lower level not getting wet as expected” (Power & Sankale 2007:6).

Additional observations mentioned by Power and Sankale (2009) from the implementation of SEMA application in Kenya for the data collection process, included the users needing to send specially formatted SMSes that have a syntax designed for the application. A benefit is that each SMS can be very ‘data rich’ in spite of its 160 characters. On the other hand, one disadvantage is that users must be trained in the syntax and use it precisely (Power & Sankale 2009) and there were problems in using this terse fixed format (Traxler, 2007) resulting in many error messages, and duplicates e.g. some teachers could not locate some
of the special characters required for the syntax of messages, such as the hash key (Power & Sankale 2007:6). Experience from Bangladesh with mobiles for education administration showed extreme learning curves for smart phones; the authors suggested ‘simple’ phones instead, together with more effective training and providing a written manual (Pouzevara & Khan 2007). Training can be performed using both formal and informal methods to help with the success of m-government (Capra et al. 2006).

Kuschchu et al. (2006) also point to the need to identify the potential effects of m-government, including the impact on staff as the need for new skills arises e.g. how to use a new device. Ojedokun and Moahi (2009:50) indicate that ICT can constitute a source of stress for employees if they have to learn computer skills resulting in e-stress and “...thinking their job has become less secure and less interesting.”

In this study, a majority of the respondents stated they needed ‘very much’ or ‘relatively much’ training to use SMS for statistical data collection, and nearly half of the group thought that there was not enough local capacity to train HTs.

It is important to remember that training is not enough. Motivational encouragement for all involved and engaged public employees are critical (Furuhol 2009). Heeks (2002b) mentions awareness as being important in Africa for building e-government solutions. Key issues include ICT awareness building, e.g. understanding the capabilities of intended ICT solutions for both management staff and users. This also includes an overall contextual awareness from external stakeholders as stressed by Sander et al (2005) from their experience in Ghana. Failures of MIS-projects in Ghana were due mainly to causes where the beneficiaries were unaware of how the MIS can be usefully employed in their daily work (Sander et al. 2005). Data collection in Ghana was a critical part of the EMIS and training was provided for head teachers each year, but the head teachers saw no benefits for them or their school. They lacked motivation and delegated the tasks to untrained staff with the consequence that the forms required extensive validation before data entry.

Lack of awareness concerning both the technology as well as economic issues was experienced from the SEMA project in Kenya (Traxler 2006). Further, Jensen states that there is not always an understanding or awareness of ICT as a development tool at a local level in developing countries (Jensen p.e. 2007). Recommendations by Sander et al. (2005) from Ghana included sensitisation of employees to policies, guidelines and standards.
III. Social Resources and Key Issues

Many troublesome challenges for e-government in developing countries seem to be of a social character as mentioned in several reports. Walsham et al. state that social conditions are often underplayed and “[S]ocial influences are crucially important to the trajectory of any technology-based project” (Walsham 2007:322). Improving e-government systems is foremost a social activity, not a technological one (Madon 2009). Hoppe et al. (2003) state that social practices such as interpersonal relations are critical to success when implementing mobile solutions.

Structural obstacles and normative rules in a society and in an organisation can constrain and channel the design of ICT solutions (Braa et al. 2004). e-Government implementation can confront existing structures (Walsham & Sahay 1999) and can be actively be resisted (Silva & Hirschheim 2007). The mutual influence between IS and the social processes is stressed with an example of the implementation of an HMIS in Ecuador where “...deep-seated resistance...” is stated to be a reason for failure (Walsham et al. 2007:322).

Key factors when implementing an e-government system include a culture values component: what stakeholders feel are right and wrong ways to do things (Heeks 2006:5-6). There is a need to take into account the structure and social dynamics of an organisation, including core values and beliefs, distribution of power, and the mechanism of control systems. Several issues are mentioned in the literature related to attitudes, beliefs and values, including acceptance, power relations, trust, and gender issues.

- Acceptance

Key factors for e-government solutions in developing countries include the attitudes of the staff (Heeks 2006:5-6). Attitudes towards ICT and actual usage of ICT are considered critical by Furuholt (2009).

A major issue when implementing the SMS-based system SEMA in Kenya included acceptability and user acceptance (Traxler 2007:5) and aspects included the notion mobile phones are socially inclusive with a high level of acceptance and usage. Mobiles are an appropriate technology (Traxler 2006) and teachers appeared to be early adopters of SMS (Traxler 2007), but that there were also negative attitudes towards SMS (Power & Sankale 2007; 2009) and towards understanding the systems role and intended use (Traxler 2007). Attitude is listed as a key issue in the e-government strategy in Tanzania (President’s Office 2009). According to Jensen (p.c. 2007), experience from Tanzania is that teachers are seen as late adopters of ICT in their occupation i.e. they do not use
ICT in their work. But it is important to remember that changes of attitude and culture are complicated and can take years (Walsham & Sahay 1999; Grönlund et al. 2008).

In this study, mobile phones were for the majority an accepted communication tool for several work-related uses. A majority of the respondents sent work-related SMS to and received SMS from ‘colleagues at my school’, ‘colleagues at other schools’, ‘parents’, and ‘school board’. In other words, SMS can be interpreted as an accepted form of work-related communication.

The experience and the frequent use of SMS services today provides a foundation for the continued development of more advanced SMS services based on local needs (Wicander 2010). SMS has become a critical aspect of mobile communication, adding significant value by expanding the amount of interaction (ibid). This can be seen as a mode of ‘converging’, which is not only about technology. A mobile phone also allows us to converge our telecommunication habits into other activities. The mobile allows us, on an individual basis, to coordinate, organise and control interaction; to interlace different activities of our daily life (Ling & Donner 2009). The impact of the mobile phone goes far beyond its level of usage and has both a material and immaterial presence in many spheres (Brinkman et al. 2009). The borders between the institutional spheres of work and home are likely to change because of mobile phones, becoming more permeable, flexible, and more interpenetrated (Pelckmans 2009). However, the definition of the public sphere and the private sphere differs between different cultural contexts (ibid). In a case study from Bangladesh it was considered an advantage that teachers could use SMS outside schools hours (Pouzezvara & Khan 2007).

In this study, a majority of the respondents used their private mobile phone for work-related calls/SMS/beeps at home: this group had converged their work and home spheres.

- **Power Relations**

  Cultural factors such as status and hierarchy are critical when implementing an MIS as mentioned by Madon (2009) from India. Madon also mentions the allegiance of public officials to social ties within the community. Kumara and Best (2006) report from an e-government project in India that caused a perceived shift in existing power relations and some local officials found the project a threat their role, authority and influence in the local community. It is also imperative to consider that power relations are both expected and accepted in many cultures (Furuholtt 2009).
Social hierarchies are translated not only through content i.e. they define what is discussed, but also who is discussing (Pelekmans 2009). A mobile phone facilitates the production, reproduction and transformation of social networks, social status and hierarchies (de Bruijn et al. 2009); it influences and reproduces power relations. A further issue is the identification process, which differs from fixed-line conversation. When a conversation starts, both the caller and the receiver know for the most part the identities of the parties involved thanks to the ID display and because both the device and the number are often personal. With that knowledge, the receiver can avoid answering. This is different from fixed-line phone calls where the receiver especially does not know the identity, location or activity of the caller (Castells et al. 2007). It is also argued that m-technology can flatten the structure with fewer hierarchical levels (Kuschchu et al. 2006).

The ‘ICT in education’ activity from 2000 in Pakistan was expected to increase productive efficiency but, according to Komatsu (2009), this was not fulfilled since there were constraints such as the procedural complexity in communication between different layers of administration. Komatsu (2009) describes how the district education offices communicate with lower-tier offices and school heads via telephone and letters. Official directives are sent by messengers hired by the office. Cooperation between district education offices, school management committees and PTAs is imperative in education development (ibid). Reduced gaps in communication can contribute to building social capital in the form of trusting relationships and horizontal human networks. In reports from Kenya, mobile technology is stated to be appropriate and socially inclusive and that the development process promotes dialogue and capacity across the local communities (Traxler 2006).

Furthermore, beeping is socially ‘sensitive’ and reports from Nigeria show that a beep is not answered if the sender is unknown. Normally, beepers are low-income people (Nyamnjoh 2009). Beeping is considered to influence and (re)produce power relations among people, using social hierarchies to reveal who is charged for phone credit.

In this study, a majority of the respondents made calls to and received calls from DEO i.e. calling is an accepted norm at both levels of the hierarchy. However, SMS as communication form between different levels of the hierarchy is not an accepted norm e.g. DEO is not an accepted receiver or sender of SMS “I don’t send SMS to DEO”; “I don’t write to DEO and parents – I phone.” DEO do not send SMS: added comment: “Not from
DEO.” Furthermore, beeping as a communication form between different levels of the hierarchy is not an accepted norm. At the same time the respondents stated the most common reason for work-related beeping both sending and receiving was ‘Meetings’ with ‘colleagues at my school’.

- **Trust**

Trust is an important issue when adopting and using a technology. Trust can apply to the technology, including the handset and network, the retailer, operator, as well as services, infrastructure and public security. Critical factors for e-government solutions listed by Guida and Crow (2009) include trust: do users trust the technology? According to Kuschchu (2006:8-9), challenges for m-government include providing security for the data.

Problems to be solved related to MIS implementation in Ghana include building confidence in the MIS capability among management and staff; MIS data were regarded as unreliable while paper-based data was regarded as accurate (Sander et al. 2005). Reports from other African countries show that voice calls are preferred over SMS and people in general trust voice calls with direct contact enabling questions to be asked and responded to immediately (Wicander 2010). On the other hand, the StudyLink project in the UK found it more reliable to send SMS then to send an email. High risk factors that were mentioned in the Tanzanian e-government strategy (President’s Office 2009) are privacy and low security of ICT infrastructure.

In the study from Tanzania presented here, a majority of the respondents stated that they trusted the technology and found it reliable to send and receive important data with SMS. Added comment: “Cannot be changed.”, “It’s the most modern technology”. This stance is also shared by the group of DEO respondents stating that they trust the technology and mention that ‘SMS reduce uncertainty and misunderstandings’.

A majority of the respondents thought it to be secure (with regards to data safety and data theft and tampering) to send important data with SMS. A majority stated the reason to be “Nobody can change or steal the info” and a majority stated the risk for loss of data when using SMS as ‘low’. But a lack of trust about data security can be exemplified by the following comments: “It can happen. There are human beings dealing with system.”; “Someone can change/steal the info”; “The SMS can’t be lost/ destroyed on the way”; “Someone might delete your message if they don’t like it.” This is also shared

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46 As explained in section 5.2.4, beeping is intentionally missing calls – a predefined message gets across without charge.
by the group of DEO respondents stating that “SMS is stored and can be read by others”; “The mobile can be stolen and SMS can be read by others”.

- **Gender**

Another issue of social character is gender. A recent study on the empowerment of women in Uganda (Jorgensen 2010) explored access, freedom, and resources to communicate and how the use of ICT including mobile phones has influenced public and private structures in Kampala in a rural setting. The study reveals substantial urban/rural and ‘access to information’ divides related to poverty, infrastructure, and gender inequality, but also to organisational structure with information-sharing problems between different levels of the organisation. The authors concluded that ICT had played a role for local empowerment, but that it is important to have new spaces for conversation and dialogue.

The importance of gender issues is demonstrated from the SEMA project in Kenya where some female teachers had problems with husbands wanting to own and control their mobile phone for their own sake (Power & Sankale 2007:6). From Ghana, gender inequality in teacher deployment is mentioned (Sander et al. 2005). Beeping is a distinctive gender-related practice in Africa – men do not beep women, an example of ‘m-etiquette’, or beeping power according to Castells et al. (2007).

In this study from Tanzania, the group of respondents consisted of 25 per cent female head teachers compared to a regional average of 12 per cent. In the total group of teachers in the region, 51 per cent were females.
IV. Financial Resources and Key Issues

After having discussed immaterial, human, and social resources, we now turn to less human-oriented resources. Several authors stress the importance of financial resources when implementing e-government solutions in developing countries (Walsham & Sahay 1999; Sander et al. 2005; Selinger 2009; Guida & Crow 2009; Kazooba 2010). Successful interventions share a combination of availability of initial funding and the accurate identification and costs of ICT infrastructure needs (Guida & Crow 2009); the number of staff involved with the e-government systems is accounted for (Heeks 2006:5-6); and resources to train personnel (Kumara & Best 2006) as well as long term operating costs are covered (Sander et al. 2005). Financial issues also include purchasing power and commercial models.

- Funding

e-Government solutions are often motivated by cost savings and cost reductions but public institutions in developing countries have financial constraints. The financial capacity on local and district levels is mentioned as a challenge for district-level administration in India (Walsham & Sahay 1999) and MIS implementation in Ghana (Sander et al. 2005). Underutilised MIS with no significant impact due to lack of financial resources is also reported by Madon (2009) from India. In the strategy for e-government in Tanzania, financial resources are mentioned as a critical success factor (President’s Office 2009). A barrier to success for ‘ICT in education’ in Tanzania is a lack of funding for ICT equipment in schools (Jensen p.c. 2007). Financial challenges, including issues such as affordability of access (Guida & Crow 2009), can have the consequence that telephones at the local governmental departments in e.g. Ghana are frequently cut off due to non-payment of bills (Sander et al. 2005). Additionally the high cost of ‘legal’ software is mentioned from Ghana (ibid).

However, it is not only about the amount of funding, it is also about allocation and budgeting and, in Uganda for instance, the district authorities had not budgeted for the project (Kazooba 2010); in Ghana, the management was not prepared to devote resources to the EMIS (Sander et al. 2005). Sander et al. (2005) stress the need for long-term financial planning to ensure long-term operating costs such as consumable items, maintenance and spares, and on-going staff training are covered. All on-going costs must be planned for and covered in the initial planning – this is essential in a context where even the cost of paper for printing in Ghana is a significant item (ibid). For example, limited funding caused the deterioration of equipment maintenance in Ghana.
m-Government is seen to be the next logical step in government strategies in Africa according to Maumbe et al. (2006) due to inter alia its affordability; cost savings and operational savings are mentioned by Kuschchu et al. (2006). The cost of bandwidth is mentioned as a hinder for ICT in education in Tanzania and m-technology is seen as an enabler that can lower both the entry costs and the cost of ownership of ICT in schools (Hare 2007). GAID (2009) mentions that the cost of using smart phones in Sub-Saharan Africa might seem high in the beginning but that the cost of paper is eliminated, and the device is reusable. At the same time, a low-cost phone model is recommended from Bangladesh due to its simplicity (Pouezevara & Khan 2007).

Mobile phones offer a cost-effective support to administration of schools in Kenya (Traxler 2006; 2007; Power & Sankale 2007) due to the ‘pro-poor’ and inexpensive qualities (Traxler 2006; 2007). Initially, in reports from Kenya it was stated that the resources to develop the SEMA system all existed locally and cheaply (Traxler 2006:12). The costs for the SMS system in Kenya consisted of capital costs, which were stated as negligible compared to other ICT interventions, as teachers buy or already own the necessary hardware, and of running costs, which were stated as minimal due to discounted bulk SMS messages (Traxler 2006:9). However, later findings from Kenya report constraints such as access to resources and major economic issues when implementing the SMS-based system (Traxler 2007:5).

In this study conducted in Tanzania, a majority of the respondents stated that the district school system does not have enough financial resources to create an SMS-based system.

- Purchasing Power

It is stated that mobile telephony as a technology is more affordable than other ICT in developing countries (Heeks & Jagun 2007a). m-Government provides opportunities due to inter alia its affordability, and m-technology is seen as an enabler that can lower both the entry costs and the cost of ownership of ICT in schools (Hare 2007). Mobile phones offer cost-effective and inexpensive support to the administration of schools in Kenya (Traxler 2006; 2007; Power & Sankale 2007). The capital cost of the SMS-based system in Kenya is considered negligible, as all teachers own the necessary hardware (Traxler 2006). An enabling feature for ICT in education in Tanzania is the increase of new ICT e.g. mobile solutions that can lower the entry cost and also the cost of ownership of ICTs in schools (Hare 2007), thereby making mobile telephony
considered a resource for the education sector in Tanzania, not the least because of its affordability (Stone et al. 2003).

At the same time, mobile services in Africa are considered expensive and Africa suffers from higher prices compared to the world average both for ownership and usage, as mobile call charges are generally high in relation to the average income levels of the population (Donner 2008; UNCTAD 2008). Mobile telephony seems to have the most cost-effective and widespread mechanisms for sustainable and effective business models reaching poor people and communities (Kleine & Unwin 2009) but university students in Tanzania pay as much as five times the amount they spend on food on their mobiles according to Kleine and Unwin (2009). There is also a correlation between income and communication habits with differences between richer urban areas and poorer, resource constrained rural areas (Nokia 2006).

In the study presented here, all of the respondents owned a new, i.e. not a second-hand, mobile phone. Income per month was reported in the largest group above the national average. Hence the purchasing power among the respondents can be stated as high(er) compared to the national average and high enough to afford a new mobile phone.

SMS is an accepted and commonplace mode of communication due to the cost ratio of SMS vs. voice is low. The cost ratio in East Africa is approximately 1:6. These pricing conditions have helped foster a culture of SMS in much of Africa (Mendes et al. 2007). The success of SMS use for student support in South Africa was due to inter alia the low cost of SMS (Nix et al. 2007). SMS is a cheaper way of communication compared to post service and fixed telephones for the education sector in Kenya (Traxler 2006; 2007). Savings with SMS in general include less postage costs, including post room and clerical costs and less phone use (Traxler 2007). Another advantage worth mentioning is that SMS can be bought in bulk with large discounts (Mendes et al. 2007).

The results from the study presented here show a perceived usefulness with SMS for data collection expressed by a majority as ‘cheaper (transport/papers)’ - “SMS = 54Tshs compared to 10 000Tshs to DEO (one way).” i.e. a ratio of 54:10 000. A majority of the respondents sent SMS daily

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47 This underscores the fact that low-income users need access at low prices (UNCTAD 2008), but also highlights the risk that mobiles aggravate poverty. In a study from 2008 in Tanzania, Mpongole et al. found that nearly 50 per cent of the respondents sometimes substitute important needs as education for mobile ownership and usage. The same study reveals that 66 per cent spent roughly 30 per cent of their income on mobile use and maintenance. The study concludes that mobile phones increase poverty in rural communities. Diga (2007) shows from Uganda that rural households are willing to make sacrifices such as the store-bought food budget in order to address the expenses of mobile phone services.
due to financial constraints and an added comment: “SMS instead of calling to reduce cost”. The lower cost for SMS is also mentioned from the group of DEO respondents. A majority also used beeping due to financial constraints. Purposes for beeping related to work was ‘Lack of money’ mentioned.

The use of mobile phones for communication with parents among primary schools in Jamaica was dependent on the teachers paying for the phone usage from their own salary (Miller & Horst 2006). Experience from Bangladesh points to the importance of finding ways to reimburse teachers’ usage of their private phones (Pouzezvara & Khan 2007). Thanks to central funding, the solution included sending free SMS for the involved teachers and schools (Power & Sankale 2009). However, teachers tried to use the free SMS system for private purposes and to send private SMS (Power & Sankale 2007).

This Tanzanian study shows that a majority of the respondents stated that they pay themselves for the work-related use of a mobile phone (calls/SMS/beeps). One respondent answered “Myself and school (by guessing)”. A majority of the respondents expressed that they needed support for using their own private mobile for statistical data collection, and many of the respondents wanted ‘airtime’ as support followed by ‘free SMS’, ‘Money for vouchers/pre-paid cards/reduced cost for SMS’ and ‘Recharging’. Added comments were: “I don’t have enough money to use my own phone so that’s why I sometimes beep”; “Money talks!”; “Because I use my money to buy vouchers and to charge the phone”. The DEO respondents mentioned that paying themselves for work-related usage of their own private phones negatively affected their attitude to mobiles as an administrative tool.

**Commercial Models**

Prepayment is the dominant mode of mobile phone subscriptions in Africa. It is considered an important adoption factor (Castells et al. 2007) due to it is convenient, flexible and simple: a pay-as-you-go system (Gillwald 2005; Engvall & Hesselmark 2005).

From the operators perspective the pre-paid model reduces the amount and expense of administrative activities such as billing and money collection. There is no need to establish post-paid accounts, and no need for a financial infrastructure that enables such accounts, and thus no problems with non-payment according to UNCTAD (2008).

Thus the pre-paid model shows several advantages, but disadvantages are also mentioned in the literature. Mobile services in Africa are considered expensive and Africa suffers from higher prices compared to the world average. Pre-paid fees are higher than post-paid ones with higher per minute rates.
(UNCTAD 2008; Hodge 2005; Esselaar & Stork 2005; Donner 2008). Even if the pre-paid model is widely used, it is the most expensive model. Furthermore, the prepaid system is correlated with lower average monthly minutes according to Castells et al. (2007). Another disadvantage is short expiry dates on vouchers.

In this study from Tanzania, all of the respondents used a pre-paid telephone service, so-called vouchers. A majority of the respondents mentioned that they had more than one SIM, using different network service providers, so-called SIM-switching. SIM switching is a way to save money by selecting the least expensive operator for the moment, at a given time, or depending on whom you call. At the same time, the perceived usefulness measured with the question concerning whether the benefits of the mobile phone justify the cost, was answered by a majority with ‘yes absolutely’ or ‘to a high degree’.

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48 This is an example of the issue when using the number of subscribers or phone owners to estimate the number of users can be misleading, as one person can own more than one SIM-card or telephone (Wicander 2010).
V. Physical Resources and Key Issues

In general, in developing countries, there are several infrastructural constraints such as poor telephone lines and network coverage, lack of electricity and poor networks of roads. e-Government projects face challenges such as lack of fundamental, ubiquitous infrastructures as well as appropriate ICT (Heeks 2002b; Guida & Crow 2009; Madon 2009). Challenges for m-government include the physical infrastructure, including equipment and networks (Kuschchu 2006). These factors are present in what Selinger (2009:217) calls the “technology dissonance” in developing countries including the availability and nature of different technology solutions: e.g. lack of access in Africa compared to Western countries.

At the same time, according to Guida and Crow (2009), most e-government projects in developing countries fail due to human-related factors, not technical ones, as mentioned before. This is in line with Kumara and Best (2006), who noted that among their list of failure factors, ‘technology’ was not included, and also with experiences from Ghana reported by Sander et al (2005). Additionally, technical challenges can be overcome in short time compared to social and cultural challenges (Grönlund et al. 2008).

- Equipment

Keys to e-government success in developing countries include accurately identifying ICT needs (Guida & Crow 2009), as well as which type of ICT are needed. Additionally, there is a need to identify the ICT state at an institution (Sander et al. 2005) including landlines as this is mentioned as a problem in e.g. Uganda (Kazooba 2010). Observations from the MIS implementation in Ghana was that there was lack of computers for entering data into the installed system but also that the existing equipment maintenance deteriorated (Sander et al. 2005), which was also mentioned in Botswana (Ojedokun & Moabi 2009). An issue mentioned in the e-government strategy for Tanzania is the outdated infrastructure and the fragmented delivery channels together with low robustness and low security of the ICT infrastructure; at the same time, technological obsolescence was measured as a low risk factor (President’s Office 2009).

Even if the Internet is dominant in e-government solutions, newer mobile technologies are vital as well (Andersen & Henriksen 2006). m-Government is seen as the next generation of governmental services in Africa (Maumbe et al. 2006). m-Government emerges as the new ‘big wave’ in the process of ICT use in the public sector, thanks to the increasing mobile infrastructure (Kuschchu 2006), with ‘mobility’ as a keyword. In an educational administrative project in
South Africa, none of the employees had email but all had mobiles (Nix et al. 2007). Also, m-technology is considered an enabler for ICT in education in Tanzania (Hare 2007). The high level of mobile phone ownership is mentioned as an advantage in Kenya when planning for the SEMA project (Traxler 2007). In Kenya in 2006, 80 per cent of the teachers have mobile phones (Power & Sankale 2007). However, Power and Sankale (2009) mention some experiences from the implementation of the Kenya project that, as the teachers were using their own mobiles, there were several different brands and models and with some there was a problem locating some of the special characters required for the messages. Experience from Bangladesh recommend the simplest model of mobile for education administration as the need for ‘sophisticated’ technology such as smart phones was overestimated (Pouezevara & Khan 2007). Also, there is a perceived pressure to adopt new technology such as m-technology (Kuschchu et al. 2006).

This study from Tanzania showed that all respondents owned one mobile phone and a majority had owned a mobile phone for at least 3-4 years; i.e. the group was well equipped.

On a regional level in Tanzania, 70 per cent of primary schools have access to mobile phones through private ownership among teachers. Castells et al. (2007) argue that the public sector has not utilised m-technology sufficiently and which presents a huge potential. The findings in this study indicate a potential for national implementation. On a national level, this can be compared to the mobile penetration in Tanzania, which in 2008 was approximately 20 per cent, as shown in section 2.6.

The group of respondents obviously belongs to a group with ‘extremely’ high mobile penetration compared to the national average; pervasive in the meaning ‘most have one’. The operational mode of sharing, i.e. a type of collective use of a mobile phone, which is stated to be common in developing countries (Wicander 2010), is not the model for access among the respondents; instead the model is individual access through ownership.

Additionally, it is stated that mobile ownership is concentrated among relatively prosperous residents in urban areas (Donner 2008); rural areas are considered having low-penetration. There is an urban-centered penetration in Africa; an asymmetric diffusion with an urban – rural divide (Castells et al. 2007; Wicander 2010), but this is not confirmed in the rural area of Tanzania studied within this particular group. The finding is in line with the fact that in Africa in general, a higher level of income is related to a higher level of mobile ownership and in Tanzania, most owners have secondary education, together
with the statement of Rafael (2003) that mobiles give voices to a ‘stable’ middle-class in developing countries.

In this study, none of the selected schools owned a mobile school phone. This was also the finding among the DEO group of respondents and this affected negatively their attitude to use mobiles for administrative purposes.

Also, a majority of the respondents could think of using their own private mobile phone for statistical data collection, thereby providing most of the selected schools with access to the necessary equipment. It is accepted among a majority of the respondents to use private property for work-related purposes. But a hierarchical power structure appears in the statement “If the minister wants me to” It is important to note that not all teachers were unanimous in being willing to use their own mobile for work-related purposes: one respondent answered: “Because it’s mine and I don’t want to use it for official use.”

• Accessories

A challenge that influences the actual use of mobile phones in developing countries is related to spare parts and accessories for mobile phones. Reported experience from Kenya was that the availability of additional equipment is considered a constraint (Traxler 2007). From implementation of EMIS in Bangladesh, it is reported in terms of accessories that the provision of spare batteries would have prevented the downtime caused by a shortage of electricity for frequent recharging; that being able to attach an external speaker would be beneficial for group interaction with the trainer or with another school; and that adding local printers would be worthwhile, so that documents sent through the phones could be printed at the school level. “However, although such technology does exist (phone-to-printer), it would not be practical in this setting due to the lack of electricity.” (Pouezvara & Khan 2007:39).

In this Tanzanian study, concerning the possibility of finding spare parts and accessories for mobile phones, half of the group found it ‘easy’, whereas some answered ‘relatively hard’ including comments such as: “Have to travel long way to Iringa, 45 km.” Also a lack of trust for retailers such as ‘street vendors’ can be exemplified by the following comments: “Street vendor – not durable”; “Batteries are faked even if you buy an original → charge daily.”

• Telecom Network

Technological challenges for m-government solutions include mobile network infrastructure (Kuschchu 2006:8-9) and network coverage (Madon 2009). In general, lack of networks and connectivity are major factors impacting mobile usage in the developing world (Donner 2008). It is common to have more than
one phone using different network service providers within a country (Nyamnjoh 2009). Furthermore, mobile services in Africa are urban-centric (Shanmugavelan & Wariock 2004; Donner 2008) with inferior coverage in rural areas (UNCTAD 2008). There are large divergences within a country as regards rural areas.

Connectivity is not only about quantity, i.e. lack of coverage (Heeks & Jagun 2007a). It is also a question of quality: about limited capacity with dropped calls and unreliable network coverage (Nielsen p.c. 2008). The issue of incomplete network coverage and reliability was a challenging factor in Kenya when implementing the SEMA project (Traxler 2006:12; 2007). Experience from Kenya showed that SMSes were not delivered and teachers had to go to ‘hot spots’ (Power & Sankale 2007:6-7). However, Hesselmark (2007) claims that there is a potential transmission capacity that can be added by upgrades in the existing mobile network. Providing security for data is the most significant issue for m-government according to Kuschchu (2006).

Infrastructure and the lack of a national network are also mentioned as a challenge for ICT in education in Tanzania (Hare 2007). At the same time, the wide network coverage is mentioned as an enabler for ICT in education in Tanzania (ibid). In the SEMA project in Kenya, m-technology was considered to be a solution to connectivity and the lack of a fixed infrastructure (Power & Sankale 2007), as there were lively and energetic mobile phone networks considered as a technically adequate system (Traxler 2007).

In the study presented here, all of the respondents reported network coverage at their schools and at their homes, i.e. this indicates network coverage in the selected area. Furthermore, a majority of the respondents rated the quality of network coverage at their schools as ‘good’. However, a majority also mentioned problems with quality and availability of network coverage at selected schools, with negative experiences mentioned: ‘disconnected network’ and ‘unavailable network’. Added comments included “Bad coverage – too far from mast”; “50% of the time we are without coverage”. One mentioned reason was related to the climate with a majority of the respondents stating that the rainy season affected the network coverage. This brings a risk for lack of trust in the technology.

As mentioned under financial resources, a majority of the respondents from the study conducted mentioned that they had more than one SIM card using different network service providers, so-called SIM switching. The reason for having more than one SIM card was for most of the respondents related to the quality and/or availability of the network and to be prepared for network
difficulties and problems: “Network differs depending on operator - bad network=switch card”. Broadly, the mobile expansion is due to network externalities as people subscribe to mobiles because other people do the same (Torrero & Von Braum 2006). SIM switching is a strategy to overcome network difficulties and problems by using different network service providers.

- **Services**

Positive attitudes towards operators and service providers are stated as a prerequisite for adopting new technologies and services. Trust creates a foundation for new mobile phone services (Nielsen p.c. 2008). Experience from Nigeria indicates that service providers have developed a new management philosophy with a different attitude towards customers compared to local industries – no cheating, no corruption, the customer gets what he/she pays for. Many customers are often positively surprised at the polite, respectful and attentive level of more service-minded customer service (ibid).

Several operators are available in the Iringa region, and in the conducted study, two operators were used by a majority of the respondents. Concerning operators, a majority of the respondents stated they had ‘good’ experience concerning support from their operator(s). “To use mobiles are very expensive, but the service is good.” But a lack of trust for operators can be exemplified by comments such as: “Unreliable support hotline” and “Closed offices are disturbing.”

Another service issue is the repair service, which in this study was stated as ‘easy’ and ‘relatively easy’ to find by a majority of the respondents. But a minority stated it to be ‘relatively hard’ to find repair service for mobile phones including the comment “Have to travel long way to Iringa, 45 km.” Concerning repair services, the quality was stated as ‘good’ or as ‘relatively good’ by the majority. But a lack of trust of the quality for repair services can be exemplified by the following comment: “We don’t have original spare parts”, “Pirate copy”.

As reported in Wicander (2010), the quality of the handsets can be related to access barriers. Strong and durable handsets are wanted due to the humid climate and rough handling of mobiles i.e. durability as mentioned by Nielsen (p.c. 2008). Constraints mentioned from the SMS-project in Kenya included climate issues (Traxler 2007).

In this study, a majority of the respondents mentioned that climate factors such as ‘rain’, ‘dust’ and ‘moisture’ affected their mobiles in a negative way.

- **Power Supply**

Energy is a major concern in most developing countries and the lack of basic infrastructures in developing countries includes power supply. Several authors
mention power supply as a critical challenge to e-government (Sander et al. 2005; Komatsu 2009; Kazooba 2010); crucial factors are availability and reliability of the power supply, i.e. both quantity and quality. Even if connected to the power grid, unpredictable power cuts disturb any system and issues such as power back-up systems are important to handle. Furthermore, the availability might also be unstable, leading to power fluctuations that can damage sensitive equipment. Other studies show power cuts in Pakistan (Komatsu 2009), lack of power in Uganda (Kazooba 2010) and severe power supply problems in Ghana (Sander et al. 2005), illustrating inadequate, insufficient, inconsistent and unavailable power supplies. The absence of a national grid at rural schools, together with breakdowns, is a major constraint of ICT in education in Tanzania (Hare 2007).

Lack of electricity (Heeks & Jagun 2007a) is also mentioned as an access barrier to mobile technology. Power supply is needed to charge the mobile phone as well as to support the mobile towers. The process that is most energy demanding is the support to the base stations (Bergström 2008), which are mostly run by diesel.

This barrier has the greatest implications in a rural context where the lack of power supply makes battery charging a challenge. To overcome the barrier, shared batteries are common in rural areas to charge mobiles, as is going to a nearby town (Nokia 2006), together with long battery time (Hellström 2009). Experience from the EMIS in Bangladesh is that the provision of spare batteries would have prevented the downtime caused by shortage of electricity for frequent recharging (Pouzevara & Khan 2007:39). Challenges in Kenya when implementing the SEMA project, according to Power and Sankale (2007:6-7), was the lack of a power supply with a majority of rural schools without electricity (Traxler 2007). This problem was solved by teachers using solar chargers (Power and Sankale 2007:6-7). Experience from Uganda shows that solar chargers are most common for charging batteries (Hellström 2009). The potential use and cost of alternative energy sources such as solar power needs to be explored (Sheriff 2007) as well as identifying the needed power supply in general (Sander et al. 2005).

This Tanzanian study showed that a majority of the selected primary schools were not connected to the national power grid (TANESCO). The national figure is 9 per cent in general and 2 per cent for rural areas. The figure for primary schools in the Iringa Region is 4 per cent and for the three selected districts it ranged from 2 per cent up to 45 per cent. A majority of the
respondents could not charge the battery for their mobile phones at school and most experienced some problems related to the charging of batteries.

- **Communication Ecosystem**

Communication in general is a major problem in developing countries due to poor telephone lines and network coverage, lack of electricity and a poor network of roads.

Ngwainmbi (1995) states that ICT can be seen as a tool for fast and reliable communication. ICT can offer alternatives to travel and facilitate a more efficient use of transport resources (Göransson & Söderberg 2003). However, in Africa, 70 to 80 per cent of the population lacks a basic telecommunications infrastructure (UNCTAD 2008). From an e-government activity in Uganda, the lack of Internet connections was a challenge (Kazooba 2010). Mobile phones are seen as having potential for the communication infrastructure (as a complement to fixed telephony/landline and postal service). In a study in Tanzania, Molony (2006) shows that users regard mobile phones as a far more reliable and faster means of sending information than using messengers, a bus or postal services to deliver a letter.

Several of the access barriers in developing countries can be stated to have the most impact in a rural context, as the poorest part of the population and the worst lack of infrastructure, both basic such as electricity and telecommunication, as well as mobile services, are found in rural areas (Shanmugavelan & Wariock 2004; Donner 2008). Hence, rural areas have relatively low mobile penetration and more poor people, which makes it difficult to reach a critical mass of users (Mendes et al. 2007), which is a prerequisite to widespread acquisition and usage of mobile phones. Basic connectivity and direct reachability, as well as individual addressability, are significant advantages for rural areas in developing countries with the key feature being connectivity, according to Castells et al (2007).

Mobile telephony reduces isolation for villages, organisations and people (Ling & Donner 2009). Mobile technology brings opportunities for empowering local rural communities (SPIDER 2006).

m-Government may become the key method for reaching rural areas (Kuschchu 2006:7; Kuschchu et al. 2006:137). Teachers in rural areas experience isolation, lack of access to teaching material, as well as poor management and support (Power et al. 2009). A tentative objective for the SEMA project in Kenya was to address this potential isolation in rural areas and findings show that the project succeeded in reducing the potential isolation and increasing the sense of community amongst rural schools (Traxler 2007).
Traxler (2007) argues that the SEMA project in Kenya has considerable potential and an SMS system should be an integral part of communication support amongst rural schools as the technology is relevant, feasible, and inexpensive.

At the same time, one reported negative effect of mobile technologies in education is a sense of isolation (Hoppe et al. 2003) i.e. ICTs can contribute to increased individual isolation (Zembylas 2009) due to reduced personal meetings: face-to-face encounters are replaced by human-to-machine encounters (Kuschchu et al. 2006:145).

In the study presented here, none of the selected schools had a landline phone. Two per cent of the primary schools in the region had access to landline phones. None of the primary schools had a computer. Of the three selected districts, one (IM) mentioned that 86 per cent of the primary schools had computers. The regional average for primary schools is one per cent. On district level, computers are available but not always connected to the Internet. In 2007, the national average for Internet connections was one per cent. The regional average among primary schools is one per cent, while one of the selected districts (IM) reported five per cent. A majority perceived mobile phones as useful for the communication infrastructure. All of the respondents stated that mobile phones could be used to improve the communication between rural schools and the administration of education (WEC/DEO/MoEVT). An added comment was: “We are far, we get late reports – no landline, slow post service.” Statistical figures illustrate that there is 1 post office per 62 000 people in the Iringa Region and 1 per 87 000 people on a national level.
VI. Institutional Resources and Key Issues

e-Government solutions face institutional and organisational issues (Guida & Crow 2009). e-Government presents a number of challenges of institutional and organisational character for developing countries.

One of the key factors for successful e-government solution is that the objectives component covers issues of formal organisational strategies (Heeks 2006:5-6); strategical thinking is a most critical factor according to Heeks (2002b).

Key issues include capacity development, commitment to change, motivation, participation, leadership, usefulness, and administrative tools.49

- Capacity Development

There are pessimists about the capacity of government and the potential for e-government, stressing that it is naive to expect technology to transform government organisations in developing countries that are “...inherently conservative, hierarchical and bureaucratic.” (Norris 2002 in Guida & Crow 2009:284). Boateng et al. (2009) stress workplace practices and processes and state that ICT alone is an insufficient predictor of productivity improvement at public sector agencies. Instead, workplace practices influence and govern the usage of ICT. Madon (2009:55) from India points out that the “...focus on improving local administrative capacity through ICT was short lived with lack of clarity about how e-administration projects and the bureaucracy impact each other in reciprocal ways”.

In general, the institutional background within which an ICT project is implemented is of importance. Such an organisational background has shown to influence the process by which resources allocated for an ICT project leads to a successful or unsuccessful system (Avgouros & Madon 2004). But Walsham et al. (2007:322) state that institutional conditions are often underplayed.

Capacity problems have several causes such as structural weaknesses in organisational and institutional arrangements (Selinger 2009). Challenges mentioned in the literature include structural obstacles in the organisation (Avgouros 2002); institutional structures constrain and channel the design of ICT solution (Braa et al. 2004). As an example, with the EMIS in Ghana (Sander et al. 2005), equipment maintenance deteriorated due to limited ability and capacity of the organisation.

49 Some of these issues can alternatively be categorised as Social issues. The present categorisation is motivated by the focus on e-government in this study.
A report from African countries regarding MIS shows that a key issue is structural weakness and organisational complexity, including fragmented, uncoordinated and overlapping organisational structures, exacerbated by donors who install their own MIS (Braa et al. 2007). Inter-operability between departments is a challenge (Layne & Lee 2001). According to Fenenga & de Jager (2007), one of the key factors in the implementation of MIS in developing countries is organisational embedding; how systems become embedded in the organisation’s structures (Braa et al. 2004). Problems and challenges mentioned by Walsham and Sahay (1999) are inappropriate systems leading to the existence of inadequate systems of data and information handling and management.

An issue for e-government solutions in general is organisation culture (Lee et al. 2005) including a culture values component: what stakeholders feel are right and wrong ways to do things (Heeks 2006:5-6). e-Government implementation can confront existing organisation cultures (Walsham & Sahay 1999) and can be actively resisted (Silva & Hirschheim 2007). There is a need to understand that e-government solutions such as MIS will have to be embedded in relatively rigid organisational structures and deep-seated resistance (ibid). There is a need to include the structure and social dynamics of an organisation such as core values and beliefs, distribution of power, and mechanism of control systems.

Key factors in the implementation of MIS in developing countries include capacity development at both the individual and organisational levels (Fenenga & de Jager 2007). Are users ready for e-government - and is the organisation ready?50 Effective e-government requires good administrative processes (Lee et al. 2005), which requires different types of capacity from administrators such as managerial skills, adaptation and learning (Madon 2009).

In the national e-government strategy for Tanzania, the lack of a coherent institutional framework, uncertainties of e-readiness, low awareness of e-government opportunities with silo-based e-government initiatives and lack of integrated IS are mentioned as critical issues (President’s Office 2009).

Challenges for m-government include institutional arrangements (Kuschchu 2006:8-9) whereas success factors for m-government include focusing on organisational factors and competences (Capra et al. 2006); is there m-readiness – readiness for a successful adoption of mobile? (Chang & Kannan 2002) From the SEMA project in Kenya, it is mentioned that cautious organisation at the local level was needed (Power & Sankale 2007; 2009),

50 In the e-government ranking presented by the UN, Tanzania ranks 137 out of 184 countries.
together with planning and interaction among all stakeholders to create synergy (Traxler 2006), as there were problems for users in understanding the role and intended use of the implemented SMS system (Traxler 2007). However, another issue mentioned is the impact on the organisational structure, e.g. reduction in number of people performing the job and/or a need for new skills for the staff (Kuschchu et al. 2006).

- **Commitment to Change**

  Commitment is mentioned by Heeks (2002b) as an important issue for Africa to build e-government solutions. Sander et al. (2005) stress that before an MIS implementation, the beneficiaries, including management staff and users, must understand and agree that the implementation will benefit their work, commit to change and adapt their working procedures in ways that will benefit them from the added functionality of the implemented MIS. “The nature of the changes to working-procedures must be evaluated, understood, and agreed by all stakeholders before the scheme is implemented” (Sander et al. 2005). Success requires a fundamental and widespread change of work practices (Walsham & Sahay 1999) and all stakeholders must be aware of the fact that users of an MIS have to adjust their operational procedures (Sander et al. 2005).

  However, there is a risk that different agendas might be at play (Furuholtt 2009) including challenges such as vested interest of various stakeholders, change of government priorities and lack of government commitment from those responsible (Guida & Crow 2009). A study by Ojedokun and Moahi (2009) on e-government solutions in Botswana shows that the installed computers were used for other official as well as for non-official activities.

  An additional challenge is presented when governmental staff shows an unwillingness to share data and information with low utilisation of an MIS (Guida & Crow 2009). From Ghana, Sander et al. (2005) mention that accountability, which the MIS could support, was not wanted from the personnel. The operational procedures were not changed, which led to data being held both in a paper-based filing system and in a digital system (PMIS), with serious data discrepancies being discovered within the paper-based system, between the paper system and PMIS. All documentation about design and implementation was missing and a fire causing the loss of a large amount of paper-based data demonstrated the value of disaster recovery planning and management procedures (ibid).

  A stable set of key actors with aligned interests (Walsham & Sahay 1999) and consensus for the MIS activity is mentioned as critical (Sander et al. 2005).
In the e-government strategy for Tanzania, the resistance to change is mentioned as a high risk factor and commitment by all actors is mentioned as critical (President’s Office 2009). It is important that the extent of change must be considered with a risk for failure with too much change (Heeks 2002b).

In the Tanzanian study presented here, a majority of the respondents stated it ‘very important’ to know the reason behind a new system of collecting statistical data, i.e. the importance of an explicit objective and understanding that objective.

- **Motivation and Participation**

One key issue for e-government solutions in general mentioned in the literature is engaged public employees (Lee et al. 2005) and motivational encouragement for all involved (Furuholt 2009). Experience of e-administration from India shows challenges that have been encountered including a need for improved participation (Walsham & Sahay 1999). One identified organisational factor is a bottom-up involvement process (Capra et al. 2006). A problem reported when implementing an e-government solution in Uganda was that all the crucial staff was not involved (Kazooba 2010). Among the recommendations from Ghana when implementing an MIS by Sander et al. (2005) was to include local divisional offices and staff. From Mozambique, the involvement of the local stakeholders in the entire process is considered crucial in the implementation of an MIS (Macome 2003). In Kenya, interaction between stakeholders was a strong benefit in order to create and sustain synergy (Traxler 2006). A critical issue from Ghana was lack of high-level support including appreciation (Sander et al. 2005). Sundén and Wicander (2006) stress that empowerment includes ownership of the planning and implementation of the intervention.

One of the key factors for successful e-government solution is for the objectives component to cover issues of self-interest (Heeks 2006:5-6). A lack of job-related benefits is mentioned as challenge (Furuholt 2009). Data collection in Ghana was a critical part of EMIS and training was provided for head teachers each year, but the head teachers saw no benefits for them or their school; they lacked motivation and delegated the tasks to untrained staff with the consequence that the forms required extensive validation before data entry (Sander et al. 2005). A study by Ojedokun and Moahi (2009) on e-government solutions in Botswana showed a lack of motivation among stakeholders and considered this a critical factor. For ICT in education, well-motivated teachers are essential (Unwin 2005a).
There is a need for a gradual sensitisation process of employees to policies, guidelines and standards as “(T)echnology is not simply a matter of computers it is also a state of mind – an entirely new way of thinking” (Sander et al. 2005).

In the e-government strategy for Tanzania, the lack of a framework to leverage private sector resources and community participation is mentioned as a critical success factor (President’s Office 2009).

In this study, a majority of the respondents stated it ‘very important’ to be involved in the planning of a new system of collecting statistical data, which indicates a need for participation.

• **Leadership**

The importance of support and leadership for successful e-government solutions is mentioned in several reports, and the lack of this support is often due to challenges such as too many ‘components’ i.e. coordination problems, coordination failure between central and local governments and unclear responsibilities of stakeholders (Guida & Crow 2009).

Leadership is a critical factor according to Heeks (2002b), including support from senior officers in the public sector (Heeks 2006), government leadership (Lee et al. 2005), leadership of individuals (Capra et al. 2006) and support by the main stakeholders (Fenenga & de Jager 2007). In particular, e-champions are among the most critical factors according to Heeks (2002b). An important lesson learned from the EMIS project in Bangladesh is that head teachers were critical to success. “They took it very seriously as a professional development opportunity for the whole school, and it was only on their initiative that all of the teachers came together on a regular basis.” (Pouzevara & Khan 2007:38)

However, a lack of sustained and effective public leadership and commitment shows the need for the institutionalisation of an e-government project instead of letting it be dependent on individual(s) and their initiative (Kumara & Best 2006).

Kumara and Best (2006) report on an e-government project in rural India that failed due to a lack of institutional resources on a local level. Support from local officers remained only as long as the ‘champions’ were active. Kumara and Best (2006) describe how the government at the highest level supported the project, but that local representatives were never deeply involved and even if they were aware of the project, they did not recognise it as serious or they shifted to other regions. Weakened support from local government is also
reported by Srinivasan (2004), who related this to a lack of institutionalisation and a top-down approach.

Support from local institutions Madon (2009), as well as supervision (Ojedokun & Moahi 2009), is mentioned by researchers in Botswana. Also the ‘decentralisation hype’ that is mentioned from Ghana makes it vital to include local offices and staff together with inter-departmental coordination (Sander et al. 2005).

At the same time, a top-down approach that does not account for user needs is mentioned as a challenge by Guida & Crow (2009). An HMIS in Ecuador was implemented but it was only partially used or not used at all and finally abandoned. The main factor in the failure of the HMIS was a top-down, centralised approach based on the needs and agendas of the senior officers at the Ministry of Public Health (Heeks 2006:23). This concerns ‘macro-level’ leadership and top-management engagement (Madon 2009; Furuholt 2009). A critical issue from Ghana was a lack of high-level support including appreciation (Sander et al. 2005), and higher-level intervention is mentioned as a need in India (Walsham & Sahay 1999). But experience from Pakistan shows that administrative elites lack competence and interest in public education management and that this constrains educational achievements (Komatsu 2009).

Instead the need for institutionalisation includes involvement from the beginning of all stakeholders on all levels, from the highest level to local level (Kumara & Best 2006; Furuholt 2009), as well as the involvement of the local stakeholders in the entire process (Macome 2003).

In this study, a majority of the respondents stated it to be ‘Very important’ that the WEC and DEO support them in taking part in new way of collecting statistical data, i.e. local leadership and local support was considered important.

- Usefulness
Broadly, mobile expansion is due to network externalities as people subscribe to mobiles because other people do the same (Torrero & van Braum 2006); the mobile is seen as an essential and useful communication tool - success depends on the number of users but also on the needs of the user. The expansion is about ‘incremental benefits’: the mobile offers increased efficiency; it improves something you already do, thereby saving both time and money (Heeks & Jagun 2007b; c; Wicander 2010).

In this study, all respondents made both private calls and work-related calls for several different reasons, which can be interpreted as extensive
perceived usefulness. ‘Usefulness’ can be expressed as the mentioned benefits of using a mobile phone, which were for the majority ‘easy to use’, ‘fast’, ‘has a variety of services’; ‘cheap’. ‘Private’, ‘useful’, and ‘flexible’ were also mentioned as benefits. The perceived ‘usefulness’ influences the level of usage. This attitude is also shared by the group of DEO respondents, who stated that the mobile makes work easier and more efficient. It is important to keep in mind that perceived ‘usefulness’ can be influenced by several disadvantages and in this study, a majority of the respondents mentioned ‘expensive’ and ‘health issues’ (radiation, noise). Health issues are also mentioned by the group of DEO respondents including health risks from both the device and the masts: cancer and reduced brain capacity as well as risk of exploding devices. Comment: “Reduce the radiation – can affect the brain.” Castells et al. (2007) discuss the health risks with radio-frequency emission, which is produced by both the handsets and the antenna. According to Castells et al. (2007), there is no clear evidence about epidemiological consequences of the emission, but there is a lack of information on long-term consequences. (See Journal of National Cancer Institute for a study of health risks related to mobile phone usage).

Other disadvantages mentioned were ‘bad sound’, ‘bad coverage’ and ‘unavailable network’ together with “Encourage thieves – they can come to carry out their act.”

Furthermore, SMS can be considered to be the most comprehensive communicational service today. Increased accuracy of communication is mentioned as an advantage of SMS (Traxler 2007), as well as positive pricing conditions (Mendes et al. 2007) and as quick and discrete ways of sending information (Wicander 2010). However, challenges and barriers in Uganda for ownership and usage included that SMS was considered inconvenient (Hellström 2009) and an issue experienced from Kenya when implementing the SEMA project was a negative attitude toward the use of SMS among the teachers (Power & Sankale 2007:6). SMS has some main challenges and limits, including the 160 characters, the interface and the keyboard (Castells et al. 2007:179).

The results of the study presented here show that all respondents used SMS in spite of asynchronous communication (indirect contact). Related to ‘usefulness’ are also the mentioned benefits of using SMS, which were for the majority ‘cheap’, ‘fast’, and ‘private’. The perceived ‘usefulness’ can also be influenced by several negative opinions about SMS, such as ‘160 characters is too short’, as mentioned by a majority of the respondents.
Administrative Tool

Key factors for e-government solutions in developing countries include attitudes of the staff (Heeks 2006:5-6). Involved in this is the attitude to ICT itself as a tool. Key factors in the implementation of MIS in developing countries are use of user-friendly ICT tools (Fenenga & de Jager 2007).

A survey among NGOs in developing countries reveals several perceived benefits of mobiles as an administrative tool (Kinkade & Verclas 2008:7) such as ability to quickly mobilise or organise individuals and to reach audiences that were previously difficult or impossible to reach. Experience from the education sector in Kenya shows that mobiles enable contact and communication between parents, students and teachers, to distribute information about seminars and meetings as “…most of the teachers now have mobiles” (Nielsen p.c. 2008). Studies from Ghana (Sander et al. 2005) showed that to ensure project applicability, the real and practical needs of the recipient must be understood.

In the study presented here, a majority of the respondents had noticed that mobile phones are used in other public services as administrative tools. All of the respondents answered that they knew that mobile phones are used to administrate education in some way and that mobile phones are used to administer education in any way at their own school. A majority made and received calls from ‘colleagues at my school and other schools’. There was, however, an added (negative) comment: “It’s better with writings.” Another comment received from the DEO group of responders was ‘important information in an SMS cannot be signed’.

A majority of the respondents stated that there is a need for using mobile phones in the administration of education. Some of the identified purposes where mobile phones can be used in primary rural schools were to ‘Simplify communication/transportation’, and ‘Reduced expenses for transport, accommodation’. Added comments were: “Save expenses using mobile instead of personal visit”; “I can call beforehand. I save time because people can be prepared when I come”. The group of DEO responders mentioned that travel and visits can be reduced by using mobiles for administration.

Mobile technology is used for many data-related tasks: data collection or transfer, and for data analysis, mapping and inventory management among NGOs in developing countries (Kinkade & Verclas 2008); the collection of health data in several African countries (Castells et al. 2007); as well as in education and security in South Africa (Maumbe et al. 2006). In the SEMA project in Kenya, m-technology was considered as a technically adequate system.
and also ubiquitous and well known to the teacher group (Traxler 2007). There are simple arguments in favour of SMS for data collection in terms of its cost, speed and accuracy (Traxler 2006:12). These arguments include ‘transformational benefits’: offering something new, e.g. new ways to access services. The transformational benefits are related to the fact that a mobile is “more than just a phone” (Heeks & Jagun 2007c).

The results of this study from Tanzania show that all of the respondents made ‘work-related calls’ including calls related to statistical data collection. All of the respondents used ‘work-related SMS’ and a majority of the respondents were also aware of the possibility to use SMS for data collection. The reasons they mentioned were: “It’s easy/simplifies”, “Takes less time”, “To avoid the transport (avoid expenses)”. The perceived usefulness of SMS for data collection was expressed by a majority as ‘faster/save time’.

Other benefits that are mentioned included increased speed, as connectivity enabled by new technology presents a substitute to local travel, and a way to avoid time-consuming and risky road transports (Dufborg 2005). A survey by Kinkade and Verclas (2008) among NGOs in developing countries shows the ability to gather and transmit data more quickly. At the same time, Jagun (2007) argues that the mobile cannot be a substitute for all travel: there is still a need for physical meetings and communication due to a lack of trust between participants. This is also shown in another study from Tanzania (Molony 2006).

Using SMS for data collection increased the accuracy of communication. The survey by Kinkade and Verclas shows moreover the ability to gather and transmit data more accurately. The mobile is shown as a resource for education in Tanzania due to its simplicity (Stone et al. 2003; Donner 2008). On the other hand, there is a lack of awareness together with e.g. underused ICT equipment in schools in Tanzania due to lack of knowledge among teachers (Jensen p.c. 2007). This is in line with the experience from Kenya concerning the possibilities of using SMS for data dissemination (Traxler 2006:4). It was found that there was insufficient awareness of the exact nature of the opportunities and challenges amongst the various different groups of potential stakeholders (Traxler 2006:12).

The results from this Tanzanian study show that a majority of the respondents thought it to be ‘good’ or ‘very good’ to send statistical data via SMS directly to the database at the MoEVT. Added advantages to using SMS for data collection included: “Can keep the info secret”, “Info straight to MoEVT”, “Possibility to store the data for the future”. At the same time,
respondents mentioned disadvantages/problems/obstacles with using SMS for data collection: “Can’t correct after sending”; “No control of mistakes”; ”Data can be stolen”; “Keeping data safe e.g. if the handset is lost the data is lost”; “The in-between officials don’t get the info (WEC, DEO)”; “If mistakes in my data WEC/DEO will not report”. That being said, a majority did not know how mobile phones could be used for collecting statistical data. Added comments were: “It is not possible to make a joint report in this way.”; “Certain data is difficult to use SMS e.g. graphs” and a majority of the respondents were not aware of the possibility of sending SMSes directly into a database at the MoEVT.
VII. Political Resources and Key Issues

Political and policy issues present further challenges as reported in the literature (Layne & Lee 2001; Guida & Crow 2009; Furuholt 2009). These kinds of issues can include a lack of or a weak supportive regulatory environment and legal framework (Guida & Crow 2009) as well as a lack of local political support (Kumara & Best 2006). One of the key factors for a successful e-government solution is that the objectives component covers issues of organisational politics (Heeks 2006:5-6).

- Policies and Strategies

Relevant policies are essential when implementing an e-government system, as is awareness and knowledge about a policy on all levels for gaining support for the system. Madon (2009) means that improving e-government is foremost a social activity, not a technological one, but that this is not reflected in policies. Jensen (p.c. 2007) states that there is not always an understanding of ICT as a development tool in the education sector in developing countries. There is a lack of policies, strategies, master plans, and holistic views (ibid) as well as changes of government priorities (Guida & Crow 2009). According to Power and Sankale (2007:6-7), challenges in Kenya were influenced relevant policies that supported innovations ICT in education.

The e-government strategy in Tanzania (President’s Office 2009) identifies as critical lack of coherent policy and legal framework for e-government implementation. Constraining features for ICT in education in Tanzania mentioned by Hare (2007) include the lack of a policy framework, which has hampered the implementation and uptake of ICT and the promotion of ICT in education at the ministry (ibid:8). According to Hare (2007) ICT education projects in Tanzania tend to precede the policy and strategy phases with the effect of uncoordinated and duplicated efforts. m-Government needs a legal framework that can accept mobile data (Kuschchu 2006).

The current presented study from Tanzania show that there is a national policy, Information and Communication Technology Policy for Basic Education and that mobiles are considered as a tool for management and administration in this policy. However, a majority of the respondents were not aware of the policy, as illustrated by the comment from one of the respondents: “Most don’t know”. In other words, there is a policy, which is good, but a majority of the ‘users’ are not aware of its existence.
• Political Support

The importance of support and leadership for successful e-government solutions is mentioned in several reports. Strong political leadership and long-term political and governmental commitment to the initiative (Guida & Crow 2009), government leadership (Lee et al. 2005), political support by the main stakeholders (Fenenga & de Jager 2007), as well as political support from local institutions (Madon 2009) are among the necessary forms of political support mentioned. Kumara and Best (2006) report from an e-government project in rural India that failed after one year due to lack of local political support. In India, e-administration has been implemented, but several problems and challenges have been encountered such as lack of political support (Walsham & Sahay 1999). Walsham and Sahay (1999) mention that the lack of political will to decentralise data and decision-making powers to local agencies leading to the centrally defined data reporting formats did not correspond to the local physical and financial reporting requirements, which led to reports continuing to be prepared manually. e-Government challenges and the role of political leadership in a rural district in Indonesia is discussed by Furuholt (2009), who contends that strong political leadership is one of the most important success criteria for e-government projects in general and in developing countries in particular. Strong leadership is even more crucial to being able to generate progress over time and to help manage e-government implementation when there are limited resources available; involvement is essential for all stakeholders including local representatives, from the beginning of the entire process (Macome 2003; Kumara & Best 2006; Furuholt 2009).

Experience from Pakistan shows that local politicians lack competence and interest in public education management and that this constrains educational achievements (Komatsu 2009). Challenges in Kenya when implementing the SEMA project included policy makers that supported ICT innovations in education and a need for sensitisation programs for policy makers (Power & Sankale 2007:6-7).

Lack of government commitment from those responsible is mentioned as a challenge (Guida & Crow 2009). Political will, support and commitment were mentioned as critical factors in the e-government strategy for Tanzania (President’s Office 2009) and political will was a high risk factor in the same document.

The current study from Tanzania presented here shows that a majority of the respondents stated it to be ‘Very important’ that the WEC and DEO
support them taking part in new way of collecting statistical data i.e. local leadership and local support was considered important.

The discussion in this section is synthesised and summarised in the following section.
6.4.3 Building on Existing Supporting Structures

The discussion takes its starting point from the proposed SMS-based system of section 6.4.1. It describes how the circumstances found in this and other studies (cf. section 6.4.2) support or hamper the proposed EMIS. On an aggregated level, the identified supporting and hampering examples can be seen as representing structures in the local context. A new system can be both supported and hampered by existing structures. ‘Supporting’ and ‘hampering’ aspects exist on both an organisational level, e.g. human capacity, and on a national level, e.g. poverty.

This section focuses on supporting and hampering structures and tentative resources needed for the SMS-based systems. The identified existing supporting structures are presented using XIF as guide. Other issues are added that are worth considering when planning for an implementation; these are identified by the phrase ‘…worth considering’ and include such issues as ‘new’ supporting structures needed to realise the SMS-based system, but also existing structures that may hamper the implementation of this solution. These issues are the ones identified in section 6.4.2; that is, they are drawn from the data collected for this study and from studies by others, national as well as international.
I. Immaterial Resource
This resource includes issues such as languages and jargons, traditional as well as new such as SMS; and content such as administrative data e.g. the information of a telephone list.

Supporting structure(s):

• High level of language competence among the respondents i.e. a majority of the respondents are bilingual (Kiswahili and English)

  ... worth considering
  • Language problems both among HTs and DOs using SMS
  • Issues of inconvenience using SMS compared to voice/call

• Extensive use of SMS indicates SMS literacy

  ... worth considering
  • Limited number of characters (160)

• All schools have a unique ID, which facilitates administrative arrangements

  ... worth considering
  • Lack of official telephone lists i.e. contact data is missing for HTs, DOs and WCs
II. Human Resource

This resource includes issues such as knowledge (basic and ICT), skill, experience, self confidence, as well as user training.

Supporting structure(s):
- High level of mobile phone experience including a high level of usage and a long period of usage
- Expressed high level of skill concerning managing a mobile phone including SMS; m-readiness
- High level of self confidence concerning mobile phone use including SMS

… worth considering
- Opinions about complexity particularly on the syntax for an SMS-based statistical data collection system
- Lack of knowledge and awareness of an SMS-based system

- High level of basic education

… worth considering
- Low formal e-literacy
- Expressed stress related to e-literacy
- Opinion that there is a lack of local capacity/expertise to train HT
III. Social Resource
This resource includes issues such as acceptance, power relations, gender issues and trust.

Supporting structure(s):
• High level of acceptance and a positive attitude towards the use of mobile phones for professional purposes, expressed as several benefits and as easy to use
  • High level of converged use of mobile phones
  • Teachers are late adopters of ICT

• High level of acceptance for using SMS as a communication medium for professional purposes
  • The issue of surveillance and being monitored

• An accepted power structure in the education sector
  • SMS is socially sensitive
  • Change of attitude takes years
  • Gender issues

• High level of trust among HT and DOs for mobile technology
  • Data security
  • Health issues (from both device and masts)
IV. Financial Resource
This resource includes issues such as purchasing power, funding, and commercial models.

Supporting structure(s):
- High level of purchasing power among HTs both for ownership and usage
  … worth considering
  - Prepayment is the most expensive model
  - Reimbursement is needed
  - Abuse of free SMS for private purposes

- Mobile technology in favour of ICT due to lower capital cost and lower running cost
- Mobile technology brings savings in the form of reduced travel expenses
  … worth considering
  - Indicated lack of financial resources on the local education level for implementing an SMS-based system
  - The issue of local resources
V. Physical Resource

This resource includes issues such as equipment (handset, accessories, spare parts, SIM cards), and infrastructure including network coverage and electricity.

Supporting structure(s):

- Access to necessary equipment (hardware) for an SMS-based system due to high mobile penetration among HTs and DO through ownership
- High level of usage of mobile phone for work-related purposes

...worth considering

- None of the selected schools or DEO owned a mobile phone
- Different brands and models
- Lack of access to spare parts and accessories and the quality of these
- Climate effects on handset durability

- Positive attitude among a majority to use private property

...worth considering

- Some negative comments about use of private property

- Network coverage is available
- Several operators available imply good coverage

...worth considering

- Both quantity and quality of coverage (especially in rural areas)
- The level of service from operators

- Repair services are available

...worth considering

- Both quality and quantity of repair services
- Battery charging problems have been solved by using alternative power solutions

...BUT All respondents expressed problems with charging of batteries

- Both quantity and quality of power solutions (especially in rural areas)
VI. Institutional Resource
This resource includes issues such as capacity development, commitment to change, motivation, participation, leadership, and administrative tools.

Supporting structure(s):
- Positive attitude to mobiles in administration of education in general and to SMS for statistical data collection in particular
- SMS can reduce uncertainty and misunderstandings regarding statistical data

... worth considering
- Safety issues e.g. risk of theft
- Administrative issues e.g. SMS cannot be signed

- High level of motivation and engagement among the group of head teachers
- High level of trust and confidence for mobile phones including SMS as administrative tool
- High reliability on data disseminated via SMS
- Estimated low risk for loss of data disseminated via SMS

... worth considering
- Opinions on data security e.g. SMS can get lost
- As SMS is stored, there is a fear that it can be read by ‘others’
- Lack of knowledge and awareness of an SMS-based system
- The opinion that lack of local resources including technical capacity/expertise to implement and maintain an SMS-based system
VII. Political Resource
This resource includes issues such as policies, strategies, and political support.

Supporting structure(s):
• National policy on ICT in education including mobile technology

... worth considering
• Low awareness on local level
• Lack of coherent and legal framework on national level
• Risk of uncoordinated and duplicated efforts
• High level of motivation and engagement among the group of head teachers
6.4.4 Possible Implications, Consequences and Effects of an SMS-based System

Introducing a new technology such as mobile telephony will have implications, consequences and effects on actors, activities, and organisational structures as well as on other technologies.

This subsection looks into the effects of the proposed SMS-based system, as part of a future EMIS; it lists some of the consequences of implementing the proposed SMS-based statistical data collection system. The discussion about ‘change’ and how to handle changes according to systems thinking is inspired by Öquist (2003; 2008). The description of specific implications is structured according to the Change Model presented in section 4.5. Leavitt explains what the introduction of ICT can imply:

“…the introduction of new technological tools – computers, for example – may cause changes in structure (e.g. the communication system ...), changes in actors (their numbers, skills, attitudes and activities), and changes in performance or even definitions of task, since some tasks may now become feasible of accomplishment for the first time, and others may become unnecessary…Clearly, most efforts to effect change, whether they begin with people, technology, structure, or task, soon must deal with the others.” (Leavitt 1965:1145).

Technology is assumed to both introduce and be shaped by change; indicating a notion of duality where technology is both influencing and influenced. The introduction of ICT, including mobiles, can be assumed to cause changes in the system, which affects the system’s actors, activities, and structures.

An education system is in itself a permanent institution in a society that has to be constant, and at the same time exist in a dynamic and changing world in which it has to cope with change. In a more technology deterministic way, even an organisation and its users should change to fully use the capacity of a new technology such as mobile telephony. Change management and administration is recognised as crucial in education development (Selinger 2009).

Social systems act as ‘reflective goal changers’ as they reflect on decisions made and use collected and stored information in the process (Ackoff 1971). When trying to introduce changes, it is imperative to keep in mind the goal of the system. Change depends on information. A social system has the capacity to exchange information with different levels and environments. For the survival
of the system, it is important to be in contact with the other levels and their surroundings and to avoid gate-keepers.

The higher up in the hierarchy, the more abstract information is circulated. A policy such as *Information and Communication Technology Policy for Basic Education* is an example of rather abstract information produced at the top of the hierarchy.

Even ‘silence’ includes a lot of information: i.e. no data is not the same as no information; instead ‘no data’ includes a lot of information.

Change is necessary for an open system to survive, to accept changes and to be flexible, and to cope with disturbances, interruptions, and instability. Modern systems theory states that disorder is a prerequisite for development; for an open system to survive there has to be constant change, development, and renewal. Organisational development is a continuous process. Mobiles can be seen as a tool for development of the EMIS, even if the introduction creates disorder within the system.

According to the systems theory, there is no linear cause-effect relation; instead a change can start anywhere. Modern systems theory includes chaos theory with influence from Prigogine, Nobel Prize winner in chemistry 1977, and his ideas about a ‘kick’: a small change can cause powerful effects in a system, cf. mobiles in developing countries.

All social systems change in relation to their environment and performance. One important feature of a social system is its adaptability to handle an ever-changing environment.

Adaptation demands resources, e.g. time, money. Adaptation can be divided not only into small changes and large changes, but also into functional and structural changes, implying a time perspective. Hence, functional adaptation appears in the short run while structural adaptation appears in the long run (Yngström 1996). In the short run, a new tool to collect data is introduced, and in the long run, a structural change of EMIS is effected, e.g. accepting data transfer from PS direct to MoEVT.

Change in hierarchical systems is not always straightforward, since all hierarchical systems are by definition conservative and rigid. To make changes in a hierarchical organisation, there is a need to start at the top. At the same time, this is the most solid level of the organisation and by that the most difficult to influence. From a systemic point of view, it is important that there is a slower pace of change at higher levels of the hierarchy to create stability. The actors on each level have different views and different levels of interest and are more or less rigid, which is related to their own amount of power and influence.
When making decisions, it is imperative to let what is best for the whole system guide the decision, creating a synergetic effect. In a hierarchical system, it is not advisable to skip a level during a decision process as this undermines the authority of the different levels. It is important to involve the PS, WEO, DEO, REO and MoEVT levels.

In every organisation, there are several unspoken rules, norms, attitudes, and values. Management is achieved through these and they ‘connect’ the different levels in the system – they are ‘tools’ to tie the levels together, making them into a system.

For the survival of a system, it is important when introducing changes to act in line with the rules, norms, attitudes, and values of the system, e.g. it is not acceptable to beep your superiors.

While changes in an organisation are best achieved and accomplished through ‘acceptance’, it is also possible to achieve change through ‘treats’. All systems have their methods of punishments, but this is not as efficient as rewards, especially not in a long perspective. To start a change process, it is effective to use ideas that emanate from within the system; it gives the initiator a feeling of acceptance, which is an efficient way to initiate change. As an example, mobile phones as administrative tools are accepted by both head teachers and district education officers, making the change process easier to initiate.

Organisational Structure

- The proposed SMS-based system implies that several levels in the hierarchical structure are by-passed; this creates an issue of logical levels that needs consideration
- There are structural obstacles concerning communication between different levels in the hierarchy, with risk of information-sharing problems, particularly because SMS is socially sensitive, an issue that needs consideration
- There is a lack of organised contact data for HTs, DOs and WCs, so there is a need for administrative arrangements such as identification and registration of head teachers’, DOs’ and WCs’ mobile numbers; these administrative tasks, however, can be tedious, expensive, extensive, and time consuming
- There is a need for an assessment of needed human resources; e.g. on the EMIS Team level, the number of staff needs to be considered: a reduction of the number of people must be weighed against the
possibility of letting the team members do more qualified analyses. There is also a need for an assessment of training staff and implementation staff

- Other organisational units might be involved, such as MoF and UNESCO, donors, which demand organisation
- There is a need for the organisation and administration of sensitisation and training programs including formal and informal modes of training
- Contracts between the government and operators constitutes an administrative iterative process
- The indicated lack of financial resources at the local level needs consideration
- There is a need for a reimbursement system
- A sensitisation process on all levels in the governmental system and in the political system is needed
- Active leadership and participation from all levels of the education sector and in the political system are needed
- Political will, support and commitments (policies and strategies) at all levels are needed
- There is a need for a coherent and legal framework on a national level to avoid uncoordinated and duplicated efforts

**Actors and Activities** (see examples further below in several so-called rich pictures where a user perspective is stressed for each level)

- The proposed SMS-based system implies the same actors but with changed activities; some actors are dispossessed their present activities and responsibilities – the issue of underutilisation of actors and disempowerment needs consideration
- There is a risk for e-stress related to lack of e-literacy if technology is seen as the determining factor in ‘good’ administration, which may then erode the agency, i.e. an issue of disempowering
- There is a risk for e-stress related to convergent use of mobiles, i.e. work-related usage of mobiles at home needs consideration
- There is a redefinition of roles with new responsibilities and new positions for HTs and the EMIS Team but with no responsibilities and no positions for ROs, DOs and WCs – adjusted job descriptions need consideration
- Fewer face-to-face meetings,…the risk for isolation need to be considered
• Travelling for distributing forms and sending completed forms will decline – have these travels met other needs that will now not be filled?
• Releasing actors for more ‘value-added tasks’ implies opportunities for personal development and capacity-building

Technology
• Before an implementation, mobile penetration needs to be investigated
• There is a need for SMS application/format preferably in Kiswahili
• Rules for constructing a predefined SMS format needs consideration due to opinions about complexity including the limited number of characters
• There is a need for software for PCs
• PaP is still needed as back-up and as a receipt (‘SMS cannot be signed’)
• Remote areas without coverage need alternative solutions
• Before an implementation, both quantity and quality of network coverage (especially in rural areas) needs consideration. An SMS-based system needs one operator with ‘good’ coverage and ‘good’ services
• Data security needs consideration (e.g. SMS can get ‘lost’, SMS can be read by ‘others’)
• A system for avoiding abuse of free SMS for private purposes is needed
• Before an implementation, both quality and quantity of repair services and accessories need consideration
• Before an implementation, both quantity and quality of power solutions (especially in rural areas) need consideration, including alternative power solutions in particular solar power and a need for spare and long-lasting batteries

Illustrating the Blended System from an Actor’s Perspective
What are the challenges of the proposed EMIS for the different actors on the different levels? On the following pages rich pictures are used to illustrate feelings and thoughts among actors on different levels. (The concept of rich picture is introduced in section 6.1.) The issues raised in the rich pictures below are a bit speculative but are meant to show possible feelings and thoughts among actors on different levels in the organization after the blended system has been implemented. Figures 6.4.2 – 6.4.6 shows head teachers, ward coordinators, district officers, regional officers, and EMIS Team, respectively. The ‘happy’, ‘angry’ and ‘neutral’ faces illustrates that both positive and negative feelings are ‘voiced’.
Figure 6.4.2 Rich Picture at School Level
Figure 6.4.3 Rich Picture at Ward Level
Figure 6.4.4 Rich Picture at District Level

I wonder if my mobile affects my brain?

This district lack resources for an SMS system!

This doesn't feel like localisation!

My office don't own a mobile!

Can I use the data cc to me for planning?

I miss the visits at the primary schools!

Is it really OK that HT's send SMS to the ministry?

Do I have to register HT's and WEC's mobile numbers?

I feel so disempowered!
Figure 6.4.3 Rich Picture at Regional Level
Figure 6.4.6 Rich Picture at Ministry Level
Additional Remarks on the SMS-Based System

None of the selected schools or district offices owned a mobile phone. The consequences of this is that the proposed systems relies on the use of private property, which relies on an ability and willingness to buy a mobile and also brings with it a risk for pressure to use private property. There is also a need for a reimbursement system. Additionally, there is a risk that different brands and models complicate the implementation. Additionally, changing mobiles/SIM cards, owning several SIM cards, moving staff and/or inactive SIM cards all constitute a risk for the proposed system as well as making an updated phone list crucial for the system.

When considering the consequences related to the use of private mobile phones, a school subscription with a SIM card belonging to the primary school – a type of ‘prepaid’ model – needs investigation. Also, office subscriptions connected to REO, DEO and WEO should be considered. Focusing on the SIM card rather than on the handset makes it possible that all types of mobiles can be used.

The alternative, where schools and offices have mobiles of the same type and model, is of course more expensive, and will also involve issues regarding theft, replacement, mending, battery charging possibilities, and private usage to name a few. At the same time, the introduction of school and office phones simplifies the training process as the same model can be used in all schools and offices. School phones also make a system for reimbursement unnecessary. As well, using a ‘simple’ model for the school phone makes the training ‘easier’ as ‘simple models’ have ‘small learning curves’.

Initially, any implementation project along the lines sketched in section 6.4.1 has to avoid steep learning curves, which is why it is better to rely on privately owned handsets. However, sustainable and long-term solutions need institutional arrangements that probably cannot build on the individual head teacher’s private property (mobiles and SIM). In the future, the school, and the different offices (WEO, DEO, REO) must own the equipment (mobiles and SIM). With regards to phone numbers, the government system should ‘own’ the phone numbers; a short code for the server at MoEVT and for intermediate offices, and then each school is given their ID as a phone number, possibly some prefix to make it work on the public telephone network.

Changing activities implies a need for new skills, which involves a need for sensitisation and training to reach awareness, to change attitudes (which might take years), and to reach commitment on all levels - both governmental and political. An articulated objective that includes the intended role and
intended use of the SMS-based system is needed since there is lack of knowledge and awareness of an SMS-based system and teachers are considered as late adopters of ICT.

Issues to be raised during a sensitisation activity include health issues, gender issues and the issue of surveillance and being monitored. The fact that SMS is socially sensitive needs discussion, as well as the expressed stress related to e-literacy. Additionally, the low awareness on a local level of ICT policy needs to be addressed and preferably articulated in a less abstract way.

Training activities should emanate from opinions about complexity issues, and issues of inconvenience when using SMS, including how to use a predefined SMS format. Related to training is that ‘moving’ and ‘new’ teachers and other staff/actors create a need for a continuous training program including written introductions and information about the SMS-based system. It is possible that an informal training program could be introduced e.g. WCs can coordinate peer-to-peer training.

The indicated lack of financial resources at the local level needs consideration. Even if SMS has a favourable cost ratio compared to voice calling, one has to be aware of the fact that the prevalent prepayment model is the most expensive model. At the same time, the availability of several operators implies low price levels and good service due to competition. Additionally, discounts for bulk SMS are possible.

The issue of funding is central. An important consequence of the proposed EMIS is the digital connectivity between different levels, which saves resources that can be used for more urgent activities than travel; it reduces internal transaction costs by saving time and money.

Even if the proposed EMIS save resources, and even if the suggested mobile technology is less expensive than other ‘new’ ICT, the EMIS still needs to be funded and in a resource-constrained context. The distribution and collection of data forms ‘today’ is financed by each district education office, but to implement the proposed system, sustainable central funding is needed.

The education sector is heavily dependent on donor funding with up to thirty different donors mentioned. There is a need for a coordinated funding process and for long-term financial planning and budgeting, including operational cost and training cost.

The present EMIS can be considered an ‘inefficient information system’. An inefficient information system is a matter of both quality and quantity of data.
Inefficient information systems involves the problem of asymmetric information i.e. an information gap - lack of data and information - incomplete, wrong, non-relevant data as well as an ‘information asymmetry’ - not everyone involved (focus on user) has access to relevant, complete, and correct data (focus on data).

An inefficient information system is also about too much data, the issue of ‘information overload’, which is an example of the maximalist aspect: the ‘nice to have data’ attitude. There is a need to discuss ‘captured data vs. used data’ and ‘useful data vs. useless data’; the ‘max-min aspect’ of the 10-page statistical data form which is considered complicated and extensive and which results in a time-consuming process.

The problem of ‘information overload’ is a phenomenon that has to be discussed with the several stakeholders involved in the process, as this is an issue for data quality, and poses a risk for compromising data validity. The problem of ‘information overload’ has to be weighed against the positive effects of gathering data, e.g. transparency, reduced corruption and governance; having an open system of communication with correct ‘internal’ data.

An inefficient information system is also a matter of the quantity of institutions involved in the data collection process.

Adding to the picture of an inefficient information system is the fact that there are in total six different institutions involved with responsibility for collection of data within the education sector. One of these is the MoEVT, but the EMIS is not connected to the other five institutions.

The collected statistical data is used inter alia as a basis for the budget process within the education sector. There are in total ten different institutions involved in the funding process with no connection to the EMIS except from the MoEVT.

The proposed EMIS will release time for the EMIS Team if implemented. The highly qualified EMIS Team with higher education in statistics and economics should be used for more advanced activities and value-added tasks.

The proposed blended solution integrates different government units within the education sector (DEO, REO and MoEVT) by sharing databases via servers. One suggestion is to use their qualifications for further implementation of the EMIS, since the present EMIS is ‘only’ used for collection and process of statistical data. The proposed EMIS also aims to let the EMIS Team work with the integration and coordination of the EMIS to other MIS, with database connections to other ministries and institutions such as the MoF and UNESCO, in order to fulfil a vertical integration of the e-government system.
An important effect of sharing of databases is the issue of transparency and governance - an open system instead of a closed system – and to become less proprietary about data and information. Information in an ‘Information Society’ implies two things: the creation of information but also the control of information. The power, capacity and capability to create new information is dependent on the access to data.

An additional important effect of the proposed SMS-system is the possibility of a ‘whistle-blowing service’ by involving MoF and donors but also local groups such as School Committees to use SMS to reduce corruption, as this is an observed problem in the education sector. Transparency is needed to track budgets and grant disbursements (e.g. when and how much) and for this there is a need for integrated databases. Today, up to ten different institutions are involved in the funding of primary schools. The stored data are only available for the EMIS Team, resulting in no transparency. One key to dealing with corruption is the existence of clear and complete work processes.

At the same time, a whistle-blowing service can be sensitive if a ‘system of corruption’ is accepted in a local culture and where there is not always support to ‘combat corruption’. When implementing an e-government system, it is essential to be aware of the informal systems existing within a public sector and that there may be those who want to keep them.

The promises of e-administration in general are to make data comparable, transparent, and accessible through coordinated inter-agency data flow and an integrated data process through inter-operability: the communication, coordination, and standardisation of data.

The promises of e-administration in the education sector through an EMIS can provide administrative support and improve data management in order to improve the overall management of the sector. The proposed SMS-based system has the potential to contribute to this objective by addressing weaknesses of the present EMIS.

Benefits for administering education for statistical data collection are improvements to the collection process (speed, frequency, accuracy, storage and analysis) and improvements to information dissemination and distribution, e.g. reports from MoEvT.

A formalised use of mobile phones in primary schools can contribute to the information system in rural areas: mobile phones become a substitute and a complement to the existing communication infrastructure. m-Government may become the key method for reaching rural area.
As noted in section 3.5 the issue of ‘mobility’ in m-government is discussed by several authors: mobility of the device and mobility of the users including government officials. For the proposed EMIS, it is less about ‘mobility’ and instead more about ‘connectivity’: reachability, individual addressability and convenience.

At the same time, one has to be aware of the fact that driving around to gather data can also have other meanings and purposes, such as other official errands.

6.4.5 Seven Aspects to Consider – the Seven Aspects Reconsidered

This section explains briefly how the suggested approach from section 3.6, with seven aspects to consider in an e-government system implementation, can be interpreted when planning for an implementation of the SMS system both on a regional level and on a national level.

The suggested approach emanates from the contextual complexity that is related to the implementation of an e-government system in a developing country context. The suggested approach involves a multidimensional view including a macro, a micro and a resource perspective.

The seven aspects are:

1. Socio-Technical aspect
2. Contextual aspect
3. Slow Time aspect
4. Small Step-by-Step aspect
5. Capacity and Quality aspect
6. Max-Min Macro-Micro aspect
7. Coordination and Consistency aspect

- Socio-Technical aspect
The first, most overarching aspect is the socio-technical aspect. Infrastructure and technology are not the ‘problem’; the problem is made up of human, social and institutional challenges so there is a need to focus on social aspects before technical issues. This is confirmed in many studies including this one, e.g. training, participation, motivation, and sensitisation. Technology per se is not the ‘problem’; rather problems are caused by how technology is introduced without consideration to human, social and institutional circumstances. At the same time, the technological part including infrastructure should not be underestimated as there are several challenges noticed, such as the quality and quantity of electricity and network coverage. The socio-technical aspect must be
articulated in policies and strategies, which are the documents that at the furthest end will guide the implementation of an e-government system.

- **Contextual aspect**
An e-government solution needs contextual awareness, an awareness of work practices regarding mobiles on all levels, from head teachers to district education officers. Another example is the institutional structure and culture that has to be ‘identified’ including norms, values, and attitudes towards using private property for work-related purposes. A third example is the infrastructural situation such as network coverage at rural schools.

Experience and studies from other contexts can contribute with frameworks and factor models as a starting point, but this has to be supplemented with field visits on all levels and working both top-down and bottom-up in order to involve stakeholders on all levels and to identify the particular supporting and hampering structures at each level and – as far as possible – at each site. There is a need to build on what is there; to build on local practices, instead of implementing a copy-and-paste solution - it is about implementing a locally adapted solution; it is about localisation and contextualisation in order to fully incorporate the technology in the existing management process.

- **Slow Time aspect**
The design of an e-government system needs a time perspective, since different challenges can be met at different times, e.g. technological challenges can be met in short time and social and cultural changes brought about in long time. Diffusion and adoption of a technology is about a long-term social process: it is a process over time and includes changes of attitude, values and beliefs. There is a need for a ‘realistic’ long-term plan including several dimensions of time. For example, with regards to training, there is a need to plan when, how long, in which order, how often, and simultaneity.

The suggested solution here might not need a long adoption time as the mobile phone is already an accepted tool for work-related use together with the use of private property, but the change of attitude to the mobile as an administrative tool might take more time and need to be considered at all levels in order not to experience an assimilation gap – i.e. to avoid ‘have but not use’. Additionally, one has to be aware that adoption is not always a continuous process; one has to understand and accept that it can be an interrupted process.

The acceptance of new tasks and new responsibilities might take time to get accustomed to. Adoption and attitude can be influenced by a change agent, and in this case, the district education officers could take on this role. At any
rate, there is a need for a continuous change support, as adoption is not a momentary process.

- **Small Step-by-Step aspect**
  Several studies stress that ‘radical changes’ create chaos, so a step-by-step aspect, with small steps is a strategy that can be used to avoid failure. Implementing the proposed EMIS on a national level might not be the best implementation strategy. Instead, it is recommended to start with one region, e.g. the Iringa Region, and then evaluate before a national implementation is planned. At the same time, all levels in the organisational structure must be involved in order to really test the system – a centralised model is proposed even if decentralisation is often favoured.

  Additionally, in line with a small step-by-step aspect, the implementation should start with selecting some key data from the statistical questionnaire. For an example, see the Max-Min aspect below.

  The term ‘leapfrogging’ is often mentioned in developing country literature. The term can be defined as jumping certain technological steps, however, it is imperative to be aware of the fact that certain steps must be taken while others can be skipped.

- **Capacity and Quality aspect**
  Capacity building is mentioned as a key issue. On an individual level, the need for training is consistently mentioned among the findings of this particular study. On an organisational level, sensitisation is needed due to structural weaknesses even if head teachers and district education officers have experience of work-related usage of mobiles. Capacity building has both formal aspects, such as when it concerns the organisational structure and organisational embedding of the proposed EMIS, as well as informal aspects such as change of behaviour and trust.

  Quality issues should be articulated on all levels - government (e.g. MoEVT, MoF), society (e.g. pupils, parents), and users (e.g. HT, DO). The added value of high quality data is critical as motivation for the adoption of the new technology. As noted before, it is also about other benefits for the administration of education through statistical data collection with improvements to the collection process (speed, accuracy, storage and analysis of data) and improvements to information dissemination and distribution, e.g. reports from MoEVT.
• **Max-Min Macro-Micro aspect**

A maximalist approach (‘nice to have but uncertain usefulness’) has to be avoided in the beginning in favour of a minimalist ‘need to have and essential’ approach. For instance, the number of pupils for each primary school is a key data type; enrollment numbers are critical for managing and financing education. Capturing such data creates benefits on all levels: it is the basic data that emanates from the village level that creates the foundation for planning at the district level and for the budget process at the ministry level.

The macro-micro level aspect concerns political frameworks on the national level as well as local resources being accounted for.

• **Coordination and Consistency aspect**

Coordination between institutions is mentioned as critical in Chapter 3. For instance, MoEVT, MoF and UNESCO are institutions that need to coordinate the proposed EMIS, a more integrated approach for the statistical data collection process. Additionally, the budget planning process for the education sector needs ‘connections’ between the local process and the central one. Integrated databases between the institutions can facilitate the budget planning process.

There is a need to articulate and introduce a culture usage procedures and data exchange data: e.g. who to report to, standardised forms including consistence in definitions, regular reporting and reviews, and a culture of feedback.

Additionally, different gateways have to be accepted in line with the underlying assumption that a non-digital paper-based system must coexist with a digital system. The type of gateway is related to the organisational level, including the resources available such as infrastructure.

This aspect is about the coordination of different MIS and consistency of data with the ambition that data from all schools must be available for all actors on all levels.

In conclusion, the account immediately above has indicated how one can interpret the approach defined in section 3.6 when planning for an implementation of the SMS-based system. Naturally, for a real implementation, many (most) questions about how challenges for the new system can be handled are not answered. Such answers are out of the scope of this study, since they must be given in collaboration with the different actors at all levels. Furthermore, countermeasures for certain obstacles may be found suitable at different locations different, as it may be found that a training program in the Iringa Municipal district may not be designed in the same way as a training
program in the Kilolo district. Nevertheless, this chapter has demonstrated how supporting structures can be found and exemplified, how obstacles can be identified and exemplified, and it has also given ample evidence that obstacles can be overcome.

6.4.6 Can Mobile Phones Effectively Constitute a Part of a Blended EMIS?

This question is raised in the Introduction, section 1.2, as the main research question to answer in this study. The research questions are used as guidance in order to reach the overall aim of this study, that is to propose an approach to designing more efficient e-government systems within the education sector with the more specific aim of

- explore more efficient data transfer (faster, more reliable, and potentially less resource demanding) by using mobile telephone technology, especially SMS, as a means for statistical data collection for Tanzanian education management.

The short answer to the main research question is ‘Yes’ and this answer is underpinned by the discussion in section 6.2 and 6.3 about how the widespread use of SMS can be utilised and in section 6.4.1 what such a blended EMIS would look like. The answer is further supported with the argumentation in section 6.4.4 focusing on ‘What would the consequences of an implementation be outside the system per se’ – the last research question.

The importance of understanding the situation of ‘today’ before proposing a change underlie the research questions of ‘How is statistical data currently collected’ and ‘What are the strengths and the weaknesses of the process’. These questions about the present EMIS are answered in section 6.1.

The importance of the present situation also motivates the research questions about the proposed EMIS ‘What are the existing supporting and hampering structures that would influence the implementation of an SMS-based system’, and ‘What ‘critical’ issues need to be considered’ which are addressed in section 6.4.2 and 6.4.3. Finally, in section 6.4.5, an implementation of the proposed EMIS is discussed using the approach on the seven aspects to consider as the last and as more overarching discussion in order to answer the main research question.
7 Contributions and Future Research

In this final chapter, the main contributions are summarised and the possibility of future research is discussed. In the final section of this chapter, the thesis is summed up in three personal lessons learned.

7.1 Recap on Background

This study has taken as a premise that education is a prioritised area in Tanzania as discussed in Chapter 2. But education is resource demanding, and Tanzania is one of the poorest countries in the world with a scarcity of resources. Furthermore, rural areas are relatively poorer and most of the 15 000 primary schools, serving approximately 10 000 000 pupils, are located in rural areas.

The administration and management of primary education is important for reaching ‘education for all’. ICT tools and e-government systems are considered by governments and international organisations to improve administration and management. In Tanzania, the e-government system EMIS, is partly implemented but shows several limitations. Statistical data is collected but the process is resource demanding and much of the collected data are never put into the system, and therefore remain inaccessible from this electronic system. A well-functioning system is important for the government and the sector as such, and it is also important for the individual primary schools, as funding is dependent on enrolment figures.

An alternative EMIS has been proposed in this study. The point of departure for the proposed solution was that an e-government system, as much as possible, must not be resource demanding and must be able to use ‘what there is’, i.e. available technology (well known, tried out, accepted, affordable). A blended digital solution was proposed.

7.2 Summary of Contributions

There are several types of contributions in the present study. Some parts deal with practical circumstance, by giving descriptions of actual problems and providing concrete recommendations for future processes for statistical data collection in the given context. Another type of contribution is about the approach used and is of a more theoretical nature. This also includes the modelling and conceptual frameworks developed in this study.
7.2.1 Practical Contributions

The present study has given a clearer view of what is actually involved in the present EMIS system (cf. section 6.1). A distinct pre-capture phase is identified, which has been shown to be resource consuming as it is mostly performed by car. As well, the capture phase is resource consuming as it is done on foot, by bike or by bus. Additionally, the amount of data that reaches the Ministry of Education and Vocational Training (MoEVT) is substantial, with a lot of the data remaining unprocessed.

Another rather practical contribution concerns the outline of an alternative statistical data collection system, where a blended solution is advocated (section 6.4.1). It suggests a digital blend of mobile technology with fixed computers. Likely effects of such a system would include increased data security, data validity, and data accessibility. This in turn should provide for better administration and better planning, which then provides for better decision-making, especially with regards to funding. It should also help other data collecting and funding ministries and organisations involved in the education sector and not only the Ministry of Education and Vocational Training. Also, planning on a local level could possibly be enhanced, as notifications of payment can be given quickly and directly to the head teachers. The latter also provides for better transparency. Moreover, it is very likely that the proposed system is significantly less resource demanding than the present system, if all overhead costs are counted.

As part of the practical contributions of this study, one can mention the many hampering structures for a new EMIS that have been identified (sections 6.4.2-4). Of course, this is not an exhaustive list of all possible structures that can be hampering, but the important contributions here are the discussions about how the identified tentative obstacles can be tackled. The head teachers’ fear that SMS is insecure as well as their fear of by-passing steps in the hierarchy must be met by awareness raising activities and support from high-level officers. Furthermore, the identified supporting structures (section 6.4.3), such as head teachers already using SMS and mobile phone calls for work-related purposes, do indeed indicate that the proposed blended system is contextually relevant in spite of the problems reported from a similar system in another East African country.

7.2.2 Theoretical Contributions

To turn to the more theoretical contributions of this study, an extensive framework for contextually analysing a phenomenon at a systems level was
presented in an earlier work (Sundén & Wicander 2006) and has here been further developed into XIF, as described in Appendix 4:4.

Notably, XIF departs from a systems level. For a more precise analysis of the head teachers’ views, a supporting analytical tool, the Triple A (introduced in section 4.5.2; see also Appendix 4:5) was designed as a conceptual model for analysis on an individual level. In section 6.2, it was used to analyse head teachers’ mobile usage. In section 6.3, it was used for analysing their views on a tentative SMS-based data collection system. Even if this model was developed for precisely these analyses, it has generic qualities which should make the model possible to use for many similar purposes.

There has also been some development of models to describe process and change. The discussion has used Heeks’ process view as a point of departure, but developed this view to include a pre-capture phase, which was argued to be essential for data collection in this particular context as it included a costly and time-consuming distribution activity. This consideration resulted in the Three-stage Data Capture Process Model (Figure 4.5.2 in section 4.5.1), which should also be of use for other studies. Leavitt’s model, with its four main categories slightly renamed – technology, organisational structure, activities, actors (Figure 4.5.1; Change Model) – was used twice, namely to describe the present EMIS (section 6.1) and the proposed EMIS (section 6.4.1) in order to make it possible to make a socio-technical analysis (section 6.4.4) of the changes implied by the proposed system.

An additional theoretical contribution is a framework constituted of seven aspects to consider when implementing an e-government solution, described in section 3.6. This framework is here used as a part of the analytical discussion, but has a generic character and can be used during the implementation process of other e-government solutions.

### 7.3 Future Research

Three different lines of future research are here suggested. First, the rich empirical data constitute a resource for future research, i.e. the field data from Tanzania collected in this study can be analysed further, deeper and in different ways if one wants to broaden the research scope outside the process of collecting statistical data.

Second, a comparative study can be done of the education management situation in Tanzania with other developing countries (e.g. East African countries). This can be of valuable interest in order to compare countries that at
the first glance can be regarded as alike and comparable, but that have to be treated as individual entities.

Third, a pilot implementation can be made, which is characterised as action research. What, then, are the implications for implementation of the proposed EMIS systems? I can start by noting that this question receives the same answer if other alternative EMIS systems were to be considered. Then I would stress that any implementation, even a trial (a pilot implementation), should be preceded by a thorough baseline study like the present one, but broader in geographical scope to include all concerned head teachers (and wards, etc.). Perhaps one does not have to approach the head teachers individually, because it should be recognised that the questionnaire is not only designed to find facts but also to make the interviewees aware of the thoughts underlying the implementation to come. The baseline study is followed by a pilot study. For this step, it is important that it has to be a vertical implementation going “all the way” through the administration, i.e. from a (large) sample of schools (but not geographically scattered) up to the level of the EMIS team. As the present study has shown, there are several inter-level issues and the pilot trial has to be able to reveal these. A vertical pilot implementation provides an opportunity to study ‘change’ at all levels and between all levels, at least if the full implementation process is not rushed but is allowed to take time.

7.4 Lessons Learnt

Finally, I would like to close this thesis in a personal way and less academic way with three overall reflections made, so-called ‘lessons learnt’. These reflections build on the findings from this research study but go a bit further and become more speculative and to the point presented in a short, rather direct and maybe in a somewhat more dramatic way. The three most intriguing reflections based on my major observations:

- The Double ‘e’ Dilemma
- The ‘Mobile to Avoid Mobility’ Paradox
- The ‘SMS to Combat Corruption’ Weapon

The first reflection is about the Double ‘e’ Dilemma related to two words with the prefix ‘e’. The digital divide is widely discussed in a developing country context, but I argue that the digital divide is not foremost a lack of ‘e’ as in ‘electronic’ but more about a lack of ‘e’ as in ‘electricity’. My experience is that the digital divide cannot be closed with electronic devices as long as there is a major problem with electricity. In other words, it does not help to solve the
first ‘e (electronic)’ as long as the other ‘e (electricity)’ is still unsolved. The dilemma is to decide which one to start with; which one to choose in a resource constrained context, as ‘e (electronic)’ solutions are more ‘hype’. The proposed EMIS is dependent on a sustainable solution of the mobile supported system as are e-government systems in general in rural areas in a developing country context.

The section reflection concerns a paradox of ‘mobile phones to avoid mobility’. In the rhetoric, a mobile is ‘always’ considered as a tool to reach mobility, both of the device itself and of the user of the mobile, which means that both are truly mobile. But I argue that in a rural area in a developing country context, it is actually the opposite in terms of the user's situation. Most people in this context have to spend so much time, so much money, so much resources and efforts, on transportation in order to communicate due to lack of telecommunication infrastructure. In this sense, the major benefits of mobile phones both on a personal level and on a local institutional level as a primary school, are ‘connectivity’ and that people for the first time can avoid moving, cycling, travelling in order to deliver a message, whether it is statistical data or a greeting to a colleague on her birthday. In other words, it is about less mobility for the user – it is about the opportunity to choose ‘immobility’.

The third, final and maybe most influential reflection concerns SMS as a weapon to combat corruption. Corruption on all levels is a well-documented phenomenon in many developing countries for different reasons. If one considers that corruption is negative to development, one must strive to combat corruption. The proposed SMS-system implies a solution that admits a more transparent data transfer, which could have an effect on existing corruption. Additionally, in line with the Paris Declaration51, transparency is an important issue to handle in order to track the international grants distributed as budget support.

So perhaps I need to change my wording in the Preface about the pen being mightier than the sword – maybe SMS will become the mightiest in the future.

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51 For information on the Paris Declaration see http://www.oecd.org/document/18/0,3746,en_2649_3236398_35401554_1_1_1_1,00.html#Paris
Personal Communication

The following persons have contributed as sources for this study. See Appendix 4:1 Field Diary Phase I for more details.

ET (2007) – short for the team members at the EMIS office

Finne, Auvo (2007)
Frankenberg, Anders (2007)
Jensen, Nils (2006; 2007)
Nielsen, Dag (2007; 2008)
Persson, Hans (2007)
Smithmanis Dry, Petra (2007)
Uimonen, Paula (2007)

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Appendices

The numbering of the appendices is related to the chapters they correspond to.
Appendix 4:0 Keywords in Systems Theory
Appendix 4:1 Field Diary Phase I
Appendix 4:2 Field Diary Phase II
Appendix 4:3 The Questionnaire
Appendix 4:4 XIF – The eXtended Sustainable ICT Framework
Appendix 4:5 Triple A
Appendix 5:1 Standard Statistical Questionnaire – Primary Schools
Appendix 5:2 Standard Statistical Questionnaire – District Summary
Appendix 4:0 Keywords in Systems Theory

A systems approach contributes to the discussions held in this study with a general and common language, that is, both with a terminology and with several concepts. The list of terms and concepts reflects key issues of systems theory relevant for the present study.

System
The term 'system' comes from Greek and denotes 'connected or regular whole'. Langefors gives his definition of systems: “A system is a correlation of objects …” (1973:35). He develops this further, saying that the true systems concept has to do with the “…problems of the whole and the interconnection between the components rather than the components proper” (ibid). Checkland (1981) adds to this definition of the concept: ”...a concept of a whole which has properties as a single entity…”

The properties of the parts are used to generate those properties of the whole that are desirable and important (Langefors 1973). Furthermore, to emphasise the system aspect is to stress that it is the combined effect of the parts that is important. The system principle states that 'the whole is greater than the sums of the parts', which includes a system's emergent properties, i.e. its synergetic effects. The term ‘synergetic’ comes from Greek, meaning ‘working together’.

System as a ‘whole’ is a fundamental aspect of a system and Bertalanffy (1968) used the concept of ‘system’ to describe organisms as wholes and showed that it could be applied to wholes of any kind. As a biologist, Bertalanffy (1968) used the concept of ‘system’ as an epistemological device to describe organisms.

The term 'system' is used in the academic discipline Information Systems, where it is related to hardware, software and the design and use of information systems to facilitate the processing and transferring of data.

Structure
The origin of systems thinking is related to ‘structuralism’ with its view of society as an organised structure as well as its holistic view. Giddens (1984) and his Structuration Theory looks at society and social systems and the mutual relationships and dependencies between humans and structures in what he calls the ‘duality of structure’ (Giddens 1984:25), understanding that people influence (control, govern, manage) structures and are influenced (controlled, governed, managed) by structures.

Different systems have different structures and are organised i.e. arranged systematically, differently. The structure of a system is the arrangement of its sub-systems.

A structure can be described as more or less ‘visible’ or ‘tangible’, more or less obvious or covered under the surface. A common term is ‘infrastructure’, which can be understood as underlying and supporting i.e. infra. Physical infrastructures can include roads and telecommunication networks, while nonphysical infrastructures can be related to views, rules, norms (both formal and informal), values, and routines. These nonphysical infrastructures may not be visible, but they are present and powerful in a society.
The term ‘structures’ is meant to be understood both as tangible structures e.g. infrastructure such as road networks, and as intangible structures e.g. norms and values. Structures are also related to resources e.g. social capitals. How people use these resources is determined by structures such as rules and routines: structures influence and are influenced by people, whereby people can change the structure and be changed by it. A structure always exists in a time and space dimension, which needs to be taken into account when changing the structure. A structure becomes more solid and ‘frozen’ if it is ‘acted’ during a long time: a structure with a long history in time and space is more difficult to change. Changing a solid structure demands more effort. But it is not only about the amount of time; it is also about the frequency of usage and the size of the space including the number of users, i.e. a national structure is more solid than a local one. E.g. usage of ICT becomes more solid if there are many users, a reliable network, and a positive attitude. Usage of ICT can be supported, persuaded, promoted, encouraged and by that become a solid structure as well as the other way around.

**Hierarchy**

A fundamental aspect of a system is that of hierarchic order. A system is organised in a hierarchy i.e. a system has a hierarchic structure with the less complex units at the lowest level forming sub-systems and the more complex units with their elements forming a supra-system. When describing and analysing systems, a hierarchy of the system is usable; a classification in a system hierarchy introduced by Kenneth (K. E.) Boulding (1985).

In every social system, there is a hierarchical structure with actions on higher levels as superior and those actions managing the lower levels. The higher up in the hierarchy of a social system, the wider the area of responsibility and power and more abstract information is circulated. Each level can be seen as a subsystem within the system.

It is also important to keep separate the private level from the official level. In hierarchical systems, it is not advisable to skip a level during a decision process as this undermines the authority of the different levels and thereby encourages corruption in the organisation. This is important for both top-down and bottom-up decisions (Öquist 2003; 2008).

The management of a social system is done through rules and norms, attitudes and values, which are prescribed by the highest level but accepted by the lower levels in the hierarchy. In every organisation, there are also several unspoken rules. Rules, norms, attitudes, values are all ‘connections’ between the different levels in the system – they are tools to tie the levels together – to make them a system (ibid).

**Logical Levels**

The structure of a system constitutes different logical levels. Logical levels can be used to illustrate communication between parts of the system, as a way to understand the organisation of the system (Öquist 2003; 2008).

The different levels and subsystems also constitute different logical levels. Each level manages the next at the same time as the highest level manages all the levels. It is imperative to keep separate the different logical levels from each other in a hierarchical system; to let
local decisions be made within the logical level and not let someone from a higher level make decisions on a lower logical level i.e. to disregard the local person in charge (ibid).

**Complexity**

The systems approach is concerned with classifying different systems into a sequence with increasing complexity (Langefors 1973). Complexity implies a large number of elements with many interactions. It expresses a condition of numerous elements in a system and numerous forms of relationships among the elements.

The concept of complexity can be used to characterize something with many parts in difficult arrangement ("detail complexity", Senge 1990:71). However, the concept can also be used for effects over time which are not obvious and with non-obvious consequences ("dynamic complexity"; ibid). Social systems are characterised by a high degree of complexity – every situation in which human beings are involved and interact will be complex. “The real leverage in most management situations lies in understanding dynamic complexity, not detail complexity” (Senge 1990:72).

**Synthesis**

Systems thinking includes synthesis of the system, which focuses on creating knowledge about the function and the behaviour of a system. This can be performed in three steps in order to describe and present the system and to explore and explain the behaviour of the system in a functionalistic, ‘hard’, systematic way.

According to Skyttner (2002:31), synthesis of a system includes three steps:

First step: Identify the system of which the unit in focus is a part. Identification of a system can be done through looking at its structure and organisation.

Second step: Explain the properties of behaviour of the system. Explaining the behaviour can be done through looking at activities, actors, and responsibilities.

Third step: Explain the properties or behaviour of the unit in focus as a part or a function of the system. E.g. explaining the properties and behaviour of EMIS through looking at activities, actors, and responsibilities.

**Environment**

It is important to assess both the system itself as well as its environment. The environment is as important as the system, since there is a mutual dependence; a constant interplay between them. The environment contributes with structure and stability but also with certain limitations such as economic. In order to define the environment, the boundary or interface must be identified. The boundary or interface includes regarding information, a coding and decoding process. The environment of a system always affects the system in some way; hence properties that do not affect the system do not belong to the environment of the system (Ackoff 1971). Instead, these ambient properties belong to the ‘context’ of the system, but they affect the system in an indirect way. Systems approach relies on the description of the system environment, the systems parts, and the intra- and extra-dependencies. The environment can be seen as a suprasystem and there is a hierarchy between the systems in the environment. The environment is the source of information,
material, and energy i.e. different resources that are vital to the continuation of the system. A
social system as an open system has the significant capacity to exchange data and
information with its environment. This implies (inter)relationship, interaction and
(inter)dependency with the environment as well as integration and coordination.

Communication
Communication is a central term in systems theory and a central activity in a system. The
interface between different levels in a system represents different levels of activities. Each
level is connected via interfaces to the other levels within the system. The system keeps the
different parts together through information. Lack of physical contact is compensated for
with a more or less complicated information system. All information systems have their own
‘language’ or code, which facilitates internal communication but obstructs external
communication (Checkland 1981). It is imperative to keep the levels apart and to
communicate between the levels using a predefined ‘script’ or language or code (Öquist
2003; 2008).

A living system depends on three types of information input (Skyttner 2002:119):

- Information of the world outside
- Information from the past
- Information about self and own parts

Most living systems receive more information from their environment than is necessary and
relevant, so there is a need to handle this overload of information. At the same time, a living
system must allow input from the environment and avoid gatekeepers for information from
the environment. The interface between the system and the direct environment is important
as well as the surrounding society; the context.

A social system keeps the system united and connected via information and if the different
parts are not physically connected, this is facilitated by using an information system. The
connection includes coding and decoding; i.e. processing data using the information system.
Information processes consume energy (Miller 1978); they consume time, money, i.e.
different resources.

Boulding (1985) talks about systems as ‘boxes’, as black, grey and white, with increasing
internal knowledge moving from the black to the white box. The white box represents a
transparent system, giving full information about the internal processes.

At the same time, there is a need to control the interchange of information in order to
regulate the flow of information, the amount of information, to avoid information overload.
But a too rigid control gives the system a closed character with only the possibility of finding
information within the system, where the information is never questioned, amplifying
negative behaviour (Öquist 2003; 2008).

Classification
A classification of systems could be made on the basis of their behaviour or function. A
social system is an open and living system; it can be categorised as concrete, living, dynamic,
man-made, human, complex, open, organised (Skyttner 2002). Social systems are human activity systems including information systems (Checkland 1981). A social system includes human action and social structures and when studying a change, a pluralistic approach is needed. Within a social system, there is a structural framework – structural conditions and circumstances such as type of organisation, dimension and size, level of differentiation, and culture – which constitutes, frames and guides what development, processes and changes are available and possible within the system and how these can vary when left unobstructed. A social system exists within an environment and the environment must be seen as part of the system that both influences and is influenced by its surroundings. The environment can be described in different layers.

An open system could be described by its input, processes and outputs including feedback. Hence, an open system has a relation to and an exchange with its environment in the form of input and output. The environment is the source of information, material, and energy, vital to the continuation of the system but also with higher complexity as outcome. This implies interaction and dependency with the environment. An organisation can be regarded as an open system with input, processes and output as the main parts of the system and it can be used in this way for diagnosing human behaviour (Andersen & Sorsveen 2003). This implies interaction and dependency with the environment. An open system exists within an environment and the environment must be seen as part of the system.

A living system can be seen as a subset of systems constituted of living elements. A living system is a physical phenomenon existing in space and time. An organisation is an example of a living system while a telecommunications system is not.

**Control and Regulation**

Control and regulation are central to systems theory. The role of regulation is to keep the range of variation under control in order to keep the system existent. Active regulation is related to ‘information’ and input is information. For survival, the system must be in constant contact with the environment; to have constant input and produce constant output; to be in constant evolution.

The control of a social system is done through bureaucratic processes. In a system, control is exercised by the part that has the largest variability. The variability has to be adequately distributed within the system. Variation is necessary for an open system to survive, to accept changes, to be flexible, tolerant; if not, involution instead of evolution becomes the result.

**Feed-back**

Systems theory is closely related to cybernetics with its breakthrough during the late 1940s with representatives such as Ashby and Wiener (Ashby 1956; Wiener 1950). One of the main contributions from cybernetics for the systems theory is the introduction of the concept of ‘feed-back’: the principle of self-regulation. The system interacts between negative feedback

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52 Studying social systems and particularly organisations has been done by for example Senge (1990) and Beer (1972).
with fixed goals and positive feedback, also called feed forward, when there are no goals to measure towards (Churchman 1968). Information allows correction and revision, i.e. positive feedback in order to let the system survive in a constantly changing world; to allow a certain amount of risk and uncertainty. From a systems theoretical view, positive feedback results in development, balance on another level, while negative feedback results in balance, to reach equilibrium, and is (more) conservative in its character. The optimal system includes an interchange between positive and negative feedback. But positive feedback can be met with resistance as it sets the system off balance.

**Adaptability**

According to Ackoff, adaptability is “…the ability of a system to modify itself or its environment when either has changed to the systems disadvantage…” (1971:668). Hence, one important feature of a system is adaptability. Adaptation is a special kind of open systems behaviour as a result of the “introduction of a unique input at some critical time…” (Skyttner 2002:100). All social systems adapt and change in relation to their environment and performance. This is true for humans as well as for groups and organisations. The adaptation can be divided into functional and structural, implying the necessity of a time perspective. Functional adaptation appears in the short run while structural adaptation appears in the long run (Yngström 1996).

**Change, Development and Equifinality**

The most complex systems, such as social systems, are ‘defined’ by Ackoff (1971) as ‘reflective, goal-changing’ as they reflect on decisions made and use collected and stored information in that process; the system has a choice of behaviour. Chaos theory states that disorder is a prerequisite for development; for an open system to survive. Constant change, development and renewal are ways to survive as a system. For this process to happen, it is important to be flexible, tolerant, open-minded, to accept a ‘well-dosed strangeness’. This is in line with the ‘modern’ systems theory stating that (Holling 1976):

- indications are something positive → drive changes
- time has legitimacy → you cannot recreate history
- accept the unpredictable and do not be too rigid concerning goals
- instability is something positive

But all hierarchical systems are by definition conservative and rigid and to make changes in an organisation, there is a need to start at the top but at the same time this is the most solid level of the organisation and consequently the most difficult to influence. The representatives for each system on each level have different views on and different levels of interest to keep the system unchanged. They are more or less rigid, which is related to their own amount of power and influence. From a systemic point of view, it is important that
there is a slower pace of change at higher levels of the hierarchy to create stability and permanency (Öquist 2003; 2008).

When making decisions on one level, it is also imperative to look at the whole group included in that level instead of focusing on an individual – to let the best for the whole system guide the decision. It is imperative that the members of a system trust the system, and engage with the benefit for the total system in mind. Trust is a central base for the survival of the system (Öquist 2003; 2008). Trust is also mentioned by several authors in relation to the adoption and use of a new technology (e.g. Molony 2006; Benbasat et al. 2010).

Input for change in a system is ‘information’. Concerning human activities, it is mostly ‘information’ that is the driving force for an activity, for a change. Even ‘silence’ includes a lot of information. When trying to introduce changes, it is imperative to keep in mind the goal of the system and to introduce changes in line with the ‘direction of travel’ and in line with the norms, rules, attitudes and values and to remember that all systems have their methods of punishment (Öquist 2003; 2008).

Changes and development in an organisation are best achieved and accomplished through ‘acceptance’. Change in an organisation is also possible to achieve through ‘treats’, to reduce the freedom of choice, but this is not as efficient, especially not in a long perspective (Öquist 2003; 2008). Instead, it is better to increase the options. In order to start a change process, it is effective to use ideas that emanate from within the system; it gives the initiator a feeling of acceptance. It is beneficial to be aware of different options and to be flexible.

According to systems theory, there is no linear cause-and-effect relation; instead a change can start anywhere and anything can be a ‘cause’. When a problem is identified in a system/organisation, it is most effective to focus on the level that is most important for a solution to the problem, with the aim not to change the whole system but instead to introduce more alternatives, more choices (Öquist 2003; 2008).

Systems theory can look deterministic but it is important to keep in mind that a social system is a biological system and there are always several different options available. The same final solution or state can be reached from different premises, and the same premises can result in different outcomes. This is defined as equifinality by Bertalanffy (1968). By that, the system can accomplish the same thing in different ways i.e. equifinality and under different conditions and with a ‘memory’ it can increase its efficiency over time (Ackoff 1971).
Appendix 4:1 Field Diary Phase I

Below follows a description of some details of the research process concerning the first phase of the study.

The source of inspiration for this study was a conference paper written by John Traxler (researcher from Wolverhampton) in 2006. It described a project in Kenya using mobile phones for administrative purposes of the education sector. I decided to look into this issue in Tanzania, as the topic for my doctoral thesis. Tanzania was my first choice as I had performed a study there in April 2006 (see Anderson et al. 2006; Wicander 2007 for details). The results and outcome from that study served as input to this one and also as input to the extended SIF, which is used as the analytical framework for this study.

The most important outcome of the study in Tanzania in April 2006 was an established network of contacts at different levels, including Nils Jensen, former ICT adviser at the Swedish embassy in Dar es Salaam. He acted as an informant and 'enabler'. An 'enabler' is a person who has knowledge and interest in your research field, who has a (wide) network in the (physical) area where you want to perform your study, and most importantly, who is willing to share both her/his knowledge and network with you. He introduced me to several persons important for the performance of this study.

Informant interviews were performed from October 2006 and onward until November 2007. In total, 15 informants were interviewed on a total of 19 occasions (some informants were interviewed on several occasions). Each interview lasted for 1-2 hours. Eight of the interviews were performed in Tanzania during October-November 2007, while the rest were performed in Sweden during 2006 and 2007. The outcome was documented in notes produced during the interviews.

During the field study, I participated in Open Access, a conference organised by KTH, and the Swedish Embassy embracing questions on ICT in Tanzania.

In October 2006, I met with Per-Einar Troften and Bengt Oberger, both at the ICT Secretariat at Sida, Stockholm, Sweden. They contributed with a description of the present ICT4D situation in general and the Swedish activities and position in this matter. A discussion was held in November 2006 with Anders Danielsson, former general director at SADEV, and Godwin Daniel Mjema, Economic Research Bureau, Dar es Salaam, Tanzania, about public financial management and its situation in Tanzania. I met them both at SADEV, the working place of Danielsson and where Mjema was a visiting researcher.

Nils Jensen, former ICT adviser at the Swedish Embassy in Dar es Salaam, was interviewed on three occasions; in April 2006 at the Swedish embassy in Dar es Salaam, in April and September 2007 in Stockholm. His contribution, in addition to being an ‘enabler’, was to inform about the prevailing ICT situation in Tanzania.

Paula Uimonen, PhD in Anthropology at Stockholm University was interviewed twice, in September and October 2007. She also contributed with information about the prevailing ICT situation in Tanzania. More precisely, her special position as a part-time employee at the
Ministry of Education and Vocational Training (MoEVT) in Dar es Salaam, introduced me to the key persons at MoEVT, including the EMIS team. She also informed me about the need of a research permit to perform research in Tanzania and introduced me to the person in charge of this process, which contributed a lot to the rapid handling of my issue, although not rapid enough.

Hans Persson, Senior Programme Officer, Education Division, Sida, was interviewed at his office in October 2007. Persson described the educational situation in Tanzania and provided me with several documents about and from the education sector in Tanzania.

Petra Smithmanis-Dry, former ICT Adviser at the Swedish Embassy in Dar es Salaam, was interviewed in October 2007 at the Swedish Embassy Dar es Salaam. She gave me an update of the ICT situation in Tanzania and connected me to relevant persons at TCRA (Tanzanian Communications Regulatory Authority), and COSTECH (Tanzania Commission for Science and Technology).

Ander Frankenberg, First secretary and Education Advisor at the Swedish Embassy in Dar es Salaam, was interviewed in November 2007 at the Swedish Embassy in Dar es Salaam. He contributed with a deepened understanding of the education situation in Tanzania and provided me with several documents.

From TCRA (Tanzanian Communications Regulatory Authority), I got information about the mobile telephony situation in Tanzania, including operators and statistics concerning mobile penetration.

At COSTECH, I was introduced to on-going ICT research in Tanzania.

From UNESCO I got information about the collection of statistical data in general in developing countries, and specifically in Tanzania.

Mr ET, representing the members of the EMIS Team, informed me about the collection of educational statistical data and the routine of processing the data.

Dag Nielsen, former director at Ericsson, was interviewed during the Open Access conference in Tanzania. He contributed with information about M4D activities with focus on Ericsson and its participation in the Millennium Villages and in different UN-activities.

Auvo Finne, former PhD candidate at University of Jyväskylä, Finland, was interviewed during his stay in Dar es Salaam in November 2007. He contributed with his experience from the development of EMIS.

There are several challenges performing research in a country and a context unfamiliar in many perspectives to your own.

Being the only one at your department and university doing this particular research makes it important to have ‘enablers’ from other areas and disciplines. This demands a network created by yourself, which takes a lot of time, effort and luck. For example, at my university, no one was aware of the need for a research permit to be formally accepted to perform research in Tanzania. Paula Uimonen informed me about this one month before I planned my field study in Tanzania. She told me that it takes at least two months to get a permit. I started the process by sending in my application via e-mail and was asked by the authority in
charge in Tanzania to send in 50USD for them to go ahead with my application. I sent the requested amount of money in traveller cheques via registered letter to the stated post address in Dar es Salaam. When I left Sweden, I still had not received my permission. Settled in Dar es Salaam, I took a taxi to COSTECH, which is the authority in charge of the research permits, and met the administrative official who told me that my payment had not reached COSTECH and my permit was accordingly not processed. So I paid again, this time in cash, got a receipt, and was promised priority due to time loss. Finally, the last week of my stay, I got a preliminary clearance. Not until I got back to Sweden did I receive the final one. The money sent by traveller cheques never showed up, although the Swedish postal service performed an investigation and could prove to me that the letter had been delivered to the stated address. One drawback with not having the research permit was that the staff at the MoEVT ‘refused’ to answer my questions referring to the need of the permit. In the final permit, there was included the name of a contact person for my research in Tanzania. When I asked via e-mail about how to get in contact with this person and what his/hers mission was I didn’t receive any answer and still have not.

There are also several other challenges e.g. how to find a decent place to stay while you perform your field study, language problems as your first language is not English and the people you are supposed to meet do not have English as their first language either, together with a high level of illiteracy and a low level of English speakers.

Another consideration is the situation of safety concerning everything from malaria and HIV/AIDS to traffic accidents and robbery. Actually, the traffic is the most dangerous thing when doing research in developing countries. You need several vaccinations, an extra travel insurance, malaria prophylaxis, mosquito net, portable burglar/robbery alarm.

The fact that there is no public transportation in a large city like Dar es Salaam makes you dependent on taxi wherever you go.

A lot of people, even officials, do not answer their e-mails, which makes it difficult to get information beforehand. This makes it impossible to plan your research in detail while at home; you have to be flexible and have several alternative plans in mind.

As the Tanzanian society is a rather hierarchical system, you always need to talk to the highest person in charge to be able to get permissions and information, and it is very difficult to make appointments via phone; you have to go in person and meet the person in charge face to face.

In spite of all these challenges, it is a fantastic experience and a great opportunity to meet another culture and to be able to perform research in another country.

Finally, the importance of an ‘enabler’ cannot be underestimated. Without ‘enablers’, people as Nils and Paula mentioned above, it would be very difficult, if not impossible to perform research in certain areas. You need to be informed about certain rules, you need to be introduced to the ‘right’ people, and especially in countries with a more hierarchical system you need to be aware of certain cultural habits; well the list can be long as indicated by the challenges mentioned above.
Appendix 4:2 Field Diary Phase II

Below follows a description of some details of the research process concerning the second phase of the study.

It took some while before the second field study could start due to:

- no prior research collaboration between my university and universities in Tanzania
- problems to get official information via e-mail (e-mails were not answered by officials at different institutions)

One of the challenges when performing research in a ‘new’ context is establishing contacts with other researchers and institutions. This was one of the challenges I met during this research process. By happy accident, when Karlstad University and the department of Information Systems organised an international conference in M4D, we got participants from Tanzania and Tumaini University in the Iringa region. Those contacts finally led to the possibility of performing the second field study in the Iringa region. Once again, the importance of ‘enablers’ cannot be underestimated. During the second phase and field study II, this enabler came to be Matti Tedre, associate professor at Tumaini University. He arranged housing, taxi in Dar es Salaam, transport in Iringa, introduction to all the key persons at the university. His contributions and efforts were invaluable to this study.

Travelling from Karlstad to Dar es Salaam is a journey of approximately 20 hours on train and plain via Stockholm and London. In Dar es Salaam, it is important to be met by an honest person who can help you with transport into the city centre as there is no public transportation and most taxi drivers do not speak English. You need to get cash as it is not possible to buy Tshs, the local currency, abroad. You also need to buy a local SIM card for your mobile as roaming is very expensive.

I was met by Frank, arranged by Matti, who drove me to the bus station, with the ‘fitting’ name ‘Scandinavia Coach Line’. As there is no regular air line with Iringa, only private companies, the only available transportation is bus, and the best is ‘Scandinavia’. But the standard is different from the Scandinavian one; no air-conditioning, over-crowded, windy by the windows, extremely hot, very dusty as the roads are not paved and bumpy.

After 10 hours on the bus, including a stop caused by road construction, I finally arrived in Iringa where Matti met me with his 4WD, the only vehicle that is good enough during the rainy season when roads are muddy and full of pot holes of one meter in depth. He drove me to the hostel owned by the Diocese of Iringa (DIRA). The hostel was cheap, clean and safe but with no hot water, floors of cement and several house pets like lizards, ants and mosquitos. At least under a mosquito net one can feel safe!

One experience worth mentioning is being woken up at five o’clock in the morning by the muezzins, whose calls were interrupted and conquered by the howling from the dogs and the crowing from the cocks in the area.
The first day Matti picked me up and we drove to Tumaini University, where he introduced me to all the ‘important’ people at the university, including Dean Lucas Mwahombela. Dean Lucas Mwahombela becomes another ‘enabler’ during this field study, as he introduced me by phone call to the Regional Education Officer (REO) and District Education Officer (DEO) as well as writing introduction letters to those persons.

I met with a class of computer students, former teachers, and together we looked through my questionnaire to verify the questions’ relevance, wording, and language. They constituted a suitable test group, as they knew the context and had a background as teachers. Further test persons were Matti and Niels Peter, a doctoral candidate from London performing his field study in the Iringa region.

Challenges during a visit in Iringa are, among others, the Internet connection, which is slow and non-existent some days; one day I had 125 e-mails waiting in my inbox. Electricity is an issue to consider; you never know when the power net stops functioning; it can happen anytime, anywhere and for any length of time. The lack of the Internet and electricity makes it difficult to be effective and to perform what you have planned for the day.

A further challenge is security, as there are no streetlamps and you are not supposed to walk alone after 7 pm. There is no public transportation, so taxi is the only option and you need to find a driver who speaks English. Mostly, you need to establish contacts with two or more taxi drivers as one can be occupied when you need a taxi and it is not a good idea just to pick one on the street. You also have to negotiate the price as there is no fixed price list and the cars have no meter. Another experience is the food; you have to very patient and learn to enjoy fried bananas and chapatti i.e. cold pancakes and Coca Cola.

The Process to get Access to the Respondents

As mentioned above, Tanzanian society is quite hierarchical and it is important to meet people in the correct order; you have to start with the highest rank in order to get access to her/his subordinates. Also, you have to meet everyone in person, face-to-face. There is a need for formal documents such as invitation letters and introduction letters which must be signed and stamped correctly and preferably written on official paper with name of the organisation at the top of the document.

The process to get access to the head teachers at the selected primary schools is described below.

To start with, you need an ‘enabler’ who will be able to start the process; in my case this was Matti Tedre. He introduced me on Day 3 to Dean Lucas Mwahombela at Tumaini University. During this first meeting, I presented myself and my research and we decided to visit the REO two days later i.e. Day 5. Next day, Day 4, back at Dean Lucas office to set a time for the visit at REO, he was not able to make it any longer and we decided that I should go there by myself. I ask Matti about an introduction letter from Tumaini University, and when this is written I went back to Lucas for a signature but he was on his way from the
office as one of the staff died the day before and the whole staff is expected to participate (except msungus – white people) in the funeral, which is performed in the home village of the deceased person.

With the introduction letter in my hand, I called my driver Julius and we visited the REO, Mr Enzefio Mtavangu, a very nice gentleman. I presented myself and my research and I got three permits to each DEO stating that I am allowed to perform my research in the three selected districts. We then drove to the DEO at the Iringa Municipal (Urban) District and the Iringa Rural District, gave the same presentation and provided the documents and asked for a list of the primary schools in the districts, but this was not possible to get the same day, instead I had to come back on Monday or Tuesday the coming week.

On Monday morning (Day 8) I was back at the DEO at the Iringa Municipal (Urban) District and I got a list of the schools together with a map. In the afternoon, I had a meeting with Lucas and we discussed how to select the primary schools. On Tuesday morning (Day 9), I was back at the DEO at the Iringa Rural District and I got a map with all the primary schools marked and I received introduction letters to the head teachers in this district and they promised to contact the respective head teachers.

The third district, the Kilolo District, is located so far from Iringa town that it is not possible to go there in advance to get introduction letters to the head teachers. Instead, this has to be done in relation to the school visits. And I was lucky when I visited the DEO early on Thursday (Day 11), as the DEO is "on location". I presented myself and my research and she wrote an introduction letter to the head teachers by hand, as there was no electricity that morning. So finally after 11 days, I have all the documents I need to be able to start my study.

Conducting the interviews
A total of 18 days were spent on this field study, including days for transport to and from Iringa. Of these days, six days were used for interviews with the selected head teachers. The rest of the time was used for preparations and for efficiency; even weekends were used as working days except one Saturday.

As there is no available public transport to the selected schools, taxi was used as my only transportation. Two drivers were selected for transport, guidance, and translation. The drivers were chosen due to their knowledge of the selected districts, their English and their reputation as safe drivers and the availability of a safe car. The drivers, Julius and Nicolas, were suggested by the staff at Tumaini University.

An ordinary day for interviews started around 06.30-07.00 in the morning and ended around 17.00-18.00 with one extreme day ending at 20.00 in the evening. Four interviews were performed most days. On average, each visit to the primary schools lasted for 2-3 hours with approximately two hours spent with the questionnaire and the rest of the time being introduced to the school, the staff and the pupils. The distances covered ranged from 48 km up to 140 km. Most parts of the roads are gravel with plenty of pot holes, which made the
ride very bumpy. The speed in general was 20-40 km per hour. The trips were also delayed by road construction work several times. In the morning, the temperature is low but it gets hot during mid day. As there were no restaurants along our way, we started each day with a stop at the market to buy bananas, biscuits and Cola Cola, which we ate and drank during the ride; I ‘fed’ Julius or Nicolas when they were driving.
Appendix 4:3 The Questionnaire

Appendix 4:3 includes:

- The introduction to the respondents at the selected primary schools
- Questionnaire A2 - Background data Regional Level
- Questionnaire A3 - Background data District Level
- Questionnaire A4 and A5 - Background data Head teacher and Primary school Level
- Questionnaire B - Mobile telephony
- Questionnaire C1 - Collection of statistical data via Mail
- Questionnaire C2 - Collection of statistical data via SMS
A Study on Mobile Phone Use and Statistical Data Collection

Tumaini University in collaboration with Karlstad University in Sweden is performing a study about mobile phone use and statistical data collection in primary schools. The research project includes interviews with head teachers in primary schools in the Iringa region.

You as a head teacher have been selected to participate in this study. Your participation in this study is of high importance so we ask You cordially to answer the questionnaire and by that contribute to high quality research. Your answers will be treated anonymous.

Gudrun Wicander, researcher from Karlstad University, is responsible for this study and she will visit your school in person and answer questions you have concerning this study.

Mr Lucas Mwahombela, Dean at Tumaini University, has coordinated the visits to the different selected primary schools.

Thank you for your time! We greatly appreciate your participation in this study!

Yours truly,

Gudrun Wicander, Eco.lic.          John-Sören Pettersson, PhD          Matti Tedre, PhD
Researcher                        Professor                           Associate professor
Karlstad University               Karlstad University                Tumaini University
Questionnaire A2 Background data Iringa Region

1. Demographic of the Iringa region
Number of districts: ___________
Identification number of the region: ________________
Population density: ______________________
Tribes: _______________________________________
Average income: _____________________________
Average age: ________________________________
Are there identification number of the districts: __________
Are there identification number of the wards: __________
Are there identification number of the primary schools: ______

2. Physical infrastructure in Iringa region
(How is the physical infrastructure characterised in Iringa region)
Roads: ______________________________________
Electricity: _________________________________
Postal service: _______________________________
Bank service: ________________________________
Public transportation: _________________________
Landline phone networks: _____________________

3. Education statistics in Iringa region (pupils, teachers and schools)
Schools:
Number of primary schools: _________________
Number/percentage of primary schools with electricity: _______
Number/percentage of primary schools without electricity: ______
Number/percentage of primary schools with landline phones: _______
Number/percentage of primary schools with mobile phones: _______
Number/percentage of primary schools with access to computers: ______
Number/percentage of primary schools with computers connected to Internet: __________

Adm. Staff:
Number of DEO: _______________
Number of WEC: _______________
Pupils:
Number of pupils in primary schools: ______________
Enrolment percentage in primary schools: ___________
Drop-out percentage in primary schools: ___________
Percentage of pupils moving to sec. level: ___________

Teachers:
Number of teachers: _______________
Number of formally qualified teachers: ___________
Number of female teachers: ___________
Number of male teachers: ___________
Number of head teachers: ___________

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Number of female head teachers: __________
Number of male head teachers: __________

Thank you for your interest in this study! We greatly appreciate your participation!

Gudrun Wicander, Eco.lic.      John-Sören Pettersson, PhD      Matti Tedre, PhD
Researcher                  Professor                      Associate professor
Karlstad University        Karlstad University              Tumaini University
Questionnaire A3 Background data District Level

1. Demographic data of ……………………………… district
   Population density: ________________________________
   Tribes: _________________________________________
   Average income: _________________________________
   Average age: _________________________________
   Identification number of the district: ______________
   Are there identification number of the wards:
   Are there identification number of the primary schools:

2. Physical infrastructure in ……………………………… district
   (How is the physical infrastructure characterised in your district)
   Roads: __________________________________________
   Electricity: _________________________________
   Postal service: _________________________________
   Bank service: _________________________________
   Public transportation: _________________________________
   Landline phone networks: _________________________________

3. Education statistics in …………………………………… district
   (pupils, teachers and schools)
   Schools:
   Number of primary schools:
   Number/percentage of primary schools with electricity: ___________
   Number/percentage of primary schools without electricity: ___________
   Number/percentage of primary schools with landline phones: ___________
   Number/percentage of primary schools with mobile phones: ___________
   Number/percentage of primary schools with access to computers: ___________
   Number/percentage of primary schools with computers connected to Internet: ___________
   Adm. Staff:
   Number of DEO: ___________
   Number of WEC: ___________

   Pupils:
   Number of pupils in primary schools: ___________
   Enrolment percentage in primary schools: ___________
   Drop-out percentage in primary schools: ___________
   Percentage of pupils moving to sec. level: ___________

   Teachers:
   Number of teachers: ___________
   Number of formally qualified teachers: ___________
   Number of female teachers: ___________
   Number of male teachers: ___________

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Number of head teachers: _______________
Number of female head teachers: __________
Number of male head teachers: ___________

Thank you for your interest in this study! We greatly appreciate your participation!

Gudrun Wicander, Eco.lic.      John-Sören Pettersson, PhD      Matti Tedre, PhD
Researcher                  Professor                     Associate professor
Karlstad University        Karlstad University          Tumaini University
**Questionnaire A4 and A5 Background data Head teacher and Primary school Level**

### Personal data

| A 1 | Name: ___________________________ |
| A 2 | Gender: □ Male □ Female |
| A 3 | Marital status: □ Married (How many wives: ____ ) □ Single □ Divorced □ Widowed |
| A 4 | Tribe: ___________________________ |
| A 5 | Highest Education-level: ___________________________ |
| A 6 | Income per month – the range or scale: ___________________________ |
| A 7 | What language(s) do you speak? ___________________________ |
| A 8 | For how long time has you been a HT? ________ years |

### Primary school data

| A 9 | Name of primary school: ___________________________ |
| A 10 | Name of village: ___________________________ |
| A 11 | Identification number of the primary school: ___________________________ |
| A 12 | Identification number of the ward: ___________________________ |
| A 13 | Identification number of the district: ___________________________ |
| A 14 | Enrolment rates (in %): ________ % |
| A 15 | Drop-out rates (in %): ________ % |
| A 16 | Movers to sec.level (in %): ________ % |
| A 17 | Number of pupils: ___________________________ |
| A 18 | Number of teachers: ___________________________ |
| A 19 | Number of male teachers: ___________________________ |
| A 20 | Number of female teachers: ___________________________ |
| A 21 | Number of formally qualified teachers: ___________________________ |
| A 22 | |

| A 23 | How are grants paid? ___________________________ |
| A 24 | When are grants paid? ___________________________ |
| A 25 | Do you get any information beforehand? ___________________________ |
| A 26 | How do you get information? ___________________________ |

| A 27 | How long time does it take to send a letter to Dar? ___________________________ |
| A 28 | Is the post service reliable? □ YES □ NO |

| A 29 | Estimated distance to the nearest post office: |
| INS |
| 2.2.2 | In kilometer: ___________________________ |
| In time during dry season: ___________________________ |
| In time during rain season: ___________________________ |
| How to go there? ___________________________ |
| How much does it cost? Tsh: ___________________________ |
| A 30 INS 2.2.2 | Estimated distance to the nearest bank:
In kilometer: ___________
In time during dry season: ___________
In time during rain season: ___________
How to go there? ________________________
How much does it cost? _____________ Tsh |
| A 31 INS 2.2.2 | Estimated distance to the nearest WEC (Ward Education Coordinator):
In kilometer: ___________
In time during dry season: ___________
In time during rain season: ___________
How to go there? ________________________
How much does it cost? _____________ Tsh |
| A 32 INS 2.2.2 | Estimated distance to the nearest DEO (District Education Officer):
In kilometer: ___________
In time during dry season: ___________
In time during rain season: ___________
How to go there? ________________________
How much does it cost? _____________ Tsh |
| A 33 PHY 1.1.1 | Is your school connected to the TANESCO power grid? □YES □NO
If NO – how far away from the TANESCO power grid is your school: ___________ km |
| A 34 PHY 1.1.2 | If YES:
How many hours per day do you have electricity? (Please tick as most appropriate)
□ 1-2 hours/day □ 3-4 hours/day □ 5-6 hours/day □ 7-8 hours/day |
| A 35 PHY 1.1.3 | If YES:
How do you find the electricity service? (Please tick several boxes if appropriate)
□ Reliable □ Sufficient □ Stable □ Regular □ Reliable □ Interrupted □ Irregular
□ Low voltage □ Varying voltage □ Others: __________________________ |
| A 36 PHY 1.1.3 | Do you have any other power supply? □YES □NO
If YES: Please, specify: __________________________ |

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| A 39 | How much money does the school spend on power per year? ________________ Tsh |
| A 40 PHY 1.2.1 | Is there a fixed telephone at your school? ☐ YES ☐ NO |
| A 41 PHY 1.2.2 | Are there any computers at your school? ☐ YES ☐ NO |
| A 42 PHY 1.2.3 | Do you have Internet connection at your school? ☐ YES ☐ NO |
| A 43 PHY 1.2.4 | Does the school own a mobile phone? ☐ YES ☐ NO |
| A 44 PHY | To what extent do you consider that mobile phones are a potential to the communication infrastructure (as a complement to fixed telephony and postal service)? ☐ Very high ☐ High ☐ Relatively high ☐ Relatively Low ☐ Low ☐ Not at all |
| A 45 POL 1.9 | Do you know if there is an ICT policy for the education sector? ☐ YES ☐ NO |
| A 46 | Would you like to add anything? |

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

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**Questionnaire B Mobile telephony**

### Access and Usage

<table>
<thead>
<tr>
<th>Q.</th>
<th>Description</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 1</td>
<td>Do you use a mobile phone?</td>
<td>□ YES □ NO</td>
</tr>
<tr>
<td>B 2</td>
<td>If NO – Why not? (Please tick several boxes if appropriate)</td>
<td>□ Don’t know how to use it □ Complicated to use □ Expensive □ No access □ No coverage □ Bad coverage □ No use of a mobile phone □ I do not trust the technology □ Health issues (e.g. radiation, noise) □ Bad sound (difficult to hear) □ Others: ______________________</td>
</tr>
<tr>
<td>B 3</td>
<td>When did you use a mobile phone for the first time?</td>
<td></td>
</tr>
<tr>
<td>B 4</td>
<td>How well can you manage to use a mobile phone? (Please tick as most appropriate)</td>
<td>Very well □ Well □ Relatively Well □ Relatively poor □ Poor □ Not at all □</td>
</tr>
<tr>
<td>B 5</td>
<td>How do you have access to a mobile phone? (Please tick several boxes if appropriate)</td>
<td>□ Own □ Share □ Borrow □ Rent □ Others: ______________________</td>
</tr>
<tr>
<td>B 6</td>
<td>Do you have more than one SIM card?</td>
<td>□ YES □ NO</td>
</tr>
<tr>
<td>B 7</td>
<td>If YES – Why do you have more than one?</td>
<td></td>
</tr>
<tr>
<td>B 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B 9</td>
<td>What function(s) do you use? (Please tick several boxes if appropriate)</td>
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<td>-----</td>
<td>---------------------------------------------------------------------</td>
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<tr>
<td></td>
<td>Clock</td>
<td></td>
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<tr>
<td></td>
<td>Radio</td>
<td></td>
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<tr>
<td></td>
<td>Alarm clock</td>
<td></td>
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<tr>
<td></td>
<td>Timer</td>
<td></td>
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<tr>
<td></td>
<td>Calculator</td>
<td></td>
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<tr>
<td></td>
<td>Games</td>
<td></td>
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<td></td>
<td>Caller number display</td>
<td></td>
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<td></td>
<td>Calendar</td>
<td></td>
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<tr>
<td></td>
<td>Camera</td>
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<tr>
<td></td>
<td>Recording</td>
<td></td>
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<tr>
<td></td>
<td>Flashlight</td>
<td></td>
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<tr>
<td></td>
<td>Others: ___________________</td>
<td></td>
</tr>
<tr>
<td>B 10</td>
<td>What services do you use? (Please tick several boxes if appropriate)</td>
<td></td>
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<tr>
<td></td>
<td>Call</td>
<td></td>
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<td></td>
<td>Voice mail</td>
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<td>Call forwarding</td>
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<td>Call waiting</td>
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<td></td>
<td>Conference calls</td>
<td></td>
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<tr>
<td></td>
<td>SMS (text message)</td>
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<td></td>
<td>MMS (picture message)</td>
<td></td>
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<tr>
<td></td>
<td>Beeping</td>
<td></td>
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<td></td>
<td>Internet browsing</td>
<td></td>
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<td></td>
<td>MP3</td>
<td></td>
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<tr>
<td></td>
<td>Video</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others: ___________________</td>
<td></td>
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<tr>
<td>B 11</td>
<td>What benefits do you find using a mobile phone? (Please tick several boxes if appropriate)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cheap</td>
<td></td>
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<tr>
<td></td>
<td>Easy to access</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fast</td>
<td></td>
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<tr>
<td></td>
<td>Secure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reliable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Easy to use</td>
<td></td>
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<tr>
<td></td>
<td>Has a variety of services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Useful</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flexible</td>
<td></td>
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<tr>
<td></td>
<td>Others: ___________________</td>
<td></td>
</tr>
</tbody>
</table>
**B 12** What disadvantages do you find?  
(Please tick several boxes if appropriate)  
- [ ] Bad sound (difficult to hear)  
- [ ] Health issues (radiation, noise)  
- [ ] Complicated to use  
- [ ] Expensive  
- [ ] Bad coverage  
- [ ] Others: ___________________

**Economy**

**B 13** FIN 2.3  
How much money do you spend per month on the mobile phone?  
- Airtime: _______ Tsh  
- Charging: _______ Tsh  
- Repair: _______ Tsh  
- Others: _______ Tsh

**B 14** FIN 2.1  
What price system do you use?  
- [ ] Fixed Subscription  
- [ ] Pre-paid card  
- [ ] Others: ___________________

**B 15** FIN 2.3  
Do you think that the benefits of the mobile phone justify the cost?  
(Please tick as most appropriate)  
- Yes, absolutely  
- To a high degree  
- To a moderate degree  
- Not really  
- Barely  
- Not at all

**Ownership** - If you own a mobile phone, please answer the questions below (B16 – B24)  
if you own more than one, please refer to the one you use most of the time

**B 16** FIN 2.1  
For how long time have you owned a mobile phone?  
- _______ month(s)  
- _______ year(s)

**B 17** FIN 2.1  
For what purpose do you own a mobile?

**B 18** FIN 2.3 / PHY 2.1  
Where did you buy your mobile phone?  
- Regular store  
- Street vendor  
- Others: ________________

**B 19** FIN 2.3  
Was it new or second-hand?  
- New  
- Second hand
<table>
<thead>
<tr>
<th>B 20</th>
<th>FIN 2.3</th>
<th>Which model?</th>
<th>Was it a pirate copy?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>□ YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>□ NO</td>
</tr>
<tr>
<td>B 21</td>
<td>FIN 2.3</td>
<td>Do you own more than one mobile?</td>
<td>□ YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How many?</td>
<td>□ NO</td>
</tr>
<tr>
<td>B 22</td>
<td>B 23</td>
<td>Why do you own more than one?</td>
<td>___________</td>
</tr>
<tr>
<td>B 24</td>
<td>FIN 2.3</td>
<td>How much did your mobile phone cost?</td>
<td>__________ Tsh</td>
</tr>
</tbody>
</table>

**Calling - If you use a mobile phone please answer the questions below**

| B 25 | HUM 3 / FIN 2.3 | How often do you make calls? | Monthly, approximately .......... per month |
|      |                  |                            | Weekly, approximately .......... per week |
|      |                  |                            | Daily, approximately .......... per day |
| B 26 | HUM 3 / FIN 2.3 | How often do you receive calls? | Monthly, approximately .......... per month |
|      |                  |                            | Weekly, approximately .......... per week |
|      |                  |                            | Daily, approximately .......... per day |
| B 27 | HUM 3 / FIN 2.3 | How often do you beep (call someone but hang up before he/she answers)? | Monthly, approximately .......... per month |
|      |                  |                            | Weekly, approximately .......... per week |
|      |                  |                            | Daily, approximately .......... per day |
| B 28 | HUM 3 / FIN 2.3 | How often do other people beep you (call you but hang up before you answer)? | Monthly, approximately .......... per month |
|      |                  |                            | Weekly, approximately .......... per week |
|      |                  |                            | Daily, approximately .......... per day |
| B 29 | Why do you make calls? | (Please tick several boxes if appropriate) |
|      |                    | □ Relationship             |
|      |                    | □ Emergences               |
|      |                    | □ Job search               |
|      |                    | □ Official calls            |
|      |                    | □ Private businesses       |
|      |                    | □ Substitute for transport  |
|      |                    | □ Others: _________________ |
| B 30 HUM 3 | To whom do you call? (Please tick several boxes if appropriate) | ☐ Family  
☐ Friends  
☐ Medical service  
☐ Private Business partners  
☐ Colleagues at my school  
☐ Colleagues at other schools  
☐ WEC  
☐ DEO  
☐ Parents  
☐ School board  
☐ Others: ___________________ |
| B 31 HUM 3 | From whom do you receive calls? (Please tick several boxes if appropriate) | ☐ Family  
☐ Friends  
☐ Medical service  
☐ Private Business partners  
☐ Colleagues at my school  
☐ Colleagues at other schools  
☐ WEC  
☐ DEO  
☐ Parents  
☐ School board  
☐ Others: ___________________ |
| B 32 | To whom do you beep (call someone but hang up before he/she answers)? (Please tick several boxes if appropriate) | ☐ Family  
☐ Friends  
☐ Medical service  
☐ Private Business partners  
☐ Colleagues at my school  
☐ Colleagues at other schools  
☐ WEC  
☐ DEO  
☐ Parents  
☐ School board  
☐ Others: ___________________ |
B 33 | From whom do you receive beeps (call you but hang up before you answers)?
(Please tick several boxes if appropriate)
- Family
- Friends
- Medical service
- Private Business partners
- Colleagues at my school
- Colleagues at other schools
- WEC
- DEO
- Parents
- School board
- Others: ___________________

B 34 | *Why* do you beep (call someone but hang up before he/she answers)?
_______________________________________

**SMS (text messages)**

B 35 HUM 3 | Do you use SMS (text messages)?
- YES
- NO

B36 HUM 3 | If NO – Why not?
(Please tick several boxes if appropriate)
- Complicated
- Expensive
- No access to mobile
- No coverage
- No need
- No advantages
- Don’t trust the technology
- Others: __________________________

If YES i.e. If you *use* SMS please answer the questions below (B37 – B43)

B 37 | Why do you use SMS?
(Please tick several boxes if appropriate)
- Cheap
- Easy to use
- Fast
- Secure
- Reliable
- Private
- Convenient
- Others: __________________________

B 38 HUM 1.1 IMM 2.1 | To what extent can you manage to use SMS i.e. to send and receive SMS?
(Please tick as most appropriate)
- Very well ☐
- Well ☐
- Relatively Well ☐
- Relatively poor ☐
- Poor ☐
- Not at all ☐
<table>
<thead>
<tr>
<th>B 39</th>
<th>What is your opinion about SMS? (Please tick several boxes if appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>□ Difficult to read on the screen</td>
</tr>
<tr>
<td></td>
<td>□ Difficult to make corrections</td>
</tr>
<tr>
<td></td>
<td>□ Difficult to scroll</td>
</tr>
<tr>
<td></td>
<td>□ Difficult to make choices</td>
</tr>
<tr>
<td></td>
<td>□ Too small keys</td>
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<tr>
<td></td>
<td>□ Language problems</td>
</tr>
<tr>
<td></td>
<td>□ Expensive</td>
</tr>
<tr>
<td></td>
<td>□ Is delivered to the wrong person</td>
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<td></td>
<td>□ Delayed</td>
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<tr>
<td></td>
<td>□ Is never delivered</td>
</tr>
<tr>
<td></td>
<td>□ 160 characters is too short</td>
</tr>
<tr>
<td></td>
<td>□ Impossible to send</td>
</tr>
<tr>
<td></td>
<td>□ Don’t get a receipt e.g. Message delivered</td>
</tr>
<tr>
<td></td>
<td>□ Others: ____________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B 40</th>
<th>How often do you send SMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monthly, approximately ………per month</td>
</tr>
<tr>
<td></td>
<td>Weekly, approximately ………..per week</td>
</tr>
<tr>
<td></td>
<td>Daily, approximately …………..per day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B 41</th>
<th>To whom do you send SMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>□ Family</td>
</tr>
<tr>
<td></td>
<td>□ Friends</td>
</tr>
<tr>
<td></td>
<td>□ Medical service</td>
</tr>
<tr>
<td></td>
<td>□ Private business partners</td>
</tr>
<tr>
<td></td>
<td>□ Colleagues at my school</td>
</tr>
<tr>
<td></td>
<td>□ Colleagues at other schools</td>
</tr>
<tr>
<td></td>
<td>□ WEC</td>
</tr>
<tr>
<td></td>
<td>□ DEO</td>
</tr>
<tr>
<td></td>
<td>□ Parents</td>
</tr>
<tr>
<td></td>
<td>□ School board</td>
</tr>
<tr>
<td></td>
<td>□ Service numbers (sport results, religious services, etc.)</td>
</tr>
<tr>
<td></td>
<td>□ Others: ____________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B 42</th>
<th>How often do you receive SMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monthly, approximately ………per month</td>
</tr>
<tr>
<td></td>
<td>Weekly, approximately ………..per week</td>
</tr>
<tr>
<td></td>
<td>Daily, approximately …………..per day</td>
</tr>
</tbody>
</table>
**B 43**
**HUM 3**
From whom do you receive SMS? (Please tick several boxes if appropriate)

- Family
- Friends
- Medical service
- Private business partners
- Colleagues at my school
- Colleagues at other schools
- WEC
- DEO
- Parents
- School board
- Service numbers (sport results, religious services, etc.)
- Others: _________________________

---

**Access of mobile phones at school**

**B 44**
**PHY 1.2**
Does the staff have access to mobile phones at your school?  
- YES  
- NO

**B 45**
If YES – How many mobile phones are there?  _______________

**B 46**
**HUM 3 / PHY 1.2**
Is there an official list from the district of phone numbers of other schools?  
- YES  
- NO

---

**Usage of mobile phone at school**

**B 47**
**HUM 3**
For what purposes do you make calls related to your work?  

**B 48**
**HUM 3**
For what purposes do you receive calls related to your work?  

**B 49**
**HUM 3**
For what purposes do you send SMS related to your work?  

**B 50**
**HUM 3**
For what purposes do you receive SMS related to your work?
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B 51 HUM 3</strong> For what purposes do you <strong>beep</strong> (call someone but hang up before he/she answers) related to your work?</td>
<td><strong>For what purposes do you beep (call someone but hang up before he/she answers) related to your work?</strong></td>
</tr>
<tr>
<td><strong>B 52 HUM 3</strong> For what purposes you <strong>receive beeps</strong> (call you but hang up before you answer) related to your work?</td>
<td><strong>For what purposes you receive beeps (call you but hang up before you answer) related to your work?</strong></td>
</tr>
<tr>
<td><strong>B 53 FIN</strong> Who pays for your work-related use of a mobile phone (calls/ SMS/beeps)?</td>
<td><strong>Who pays for your work-related use of a mobile phone (calls/ SMS/beeps)?</strong></td>
</tr>
<tr>
<td><strong>Charging</strong></td>
<td><strong>Charging</strong></td>
</tr>
<tr>
<td><strong>B 54 PHY 1.1</strong> How do you charge the battery for the mobile phone?</td>
<td><strong>How do you charge the battery for the mobile phone?</strong></td>
</tr>
<tr>
<td><strong>B 55 FIN</strong> How much do you pay for charging the mobile phone?</td>
<td><strong>How much do you pay for charging the mobile phone?</strong></td>
</tr>
<tr>
<td><strong>B 56 PHY 1.1</strong> How far is the charging location?</td>
<td><strong>How far is the charging location?</strong></td>
</tr>
<tr>
<td><strong>B 57</strong></td>
<td><strong>In kilometer:</strong></td>
</tr>
<tr>
<td><strong>B 58</strong></td>
<td><strong>In time during dry season:</strong></td>
</tr>
<tr>
<td><strong>B 59</strong></td>
<td><strong>In time during rain season:</strong></td>
</tr>
<tr>
<td><strong>B 60 PHY 2.1</strong> What different alternatives do you have for charging the mobile phone?</td>
<td><strong>What different alternatives do you have for charging the mobile phone?</strong></td>
</tr>
<tr>
<td><strong>B 61 PHY 1.1</strong> How often do you charge the mobile phone?</td>
<td><strong>How often do you charge the mobile phone?</strong></td>
</tr>
<tr>
<td><strong>B 62 PHY 1.1</strong> How long does it take to fully charge the mobile phone?</td>
<td><strong>How long does it take to fully charge the mobile phone?</strong></td>
</tr>
<tr>
<td><strong>B 63</strong></td>
<td><strong>How do you spend the time waiting?</strong></td>
</tr>
<tr>
<td><strong>B 64</strong></td>
<td><strong>If there is electric power at your school – do you charge your mobile phone there?</strong></td>
</tr>
<tr>
<td><strong>B 65 PHY 1.2</strong> Is there network coverage at your school?</td>
<td><strong>Is there network coverage at your school?</strong></td>
</tr>
<tr>
<td><strong>B 66</strong></td>
<td><strong>If YES – How is the quality? (Please tick as most appropriate)</strong></td>
</tr>
<tr>
<td><strong>B 67</strong></td>
<td><strong>What is the reason for poor coverage/network problems at your school?</strong></td>
</tr>
<tr>
<td>Section</td>
<td>Question</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>B 68</td>
<td>Does the rain season affect the network coverage?</td>
</tr>
<tr>
<td>B 69</td>
<td>If YES – In what way? How do you handle it?</td>
</tr>
<tr>
<td>B 70</td>
<td>If NO – How far away from your school do you have network coverage</td>
</tr>
<tr>
<td>B 74</td>
<td>Is there network coverage at your home?</td>
</tr>
<tr>
<td>B 75</td>
<td>If YES – When you are home, do you use your private mobile phone for work related calls/SMS/beeps?</td>
</tr>
<tr>
<td>B 76</td>
<td>In what way does the climate affect your mobile?</td>
</tr>
<tr>
<td>B 77</td>
<td>Dust:</td>
</tr>
<tr>
<td>B 78</td>
<td>Moisture:</td>
</tr>
<tr>
<td>B 79</td>
<td>Heat:</td>
</tr>
<tr>
<td>B 80</td>
<td>Rain:</td>
</tr>
<tr>
<td>B 81</td>
<td>Cold:</td>
</tr>
<tr>
<td>B 82</td>
<td>Sunshine:</td>
</tr>
<tr>
<td>B 83</td>
<td>How easily can you find spare parts/accessories for your mobile?</td>
</tr>
<tr>
<td>B 84</td>
<td>How easily can you find repair service for your phone?</td>
</tr>
<tr>
<td>B 85</td>
<td>How do you find the quality of the repair services?</td>
</tr>
<tr>
<td>B 86</td>
<td>Which operator(s) do you use?</td>
</tr>
<tr>
<td>B 87</td>
<td>Why did you choose this/these operator(s)?</td>
</tr>
<tr>
<td>B 88</td>
<td></td>
</tr>
<tr>
<td>B 89 HUM 4.1</td>
<td>What is your experience concerning support from your operator(s)?</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Very good □ Good □ Relatively good □ Relatively Bad □ Bad □ Very bad □</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B 90 HUM 3</th>
<th>What experience(s) have you had?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Please tick several boxes if appropriate)</td>
</tr>
<tr>
<td></td>
<td>□ Disconnected network</td>
</tr>
<tr>
<td></td>
<td>□ Unavailable network</td>
</tr>
<tr>
<td></td>
<td>□ SIM ceased</td>
</tr>
<tr>
<td></td>
<td>□ Losing airtime</td>
</tr>
<tr>
<td></td>
<td>□ Closed offices</td>
</tr>
<tr>
<td></td>
<td>□ Unreliable support hotline</td>
</tr>
<tr>
<td></td>
<td>□ Others: __________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B 91</th>
<th>How often do anything of this happen?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monthly, approximately ........per month</td>
</tr>
<tr>
<td></td>
<td>Weekly, approximately ........per week</td>
</tr>
<tr>
<td></td>
<td>Daily, approximately ........ per day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B 92 HUM 4.1</th>
<th>What is your experience concerning support from your operator(s)?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very good □ Good □ Relatively good □ Relatively Bad □ Bad □ Very bad □</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B 93 PHY</th>
<th>To what extent do you consider that mobiles phones are a potential to the communication infrastructure (as a complement to fixed telephony and postal service)?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very high □ High □ Relatively high □ Relatively Low □ Low □ Not at all □</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B 94</th>
<th>Would you like to add anything?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>_______________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>_______________________________________________________________________________</td>
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<tr>
<td></td>
<td>_______________________________________________________________________________</td>
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<tr>
<td></td>
<td>_______________________________________________________________________________</td>
</tr>
</tbody>
</table>
**Questionnaire C1 Collection of statistical data via Mail**

<table>
<thead>
<tr>
<th>Present situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.1</td>
</tr>
<tr>
<td>C1.2</td>
</tr>
<tr>
<td>C1.3</td>
</tr>
<tr>
<td>INS 2.5.1</td>
</tr>
<tr>
<td>C1.4</td>
</tr>
<tr>
<td>C1.5</td>
</tr>
<tr>
<td>C1.6</td>
</tr>
<tr>
<td>C1.7</td>
</tr>
<tr>
<td>C1.8</td>
</tr>
<tr>
<td>C1.9</td>
</tr>
<tr>
<td>C1.10</td>
</tr>
<tr>
<td>C1.11</td>
</tr>
<tr>
<td>C1.12</td>
</tr>
<tr>
<td>C1.13</td>
</tr>
<tr>
<td>C1.14</td>
</tr>
<tr>
<td>C1.15</td>
</tr>
<tr>
<td>C1.16</td>
</tr>
<tr>
<td>C1.17</td>
</tr>
<tr>
<td>C1.18</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Safety issues**

<p>| C1.19 | How high do you think the risk is that the stat.form/questionnaire is lost on its way from school to the ministry? (Please tick as most appropriate) |
| INS 2.1 | □Very high □High □Relatively high □Relatively small □Small □Non-existent |
| C1.20 | Have you heard about/How high do you think the risk is that the Ministry of Education receives questionnaires that have mistakes/wrong data? |
| INS 2.1 | □Very high □High □Relatively high □Relatively small □Small □Non-existent |
| C1.21 | If it happens – Why? |
| C1.22 | Does it happen that the WEC changes the stat.data? □YES □NO |
| C1.23 | If YES – Why? |</p>
<table>
<thead>
<tr>
<th>C1.24</th>
<th>Does it happen that the DEO changes the stat.data? ☐ YES ☐ NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.25</td>
<td>If YES – Why?</td>
</tr>
<tr>
<td>C1.26</td>
<td>Would you like to add anything?</td>
</tr>
</tbody>
</table>
Questionnaire C2 Collection of statistical data via SMS

<table>
<thead>
<tr>
<th>Adm. tool</th>
</tr>
</thead>
</table>
| **C 2.1** | Do you know if mobile phones are used to administer the education in some way/in general?  
[ ] YES  [ ] NO 
If YES - How? |
| **C 2.2** | Are mobile phones used to administer the education in any way at your school?  
[ ] YES  [ ] NO 
If YES - How? |
| **C 2.3** | Do you think that there is a need/for/a good idea using mobile phones in administration of education?  
[ ] YES  [ ] NO 
If YES: To what extent?  
[ ] Very high  [ ] High  [ ] Relatively high  [ ] Relatively small  [ ] Small  [ ] Non-existent 
If YES: For what purposes do you think mobile phones can be used in primary rural schools? |
| **C 2.4** | Do you think that mobile phones can be used to improve the communication between rural schools and the administration of education (WEC/DEO/MoEVT)?  
[ ] YES  [ ] NO 
If YES – To what extent?  
[ ] Very high  [ ] High  [ ] Relatively high  [ ] Relatively small  [ ] Small  [ ] Non-existent 
Why? |
| **C 2.5** | Do you know/Have you observed/noticed if mobile phones are used in other public services?  
[ ] YES  [ ] NO 
If YES – In what way? |
| **C 2.6** | How do you think mobile phones could be used for collecting statistical data? |
| **C 2.7** | Are you aware of the possibility to use SMS for data collection?  
[ ] YES  [ ] NO |
| **C 2.8** | Are you aware of the possibility to send SMS directly into the computer system at the Ministry of Education?  
[ ] YES  [ ] NO |
| **C 2.9** | What is your opinion on the possibility/idea/suggestion to send statistical data via SMS directly to the computer system at the Ministry of Education?  
[ ] Very good  [ ] Good  [ ] Relatively Good  [ ] Relatively bad  [ ] Bad  [ ] Very bad |
| **C 2.10** | What advantages do you think there are using SMS for data collection for the:  

- school  
- for the pupils  
- for yourself as a HT |
<p>| <strong>C 2.11</strong> | What disadvantages/problems/obstacles do you think there are using SMS for data |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Response Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>collection for the:</td>
<td>school</td>
</tr>
<tr>
<td></td>
<td>for the pupils</td>
</tr>
<tr>
<td></td>
<td>for yourself as a HT</td>
</tr>
<tr>
<td>If mobile phones could be used for stat. data collection – What type of feedback from the Ministry of Education would you want to get?</td>
<td>How - In what way?</td>
</tr>
<tr>
<td>Do you know if regular phones/computers/Internet are used for statistical data collection in any sector?</td>
<td>☐ YES ☐ NO</td>
</tr>
<tr>
<td></td>
<td>If YES – How?</td>
</tr>
<tr>
<td>Do you know if mobile phones are used for statistical data collection in any public sector?</td>
<td>☐ YES ☐ NO</td>
</tr>
<tr>
<td></td>
<td>If YES – How?</td>
</tr>
<tr>
<td>Do you have enough SMS knowledge/experience to use an SMS-based system/ SMS for statistical data collection?</td>
<td>☐ Absolutely ☐ High degree ☐ Moderate degree ☐ Not really ☐ Barely ☐ Not at all</td>
</tr>
<tr>
<td>How much training do you need to use an SMS-based system/so that you could use a mobile and SMS for statistical data collection?</td>
<td>☐ Very much ☐ Relatively much ☐ Average ☐ Relatively little ☐ Little ☐ No at all</td>
</tr>
<tr>
<td>How complex do you think it would be to use SMS for data collection?</td>
<td>☐ Very much ☐ Relatively much ☐ Average ☐ Relatively little ☐ Little ☐ Not at all</td>
</tr>
</tbody>
</table>

321
## Participation

<table>
<thead>
<tr>
<th>C 2.31 SOC 1.1</th>
<th>How important is it for you that you are involved in the planning of a new data collection system/an SMS-based system?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Very imp ☑ Imp ☐ Rel. imp ☐ Rel.unimportant ☐ Unimportant ☐ Not imp at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.32 SOC 3.3/SOC 1.1.2</th>
<th>How important is it that you know the reason behind a new system/ of using SMS as a new way of collecting statistical data?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Very imp ☑ Imp ☐ Rel. imp ☐ Rel.unimportant ☐ Unimportant ☐ Not imp at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.33 SOC 1.1/SOC 3.3.1</th>
<th>How important is it that the WEC and DEO support you taking part in new way of collecting statistical data?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Very imp ☑ Imp ☐ Rel. imp ☐ Rel.unimportant ☐ Unimportant ☐ Not imp at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.34</th>
<th>What kind of support would you need?</th>
</tr>
</thead>
</table>

## Safety

<table>
<thead>
<tr>
<th>C 2.35</th>
<th>Do you trust the technology? Do you think it is reliable to send important data with SMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ YES ☑ NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.36</th>
<th>If YES: To what extent do you think it is reliable to send important data with SMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Very high ☑ High ☐ Relatively high ☐ Relatively low ☐ Low ☐ Non-existent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.37</th>
<th>If NO: Why not?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>C 2.38</th>
<th>Do you think it is secure (data safety and data theft and data tampering) to send important data with SMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ YES ☑ NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.39</th>
<th>If YES: Why?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>C 2.40</th>
<th>If YES: To what extent do you think it is secure to send important data with SMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Very high ☑ High ☐ Relatively high ☐ Relatively low ☐ Low ☐ Non-existent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.41</th>
<th>If NO: Why not?</th>
</tr>
</thead>
</table>

## Support

<table>
<thead>
<tr>
<th>C 2.42</th>
<th>To what extent do you think that the information you receive via SMS is reliable?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Very high ☑ High ☐ Relatively high ☐ Relatively low ☐ Low ☐ Non-existent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.43</th>
<th>How high do you think the risk is for loss of data when using SMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Very high ☑ High ☐ Relatively high ☐ Relatively low ☐ Low ☐ Non-existent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.44 INS 2.1</th>
<th>Do you think there are local technical people/capacity/support to implement/introduce a new SMS-based system?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Absolutely ☑ High degree ☐ Moderate degree ☐ Not really ☐ Barely ☐ Not at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.45 SOC.1.2</th>
<th>Do you think there are local technical people/capacity/support to implement/introduce a new SMS-based system?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Absolutely ☑ High degree ☐ Moderate degree ☐ Not really ☐ Barely ☐ Not at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C 2.46 SOC.1.2</th>
<th>Do you think there are local technical people/capacity/support to train HT?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Absolutely ☑ High degree ☐ Moderate degree ☐ Not really ☐ Barely ☐ Not at all</td>
</tr>
<tr>
<td>C 2.47</td>
<td>FIN 1.1</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Private use**

<table>
<thead>
<tr>
<th>C 2.48</th>
<th>SOC 1.4</th>
<th>Could you think of using your own private mobile for statistical data collection?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>✔ YES ☐ NO</td>
</tr>
</tbody>
</table>

If YES: Why? If NO: Why not?

<table>
<thead>
<tr>
<th>C 2.49</th>
<th>SOC 1.4</th>
<th>Do you need any support/favor for using your own private mobile for statistical data collection?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>✔ YES ☐ NO</td>
</tr>
</tbody>
</table>

If YES: Why? If NO: Why not? If YES: What type of support/favor do you need/wish? (Free SMS – Airtime – Others) If NO: Why not?

<table>
<thead>
<tr>
<th>C 2.50</th>
<th>PHY</th>
<th>To what extent do you consider that mobile phones are a potential to the communication infrastructure (as a complement to fixed telephony and postal service)?</th>
</tr>
</thead>
<tbody>
<tr>
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<td>✔ Very high ☐ High ☐ Relatively high ☐ Relatively Low ☐ Low ☐ Not at all</td>
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Thank you for your interest in this study! We greatly appreciate your participation!

Gudrun Wicander, Eco.lic. John-Sören Pettersson, PhD Matti Tedre, PhD
Researcher Professor Associate professor
Karlstad University Karlstad University Tumaini University
Appendix 4: XIF – the eXtended Sustainable ICT Framework

One of the applied analytical tools is XIF – the eXtended Sustainable ICT Framework, which emanates from SIF – the Sustainable ICT Framework, developed by Sundén and Wicander (2006). XIF is a generic framework on a systems level for analysing factors influencing sustainable ICT use with focus on rural areas in developing countries. It was used as a guide for developing the questionnaire for this study as well as a tool for the analysis – as an analytical model on systems level.

The Background of XIF
Expectations of ICT for socio-economic and human development have been high, but the real benefits and the positive impacts have been somewhat disappointing. Failures of ICT projects have been discussed for several years and many studies concerning failure and success have been conducted concluding that ICT projects in developing countries have not all been a success (Sundén & Wicander 2006). There is also a lack of knowledge, an “empirical vacuum”, about factors that influence the success of ICT projects (Keniston 2002). Information about specific ICT needs, sources of information, mode of learning, as well as forms of business, are examples of information needed to shape a realistic ICT profile for a specific rural community (Mansell 1999; d’Orville 2000).

The Ambition of XIF
XIF has the ambition to tackle the problem of failed ICT projects in a development country context as a tool for analysing the underlying factors of failure. XIF also has the ambition to act as a guideline for planning, implementing, and evaluating ICT projects in developing countries. The framework brings a sustainability aspect into the picture of ICT and the requirement of ‘sustainable ICT use’ stresses that ICT is long-lasting and that ICT meets the needs of the user. One of the most important success criterion among ICT projects in a development country context is “user involvement” (Sundén and Wicander 2006). Pena-López (2009) states that “…human action before use – commitment, training, participation – have a key role in this model and are essential to the best of achievements of an ICT4D project.” (Pena-López (2009:183) Pena-López concludes “This model makes the other ends meet in this human geographical centre…the design, with the individual at the centre of it, interacting on one side with infrastructures and on the other side with content is what makes this model so appealing to us.” (p. 183)

The harsh socio-economic and infrastructural context makes the sustainability of ICT a major issue. The framework represents a complex reality and provides a way of thinking about sustainable ICT use – this means the ability to identify and manage factors threatening the long-term viability and use of ICT. XIF has the ambition to act as a tool for conceptualisation that can support the understanding of the conditions
for sustainable ICT projects in developing countries on a systems level. The concept of sustainable ICT implies how to access, use and manage resources in an efficient, effective, and long-term way.

The Development of XIF

XIF can be classified as a prescriptive and normative framework based on a systemic view. It has an analytical structure that can be used to enhance ICT use, effectiveness and efficiency; it has a functionalistic approach but in a technology non-deterministic way. XIF is a theoretical model; the fourth step of a subsequent process described below in chronological order:

The four-step process:
1. SLF – the Sustainability Livelihood Framework by Ashley and Carney (1999)
4. XIF – the eXtended Sustainable ICT Framework by Wicander (this appendix)

The framework emanates from the Sustainability Livelihood Framework (SLF) by Ashley and Carney (1999). In the first step, SLF was developed as a reaction to a changed view on aid and assistance. SLF is a set of principles useful to understanding livelihood strategies of the poor with sustainability as a main concept. SLF consists of five capital assets: human, social, natural, physical, and financial. (Development in the notion of ‘freedom’ can include access to ICT such as media and broadcast information; Sen 1999. The capability approach by Sen has influenced for instance the livelihood framework, which constitutes the foundation for XIF.)

In a second step, the SLF was adapted to an ICT context by Batchelor and Norrish (2002; 2003) through inter alia changing ‘natural’ capital to ‘content’ capital creating what is here called the Batchelor and Norrish Framework (BNF).

In a third step, the BNF was further refined by Sundén and Wicander (2006) through changing the resource category ‘content’ capital into a new resource category, the Immaterial Capital in order to give this capital a similar category level.

Further, the framework was improved by adding one more level, a subcategory level, for making the categorisation of factors more precise, clear and manageable, as the category level seemed abstract and very high-level. Introducing a subcategory level also facilitated a more practical use of the framework. Subcategories are “concepts that pertain to a category, giving it further clarification and specification” (Strauss & Corbin 1990:101). Also, some of the identified factors were re-named making them more distinct.

Additionally, two more dimensions were added, a space and a time dimension to give the framework a more contextualised dimension and to stress the sustainability approach.

SIF is the final result of this third step. In short, SIF constitutes three dimensions: resource, space and time. SIF includes five resource categories, the five capital assets
Human, Social, Physical, Financial, and Immaterial capitals, comprising 15 subcategories with in total 41 factors found critical in various empirical studies. SIF has a 'project' perspective and the 41 factors represent both micro, meso, and macro levels.

The 41 factors divided into the five categories can be calculated in number and percentage:

- **Social Capital**: 12 factors → 29 per cent of the factors
- **Immaterial Capital**: 9 factors → 23 per cent of the factors
- **Human Capital**: 9 factors → 20 per cent of the factors
- **Physical Capital**: 6 factors → 15 per cent of the factors
- **Financial Capital**: 5 factors → 13 per cent of the factors

As can be noted, the absolute numbers of factors are considerably higher in the Social capital group compared to the Physical and Financial Capitals. This does not reflect by itself the relative importance of the different capitals for sustainable ICT use. It is possible that it is an effect of social factors being more difficult and complex to express.

In the fourth step, SIF was expanded with two more capital assets; a political and an institutional capital as further research, experience, and other studies indicated the need to further develop SIF. Input came mainly from three sources: the criticism and critique of the original framework SLF, a project and model for benchmarking sustainable ICT activities (SIMBA) together with an extensive evaluation of digital development models including SIF made by Pena-López (2009).

The original framework, the SLF by Ashley and Carney (1999), has been discussed, criticised, critiqued, and further developed in a number of publications. An annotated bibliography by Toner and Howlett (2001) counts over 100 contributions. Some of the critique has focused on the lack of a political and institutional capital.

The second source of input for the need of an extended SIF is the experience from the SIMBA project. (For the full report see Andersson et al. 2006). The objective of the SIMBA project was to design a model for benchmarking 'developing countries' and their preconditions for successfully creating a sustainable broadband market in rural areas. SIMBA is supposed to be used as a tool for evaluating the preconditions for an ICT project and as a tool for comparison between different countries. The centre of attention was directed to how locally sustainable ICT solutions could be developed.

The SIMBA model is a generic pilot model; a prototype consisting of five categories with a total of 16 subcategories and 81 indicators that can provide guidance for an evaluation process. The category Institutional framework includes policies and regulations, in particular in the area of communication, including law and law enforcement. A verification of the chosen indicators in SIMBA can be seen in the

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53 SIMBA is an acronym for Sustainable ICT – a Model for Benchmarking Activities with a Broadband Focus. The term Simba is Kiswahili, the national language in Tanzania, meaning 'lion'.

SIF has been discussed and evaluated by Ismael Pena-López (2009) in his doctoral thesis “Measuring digital development for policy-making: Models, stages, characteristics and causes.” Pena-López evaluates, both qualitatively and quantitatively, 55 main models (with a total of 1489 indicators/factors), including SIF and SIMBA. Pena-López states that “…a major concern is in how few existing indicators measure both the regulation of the Information Society in general and, specifically, the existing policies to foster it.” (p. 285). Pena-López expresses his surprise that this category gets low “attention” of all the analysed models – “…it looks like what is being measured is how infrastructure or capital is transformed into effective use, but bypassing the black box of how this transformation actually takes place.” (p.283) i.e. there is a lack of policy and regulation factors in the 55 models.

The eXtended SIF – XIF

The critique of SLF and the need for a political and an institutional capital is a motivation for adding these capitals to SIF.

Furthermore, observations made in the SIMBA project in Tanzania revealed great obstacles concerning ICT activities related to policy and regulatory environment (Andersson et al. 2006; Wicander 2007). This experience from SIMBA indicates the importance of policy and institutional factors, and yet another motivating factor for an extended SIF.

The work of Pena-López (2009) indicates the lack of policy and institutional factors in most models. The importance of policy and regulatory factors is also verified in Wicander (2010).

Taking this general experience into account clearly indicates the need to further develop, extend and expand SIF and the need for adding two more capitals into the framework: a political and an institutional capital - the pentagon is extended to a septagon: XIF – the present model.

In order to properly classify policy and institutional factors, there is a need for relevant subcategories. The category The Institutional Framework in SIMBA includes some of the tentative missing parts of the SIF and the subcategories Policies, Institutions, and ICT Regulation are added to the original version. These subcategories consist of factors that affect public actors when deploying ICT-projects. These are factors that will set the limits for what actions, processes, and technologies are available and possible to use. When planning for an ICT project, it is of great importance to be acquainted with the political and institutional framework to know which options are available and which are not.
Additionally, as a result of the extended SIF, some of the original factors classified into one of the five categories, need to be reclassified as they better fit into one of the ‘new’ categories.

The coding system also has to be changed to fit the extended framework. As there are two categories starting with ‘I’ (Immaterial and Institutional) and two starting with ‘P’ (Physical and Political), there is a need to be able to make a distinction between those. Hence ‘Immaterial’ capital is labelled IMM, ‘Institutional’ INS, Physical PHY, and Political POL. Human capital is labeled HUM and Social capital SOC.

**Political Capital**
The extended SIF includes Political Capital (POL). Political Capital can be defined as: the legal framework, power structures and relations including policies, strategies, regulations, laws, programs, priorities and rules. Within this category, 13 factors are identified belonging to the two subcategories Policies and Strategies (POL 1), and Political and Policy Environment (POL 2).

See below for the factors belonging to Political Capital. Each factor is presented with its new code, and in brackets its old code.

**Institutional Capital**
The extended SIF includes Institutional Capital (INS). A definition of Institutional Capital includes: the implementation and implementers of policies and strategies including structures, institutions, groups, organisations, ‘public players’, community, public services, participatory ways of working, and institutional arrangements. Within this category, 10 factors are identified belonging to the three subcategories Institutions (INS 1), Institutional Environment (INS 2), and Governance (INS 3).

See below for the factors belonging to Institutional Capital. Each factor is presented with its new code, and in brackets its old code.
List of factors of the XIF framework

**IMM - Immaterial Capital**
IMM 1 Content
- IMM 1.1 Externally Produced Information
- IMM 1.2 Externally Adapted Information
- IMM 1.3 Locally Adapted Information
- IMM 1.4 Locally Developed Information
IMM 2 Form
- IMM 2.1 Language
IMM 3 Software
- IMM 3.1 Locally Tailored Software
IMM 4 Documentation
- IMM 4.1 User Manual
- IMM 4.2 Technical Documentation

**HUM - Human Capital**
HUM 1 Cultural Endowment
- HUM 1.1 Self Esteem
HUM 2 Knowledge
- HUM 2.1 Basic Education
- HUM 2.2 ICT Education
HUM 3 Skill
- HUM 3.1 User Training
- HUM 3.2 Maintenance Training
- HUM 3.3 Production Training
- HUM 3.4 Management Training
HUM 4 User Assistance
- HUM 4.1 Intermediary
SOC - Social Capital
SOC 1 Social Environment
   SOC 1.1 Local Capacity
   SOC 1.2 Identified Needs
SOC 2 Teamwork
   SOC 2.1 Participation
   SOC 2.2 Key Linkage
   SOC 2.3 Explicit Objective
   SOC 2.4 Leadership

POL - Political Capital
POL 1 Policies and Strategies
   POL 1.1 National ICT Policy
   POL 1.2 National ICT Strategy
   POL 1.3 Local ICT Policy
   POL 1.4 Local ICT Strategy
   POL 1.5 Universal Access Strategy
   POL 1.6 Sectorial ICT Policy
   POL 1.7 Sectorial ICT Strategy
   POL 1.8 National/Regional Electrification program
POL 2 Political and Policy environment
   POL 2.1 (S 2.1) Telecom Market Regulation
   POL 2.2 (S 2.2) Publishing Laws
   POL 2.3 (H 1.2) Social Power
   POL 2.4 Governmental prioritising of ICT
   POL 2.5 Regulations/Regulatory and Licensing system
INS - Institutional Capital
INS 1 Institutions
   INS 1.1 Regulatory Authority
   INS 1.2 Coordinating ICT Group

INS 2 Institutional Environment
   INS 2.1 Public Security
   INS 2.2 Postal Service
   INS 2.3 Local Mobilisation
   INS 2.4 Universal Access
   INS 2.5 Ownership

INS 3 Governance
   INS 3.1 Political Stability
   INS 3.2 Regulatory Quality
   INS 3.3 Control of corruption

FIN - Financial Capital
FIN 1 Financial Support
   FIN 1.1 Funding
   FIN 1.2 Loan Market
   FIN 1.3 Universal Access Fund

FIN 2 Local Economy
   FIN 2.1 Bill Service
   FIN 2.2 Commercial Models
   FIN 2.3 Purchasing Power

PHY - Physical Capital
PHY 1 Infrastructure
   PHY 1.1 Electricity
   PHY 1.2 Telecom Network
   PHY 1.3 Transport Network

PHY 2 Technology
   PHY 2.1 Hardware (HW)
   PHY 2.2 Operating Systems (OS) Software
   PHY 2.3 HW & OS Documentation
Appendix 4:5 Triple A

Triple A is a conceptual model for analysis of the usage pattern and profile of mobile phones, both private use and work-related use, among head teachers. The Triple A model is developed to describe the current situation i.e. how head teachers use their mobiles for private and work-related purposes. On an individual level, the model is developed for the categorisation of a personal, subjective understanding, view, opinion and perception.

The Triple A model consists of three (3) ‘A’ concepts: Access, Attitude, Awareness. The three ‘A’ concepts are related to each other in a systemic way, as a system with mutual interdependency and mutual influence between the three ‘A’ concepts. The Triple A model is developed in order to capture both social and technical aspects i.e. socio-technical aspects in a user perspective, including both ‘hard’ and ‘soft’ structures, but has its main focus on ‘soft’ issues.

- Human and social aspects and structures (soft) via attitude and awareness
- Technical aspects and structures (hard) via access

The three ‘A’ concepts can be defined with terms that are central on an individual level:

- Access - economy, equipment, infrastructure, ownership and usage
- Attitudes - complexity, norms and values, self confidence, trust, and usefulness
- Awareness - experience, knowledge and skill

The notions of ‘access’ mentioned in this study cover a broad range of states including being covered by a mobile signal and/or the de-facto capability to send a message, and/or to receive a message and/or the ability and capacity of effective usage (Wicander 2010). (For a discussion of ‘access’, see Peña-López 2009)

Usage patterns within and across regions are apparent, according to Donner (2008). In studies about everyday use, it is obvious that mobile use is an effect of the context it is used in. Mobile use reflects social processes. Thus socio-cultural and economic factors could be seen as determinants of the use of the mobile system (Wicander 2010).

Cultural conditions influence usage patterns of mobile handsets (Blum, Chipchase & Lehikoinen 2005; Yan & Gu 2007; Donner 2008). Within the handset lie several features, functions and attributes, which are used in different ways by different users (Wicander 2010)

The three ‘A’ concepts build on the theories Diffusion of Innovation, and Technology Acceptance Model, together with the XIF.

The Diffusion on Innovation theory is used to explain social change in relation to the adoption of an innovation such as a new technology, from an individual perspective. Rogers (2003:21 in Sundén & Wicander 2006) describes adoption as the decision to fully use an innovation, i.e. usage of an innovation is the best course of action.
Furthermore, as stated in Sundén & Wicander 2006:86, the adoption process is a social process in which subjectively perceived information is communicated. According to Rogers (2003 in Sundén & Wicander 2006), other variables in the diffusion process are education, knowledge and socio-economic status including the roles of an opinion leader and change agent. An additional factor in the diffusion process, according to Rogers (2003 in Sundén & Wicander 2006), is the consequence of an innovation, which refers to the change of an innovation to the individual and/or a social system.

The Technology Acceptance Model (TAM) was developed by Davis in the late 1980s and is a well-known and accepted theory and model within the IS discipline. TAM includes different aspects on an individual level that affect a user’s attitude to acceptance of an information system and/or to a technology and to the usage of the information system and/or technology (Davis 1989).

Key aspects are:

- perceived usefulness
- perceived ease of use

Usefulness includes what benefits the information system and/or technology is perceived to bring. Ease of use is influenced by the user’s knowledge, skill and capability. Several external factors affect a user’s attitude to the acceptance of an information system and/or to a technology and to the usage of the information system and/or technology such as training, system development, and system characteristics.

The three ‘A’ concepts derive from several XIF factors with a focus on individual level i.e. several factors from XIF are condensed to the three ‘A’-concepts to stress the individual perspective. See below for a detailed list of the contributing XIF factors.
Access
The ‘access’ theme includes issues such as economy, equipment, infrastructure, ownership and usage. The ‘access’ concept derives from several XIF-factors. ‘Access’ includes the following XIF-factors in alphabetic order:

- Economy
  - FIN 1.1 Funding
  - FIN 2 Local economy
  - FIN 2.2 Commercial Models
  - FIN 2.3 Purchasing Power
- Equipment (handset, accessories, spare parts, SIM cards)
  - PHY 2 Technology
  - PHY 2.1 Hardware
- Infrastructure
  - PHY 1 Infrastructure
  - PHY 1.1 Electricity
  - INS 2.2 Postal Service
- Ownership
  - INS 2.5 Ownership
- Usage (language, service, intermediary, climate, operators, charging)
  - IMM 2.1 Language
  - HUM 4.1 Intermediary
  - SOC 1.1 Local Capacity

Attitude
The ‘attitude’ theme includes issues such as complexity, norms and values, self-confidence, trust, and usefulness related to mobile phone usage. The ‘attitude’ concept derives from several XIF-factors. ‘Attitude’ includes the following XIF-factors listed in alphabetic order:

- Complexity (easy to use)
- Norms and Values
  - POL 2.3 Social Power
- Self confidence
  - HUM 1.1 Self Esteem
- Trust
  - INS 2.1 Public Security
- Usefulness (Advantages/Disadvantages)
  - SOC 1.2 Identifying Needs
Awareness
The ‘awareness’ theme includes issues such as experience, knowledge and skill related to mobile phone usage. The ‘awareness’ concept derives from several XIF-factors.
‘Awareness’ includes the following XIF-factors:
- Experience
  - HUM 3.1 User Training
- Knowledge (basic)
  - HUM 2.1 Basic Education
- Knowledge (ICT)
  - HUM 2.2 ICT Education
- Skill
  - HUM 3 Skill
Appendix 5:1 Standard Statistical Questionnaire – Primary Schools

The standard questionnaire for collecting statistical educational data on primary school level contains the following headlines:

1. SCHOOL INFORMATION/PARTICULARS
2. PUPILS INFORMATION
3. TEACHERS INFORMATION
4. SERVICES AVAILABLE
5. EDUCATION DEVELOPMENT
6. PERMANENT BUILDING
7. FURNITURE
8. BOOKS AND FACILITIES USED FOR TEACHING PURPOSE
9. FACILITIES FOR SPECIAL EDUCATION
10. FINANCIAL INFORMATION FOR THE PERIOD OF JANUARY – DECEMBER

1. SCHOOL INFORMATION/PARTICULARS
   (e.g. name, address, region, district, division, ward, registration number, owner, and location)

2. PUPILS INFORMATION
   1. Number of pupils enrolled by age, sex, and grade
   2. Number of non-citizen pupils by sex and grade
   3. Grade I pupils enrolled this year by sex
   4. Grade I pupils with pre-primary education background by sex
   5. Number of grade I repeaters by age (years) and sex
   6. Number of repeaters by grade and sex
   7. Number of disabled pupils by type of disability (visually impaired/albino, deaf/mute, deaf-blind, physically impaired, mentally impaired, autism, multi-impaired, others such as problems in behaviour, learning or speech) and by sex
   8. Number of dropouts or intransfer pupils last year by reason (truancy, pregnancy, death, lack of needs, illness, taking care ill people, others such as misbehaving) and by sex (except pregnancy)
   9. Number of orphan pupils by grade, sex and type of orphanage (one parent, both parents)
   10. Number of pupils living in most vulnerable environment by grade, sex and type of vulnerability (sick pupils for more than 3 months, pupils who are head of the houses, other)
11. Number of pupils living in most vulnerable environment who are
    supported by sex, grade and name of supporter (community based
    organisations, district fund, non-governmental organisations, central
    government, others)
12. Number of pupils living in most vulnerable environment who are
    waiting to be supported by sex and grade
13. Feeding programme by sex, number of pupils who eat, source of
    food provision (international organisation, non-governmental organisation,
    community based organisations, district fund, central government, self-reliance,
    donor groups, community e.g. parents) and by amount in TShs.
14. Number of pupils by distance of the school from their residence
    (for day pupils) by sex, grade and distance (0-3 km, more than 3 km)

3. TEACHERS INFORMATION
1. Teachers by qualifications by sex and by qualification (degree,
    diploma, grade A, grade B/C)
2. Teachers employed last year (those who have started teaching for
    the first time) by sex and by qualification (degree, diploma, grade A)
3. Teachers teaching education on fight against AIDS by sex and by
    type of teachers (teachers who have been trained, teachers who have not been
    trained)
4. Teachers delivering counseling service by sex and type of teachers
    (teachers who have been trained, teachers who have not been trained)
5. Teachers teaching disabled pupils by qualification (certificate
    special education, diploma special education, degree special education), trained
    respectively non-trained, by sex and by type of disability (visually
    impaired/albino, deaf/mute, deaf-blind, physically impaired, mentally impaired,
    autism, multi-impaired, others such as problems in behaviour, learning or
    speech)
6. Number of disabled teachers by qualification (certificate special
    education, diploma special education, degree special education) by sex and by
    type of disability (visually impaired/albino, deaf/mute, physical impaired)
7. Teachers attrition
   i. Retired teachers by reason (long term illness, short time illness, no
      reason stated, retirement age, others) and qualification (normal teachers (A),
      special education teachers (B), others) and by sex
ii. Teachers dead last year by reason (long term illness, short time illness, accident, others) and qualification (normal teachers (A), special education teachers (B), others) and by sex

iii. Teachers terminated or leaving profession last year by reason (long term illness, misbehaving, truancy, no reason stated, others) and by qualification (normal teachers (A), special education teachers (B), others) and by sex

iv. Teachers not attending school by reason (studies, pregnancy leave, leave without payment, illness, taking care of ill people, exchange program, suspended), by length (less than 1 month, 1-3 months, 4-6 months, more than 6 months) and by sex

4. SERVICES AVAILABLE
   1. Service available (tap water, dam water, electricity, play ground, first aid kit, and 'uelimishaji rika')

5. EDUCATION DEVELOPMENT
   1. Streams launched/opened
   2. Teachers houses built
   3. Classrooms built
   4. Boys latrines built
   5. Girls latrines built

6. PERMANENT BUILDING
   (brick walls, iron roofs/tiles) by needs, available and shortage
   1. Class rooms
   2. Teachers houses
   3. Boys latrines
   4. Girls latrines
   5. Office (head teacher’s office, teachers office)
   6. Library
   7. Kitchen
   8. Dining hall
   9. Store

7. FURNITURE
   (by needs, available and shortage)
   1. Tables
   2. Chairs
   3. Cupboard
   4. Drawer
5. Desks by number and type of desks (one seater, two seaters, three seaters, more than three seaters)
6. Desks shortage

8. BOOKS AND FACILITIES USED FOR TEACHING PURPOSE
1. Text books by grade, need, available, and subject (mathematics, English, Swahili, science, social studies, geography, civics, history, life skills, personality and sports, French)
2. Supplementary books by grade, need, available, and subject (mathematics, English, Swahili, science, social studies, geography, civics, history, life skills, personality and sports, French)
3. Teaching facilities by needs, available, and shortage and by science kits, mathematical kits, globe, and slates.

9. FACILITIES FOR SPECIAL EDUCATION
1. Need and shortage by needs, available, shortage and by type of facilities (perkins brailllers, type writers, hands frames, stylus, thermoform, braillon paper, hearing aids, speech trainer, audiometers, others)
2. Availability of facilities for special education by type of disability (visually impaired/albino, deaf/mute, physically impaired, mentally impaired, autism, multi-impaired, others such as problem in behaviour, learning or speech)

10. FINANCIAL INFORMATION FOR THE PERIOD OF JANUARY – DECEMBER
Source of income by income, expenditure and balance
1. Capitation grant
2. Development grant
3. Self reliance
4. Donors
5. Community contribution
Appendix 5:2 Standard Statistical Questionnaire – District Summary

The instrument for the district summary includes the same ten groups of questions except the first, which in the district summary focuses on:

DISTRICT INFORMATION (e.g. district, region, number of government respectively non-government schools, religious affiliation, and location i.e. urban respectively rural).

Upon the district information follows then the summary of the primary school questionnaires, that is (cf. appendix 5:1):

1. SCHOOL INFORMATION/PARTICULARS
2. PUPILS INFORMATION
3. TEACHERS INFORMATION
4. SERVICES AVAILABLE
5. EDUCATION DEVELOPMENT
6. PERMANENT BUILDING
7. FURNITURE
8. BOOKS AND FACILITIES USED FOR TEACHING PURPOSE
9. FACILITIES FOR SPECIAL EDUCATION
10. FINANCIAL INFORMATION FOR THE PERIOD OF JANUARY – DECEMBER
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Contact person: Professor Birger Rapp, director of MIT, birra@ida.liu.se, Phone: 013 281525.
Address: Forskarskolan Management och IT, Företagsekonomiska Institutionen, Box 513, 751 20 Uppsala.

Contact person: Professor Pär Ågerfalk, director of MIT, Uppsala University
par.agefurfalk@im.uu.se
Address: The Swedish Research School of Management and Information Technology, Department of Business Studies, Uppsala University, Box 513, 751 20 Uppsala
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e-Government systems are considered by both governments and international organisations to improve administration and management. In Tanzania, an e-government system for education administration, EMIS, is partly implemented but shows several limitations. Statistical data is collected but the process is resource demanding and much of the collected data are never put into the system, and therefore remain inaccessible from this electronic system. The overall aim of this study is to propose an approach to designing more efficient e-government systems within the education sector. The focus is on public schools. The more specific aim of the present study is to:

explorer more efficient data transfer (faster, more reliable, and potentially less resource demanding) by using mobile telephone technology, especially SMS, as a means for statistical data collection for Tanzanian education management.

A mobile supported SMS-based statistical data collection process employing a blended digital solution is proposed. Likely effects of such a system would be ‘better’ data e.g. less transmission errors, which provides for ‘better’ administration, ‘better’ decision-making, and also provides for transparency. Moreover, it is very likely that the proposed system is significantly less resource demanding than the present system.

Three overall reflections are made based on the major observations of the research findings: the Double ‘e’ Dilemma, on the problem of prioritising electronics before electricity, the Mobiles to Avoid Mobility paradox, highlighting connectivity before mobility, and the opportunity to use the SMS to Combat Corruption weapon.