Human-Computer Interaction in a Community Development Context
A case study of software utilization in Karagwe, Tanzania

*Master of Science Thesis*

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A case study of software utilization in Karagwe, Tanzania

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Abstract

In recent years, the international academic discourse concerning ICT and development has shifted its focus from technology to human and social factors, curiously echoing a similar shift of focus towards Interaction Design in the software industry. This master's thesis explores this point of intersection where the fields of culture, usability, ICT, development and the so-called digital divide overlap. Starting off from an ethnographic field study conducted at a non-governmental organization in north-west Tanzania, the use of ICT was examined within a rural development context, giving special reference to software and cultural adaptation. The study found that the success of ICT was affected by a multitude of factors that were specific for the targeted setting — primarily a lack of computer know-how, electricity and Internet connectivity — while culture did not constitute an impediment for efficient use of "western" technology. A wider perspective that reaches beyond the organization's present situation uncovers serious shortcomings concerning the social knowledge structures. The thesis concludes that cultural remoteness is not likely to be a major impediment to ICT use for organizations in rural locations. Far more serious problems are caused by the spatial remoteness and social seclusion that impair an organization's ability to acquire new knowledge and technology. Finally, new questions are raised for future research to answer regarding the impact of cultural software adaptation on public ICT use.

Keywords: Interaction Design, Culture, Context, Usability, Development, Tanzania, Ethnography, Participant Observation, Digital Divide, Karagwe
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1. Introduction

As information is becoming more and more crucial for participating in the global economy, Information and Communication Technology (ICT) is being increasingly recognized as an important instrument for economic progress in developing countries (World Bank, 1998; Avgerou, 2003). There is, however, an economic and technological gap between the developed world and the developing world. This gap, commonly referred to as the digital divide, separates people in developing countries from the global information society.

In the past, numerous sincere attempts have been made to bridge the digital divide and to improve peoples’ lives around the world using ICT. These include numerous government initiatives in South Asia (Pigato, 2001), ICT initiatives of the United States Agency for International Development and Nicholas Negroponte’s One Laptop per Child project among many others. A common criticism of past projects has been a too strong focus on technology and an insufficient amount of attention directed to human and social factors in the targeted setting. It has become ever more apparent that the usefulness of any technology or equipment is ultimately dependent on the context where it is applied. Thus, different contexts bring about different challenges for the optimal utilization of technology.

The purpose of this master’s thesis is to identify and analyze the most salient factors affecting the success of ICT in a rural development context. In order to shed light on these issues, the use of ICT and the underlying problems that prevent available computer resources and equipment from being utilized at their full potential are examined in the context of the Mavuno Project. The Mavuno Project is an NGO that is working to improve living conditions within local communities of the Karagwe district in Northwest Tanzania.

The report begins with the introduction of underlying theories that provide the reader with an understanding of how this thesis fits into its academic context. Based on theory and related research, the thesis’ three main research questions are raised. These three questions form the back bone that the report is based around. After the research questions have been formulated, the following chapters motivate and describe the methods used to answer these questions. The findings are accounted for in the Results chapter, where experiences made
during field work are categorized and described using the theoretical models previously explained. In the end, the findings are discussed in light of the three main research questions and finally conclusions are drawn.

Using theory as a starting point, we find that the academic discourse surrounding the digital divide puts forth numerous paradigms stressing different factors relating to the successful application of ICT in various contexts. In order to produce a sound analysis of the situation in Karagwe one first needs to take a closer look on the present state of research and the academic debate.
2. Theory

2.1 The Digital Divide and ICT for Development

Mastering the use of ICT is gradually becoming more necessary for people to fully participate in the modern information society. ICT is now being increasingly recognised as an important instrument for economic growth in developing countries and for raising living standards and quality of life of the poor (Pigato, 2001). It has also played an important role in the development of the so called third sector, i.e., non-state, non-business, political and social activity (Warschauer, 2004, p. 192). ICT diffusion differs around the world and Africa is far behind all other continents in terms of Internet connectivity (Furuholt & Kristiansen, 2007; Pigato, 2001). This phenomenon is commonly referred to as the digital divide, expressing among other things a lack of access to the global pool of knowledge, and to the global digital commerce.

Much of the early literature on the digital divide limits its scope to access to computers and the Internet (Hargittai, 2002) which has strengthened the notion that the key factor to close the digital divide is to provide access to technology. Although few researchers have made explicit claims, such as "access translates into usage" (Hoffman & Novak, 1998), this notion has not been extensively argued for. It has rather been presupposed, especially in the earlier attempts to understand the digital divide.

The strong focus on technology has also had a clear impact on public policy and projects aimed at closing the digital divide. During the Clinton administration, President Bill Clinton stated his ambition to bridge the digital divide (Bowman, 2000; McCullagh, 2000) and numerous efforts to encourage the use of technology in public education were made in the United States (Beasley & Sutton, 1998). The Clinton-Gore Agenda for Creating Digital Opportunity proposal included a $2 billion tax incentive to encourage private sector donation of computers, sponsorship of community technology centers, and technology training for workers. Additional grants included $150 million to help train all new teachers entering the workforce use technology effectively in the classroom, $100 million to create
up to 1,000 community technology centers in low-income urban and rural communities, $50 million for a public/private partnership to expand home access to computers and the Internet for low-income families, $45 million to promote innovative applications of information technology for under-served communities, $25 million to accelerate private sector deployment of high-speed networks in under-served urban and rural communities and $10 million to prepare Native Americans for careers in information technology and other technical fields (The White House, 2000).

The vast majority of the funds concerned provisioning sufficient equipment and extending infrastructure, leaving only small amounts for education and other measures considered peripheral. And although some resources were allocated for training on information literacy the proposal is permeated with the notion that access to computers and the Internet is the key to closing the digital divide. The initiative’s focus on universal Internet access throughout the nation was supported by the National Telecommunications and Information Administration (NTIA) — the president's principal adviser on telecommunications and information policy. In NTIA’s first study of the digital divide, Falling Through the Net (1995), telephone penetration and computer and modem ownership is mapped throughout the United States; applying a focus on access which dates back to a federal-government policy of the Eisenhower administration (DiMaggio & Hargittai, 2001).

The access centred approach, however, has not been without its fair share of critiques. In his Technology and Social Inclusion - Rethinking the Digital Divide (2004), Mark Warschauer illustrates the inadequacy of this approach using examples of failed ICT projects in India, Ireland and Egypt. He argues that the digital divide provides a poor framework for both analysis and policy and that many problems with ICT projects are neither isolated nor random:

"Rather, these same types of problems occur again and again in technology projects around the world, which too often focus on providing hardware and software and pay insufficient attention to the human and social systems that must also change for technology to make a difference." (Warschauer, 2004, p. 6)
Warschauer agrees with many others in the field that the concept is misleading in the sense that it implies that ICT alone is a suitable measure of — or prerequisite for — development. A common argument is that the digital divide gives the wrong impression about the phenomenon because it depicts it as purely technological, not taking human and social factors in mind, such as education, literacy, language skills, content and institutional structures (Furuholt & Kristiansen, 2007; Warschauer, 2002; Pigato, 2001).

The concept is also accused of implying a binary division, i.e. that it does not recognize the fact that individuals, organizations and societies use ICT to various degrees (Wilson, 2003; Warschauer, 2002). Wilson (2003) criticizes the concept of a digital divide and the international ICT and development discourse, claiming that it “reproduces the binary opposition between the developed and the underdeveloped”. She argues for moving on to "locally specific, achievable and relevant development objectives" rather than sticking to "models of development based on catching up western ideals" — an argument that is shared with others in the field (Bergquist et al., 2005; Thompson, 2005). Furthermore, many different interpretations of the digital divide concept are being used, which also makes it less useful (Furuholt & Kristiansen, 2007; Wilson 2003).

In response to these shortcomings, new frameworks have been proposed that encompass richer sets of human factors. This thesis uses Warschauer’s (2004) framework which is based on the concept of social inclusion, referring to "the extent that individuals, families, and communities are able to fully participate in society and control their own destinies, taking into account a variety of factors related to economic resources, employment, health, education, housing, recreation, culture, and civic engagement". This turns attention away from equipment and material resources and towards “the wide range of physical, digital, human, and social resources that meaningful access to ICT entails”.

Warschauer breaks down attributing factors into four distinct categories: physical, digital, human and social.

"Physical resources encompass access to computers and telecommunication connections. Digital resources refer to digital material that is made available online. Human resources revolve around issues such as literacy and education (including the particular types of literacy practices that are required for computer use and online communication). Social resources refer to the community, institutional, and societal structures that support access to ICT." (Warschauer, 2004, p. 48)

Resources from all four categories are important for a successful integration of ICT in society. Warschauer stresses that all four categories are both resources and contributors to the effective use of ICT and that the outcome of successfully integrated ICT will include an
increase of resource from all four categories. For example, physical resources include computers and electricity which are the most obvious necessities for using ICT. If hardware is put to good use there is a good chance that ICT utilization will increase with time and result in an increase of hardware — but also other social, human and digital resources.

Social resources concern social capital — as opposed to human and physical (financial) capital — referring to trust and formal and personal relationships between individuals and organizations. It is "the ability of actors to secure benefits by virtue of membership in social networks or other social structures" (Portes, 1998). Social capital can significantly influence the ability to use ICT and if properly exploited, ICT can be promoted in ways that encourage the development of social capital (Warschauer, 2004, p. 197).

Human resources refer to the population's computer experience and computer skills that enable them to utilize available hardware and software. When designing an ICT strategy it is important not only to ensure a sufficient hardware supply but also to ensure a sufficient supply of knowledge on how to utilize the physical resources. This involves capacity building and human resources — and again the resources are expected to increase as an outcome of an effective use of ICT. This means that computer knowledge is likely develop and spread wherever ICT is being used in a meaningful way.

Warschauer compares computer skills to literacy, quoting de Castell and Luke (1986, p. 374) who claim that being literate "has always referred to having mastery over the processes by means of which culturally significant information is coded". Digital resources refer to this digitally encoded information as well as the software that is required to encode and decode it. Hardware alone will clearly be of no use without relevant digital resources. For example, a computer might be perfectly functional in technical terms yet completely useless if not equipped with — or connected to — digital resources in a language that can be understood by the user. Digital resources include operative systems and software — e.g., word processing software and web browsers — but also documents and web content. Once again, an increase of digital resources (e.g., documents and web pages produced) is expected to result from successful ICT use. In the case of software, usability plays an important role which will be examined more closely in the following sub-chapter.
Since the availability and importance of various resources vary from one location to another — and from one time to another — different contexts will pose different challenges. For example, the greatest problem can be a lack of digital resources (e.g., localized software or web content) in one setting, while in another setting the greatest problem is a lack of physical resources (e.g., Internet infrastructure). Thus, in order to achieve a successful implementation of ICT it is vital to understand the preconditions of the particular context. This brings us to the primary research question of this thesis:

What are the most salient physical, digital, human and social factors affecting the success of ICT?

This thesis defines the term “success” as perceived by the actors of the targeted context, thus applying a local perspective.

As previously pointed out, resources ought not to be seen only as an input but also as an output of ICT use. This implies that successful ICT integration should result in an increase of resources (e.g., additional computers purchased and further computer skills obtained). This raises a second question that refers to the positive benefits produced in the process of utilizing ICT:

What is the outcome - in terms of physical, digital, human and social resources - of ICT use?

The final research question concerns the user’s understanding and approval of software and the potential benefits from cultural adaptation of user interfaces. As we now turn our attention towards user interfaces and human perception of computerized systems we are entering the multidisciplinary field of human-computer interaction.
In recent years, the international academic discourse concerning ICT and development has gradually shifted its focus from technology to human and social factors, curiously echoing similar development in the area of software design. As the software industry has grown more competitive, the importance of software usability has increased in turn (Nielsen, 1993, p. 9). The field of human-computer interaction is very broad and stems from the scientific discipline of ergonomics. With the shift of technology that introduced computers in the workplace, we have proceeded from physical models supporting the design of machines and work stations, to mental models supporting the design of software and user interfaces. In particular, usability engineering — the younger cousin of software engineering — concerns the design of interfaces that allow users to access available functionality efficiently (Nielsen, 1993, p. 23; Rosson & Carrol, 2002, p. 9). Both fields emerged as a consequence of the increased system complexity that advancements of computer science have made possible. While the software engineer works to structure and manage an increasingly complex codebase, the usability engineer struggles to make this new functionality, usable.

The overall aim for any system is to satisfy the needs and requirements of its users and other potential stakeholders. This is commonly referred to as the overall — or system — acceptability. Usability is only one of many components that constitute the overall acceptability and therefore it is important to view usability not only as an isolated feature but to recognize its integration in the larger context.
As seen in Figure 2 above, usability is comprised of five separate components, usually denoted learnability, efficiency, memorability, error and satisfaction, respectively. The usefulness of a system is usually attributed to its constituent utility and usability, where utility denotes whether the functionality of the system in principle can do what is needed and usability denotes whether the user is able to make use of that available functionality. A system is considered to be useful if it can be used to achieve a desired goal, i.e., if it contains functionality that someone can utilize.

Usefulness alone — however — is not a guarantee to satisfy all users. In order for a system to be practically acceptable it needs to meet additional requirements. If, for example, an application contains functionality that is useful to a certain company, it will not be a reasonable alternative if its price is too high, or if it runs on a different operative system than what is used by the company. It will not be practically acceptable. These issues might seem peripheral from the point of view of a software or usability engineer, but they are all vital for the success of a system and they must be taken into consideration during the design process (Nielsen, 1993).

Aiming to make new applications more user friendly — rather than focusing on actual functionality — developers have placed much effort in studying users and the mental models governing their understanding of software (Rosson & Carrol, 2002, p. 15). With the
The growing necessity of targeting a global audience has become apparent in that the understanding of software is highly dependent on context. Thus, different contexts bring about different software requirements. Localization and internationalization of commercial software is now being recognized as a vital factor for making a successful impact on the global market (Esselink, 2000; Kersten, Kersten & Rakowski, 2002). As an example, Collins (2002) cites the Washington Times on studies showing that retail customers are up to as much as three times more likely to purchase products from websites that use the customers’ native languages.

Localization involves adapting software to different languages (linguistic localization) and regional differences (including date, time and currency formatting). Many experts in the field, however, argue that mere localization is insufficient in providing universal acceptability (Keniston 1997; Barber & Badre, 1998; Sun 2004; Vöhringer-Kuhnt, 2002; Reinecke & Bernstein, 2007). There is presently a broad consensus within the interaction design community that culture is an important factor influencing usability and user satisfaction. Thus, it is reasonable to assume that an interface designed for a certain culture is likely to be less suitable to members of other cultures. This makes the process of interface design more complicated since there might not be a single universal design that is optimal for all users. Abandoning the ordinary localization approach, new methods (e.g., cultural localization and cross-cultural design) are proposed for adapting software across the globe.

In their paper entitled Culturally Adaptive Software: Moving Beyond Internationalization, Reinecke and Bernstein (2007) propose a method they call culturally adaptive interfaces. This approach involves automatic acquisition of details concerning the user's cultural identity during system interaction and subsequently adapting the interface. During the field work, however, Reinecke and Bernstein applied a more conventional approach using an iterative development process. The paper describes the authors’ efforts of designing and implementing software that was to be used by agricultural advisors in Rwanda. It concludes that:

"[The Rwandans] could not optimally use the software in terms of information perception and handling. [...] Difficulties emerged..."
from too much freedom in the choice of functionalities: Rwandans, who learn to strictly follow instructions from a young age, seemed to be overwhelmed by the range of functionalities available in the software. […] A playful arrangement of constituents, allowing for explorative behaviour, and a colorful user interface with a realistic appearance, were further adaptations that were needed for reconciling the software with the target culture. After these extensive circular adaptations to the cultural frame of Rwandans during a time span of approximately five months, evaluations finally fulfilled the expectations of improved usability and a reduction in time required for familiarization with the software.” (Reinecke & Bernstein, 2007)

Unfortunately, the methods used to produce the above results are questionable; e.g., it is not clear if Reinecke & Bernstein did use a control group or if the same group of people was used over and over throughout the circular adaptations and that the five months of repeated interaction might have caused the increased efficiency.

Nevertheless, Reinecke and Bernstein’s work in Rwanda calls for further investigation on how usability relates to culture. Returning to the primary research question that concerned factors influencing the success of ICT use, we now come across an unexplored area where aspects of culture, usability and development intersect. Given that digital resources are vital for successful ICT use and that digital resources include usable software, there is good reason to examine the influence of culture on usability within a development context. In doing so, we bring together the fields of ICT for development and cultural usability, reaching the thesis’ third and final research question:

*How does localization and culturally adapted interfaces impact the success of ICT use?*

Having framed the three main research questions, it is time to properly delimit the scope of the study.
3. Scope and Limitations

In the introductory chapter of this thesis the main research objective was expressed, i.e., to identify and examine the most salient factors concerning the application of ICT within a rural development context. The previous chapter presented related theories and motivated the use of a framework based on the concept of social inclusion. Comparing the discourses surrounding the so called digital divide and the field of human-computer interaction a rationale was provided for giving special reference to the impact of cultural adaption on software usability.

The strong development focus originates from the complex of problems that have hampered previous ICT initiatives in third world countries. Concerning appropriate spatial limitations, the desired development context offers a multitude of possible geographic settings. Tanzania was chosen as the host country for a number of reasons. For one thing, it is among the poorest countries in the world (United Nations Development Programme [UNDP], 2008), ranked at 159th place out of 177 countries in the *Human Development Report 2007/2008* (Watkins, 2007). Another important point that makes Tanzania a strong candidate is the fact that it is a peaceful and politically stable democracy. Apart from being highly practical, a politically stable location screens off undesired influences from tribalism, war, armed conflicts, etc, that otherwise might dilute the research.

There are also additional arguments for selecting Tanzania, besides scientific accuracy. Tanzania receives high amounts of economic aid — including ICT assistance — which makes it meaningful to assert an efficient transformation of support into benefits. The study was conducted in cooperation with the Mavuno Project — a non-governmental organization (NGO) that receives economic aid from various foreign organizations in order to promote community development through its various programmes (Mavuno, 2008a, 2008b). Situated in the Kagera region, west of Lake Victoria, the organization maintains a strong local focus operating exclusively in the villages of Bugene, Ihanda, Rukole, Chonyonyo and Mabira of the rural Karagwe district. Comprehensive descriptions of Mavuno, Karagwe and Tanzania are presented in the chapter 6.1.
This study is further limited to the organization's work to provide community development using the definition given by the Federation for Community Development Learning:

“Community Development is the process of developing active and sustainable communities based on social justice and mutual respect. It is about influencing power structures to remove the barriers that prevent people from participating in the issues that affect their lives.” (Federation for Community Development Learning, n.d.)

As the scope is limited only to include the work of the host organization it is implied that it does not stretch to concern neither public nor private sector use of ICT. Although both private and public ICT access relate to community development they are beyond the scope of this study.

The time scope was set to the duration of the field work, i.e., January through May, 2008. This was due mostly to practical considerations — the period of time needed to be long enough to provide reliable research data while remaining financially viable. Possible extrapolation, in terms of time and space, of the findings and conclusions are described in the Discussion chapter.

In order to explore the research questions within the limitations specified above appropriate methods for gathering data are required. The next chapter motivates and describes the methods used.
4. Data Collection and Methodology

The choice of methods was based on the need to meet two basic objectives — the first being that of gaining access to the actual research setting. Mavuno employs strict considerations before granting an individual permission to enter the organization and always assess the potential working contribution of an individual based on his or her knowledge and experience. Hence, it was necessary to contribute a fair amount of work in order to gain access to the setting. The second objective was that the method should provide a way to examine how Mavuno utilizes ICT in its work given the particular conditions and circumstances presented by the setting.

To best meet these objectives, the method of participant observation was selected. This seemed to be most likely to grant access to data in the targeted setting. In addition, the method of participant observation promised — and proved — to uncover valuable bits of information that could not be attained otherwise. It was by working closely together with the people at Mavuno that the discovery of the study’s key findings was made possible.

I decided to use an open approach where I informed the people I was working with about the nature of the study and kept recording equipment (digital video camera and mp3-recorder) visible while in use; a decision based on ethical and practical considerations. It would not be fair to lie or retain information from Mavuno in order to hide the fact that I was conducting research within the organization. Furthermore, I predicted that I might need to actively involve members of the Mavuno staff during later stages of the field work, e.g., for enquiries, questionnaires, etc. Still, I tried my best not to let my research affect daily activities while keeping to Cato R. P. Bjørndal’s main rule of having the main purpose of the observation clarified, understood and accepted by the people involved (Bjørndal, 2002, p. 45).

Hence, my roles at Mavuno were both that of the volunteer and that of the ethnographer. In the eyes of the Mavuno employees, however, the volunteer role was undoubtedly dominant.
During my stay with Mavuno I served as an all-purpose “computer expert” and I was given a multitude of computer related tasks. This included everything from providing general advice and purchasing equipment to repairing and installing printers, assembling computers, setting up local area networks and designing and implementing a web based database system. The general nature of my work allowed me to come across a very wide range of problems and it provided me with a good overhead view of Mavuno’s current situation. Working together with the permanent work force I was given the opportunity to learn how Information and Communication Technologies are integrated into the everyday work and activities of non-governmental organizations, such as the Mavuno Project. I was regularly confronted with problems that I had not previously been familiar with, and through careful observations I gained an understanding of the many challenges that this setting presented for a successful use of computer hardware and software. Results were mainly obtained from first-hand experience and through interviews with the Mavuno staff and volunteers. Interviews with the Mavuno staff, which had ample experience of the situation at hand, provided accurate accounts of past and present challenges to the organization. Volunteers, on the other hand, had naturally attained rather limited insights from their brief or sporadic encounters with Mavuno. Their accounts, however, were also very valuable since the volunteers were able to view the organization from outside perspectives. Finally, interviews with Stephen Kileo from Chema, a prominent NGO in the neighboring hamlet of Omurushaka, offered regional comparisons to Mavuno’s work.

The method of participant observation required me to recognize the fact that my work as a volunteer and my work as an ethnographer were both part and parcel of the social world under investigation. A participant observer is not isolated from the setting and, therefore, one must never forget to account for one’s own presence and participation as central elements during all observations. This reflexivity is crucial in all ethnographic work and it draws on one characteristic feature of human social life – our ability to view ourselves and our practices as objects in the world, and from different perspectives (Hammersley & Atkinson, 1994, p. 234).

My daily routine usually consisted of conducting work for Mavuno during the day time while taking notes on interesting or peculiar events, and writing up these notes along with
additional reflections in a field journal during evenings and other spare time. Events were usually written up in the field journal the same day or the day after they occurred but sometimes there could pass a number of days before notes were written up. Depending on the nature of work I was involved in at the time there could sometimes pass quite a few days without any notes being taken (e.g., while working with web development alone), and other days a large amount notes could be taken during a short period of time (e.g., when giving the students at the Mavuno Technical Centre their computer exam).

The purpose of writing the field journal is to attain a deeper understanding of past events through written reflection which facilitates an inner dialogue (Bjørndal, 2002, p. 62). Without the discipline of tedious note taking and journal writing, events will fade from memory and this might result in an incoherent and muddled ethnography (Hammersley & Atkinson, 1994, p. 150). Additionally, I found that written reflection — whether for the field journal, through the mail correspondence with my thesis supervisor or writing the draft for this document — was helpful in establishing a distance from the data and an estrangement to the setting that enabled me to carry out the ethnographic work (Hammersley & Atkinson, 1994, p. 212-213).

The main drawback of the chosen method is that the results can not easily be extrapolated to other locations or over time. The conditions that form one setting can not with certainty be said to exist elsewhere, unless a similar study has been conducted there. These conditions also change with time, reflecting the dynamic nature of human social practices and making predictions of the future complicated.

This field study utilizes a wide focus in order to capture a broad spectrum of factors attributing the use of ICT. This approach is useful in identifying the most critical factors and obstacles, and it offers sufficient flexibility to examine them in detail. The main advantage of this method, like all qualitative research, is that it provides a close view of the target phenomena. By participating in daily activities over an extended period of time, the researcher can receive valuable insights into the social practices of the targeted setting and gain a proper understanding of the causality and correlations that underlie statistical data. Quantitative research may well be rendered inconclusive — or incorrect — if the
knowledge of the social context is lacking or superficial. Once an appropriate assessment of the situation has been made, relevant hypotheses can be formulated.

In conclusion, the participant observer method provides the most suitable approach for the kind of qualitative research that the thesis requires. It produces a detailed understanding of the targeted setting, and thus, it is a good basis to direct further work and research concerning the use of ICT for development.
5. Implementation and Data Extraction

Working together with Mavuno did provide the research material necessary to answer the thesis’ three research questions and the findings from Karagwe did contradict many of the assumptions made during pre-field work and preparations. The field work, which was carried out during a period of approximately four months, forced me to abandon some of my preconceived notions and offered new perspectives on the interplay of ICT, society and culture, guiding the research in new directions.

As I left the university, heading for Tanzania, pre-field work and related academic literature had prepared me to see technology as a cultural utility rather than a neutral resource that can be exploited by human beings equally across cultural boundaries. Thus, I began my field work with a determination to identify and describe cultural peculiarities affecting the use of ICT in Karagwe. Yet, contrary to my expectations, I did not find that the difference of culture was reflected by significantly different patterns of ICT use.

During my first week after arriving at the Mavuno grounds I was assisting the local computer teacher in drafting a computer exam for the students at the Mavuno Technical Centre. Having previously supervised computer courses in Sweden I saw this as a great opportunity to explore how attitudes towards technology and education differ between the two contexts. Assuming that separate cultures values different aspects of knowledge and favour different pedagogic methods I expected to make some interesting findings particular to the Karagwe context.
I began my work by interviewing the MTC teacher in order to gain an understanding of the overall aims and objectives of the course. As it turned out, however, the course had not been designed by the teacher from Karagwe, but by German volunteers who had also carried out most of the tutoring. This meant that no culturally significant information could be drawn from the design of the course since, naturally, the exam would follow a German/European design. Instead, I sought to extract vital clues regarding cross-cultural ICT understanding by observing the MTC students closely as they were confronted by various tasks during the exam.

For practical reasons (resulting from a lack of computers and electricity) the students took the practical exam one-by-one which provided me with a good opportunity to observe the students as they attempted to solve numerous computer related tasks. This resulted in approximately ten hours of audio and video recordings and a great deal of notes detailing
the students’ — and the teacher’s — ability to master the basics of computer hardware and software.

A few rather interesting findings were made during the exam (e.g., a consistent inability to perceive the alphabetic ordering of Microsoft Word’s font combo box) but what was really striking was in fact the lack of observed peculiarities attributable to the culture or context. Nonetheless, I was determined to keep on searching for ICT issues related to culture and context in my coming work at Mavuno.

Following the supervision of the computer exam I was shortly handed my next major assignment. Mavuno’s needy children programme is an initiative aimed to reduce poverty and foster development locally by providing children in the nearby villages with basic material and medical assistance. A vital part of this work involves keeping track of the children under Mavuno support by maintaining records detailing the children’s family situations and material needs. Mavuno decided to have me design and implement a system to store records digitally rather than on paper, which had been the case until then. By using a computerized system, the organization was hoping to make administrative work more efficient, storage of the records safer and to improve the programme’s ability to secure financial support from foreign donors.

I found the assignment to be a moderate challenge that would offer new ways to study Mavuno’s use of ICT for its administrative work. From previous experiences developing information systems in Sweden I knew it to be critical to gain a thorough understanding of the customer’s needs and expectations. The key to learning what features are desired lies in understanding the context in which the software will be used — a principle that underlies the user-centered design philosophy.

Given that different contexts bring about different conditions for the optimal use of software — thus producing different software requirements — I found it reasonable to assume that I would be able to determine some aspects of the software requirements attributable to the context during the software development process.
Using the participant observation strategy I began collecting data both for the system design and for the ethnographic research. This involved interviewing select members of the Mavuno staff, although I spent most of my time learning about the programme visiting numerous primary schools throughout Karagwe. I also had Philemon Joseph, who was in charge of the needy children programme, write user stories for the proposed system. By working together with Philemon for a couple of weeks, I gained sufficient understanding of the needy children programme and what software was actually required. At this stage, the design of the user interface and the construction of the database schema was rather trivial.

What was striking about the observations was once again a lack of issues attributable to the context. Although the context did influence the software design (e.g., postal addresses were represented differently and there were stricter restraints on bandwidth use), it never caused any major implications for the design of the system. There were no usability issues.
motivating design decisions that would have been any different had the system been
designed, e.g., for Swedish clients.

For the remainder of the field work I was in charge of maintaining, purchasing and
installing computer and networking equipment, though most of my work consisted of
supporting the Mavuno staff whenever they ran into technical problems. The technical
problems usually involved installing software, drivers and operative systems or getting rid
of viruses and other malware. These are basically the same computer issues that I find
myself helping colleagues, friends and family with in Sweden, and they can hardly be said
to arise from a separation of cultures.

Confronting my pre-field work assumptions with the experiences in Karagwe I gradually
began realizing that the issue of culture was not a critical factor in the Mavuno context.
Although I do not share the cultural background or belonging of the people that I was
working together with in Karagwe, this cultural separation was not reflected by
significantly different usage patterns, objectives or modes of interaction. In fact, my
experiences from the field work suggest that it is more accurate to view the challenges of
understanding ICT as human-computer issues rather than as culture-culture issues. Issues of
cultural belonging and cultural background were also dwarfed by social factors — most
notably education and computer experience.

During the course of the field work, I therefore shifted the focus of the research more
towards the physical, digital, human and social factors that make up Warschauer’s
framework (see chapter 2.1), gathering data first-hand working with the Mavuno stuff and
through interviews. When I reached the end of the field work in May, I had interviewed
plenty of community development workers and volunteers and recorded numerous hours of
audio data to base my results on.
6. Results

This chapter details the findings made during field work. The initial sub-chapter provides some general information concerning the overall situation and the technological preconditions of the setting — i.e., Tanzania and the Mavuno Project — in order to give the reader a better view of the research context. In the following sub-chapters, each of the four categories of ICT resources are accounted for, reconnecting field data to the chosen theoretical framework and the main research questions (see chapter 2).

6.1 Setting

6.1.1 Tanzania

Tanzania is located in East Africa, by the Indian Ocean. It borders to Burundi, Democratic Republic of the Congo, Kenya, Malawi, Mozambique, Rwanda, Uganda and Zambia and has an area of 945,087 km² (Central Intelligence Agency [CIA], 2008). The United Republic of Tanzania was formed in 1964 with the merging of the former colony of Tanganyika, on the mainland, and the former Protectorate of Zanzibar, shortly after they achieved independence from Britain (CIA, 2008; UNDP, 2008). One-party rule came to an end in 1995 with the first democratic elections held in the country since the 1970s (CIA, 2008). Tanzania remains one of the most politically stable countries in sub-Saharan Africa (UNDP, 2008).

Following the independence in the early 1960s, President Julius Nyerere begun enforcing Ujamaa — East-African socialism — throughout the nation. Swahili was introduced as a second national language and taught in all primary schools in order to unite the population. During the late 1970s Tanzania suffered an economic crisis that prevented the state from financing basic social services (UNDP, 2008). The continued failures of the socialist economy eventually made a shift towards more liberal politics inevitable, which effectively ended the Ujamaa.
Since then, Tanzania has undertaken many steps to transform the formerly socialist economy into a market oriented economy, including the liberalization of prices and markets, the divestiture of government interests in commercial activities, increased participation of the private sector in utilities and improvements in the business environment. Still, Tanzania remains among the poorest countries in the world (UNDP, 2008). It had an annual per capita income estimated at US$390 in 2006 (UNDP, 2008) and according to the Human Development Report, Tanzania is ranked at 159\textsuperscript{th} place out of 177 countries (Watkins, 2007).

The economy depends heavily on agriculture, which accounts for about 45.7\% of the gross domestic product, provides 85\% of exports, and employs 76.5\% of the work force. Growth in the agricultural sector continues to decline and, according to the UNDP, the rate of growth for this sector, which affects 81 \% of Tanzania’s poor, grew by only 4.1 percent in 2006, and they declare that this must improve if poverty rates are to reduce. (UNDP, 2008)

In 2005, the proportion of the population below the national food poverty line was estimated to 19 percent, while 36 percent of the population were living below the national basic needs poverty line. In 2006 the Tanzanian population was estimated to 35 million and the life expectancy for people born that year was estimated to 52 years. Progress in poverty reduction has been relatively fast in urban centers compared to rural areas. Much of the growth between 1991/92 and 2000/01 did not translate into poverty reduction. In other words, the growth process was not pro-poor. Rising inequality has to be arrested as it undermines pro-poor growth and poverty reduction (UNDP, 2008).

In Tanzania, like in most East-African countries, there is an acute shortage of electricity which affects a major part of the industry and society. Frequent blackouts are hampering the use of equipment that requires a steady supply of electricity, including computers (Energy Sector Management Assistance Program, 1998). In Tanzania mainland, the national electricity transmission grid is maintained and regulated by the governmental Tanzania Electric Supply Company (Tanesco) that is responsible for the generation, transmission, and distribution of electricity. Tanesco has long enjoyed a position of national monopoly which, until recently, has been characteristic for the electricity industry in
eastern Africa. This is thought to be a large contributor to the under performance of power generation and supply in the region.

In 2002, Tanzania had a National Electrification level of only 10% and power was only available for a privileged few. In fact, all East-African nations — with the exception of Mauritius — did record national electrification levels of 10% or less. This is very low compared to other developing regions such as Asia and Latin America, where many countries record an electrification level as high as 70% (Karekezi & Kimani, 2005).

Unfortunately, recent East-African power sector reforms have had none or little positive impact on rural communities in the region. For the last 10 years, no significant changes to electrification levels have been registered in Kenya, where less than 1% of the rural households have access to electricity (Karekezi & Kimani, 2005). In Tanzania, around 2% of the rural population have access to electricity (Programme for Basic Energy and Conservation, n.d.).

**6.1.2 The Mavuno Project**

The Mavuno Project (Mavuno) is a grassroots non-governmental organization that operates in the Karagwe district in the Kagera region of north-west Tanzania — bordering Rwanda in the west and Uganda in the north. The tribal language of Karagwe is Kinjambo but Swahili is the language most widely spoken. Command of English and other foreign languages is rare. Mavuno was founded in 1993 with the aim to provide services to facilitate community development in the five villages of Bugene, Ihanda, Rukole, Chonyonyo and Mabira. During the field study in early 2008, Mavuno had between 200 and 300 members who reside in those villages, supporting the organization economically. The majority of the members hold small plots of land for cultivating different crops and keep livestock for their livelihood.

The constitutional objectives of Mavuno are to engineer a sense of duty in the members to realize their role in the society and act in uplifting the standards of rural families by improving the status of their holdings. The structure of the organization is composed by a general assembly, a board, an advisory committee, a chairperson, a project manager, a
secretary, an accountant, extensionists and a patron. Their purpose is to ensure the long-term improvements as stated in the Mavuno Constitution.

Mavuno employs numerous approaches to realize these aims of rural development. Currently, the organization focuses its efforts on the operation of programmes within the fields of water supply, education, agriculture, entrepreneurship and support of poor children. The organization has previously been operating other programmes concerning HIV awareness, women and youth development and sanitation, etc.

During the time of the field study four rain water harvesting tanks were constructed in collaboration with Engineers Without Borders Germany and water tank engineers from Kenya. The construction of water tanks involves three stakeholders: Mavuno supplying communication, management and expertise, local villagers supplying labour and external donors supplying funds for materials. Availability of these tanks efficiently eases the living conditions of poor people who otherwise have to walk long distances to get the water they need for their daily use.

The Mavuno Technical Centre (MTC) was founded in 2006 as a response to the problems of lacking human resources in the villages. In Karagwe there is no education available beyond secondary school causing a flow of people and know-how from the villages to urban areas, consequently stripping the district of knowledge and competence. The aim of the MTC is therefore to teach people technical skills and entrepreneurship that hopefully will be used to start up successful, small scale business ventures.

Another important area of work is spreading awareness of the benefits of organic agriculture and sustainable use of natural resources. Through seminars and workshops, villagers are taught how to plan the use of their plots in order to maximize returns. Farmers are encouraged to keep small animals that provide them with manure and are taught how to grow and use natural pesticides, rather than to rely on chemical fertilisers and pesticides purchased from outside the district. In this way, revenues generated from selling an abundance of crops will remain in the area. Furthermore, people are encouraged to plant and grow trees to preserve moisture and nutrition in the soil and, in the long-term, to combat the emerging desertification and the danger of drought and famine it brings.
The Mavuno Small Crediting Scheme was launched to support families, entrepreneurs and small scale businesses in the area. People who are normally not considered to have sufficient security to take loans from regular banks can borrow small amounts of capital, up to a maximum of 500,000 Tanzanian shillings, which are usually used to pay school fees or to sustain and develop their enterprises. Loan takers are usually organized in groups, which improves security and eases administration.

Although primary education is provided by the government free of tuition fees, poverty in the Karagwe district still prevents many children from attending school. Families don’t always manage to provide the school uniforms, shoes, exercise books, pens, pencils etc. that their children require and some children are orphans and live under very poor conditions. Mavuno works to locate and support these children by supplying necessities for school. Other things that they need at home, such as medicine, mosquito nets, soap and toothpaste, are provided as well.

In conclusion, Mavuno’s primary concerns are to serve the community by supplying access to fresh water, education, sustainable agriculture, micro credit financing and support of poor children. These issues are considered to be fundamental prerequisites before any further development can take place. With the above programmes established and operational, Mavuno is turning its attention to Information and Communication Technology as the next step to promote further development in the local area.

The proposed launch of a small Internet café later this year demonstrates Mavuno’s ambition to serve as a public access point for the local community. Mavuno anticipates that the Internet café will primarily be used as a center of communication, especially for emailing. Secondly, it is expected to be used as a library or information hub where the local population can find the information that they need. Since most of the Internet café visitors are expected to have very little, if any, knowledge of computers and English, Mavuno plans to permanently employ one of the graduates from the MTC to assist and educate the customers.
In addition to the Internet café, Mavuno plans to use their satellite Internet connection to connect a nearby school and possibly some local businesses. By sharing the connection, Mavuno will be able lower their expenses and further integrate ICT in Karagwe.

6.1.3 Present ICT use

Mavuno relies on ICT for most parts of its administrational work. It works closely together with other groups and organizations throughout the world — especially in Europe — that contribute to various projects economically and by sending volunteers. Other work, such as the small crediting scheme, is not as dependent on communication with the outside world but relies on ICT to keep computerized records. Over time, email has come to replace regular mail and telephony as the primary means of communication, and it is now an integrated and essential part of the daily work at Mavuno.

The Mavuno Project uses computers in various ways for external communication and to make their administrative work more efficient, reducing the time of reaching their development plan goals. One of the important areas of ICT use at Mavuno is to document and store information. For the small crediting scheme, this includes keeping records of day-to-day transactions, payments and receipts as well as customer information. Other areas of work, such as the construction of rain water harvesting tanks, also rely on computers for documentation. Computers have proven to be good in preserving information that was previously exposed to rain water in leaking offices.

Although documentation could also be done by hand, ICT reduces the amount of work and makes the information more easily accessible. Improved access to information is useful for people who join Mavuno’s work at later stages, especially volunteers. This enables them to obtain the information that is required to get involved in the work. Access to information has also been beneficial to the public. When people come to Mavuno with questions, ICT makes it is easier to find the information that they look for.

Furthermore, Mavuno uses ICT to search and retrieve information from the Internet that is useful to the organization. This especially concerns agriculture and animal keeping; for example, the staff have found simple and reliable methods to check whether eggs are
fertilized or not. The volunteers also rely on Mavuno’s Internet connection to find important information for their reports and evaluations.

During the field study, one of the volunteers was responsible for evaluating a proposed project aiming to provide food security in Karagwe. The Mavuno Seed Security Project included storing, marketing and trading crops harvested by the local farmers. This required price and market information to be retrieved from remote places. Using the Internet, up-to-date information was acquired in a swift and cheap manner. Another example is when one volunteer was evaluating Mavuno’s micro crediting scheme. Using the Internet, he was able to read about and compare crediting schemes from other organizations in various countries.

For Mavuno, communication over the Internet has proven to be considerably faster and more reliable than conventional postal delivery services. Before the organization began using computers in 2000, all documents, reports and proposals were sent to donors and other interested parties via standard mail. Using the Internet, Mavuno can send and reply to emails within one day, which previously could take up to one month. In addition, Mavuno occasionally used the connection to communicate over Skype, a software application that enables free voice chat over the Internet.

The Internet does not only increase the efficiency of communication. Since many donors and sponsor organizations in Europe and America have switched to Internet-based communication this requires their partner organizations to adapt accordingly. Therefore, ICT is crucial for Mavuno to establish partnerships, exchange information and to stay in contact with their partner organizations. Reports and evaluations are shared through the Mavuno website, www.mavuno.net. ICT is also used to get in contact with volunteers and to prepare them before coming to Karagwe. In addition to their above mentioned tasks, the volunteers also use the Internet to communicate with their respective home organizations, families and sponsors.

The process of producing letters, using type-writers or writing by hand, used to be more cumbersome and time consuming than writing emails on the computer, especially since there previously were no photocopy machines in the area. And, although computer
equipment, electric power and Internet connectivity is expensive, the use of computers has enabled Mavuno to reduce other administrational expenses; e.g., costs from purchasing type-writers, files, papers, envelopes and stamps etc.

Computers are also used to a lesser extent for playing music. Music is sometimes played for leisure during work, and occasionally to entertain guests during larger meetings and gatherings.

6.1.4 Future ICT use

Apart from the current ICT benefits that are mentioned above, Mavuno places great confidence in information technology and the Internet for its potential to promote future development in Karagwe. Although the organization primarily works to ensure access of basic needs (e.g., supply of fresh water), ICT is considered to be vital for many aspects of community development, especially in rural areas. As basic material necessities are gradually becoming more and more available to the community, focus shifts towards new objectives that promote sustainable development through knowledge, information and education.

As for administration, Mavuno is pleased with the way in which computers have improved their work and there are plans to extend the use of digital equipment in the future. Among these are plans to equip the five new offices with a computer each, following Mavuno’s relocation to the recently constructed office building. The agriculture programme includes records of farmers involved in various projects and contributions and support from Mavuno and external donors. Another plan is to computerize records for the agriculture programme and the needy children programme and yet another potential benefit of ICT is for the operation of Mavuno’s micro crediting scheme, see the Digital Resources chapter.

Still, the greatest expectations for ICT rest with the Mavuno’s proposed public Internet café. The Internet café is envisioned as a means to help people improve their own living conditions and to facilitate development. Hopes are that, using Mavuno as a central node of information and communication, it will enable the local population to empower themselves
by connecting to the outside world. Mavuno believes that a well informed society is capable of improving its own situation and that proper information will help people.

In order to make the Internet café a reality, a reliable Internet connection must be maintained. Mavuno plans to share its satellite Internet connection with an English medium school in the area, using a micro-wave radio link, to make the dish more affordable. Since the purpose of the connection is to help people develop, connecting more local organizations is well in line with the Mavuno’s overall objectives.

The Internet café is expected to primarily be used for email communication. Secondly, it will be used as an online library where people can retrieve information that is of value to them. Chema — an NGO that works closely with Mavuno — has experienced that lots of people — students especially — have benefited much from the public Internet café that it runs in the neighboring hamlet of Omurushaka. Students, who occasionally crowd the café, are able to obtain their school results and find out whether they are accepted to universities or not, saving them expensive and time consuming travels. A lot of students also come to download forms to apply for universities and schools. Mavuno believes that their proposed Internet café will support local students in the village of Ihanda the same way that Chema’s Internet café does in Omurushaka.
Stephen Kileo — coordinator of the Chema programmes — is confident that people in Karagwe need to see and be aware of other parts of the world in order to adapt and develop. Most of the population is dependent on agriculture, but even farmers can improve their lives using ICT. Kileo believes that farmers would only need to spend around half an hour every day, keeping records about their activities, to improve the efficiency of their work. Another NGO that works within the district, SCC VI Agroforest, encourages farmers to think of managing their plots not just as chores — but as running small business enterprises — and teaches them how to benefit from planning and specialization.

Mavuno believes that by using ICT they will be able support farmers like Chema, SCC VI and other NGOs have done before them. Farmers who are dependent on marketing to promote their products can use ICT to communicate with consumers. Mavuno is currently promoting organically grown crops from Karagwe for sale in cities within and outside of
the Kagera region. ICT provides the producers with access to valuable market information which includes prices of crops in, e.g., Dar es Salaam and Mwanza. By making the farmers aware of prices in other cities, they can adjust their prices according to the outside markets and thus increase their profits.

So far, the major benefit of Chema’s Internet café for the local population is that it has enabled farmers to learn more about certain crops and new techniques to apply on their own plots. Since most of the people in the Mavuno area are familiar with agricultural activities and animal keeping, Internet access is expected to help farmers improve their practices by comparing and sharing experiences with other people.

Mavuno believes that a lot people in the villages will be able benefit from using computers at a public access point in Ihanda. Charles Bahati, who is the Mavuno Project manager, explains that parents, for example, might want to use the Internet to find information about good schools for their children to attend. He adds that the Internet also has great potential for spreading HIV information and that it will benefit youths who will grow up to be familiar with the technology.

Mavuno plans to provide the needy children under its support with regular access to the Internet café free of charge. For other people, a small fee of 500 or 1,000 Tanzanian shillings will be charged to make the project self-sustainable. The objective is not the make profit from the café but only to have the revenues cover expenses for Internet and electricity so that no external inputs are needed to keep the café running. Joseph Baraka — who manages Mavuno’s micro crediting scheme — believes that although only a few people might come to use the Internet café at first, more and more people will eventually come as rumors about its benefits start spreading by word of mouth. He believes that the Internet will spread like television once did. Initially, people used to travel to the hamlet of Omurushaka and pay 500 shillings to watch a game of football, especially during the world cup. Eventually, the increasing demand for television would help extend the electricity grid into the villages.
6.2 Physical Resources

6.2.1 Electricity

The Mavuno Project site is located in the remote village of Ihanda which was not connected to the national electricity transmission grid until March 2008. Prior to this, Mavuno relied on solar power generated by panels mounted on the office roofs. The solar panels were not always sufficient for powering all of the equipment, especially during rainy or cloudy weather. The Mavuno Project manager, for whom electricity is most vital, was able to maintain a constant power supply by using a separate set of batteries. Other staff members usually had many different working assignments, not all of them requiring electricity, which meant that they were not left idle during power outages. Sometimes though, lack of power would make the work stack up and cause inefficiency in the workflow.

The main problems arose for the volunteers who required electricity and computers for writing their reports. The power situation was forcing them to better manage the time they spent using the computers by first writing paper drafts of reports that they could quickly enter into the computer at a later time. The lack of electricity also limited the amount of work that could be completed within a day.

When electric power is not sufficient it is important to mind the power consumption of the equipment. Mavuno has taken steps to lower its power consumption by switching from desktop computers and CRT screens to laptops and LCD screen that are more power efficient. In addition, one should keep in mind that computers with high frequency CPUs usually consume more power than computers with low frequency CPUs. There are also CPUs designed especially for low-power environments, e.g., the Intel XScale that can run at 600 MHz using only half a watt of power — just a fraction of what most modern CPUs consume. When purchasing computers to be used in this kind of environment, it may also be a good idea to look for labels indicating that the equipment meets some energy efficiency criteria, e.g., U.S. Environmental Protection Agency’s (EPA) Energy Star program, 80 PLUS, and Climate Savers Computing Initiative (CSCI). Such labels are often
used to ensure the presence of energy-saving features that turn off the power or switch the system to a low-power state when inactive.

Unfortunately, being connected to the Tanesco grid is not a guarantee for constant access to electricity. In Karagwe, grid power is very unreliable, especially during thunderstorms and rainy weather, and sometimes Tanesco switches off the electricity during weekends for maintenance or to connect new customers. In addition, frequent power failures in the transformers that connect Karagwe to the national grid are causing further problems. Still, Karagwe is better off than many other parts of the country. Tanzania suffers from an acute power shortage and this is especially affects urban areas where the electric capacity is insufficient to meet the demand.

During the early stages of this field study, the Richmond Development Company — that promised to supply Tanzania with ample electricity — was exposed as a fraud. The unfolding of the Richmond scandal caused President Jakaya Kikwete to dissolve the entire Cabinet following the sudden resignation of former Prime Minister Edward Lowassa. A committee appointed to investigate the Richmond affair had found that the $170 million contract had been given to the Richmond Development Company in spite of the advice from the Tanesco technical committee that had evaluated eight companies that tendered to supply power. In fact, it was found that the Richmond Development Company had the most shortfalls of all eight companies and that the decision to go ahead with the signing of the contract had been a product of a substantive amount of political pressure exercised by Mr. Lowassa (The East-African, 2008, February 11-17).

In April 2008, additional media attention was drawn to alleged embezzlement of public funds with regards to the Tanzania power situation when a member of parliament openly criticized former President Benjamin Mkapa for secretly purchasing the Kiwira Coal Mine Company. The United Nations Development Programme (UNDP) states, however, that Tanzania has progressed in its struggle to fight corruption, now being close to the international average. UNDP attributes this progress to good governance of President Kikwete, former President Mkapa and the national anticorruption strategy (UNDP, 2008).
Although Mavuno could not rely on the Tanesco electricity for a constant supply of power, the combination of solar and grid electricity was sufficient to operate the equipment. Mavuno is planning to extend their solar panel array in the future to provide a secure backup solution for the new computers that will be purchased for the Internet café.

In addition to the unreliability of the supply, the power grid suffers from occasional voltage spikes that are harmful to digital equipment. Therefore, stationary computers and computer screens require line regulation from uninterrupted power supply (UPS) units for their protection. This is an important concern when purchasing and installing computer equipment. Apart from protecting sensitive equipment from burnouts, the UPS unit is equipped with an internal battery that buffers the electric power so that work can continue for a short time even during temporary power cuts. UPS units are generally not required for laptop computers that come with external AC/DC adapters and internal batteries that regulate and buffer the electric power.

6.2.2 Internet Connectivity

The Mavuno Project is dependent on Internet connectivity for administration and communication. When I arrived in January 2008, Mavuno was accessing the Internet through a fixed microwave radio relay connection. The microwave radio system formed a link between Mavuno and Fadeco — another NGO in Kayanga, approximately 5 kilometres away — using two directed antennas on the office roofs. Fadeco was connected to the Internet with a satellite dish.

Compared to European standards, this connection was very slow but it did provide necessary bandwidth for an organization like Mavuno to conduct its work. Apart from administrative use, Fadeco was running a small Internet café, which meant that during working hours a lot of people were usually sharing the bandwidth. Mavuno experienced an increase of speed during evening hours which was used to download larger documents and applications, and occasionally communicating over Skype. Skype is a software program that allows users to make calls over the Internet to other Skype users free of charge, and to landlines and cell phones for a fee. With a little bit of patience, and by adjusting their usage patterns, the Mavuno staff managed to cope with the low bandwidth.
The European volunteers, who were used to high-speed Internet, were less satisfied with Mavuno’s low bandwidth connection. They were forced to adapt by planning ahead and adjusting their way of working with the Internet. The multi-tab browsing that can be done with faster connection was not possible, which meant the volunteers had to refrain from clicking too many links at a time. Even though there were no situations where the Internet connection stopped the volunteers from working completely, various tasks, e.g., uploading news articles and pictures, took longer time than they were used to. Usually, when sending files, they would just click the send, or attach, button and leave the computer for some time as it was uploading the data.

Sending larger files through HTML forms, used by most web-based email services, proved to be problematic because the upload could fail without giving any feedback indicating that the file transfer had been discontinued. It was therefore sometimes necessary to split large ZIP files into smaller files and to reduce the quality of pictures. The full quality pictures would be brought back to Europe later when the volunteers returned.

Unfortunately, sharing the Fadeco Internet connection proved to be a very unreliable solution. Fadeco was depending on electricity from Tanesco, which meant that whenever they experienced a blackout, Mavuno’s Internet connection broke down. The fact that the UPS device installed at Fadeco required to be restarted manually after each power cut made matters even worse because there were not always people present at Fadeco who knew how to flip the switch. In fact, a constant lack of technical know-how at Fadeco kept Mavuno offline for, all in all, approximately half the duration of the field study in 2008. Interruptions of the Internet connection could range from a few hours and up to several weeks.

The Fadeco problems came unexpectedly and caused expenses from gasoline and Internet café fees for accessing the Internet, which had not been budgeted for. These financial problems, together with an ambition to connect more people in the rural areas, led Mavuno to investigate other possibilities of gaining access to the Internet.

Using Internet cafés, the Mavuno Project manager, whom is most reliant on the Internet, was still able to perform all his work. He had previously been using the Internet from his
office, usually replying emails in the afternoons and during Sundays, but now he had to adjust his timetable to visit the Internet cafés during working hours.

At the time of the field study, Asymmetrical Digital Subscriber Line (ADSL) Internet was available in the central villages of Karagwe. The ADSL technology enhances the performance of existing landlines to enable high-speed data transfer. Unfortunately, this technology was not available in many remote villages, including Ihanda where Mavuno is located, since the telephone network did not reach there. Another problem with the ADSL connection was the cost involved. The service provider, TTCL (Tanzania Telecommunications Company Limited), was charging 40/- (Tanzanian shillings) per megabyte of data transfer (upload and download) or between 360.000/- and 1.000.000/- per month for flat rate access.

Since ADSL Internet was neither available, nor affordable, I began investigating the possibility of installing a satellite dish on the Mavuno site. In April, I visited SatCom Networks, Raha.com and Afsat Communications in Dar es Salaam, who all offer Internet connectivity over satellite links. I found that prices and quality of service varied significantly between the three of them. It’s important for not-for-profit organizations like Mavuno to mind their expenses carefully, making cost a primary concern. The most cost effective solution, a 64kbps connection at $155 per month plus VAT, equipment and installation charges, was offered by SatCom Networks. The 64kbps are shared by four customers, ensuring a minimum speed of only 16kbps per customer if all customers use it simultaneously, and a maximum of 64kbps with one simultaneous user. This speed is very low compared to the ADSL connections of up to 2048 kbps downstream and 1024 kbps upstream (with no guarantees for minimum upload or download speeds).

In the end, Mavuno settled for the 64kbps SatCom connection but remained hesitant to strike a deal since they were not confident that SatCom would release the equipment once the payment was through. For that reason, the deal was postponed until mid 2008.
6.2.3 Computer Equipment

Support from foreign organizations constitutes Mavuno’s major inflow of computer equipment. In January 2008, five computers were being used at Mavuno. Two were laptops used by the project manager, two were stationary computers used by the Technical Centre and another stationary computer was being used for the micro crediting scheme. During the field study, arriving volunteers supplied four additional desktop computers to be installed in the recently constructed offices.

The computers were shared by three Mavuno employees and four students at the Mavuno Technical Centre. Mavuno also possessed three printers, but due to various technical problems only one of them — if any — was up and running at a time. Other equipment included standard computer peripherals devices (e.g., mice, keyboards and USB flash drives), two network switches and a radio link antenna.

Much of the computer equipment brought to Mavuno had already been in use in Europe for a few years. This meant that computers were considerably slower in terms of computing power than their modern counterparts, running at clock rates ranging from a few hundred MHz up to 1 GHz. This was, however, not a major concern and it did not significantly impact the general workflow of the Mavuno staff.

All in all, Mavuno’s computer equipment was sufficient and served its purpose well. Equipping the new offices with a stationary computer each, and starting up the Internet café, will require Mavuno to obtain an additional five to ten stationary computers. Together with the new satellite Internet connection, this will amount to a huge increase of physical resources.
6.3 Digital Resources

Mavuno was predominantly using Microsoft software, mainly the Windows XP operative system and the Office 2003 suite, with licenses supplied by foreign partner organizations. Microsoft Word was used for all word processing, e.g., writing reports and project proposals, and Microsoft Excel was used for book keeping. Generally, the software worked well in the Mavuno context, although, some considerations should be taken in mind.

When using software that relies on Internet connectivity one must take in mind that Internet connections in Tanzania are still generally slow, unreliable and expensive — especially in the rural areas. Much is already covered by the TCP/IP protocol, e.g., packet loss. But for software that is used to transfer files, especially of larger sizes, functionality that enables the user to monitor the transfer rate and progress, and to resume transfers in case of network failure, can be of great importance.

In the case of web content, web software and online services, one might want to consider scaled down versions designed for low bandwidth connections, e.g., the basic HTML version of Google Mail. These low-end versions usually offer the same, or nearly the same, functionality for users with slower Internet connections. Volunteers from Engineers Without Borders also requested a low-bandwidth version, without the “fancy stuff we don't need”, of the Content Management System they were using to update their web page with news from Karagwe.

One should also be careful using software that occupies bandwidth automatically. For example, some anti-virus software will attempt to download a large amount of data through automatic updates, which may have adverse effects on working efficiency.

The use of solar panel poses further problems. When the solar panel batteries are discharged, the power is cut and computers shut down without warning. This may result in a loss of working data from unsaved documents and a great deal of frustration for the user. Therefore, applications that come with automatic backup or auto-recovery functionalities are preferred when using solar power. This will prevent valuable data from being lost because of sudden power cuts.
Records concerning members of Mavuno’s micro crediting scheme and their day-to-day transactions have gradually been computerized but paper transcripts are still kept as a backup. Microsoft Access is currently being used to store the information, but Mavuno is not satisfied with this solution because paper records are sometimes more efficient to use for extracting certain information. In the future, Mavuno would like to integrate records of member information and account information, and enable password protected account access over the Internet, like an ordinary bank. Member information should include photographs so that the members can be identified before withdrawing money from their accounts.

For the micro crediting scheme it might be a good idea to look at management information systems in the future, especially those specifically tailored for microfinance institutions, e.g., Mahakalasm, Mifos and the Microfinance Open Architecture Project (MOAP). Some management information systems also provide additional functionality that ensures consistent and transparent reporting for increased financial accountability. For Mavuno, which strives to be as transparent and as credible as possible, this can help build trust and confidence in current and future partner organizations.

The needy children programme involves keeping information concerning children, their guardians, living conditions and supporters/god parents. Using digital records, Mavuno hopes to share this information online with organizations and god parents supporting the children. There was also a demand for a competent document management system and some good CD burning software.

Through interviews with the Mavuno staff it was made clear that there was not a strong demand for software in Swahili since they were in good command of the English language. Still, the vast majority of the district's population have very poor English skills, which makes software in Swahili a more interesting alternative for the planned Internet café.

In December 2005, Microsoft launched a Swahili version of Microsoft Office in order to secure a hold on the East-African market. There is also a Swahili Language Interface Pack (LIP) available for download for the Windows XP operative system. If Mavuno decides to start using software in Swahili, another possibility is to switch to open source software. The
Kilinux project, which aims to create an operating system in Swahili, has released Jambo OpenOffice — an open source office suite based on OpenOffice.org — and Jambo Mozilla Firefox — a localized version of Mozilla Firefox — for Swahili speakers. Unfortunately, both Jambo OpenOffice and Jambo Mozilla Firefox are outdated. Jambo OpenOffice was officially released on 28 February 2005 in version 1.1.3 and Jambo Mozilla Firefox was officially released on September 28, 2006 in version 1.0.3. At the time of writing — January, 2009 — the current versions of Jambo OpenOffice and Jambo Mozilla Firefox are 1.1.3 and 3.0.1 respectively. The Kiswahili Linux Localization Project has announced that a new version of Jambo Mozilla Firefox will be released in early 2009 (2008, December 3).

An obvious advantage of Jambo OpenOffice and Jambo Mozilla Firefox - both of which are running on the Linux operative systems — is that they don't come with any license fees. Interviews made it clear that Mavuno was not opposed to switching from proprietary to open source software in the future — not only for the Internet cafe — but also for administrative work. The decisive factor was as always what software the representatives from the partner organizations choose to endorse, supply and teach. Mavuno were in fact rarely active in the process of making these decisions. As for the economic benefit of open source software Mavuno remained unaffected since the Microsoft licenses were purchased by their partner organizations.

Mavuno has not yet produced a large amount of digital resources. The Mavuno web site is obviously an exception, but it is currently not being updated on a regular basis. The project manager did express plans of appointing an employee to be responsible for updating the site regularly and to publish reports and other relevant documents produced by the organization, but it was not clear when this would take place. Apart from the web site and written documents, the records of the micro crediting scheme are digital resources that are important to Mavuno. These resources, however, are not directly accessible to the public. If Mavuno would devise a new system for managing the micro crediting scheme, where loan takers are able to access their accounts from the Internet, this would constitute a significant digital resource output to the community.
6.4 Human Resources

In the case of Mavuno, human resources refer to the employees’ computer experience and computer skills. The Mavuno computers were mainly used by the project manager, Mr. Charles Bahato, who managed the majority of the organization's administrative tasks, and Mr. Joseph Baraka, who was responsible for the micro crediting scheme. In addition, Mr. Medard, a senior member of the Mavuno board was sometimes using the computers for writing project proposals.

Although their computer skills were sufficient for handling the operative system and applications used in their work — as well as browsing the Internet and writing emails — their skills did not extend to cover basic system administration. Therefore, problems occurred when they were confronted with technical tasks such as troubleshooting malfunctioning computers, replacing broken hardware, formatting computers and installing operative systems, applications, drivers and printers.

The inability to solve basic computer problems made the organization particularly vulnerable to malicious code that is usually injected from the Internet or occasionally from CD-ROMs and USB flash drives. Mavuno's computers have frequently been infiltrated by viruses and other kinds of intrusive software that has disturbed the work flow but so far malicious code still has not caused a loss of important information or other critical damage to the organization.

The lack of computer know-how makes Mavuno dependent on external computer support and, although the computer experience constantly increases with daily computer use, external support remains to be the organization's main supply of computer knowledge. The lack of formal computer training has been recognized as a very serious problem regarding the use of ICT in Karagwe. Chema has already experienced how an organization and the public can benefit from e-learning. Their Internet connection is regularly used for distance learning on topics such as sustainable agriculture and economics.

If Mavuno's Internet café becomes a reality, the organization plans to permanently employ one of the graduating students from the Mavuno Technical Centre to teach ICT to visitors.
The fact that the Internet café is expected to increase the number of computers at Mavuno from five to around fifteen in 2008 will further require Mavuno to employ someone with sufficient technical skills to maintain the computers. The same goes for maintaining the Internet connection which is necessary for offering reliable Internet services.

By providing basic knowledge on how to use computers and the Internet, Mavuno believes the Internet café will help people educate themselves. Apart from refining their ICT skills, they will have the opportunity to study a broad spectrum of topics over the Internet. This could well prove to contribute a significant increase of human resources that would benefit the local community.
6.5 Social Resources

Examining the impact of social resources — resources that enable the acquisition of other resources through social networks — on Mavuno's use of ICT, one must first recognise three mutually exclusive levels of social capital (Warschauer, 2004, p. 197). Micro-level social capital concerns personal relationships within communities while macro-level social capital concerns social structures of governments and large institutions, how they provide resources and how they facilitate support to individuals and society. In between is the meso-level social capital that concerns relationships between private companies and civil society organizations, which is our primary focus.

The importance of meso-level social capital for all of Mavuno’s function can hardly be stressed enough. Mavuno is supported by various partner organizations that supply capital, equipment, knowledge and expertise. These external stakeholders constitute vital social resources that are products of both local and global community efforts. Mavuno’s core activities and general administration is primarily funded by members from the five villages while other organizations and benefactors fund specific programmes. Foreign organizations, NGOs, Rotary Clubs, embassies, etc., usually partake in the execution of single programmes that Mavuno proposes.

As expressed in the Human Resources chapter, Mavuno lacks sufficient computer knowledge to maintain the computer equipment that is being used. It is not, however, sufficient only to take account of the present state of expertise. A wider perspective is needed where the process of acquiring new knowledge is accounted for.

Support from foreign organizations makes up Mavuno’s major inflow of computer equipment and computer knowledge. Although a few Mavuno staff members have partaken in formal ICT education, the major influx of computer know-how clearly comes from volunteers who are visiting the organization. New hardware and software is usually picked out by volunteers — not by Mavuno employees. Volunteers bring equipment, operative systems and software applications when they come, or download them from the Internet, and apply them as they see fit. In an informal manner, members of the Mavuno staff are instructed on how to operate the new systems. The volunteers, male and female, are
predominantly university students from various European countries. Their influence shapes Mavuno’s use of ICT more than any other single factor.

First and foremost, this is a question of knowledge. Volunteers provide Mavuno with knowledge about what technology exists, knowledge about what technology is the best choice and knowledge about how to acquire, install and use the preferred technology. This creates a one-way flow of hardware, software and knowledge — i.e., physical, digital and human resources — which makes Mavuno reliant on sporadic outside support.

Thus, the choice of technology is primarily based on what volunteers endorse, provide and introduce to the staff. Through interviews with Mavuno and Chema employees, it was made clear that all other concerns (price, language, open source vs. proprietary etc) were overshadowed by this single factor. Decisions were often made by volunteers before leaving Europe and before gaining a good understanding of the context setting in which the technology would be used.

The foreign influx of knowledge is crucial to Mavuno — yet problematic in a number of ways. First of all, volunteers stay with Mavuno rather sporadically. At times there can be up to six volunteers working with Mavuno simultaneously. At other times, several months can pass without any volunteers visiting the organization. Furthermore, the skills of the volunteers vary substantially.

Volunteers usually stay for rather short periods of time and only a few return to Mavuno for further work after there first visit. The consequence is that Mavuno's most important influx of computer know-how is made up of a large number of people who stay only briefly with the organization. The result is an irregular and unpredictable capacity for maintaining the equipment that is being used and for introducing new technology to the staff.

Apart from cooperating with foreign partner organizations, Mavuno is also working closely together with other NGOs in the area, Chema especially. This cooperation serves to facilitate an important exchange of knowledge on the various topics where the work of the NGOs within the district overlaps. Looking at ICT specifically, Chema has provided Mavuno with lots of important advice regarding the acquisition, setup and use of hardware, software and Internet. This is well in line with Warshauer's claim that most people rely on
their social networks to offer support and assistance in decision making and the acquisition of ICT equipment (Warschauer, 2004, p. 156).

In addition to exchanging knowledge, the organizations also share the limited physical resources among each other. This is vital in Karagwe where the supply of electricity and Internet connectivity is frequently interrupted. In this way, local cooperation enables the NGOs to avoid costly trips to Bukoba — the closest city — where electricity, Internet connectivity and spare parts are easier to come by. Local cooperation provides Mavuno with a reliable social network that can be utilized regardless of sporadic foreign support.

![Figure 6: The Fadeco Internet café and community radio constitute important social resources in Karagwe.](image)

Although the NGOs cooperate well, they are working within a vacuum. There are no universities or other institutions for higher education in Karagwe and only a few of the companies in the district use ICT in their work. People with ICT educations tend to migrate towards urban areas where there is higher demand for their services. This makes technical
expertise rare in all of Karagwe and computer maintenance becomes very costly in terms of both time and money. For example, when a computer containing several important documents broke down in 2004, it took Mavuno four months to retrieve the lost information because they had to travel to Kampala in Uganda with the broken equipment.

In fact, one of the toughest challenges that Karagwe faces is the emigration of educated people. The Mavuno Technical Centre was initiated to tackle this challenge by providing education that is useful to local entrepreneurs who run businesses of different kinds in the district. As part of their training, the students learn to handle computers and common applications. The courses did not extend to include system administration or installation of operative systems, drivers and applications — knowledge that Mavuno is in dire need of.

Similar findings have been uncovered by Bergquist et al., (2005) who account for a significant lack of knowledge about system administration in their ethnographic study of open source software in Namibian schools. In their report, they employ the term knowledge infrastructure, stressing the inert and hard-to-change properties of social knowledge structures.

Similarly rigid knowledge networks exist in Karagwe as part of larger social patterns where rural and underdeveloped regions are drained of their human resources. This phenomenon, which is well known by the local NGOs, is a serious obstacle to the district's development.

Social capital is particularly critical for the use of ICT since it relies on strong social networks to provide both knowledge and technology. This makes access to social resources the single most important factor for successful use of ICT.

Social capital is very important for Mavuno’s use of ICT. The use of ICT, however, is not a goal in itself. As stated by Warschauer:

"The larger question is not whether social capital provides support for using the Internet but whether using the Internet extends people’s social capital." (Warschauer, 2004, p. 157)

This places a great emphasize on having ICT output an increase of social resources. A good example of how Mavuno uses ICT to produce social resources is the Mavuno Technical
Centre. The MTC is a powerful tool for development as it strengthens local knowledge networks, although its irregular funding prevents it from operating constantly.

Another benefit is that ICT is already being used to initiate and maintain contacts with partner organizations around the world and it will undoubtedly be even more indispensable in the future. In addition, the Mavuno staff expects that the organization will become more see-thru by publishing reports and information about the organization and its activities on the Internet. They expect an increase of Mavuno's credibility and consequently increasing access to social resources. As previously noted in the Present ICT Use chapter, Mavuno's ICT access has also been beneficial to the public outside the organization. The ability to assist villagers using the Internet turns Mavuno itself into a social resource for the entire community.

Mavuno’s greatest expectations lie with the proposed Internet café (see the Future ICT Use chapter). Based on positive experiences from Chema, Mavuno expects the Internet café to improve the ability of members of the local community to gather information and maintain relationships over the Internet, thus increasing social capital.
7. Discussion

The previous chapter detailed the findings that were discovered during field work and in this chapter these findings will be discussed in relation to the thesis’ main questions. This is the first of the three research question, as stated in the Theory chapter:

- What are the most salient physical, digital, human and social factors affecting the success of ICT?

The Mavuno context presents numerous challenges for success use of ICT — a lack of electricity and Internet connectivity being the most visible obstacles. Digital resources were generally sufficient in meeting the organization's needs (though some improvements were desired). As for Mavuno’s human resources, the employees were well capable of performing their everyday administrative tasks. They were, however, not capable of managing technically demanding tasks, including setting up and maintaining the computer systems. Technical tasks were therefore carried out with the assistance of other organizations that also supplied new equipment. Warschauer relates this to the utilization of social networks and social resources:

"Entering the world of computing is quite complex. It involves making decisions about whether to buy a computer, what kind of computer to buy, how to set it up, what kind of software to get, how to install it, how to obtain and set up Internet access, and then how to use the computer, the software, and the Internet. Most people rely on their social networks to offer support and assistance in this." (Warschauer, 2004, p. 156)

The fact that Mavuno was reliant on other organizations to acquire new hardware and software was problematic in different ways. First, different settings pose different problems and ultimately Mavuno knows their own particular ICT requirements best. Second, the fact that the Mavuno staff was incapable of managing system administration has made the organization dependent on ICT support from European volunteers to be able to perform core administrative work. This made Mavuno vulnerable to the whims of their partner
organizations and the cultural and political climate in the north. Third, the dependence on northern ICT support seriously impaired Mavuno's ability to obtain new knowledge and technology.

The dependence is a product of serious shortcomings concerning the social knowledge structures, ultimately caused by Mavuno's spatial remoteness and social seclusion. This is the single most salient factor affecting the success of Mavuno's ICT use. In order to break this dependence, Mavuno needs to shoulder a central role when deciding what technology to obtain and use and to base these decisions on the organization's particular requirements.

Mavuno employs this approach for its programmes already. The programme's needs are first assessed (e.g., solar panels for the Mavuno Technical Centre, engineers and materials for improving rural water supply or supplies for the needy children programme). Project proposals are then sent to partner organizations that hopefully provide the desired support.

In order for Mavuno to apply a similar approach for its ICT needs, the organization must first become capable of monitoring and assessing the technology available on the market. This includes operative systems, management information systems, word processing software, numerous brands of desktop and laptop computers and much more. Taking this step is necessary to attain information independence and sustainability, and it should be at the top of Mavuno's ICT agenda.

With virtually no ICT integrated into society, the remoteness of the Mavuno setting makes the challenge of developing necessary competence even greater. The Karagwe district doesn't host any universities or other institutions for higher learning, practically no ICT is used in the private sector and only a fraction of the population has ever seen a computer. The major source of ICT knowledge within the district is accumulated by cooperating NGOs — the importance of which must not be underestimated. The key for Mavuno to break its dependence on remote partners lies in strengthening the local social networks that the organization forms together with other NGOs in the Karagwe district.
- **What is the outcome - in terms of physical, digital, human and social resources - of ICT use?**

In accordance with Warschauer (2004, p. 48), resources of all four categories were produced as a consequence of Mavuno's ICT use — albeit to varying extent. The most significant physical resource output involved connecting the village of Ihanda to the Tanesco electricity grid, which is likely to facilitate electrification in the area. Among other physical resources produced were the recently installed satellite dish — providing a reliable Internet connection — and the new computer equipment that was obtained to meet Mavuno’s increasing use and demand of ICT.

The digital resources authored so far consist of various documents and records produced by the programmes and the Mavuno web site. As for human resources, the staff's ICT skills do increase with daily computer use but more importantly with sporadic visits from volunteers who introduce new technology. Mavuno's use of ICT is also supporting the production of social resources by facilitating communication with remote organizations that supply knowledge and technology.

At present, the produced physical, digital, human and social resources are directly beneficial to Mavuno and indirectly beneficial to the community through the Mavuno programmes. Mavuno plans to start up an Internet café enabling the local community to reap the benefits of the Internet connection directly. Taking the step to supply public ICT access will undoubtedly be a great challenge for Mavuno. The organization's computers are currently being used by only three employees and a few volunteers with good computer skills. The outset of the Internet café will require the acquisition of more computers and consequently increase the organization’s computer maintenance needs.

Furthermore, the public computers will be used by people with little or no previous computer experience. Thus, in order for Mavuno to supply the local community with meaningful ICT access it will also need to support the Internet café visitors and teach them the basic skills needed to make use of the computers and the Internet. If Mavuno succeeds with the implementation of the Internet café, it will become a valuable ICT resource for the
local community and contribute to even further growth of — particularly human and social — resources.

- **How does localization and culturally adapted interfaces impact the success of ICT use?**

Mavuno's computers were mainly used by three of the employees who all had sufficient English skills to understand and handle the software they needed to use in their daily work. Software translation was therefore deemed unnecessary by the organization.

For Mavuno, the use of software — mainly standard desktop applications such as Microsoft Word — was not an objective in itself but an efficient way of meeting the objectives set by the programmes and core administration. The results from the field study show that Mavuno — that consistently sticks to the technology endorsed by volunteers — places the greatest value in the social acceptability of software. Should Mavuno take on a more active role in deciding what software to use in the future, other aspects of Nielsen's (1993) division of system acceptability might be given higher priority.

If Mavuno made its own ICT decisions, the technology obtained and used would better suit the organizations particular requirements. The idea of focusing on the main stakeholder's requirements is also present in software development and user-centred design. The cultural distance that separates software users from software designers is arguably far greater in Karagwe than in a European context. The findings of Reinecke & Bernstein's (2007) research in Rwanda — which borders to Karagwe and shares a similar culture — indicate that culture does have a significant influence on usability. Thus, it would seem reasonable to assume that somewhat similar usability issues would be observed in Karagwe.

Contrary to this, the study did not find any indications suggesting that cultural factors had a negative impact on software usability in Karagwe. The problems of incorporating computer know-how sprung from the spatial remoteness of the setting and the social seclusion that it entails. Therefore, cultural adaptation of interfaces was deemed superfluous. It should be emphasized that, although the Mavuno employees did belong to the local culture, they did not correspond to the general population in terms of educational level, language skills and computer experience. The influence of culture and culturally adapted interfaces may be
more salient in case of public ICT use (see the *Further Research* chapter below), but as for NGOs operating in rural areas, cultural remoteness is not likely to be a major impediment to ICT use.
8. Conclusions

Non governmental organizations and other civil society organizations that operate in rural settings are often dependent on ICT for cooperation with other organizations. ICT becomes a critical factor when the external support attained through cooperation determines an organization’s ability to promote rural development. This thesis explores the complex of problems that emerge when ICT is applied in a rural development context.

The field work conducted in rural Tanzania found that lacking infrastructure — in terms of electricity, Internet and knowledge — is causing the most salient obstacles to efficient ICT use. Remote and underdeveloped regions tend to be the last ones to be connected to electricity and telephone networks, which has got a negative impact on the quality, reliability, availability and pricing of the electric supply and Internet connectivity.

Even greater challenges are posed by the fact that rural areas often provide only limited access to the human resources that are required to set up, operate and maintain necessary hardware and software. Hardware, software, electricity and Internet connectivity can not guarantee meaningful ICT access unless there is sufficient technical competence to manage and make use of the equipment.

Lacking the ability to understand and master ICT can be a critical problem in remote settings, such as Karagwe, Tanzania, where the field work was conducted. Yet the assumption that a shift of culture complicates the process of learning to understand and make use of technology that is designed elsewhere could not be confirmed. In fact, cultural factors were dwarfed by the social factors associated with rural marginalization.

Further, the findings from the study point out that dependence on external support for the operation and maintenance of ICT can be harmful to an organization. It risks becoming an unreliable bottleneck causing an inefficient workflow, and it is necessary for an organization to break this external dependence in order to attain sustainability.
9. Further Research

The use of ICT at Mavuno is presently limited to administrational work for the facilitation of community services, which means that computers are only being used by Mavuno employees. The Mavuno employees can not be considered representative for the community at large in terms of educational level, language skills and computer experience. The fact that culturally adaptable interfaces were deemed superfluous for them does not assure that the same holds true for the community at large.

Although it did not fit within the scope of this field study, direct use of ICT by the general community holds great potential for rural development and social inclusion. Public ICT access introduces a new scenario with completely different challenges for successful ICT use. A follow-up study of Mavuno’s proposed Internet café — or a similar public ICT setting — is therefore suggested to complement this study and to provide a more accurate and holistic analysis of how the rural community interacts with ICT in order to attain sustainable development.
10. References


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