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Bridging the Digital Divide in Zambia

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Abstract

The research done for this thesis aims to determine how the digital divide can be bridged in Zambia. Education, infrastructure, and government policy have been identified as the three main elements that are necessary to achieve this. It has also been determined that ICT needs to be appropriate, relevant, and sustainable to the context it is to be placed in. The focus should be on what people want to use ICT for, as opposed to what is thought to be needed by these people. Best practices and lessons have been identified from countries that have made efforts on the fronts of ICT in education, infrastructure, and government policy. Research has also been done on the current situation in Zambia on these topics. This information combined has led to causal loop diagrams on each topic. These models show all variables relevant to the particular topic, and how these variables affect each other. This has led to conclusions and discussions on these topics separately, but also to a model that brings together these three topics including appropriate ICT. The main conclusions from this final model are as follows. Government investments in education, infrastructure, and the private sector will in turn result in gains for the government. In turn government investments are weakened by corruption/misappropriation of funds and an inability of government staff to properly execute policies. It is also concluded that local factors such as HIV/AIDS, gender discrimination, poverty, and collectivism harm the access, quality, learning outcomes, and effectiveness of education. It is not enough to make efforts only on government level or community level, both top down and bottom up approaches need to be made to bridge the digital divide. With these conclusions the main discussion point is the question if these negative influences coming from government and community level can be weakened as they are (in part) cultural factors.

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By writing this section I am writing the last sentences of my masters thesis. This was the last thing to be done before finishing my studies for Information Science and becoming a university graduate. This also implies that my days as a student are almost over. This thesis has taken up most of my time over the last six months, and I am proud of the result I have to show for it. I would like to thank the people who have helped me in writing this thesis. Thanks to my supervisor Theo van der Weide. He has helped me to find new ideas, look at matters from a different perspective, and has been a great motivator in writing this thesis. I have very much appreciated his positive approach. Thanks to Luca Consoli, my second corrector for this thesis, for being critical and asking difficult questions, which has resulted in this thesis being even better. Thanks to Ruud Crul, ICT4D expert with project experience in Zambia and other parts of Africa, for advice and comments on drafts of thesis. And finally many thanks to my friends and parents for showing support and interest in the progress of my work on this thesis.

Contents

1	Introduction	8
1.1	Problem statement	8
1.2	Method	10
2	Digital Divide	12
2.1	In a broader sense	12
2.1.1	Between countries	12
2.1.2	Within populations	13
2.2	Causes of the divide	14
2.2.1	Demographic factors	14
2.2.2	Infrastructure	15
2.2.3	Commitment to ICT	16
2.3	Effects of the divide	16
2.3.1	Education	16
2.3.2	Innovation	17
2.3.3	Business	17
2.3.4	Democratic participation	18
2.4	Goals	18
3	What to use ICT for?	19
3.1	Applications	19
3.1.1	Appropriate ICT	19
3.1.2	Economy	22
3.1.3	Government	22
3.1.4	Healthcare	24
3.2	Foundation	24
3.2.1	Education	24
3.2.2	Infrastructure	30
3.2.3	Government Policy	34
4	Zambia	36
4.1	Culture	36
4.2	Health	38
4.3	Environment	38
4.4	Economy	39
4.5	Politics/government	40
4.6	Desired impact	40
5	Appropriate ICT in Zambia	42
5.1	Social context	42
5.2	Healthcare	43
5.3	Environment	44
5.4	Economy	45
5.5	Politics/government	46
5.6	Conclusions	47

6	Education	47
6.1	Current situation	47
6.1.1	Education system	47
6.1.2	Government efforts	49
6.1.3	Access to education	50
6.1.4	Quality of education	51
6.1.5	ICT in current situation	52
6.2	Case studies from Zambia	53
6.3	Model	55
6.4	Conclusions	63
6.4.1	Discussion/future research	64
7	Infrastructure	65
7.1	Current situation	65
7.2	Model	68
7.3	Conclusions	70
7.3.1	Discussion/future research	70
8	Government Policy	70
8.1	Current situation	70
8.2	Model	74
8.3	Conclusions	76
8.3.1	Discussion/future research	76
9	A model for Zambia	76
9.1	Validation	79
10	Conclusion	80
10.1	Discussion/future research	83

List of acronyms

AAG	Asian-American Gateway
ASEAN	Association of Southeast Asian Nations
BESSIP	Basic Education Sub-Sector Investment Programme
DAI	Digital Access Index
EU	European Union
FBE	Free Basic Education
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GNI	Gross National Income
GNP	Gross National Product
GPS	Global Positioning System
HDI	Human Development Index
ICT	Information and Communication Technologies
ICT4D	Information and Communication Technologies for Development
IFC	International Finance Corporation
IICD	Institute for International Cooperation and Development
IMF	International Monetary Fund
ISP	Internet Service Provider
ITU	International Telecommunication Union
MFEZ	Multi-Facility Economic Zones
MoE	Ministry of Education
MoESP	Ministry of Education Strategic Plan
MPTC	Ministry of Posts and Telecommunications
MTENR	Ministry of Tourism, Environment and Natural Resources
OECD	Organisation for Economic Co-operation and Development
PAGE	Programme for the Advancement of Girls Education
PIAC	Public Internet Access Centre
PPP	Purchasing Power Parity
R&D	Research & Development
REA	Rural Electrification Authority
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SLCS	South Luangwa Conservation Society
TC	Telecom Cambodia
TESSIP	Technical Education Sub-Sector Investment Programme
TEVET	Technical Education, Vocational and Entrepreneurship Training
TEVETA	Technical Education, Vocational and Entrepreneurship Training Authority
UAF	Universal Access Funds
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

UNICEF	United Nations International Childrens Emergency Fund
USAID	United States Agency for International Development
VoIP	Voice over IP
ZAWA	Zambian Wildlife Authority
ZDA	Zambia Development Agency
ZHMIS	Zambia Health Management Information System
ZICTA	Zambian Information & Communications Technology Authority
ZIMS	Zambia Immigration Management System

1 Introduction

1.1 Problem statement

Inequality can be defined in several different categories. In mathematics two objects are unequal when one is greater or fewer than the other. In economics inequality is, simply put, the difference between rich and poor, those who possess many economic assets and those who do not. Social inequality is the difference in social status within populations. In society and in economics inequality can lead to large differences between people, groups of people, and even countries. People are sometimes classified as either ‘haves’ or ‘have not’s’.

This inequality is not only about what people possess but also about the opportunities they have and are likely to come across. This lack of opportunities for ‘have not’s’ will also mean that their chances of becoming a ‘have’ either socially or economically are slim. Assuming this is indeed the case creating more equal opportunities for the ‘have not’s’ should lead to more equality in the future.

Access to health care, education, housing, career opportunities, food, transportation, voting rights and clean drinking water are all things that are taken for granted by some, and desperately needed by others. In the year 2000 the United Nations have set eight Millennium Goals that aim to end poverty by 2015. Goals are in areas such as reducing poverty and access to health care and education. Target 2A aims to “ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling” [101]. In Sub-Saharan Africa and large parts of Asia and South America this goal will most likely not be met by 2015. The United Nations states that “being poor, female or living in a conflict zone increases the probability that a child will be out of school .” [101] This confirms even more that inequality leads to unequal opportunities.

ICT (Information and Communication Technologies) is a source of opportunity that is used widely in developed countries. Almost all businesses rely on some form of ICT to keep their business running, deal with their administration and finances, gather and exchange information, streamline their processes, and endless other activities. Students also use ICT to their advantage due to the endless knowledge that is available online. Knowledge from all areas of the world can be accessed through a computer with internet access. Not only students, but all people that have access to the internet have access to the global knowledge system that is shared online. This shared knowledge is a large factor in R&D (Research & Development) activities and thus in innovation. According to [107] systems of knowledge production (e.g. universities and public laboratories) have become the main motors of development in the global world over the last decade. It is also stated that this knowledge is the basis for social development. This knowledge should be placed in the service of development, applied, and good practice should be shared. Due to the fact that some have access to this knowledge system and others don’t the term “Knowledge Divide” has been defined. This term is described by [107] as a “*concept used to describe the gap in living conditions between those who can find, manage and process information or knowledge, and those who are impaired in this respect and will become increasingly isolated and marginalized*”. Without access to this knowledge system countries cannot gain the highly educated and skilled personnel they need to achieve innova-

tion and thus (sustainable) economic growth. As is said before these countries, or groups of people will become even more isolated and marginalized.

It is clear that computers and the internet are needed for access and participation in the global knowledge system. To be able to generate knowledge higher education and highly educated people are necessary. This is a problem in counties where even primary education is not received by many, and access to computers and the internet is often not available. In Sub-Saharan Africa the percentage of people with access to the internet was 3,23 in 2007. [32] In the United States this percentage for the same year was 75. This is a huge gap.

This gap, the “Digital Divide” is defined by [58] as “*the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICT) and to their use of the Internet for a wide variety of activities*”. The United Nations Development Programme states that “*The network society is creating parallel communications systems: one for those with income, education and literally connections, giving plentiful information at low cost and high speed; the other for those without connections, blocked by high barriers of time, cost and uncertainty and dependent on outdated information.*” [104] Senegalese President Abdoulaye Wade has stated that “*The digital gap brings with it a danger of isolating certain peoples, those in Africa in particular ... It is paradoxical and ironic that the continent which invented writing is excluded from universal knowledge.*” [52] Many initiatives have been taken to bridge this divide, but for many countries where incomes are low, food is hard to come by, and (quality) education and healthcare are not self-evident, the barrier to ICT proves to be one that is difficult to cross.

This leads to the question of what can be done to bridge this divide, and let developing countries benefit from the opportunities that ICT can provide. Should ICT in developing countries be applied in the same way as in developed countries? Or should we look at the specific needs of these countries and ask ourselves how these needs can be facilitated by ICT? Also, how can ICT be facilitated in developing countries? In order for these countries not to become dependent on developed countries to provide them with ICT they will have to produce their own (affordable) ICT products. The necessary infrastructure to facilitate new ICT will also be necessary, but what infrastructure is needed and how can this be realized? For ICT to succeed and to be sustainable the government should be supportive of this development. But what should governments contribute to create a sustainable ICT environment? These questions are the ones that will be researched in this thesis. The main question is:

How can ICT successfully be put to use in a developing country?

In order to find a gratifying answer to this question the other points posed in the previous paragraph must be addressed. This leads to the following four sub questions.

1. In what form should ICT be applied in a developing country?
2. How should education be used to create a sustainable ICT environment and how can this be achieved?

3. What infrastructure is necessary to create a sustainable ICT environment and how can this be achieved?
4. What should governments contribute to create a sustainable ICT environment?

1.2 Method

The research questions posed above are quite broad. In this section their exact meaning for this thesis, and the method that will be used for answering these questions will be explained. First of all the results of this thesis will not be applicable for all developing countries, the focus of this research will be on one country specifically, this country is Zambia. This thesis will consist of a theoretical framework, four chapters answering the four sub questions, a chapter that answers the main research question, and a chapter that states the conclusion(s) that can be drawn from the results of this research. The necessary information will be gathered through literature, and the outcome of this research will be a series of models which will be explained in more detail later. Each sub question will be answered in part in the theoretical framework, and in part in its own chapter. The part in the theoretical framework will be more general, and the part in the separate chapter will be specifically about Zambia.

The theoretical framework will consist of three chapters: digital divide, what to use ICT for, Zambia, and a concluding section at the end. The chapter about the digital divide will elaborate on what the digital divide is, what the causes and effects are, and what goals for bridging this divide can be. The “what to use ICT for” chapter will be the part in which the sub questions are partly answered. This chapter consists of two sections called application and foundation. The content of these sections will be elaborated on further on in this “method” section. The chapter on Zambia will contain all factors of appropriate ICT (which is also an important part of the “what to use ICT for” section). Appropriate ICT is described in [67]. This article states that *“ICT design and implementation must be carried out in relation to the culture, environment, organization, available resources, economic and political circumstances, and the desired impact.”* These factors (related to Zambia) will be the contents of this section, and will also play a role the rest of this thesis. The conclusion of the theoretical framework will focus on how the information gathered in this chapter will affect the method used, and how this method can be specified further.

In this thesis it will be assumed that the foundation of implementing ICT in any country is education, infrastructure, and government policy. This is why the last three sub questions refer to these three elements. In order to implement ICT in Zambia these three elements need to be in place (with reference to ICT). This is why research will be done on these three subjects. In the second chapter of the theoretical framework theories and case studies will be presented about the importance and implementation of these three elements. These theories and case studies will be regarded as best practices from around the world, and it will have to be determined if these can also be applied to Zambia. This will be done by determining if the practice is relevant to the context it is in, or if it is a universal best practice. If it is relevant to the context this context will have to be similar to Zambia’s in order to be regarded as applicable. Universal best practices are not tied to a certain environment, culture, organization, or other appropriate ICT indicators. The individual chapters on each subject will

determine what is right for the context in Zambia specifically. This will use the information gathered in the theoretical framework, in addition to new information. These chapters will all have the same structure. This structure is as follows: current situation, model, conclusions, and discussion on the results. The current situation will refer to what is already available in Zambia regarding education, infrastructure, and government policy, and how well this does (or doesn't) work. All information from the chapter itself and from the theoretical framework to will be incorporated into a model. This model will illustrate the relationships between different variables within the subject of that chapter. The modeling technique used will be system dynamics which will be explained further in the next paragraph. The information that can be extracted from this model will be used to draw conclusions about how to create a situation that is ideal for Zambia.

System dynamics is a tool or profession according to [18] that can be used to better understand complex situations. The same article states that "*System dynamics is a practical profession that starts from important problems, comes to understanding structures that produce undesirable symptoms, and moves on to finding changes in structure and policies that will make a system better behaved.*" System dynamics is used by businesses, but also by governments in gaining a better understanding of change (e.g. social or economic change). The systems that this is applied to can be technological, social, or ecological. Therefore this is a suitable tool for gaining a better understanding of the change needed to bridge the digital divide in Zambia. System dynamics had many applications, but for this thesis causal loop diagrams will be used. A causal loop diagram visualizes how certain variables affect each other, either positively or negatively. Such a diagram consists of nodes and arrows (arrows labeled with a + or a - to denote the relationship between the nodes (or variables)). Examples of causal loop diagrams are available in [118].

The foundation that is made by the last three sub questions is needed for the application of ICT. This application is the first sub question and will therefore be the first chapter (after the theoretical framework). As with the other three sub questions this one will be answered in part in the theoretical framework, and in part in its own chapter. In the theoretical framework applications of ICT that are used in both developed and developing countries will be shown. These applications can be related to the economy, government, or healthcare. It is also important that the desired impact of ICT is determined, for individual applications/organizations, but also for the country as a whole. Appropriate ICT will play a large part in the application of ICT. In the chapter itself Zambia will be the focus. This chapter will have a different structure than the ones described before. It will consist of the following sections: social context, economy, government, healthcare, environment, and conclusions. As has been said before the desired impact of ICT in Zambia will be determined/discussed.

The concluding chapter will tie the four sub questions (chapters, models) together. One large model will be created encompassing all elements that were presented in this thesis. This model should give a good idea of how all elements are related and how they affect one another. This can then be used to answer the main question: how can ICT successfully be put to use in a developing country (Zambia)? To validate this research an expert on implementing ICT in Zambia will be consulted. This expert will comment on the results and assumptions during the writing of this thesis, and will determine if the assumptions and the reasoning in this

thesis are correct. Also the suitability of the model for Zambia will be determined by this expert.

2 Digital Divide

The digital divide, the subject of this thesis, will be elaborated on in this section. Note that the term digital divide is not only something that divides developing and developed countries. It can also be a divisor within populations, in any kind of country or continent, between old and young, rich and poor, urban and rural. It is important to note that developed countries share this problem, be it in a different form, it is a problem none the less. The first section of this chapter will focus on the different forms of digital divide. The rest of this chapter will focus on the subject of this thesis, the digital divide and developing countries. What are causes and effects of this divide, and what do we want to achieve by bridging this divide?

2.1 In a broader sense

As the title of this section states, this section is about the digital divide in a broader sense, not just about developing countries and not just about the divide between countries. It is about the divide between countries, but also within populations. About both developing and developed countries. How big is the problem of the digital divide really?

2.1.1 Between countries

To be able to talk about the digital divide there must be a way to measure this divide. In the introduction chapter of this thesis the digital divide was described as the difference in access to ICT and the internet for certain individuals or groups of people. Therefore we will take access to ICT and access to internet as indicators of the divide. For this purpose the ITU (International Telecommunication Union) DAI (Digital Access Index) will be used. It measures the ability of the inhabitants of a country to access ICT and internet based on four indicators, namely infrastructure, affordability, knowledge and quality, and actual usage of ICT. [34] Countries are ranked by the DAI as high, upper, medium and low, and are scored from 1 to 0, 1 being highest digital access score and 0 being lowest digital access score.

In the beginning of this chapter the distinction between developed and developing countries was made, but what does this distinction mean? When is a country a developing, or a developed country? In this thesis the HDI (Human Development Index) will be used. This index measures three indicators per country, namely life expectancy at birth, mean years of schooling, expected years of schooling, and GNI (Gross National Income) per capita. The HDI and its indicators can be found in the UNDP (United Nations Development Programme) Human Development Report which is published on a yearly basis. The figures used for this thesis are from the 2011 Human Development Report. [106] An HDI score is a number from 0 to 1, 1 being the highest level of human development and 0 being the lowest. Using these figures countries are characterized as having very high, high, medium, or low human development.

Both these figures, HDI and DAI are very useful for gaining a better understanding of the digital divide between countries, and also of the gap between developed and developing countries. Let's take a look at the top three countries on the HDI. These countries are Norway, Australia, and The Netherlands, their respective scores being 0,943; 0,929; and 0,910 for 2011. The DAI for these countries is 0,79 for Norway, 0,74 for Australia, and 0,79 for The Netherlands. These three countries are all classified as having a high DAI. Now let's look at the bottom three countries in the HDI. These countries are Burundi, Niger, and Democratic Republic of the Congo, their respective HDIs being 0,316; 0,295; and 0,286. [106] Their respective DAIs are 0,10; 0,04; and 0,12, all of these countries are classified as having a low DAI. [34] This would suggest that developed countries have much better access to ICT and internet than developing countries, and in any case a huge gap, or digital divide between countries.

2.1.2 Within populations

A less obvious divide is the one between populations, be it in developed countries or in developing countries. This section will show figures and causes for such a divide between populations in one developed country, the United States of America, and one less developed country, Syria.

The United States can be called a developed country due to its score on the HDI (0,910) which places it in the very high human development category. [106] It is also categorized as high in the DAI, with a score of 0,78. This would lead to believing that most people in the United States have access to ICT and internet. Sadly this is not the case as according to [112] one third of the American households does not have a broadband connection. This report also states that there are significant differences between demographic and geographic groups across the country. College educated people are three times more likely to have broadband access. People who are White or Asian have been shown to exceed people who are Black and Hispanic in having a broadband connection by at least 18 percentage points. Rural communities are behind urban communities by 10 percentage points. According to [119] the older generation (ages 55 and older) use broadband the least, and people with ages 18-24 are the most frequent users. It is also stated that people with higher income have higher broadband usage. President Obama has recognized these differences and has announced a National Wireless Initiative, having the goal of connecting 98% of Americans to high-speed wireless internet within 5 years. He has also addressed this difference in his State of the Union Address in January 2011. [112]

Syria, a country which is in the news almost daily at the time of writing is also a country with a low DAI (0,28). It can be called a less developed country, its HDI is 0,632 placing it with the medium developed countries. Internet was introduced in Syria in the year 2000, yet today, 12 years later only 18% of Syrians use the internet. This is less than 4 million people, of which only 200.000 have broadband access, the rest has a slow dial-up connection. High speed access is only available in larger towns and cities, leaving people in rural areas behind. Aside from this internet is very expensive for Syrian citizens, especially in rural areas which often inhabit the poorest Syrians. 3G access costs 63 USD per month for 3 gigabytes, and broadband costs 21 dollars per month. [88] Combine that with the current violence and unrest in Syria and the temporary blackouts of internet and mobile networks. The rural areas in Syria are obviously divided from the urban areas, but at the moment no one in Syria, urban

or rural, can be very sure about their connection to the web.

2.2 Causes of the divide

When reviewing literature about the causes of the digital divide a long list can be made. In this section the main causes will be listed and elaborated on. This and the following sections will focus on the digital divide that affects developing countries. Therefore this section will name factors that cause the digital divide in developing countries. According to [9] the main cause of the digital divide is income differentials. Other causes named by [9] are years of schooling, illiteracy, age, urbanization rate, telephone density, electricity consumption, and regulatory quality. [58] claims that income and education are the most important determinants of the digital divide. They also name age, gender, racial and linguistic backgrounds and location as important indicators. Willingness of countries, businesses and individuals to use to their advantage, and commit to ICT and the internet is also an important factor according to [58]. This point is shared by [14] who state that *“it is factors related to the ideology of development, rather than development per se, that are crucial for a country’s IT connectivity.”* They state that the more links a country has to the global society and the more institutions of science and education it has, the faster it adopts ICT and internet. These factors will be divided up into categories and elaborated on further. Categories are demographic factors, infrastructure, and commitment to ICT.

2.2.1 Demographic factors

Demographic factors deemed relevant by the existing literature and named in the introduction to this section are income, years of schooling (education), illiteracy, age, urbanization (location), gender, and racial and linguistic backgrounds.

Due to the fact that income and education were named as the most important factors causing the digital divide these will be named first. It is not difficult to imagine that when people have very little money to spend their priority will not be to spend it on computers and internet. [9] states that each \$1000 increase in income per person leads to an increase of more than one percentage point in the number of PCs per person. The same is said for education, meaning that one more year of schooling per person leads to an increase of one percentage point in the number of PCs per person. Education is also a very important factor because using a computer and the internet require a certain set of skills that need to be acquired (for example at a school). According to [122] the gap in access to ICT between high income and low income children can be reduced by two thirds by schools. Illiteracy, which is very much connected to education, is a very important factor in the digital divide. Using a computer, and even more so, using the internet requires reading in most cases. People who do not possess this skill are clearly in a disadvantaged position. As are people who are not able to speak or read the English language since more than 80% of the content on the internet is in English. [114]

Age and gender have been said to play a role in the digital divide. In Chile 74% of internet users is under 35 years of age, in China this is 84%, and other countries follow this pattern according to [105]. In Ethiopia 86%, in Senegal 83%, in China 70% and in Latin America 62% of internet users are male. However this gap seems to be decreasing rapidly.

[105] As has been said before in this chapter, in the United States racial background plays a role in the use of ICT and internet, it is not known what this means for developing countries. [58] Urbanization rate is a very telling factor in the digital divide. What this says is that people in urban areas are more likely to have access to ICT and internet. For example 80% of the people who use the internet in the Dominican Republic live in the capital, and in Thailand 90% live in urban areas. [105] Often the cost of an internet connection is higher in rural areas, and speeds are slower. Also people with better jobs tend to live in urban areas, and poorer people live in rural areas. [58] The information presented in this section was acquired around the year 2000, which is 12 years before the writing of this thesis. Because ICT tends to move quite quickly it cannot be guaranteed that these numbers are accurate at the time of writing. However it is believed that these numbers do paint a good overall picture regarding demographic factors.

2.2.2 Infrastructure

On the topic of infrastructure the two main things needed are electricity, to power a computer, and internet access. There are several ways for people to access computers and the internet. People can have computers in their homes, however this requires a significant investment in a computer, and also requires the availability of a reliable electricity supply to make this investment worthwhile. Today 32% of people living in poverty have no access to electricity, this is 62,3% in Sub-Saharan Africa. [106] This means that many are excluded from access to ICT. Furthermore it is often the most poor that continue to be excluded due to the fact that electricity companies (and internet service providers) do not consider investing in areas with a high poverty rate to be profitable. Therefore the people living in these areas stay disconnected. The lack of connectivity in these areas also causes businesses to stay away from these areas, leading to a lower chance of job opportunities and income.

Furthermore, looking at people who do have computers in their homes, how do they access the internet? Broadband or wireless connections are the most obvious solutions, however these are not always an option. Even if (one of) these options were available these might be much too expensive for people living in developing countries, especially for those with very low (or no) incomes. In 2008 mobile phone subscriptions in developing countries were equal to half of their population [33]. The popularity of mobile phones in developing countries has opportunities for the internet, as people can reach the internet through mobile networks.

Public access also provides many opportunities for access to ICT and the internet. These are defined by [33] as follows: “A *public internet access centre (PIAC)* is a site, location, or centre of instruction at which Internet access is made available to the public, on a full-time or part-time basis. PIACs include telecentres, digital community centres, Internet cafés, libraries, education centres and other similar establishments, whenever they offer Internet access to the general public. All such centres should have at least one public computer for Internet access.” While this is a good definition there are also other options for public access. For villages that are too remote for internet there is an interesting solution in use in northern Cambodia. Five men drive by fifteen villages in northern Cambodia every day on a motorbike equipped with a portable computer. Villagers enter their search queries and emails on these computers. Then the motorbikes bring this information to a central satellite station which is connected to the

internet. This process in reverse brings the requested information back to the villagers. [31]

2.2.3 Commitment to ICT

A large part of making the most of what ICT and internet have to offer is commitment. Commitment in the sense of the government supporting and creating initiatives to promote its use. Commitment in the sense of people being willing to use ICT. Commitment of people and businesses to use ICT to their advantage and incorporate it in their businesses.

Let's take Arabic countries as an example. In these countries both cultural and political reasons play a role in the commitment to ICT. In Arabic countries oral communication, also called 'isnad' is considered more trustworthy than communication over the internet, which is mostly through text and images. Many government leaders in these countries see the internet as something western that is used to spread immoral, and anti-governmental information. This aversion results in limited and monitored internet access in many Arabic countries. [19]

It has also been shown by [14] that countries that are committed to the ideology of development, and thus have more connections to global society, and institutions of science and education, have more of a commitment to ICT. It is therefore, as [58] also states that the attitude of a country (but also of people and businesses in a country) to make the most of what ICT has to offer that has much to do with the way a country adopts (or doesn't adopt) ICT. Governments already reluctant are not inclined to spend their scarce resources on something they do not fully believe in.

2.3 Effects of the divide

Those who have access to, and use ICT and the internet can benefit from it, others cannot. It is that simple. And while the digital 'haves' are benefitting from what ICT has to offer them the 'have not's' are getting further and further behind, and this cycle will continue to develop itself. Essentially the (digitally) rich get richer, and the poor get poorer. This point will be illustrated by naming the actual effects the digital divide has on several points all revolving around knowledge. These points being education, innovation, business, and democratic participation.

2.3.1 Education

This piece on education will be short, and will only describe the effects of not using ICT in education. Further on in this thesis the actual benefits of using ICT in education will be talked about. Of course one effect of not using ICT in education is not making the most of the benefits that ICT can offer to education. In developed countries ICT has been in use in education for the last 20 years. Being able to use these technologies has become a requirement in the workplace in developed and increasingly in developing countries. For children living in poverty it is very unlikely to have access to a computer at home. Therefore using and teaching ICT in education is important in giving these children the skills they need to find jobs in the future, and work their way out of poverty. This (a skilled labor force) is not only beneficial to individuals but also to the economy of the country they live in. Furthermore without the knowledge that can be attained through the internet these children and young adults are left

without the up to date knowledge they need in order to be innovative. This knowledge is necessary to keep up to speed with the rest of the world, and to be able to participate in and contribute to the global knowledge system. Internet dependency is a problem for education facilities not connected to the internet, as much of the available (current) literature is only available online, and registering for a conference of international project also requires internet access. [5] Another problem is that teachers that have not been educated in ICT do not have the skills needed to teach their students to use these technologies, and may also not be aware of the benefits that ICT can bring to their education and future. Teachers in all phases of education should be able to use ICT and internet in order to teach their students how to make use of these technologies. Lack of these technologies will only increase the divide as connected countries move forward and others stay behind.

2.3.2 Innovation

This section builds on the previous one as education and knowledge are vital in achieving innovation. Well trained researchers, and access to the global knowledge system are two factors without which there will be no innovation. [107] reports that the percentage of GNP (Gross National Product) spent in Africa on R&D was under 0,5% between 1992 and 2000. The named effects of this were “a weakened university system and an often fledgling private sector with little government support.” [107] It is also stated that in developing countries signs of innovation, such as scientific papers and patents, are very low. In Africa universities are the main sources of research. These universities are entirely funded by governments for whom universities are not a priority. This leads to a lack of resources, researchers who are not connected to global research, outdated facilities, and brain drain. [5]

Economic innovation has the greatest potential for giving developing a sustainable chance to become developed countries. The G8 has recently confirmed the power of the internet in innovation by stating “The Internet is a driver of innovation, improves efficiency, and thus contributes to growth and employment.” [83] Investment in ICT and internet are necessary for the realization of the R&D efforts needed for innovation. Innovation in turn is needed for developing countries to be able to stand on their own and have a thriving economy, businesses and job opportunities for their people.

2.3.3 Business

ICT and innovation are needed by businesses, also for businesses in developed countries to be able to participate in the global economy. Across the world are so called technology growth hubs. These hubs contain start up businesses, research institutes, and venture capital. Examples of these hubs are Silicon Valley in the United States, Bangalore in India and El Ghazala in Tunisia. [105] These hubs bring together innovation, business, and investment, ideal circumstances for people wanting to start businesses. These hubs are also linked to each other through technology development networks, and are therefore able to share information and work together.

There are many other ways ICT can contribute to business success. ICT can provide gains in productivity, efficiency and growth for businesses. Growth can be achieved by using e-

commerce to reach a new base of customers (potentially worldwide). ERP systems can contribute to increasing business productivity and efficiency. Administration in health care facilities (for example) can be improved using ICT solutions. Even much simpler options are available for enhancing businesses, such as farmers being able to track their herds using GPS. By customizing technologies many kinds of businesses can be helped using ICT. These opportunities do require investment, commitment and the necessary infrastructure. Businesses in regions where this is not available miss out on these opportunities.

2.3.4 Democratic participation

In the last year or two the internet has shown itself to be a huge instrument in achieving democracy. Examples are the Arab Spring and WikiLeaks. The internet and social media have the power to inform people of what is going on in their countries and in the world. It has the power to unite and coordinate people in their protests. When people are informed (for example about politics) they can make informed decisions. But what about countries where most people do not have access to the internet? What about countries where the political regime monitors activity on the internet and blocks undesired content?

In the literature the internet is shown to have the potential to have democratic effects, there are some side notes that accompany these claims. The internet can have effects that increase democracy, but this is more likely in countries where the process of democratization is already in motion. [21] This makes sense as where governments do not want democracy the internet is more likely to be censored and monitored, minimizing the democratic effects of the internet. However, where there is some form of democracy people with access to the internet do have the power to stay informed. This in itself is much more than people without internet access, who have little or no access to information.

2.4 Goals

This section may contain more questions than answers. It is about what goals we have in bridging the digital divide. Of course these goals are not the same for every person or every country, but it is something to think about none the less. Is ICT a goal in itself or is it part of a bigger goal, and what would that goal be? An end to poverty, democratic freedom, equality among people? Should ICT even be a priority when there is a shortage of food, water, education, healthcare, freedom, and so forth. Does ICT lead to economic growth, or is it the other way around? Does ICT, as some claim, have leapfrogging abilities? Meaning that countries do not have to go through a process of growth in ICT, they can be up to date right away. Clearly there are many questions, to which there are many possible answers and opinions. These answers and opinions will be put forth in the rest of this section.

Three perspectives provide possible answers to many of these questions. These are the market economy perspective, the IT for development perspective, and the social capital perspective. These were classified by [44] as possible answers to the question of why IT should be invested in over other goods and services. The market economy perspective says that ICT should not get a unique treatment, and its use should not be promoted. The use of ICT should be determined by market forces. There should be a competitive environment that encourages

innovation, and through this prices for ICT will go down. Market forces can be distorted by subsidies, and this will lead to an inefficient allocation of resources. The IT for development perspective looks at this a completely different way. This perspective says ICT and telecommunication services should be subsidized in order to bridge the digital divide. ICT is something that needs to be subsidized because people with low incomes cannot afford it, but it can support these people in increasing their incomes. The social capital perspective looks at this from yet another angle. It looks at the needs of people regarding ICT. It does not believe that ICT can leapfrog into a country, avoiding institutional obstacles, as well as deficiencies in skills and resources. The social capital perspective looks at ICT as something that can bring communities together, and focuses on its social and political importance. [44]

It is important, when trying to bridge the digital divide, that one determines from what point of view ICT should be regarded and that policies are formed around these viewpoints. These may not be the only views out there, but they do sum up the most common ones, and address the questions posed in the beginning of this section.

3 What to use ICT for?

This chapter will be about using ICT to bridge the digital divide. The chapter is split into two sections, the first is about the different applications ICT have for the development of a country. The second section is about the foundation that needs to be in place in order for ICT to become successfully integrated into the daily lives of people in developing countries. This foundation consists of three key elements: education, infrastructure, and government policy. It should be noted that education is both an foundation and application of ICT, and both aspects will be covered in the section on education.

3.1 Applications

3.1.1 Appropriate ICT

Before going into the actual applications of ICT it is important to consider that ICT applications that work in developed countries may not be as successful in developing countries. This can be due to differences between countries that have effect on the use (and need for) certain kinds of ICT. For this reason we will talk about appropriate ICT first. The notion of appropriate ICT as mentioned in the beginning of this thesis comes from [67]. Its goal is to create ICT solutions that are appropriate to the context they are to be used in, and thus appropriate to the needs, expectations, and limitations of the people and environment of that context. There are two perspectives to appropriate ICT, the product and the process perspective. The product perspective is focused on the hardware and software side, making sure the technology is appropriate for the context it is in. The process perspective focuses on delivering ICT solutions that are relevant for the users and will actually be used. The end users should be actively involved in the design process and adequately trained to use and maintain the software and hardware. Change management is an important part of the process perspective. There are several factors that [67] deems relevant to establish the context of a particular organization or country, these factors being culture, environment, organization, economy, and political climate. The exact definition of appropriate ICT as stated by [67] is as follows “*The integrated*

and participatory approach that results in tools and processes for establishing Information and Communication Technology (ICT) that is suitable for the cultural, environmental, organizational, economic and political conditions in which it is intended to be used.” A framework for the design and implementation of appropriate ICT has also been defined based on the System Development Life Cycle framework consisting of the following steps: definition, design, construction, installation, and operation/maintenance. The table (table 1) on the next page illustrates questions that help guide the execution of these phases for realising appropriate ICT solutions. For each phase there are questions for hardware and software (product perspective) and change management (process perspective). This table is originally found in [67].

Change management is an interesting concept, it also depends on culture what strategy for change management is likely to be a successful one according to [125]. When trying to make a change in any culture you are likely to encounter cognitive dissonance. Cognitive dissonance is a lack of comfort people feel when they have to take on new ideas that do not match their current beliefs or ideas. A change manager needs to overcome this discomfort in people in order to achieve the desired change. This is where Lewin’s three step model of unfreezing - moving - freezing comes in. Unfreezing means showing people why a change is necessary, moving is teaching people new attitudes and skills, and freezing is creating a routine for the newly acquired knowledge. Often only the second step is taken, while the other two are just as important for achieving a long term change, and commitment to this change. The first step “unfreezing” is the step that is most culturally dependent, and management style and motivation will have to be adjusted to the cultural situation.

[125] has identified 6 clusters of countries based on the profiles of these types of countries according to Hofstede’s five cultural dimensions (more about these dimensions can be found in the next chapter). For each of these clusters [125] has identified a concept that is key when trying to lower the resistance to change (for examples of countries and scores of the Hofstede dimensions see [125]). In the “contest cluster” the key concept is self interest. The change needs to be presented in a way that plays on this. Change needs to be presented either as if something will go horribly wrong if the change is not implemented, making it in everyone’s best interest to make the change. Another way of presenting a change is that participating in the change will be good for the individual in terms of being rewarded. In the “network” cluster the key concept is shared interest. People believe that management cannot decide what is good for them because they don’t know anything about the reality on the work floor. The only good way to create a change is by involving all actors in the decision making process. In the “pyramid- and family clusters” common interest is the key concept. In these two clusters people believe that the top of an organization should have everyone’s best interest in mind, and be willing to protect the groups best interest. The belief is that top of the organization has a complete view of the whole organization and is thus the one who should make the decisions about change. In terms of communicating about this change wishes should be made very clear, no ambiguity. The difference between these two groups is that there is low uncertainty avoidance in the family cluster, while this is high in the pyramid cluster. This makes that in the pyramid cluster decisions need to be delivered in writing, in a formal manner. In the family cluster a visible commitment to change is required from the leaders of the organization.

Table 1: Key guiding questions for Appropriate ICT Development [67]

Phase	Hardware	Software	Change Management
Definition	Specific requirements to hardware in terms of climatological and environmental conditions? What are the possibilities in terms of enabling factors (Internet connectivity, electricity)?	What are the needs? What are the expectations?	What ICT knowledge levels? What the financial constraints? What is the cultural context? What added value is created? How is the economic equilibrium affected? What new ways of working are introduced? What will the impact be of the system in terms of organizational change? What is the involvement in the idea generation of key decision makers (political leaders, religious leaders)?
Design	What is offered on the local market? What are physical constraints? What the financial constraints?	What interoperability needs? What localization is needed? What flexibility is expected?	What are the information needs of the various target groups? How will these needs evolve? How do the expectations change?
Construction	What local skills are available? Is the equipment protected against physical conditions?	What local skills are available? Are features in line with skills? Are free and open source alternatives considered? Are the systems well documented?	Are local skills and knowledge being developed? Are stakeholders actively involved? What new ways of working are introduced? What will the impact be in terms of organizational change?
Installation	Is all the equipment well protected?	Has the system been tested with all stakeholders?	Are all stakeholders involved in training program? Is the added value made clear?
Operation/maintenance	Is local capacity sufficient? Are spare parts easily available?	Are software maintenance skills available?	Is a support organization in place? Is the support organization able to support all stakeholders (e.g. Gender issues)

Future public interest is the key concept in the “solar cluster”. In this cluster the top of the organization is the one who has the necessary knowledge and power to make decisions about changes in the company. Commitment to these changes by the company leaders should be very visible, otherwise these changes will not be executed by the staff. The interest of the group is not top priority in this cluster, the future of the company is. People take pride in their work, this means that management should be visible but not too controlling or involved in the details of the work. The last cluster is the “well-oiled machine cluster”. Here the key concept is “agreed upon balanced interest by experts”. This concept is a bit vague, but it means that people who want to make decisions about change need to be recognized as experts by the staff. Without this credibility the chance of success is small. [125] It should now be clear that context is very important in creating appropriate ICT, and culture is very important in realizing the change that is necessary to implement these new technologies effectively.

3.1.2 Economy

This section is on the applications and impact that ICT can have on economic growth. This possibility for growth using ICT has already been shown to exist in developed countries. Growth in productivity and efficiency, e-commerce, and growth in telecom and broadband sectors are examples of how ICT can boost the economy. The production of ICT and related products also grows as demand for these products increases, which further boosts the economy and creates jobs. [59] ICT also has the power to make distance a less relevant factor. Thanks to the internet, e-mail, online banking, and e-commerce the need for travelling and transportation are reduced, which saves money. [59] states that just having ICT in a country is not enough, *“Other factors, such as the regulatory environment, the availability of appropriate skills, the ability to change organisational set-ups, as well as the strength of accompanying innovations in ICT applications, affect the ability of firms to seize the benefits of ICT. Consequently, countries with equal ICT diffusion will not always have similar impacts of ICT on economic performance.”* [59] The effect of ICT on economic growth in the following countries: Australia, Canada, Finland, France, Germany, Italy, Japan, United Kingdom and United States was measured by [10]. This was done in the 1980’s and 90’s. The results showed a growth between 0,2 and 0,5 % in these two decades due to ICT, rising to 0,3 - 0,9 % in the second half of the 90’s. The highest growth being observed in the United States, Australia, Finland and Canada. [10]

3.1.3 Government

What is e-government, and what areas does it cover? For this section we will use the definition provided by [23]: *“eGovernment is the use of information and communication technologies (ICTs) to improve the activities of public sector organizations.”* This article also states three areas that e-government covers, these areas are e-administration, e-citizens and e-services, and e-society. E-administration deals with making government processes more efficient and more effective. This covers matters such as cutting process costs and monitoring process quality, making more efficient/effective connections between agencies, departments, and data storage. E-citizens and e-services are aimed at connecting the people to the government. The citizens can either play the role of voter (or someone who the government has to be accountable to), or someone who is a customer of the government and makes use of its services. The government

communicates to the people about its decisions and actions, making itself accountable. The government listens to the people, increasing the public participation. Finally the government makes itself more accessible and convenient to the people, improving the services it provides. Lastly e-society connects the government to other organizations. These organizations can be other government institutions, companies, community organizations, and NGOs. The government can build partnerships through which it helps to develop communities in a social and economical way. It can also make itself more convenient to businesses that need to deal with government agencies by improving/digitizing processes, regulations, and services. [23] [55] states that the potential benefits of e-government are huge, potentially increasing government transparency, accountability, and public participation. An optimistic view of ICT is that citizens will start to demand more from their government as they have become accustomed to technical means of communication. Pessimists argue that institutions will only use the technology for their own benefit and not introduce new opportunities. Research has shown that the pessimistic perspective is most commonly the reality. [62] Research from Sweden, however, shows that citizens have been asked to participate, with good results. This leads to the conclusion that it is not that governments do not want to provide new services and opportunities to their citizens, but that they are slow in implementing these new services, and that the knowledge and enthusiasm for these technologies is lacking. [62] According to the e-government survey 2012 conducted by the UN the top 20 countries that are leading in e-government are all developed countries with high incomes. The emerging leaders group does contain some developing countries that are beginning to bridge the digital divide. These countries, among which are Kazakhstan, Chile, and Malaysia, have invested greatly in ICT in the past number of years. They have improved their infrastructures and human capital (skills), and provided user centric e-government services. [102] Singapore has been very successful in deploying e-government, and is number 10 on the list of World e-government development leaders 2012. In 2001 Singapore already provided 92% of its government services online. [40] has identified some lessons that can be learned from Singapore's efforts towards e-government. One lesson is that Singapore had a clear vision of what it wanted from e-government, and also articulated this clearly. Communication to stakeholders of what their role is and what is expected from them. Communication about the importance of e-government and motivation of stakeholders also played an important role. This vision was made into a business model that (among other things) identified all areas in which the government communicates with its citizens. Areas in which value could be added by providing services online were identified. High level system integration and making certain entities accountable for progress were also identified as success factors. Making e-government available to all citizens by bridging digital divides was another factor. The move from a bureaucratic to an open and knowledge sharing system is yet another factor. [40] [35] identifies universal challenges that e-government faces, these including the following. Stakeholders should have the necessary skills, and be aware of the value of e-government, the information and services provided should be useful, initiatives at all levels of government should be coordinated, indicators and methods for assessing e-government performance should be developed, responsiveness and responsibility of government workers should not decrease with the use of e-government, and finally language and communication issues should be addressed as well as the needs of disabled citizens. This article also states that *"the biggest concerns for e-government managers were not technical issues, but instead were policy issues, including coordination and collaboration between agency leaders, agency-centric thinking rather than focusing on the overall goals and functions of e-*

government, and communication to better understand and foster inter-relationships between e-government projects.” [35] In Kerala, India FRIENDS, and Keltron Information Kiosks were set up to provide access to e-government services to all members of the population. These kiosks are basically internet cafes at which one can handle their government affairs. [42]

3.1.4 Healthcare

Health care is a major issue in developing countries and plays a role in three of the eight Millennium Development Goals that the UN has set for 2015. These goals are to reduce child mortality, improve maternal health, and to combat HIV/AIDS, malaria, and other diseases. [101] How can ICT contribute to the improvement of health care in developing countries? [7] has identified 6 contributions of ICT to healthcare.

- *“Improved dissemination of public health information and facilitated public discourse and dialogue around major public health threats*
- *Enabled remote consultation, diagnosis and treatment through telemedicine*
- *Facilitated collaboration and cooperation among health workers, including sharing of learning and training approaches*
- *Supported more effective health research and the dissemination and access to research findings*
- *Strengthened the ability to monitor the incidence of public health threats and respond in a more timely and effective manner*
- *Improved the efficiency of administrative systems in health care facilities.” [7]*

The same article also proposes a number of simple guidelines for ICT in healthcare. These guidelines look familiar as they build on the same idea as appropriate ICT does. The guidelines are to not complicate matters, the technology used should be local, relevant and simple. The technology should not come out of nowhere, it should use, and build on what is already there. Education and training is important for the users of the technology. Users should also be involved in the design, and should be aware of the benefits of the technology. There should be approaches to evaluate and monitor the new technologies. Also knowledge about effective (and ineffective) methods should be shared. [7] The paper also names some concrete applications of ICT in healthcare. These applications have saved lives, but also improved health. For example mobile phones are used to remind TB patients to take their medicine. Epidemics can be traced through satellite technology, and help people get treatment in time. Campaigns have been set up to make people and communities aware of how to respond to HIV/AIDS. There are many other applications, but it is important to be aware of the fact that not all applications work in all places or situations. In healthcare (as all other situations) technologies should be appropriate to the context.

3.2 Foundation

3.2.1 Education

In light of this thesis the role of ICT in education can be seen in two different ways. The first is the education in the use of ICT, the second is the use of ICT in education. Both will be

focused on in this section. This section will be made up of three parts due to the broad nature of this topic. The first part states the effects and benefits that ICT can have on education. The second part will be about the levels of change ICT can bring to education. Finally the third part will give examples from case studies about implementing ICT in education. These cases studies will be from both developed and developing countries.

In the available literature much is said about the benefits of using ICT in education. It is reported that immediate benefits for students in primary and secondary education are that students show an increased motivation, attendance and higher academic results. Technology skills, English language, math and science scores, and self esteem have also shown to improve when using ICT in education. Not only students stand to benefit, teachers also report to be more motivated, and interact more with students as well as other teachers. IICD (Institute for International Cooperation and Development), which is a non profit organization that uses ICT for development purposes believes ICT contributes directly to education by helping teachers. It can be used by teachers to gather and share teaching materials online. Teachers can create handouts for their students, giving them materials they can take home and study, but also watch videos that illustrate the learning materials. [29] [25] writes about the roles that ICT can have in education. ICT can take on a pedagogical tool role, a cultural, societal and professional role, and an administrative role. The pedagogical tool role means that students can learn to work in different ways, for example collaboratively and project based. Using the computer students can also work through the learning material at their own pace, making more interesting for students who are fast learners and students who have learning disabilities. It is also said that ICT in the classroom makes students more motivated towards learning, potentially making them more active learners. The cultural, societal and professional role entails communication, primarily through the internet. Students can communicate with other classes, perhaps from different countries and different cultures. Teachers can interact with other teachers, sharing experiences, problems, teaching materials, and so forth. E-learning and online training is also a possibility. Administrative roles for ICT include student records, lesson plans, teaching materials, administration, and finances being kept digitally. This makes administration less of a hassle and makes it easier to share information with parents, policy makers, and other relevant parties. [25] In tertiary education ICT can aid students in learning through the available global knowledge on the internet, but also through e-learning. This makes tertiary education possible for students off campus. This lowers the barrier to tertiary education for students living far from higher education facilities. [80]. ICT in schools also provides more equality between students from rich and poor families. [115]

The levels of change ICT can provide in education depends on the way ICT is seen, but also the way teaching is regarded by policy makers, teachers and parents. It is dependent on how innovative the school can be and wants to be. [47] has created a schema with three levels of innovation regarding the manner in which ICT is used in schools. These three levels are assimilation, transition and transformation. These levels are defined as follows: Assimilation is the lowest level of innovation. ICT is used for typing papers, creating digital presentations, and specific projects. It is used as a tool for specific purposes, but the way the school actually runs, and the way students learn does not change. The transition level integrates ICT into the regular school activities. The content, manner of teaching, and organization start integrating technical solutions alongside the traditional ones. The way the school operates is the same,

but the way some activities are handled changes through the integration of ICT. The transformation level the school as a whole changes. The roles of student and teacher change, the way information is gathered changes, the time and place school activities are done changes, the curriculum is enriched, and the manner of learning changes. [47] has created a schema that puts these roles into perspective. The space in which a student learns moves from public spaces within the school to personal spaces, both within the school and in community spaces. Time for learning moves from allocated time blocks which are the same for each student, to the student allocating their own time according to their own needs. Outcome becomes more important than time spent. The teacher becomes an expert colleague in stead of the main source of information and leadership. Instead of having regular subjects that make use of ICT, new subjects are being designed using ICT. Assignments go from highly structured to being more open and creative, and students work in personal digital spaces instead of with generic digital tools. The innovation levels of ten Israeli schools that were models for innovation have been researched. Most of these schools were between the transition and transformation levels. Conclusions from this research were that ICT innovation within schools is an extremely complex process that is done gradually. It is difficult even in situations that are most favorable in terms of leadership, human capital, infrastructure and financial resources. [97] A different study reported similar levels of ICT integration in Japan. [126]

In this following section best practices that have come from case studies will be presented. The first part will contain case studies from developed countries, and the second part will be from developing countries. The following study [74] has studied the implementation strategies of schools that have successfully implemented ICT in Australia, Canada, Finland and Israel. In all these schools one of the success factors states was that computers and infrastructure were (put) in place at these schools and this was a non issue. Schools had access to internet and some even had their own intranet. It is remarked that funds for maintenance and upgrades should be not be forgotten. The long term sustainability of ICT in the schools depends on the allocation of these funds. It should also be mentioned that many of the students has access to a computer and internet at home and thus already had at least basic ICT skills. The goal for these schools was to integrate ICT in their curriculum and use it to change and improve the teaching and learning process. In one school ICT was fully integrated into one core subject in the curriculum, and ICT elements were added to other subjects. Electronic portfolios were used to assess students achievements. Another school had its own intranet and published all resources needed by students online. This made learning something students could do whenever and wherever they wanted, and made learning more individualized. Students had personal web spaces, and websites were used for student presentations and assessment. In this school ICT was also embedded in the curriculum, and not a loose concept. In these schools classrooms had 1-3 computers and schools also had computers in libraries and computer labs as well as in teacher lounges. Teacher training played a very large part in all schools. In some schools teacher training was mandatory, in some schools it was not. In some schools teachers received more salary if they participated in teacher training, and in some schools teachers were told they would receive more recognition and would be more likely to be promoted by participating in training. Training was done both in school, and out of school, and both during and outside of work time. A number of people acted inside schools to guide teachers. One school had ICT experts work together with one pedagogical leader (teacher) for each subject to create new teaching methods that incorporate ICT into the curriculum. This re-

sulted in the learning style becoming more active. Support “champions” (early adapters and risk takers), which were usually the younger teachers were appointed to lead the other staff in experimenting with these new learning and teaching techniques. In Israel there were three types of training. Basic skills training (Office, internet), training in integrating ICT in the learning process, and training for a group of “leading staff members” to develop curriculum into which ICT is integrated. Here training was done in government funded training centers. Students were also able to teach teachers. Training was based on the individual needs and skills of teachers. Plenty of guidance is necessary to train the teachers and convince them of the use for ICT in education. This does not mean that all teachers participated. Some did not see any use for ICT in school and some did not want to learn new skills. Real changes in the learning and teaching process occurred when teachers began to see the potential of ICT, for example online lessons and the sharing and publishing of teaching materials online. In Canada support from parents was high. This was because the relationship between the schools and the families was close, but also because the ministry of education and the media had raised awareness about the importance of ICT in education. In Finland communication between parents and teachers improved through the use of email. [74] A different study in Japan also shows that teacher training is an important success factor. These schools ensured a minimal level of technical skills in their teachers, and the sharing of course materials produced by the teachers. [126] A study that was conducted to identify obstacles to integrating ICT in education found that educational practitioners identify lack of computers and lack of teacher knowledge as main obstacles. It is noteworthy that the researchers found that even when the availability of computers was favorable many educators (40%) still reported lack of computers to be an obstacle. The author concludes that more computers would not be the solution, but staff should be trained to use the computers more effectively. It is also concluded that the knowledge of the ICT support staff at school, and their knowledge of the use of using ICT for educational purposes, is beneficial to the skill development of teachers. [61]

IICD has set up many initiatives to facilitate ICT in developing countries such as Bolivia, Zambia, Burkina Faso, and Tanzania. They have had successful outcomes and sometimes less successful outcomes. They have learned from these initiatives and composed a list of “practical lessons learned”. [27] In this paragraph the main points of this list will be presented. These lessons are for primary, secondary, and tertiary education, and also for teacher and technical training institutions. The first set of lessons is about integrating ICT in teaching and learning. First it is said that teachers should have ownership in the teaching materials and that these should be appropriate for the areas situation. Teachers should be trained to create their own teaching materials. This will also increase the usability of these materials. If other teaching materials need to be used in the beginning because there is not yet any teacher created content then teachers should be consulted in the selection of these materials. To increase the potential for school graduates on the labor market schools should adapt their curriculum and the use of ICT in the curriculum to the needs of the government and private sector. It may not be possible to fully integrate ICT and this can be very time consuming, so choosing wisely where to use ICT is very important. Effective teacher training is achieved when teachers are no longer afraid of ICT and when they can directly apply what they have learned in their teaching endeavors. Teachers should learn basic ICT skills, but also about ICT based teaching. Teachers should be confident about using ICT in teaching. Teachers should be able to share knowledge and experiences amongst each other. Therefore there should be

a network where teachers can communicate with teachers within the same school, but also nationally and internationally. This way teachers can share teaching materials but also stay motivated by learning from one another. To also motivate school leaders and administrators ICT should also be used to enhance management and administration. Then these people will also become motivated to use ICT. School management and administration staff should, for this reason, also be trained in ICT skills. Next are some lessons on technology. Teachers and students report that a major obstacle is not enough computers. They say that this is the main reason for not being able to use ICT effectively. IICD states that this is most important in rural areas where school is often the only place where teachers and students have access to computers. The internet is seen as a necessary tool. For teachers to access online teaching materials and lessons, for teacher and student networking, and for the exchange of management and administrative information. IICD points out that internet should only be used in areas where this is not overly expensive. In areas where internet is not an option other options such as CDs and partner organizations who can share information should be used from an early stage. It is important to consider the costs of the technology long term. Second hand computers may be available at no to very little cost but may be more expensive due to high maintenance and repair costs. Appropriate software should also be chosen. This should not be expensive software that requires high bandwidth. Simple solutions may often be satisfactory. Much has been said about using open source software. This may or may not be a good solution, it is important to carefully consider the available options and choose the one that is most appropriate. The final category is sustainability. It is important to have support from parents, school management and administration, and local government. ICT should be used by a large part of the teachers and students instead of only a small group in order to make ICT an integrated part of education. For sustainability it is also important to have a committee to maintain and manage the ICT at the school. Financially the ICT at schools should be sustainable. Not only the initial costs of ICT should be considered, but also the recurring costs such as maintenance and repairs, salary of ICT staff, internet and electricity. IICD states that smaller rural schools are usually able to sustain small computer labs. Maintenance should be done by school staff as help from outside can be very expensive. The school should have a trained ICT manager, but as these are difficult to retain a group of teachers and students should also be equipped with the necessary skills to maintain the computers. [27] Aside from these lessons other practical applications or methods for using ICT in education have been developed. One example is multiple mice. According to [60] there is a high student/computer ratio in schools in developing countries. This leads to one child, usually the oldest, controlling the mouse and the others passively looking on. Often only the child that is actually using the computer, and thus controlling the mouse, is learning and the others are not. Therefore [60] has developed software that allows multiple mice to be used on one computer. There is more than one cursor on the screen. This way multiple students can use and learn from a computer at the same time. The authors state that multiple mice have shown to increase engagement in students. UNESCO Bangkok proposes three ways to distribute computers within schools. Computers in the classroom, computers on wheels (or COWs), and computer labs. It also lists the pros and cons for each option. Computers in the classroom have the benefit of easier and more frequent access to computers for teachers and students. A problem is that this will usually mean that a class often gets only a few computers because of money and space restrictions. This will lead to ineffective use of computers as not all students can use the computers at the same time. Computers on wheels are carts that hold

a number of laptops (usually 10-20) a printer and a network connection. These carts can then be wheeled from classroom to classroom when they are needed. This has a number of benefits being that teachers can have a significant number of computers in their classroom without having to allocate room for them, no separate room has to be made available as a computer lab, because laptops run on batteries no extra outlets have to be fitted into classrooms, and because of the low number of computers at one school there are less software and hardware costs. Downsides are that the initial costs are higher than for PCs, maintenance costs will be higher as they are used more intensively, laptops are more likely to be dropped and damaged than PCs, and they can easily be lost or stolen because they are more mobile than PCs. Computer labs have many of the same benefits as COWs. Also only one or two rooms need to be equipped with electrical outlets, internet access, etc. Costs of computers for computer labs are less expensive than the laptops needed for COWs. Downsides are that demand for computer labs can get too high, with not every class getting enough time in the lab. This can lead to teachers not wanting to use the labs anymore. [110]

This section has mostly been about primary and secondary education. This next paragraph will focus on tertiary education. When reviewing the literature e-learning and online learning seem to be popular topics when talking about ICT in tertiary education. This can be both on and off campus. Let's begin with using ICT for on campus learning. There are many applications for this as named by UNESCO. *“Learning and course management systems are useful in generating and managing a variety of student support services and products, such as course outlines, digitally recorded classroom material, discussion groups, laboratory manuals and lab assignments, lecture notes, live lectures for later viewing and re-viewing, links to course specific websites, online tutorials, supplementary readings, and virtual office hours for teacher-student consultations. Virtual libraries, where they exist, are a particular boon to students as they cut down on costs of acquiring expensive textbooks, journals and reference material.”* [108] This paper shows the same as is said regarding primary and secondary education, namely that serious efforts and investments should go into teacher training. Also teachers need to be involved in the designing and creating of the ICT program, this to make sure that it is appropriate to the context in which it is being used. It is also proposed that higher education institutes that do not yet have ICT resources to first have a number of training sessions. This training should be on benefits of ICT, procurement of ICT (hardware and software), long term costs, training, contracting, power, connecting with other institutions, and all other things that come with being properly prepared for integrating ICT into the institution. These trainings should be used to create an ICT plan for the long term. Furthermore ICT should not be implemented across the entire institution at once. It should be piloted at a departmental level, to show policy makers that it is effective. Afterwards, when introducing it to the rest of the institution the hardware and software should be consistent throughout. The paper also lists pitfalls which just about summarize everything that has been said in this whole section. It is noteworthy to say that these are the same for tertiary and primary and secondary education. *“The four most common mistakes in introducing ICTs into teaching are: (i) installing learning technology without reviewing student needs and content availability; (ii) imposing technological systems from the top down without involving faculty and students; (iii) using inappropriate content from other regions of the world without customizing it appropriately; and (iv) producing low quality content that has poor instructional design and is not adapted to the technology in use.”* [108] Distance learning, or e-learning can be very successful

if done in the right way. [109] has taken the results of seven case studies on this subject and distilled some key points in distance learning from schools in India, China, Korea, Australia and Singapore. Of course distance learning means not being on campus but still having access to learning materials and communicate with students and teachers. To realise this a website and webportal are necessary. The successful institutions in the studies all have such facilities, and have gone above and beyond to make sure that these are user friendly and easy to access. Information and services for students also need to be handled online. Student records, test scores, timetables, payments, and all other necessary information need to be stored and be accessible for both administrators and students. Examples of services are employment services which advise students on future career paths, advisory services where students can consult faculty on subject selection, and a returning student service are services offered by the studied institutions. Modified versions of learning management systems such as Moodle and Blackboard are used by the institutions in the study. These provide students and faculty with online lecture, study materials, exams (and grading of these exams), submission of assignments, and communication between teachers and students. Learning materials are also available online, including virtual labs, libraries, project based learning, discussion, seminars, and pre recorded lectures. Of course administration and human resources are also handled using ICT systems. [109] These countries all have a relative degree of development and ICT infrastructure in place. A developing country that is also integrating ICT in tertiary education is Nigeria. Nigeria is working on both on campus and off campus e-learning. Nigeria's National Open University has 27 study centers spread across the country, and it aims to open more to have one center in each of the 36 states. Its aim is to make tertiary education available to all Nigerians. These study centers all have at least 25 computers that are connected to the local area network, and it is planned to connect these to the university system to be able to offer all students distance learning courses. At each of these study centers there are teachers and counselors to instruct and guide the students. ICT skills are becoming mandatory for students of teacher colleges, and also for some other students. There are two universities in Nigeria that are serving as an example for other universities that aim to introduce ICT to their programs. The Obafemi Awolowo University has internet via satellite, and an intranet. The campus has 15 computer labs, totaling around 1000 computers. It uses ICT for teaching, research, and administration. The second university, the University of Jos is getting support from the African Virtual Open Initiatives and Resources and the Carnegie Corporation. With this support it is creating its own e-learning programs, for example a website for medical students which allows them to perform virtual dissections. The Universities of Oxford and Cambridge have also taught courses at the university as part of a collaboration program. Other universities are making trips to these universities to learn how to integrate ICT in their own universities. [1]

3.2.2 Infrastructure

This section will discuss the infrastructure that is needed for ICT. In developing countries all the necessary infrastructure is already in place, and has been rolled out over time, progressing from one version to another. This raises the question if this should be the same for developing countries, or if they can jump right into the newest technologies. This is a discussion that is seen often in the literature, the question if ICT has leapfrogging capabilities. Since we know the infrastructure for ICT has been a gradual process based on new technologies emerging, and the demand for these technologies being the reason for them becoming available this

process will not be a focus of this section. This is not saying that this thesis assumes that leapfrogging is the way to go, however this process took 20 years in developed countries. If developing countries were to take the same approach they would not be making use of the available technologies and knowledge and would always stay behind. For this reason we will look to two categories of countries to gain knowledge on the implementation of ICT infrastructure. The first will be the BRICS (Brazil, Russia, India, China, South Africa) countries which are still considered to be developing countries, but whose economies are growing at a rapid pace. The second categories will be the other developing countries that are not yet on the fast track to development.

As said before leapfrogging is seen by some as the only way for developing countries to catch up with developed countries on the ICT front. [17] defines technology leapfrogging as *“the adoption of advanced or state-of-the-art technology in an application area where immediate prior technology has not been adopted.”* A number of objections have been made against leapfrogging, however these objections refer to the human aspects behind technology such as education, training, policies, and social context. These aspects will be dealt with in other sections of this thesis. Several articles have made recommendations about how to implement current ICT in developing countries. According to [17] leapfrogging technologies should not rely on a tangible grid, and therefore should be wireless. Wireless technologies are estimated to cost 20% of fixed technologies. These technologies include mobile telecommunication, satellite communication, but also decentralized electricity sources (such as solar power). This has been proven to work as many countries in Africa, but also China, have replaced or skipped fixed networks for mobile phones. Further recommendations made by [17] are that developing countries should not use immature technologies that have not been proven useful by developed countries as this poses a high (financial) risk. Competitive market conditions have also been said to be necessary as monopolies can lead to prices being high. It has been shown that mobile penetration is higher in competitive markets. To prevent leapfrogging from creating a digital divide within the country all areas, including rural areas should be covered. Leapfrogging also requires strong and committed government policies. For this reason leapfrogging related to this subject will be covered in the next section, which is about government policy. As human resources, a properly educated and IT literate labor force, do require time to achieve leapfrogging was not covered in the education section.

BRICS countries have shown a major growth in their economy, but also on the front of ICT in the last ten years. This leads to believe there is a lot to learn from these countries. How did these countries develop their ICT infrastructure and what were their success factors? First we will look at India and China. Telecommunications in these countries were owned by the state, monopolistic, against innovation, and inefficient, according to [89]. Liberalization is named as one of the prominent factors that helped to grow the ICT infrastructure in these two countries. It is said that China is at a more mature stage at the moment, but that India is catching up. Other factors for growth were heavy investment by the governments, foreign direct investment (FDI), and demand from the population. This demand led to internet being introduced in both countries. Especially in India these measures were not yet enough. Even though competition was allowed, there was no competitive environment, and regulations caused companies to face hurdles when wanting to build new facilities. From 1998 even more changes took place in both India and China. In China the government reorganized the tele-

com companies into seven separate companies to encourage competition. FDI also continued to grow. Within China the digital divide continued to shrink to almost not existing. In India the telecommunications market grew tremendously due to further liberalization. India also saw the need for electricity and telecommunications for economic growth and FDI. Due to an unstable political climate India has been left behind China. Another factor is that China is years ahead of India in terms of physical infrastructure, meaning electricity and roads. [89] Obviously most of these factors have much to do with government policy, and thus creating an ICT friendly environment seems to be a key factor in creating a solid ICT infrastructure. In Brazil, where all telecommunications were in the hands of the government, privatization was started in 1998. Here privatization did not have such positive effects as in China and India. This is largely due to ineffective regulation. Before this year regulation and operation were in the hands of one party. The goal of privatization was to create a competitive telecommunications market, this however failed because one consortium gained control over all fixed line telephone structures. This resulted in a monopoly. This was not the case for mobile telephony, which did grow. Flaws in the contracts between the private companies and the government led to other problems. One is that these companies are not required to provide all areas in the country with access, meaning that large parts of the country (44% of the municipalities) are neither covered by mobile signal nor internet. Rural areas are completely disconnected, apart from being covered by fixed line connections which are very expensive due to the monopoly. [2]

Moving on to developing countries. The Thai government announced big plans when the Asian-American Gateway (AAG) was opened in 2006. This is a submarine communication cable connecting the two continents. Thailand announced itself to be ASEAN's (Association of Southeast Asian Nations) new ICT hub. While internet usage did improve by about 30% per year Thailand is lagging behind its poorer neighbors. This can be directly blamed on a poor government policy, and execution of this policy. It has been said earlier in this section that liberalization and privatization (combined with proper regulations) can support the creation of a solid ICT infrastructure. Thailand has set up a commission to act as an independent regulator, and the ministry of ICT has set up policies meant to ensure competition and standards these measures have not been as successful as was hoped. Due to liberalization only partly being achieved prices are still high, and quality and access of internet are still quite poor. [6] Overall Thailand does not seem motivated to liberalize its ICT infrastructure. This in contrast to Cambodia which has been developing its ICT infrastructure more successfully since the end of the nations conflicts. Cambodia has received aid from, and worked together with the UN, the World Bank, IMF (International Monetary Fund), EU (European Union), ASEAN, but also with non government- and international organizations and private consulting firms to establish ICT in the country. Telecom companies also have a share in the development and improvement of ICT infrastructure. [84] In 2006 Cambodia introduced the Telecom Sector Reform. Before this reform the Ministry of Posts and Telecommunications (MPTC) were the policy makers, regulators, and operators of the telecommunications network. Now these are in the hands of separate authorities. The MPTC is still policy maker, there is a Telecom Regulator of Cambodia, and operation is done by Telecom Cambodia (TC). TC is state owned, and runs alongside other telecom operators and internet service providers (ISP). As of 2011 Cambodia counts 4 fixed line operators, 3 international carriers, 16 operational ISPs, 15 operational Voice over IP (VoIP) companies, and 229 internet cafes. There are also 10 mobile operators of which 6 offer 3G. Telecom operators have been laying

a fiber optical backbone for the country, connecting it with neighboring countries. The result of this is that all 24 provinces in Cambodia are currently connected. In 2006 there were 1,1 million mobile phone subscriptions, in 2010 there were 7,5 million. In 2006 there were 9 thousand internet subscriptions, in 2010 there were 194 thousand. This is a huge growth over four years. Cambodia also plans to offer wireless broadband in the future. There are also many projects to improve the ICT penetration in rural areas. [49] All in all it can be said that Cambodia is far from there yet, but is on the right track and has a government that is committed to ICT and open to support from outside organizations and foreign investments.

The infrastructure in Africa is as follows. Fixed lines were used for telecommunications in the past and did not have much success as penetration levels were low. A preferred substitute was mobile networks which were generally cheaper and more flexible. With the increased popularity of the mobile phone and mobile networks the infrastructure for these networks also expanded. According to [123] in 2009 90% of people in urban areas lived in range of a mobile network, this is 48% for rural inhabitants. These numbers are still growing, but at an increasingly slower pace as many uncovered areas are not interesting from an economic standpoint. The fixed lines in Africa are not sufficient for broadband services. For this purposes wireless technologies are being used. Providers are updating their infrastructures to be able to deliver 3G and in lesser numbers LTE. The “last mile” as it is called, the part of the net between the network and the user is expected to remain wireless, however networks are upgrading the backbone of their networks to fiber optic technology. Half of the fiber optic cables being installed are being provided by private companies, and this number is expected to go up as more mobile networks start providing data services to their customers. In Africa we see the same as we have seen in the rest of this section regarding government policies, as [123] writes *“countries that have encouraged investment in fiber networks through issuing licenses and assisting operators to obtain rights of way, for example, have achieved much better results than those that have placed restrictions on fiber networks. Such restrictions include licensing constraints that limit the potential size of operators’ markets, obstacles to obtaining rights of way, and, in some cases, outright monopolies.”* It is also mentioned that competing networks cause prices to drop. A problem is that these backbones usually run from major city to major city, or to borders or submarine cables. This means that rural areas are often not connected. We have also seen this problem in Brazil, where regulations did not demand network operators to provide universal access causing many areas to remain disconnected. Another positive development that is seen by [123] is that privatization and mergers cause companies to have shares of mobile networks in neighboring countries, meaning that countries are being linked creating cross border networks. It also means that countries which do not have a coast are also being connected to submarine cables.

Electricity is another important part of infrastructure that is to be covered in this section. In the beginning of this section it was mentioned that leapfrogging technologies should not rely on a tangible grid. For electricity decentralized power sources such as solar power were suggested. In developed countries almost all people (99,8%) have access to electricity (in 2008). In developing countries this is only 72%, leaving 1,453 billion people without electricity. In Sub-Saharan Africa only 26% of people have access to electricity, this is 561 million people. [116] The problem is worse in rural areas as only 14% of people in rural areas have electricity, compared to 60% in urban areas. These numbers make widespread use of com-

puters in this area of the world difficult to envision. The lack of electricity and modern fuels also cause people to rely on solid fuels for cooking. These fuels are less energy efficient and pollute the air. This is a cause of a large number of deaths in developing countries. More about this can be read in [116] and [124]. Clearly there is more than one good reason to make electricity and modern fuels universally available. According to [124] governments and other organizations working to make energy sources available to a larger number of people are looking to renewable energy sources to achieve their goals. [124] also states that “*As new approaches to electrification evolve—ones that don’t rely on expensive regional or national grids but rather a diversity of locally available energy resources—we can begin to reach for the goal of access to electricity for all, rural as well as urban. But access to electricity needs to be based wherever possible on low-carbon energy, since we need to preserve a climate conducive to health and well-being.*” Of course a very good case can be made for renewable energy sources as well as bio fuels. For these sources of energy there is no longer a need to rely on other countries for fossil fuels, and also no need for potentially dangerous power plants.

We should also look to Chile and Argentina as these countries were among the first to successfully reform their electricity markets. Not surprisingly the lessons learned from these electricity market reforms are the same that we have learned earlier in this chapter about telecommunications markets, namely privatization and liberalization. Whereas Chile had a rocky start with its reform it now has 31 generating companies, 5 transmission companies, and 36 distribution utilities which for the most part are privately owned. In the beginning (in 1982 when the electricity power law was put into place) the state owned power company was privatized and made into one private company. This company generated, transmitted, and distributed electricity. Later the market was also liberalized and competition increased. There are also no restrictions for foreign investment. [64] Argentina had learned from the mistakes made by Chile. The country unbundled generation and transmission, privatized, and liberalized the electricity market from the beginning of the reform in 1992. It is also suggested by [65] that governments should not unnecessarily interfere with the pricing of electricity.

3.2.3 Government Policy

This section will discuss what governments should do to help their countries bridge the digital divide. In the previous section much has been said about what governments should do to help facilitate the necessary infrastructure for ICT. Therefore infrastructure will not be discussed in this section. What will be discussed are policies to promote the use of ICT as presented by [44]. Furthermore government policies regarding ICT will be discussed for various countries.

A number of policies are suggested by [44] to facilitate the use of ICT. One of them is investment in infrastructure. As was said before this will not be covered in this section, for this information [44] as well as the previous section of this thesis can be consulted. Another policy suggested by [44] is investment in education. It is stated that the focus should be on secondary and tertiary education. This is due to the fact that only people with these levels of education have the skills to create new technologies and industries, and be innovative. These students should study subjects such as mathematics, engineering, computing, and science. The government should improve access to education for example by providing students with the financial means to get such an education. This can be achieved through student loans or

bursaries. Of course [44] realizes that this may not be a major concern or priority in countries that are still struggling with universal primary education. Apart from traditional education companies should also be continually educating their employees in order to keep up with the ever changing ICT market. The government should provide companies with incentives to realize these trainings, for example tax related benefits. Also, communal access to ICT that is deemed useful should be subsidized by the government. An example of this are the PIAC mentioned in the previous chapter of this thesis. A lot of literature on telecenters is available, examples are [31, 33, 48, 66].

What the government should also do according to [44] is foster an environment that encourages innovation through R&D. The government can create favorable conditions for companies willing to invest in this by offering financial as well as legal incentives for the private sector. Tax breaks come to mind, but also enforcement of (intellectual) property rights (such as patents) and contracts. Intellectual property rights, especially with respect to ICT is a topic of great controversy, even in developed countries. A perfect solution is yet to be found and this thesis will not attempt to say what road developing countries should take on this matter. It is however important that companies feel comfortable in investing in innovation by having some guarantee that they will profit from their inventions. Another important factor is rule of law, meaning that the law is enacted and the private sector is not subject to the whims of government officials. According to [44] governments should take up R&D on topics where the private sector stays behind, such as basic research. This can be done through direct investment in research, but also by establishing links between companies and universities. In developing countries the focus should be on adapting new technologies to local needs.

The ICT hubs mentioned in the previous chapter come to mind now. Bangalore is a very successful ICT hub in India. [13] has identified a number of factors that have made this ICT hub successful. The government provides tax incentives for ICT companies that come to Bangalore, these incentives are also provided for companies that invest in infrastructure. In the industrialized areas telecommunications and electricity services are much better than in other parts of the state. There are many training institutes in Bangalore, more general higher education institutes, but also specific institutes for science and technology. Bangalore is being promoted by the state government as a software capital by the government. The government has also set up incentives to discourage companies from settling in the urban areas, and instead settle in the less economically developed areas of Bangalore. This has been done to optimally use the available land for boosting the economy and creating jobs. Government agencies have also set up industrial estates in and around Bangalore. Water and electricity have been available in Bangalore at low prices, and the government takes measures for this to remain the case. [13] More generally speaking things successful ICT hubs have in common according to [44] are easily available superior infrastructure, appropriate government policies that support growth, skilled human capital, the presence of multinationals, and the availability of venture capital. The presence of universities and research facilities that are capable of being innovative and an entrepreneurial spirit among the population are also important factors.

This next paragraph will be about the government policies regarding ICT in Botswana, South Korea, and Peru. [79] has conducted a study comparing the ICT policies of Botswana and

South Korea. Since South Korea has been very successful in implementing ICT the study compares these countries to see what Botswana, as a country that is just beginning to use ICT, can learn from South Korea's ICT policies. The very first thing South Korea took care of was providing institutional, legal, and regulatory frameworks. This was done by implementing e-government projects and instating a large number of new laws regarding ICT. Education is also a big factor as children in South Korea receive good education that incorporates ICT from the beginning of primary school. Another factor in ICT is the awareness of the usefulness of ICT, and therefore the commitment from the population to using ICT. In South Korea government and the private sector worked together to achieve an infrastructure for ICT through a significant number of projects. These projects caused the accessibility of ICT to rise quickly, to where now the percentage of people in South Korea to be connected to broadband internet is the largest in the world. [79] At the moment Botswana is primarily focusing on infrastructure and policy frameworks in its efforts to bridge the digital divide. The article states that Botswana should put more emphasis on ICT training and education, and also on awareness campaigns to spread the knowledge about the benefits of ICT to its citizens. [16] has written about lessons that can be learned from ICT policy in Peru. The main problems related to implementing ICT in Peru is that too much is expected in too little time, and that there is no nationwide plan covering all aspects of ICT, most projects are separate from each other and have short term goals. Peru has complex bureaucratic structures, and cultures that are not considered when planning ICT initiatives. This makes executing such a plan more difficult than anticipated. Also projects are given too little time to achieve what are expected to be substantial results. This all has led to disappointing results regarding the use of ICT in Peru. The author concludes the following: *“In order to achieve better results in ICT initiatives, developing countries have to should adopt realistic long-term plans. The strategy should accommodated the country’s ICT initiatives and reflect acceptable levels of change adjusted to the country’s resources, and executed in stages within reasonable timeframes that would respond to both the social and cultural changes brought by ICT. Developing countries implementing ICT initiatives should consider suitable strategies in order to empower their citizens before going to advanced stages of the initiatives.”* [16]

4 Zambia

4.1 Culture

When speaking about culture the five Hofstede dimensions will be used. These five dimensions are power distance, individualism, masculinity, uncertainty avoidance, long-term orientation. Hofstede has made each of these dimensions into an index on which countries can be scaled. [26] First the five dimensions will be explained, later the index scores of both Zambia and the Netherlands will be presented. The reason for presenting the scores for the Netherlands as well is so that the differences between the two countries become clearer. In order to bridge the digital divide the people of Zambia must be understood. Changes must be made in a way that works for Zambians, and this will most likely not be the same way as in western countries such as the Netherlands. How these cultural factors affect change has been discussed in the previous chapter.

Now the first dimension is power distance. This is the manner in which people accept an

uneven division of power, and thus inequality among people. In countries with a high power distance hierarchies are accepted and not questioned. In countries with a low power distance efforts are made to equalize the division of power and unequal power divisions are met with resistance. In Zambia the power distance is 60 (out of 100) and in the Netherlands this is 38. This means that the division of power in Zambia is much different than it is here in the Netherlands. The second dimension is individualism. A high score on this indicator means a high degree of individualism, a low score signifies a high degree of collectivism. Individualism means that people don't have very strong ties to their social groups, and are only expected to take care of immediate family members. In collectivist cultures people are expected to take care of their complete social group, and have very strong ties with this group. Being taken care of also entails being loyal to that group unconditionally. In Zambia the score is 35, while the score in the Netherlands is 80, meaning that Zambia is a collectivist country, and the Netherlands (strongly) individualist. Masculinity is the third dimension. A high score on this dimension signifies a masculine culture, a low score signifies a feminine culture. Masculine cultures are competitive, materialistic, failure is not an option, and assertiveness is rewarded. Feminine cultures do not place much value on achievement or materialism, it is more geared toward cooperation, modesty, and looking after the weaker members of society. In Zambia the score is 40, in the Netherlands it is 14. The Netherlands is clearly very feminine, while Zambia seems to be in between the two. The fourth dimension is the uncertainty avoidance index. Is a country comfortable with the fact that they cannot predict the future or not? Does a country try to control the future, or do they go with the flow? Countries with high uncertainty avoidance prefer to stick to their traditional values and resist change and unorthodox behavior. Countries with low uncertainty avoidance are not so rigid in their practices and beliefs. On this dimension the Netherlands and Zambia score (almost) equally. Zambia scores 50, while the Netherlands scores 53. The last dimension is long term orientation. This has two sides to it, first is traditions. Short term oriented countries score low on this dimension, they believe there is one "truth" and that traditions should always remain the same. Long term oriented societies believe that "truth" depends on the situation and context that is applicable to the time, they are able to adapt their traditions to the time. The second side is what the name indicates, short term oriented countries do not save resources for the future and are after quick results, long term oriented countries are more likely to be thrifty with their resources and have long term goals. This dimension does not have a score exclusively for Zambia, however Zambia is in the Eastern Africa group, and this group scores 25 on long term orientation. The Netherlands scores 44. [26]

As can be learned from the previous paragraph Zambia has a collectivist culture. Extended family and the local community are very important factors in the lives of Zambians. Most people live with their parents until they are married, and families have several (many) children. People feel close to their family members even if they do not see each other often. The elderly and professionals such as doctors and teachers are especially regarded as people who are to be treated with respect. The Zambian government recognizes 73 different ethnic groups. Between these groups many languages exist, of which 7 are official languages. English is the official language of the government. The cultural groups do not differ a great deal. This is due to people moving to different areas looking for work, and also due to President Kaunda calling for national unity after Zambia gained its independence in 1964. Zambians are proud of the peace in their country due to the (almost) complete lack of violence between the ethnic

groups. 99% of the people in Zambia are Africans. Some are businessmen from South Africa, or Zimbabwean farmers who lost their land due to the struggles in their country. The other 1% are European, North American or Indian who came to Zambia to work in business, commerce, farming, or tourism. Religion is also an important part in Zambian life. 75% of people are Christian, and 20% are Muslim. The Christians are either protestant (which was introduced to Africa by missionaries) or belong to one of the locally established Christian faiths. Many Zambians also follow traditional religions in addition to the religions named above. By law men and women are equal in Zambia, and discrimination by gender and marital status is illegal. In practice there is much discrimination against women. Women often have to do all the house work, take care of the children, and work on the farm. The opportunities women get are few. It is difficult for girls to get an education, much more girls drop out of school than boys. It is difficult for women to get credit or loans. Banks often require men to be a guarantor for the loan, and even permission from the husband. This makes it difficult for women to acquire means to make a living for themselves. [51]

4.2 Health

Health, or better said lack thereof is a major issue in Zambia. HIV and AIDS are a common disease as more than 1 in every seven adults is infected. This is one of the worst HIV and AIDS epidemics in the world. 76.000 adults were became infected in 2009, this is 200 people per day. The life expectancy at birth is now only 39 years. Even though the country has received vast amounts of money to fight this epidemic numbers are not dropping. This has major consequences for the economy which is weakened by this disease. Of course this has many more consequences, a good source for further information on this topic is [3]. Further health related problems Zambia deals with are infant and child mortality. Per 1.000 live births 86 infants died, and 141 out of 1000 children died under the age of 5 in 2009. In 2008, out of every 100.000 live births 470 mothers died. Only 46,5% of births in 2009 were attended by a health care professional. In 2009 45,8% of children under 5 had stunted growth and 14,9% of children under 5 were underweight due to malnourishment. 433 out of every 100.000 people contracted tuberculosis in 2009, and nearly 3 million cases of malaria were reported which resulted in 3.862 reported deaths due to malaria in 2009. In this same year 4,8% of the GDP was spent on health care. [91] Furthermore urban areas are crowded as they accommodate almost half of the Zambian population. This leads to shortages of water, electricity, and sewage problems. This in turn causes cholera outbreaks in the rainy season. Money for healthcare is often not available as the families of city workers sometimes have to live on less than 1 \$ a day. This is not much better in rural areas as many farmers work to sustain themselves, and the failure of their crops means no money and no food. [51]

4.3 Environment

This section will discuss the geography and climate of Zambia. Zambia lies in the south of Africa. Its neighboring countries are Mozambique, Zimbabwe, Botswana, and Namibia to the south, Angola to the west, the Democratic Republic of the Congo to the north, Tanzania to the north-east, and Malawi to the east. It is a very large country, the 39th largest in the world, consisting of 752.614 square kilometers. The country is divided into nine provinces: Central, Copperbelt, Eastern, Luapula, Lusaka, Northern, North-Western, Southern, and

Western. [121] It is a country that is situated quite high, averaging between 1060 and 1363 meters above sea level. This is due to the fact that Zambia is mostly a high plateau, with some mountains and hills. The north consists of broad plains, which flood in the rainy season. The altitude lowers in the south of the country, here the plateaus are broken by large river valleys. [128] Zambia is rich in water, consisting of some major rivers and lakes. There are two river basins covering most of the country, these are the Zambezi/Kafue basin, and the Congo basin. The Zambezi/Kafue basin consists of a number of rivers, one of these being the Zambezi river which falls over the very famous Victoria Falls. [121] The country also consists of 19 national parks, the most famous being North- and South Luangwa, Kafue, and Lower Zambezi which have both beautiful scenery and wildlife. [51] The climate in Zambia is classified as “humid subtropical” and “subtropical wet and dry”. This goes for most of the country, except the south-west which has a “steppe climate”. There are three seasons, dry and warm from May-August, dry and hot from August-October, and the rainy season from November-April. September and October are referred to as “suicide months” due to very high temperatures, in which conditions get very dry and dusty. [51]

4.4 Economy

Zambia has quite a low score of 0,430 on the HDI in 2011, much of this having to do with the poverty in the country. This puts Zambia in 164th place, out of 187. The percentage of people living below the income poverty line is 64,2%. [106] Zambia had a population of 12,93 million in 2010, with a population growth rate of 1,6%. GNI per capita (PPP (Purchasing Power Parity)) is \$1380. The GDP (Gross Domestic Product) was \$16,19 billion, with a growth rate of 7,6%. Inflation was 11,7%. [94] Unemployment is a major issue as this was estimated to be 50% in 2009. Zambia’s major economic sectors are copper mining (and other metals and minerals), construction, chemicals, food/beverage, textiles, fertilizers, and horticulture. There has been a rise in the Zambian economy (and drop in inflation) in the last few years, and economists seem to be optimistic about the direction in which the Zambian economy is heading. Causes of this are liberalization and privatization. After years of declining copper mining due to a lack of investment the copper market was privatized. This has caused a rise of foreign investment in the copper industry. This combined with higher copper prices has improved earnings from copper. Prices of maize, which is a major crop in Zambia also rose. Zambia qualified for and received debt relief under the Highly Indebted Poor Country Initiative in 2005. The liberalization in Zambia is showing positive signs, but there is much room for improvement, which will attract even more foreign and private investment. “According to the World Economic Forum, Zambia ranks 112 out of 133 in the Global Competitiveness Report. The country ranks 99 out of 180 on the Transparency International on Corruption Perceptions Index.” [15] This source also states that shifts in the labor force will also make Zambia more money. 9% of the labor force works in the service sector, however this sector creates 49,5% of the GDP. The same can be said for industry, which employs 6% of the labor force and creates 31,3% of the GDP. In contrast agriculture uses 85% of the labor force, and this sector only creates 19,2% of the GDP. This suggests that the labor force could be used in a more effective way. Overall “*imports and exports [are] increasing, currency [is] stabilizing and national interest rates [are] going down*”. [15] This being said Fitch Ratings has downgraded Zambia in March 2012. Ratings have gone from stable to negative (remaining at B+). This downgrading is the result of government policy

changes, and plans to turn back privatizations. [43]

4.5 Politics/government

The head of state and head of government in Zambia is the President. The political system in Zambia is called a Presidential Representative Democratic Republic. It can also be called a multi-party democracy. The cabinet consists of the president, vice president, and ministers for each of the 17 ministries. This cabinet holds the executive power in Zambia. The National Assembly consists of members that were chosen for each of the country's 150 constituencies (electoral districts), plus up to 8 members that are appointed by the president, and lastly a speaker. This National Assembly has the legislative power in Zambia. The judicial power lies with the courts. The higher of these courts is the Supreme Court, with three levels of courts below it. The vice president is appointed by the president. All members of the government serve in 5 year terms, the president being limited to two terms in office. More locally Zambia has ten Provincial ministers (governors), one for each province. [120] Currently the president is Micheal Sata of the Patriotic Front party. Guy Scott is the vice president. The three largest parties in the National Assembly are the Patriotic Front party (democratic socialism, 60 seats), the Movement for Multi-Party Democracy (social democracy, 55 seats), and the United Party for National Development (liberalism, 28 seats). In the last elections a major change occurred as the PF gained 17 seats, and the MMD lost 20 seats. [120]

4.6 Desired impact

This section will be part of the conclusion to this theoretical framework. It is a follow up to the "Goals" section in chapter 2. That section contained quite a lot of questions, and not so many answers. Using what has been learned by writing this theoretical framework a better answer can be given to what goals we strive for (or what impact we desire) when implementing ICT in a developing country (Zambia in this case). Three points of view (and approaches) were named in the previously mentioned section. These were the market economy perspective, the IT for development perspective, and the social capital perspective. As was to be expected each of these approaches has merit and no one way is the right way. What we want from ICT in Zambia is to help people free themselves from poverty. What ICT can do to help achieve this goal can be read in the previous chapter. The next chapter will explicitly relate what ICT can do to the situation in Zambia. Now let's discuss the three perspectives. The market economy perspective states the following "ICT should not get a unique treatment, and its use should not be promoted. The use of ICT should be determined by market forces. There should be a competitive environment that encourages innovation, and through this prices for ICT will go down. Market forces can be distorted by subsidies, and this will lead to an inefficient allocation of resources." Now according to the previous chapter this perspective is right in saying that a competitive environment that encourages innovation should be in place. However saying that the use of ICT should not be promoted and its use should be determined by market forces may not be the right way to go. In a country that does not have any social or other context in which ICT fits it is necessary to promote ICT in a way that people see the benefits of using it. Also in a country in which 64,2% live under the poverty line it will take a very long time for prices of ICT to go down sufficiently for ICT to become affordable for the majority of the population. Another point that is missed is that the knowledge and training

needed in order to use ICT will still be missing when using this perspective. The IT for development perspective says that “ICT and telecommunication services should be subsidized in order to bridge the digital divide. ICT is something that needs to be subsidized because people with low incomes cannot afford it, but it can support these people in increasing their incomes.” This perspective does call for a special treatment of ICT, but does leave out a few important things, such as social context, but also long term solutions and the market. Finally the social capital perspective “looks at the needs of people regarding ICT. It does not believe that ICT can leapfrog into a country, avoiding institutional obstacles, as well as deficiencies in skills and resources. The social capital perspective looks at ICT as something that can bring communities together, and focuses on its social and political importance.” This perspective does take social context and education into account, however only focuses on social and political issues that can be solved with ICT. ICT has many other uses that can be benefitted from. It is however realistic in saying that obstacles and deficiencies need to be addressed in order for ICT to work in a country. Overall this last perspective seems to be the best one in terms of being the most realistic. However positive points from the other two perspectives need to be merged with the social capital perspective in order to come to a (reasonably) ideal solution.

We also need to consider the shifts in ICT4D (Information and Communication Technologies for Development) in the last two decades. From the mid 1990’s to the mid/late 2000’s ICT4D can be characterized by what has been named ICT4D1.0. From the mid/late 2000’s ICT4D has shifted to what is called ICT4D2.0. The main difference between these two is the shift from the supply to the demand side. ICT4D1.0 is said by [24] to take existing ideas about how ICT should be used for development purposes and impose these on the intended users. ICT4D2.0 takes a different approach, as it builds ICT solutions around what the intended users want, their existing resources, and their skills. It should be asked how people in developing countries would use ICT if it were up to them. This can be compared to taking the “appropriate ICT” approach. Sustainability, scalability, and evaluation have also become important terms in ICT4D2.0. This due to the fact that many ICT projects did not survive in the long term due to lack of financing, and the need to reach a larger set of people with these ICT projects. [24] This new approach to ICT4D has learned from the shortcomings of the previous approach and must therefore be taken into account in bridging digital divides.

Conclusions

This concluding section to the theoretical framework will reflect on the results of the theoretical framework, and particularly on what these results mean for the method that was set out in the first chapter of this thesis. In the method section it was said that it should be carefully considered if best practices that are identified in chapter 3 can be applied in Zambia, if these are universal best practices. The reviewed research has shown that the practices identified are universal, as these practices have shown to be effective in many articles, countries, and situations. Therefore these results will be used in the models that will be created in the next chapters. The reviewed research has also shown that culture, social context, appropriate ICT, and change management play very large role in bridging the digital divide. Therefore more attention will be given to these subjects in the rest of this thesis. Special focus for these subjects will be in chapter 5, but they will also be important in chapters 6, 7 and 8. Chapter 9 will present a model for Zambia, this model will bring together the models from chapters 6,

7, and 8, but will also incorporate the information presented in chapter 5. This way all information presented in this thesis will be present in the final result. This final model should also give more insight on links between concepts that have not been seen before. These insights will be presented in the concluding chapter of this thesis, chapter 10.

5 Appropriate ICT in Zambia

This chapter will describe ICT applications that are appropriate to the Zambian context. First the impact that the cultural and social context in Zambia has on the way change management should be approached will be described. This can help in understanding how the transition to using ICT in the Zambian context can best be achieved. Next four areas in which ICT can be used will be described. These areas are healthcare, environment, economy, and politics/government. These sections will not address all the appropriate ICT factors as given in 3.1.1. It will describe how ICT can be used specifically to address Zambian issues. Specific questions such as in tables 1 and 2 should be answered locally by people who are creating these ICT solutions. In terms of environment it should be considered that Zambia can be both very rainy, but also very hot and dusty, depending on the season. It should also be considered that for the most part ICT skills of the intended users will be poor to non-existent, just as the necessary infrastructure.

5.1 Social context

In this section the knowledge presented about change management, and Zambian culture will be combined and added to. First we will take another look at how Zambia scores on Hofstede's five cultural dimensions. Power distance is 60; individualism is 35, masculinity is 40; uncertainty avoidance is 50; and long term orientation is 25. Now we will look at the six clusters of countries that Wursten has identified based on these five dimensions. Zambia fits best in a combination of the pyramid- and family clusters. These clusters are both characterized by high power distance, low individuality, and medium masculinity, which also fit Zambia. The pyramid cluster has high uncertainty avoidance, while the family cluster has low uncertainty avoidance, and Zambia scores in between. These dimensions and clusters have been described in sections 3.1.1 and 4.1. The pyramid and solar clusters have been described as follows: "In the "pyramid and family clusters" common interest is the key concept. In these two clusters people believe that the top of an organization should have everyone's best interest in mind, and be willing to protect the group's best interest. The belief is that top of the organization has a complete view of the whole organization and is thus the one who should make the decisions about change. In terms of communicating about this change wishes should be made very clear, no ambiguity. The difference between these two groups is that there is low uncertainty avoidance in the family cluster, while this is high in the pyramid cluster. This makes that in the pyramid cluster decisions need to be delivered in writing, in a formal manner. In the family cluster a visible commitment to change is required from the leaders of the organization." An important factor in these clusters is clarity. The process of change, and the steps that need to be taken, should be completely clear, and no decisions should be left to the people at the bottom of the power hierarchy. This has everything to do with a high power distance. [125] South Korea is a typical example of a country that falls in the pyramid cluster. This country has been exceptionally successful in implementing ICT.

Because South Korea has many cultural similarities to Zambia this is a good country to take lessons from. One of the reasons its success with ICT is that South Korea has launched long term campaigns to increase both awareness and understanding of ICT, and also the reliability and security of access to information. [38] This is important in countries that have high uncertainty avoidance and low individualism. Low individualism, or collectivist countries are high context countries meaning that the information people share in these countries is highly dependent on the context in which it is shared. Examples of context are the situation and non verbal communication. In these cultures face to face and oral communication are regarded as more trustworthy than information that is low context such as written information. People in high uncertainty avoidance countries tend to see printed information as more reliable and secure than information that is stored on a computer or on the internet, such as e-mails and internet publications. For these reasons awareness and understanding are important and should be promoted by the government. [86]

Due to gender inequalities in Zambia care should be taken to not drive a further wedge between men and women, and boys and girls in using ICT. ICT should be promoted among men and women alike, and it should not be made into a technology that is only used by men. Zambia is a collectivist country, and as we have read in the previous chapter people feel very connected to their extended family and community. ICT could be inserted into the social context as a technology that connects people. This could be through email, but as Zambia is a high context country video chatting may be a preferred option. This has also been shown to be true in Arab countries in which video chatting has become very popular. [19] Of course we want people to use ICT for more than just socializing, this can be seen as a foot through the door for inserting ICT in the everyday lives of people in Zambia. Using ICT for chatting will require some (very) basic ICT skills, and may also help people to see these technologies in a positive light. Having these basic skills and a more positive perspective may also lead some people to explore their further options in using ICT and make them want to acquire further skills to do so. An example of this could be that people start using ICT to sell their products online, or to look for a job through the internet. It is important that a context is created for using ICT, and that it becomes popular among Zambians. Inserting ICT into the social context by using it to connect people seems like an appropriate way to do this in Zambia.

5.2 Healthcare

In the previous chapter many health issues that Zambia is facing came to light. To assess how ICT can contribute to health care in we will first describe the current health care facilities in Zambia. Over the last ten years access to health care in terms of distance to health care facilities has improved. In urban areas nearly all people live within a range of 5 km to the nearest facility, for rural areas this is much lower, around 62%. Furthermore the percentage of people in rural areas that live more than 16 km away from the nearest facility is 10%. Money has much to do with the kind of medical attention people seek, which can be public, private, or traditional. The richer people are the more likely they will seek health care from a private health care facility, of the poorest people almost 35% turn to traditional medicine. Actually for the rest of the population, except the richest quintile, almost 20% also use traditional medicine. It is noteworthy that immunization of children is decreasing, from 80% of children being vaccinated against polio in 1990 this number has dropped to below 60% in 2010. The

number of women receiving prenatal care has also dropped from 80% in 1990 to 40% in 2010. Use of prevention methods against malaria have strongly increased since 2005. The distribution of health care professionals is uneven across the country with Northern, Eastern, and Luapula provinces having the smallest health care workforce, and Lusaka and Copperbelt provinces having the largest. These numbers however are still quite small as in Northern there were 0,68 health care professionals per 1.000 inhabitants, and in Lusaka and Copperbelt this number was 1,66. There is also a shortage of medications in health care facilities which leads to patients having to go and seek medications themselves. It also takes a long time for (especially rural) health care facilities to order and receive stocks of medicines. [45] Major problems in health care in Zambia are a shortage and uneven distribution of skilled health care workers, especially specialists. Other problems are a shortage of supplies including medicines.

Since we know that medical professionals and health care facilities are unevenly spread across the country ICT should help to lower these distances by facilitating communication lines for health care personnel between different areas of the country. IICD [30] uses telemedicine to connect medical personnel and specialists to health care practitioners in rural health care facilities. The internet can also be used to inform people about health issues and health care and thus increase awareness and understanding. Medicines can also be ordered from neighboring hospitals through the internet. These applications can be very useful for rural and other underserved areas because they increase the access to the needed care. Another application can be improved administration. IICD has used electronic databases for blood donation. Because HIV/AIDS is such a big issue in Zambia it is important that donor blood is carefully monitored, this can be aided by improved administration. [30] All these solutions are particularly appropriate for Zambia because they address issues specific to this country, one being the uneven spread of medical specialists, and the other being the severe HIV/AIDS epidemic.

5.3 Environment

Zambia is home to many species of wildlife that live in national parks and game reserves, and sometimes outside of these areas. Examples of this wildlife are animals such as the big five which consists of the lion, leopard, buffalo, elephant, and rhino. There are also many other species of animals, birds, and fish. Sadly due to a rise in population causing humans to move into animal territories, farming, poaching, climate change, corruption, and mismanagement of wildlife the numbers of animals inside and outside national parks are decreasing. [117] In Zambia the Ministry of Tourism, Environment and Natural Resources (MTENR) is responsible for providing and managing legislation and policy frameworks regarding of Tourism, Environment and Natural Resources. Zambia's environment consists of a number of elements, but this section will focus on Zambian wildlife and how ICT can aid in the conservation and management of this wildlife.

The Zambian Wildlife Authority (ZAWA) falls under the MTENR and among other things is responsible for management and research of Zambian Wildlife. [73] A non profit organization that works closely with both ZAWA and local communities is the South Luangwa Conservation Society (SLCS). This organization focuses on three aspects in order to conserve the wildlife in one of Zambia's most popular national parks South Luangwa. These three aspects

are patrolling and investigation, human animal conflict mitigation, and wildlife rescue. Patrolling and investigation are done by scouts. They remove traps, confiscate weapons and animal trophies such as skins and ivory, apprehend suspects, and patrol the national park. The scouts receive training from among others INTERPOL on intelligence led investigation. Conflicts between humans and animals occur when animals cause damage to farmer's crops or wild stock. This leads to farmers killing animals. SLCS helps in this area by helping and educating farmers on how to protect their products from wildlife and raising community awareness on the importance of wildlife conservation. Wildlife rescue is done by freeing and treating animals that have been snared or trapped. Continuous training on wildlife rescue is provided. Research is done on the effectiveness of anti-poaching measures and poaching trends to further improve anti-poaching measures and monitoring. [82] At SLCS ICT is used in a number of capacities such as creating digital reports of conflicts and producing monthly reports on this, and maintaining a database to share information. GPS (Global Positioning System) and GIS (Geographic Information Systems) are used for the mapping and analysis of data on wildlife. Furthermore ICT could be used for further training of SLCS and ZAWA personnel and in community awareness campaigns.

5.4 Economy

General ways in which ICT can help boost the economy has already been covered in section 3.1.2. This section will be about matters that can influence the economy that are specific to Zambia. In previous section of this chapter two matters that that influence the economy, and can in turn be influenced by ICT have already been mentioned. These are HIV/AIDS and tourism. HIV/AIDS affects the economy by negatively affecting the labor market. This is a big problem in Zambia, and ICT can help combat this problem (see 5.2) Wildlife in Zambia is important to the economy because this is the biggest earner in the tourism industry. [117] It is therefore important to the Zambian economy to protect this wildlife (and use ICT to do so; see 5.3). Furthermore factors that ICT can contribute to the economy such as raising productivity and efficiency (see 3.1.2) can boost Zambia's existing economic sectors such as agriculture and copper mining. ICT itself will also help the economy by creating jobs for production and sales and revenues from sales of ICT products. In creating an ICT sector in Zambia it is important that ICT products are adapted to the needs and conditions in Zambia to ensure the effectiveness and sustainability of ICT products and services. Research facilities and universities should focus on creating ICT that is appropriate to the needs of people that live in Zambia. Examples of how this can be done by creating computers that can survive Zambia's climate, which can be both very hot and dusty and very rainy. Furthermore technologies and computers should be affordable to the average Zambian should be created and put on the market. Also Zambian interests, needs, and language should be taken into account when creating software.

The government should play a large role in creating the necessary conditions for realizing this (ICT driven) economy. More about this can be read in the last part of the next section.

5.5 Politics/government

Of course the way ICT can aid in politics and government is in the form of e-government. What this can contribute in general can be read in section 3.1.3. In short e-government can increase public participation and transparency, and make it easier for businesses (and people) to access government services. For countries in sub-Saharan Africa it is often the case that the necessary information for effective government processes is not available. An example of this information is land registers. Also many people living in poor areas do not have a birth certificate. This makes it difficult to obtain things such as building permits, which can take years. People without a birth certificate will also have difficulties in obtaining access to public services. Furthermore “acceleration money” is often demanded before anything will get done. According to [78] e-government services can improve these processes. Using e-government systems in tax and financial administration, which is often not very well organized in these countries can also be very useful. The money flows can be better controlled and supervised, and corruption and misappropriation of money can be detected. Also tax incomes from citizens can be monitored and controlled more effectively. Through electronic administration it is also possible for governments to extract statistical information which can aid in creating more appropriate and effective policies. Of course in these countries where there is little experience with e-government and the exact consequences are difficult to oversee care should be taken to avoid undesirable results when implementing e-government services. [78]

The Zambian government has already introduced a number of e-government systems. These systems are mostly for providing information, in stead of communication between the government and citizens. Three examples of e-government systems are the Zambia Health Management Information System (ZHMIS), the Zambia Online Legal Information Portal (Zamlii), and the Zambia Immigration Management System (ZIMS). ZHMIS is a system this is intended to improve health management, and was designed together with local people. It was designed to be very user friendly. Zamlii is made to provide all Zambians with up to date legal information, and is also a very user friendly system. ZISM is made to make immigration services such as granting visas and permits faster and less complicated. This was meant to make it easier for companies to establish themselves in Zambia, and cut away some of the red tape companies now encounter. This in turn would create more income for Zambia. All these initiatives have good intentions, but some problems have arisen which make them less effective than they should be. [36] has listed the problems that were encountered in these projects. The problem with Zamlii was mostly that only people who has internet access could make use of this service (we can see in chapter 7 that very little people in Zambia have access to the internet). With ZISM the problems were that many of its intended users had no knowledge on using computers, users did not want to use the system, or did not trust the system, or had a lack of confidence in using the system. Furthermore not enough resources were put into ongoing training for the system’s users. A lack of infrastructure at locations where the system was to be used also presented a problem. With ZHMIS problems were a lack of (continuous) funds, and a lack of continuity in support from government and partners. Training of users proved to be too expensive, and a lack of infrastructure, and high internet costs. [36]

The government can contribute to the growth of ICT in Zambia by creating conditions that are favorable to this growth. This can be done by investing in the three areas that are con-

sidered in this thesis to be the foundation for the growth of ICT. These areas are education, infrastructure, and government policy, and will be covered in the next three chapters. Some examples of what the government should do are creating a competitive environment which encourages investments in ICT from private companies; and facilitating more affordable prices for internet access. (Note that in Zambia a 64 kbps connection costs 350.000 kwacha (about \$66), which is not affordable for most Zambians. [22]) Facilitating education and training in the use of ICT; creating appropriate policies and legislation; raising awareness among the people; and making Zambia an attractive place to start a business and invest in are also examples of how the government can contribute.

5.6 Conclusions

This chapter has covered a number of areas in which ICT can be used to improve the way things are done. Of course this is not an exhaustive list and many more areas and applications can be named. Important is that it can be concluded that the purpose of ICT can often be to improve administration and information sharing, and also for the sharing of knowledge and spreading of awareness and understanding among Zambians. These are quite simple purposes but ones that can have big effects if implemented and actually used correctly. From the sections in the theoretical framework we have learned about appropriate ICT and ICT4D2.0. It is important that the lessons from these two approaches are considered in order to make ICT relevant and sustainable in Zambia. ICT should take on a form that is relevant to the lifestyles of the people in a particular community. It should take the ICT4D2.0 or appropriate ICT approach. These should be small scale local approaches facilitated by local volunteers and focused on what the intended users want. The private sector should focus on creating ICT that is relevant and affordable for Zambian people. These solutions should consider Zambia's climate, culture, languages, and the needs and wants of the people. Creating a social context for ICT may be done through its ability to connect people. The preferred way to do this is through video chatting. In order for ICT applications to have some effect ICT needs to become a normal part of life in Zambia which is available and accepted. To achieve this visible commitment from leadership (government) to this change is necessary. Long term awareness and understanding campaigns should be launched by the government. It is also important to make people aware of the reliability and security of information on computers as opposed to other forms of information storage and sharing. Furthermore it is very important that people are educated on using computers and that the necessary infrastructure for the use of ICT is in place. The realization of these three factors; education, infrastructure, and government will be the focus of the next three chapters.

6 Education

6.1 Current situation

6.1.1 Education system

In Zambia there are officially four levels of education, these are early childhood education (pre-school), basic education, high school, and tertiary education. This section will cover information about these forms of schooling, including basic information, numbers and curricula.

Though early childhood education exists in Zambia very few children experience this form of education. According to the Zambian Ministry of Education (MoE) the goals of these schools are as follows: *“This initial education also helps to build up children’s cultural capital and to compensate for disadvantages that they may bring from homes where few reading, writing or other education-related materials are found.”* [72] There are by no means enough of these pre-schools to accommodate all children, and most of these schools are private schools and thus depend on fees to keep them running. This means that these schools are not affordable for most Zambian families. Also the majority of these schools are situated in urban areas, so pre-school education is difficult to attain for rural children. [72]

Basic education in Zambia consists of three levels. These levels are lower basic school (grades 1 through 4), middle basic school (grades 5 through 7), and upper basic school (grades 8 and 9). Basic schools can be government schools, private schools, schools run by churches, and community schools. Government schools are run and funded by the government. Private schools are run by private individuals or groups and school fees are paid by parents. Church schools are run and funded by churches and may receive school grants. Community schools are run by communities and may receive school grants, and support from churches and NGOs. In 2006 there were 7.635 basic schools in Zambia. Of these schools 61% were government schools, 5% were private or church schools, and 34% were community schools. [71] In Zambia basic education is compulsory, however lack of resources does not make enforcing this requirement possible. Also, since there are especially little resources for grades 8 and 9 only the highest scoring students are admitted to these grades. [63] The curriculum in basic education consists of six elements, these being Literacy and Languages, Mathematics, Integrated Science, Creative and Technology Studies, Social and Development Studies, and Community Studies. [68] English is the main language in Zambia, and in Zambian education, but seven district languages are also used in education. These languages are Bemba, Kaonde, Lozi, Lunda, Luvale, Nyanja, and Tonga. [63]

High school in Zambia consists of grades 10 through 12. Students get admitted to high school based on their examination results in grade 9. As with basic schools there are also different kinds of high schools. There are government schools, private schools, and church schools. The total number of high schools in Zambia in 2006 was 534. Of these schools 84% were government schools and the rest (16%) were private or church schools. [71] The curriculum offered by high schools consists of core subjects and optional subjects. The core subjects are English, Mathematics and Science. Optional subjects are in the fields of Humanities, Science, Mathematics, Commerce, Technical areas, Practical areas, and Art areas. It is observed by the Zambian MoE that these last three areas are not very popular. Students tend to choose the more academic subjects over the more practical ones. Two reasons for this are given. Academic subjects are regarded as more important by students, as well as teachers and parents. Also materials and qualified teachers often are not available to teach the more practical subjects. [72] This is a sad fact because most students will try to find work after completing high school instead of receiving further education. Academic subjects are much less useful to this end than the practical subjects.

There are various forms of higher or tertiary education in Zambia. Two fall under the MoE, these are the universities and the teacher training colleges. Zambia has three publicly funded

universities, the University of Zambia, the Copperbelt University, and the Mulungushi University. There are 14 teacher training colleges, 12 for basic education and 2 for high school education. The other forms of higher education fall under TEVETA (Technical Education, Vocational and Entrepreneurship Training Authority). There are 314 schools registered with TEVETA. [70]

6.1.2 Government efforts

Government spending on education was 1,3% of GNI in 2009. [92] This was 21,97% of the total government expenditure. [95] This has risen from 14,8% in 2004. [111] Due to a heavy debt burden education budgets in Zambia were cut back on in the 1980s and 1990s. Naturally this had negative effects on school enrollment and literacy. For this reason the Zambian government, working together with international development agencies started BESSIP (Basic Education Sub-Sector Investment Programme) which ran from 1999 to 2002. [63] The goal for BESSIP was to increase access to basic school for all children and to improve the quality of education. The following concrete goals were set. By 2005 enrollment should be 100%. Results for English should be satisfactory for 65% of the students, and results for mathematics should be satisfactory for 50% of the students. Also the student teacher ratio should be 40:1. Higher basic education should be accessible for all children by 2015. [63] Furthermore in 2002 the Zambian government introduced the FBE (Free Basic Education) policy for grades 1 through 7. This program removed fees for lower and middle basic school. [77] Both BESSIP and FBE had problems distributing the funds to achieve their goals correctly. With BESSIP this improved in the second phase. The FBE was introduced and implemented very suddenly and funds had to be rolled out immediately. This did not go smoothly, and in the beginning all schools, regardless of size received the same amount. This problem was solved after a year, but still the funding was not enough to cover the costs for most schools. [63] Also, FBE does not mean that education is free and available to everyone, barriers still exist. Schools can still charge fees for things such as uniforms, PTAs (Parent Teacher Associations), and exams. [39]

After BESSIP was concluded the MoESP (MoE Strategic Plan) was launched. This plan was to run from 2003 to 2007, and focused on all forms of education, basic school, high school, and tertiary education. This plan gave special emphasis to rural areas, and set out to improve resources in these areas. This included providing teachers, construction of schools, improvement of infrastructure and providing materials. [63] Additionally the Zambian government has taken the following measures to increase participation in education. These measures include the Programme for the Advancement of Girls Education (PAGE), but also a policy for pregnant girls to re-enter schools. Measures to help the poor attain an education include bursary schemes and the School Health and Nutrition Programme. [39] In 2005 2,11% of basic school children, and 4,68% of high school children received bursaries from the government. Also, due to the discrepancies between high school education and the demands of the labor market the TESSIP (Technical Education Sub-Sector Investment Programme) program, which ran from 2003 to 2005, was started. [68]

6.1.3 Access to education

In this section the most recent available data on access to education in Zambia will be presented. This data may be a number of years old as recent data may not be available in many cases. The next section will focus figures related to the quality of education. Access to education consists of a number of elements. Enrollment, attendance, completion, and differences between boys and girls, and children from urban and rural areas.

The number of children of lower and middle basic school age that were out of school in 2010, in Zambia was 184.450 out of 2.515.462. The number of children enrolled in lower and middle basic school in 2010 was 2.899.131. [103] This seems strange because this is more than the number of children of lower and middle basic school age. Explanations for this can be that children do not enter school at the expected age, which is 7. In 2005 6% of boys and 7% of girls who entered grade 1 were under 7 of age. Also 30% of boys and 26% of girls to enter this grade were older than 8. [63] Repetition of grades can also be an explanation. In 2005 Eastern, Lusaka and Luapula provinces had the lowest net intake rates. Copperbelt province had the highest net intake rate. Eastern and Luapula provinces are mostly rural, and Lusaka and Copperbelt mostly urban. [70] After FBE was introduced there was a large growth in enrolment. Students who had dropped out of school because their parents could not afford it returned to school. Of these students 66% came from rural areas, these students made up 10% of enrollment in rural areas and 5% in urban areas. [63] In 2009 the net enrollment rate in lower and middle basic school in Zambia was 90,7%. For boys this was 89,6% and for girls 91,8%. [91] School attendance and completion are also important factors in accessibility to education. Between 2005 and 2012 the net attendance ratio in Zambia for lower and middle basic schools was 81% for boys and 82% for girls. [111] Completion rates for 2007 for grade 7 were 81.61% total, 88.34% for boys and 74.94% for girls. Completion rates are the percent of enrolled students to complete a grade. The net enrollment for high schools in 2005 was 21.54% total, 24.63% for boys and 18.51% for girls. With the highest enrollment rate in Copperbelt province. Attendance in upper basic and high school was 38% for boys and 36% for girls between 2005 and 2010. The completion rate for grade 9 (upper basic school) was 43.08% total, 46.77% for boys and 39.43% for girls. The completion rate for grade 12 (high school) was 17.72% total, 20.32% for boys and 15.18% for girls. [70] Of the students that complete high school only 6% are able to access tertiary education. This has been stated by the director of TEVETA dr. Patrick Nkanza in 2010. Two percent go to universities, three percent go to TEVET (Technical Education, Vocational and Entrepreneurship Training) institutions, and one percent goes to other tertiary education such as teacher training colleges. [50]

Furthermore 2,97% of the students in basic schools, and 1,77% of the students in high schools had special education needs. These students had visual, hearing, physical, or intellectual impairments. In 2005 there were 79 special education schools, and 244 special education units within schools to accommodate these students for basic education. For high school children there were 6 schools and 16 units. In this same year 1,9% of the basic school teachers, and 1,7% of high school teachers had a Special Education Degree, a Special Education Diploma, or a Certificate in Special Education. [70]

6.1.4 Quality of education

Quality of education will be measured using a number of factors. These factors include repetition rates, certification of teachers, pupil/teacher ratio, materials and facilities, test scores and special education. As the majority of the available literature is on primary schools there is little information on high schools and tertiary education.

The following figures are for 2005. Repetition rates in this year were as follows. 7,20% for grades 1-9 and 1,24 for grades 10-12. The repetition rates were lowest in Lusaka and Copperbelt provinces. For basic schools 67,7% of teachers had a primary teaching certificate, and 16,5% had a basic/secondary teaching diploma. 6,6% of teachers were untrained. In high schools 11,8% of teachers had only a primary teaching certificate. 64,6% had a basic/secondary teaching diploma. 10,6% had a Bachelor of Education, and 4,8% had an advanced diploma. Also 0,6% of teachers were untrained. In the same year 5466 teachers left schools, 4965 in basic schools and 501 in high schools. Out of these 909 died. [70] HIV/AIDS is said to have an impact on teachers being absent. [63] The ratio of students per teacher is 57,5:1 for grades 1-7, 32,3:1 for grades 8-9, and 21,8:1 for grades 10-12. [70] Double shifts, meaning that students go to school for only one part of the day (morning or afternoon) are common practice to deal with the shortage of teachers and classrooms. This is most common in lower basic education (grades 1-4). [63] In total there were 4066 schools teaching grades 1-7, 1750 for grades 1-9, 176 for grades 1-12 and 56 for grades 10-12. The total number of laboratories was 161 for basic schools. Of these 44 were temporary structures and 55 were incomplete. For high schools the total was 564. There were a total of 444 libraries for basic schools, 154 temporary and 38 incomplete. [70] For high schools the total was 189. Test scores were not very high in 2006. In that year 70% of grade 5 students did not meet the minimum requirements for English, and 65% did not meet the minimum requirements for mathematics. Urban schools tend to score better, with Lusaka scoring best. Average scores for English were 36 in urban areas and 33 in rural areas (40 being the minimum requirement for both English and math). For math the scores were 41 in rural areas and 39 in urban areas. Urban areas (especially those in Lusaka) is where most private schools are located. This could be an explanation for the higher scores in Lusaka and urban areas. [63] SACMEQ (Southern and Eastern Africa Consortium for Monitoring Educational Quality) has chosen some indicators (which were drafted by the MoE) for evaluating the quality of education in Zambia. These criteria pertain to basic learning materials, mathematics textbooks, and class size for grade 6. It is stated that each student should have an exercise book, a pencil or a pen, and a ruler. Each student should also have his/her own mathematics textbook, or share one with at most one other student. The maximum class size for grade 6 should be 40. The study done by SACMEQ showed that the first criterion was not met, only 59% of students in 2007 has these basic learning materials. Criterion 2 was also not met as only 27% of the students had (or shared with one other student) a mathematics textbook in 2007. Most of Zambia also did not meet the class size criterion in the same year as the average class size for grade 6 was 46. SACMEQ concludes that these results may have had a negative impact on learning outcome for grade 6, and that the general situation was better in most other SACMEQ countries. [76]

There is not much information available on the tertiary school system in Zambia. In 2002 only 5% of the education budget went to the (at the time) two public universities in Zambia. This

amounted to 6,5 billion kwacha (about \$1.228.500). Of course this is inadequate to fund two universities. This caused numerous problems for these universities which in turn impacted the learning outcomes of students. Among these problems were infrastructure that remained unmaintained, library books that were outdated and not enough teaching and learning materials. This is not only a problem for the staff and students of universities, but also for the future of education in Zambia. The reason for this is that universities educate teachers for upper basic education and high schools, and teachers for teacher training colleges. [68]

6.1.5 ICT in current situation

The Zambian government has recognized the need for ICT in education in order to boost the countries economy and eradicate the poverty that plagues the country. To this end it has drafted a National ICT Policy, which was launched in 2007. This policy states the following goal regarding education *“to integrate ICT in the education system and develop the nations Research and Development (R&D) capacity to support, facilitate and contribute to the development of key sectors of the economy including the development of appropriate local ICT products and services.”* [69] The policy also recognizes that the education sector in Zambia is underfunded causing a large part of the population not to have access to high school or tertiary education. It is said that without this education these people cannot contribute to the development of Zambia. [69]

This policy has identified a number of challenges that education faces. These challenges are as follows:

- *“General financial and technological resource constraints that the government faces in its effort to develop and improve the educational system including efforts directed at integrating ICTs in education;*
- *Inadequate awareness on the benefits of integrating ICTs in the administration of the delivery chain in the education sector;*
- *Lack of coordinated approach in the adoption and implementation of initiatives targeted at the deployment of ICTs within the educational system;*
- *High opportunity cost of deploying ICTs in the educational system - it is difficult to justify spending scarce and limited resources on ICTs when many institutions are still lacking basic amenities and educational supplies; and*
- *Shortage of teachers with ICT skills to meet the requirements of the schools, thus limiting ICT penetration within the education system.”* [69]

Another problem is that too little digital education materials are available that are compatible with Zambia’s local curriculum and languages. In 1998 computer studies was created as a subject for public schools. This led to disappointing results, partly due to lack of encouragement for these programs. A very small number of public schools are now offering ICT to their students. However, private schools have been encouraging ICT in their curricula with more successful results. It has also been said that the results of R&D and higher education institutes in ICT are below par and need to be improved. [69]

6.2 Case studies from Zambia

Before going into case studies that have been done in Zambia with reference to ICT in education, this paragraph will focus on three other issues that have been recognized by the Zambian government as key concerns affecting education. These three concerns are poverty, HIV/AIDS, and special needs education. For ICT to succeed in education, access and quality of education must be improved. These three factors are very detrimental to both access and quality of education, and are important factors to consider. We know from previous sections of this chapter that FBE was introduced in Zambia in 2002. This has raised enrolments, but due to the lack of adequate additional funding quality of education has dropped. Primary education has been getting attention from the Zambian government, but secondary and tertiary education are being left behind. This has caused the accessibility and quality of education on these levels to be below par. The discrimination of girls and women, which has also been addressed earlier in this thesis also had effects on the education of girls. While enrolment of girls in basic education is about the same as that of boys, participation and completion of education by girls is much lower than that of boys. This is seen more in rural areas than in urban areas. Education for girls is seen as a waste of money by many Zambians. As for the effects of poverty on education, the following are named by [68]: *“low enrolments, low progression and high drop-out rates, poor performance, poor attendance, long distances to school, poor learning environments, lack of opportunities for appropriate skills training, malnourished learners, demotivated and ill-qualified teachers, high illiteracy levels, ill health among teachers, pupils and others in the education system, lack of motivation for parents to send their children to school; and wide gender gaps in school attendance between girls and boys.”* For children with special needs due to a handicap it is difficult to participate in “standard” education. Despite policies that state that special education and facilities should be available, these children are often left with less opportunities for receiving education than others. The number of teachers that are qualified to teach children with special needs is also very low. [68]

HIV/AIDS, which has been discussed earlier in this thesis has a large impact on education. There are a number of aspects to this impact such as the impact on students, parents, teachers, and the government (budget). Due to HIV/AIDS many children become orphans because their parents die from this disease. This makes these children vulnerable, and causes them to have to leave school to take care of other duties. This also goes for children whose family members are suffering from the disease and therefore cannot work and need care. These children have to take over many duties such as working to make money for the family, taking care of family members that are ill, and even heading the household and raising siblings because both parents are gone. [75] Most often it is girls that are forced to leave school to perform these duties because education for girls is deemed less important. [54] This causes less children to attend school. It also causes family incomes to drop because due to sickness. This means there are less children in school, and more children from poor families who cannot afford to pay school fees, which means less money for the school. Performance among students drops because they are tired from working before school, hungry, or stressed. HIV/AIDS affects teachers as well. Many teachers in Zambia die due to this disease. It is also a cause of absence among teachers who are ill, need to take care of family members, or attend funerals. Teacher illness also causes teachers to be moved to from rural to urban schools because they need to be near medical facilities. This means that classes remained without a teacher, or that other

teachers took over these classes causing very large numbers of students to be in one class. [75] Shortages of trained and qualified teachers are a problem in any case especially in rural areas. Teachers tend to leave rural areas because of the poor conditions in these areas. [63] HIV/AIDS also has a large effect on the government budget. First of all higher costs for the health sector due to HIV/AIDS causes less money to be available for other sectors such as education. For the education sector specifically losses are incurred due to the loss of government trained teachers and thus the need for the government to train additional teachers, wages of teachers that are absent due to illness (these wages will continue to be paid for long periods of time), and funeral costs that the MoE is obliged to pay. [20] This, combined with the decline in school fees causes many problems for schools such as shortages in books, writing materials, chairs, desks, electricity, and other items schools need.

Cultural factors (Hofstede) that can be related to the effects of education are power distance, individuality, and long term orientation. As can be read in an earlier chapter of this thesis Zambia scores high on power distance and low on individuality, and long term orientation. This can explain the following observations made by the Zambian Ministry of Education. People who acquire an education, and the skills that come with that such as critical thinking and creativity will find that these skills are not appreciated in their society, and even frowned upon. Change does not seem to be welcome, and the best way to exist in society is to conform to the established and old way of doing things, in which decisions are made by adults (often men). Individuals are expected to conform to society and its norms, and not express opinions. Furthermore money and success of members of society is seen as something that is to benefit all members of the community (even to the detriment of the one who earned the money). If society does not benefit from ones success that person is ridiculed and envied. Property rights are not recognized, as property is seen as something that belongs to everyone (and no one at the same time). Using national resources to invest, reform, and create jobs to alleviate poverty in the long run is not seen as something that is acceptable. Schools are powerless in creating successful and knowledgeable people when this does not conform to the expectations and beliefs of society. From a brighter point of view literacy is seen as an important factor as literate parents are more likely to send their children to school. These parents are also better in state of reducing poverty for themselves, and teaching their children to do the same. [68]

The e-Brain forum of Zambia, which is a network for knowledge sharing and learning about ICT for development in Zambia. Member of this network have put together a report on ICT in the education system in Zambia. This organization has analyzed the current situation regarding the use of ICT in education and come up with opportunities for improvement. e-Brain suggests a step by step introduction approach to ICT. First a small number of schools should be chosen as “champions”. The focus should be on making these schools successful in using ICT. Based on these examples further steps can be taken to introduce ICT to education. Using ICT for curriculum development is also suggested. This is to be done using the internet to learn from what other countries have done. Collaboration between the public and private sector is also named, for example for acquiring resources at reduced prices. Top level management should be convinced of the importance of using ICT in education, their support is needed for success. [81] [41] has also identified a number of reasons why ICT is not being used in education in Zambia. Cost and quality of ICT and infrastructure, and government policy are named as factors (these will be discussed further in the next two chapters). Corruption

is also said to play a part, as misappropriation of funds leads to less money being available, including for ICT in education. Not knowing the benefits of ICT leads to ICT not being used even if it is available. People can see ICT as something that is for developed countries, and will not work for them. Teachers also worry about being replaced by ICT, or the complexity and increased workload that ICT will bring. In Zambia language is also an issue, as most software is in English, and not in its native languages. The large number of native languages also makes it difficult to translate software to all languages. It is also difficult for Zambia (as for many other developing countries) to keep up with the rapid changes in technology. People may not know of the new technologies and opportunities in ICT, or may be reluctant to upgrade due to the costs. Another factor is the shortage of people who can create, maintain, and use technologies for teaching. Schools also cannot afford or retain staff for ICT maintenance. Furthermore (as has been said before) there is a high death rate due to HIV/AIDS which also affects skilled people. It is also difficult to get students in school because they (or their parents) may have other priorities. People see the integration of ICT into the school curriculum and education as a very difficult task, and therefore do not attempt to do this. Lack of time for teacher training, and lack of motivation of teachers and students are also seen as factors. [41] The Education Support Network Project is an initiative by IICD to help teachers create and share their own teaching materials. The reason behind that initiative is the lack of teaching materials in Zambian schools. The project started with 8 pilot schools. The goal of this project is to have teachers create their own teaching materials (teaching notes) and share these through the network with the participating schools. Once the teacher sends in a note this is enriched with (for example) pictures from the internet, and approved by a curriculum committee, and then sent back to the participating schools. Apart from the basic ICT skills needed to type and send the teaching notes all staff and management in a participating school received a "Sensitization Workshop". This and the workshop for headmasters on ownership and sustainability were major success factors in this project. There were some lessons that were learned from this project. The teachers at these schools already made teaching notes, so this concept was not entirely new, it built on what was already being done. This made for better acceptance and sustainability of the project. The cycle of creating, sending, editing and feedback on notes took longer than expected, and not very many notes were submitted in the first years. Meetings with schools resulted in fine tuning the process which led to improvements. The teachers used their newly acquired ICT skills to find better jobs, which is good for teachers but bad for the schools as they lose skilled personnel. And finally getting the benefits of this project recognized at a national level by the ministry takes much time, effort and persistence according to [8]

6.3 Model

Based on all the information presented in this chapter and in the education sector of the theoretical framework a model has been created to illustrate the relationships between all factors having to do with education. In the first chapter of this thesis causal loop diagrams have been explained. Because these are the first models in this thesis some further clarification may be needed to understand the meaning of these models, and how they came to be. The models contain a number of variables, and variables that influence each other are connected by arrows. These arrows are assigned a value, either a + (plus) or a - (minus). A plus denotes a positive causal link, and a minus denotes a negative causal link. A positive causal link

means that if the variable at the beginning of the link increases, the variable at the end of the link also increases (and of course if the variable at the beginning of the link decreases, the variable at the end of the link decreases as well). A negative causal link means that the variables do the opposite, so if the variable at the beginning of the link increases, the variable at the end of the link decreases, and vice versa. For example, in figure 6 we can see that there is a positive causal link between corruption and misappropriation of funds. This would mean that if there is more corruption there is more misappropriation of funds, and if there is less corruption there is less misappropriation of funds. We can see a negative causal link between misappropriation of funds and funding for education. This means that if misappropriation of funds goes up, then there are fewer funds available to go to education, and vice versa.

Now that the meaning of the models is clear, how they came about will be explained. From the information that is relevant to education all variables having to do with education were selected. As there are many of these variables the decision was made to make several models in stead of one. This is to increase readability as one huge model would not fit on one page. All these variables were divided up into a number of categories, in this case the categories are student outcomes, effects on teaching/learning styles, teachers, sustainability, support/resources, and local factors/effects on education. The first model (figure 1) is the one that shows the causal links between all these categories, and the next models are the models showing the causal links between the variables belonging to these categories. Note that there is no separate model for student outcomes as this is just a list of outcomes with no causal links between them. Therefore these outcomes were included in the first model. In the local factors/effects on education model the local factors are colored red, and the effects on education are colored green. Local factors and effects on education have been put into one model because they affect each other in many aspects. However they have been put into separate categories in the first model as they are quite different categories. The conclusions that can be drawn from these models will be presented in the next section. The models for education (figures 1-6) can be found on the next six pages.

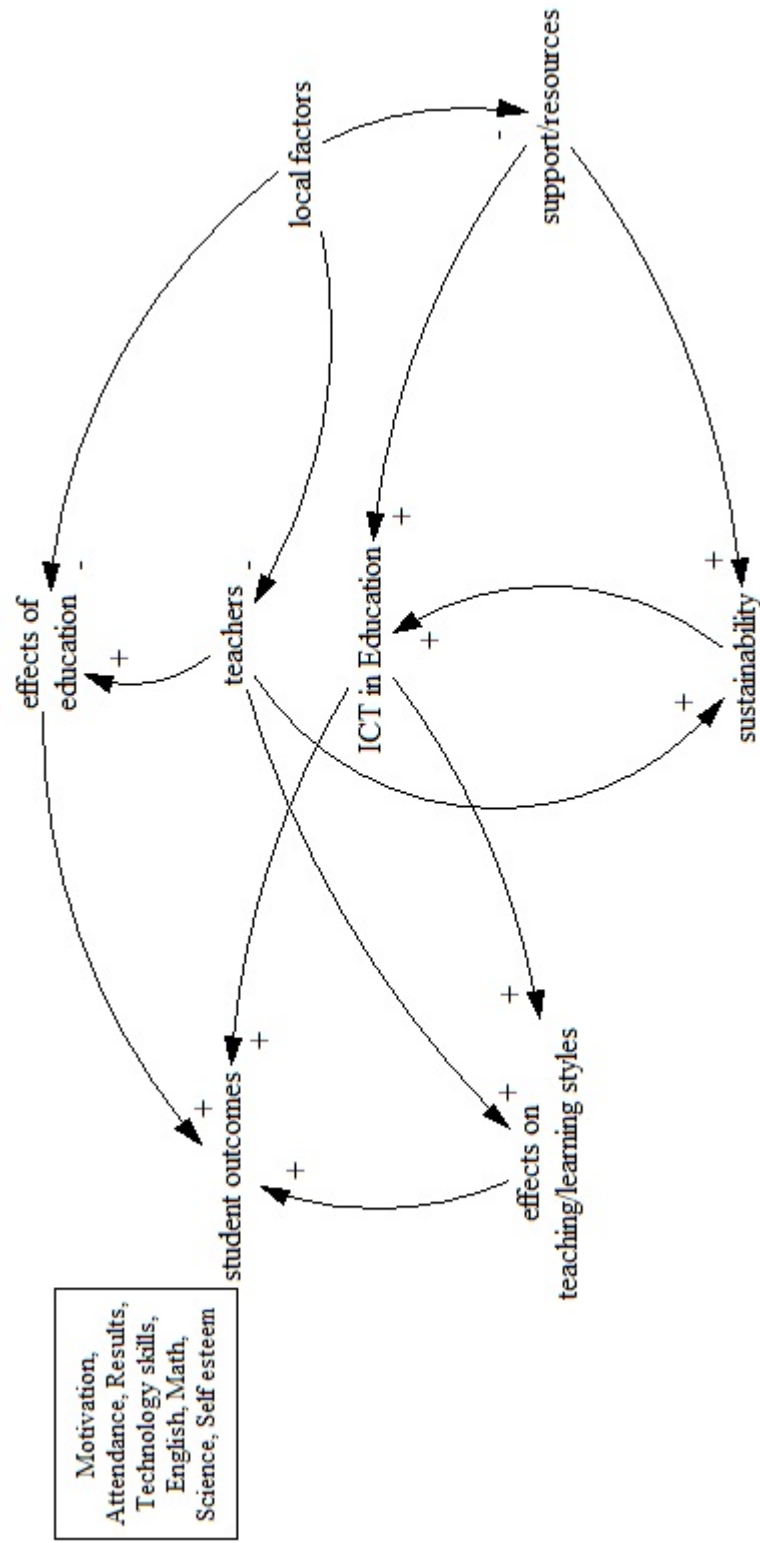


Figure 1: General model for education

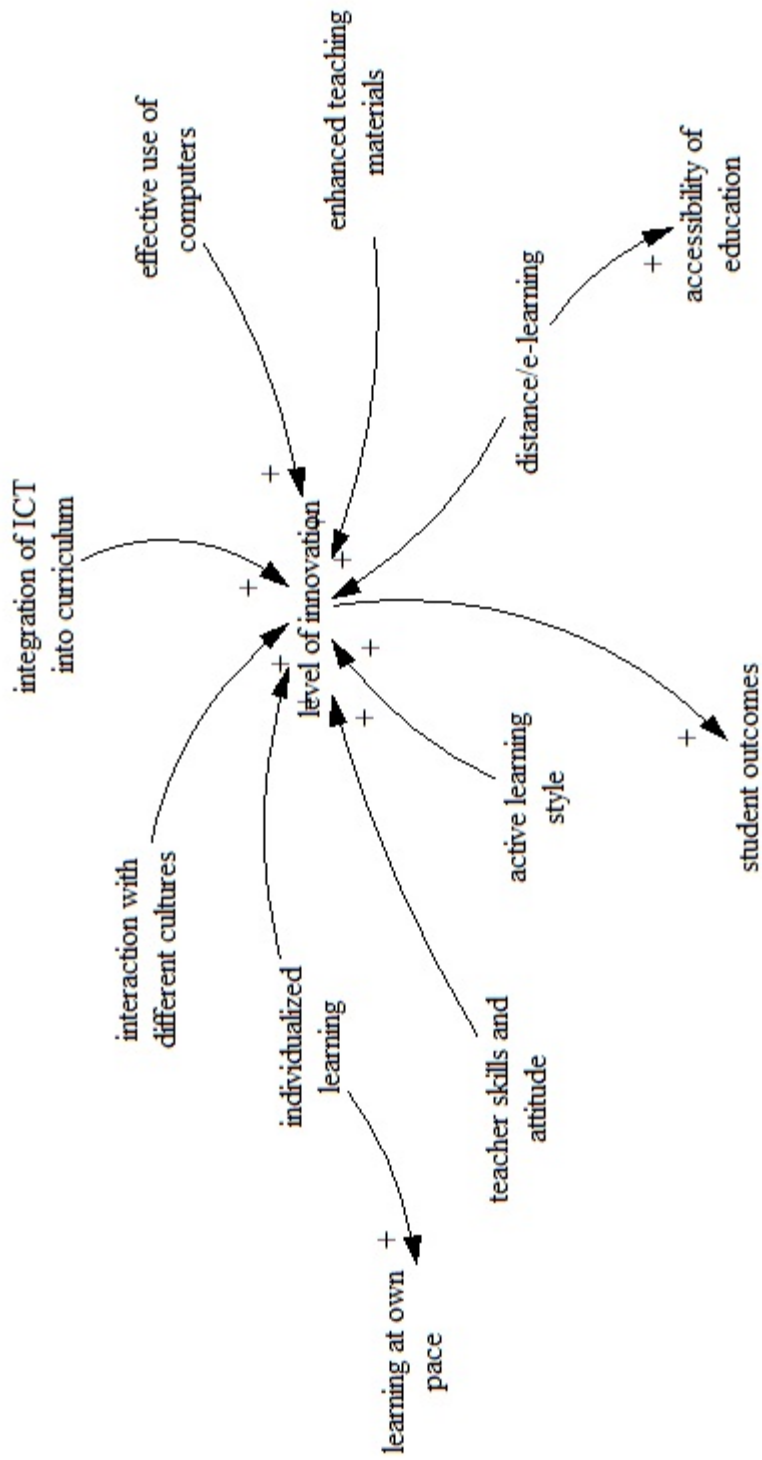


Figure 2: Effects on teaching/learning styles

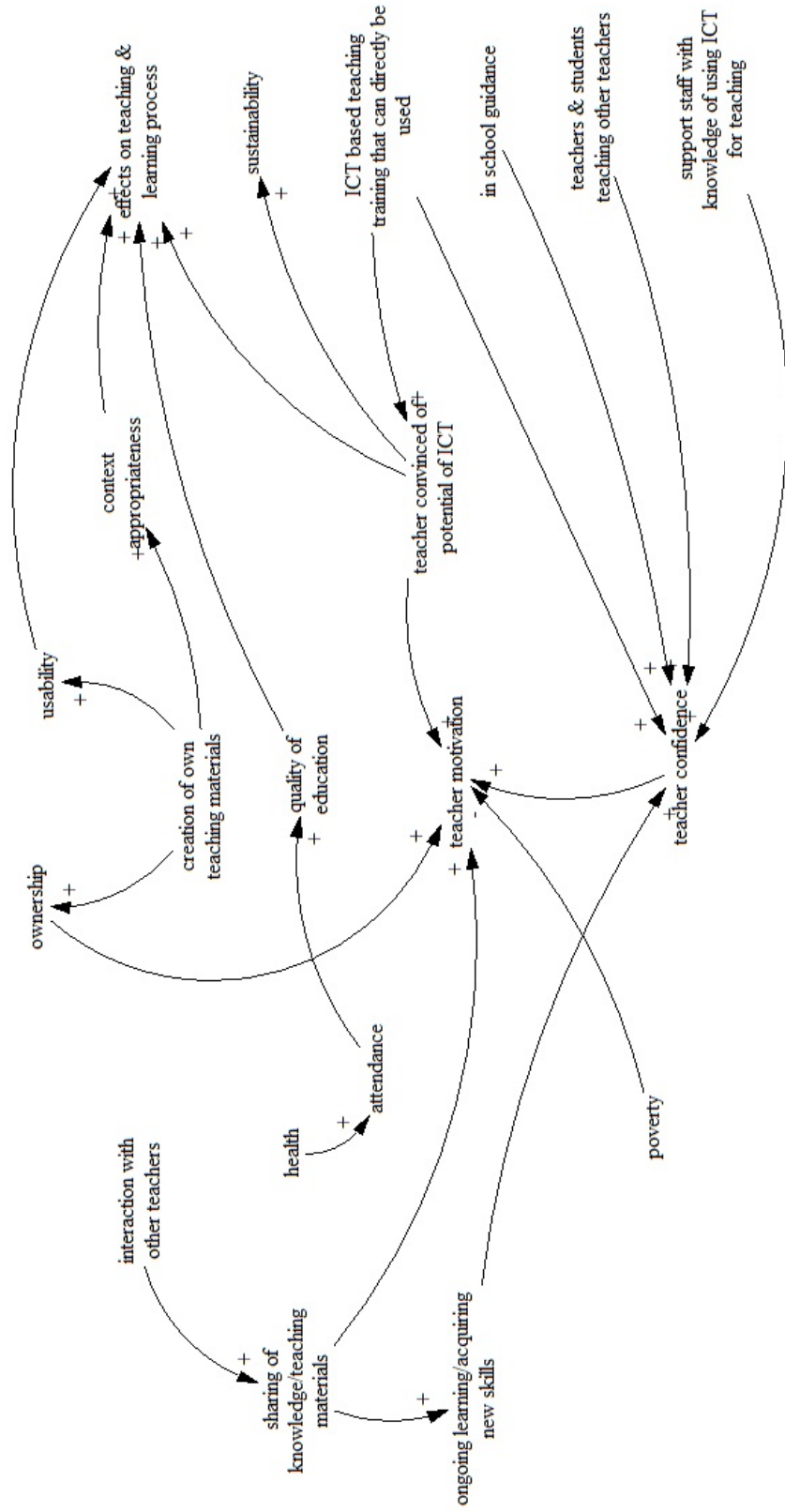


Figure 3: Teachers

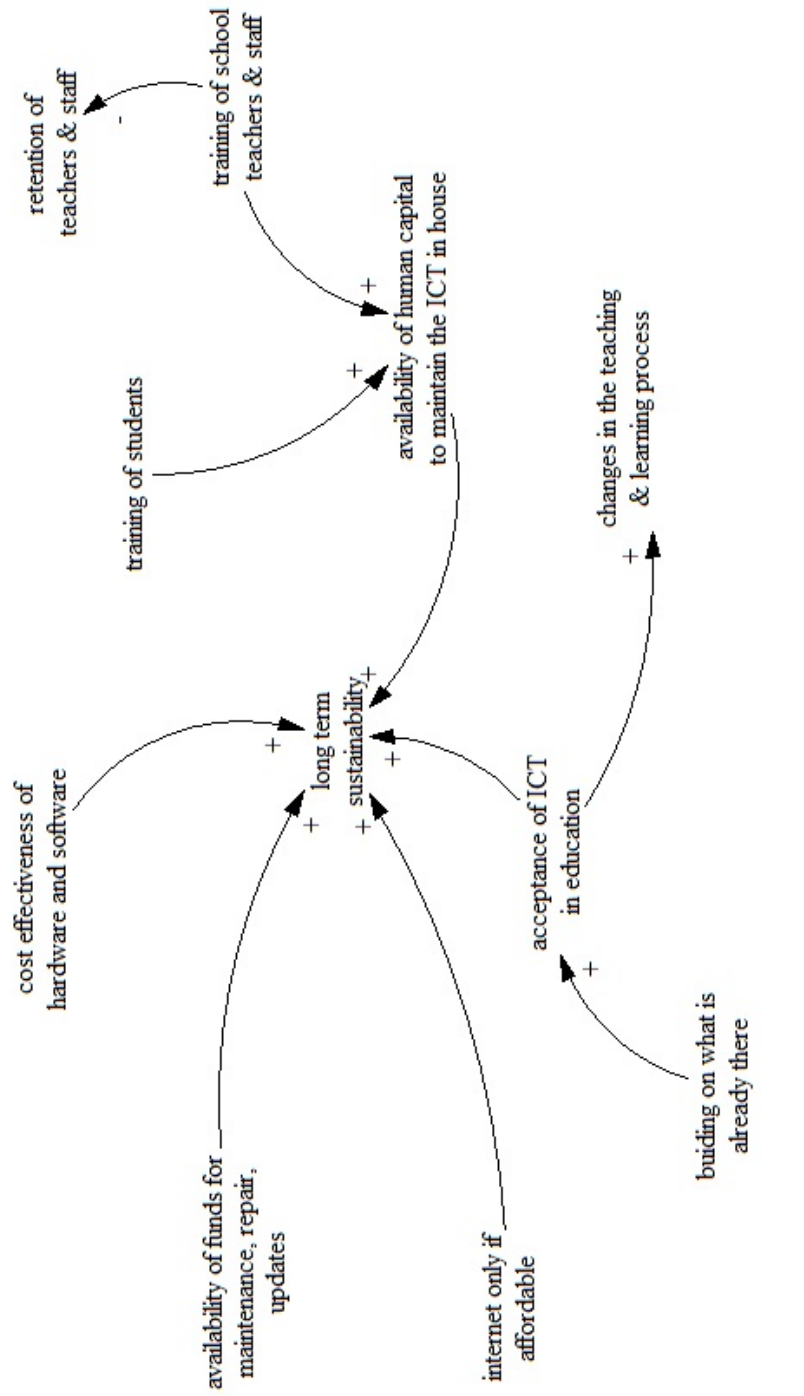


Figure 4: Sustainability

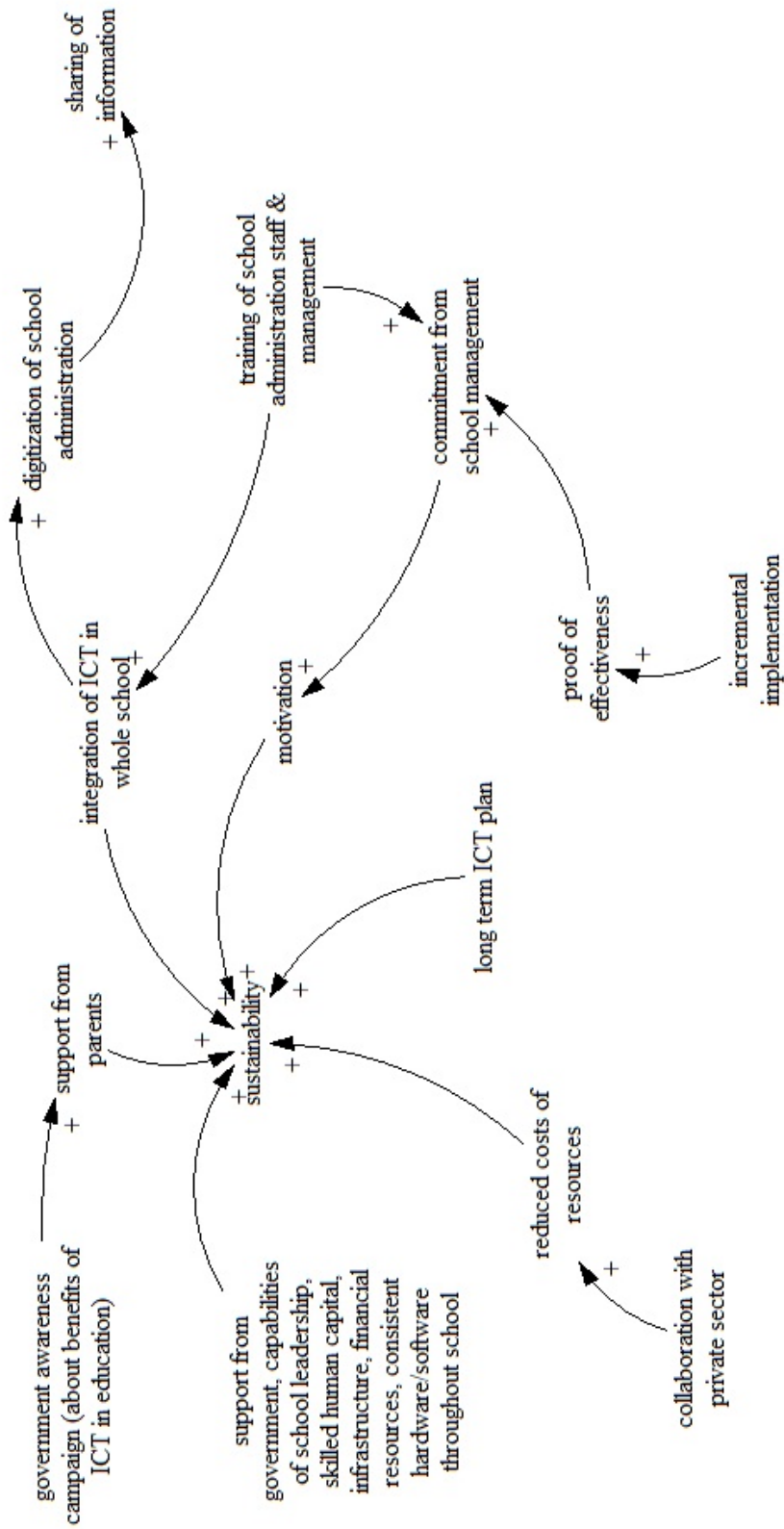


Figure 5: Support/Resources

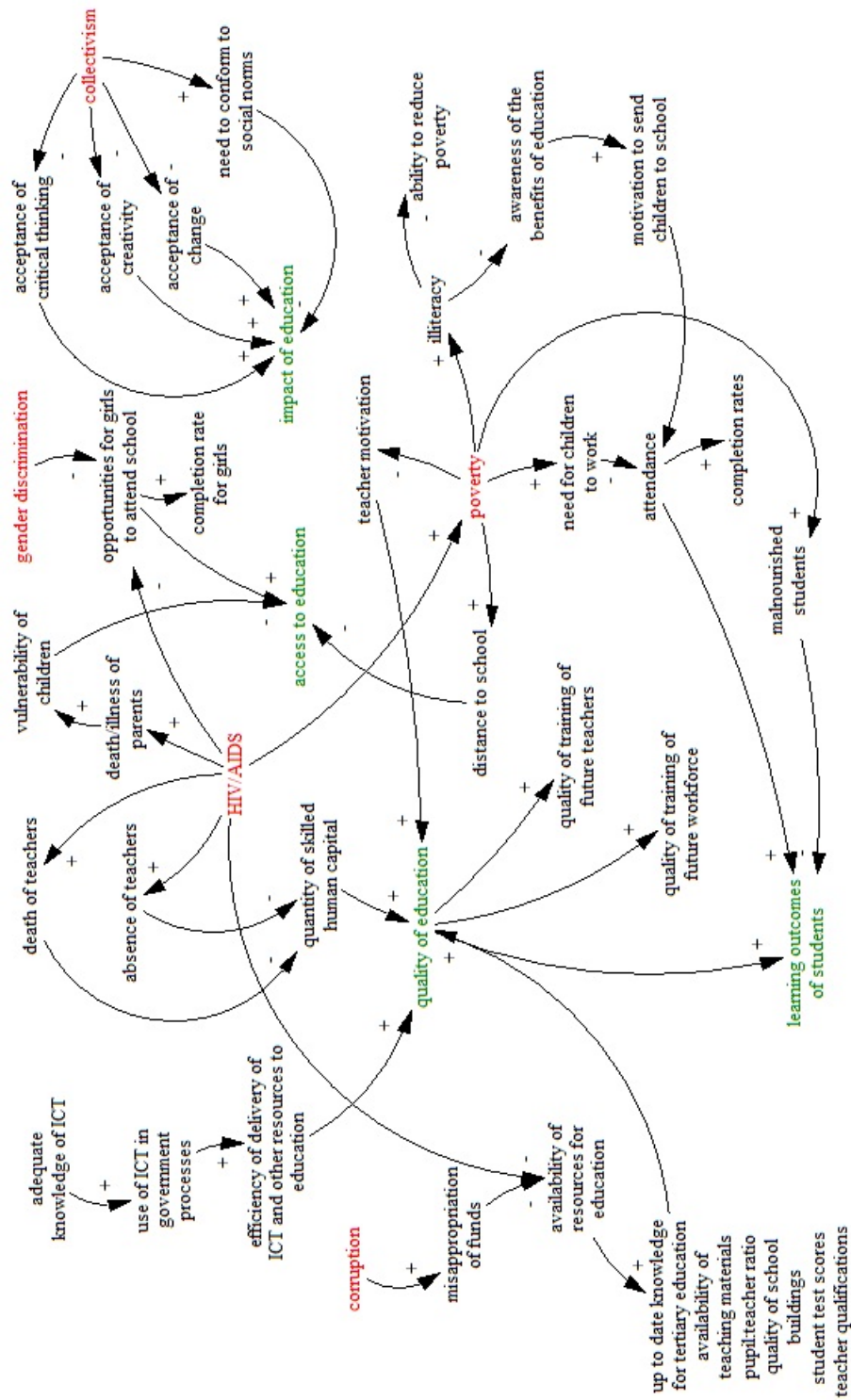


Figure 6: Local factors/Effects on education

6.4 Conclusions

As we can see in the first, general model (figure 1) we can see that there are six categories (excluding the ICT in Education node). All nodes are positive causal links except those originating in local factors. From this we can conclude that circumstances in Zambia are not beneficial to all other categories (which are all linked positively). Further strengthening of these circumstances would mean a negative impact on all other categories. Looking at the local factors we can distil four main factors that have a negative impact on the quality and access to education, and one that has a negative impact on the impact that education has. The four factors that negatively impact quality and access to education are poverty, HIV/AIDS, gender discrimination, and corruption. The factor that has a negative impact on the impact of education is collectivism, which is a cultural factor. Another factor that does not directly impact education and therefore is not included in these models, but has been discussed in this chapter is a short term orientation in Zambia. This leads to a disapproval of measures such as investments to alleviate poverty in the long term. Since short term orientation has an impact on poverty this is relevant to this model as poverty plays a key role in the local factors model. This means that cultural factors have two key impacts. Collectivism has a negative impact on the impact of education. This means that quality, and ICT in education become less relevant if education has no impact on the lives of children that are being educated. Community acceptance of education, and awareness on the importance of education should be important goals to strive for. Adult education can play a role here as parents who are literate are more likely to send their children to school and see the importance of education. Literate parents are also more likely to be able to get themselves out of poverty and teach their children how to do the same. Furthermore the importance of investments and reforms for the long term alleviation of poverty should gain more acceptance and appreciation among Zambians. From a previous section in this thesis we know that societal and cultural ideas about health and HIV/AIDS play a role in the further spread of this disease. As can be seen HIV/AIDS has a widespread influence on education, and it affects many different aspects. Not only does it prevent children from going to school, and cause many teachers to be absent, it also increases poverty (which has a negative effect on education), and takes up government resources that could have gone to education. Of course gender discrimination is also a cultural/societal factor. Corruption has also been shown to be (at least in part) a cultural phenomenon ([4]). From this we can conclude that culture and society have the largest impact on education. It can also be said that education does not have much of a chance of having a positive impact on a country if there is not a change in attitudes among the population, or perhaps a change in the way education is handled. Further things that stand out is that teacher training plays a large role in the success of using ICT in education. Other relevant factors are teacher interaction and the creating and sharing of teaching materials. The long term sustainability of ICT in education is dependent on resources (human capital/funds) being in place for maintenance, and the purchasing of technologies that are affordable and cost effective in the long term. From the support model it seems that an important factor is that the whole school, including management and administration is also involved and trained in using ICT for their work as this increases commitment.

We can also use these models as a reasoning tool in determining what changes need to be made to make education and ICT in education in Zambia a success. To visualize this even

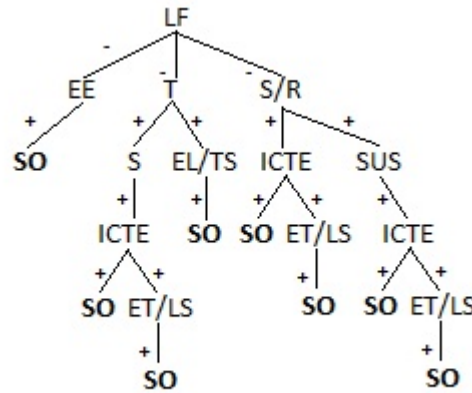


Figure 7: Tree - education

better a hierarchical tree view has been made of the first model. This can be seen in figure 7. As has been observed before we can see that only local factors have negative causal links to other categories. But we can also see that all other chains of causal links eventually lead to student outcomes. From this we can conclude that a reduction in local factors will lead to an increase in the categories effects on education, teachers, and support/resources. Increases in these categories will eventually all lead to an increase in student outcomes as all other links are positive causal links.

6.4.1 Discussion/future research

Seeing these models a few issues arise that need to be addressed. First we see a bit of a conundrum in the “sustainability” model (figure 4). Here we see that training of teachers and other school staff leads to an increased ability of the school to maintain their own ICT. We also see that training of teachers and other school staff has a negative effect on the retention of teachers and staff. This is because due to this training teachers and staff gain opportunities for finding better (paid) employment elsewhere. This is a difficult problem which needs to be addressed because school staff needs to be trained to use ICT if ICT is to be used in education. On the other hand it seems like a waste of resources to train staff that will subsequently leave due to the opportunities this training provides them. Solutions to this problem should be found and researched. An idea might be to obligate teachers and staff that are trained to stay with the school for at least a certain amount of time after training. Another point that arises comes from the “teachers” model (figure 3). We see that interaction with other teachers, sharing of knowledge and teaching materials, and ongoing learning all increase teacher motivation. The question that this poses is if increased teacher motivation in turn leads to teachers wanting to learn and interact even more, and share more information, which would in turn increase motivation further. This seems plausible, and if this is the case a loop would be created in which these variables continue to have a positive and strengthening effect on each other. This would make these variables an even more important point to focus on when trying to motivate and train teachers in using ICT in education. Finally there is a big issue that is to be found in the local factors/effects on education model (figure 6). First

we know that using ICT in education leads to a more active learning style, which changes the student-teacher dynamic. The teacher is no longer just a person who stands in front of a classroom and lectures to the students, the teacher is now someone who facilitates learning and is more interactive with the students. The question this poses is if this active learning style is possible due to the high power distance. Is it possible for students to interact with their teacher, thus creating a less hierarchical relationship between teacher and student? It is often said that education leads to change, but the outcome if this model leads to question this. From a western way of thinking it would be logical to say that education leads to more knowledge and critical thinking, and that this new attitude would lead to a lower acceptance of gender discrimination and corruption, and a better way of dealing with and preventing HIV/AIDS. Education in western eyes also leads to more opportunities for making money, and thus less poverty. However due to the culture which is collectivist, high power distance, and low long term orientation Zambia is a country in which change, and adapting traditions to the current time and context are not seen as positive. This leads to the question of if and how education can be made more effective in creating more positive local circumstances, and lessening the grip that gender discrimination, corruption, HIV/AIDS, and poverty have on Zambia. Perhaps it is important to not only focus on the education of children, but also on educating and raising awareness among adults. Long term government campaigns, and strong visible commitment from the government on these issues, but also on the benefits of ICT (in education) may be very beneficial to this end. However more research should be done to determine an answer to these questions.

7 Infrastructure

7.1 Current situation

This section will consist of two parts. The first will be about ICT infrastructure, such as telecommunications and broadband. The second will be about electricity.

We will begin with some numbers on the infrastructure and accessibility of ICT in Zambia. Zambia scores quite low, 0,17 on the DAI. [34] In terms of mobile telephony Zambia is growing rapidly with a growth rate of 47% in 2011, and nearly 8,2 million subscriptions, which is 62,55 subscriptions per 100 people. [127] Fixed telephony is not used as much as there are only 0,7 telephone lines per 100 people. Even though mobile telephony is doing so well only 50% of the population is covered by a mobile signal. Fixed telephony is much more expensive than mobile telephony at \$24,6 compared to \$12,7. Revenue from telecommunications is 2,6% of the GDP, and investment in the telecommunications sector is 29,3% of the revenue. [90] Currently there are three mobile phone operators in Zambia: Zamtel, MTN and Airtel. Airtel has the largest market share at 52% of subscriptions, MTN has 33% and Zamtel has 15%. Zambia also has 14 operating ISPs with a total of 20.875 subscribers in 2011. Zamtel has the largest share of these subscriptions at 60,8%. Mobile broadband is offered by Airtel and MTNZ with a total of 28.992 subscriptions in 2011. With ISPs and mobile broadband combined Zambia has a total of 49.867 internet subscriptions, this is 0,38 subscriptions per 100 people, with a growth rate of 44,81% in 2011. [127] As we can see mobile telephony and internet are in a competitive market, however international telephony is not. [123] states that the international services market was open to competition, however barriers were high

to enter this market as the required license for entering this market costs \$12 million. This is the reason that there is only one provider in this market as of 2009 which is Zamtel. Prices for international calling is very high and quality is poor. This is also a reason on foreign investors to choose not to establish businesses in Zambia. It is also noted by [123] that the fee for such a license is only \$100.000 in Uganda, which does now have a competitive international services market.

The Zambian Information & Communications Technology Authority (ZICTA) is the autonomous regulator of ICT services in Zambia including telephony and internet. It also has the task of managing the Universal Access Funds (UAF) and using this to ensure access to ICT in all areas of the country, even those that are not seen as economically viable by services providers (mainly rural areas). The telecommunications market in Zambia was reformed in 1994 with the Telecommunications Act which quickly caused growth in the telecommunications sector. These reforms consisted of telecommunications and post being split up into two separate companies, and the function of regulator being removed from these companies and made into a separate entity. Privatization and liberalization were also part of these reforms. Even though privatization was a part of this act government retained all control of Zamtel until 2010. The situation was not yet ideal, with high prices and not enough demand, so more reforms were made in 2009. These reforms consisted of the following: *“the development of a national ICT policy, enactment of the Information and Communications Act in 2009, partial privatization of the loss-making incumbent ZAMTEL, and liberalization of the international gateway.”* Goal of these reforms was to further open the market to competition. Despite these measures things do not seem to be going in the right direction due to measures taken by the Zambian government. First of all there is a ban on providing licenses for more than three mobile operators. The government created this law when it sold a majority of Zamtel in order to protect it from too much competition. Furthermore the government gave Zamtel access to a large share of the fiber optic cable of ZESCO which is Zambia’s largest and state owned power supply company. This makes Zamtel a dominant player in the broadband market, which does not foster competition. ZICTA has been made the autonomous regulator of the telecommunications industry. According to [22] ZICTA has a difficult task and needs to make some significant changes in the way it operates. Its decision making should be more transparent and predictable, and strengthen its credibility. [87] also names a number of challenges that telecommunications reforms in Zambia have faced. First is the resistance to the privatization of Zamtel. This resistance is led by opposition parties and labor unions. This has to do with the national pride that is seen in these companies. People feel that by letting this (and other large Zambian companies) be bought by foreign companies something that they are proud of is take away. Another objection is that the privatization will have negative consequences for the employees of these companies, as has been seen before in the privatizations of other companies. The second challenge is the lack of ability at various levels to create effective policies and regulations which affects the success and sustainability of initiatives. The following challenges are named regarding policies and regulations: “

- *Leadership of the national ICT portfolio; and the visibility of the National ‘Champion’ for ICTs among the public;*
- *Capacity for policy formulation/development at various levels of society;*

- *Institutional framework and capacity for policy implementation at national, provincial and district levels;*
- *Developing clear roles and responsibilities of various stakeholders;*
- *Mainstreaming of ICTs by Cooperating Partners in country programmes; and reflection of ICT commitment in national budgets;*
- *Inadequate and ineffective legal and regulatory framework;*
- *Inadequate capacity to undertake ICT investment promotion/campaigns at national, regional and international levels.” [87]*

Furthermore regulations on pricing of telecommunications and especially internet needs to be put in place. Especially in underserved areas such as poor and rural areas the costs of these services are much higher than people can afford which results in low usage. ZICTA should take more leadership in these areas. Gains that have been achieved through reforms, privatization, and liberalization are also listed by [87]. These are large investments in the fiber optic backbone across Zambia by the newly privatized Zamtel. Prices have dropped and quality has improved. ZICTA and mobile services providers have connected all rural parts of Zambia as of 2011. [87] Also it is reported that Airtel has rolled out a 3G network as of this year increasing internet speeds and significantly lowering prices. [98] The price for entering the international services market has dropped from \$12 million to \$ 350.000, which has seen new companies enter this sector. Prices for international calling rates have gone down by 70% as a result of this. [37] It is not all positive as this year (2012) the privatization of Zamtel has been reversed, which is a worrying sign for investors, and has resulted in Zambia’s economic outlook ratings to be downgraded. [43]

The fact that computers need electricity in order to work means that this is also an important aspect to cover in this chapter. According to The World Bank only 18,8% of the population of Zambia had access to electricity in 2009. (See 3.3.2 for more information about the health risks of not having access to electricity.) In 2008 Zambia produced 9,7 billion kWh of electricity, of which 99,7% was hydroelectricity and 0,3% came from oil. 9,7 billion kWh may sound as a lot but when compared to the 255,5 kWh that South Africa produced in 2008 it really isn’t very much. Furthermore 23,3% of the power is lost on its way between the power supply and the consumer. [91] The World Bank has also observed that for businesses who wish to obtain a connection for electricity to their building it is an expensive and time consuming procedure. The procedure consists of five steps, and these take a total of 122 days, and 69.937.132,50 Zambian Kwachas (about \$13.000). Of this money 6 million kwacha goes to the government for permits, and the rest goes to the electricity company. This is not an attractive prospect for organizations/people that are considering to start a business in Zambia. [93] Zambia’s largest electricity supply company is the state owned ZESCO, which produces most of the electricity in Zambia. The other company is CAPC which is owned by Zambia and Zimbabwe. [46] These two companies exploit the country’s hydro power stations which have a shared capacity of around 1.700 MW. It is estimated that Zambia’s hydro resources have the potential to produce 6.000 MW. Even though so little people have access to electricity a large share of the power is consumed by the mining sector, and power is also being exported to neighboring countries. This is due to the fact that the purpose of building Zambia’s electricity

grid was to supply the mines with power. For this same reason rural areas were not taken into account in the building of this grid. It is estimated that the mining industry receives 50% of the power supply, urban areas receive 48% and rural areas 2%.[28] Power stations, substations, and diesel stations are well distributed across the middle and eastern sections of the country, but less so in the northwestern part. [11] As there are no plans coming from the electricity companies to provide power in these parts this is left up to private organizations. To this end (among others) Zambia received \$8,1 million in official development assistance to be put towards energy in 2009. [91] The Rural Electrification Authority (REA) is an initiative of the Zambian government started in 2003 to provide electricity to people living in rural areas. According to IICD alternatives to hydro energy should be provided in rural areas. In an earlier section of this thesis it was said that wireless energy sources such as solar power are a good approach for developing countries. As Zambia gets a lot of sun this seems to be an appropriate approach. Another renewable energy source is wind energy. Alternatives to renewable sources are wood fuel, (bio)diesel and biomass. Renewable energy sources are more cost effective and sustainable in the long run, but do require investments to get started. The availability of fossil fuels is declining and prices are going up. For this reason bio fuels such as biodiesel (and related crops such as jatropha) are being considered as a source of energy. [28]

7.2 Model

On the next page the model for this chapter, infrastructure can be found (figure 8). More information about these models can be found in section 6.3. The two main focuses of this chapter, telecommunications- and internet and electricity infrastructure have both been captured in this model. Variables that relate to both these subjects are black, variables that relate only to telecommunications- and internet are blue, and variables that relate only to electricity are purple.

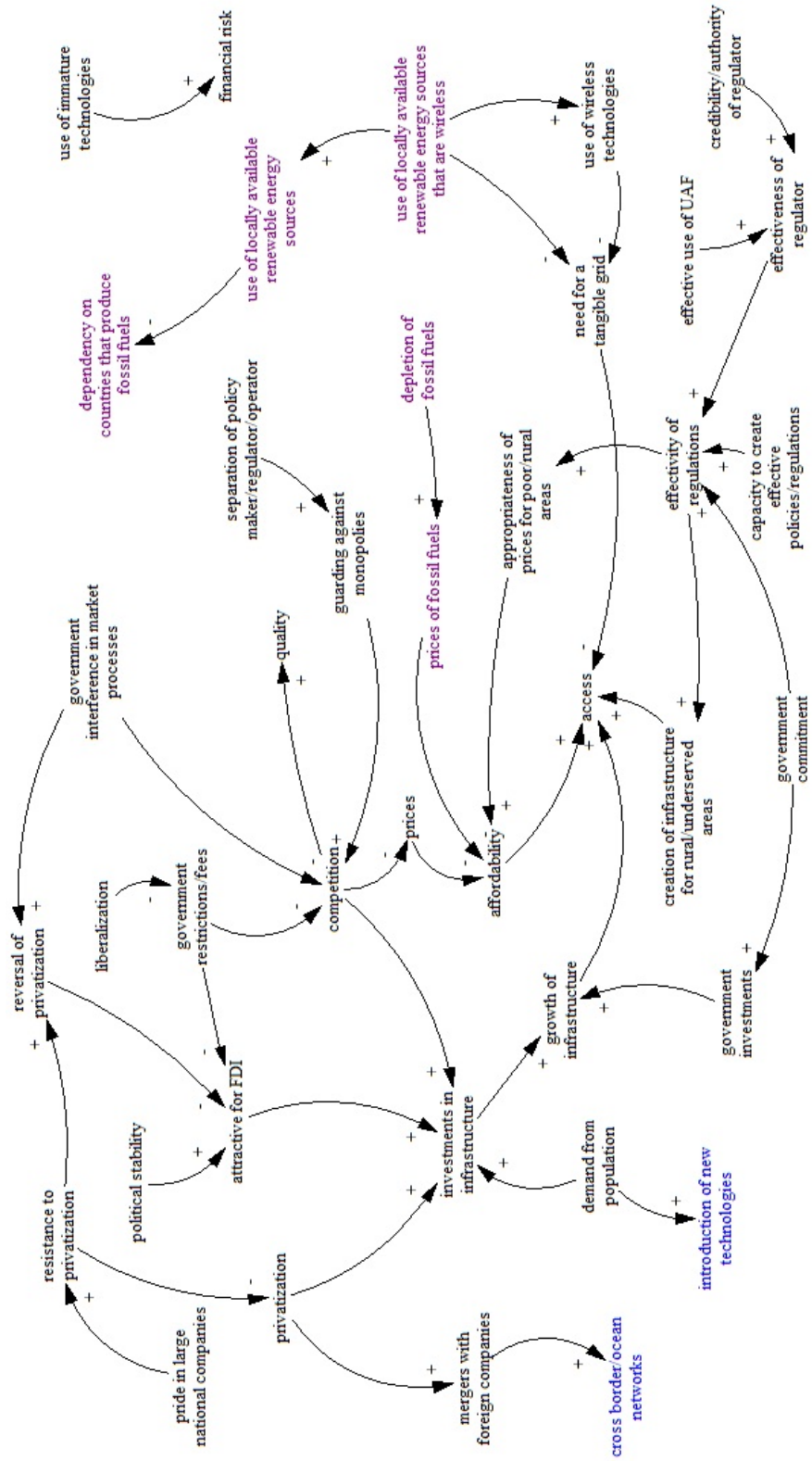


Figure 8: Infrastructure model

7.3 Conclusions

One thing that clearly shows in this model is that (almost) all causal link chains eventually lead to access, and improved access to ICT infrastructure in Zambia is what we wish to achieve. Key variables in this are liberalization, privatization, political stability, and effective regulations. These lead to competition and FDI, which leads to more investments in infrastructure, improved quality of services, and increased affordability, and these in turn lead to improved access. For electricity important factors are the use of locally available, renewable energy sources and wireless technologies. Zambia already uses hydro power to generate almost all of their electricity, however this is distributed through the power grid which does not extend to all parts of the country. This is why it is important to use wireless technologies, which generate energy from renewable sources such as solar panels. Zambia is fortunate as it has plenty of sources for creating energy from renewable sources. While technologies for generating energy from renewable sources do require sizeable investments to start up, they are cheaper in the long run. Wireless technologies do not rely on a grid, and can thus be a solution for areas that are not connected to this grid. We also see that just having regulations, and a regulator are not enough. For one the regulator should be autonomous, and be effective in terms of having the authority and credibility to perform its tasks. The people who create the regulations (at all levels) should have the necessary knowledge and skills to do so, and to create effective regulations. This will lead to access for all people in Zambia, through affordability of access, and through infrastructure being in place in all areas (not just economically viable ones).

7.3.1 Discussion/future research

As was mentioned before effective regulations should be in place to ensure and also access to and affordable ICT infrastructure services for all Zambians. Ensuring this access does require the government to interfere in the natural market processes. In these market processes only economically viable areas will be invested in by service providers. Interference, as we have seen in not only in Zambia but also in other countries such as Chile, is detrimental in creating a competitive environment, and in attracting FDI. Therefore there should be a middle ground that ensures both a competitive environment, but also access and affordable infrastructure for areas that are not attractive to service companies. For ensuring access to these areas either the government needs to invest in infrastructure and provide reasonable prices for these areas, or ensure through regulations that the companies that obtain licenses from the government create the necessary infrastructure and affordable prices in these areas. Unfortunately both of these measures involve interference on the part of the government, which is undesirable. Therefore these measures should be changed and implemented in a way that does not (or as little as possible) negatively impact competition. This requires further research.

8 Government Policy

8.1 Current situation

Zambia has a large number of government policies regarding ICT. It is the goal of the Zambian government to make Zambia a middle income country by 2030, and ICT is seen as a tool that will help achieve this goal. A number of the policies in which Zambia sets out its

goals with regard to ICT are listed by [53] as the following: “*The Zambia Science and Technology Policy (1996); The Zambia Vision 2030 (in 2005); The Zambia National ICT Policy (Launched 2007); The Ministry of Education ICT Policy; The Zambia ICT Act of 2009; The Computer Crimes and misuse Act*”. Policies on education and infrastructure have already been discussed in the previous two chapters, and a bit more about these policies (and other ICT policies) and their execution will be covered in this chapter. Furthermore this chapter will assess if Zambia has the necessary policy frameworks in place to be an attractive country for ICT related businesses to settle in. The criteria for assessing if this is the case can be found in section 3.2.3. E-government will not be covered specifically in this chapter as this has been covered in section 5.5.

In the previous chapter Zambia’s ICT authority ZICTA has been said to lack credibility and transparency. Further causes of the lack of effectiveness of ZICTA (which has been made the autonomous regulator of the ICT sector by the Zambia ICT Act of 2009) are identified by [53]. These problems are the same problems that have been identified as problems in executing policies that have to do with ICT in education. These problems are that there is no communication between ministries and government agencies, which hinders the execution of policies that rely on multiple parties for their execution. An example of a problem arising due to a lack of communication and cooperation is that the Ministry of Education cannot broadcast educational television programs that can be used to aid distance learning because it is not granted a license by the Ministry of Information and Broadcasting. An ICT policy being prepared by the Ministry of Education since 2007 is still in draft. The Ministry of Science, Technology and Vocational Training has finished an ICT policy in cooperation with several organizations, these organizations were not involved in executing the policy. [53] states that problems in the execution of policies have to do with a lack of capacities at middle- and senior management levels. These problems have to do with a lack of knowledge on ICT and knowledge sharing, lack of dialogue with different ministries, agencies, and other strategic partners, the lack of capacity to execute policies, and monitoring and evaluating progress made. Therefore there is a need for capacity building among people in these functions. [22] also names three issues that affect the implementation of ICT policies which are lacking leadership and capacities at ministerial level, lack of skilled personnel to guide the implementation, and inadequate planning and budgeting which led to a lack of funding. Regarding the National ICT Policy [85] states that a lack of a specialist ICT department has caused large delays in the implementation of this policy. This both causes ICT to still not be used as the government would like, but also that the plans in this policy may not still be relevant due to changes in the field of technology. [85] therefore calls for review and change of this policy. Furthermore the government is lacking on raising awareness among Zambian people and communities about the benefits that ICT can bring to them. According to [85] the government should take lessons learned by NGOs in the field of ICT4D. They have found that the smaller scale local projects have been most effective and sustainable in poor communities. These initiatives focus on the needs of the community (instead of technology), and use local languages and volunteers for these projects. This in contrast to large projects that are centrally managed.

In the previous chapter we have concluded that FDI is important for realizing the necessary ICT infrastructure, but FDI is also important because it brings (tax) income and job opportunities to countries. Many businesses and organizations rely on ICT for their busi-

ness activities. For this reason infrastructure, skilled human capital, and government support need to be in place. In this next part we will talk about the level of government support that Zambia provides for companies in Zambia and considering moving to Zambia. Is Zambia an attractive country to for doing business from a government policy perspective? The International Finance Corporation (IFC) (part of The World Bank Group) runs the Doing Business project which ranks 183 countries on several characteristics of doing business. For the overall category “Ease of Doing Business” Zambia comes in at place 84 for 2012 (down from 80 in 2011). [93] What immediately stands out is that Zambia ranks very high on the “getting credit” category at place 8. This category measures the legal rights of borrowers and lenders, and the rules regarding credit information (among others). Zambia also scores quite well on “paying taxes” at place 47. This category measures the effort it takes to file taxes and the height of taxes for businesses. On the other hand Zambia scores terribly on both “trading across borders” (153) and “dealing with construction permits” (148). Both the time it takes, and the cost of importing and exporting goods are very high in Zambia. For construction permits it is not the time or procedures, but the costs involved that make this rank so poorly. The total cost of obtaining a construction permit is 106.931.429 kwacha plus \$2 (about \$20.426). “Getting electricity” has been discussed in the previous chapter, this holds place 118. Also interesting for potential investors are the categories “protecting investors” (79) and “enforcing contracts” (85). Regarding the protection of investors category Zambia scores significantly low on the transparency of transactions. On the enforcing of contracts Zambia scores quite well compared to both Sub-Saharan Africa and OECD countries. However this category is only measured by time, cost, and number of procedures. [93]

In 2006 the Zambia Development Authority (ZDA) was instated. This authority was meant to facilitate economic growth, and promote investments. According to [99] the policy under which the ZDA was created this poses some serious added hurdles for companies wanting to invest in Zambia. Now investors must be approved by ZDA in order to obtain a license allowing them to invest. This process is burdensome for investors and requires a business plan, risk assessments and other documents. It is the responsibility of the financier, and not of the government to assess whether a potential business will be successful. The government should only ensure that the investor complies with regulations, and incentive requirements (if applicable). [100] names experiences from the private sector. About the licensing process complaints are made about the large number of necessary licenses, the (long) time it takes to obtain licenses and permits, and the (sometimes annual) need for renewal of licenses. Under ZDA a one stop shop for processing licenses was promised, which according to experiences named in [100] is not present. It has also been said that these very time consuming bureaucratic processes encourage bribery, and that this is becoming a more common way in making sure things get done quickly. Though Zambia has laws and signed agreements with foreign companies and countries regarding the protection of investors it is observed by [56] that *“investor protection issues are a grey area in Zambia and there has not been any coherent policy and implementation framework put in place”*. The same can be said for the protection of (intellectual) property rights as it is stated that Zambia has made efforts to create legislation on this topic that conforms to international standards, and has also signed international agreements on these issues the execution of this legislation leaves room for improvement. As [56] states: *“the courts in Zambia are reasonably independent, however contractual and property rights enforcement is weak and final court decisions can take a long time”*. This brings us

to the issue of rule of law in Zambia, which USAID (United States Agency for International Development) has reviewed in [113]. It puts forth a list of issues the Zambian judicial system faces:

- *“Many treaties to which Zambia is a party are unenforceable in Zambian courts for lack of implementing legislation.*
- *Many legislative proposals to strengthen the rule of law await the completion of slow and uncertain government review procedures.*
- *The constitutional practice of Presidential designations of “acting” Supreme Court judges, including temporary designations of Supreme Court judges who have reached mandatory retirement age, is widely seen to undermine judicial independence.*
- *Inadequate resources for the judiciary impede recruitment of highly qualified judges and staff, increase vulnerabilities to corruption, and inhibit the development of training, research, and management systems. The local courts are especially affected by underinvestment. Financial shortfalls also affect other institutions in the justice sector, including the police, public prosecutors, legal aid providers, and the prison service.*
- *In the Zambian courts, both civil and criminal cases incur unreasonable delays due to complex procedures, lax case management, lack of performance management, absence of recording equipment to create court records, and judicial vacancies. An overwhelming backlog of appeals delays unreasonably the finality of judgments and is cited as a factor in a perceived decline in the clarity and legal acuity of appellate decisions.” [113]*

Lengthy and troublesome judicial procedures are named by members of the private sector in Zambia to fuel corruption. It has also been said that laws, privileges, and fees applicable to the private sector are known to change with little or no prior notice. [100] Transparency international publishes annual figures relating to rule of law and corruption. On rule of law Zambia scored -0,493880289 (scale from -2,5 to 2,5), which is quite low. For judicial independence Zambia scored 3,5 (out of 7) for 2011-2012. On the Corruption Perceptions Index Zambia scored 3.2 (out of 10). [96] [57] has conducted a recent study on corruption in Zambia. Both bribery and misappropriation of funds are common and widespread. Bribery is highest in the police, judicial, and tax systems. Misappropriation of funds is most common in the Ministry of Work and Supply, and the Ministry of Communication and Transport. It is estimated that \$74.891.000 were misappropriated every year between 1984 and 2004 in Zambia. Furthermore it is stated that the private sector is not only a victim of corruption, but also an instigator, seeing corruption as an easier or better way of getting things done. [57] The Zambian government has named a number of sectors to be priority sectors, and has special incentives for these sectors (ICT is not one of them). Tax related incentives are also discriminatory as they favor export over import. The corporate tax rate is 35%, but lower rates apply to certain favored sectors. Tax incentives also apply to investors that invest large sums. These incentives do not apply to small and medium investors. [99] The MFEZ (Multi-Facility Economic Zones) also provide tax benefits for investors creating business in these zones. ICT does fall under the priority sectors for these zones. These zones can be created by anyone that can comply to the requirements set for these zones. These include investing in a MFEZ priority sector, attracting local and FDI, creation of employment, skills transfer,

and environmental protection. The tax benefits include 0% tax on dividends and profits for companies in the MFEZ priority sector for 5 years. The full list of requirements and incentives can be found in [100] The sale of land in Zambia requires presidential consent. According to [99] this rule should be removed as it interferes in the land market and poses additional risks for investors. Another problem for investors is a shortage sufficiently trained personnel. Companies often need to train workers and bring in managerial and highly technical staff from other countries. According to [99] there is no communication between the public training and education facilities and the private sector, making it impossible for these facilities to properly assess the exact skills needed on the labor market. This makes it difficult for companies to keep their skilled workers, and makes it necessary for these companies to provide high wages in order to keep these workers. The lack of infrastructure (electricity and roads) are also named by the private sector to pose issues and raise costs of production. [100]

8.2 Model

On the next page the model for this chapter, government policy can be found (figure 9). More information about these models can be found in section 6.3. The main focus of this model is how government policies and actions can affect access to ICT and investments (in the ICT sector). Two subtopics are e-government and ICT hubs. These have been put into the model as separate phenomena (e-government variables are red, ICT hub variables are green). The reasoning behind this is that creating separate models for these subtopics would not be very interesting in the sense that these would primarily contain a list of conditions that have a positive impact on the creation of e-government and ICT hubs. These conditions can be read about in sections 3.1.3, 3.2.3, 5.5, and 8.1. For this model only causal links regarding these two subtopics have been included.

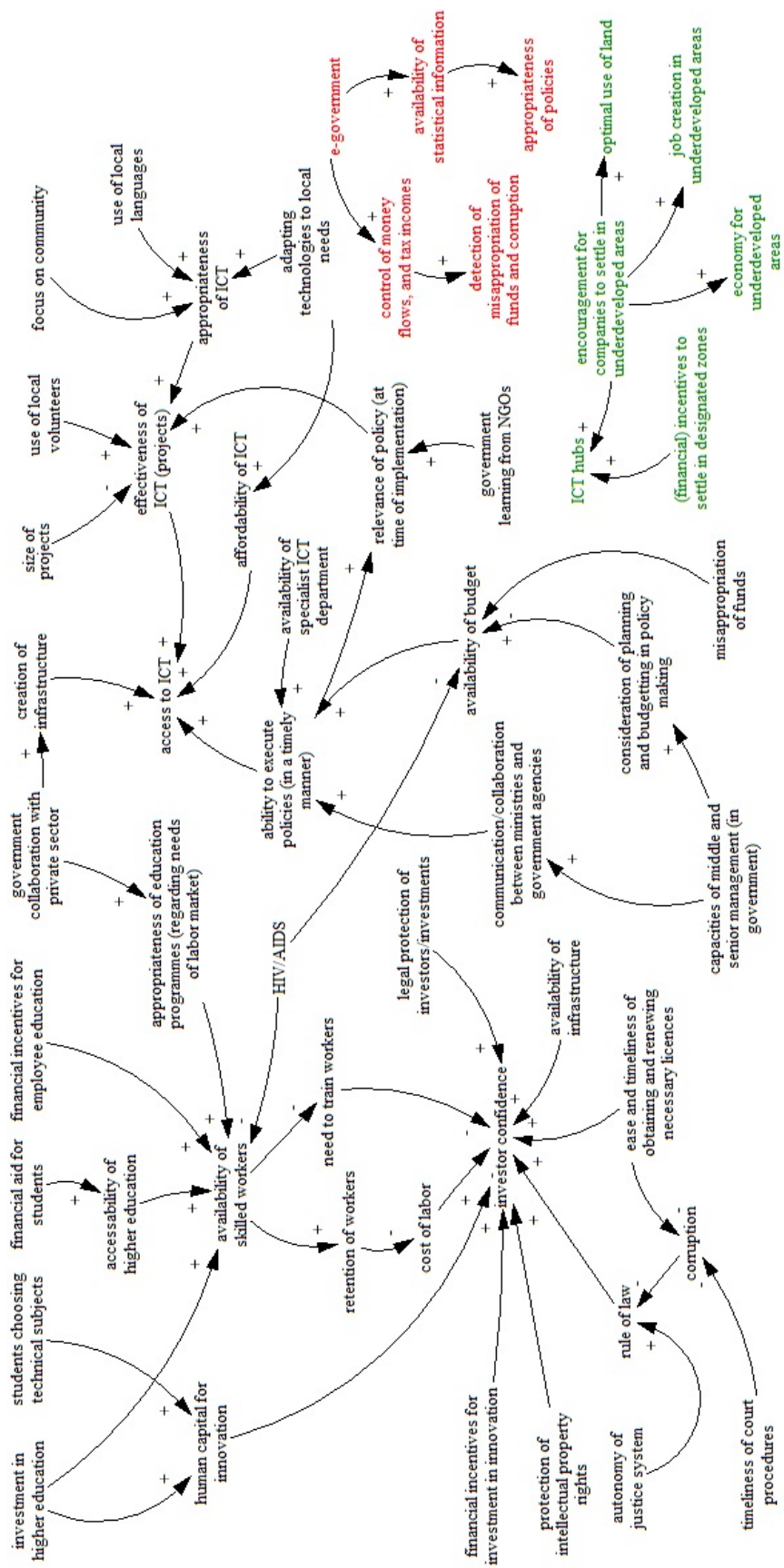


Figure 9: Policy model

8.3 Conclusions

What stands out right away in the model on the previous page is the large amount of arrows leading to investor confidence. This must mean that there is a lot that can be done to create investor confidence, such as financial incentives (e.g. tax cuts), improving education to increase the amount of properly trained workers, enforcing rule of law, and protecting investors and their investments. We also know that there are policies to improve many of these issues in Zambia. We also know that these policies are not being properly executed. This is due to a lack of capacity of government staff to do so, and the budgets for doing so not being available. This leads to the conclusion that it is of great importance that government staff be educated and trained in being able to execute these policies, and that a specialist ICT department is available to supply the necessary knowledge regarding the execution of ICT policies. Furthermore misappropriation of funds leads to less funds being available for the execution of these policies. According to these models e-government can aid in detecting the flow of money, and thus the misappropriation of funds. The model also shows that making processes such as the granting of licenses and legal procedures easier and less time consuming will have a negative effect on corruption. This can be explained by the fact that there is less need for paying “acceleration money” to get things done. Another interesting conclusion is that the availability of skilled workers going up will have positive effects for investor confidence as the cost of employing these workers will go down. This is because there will be less competition to retain these workers, and thus less need to raise their salaries beyond reasonable levels. Finally, as we had already learned from the chapter on education, HIV/AIDS also poses a threat to both government budgets and the availability of skilled workers.

8.3.1 Discussion/future research

As we have concluded in the previous section there is much that can be done by the government to raise investor confidence. It would therefore be plausible to say that the ability of the government to execute their policies (which at this point leaves much to be desired) will also increase investor confidence. Also we can see that there is no link between the variables “detection of misappropriation of funds and corruption” and “misappropriation of funds”. It is however plausible that the detection of this misappropriation will lead to less misappropriation of funds. However this can not be concluded with certainty as it has been mentioned that the acceptance of this phenomenon is a cultural factor. Therefore we cannot say that these detection mechanisms will actually be put to use to serve their purpose. Another question is if all the tax cuts that go to increasing investor confidence are worth it. Do they not cost the government more than they stand to earn? There should be a balance as in Zambia companies that settle in a MFEZ pay 0% taxes on dividends and profits for 5 years. This seems a bit extreme. It may be worthwhile to assess if there cannot be a middle ground for less tax cuts but still attracting investors.

9 A model for Zambia

The model that has been created for this chapter is one that summarizes the models that have been presented in the previous three chapters. This model (figure 10) also brings together

these three models and shows the links that exist between them. At the top of the model we find the government, and at the bottom is the community. In the middle we find the three main contributors to bridging the digital divide: education, infrastructure, and the private sector. Note that government policy has been replaced by private sector. This is because the government policy chapter is mainly about stimulating the private sector through government policy. We also see two blocks of mitigating factors. The block near the government mitigates the government from being an effective party in bridging the digital divide. The block near the community mitigates the community from benefitting from education. Notice that the links between these blocks and government and community are not labeled with a plus or a minus. That is because we cannot be sure what the exact relationship between these elements is. Therefore we cannot say that a stronger (or weaker) government or community will have a positive or negative influence on these mitigating factors. What we do know is that these factors are a part of/stem from the government and the community. Therefore these links are represented by an unlabelled arrow. The causal links in this model represent the influences that these elements (government, community, education, infrastructure, private sector) have on each other. This is an “astronauts view” of the situation and it describes the main elements and links. To zoom in and get a detailed view we need to look at the model in the previous chapters. The blocks of mitigating factors are also only the most important factors. For other factors the previous chapters will have to be consulted. In the next part of this section some statements will be made that sum up the conclusions that can be drawn from this model.

Now the causal links and loops made by these links will be discussed and related to the previous, more detailed models. Loops are an important part of this model because loops can have an amplifying effect. This will be explained using a simple loop from the model in this chapter. We can see that there is a causal link that goes from private sector to infrastructure, and one that goes back from infrastructure to private sector. These links can be explained if we look at the models for infrastructure and government policy. We see that the availability of infrastructure leads to investor confidence. Investor confidence of course is necessary because it leads to private sector investments. We also see that FDI and privatization (private sector) leads to more investments in infrastructure. Thus we have a cycle of more infrastructure leading to more private sector investments leading to more infrastructure, etc. This is what is meant by the amplifying effect that cycles (can) have. As we can see in this model many loops can be identified. Let's look at another one. A link goes from government - to education - to private sector - back to government. This can be explained as follows. We know that government investments lead to better learning outcomes for students. Better educated people lead to a larger number of people having the skills that the private sector needs. A stronger private sector leads to more income for the government in the form of taxes. This in turn leads to the government having more funds available. We do see a problem in this loop in the form of the block that stands between government and education (in this case). We see that corruption/mitigation of funds leads and the inability to execute policies leads has a negative effect on education, infrastructure, and private sector. This due to the fact that corruption/misappropriation of funds leads to a decrease in government budget, so less money can be spent in these areas. The inability to execute policies means that improvements in these areas cannot be achieved. We see that if the strength of this block goes down, then the strength of education, infrastructure, and private sector will go up. There are many other loops that begin with government and through private sector lead back to government. Exam-

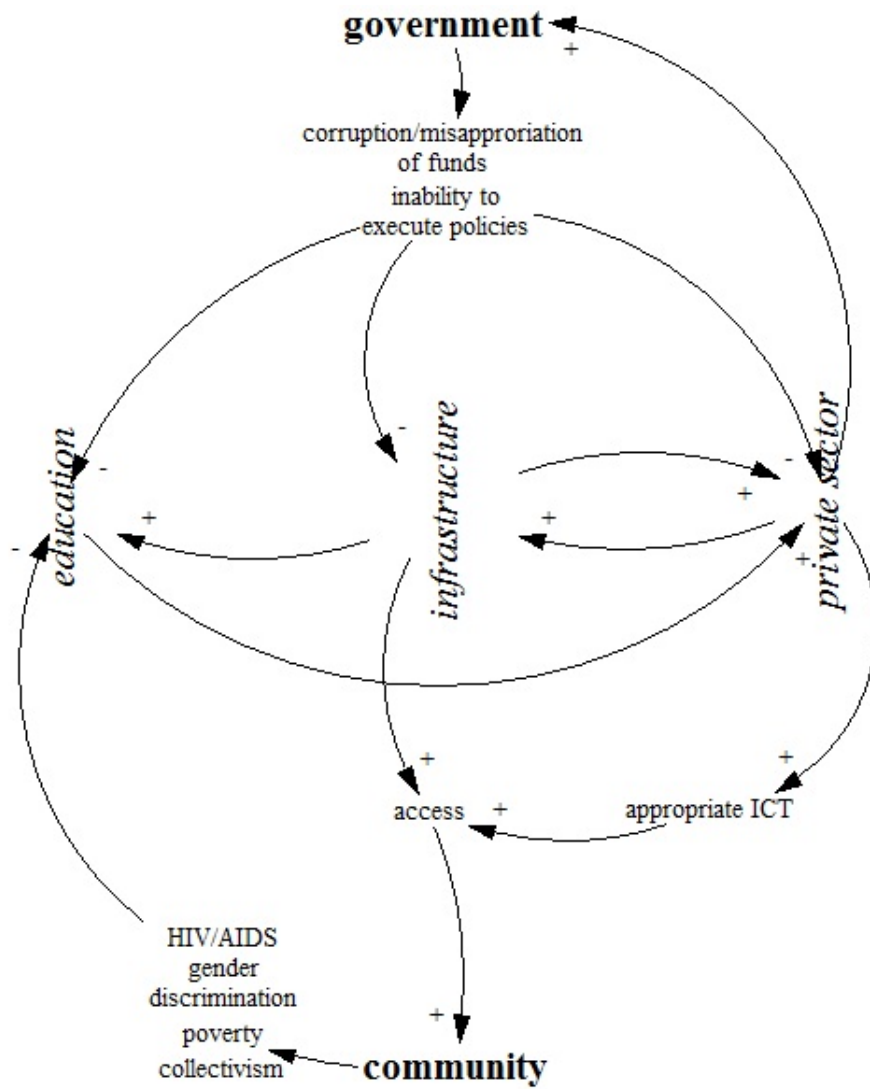


Figure 10: Zambia model

ples are government - infrastructure - education - private sector - government; government - private sector - infrastructure - private sector - government; government - education - private sector - infrastructure - private sector - government; and so forth. This leads to conclude that all government money spent on these three elements (education, infrastructure, private sector) will eventually benefit the government, which enables the government to spend even more money on bridging the digital divide (or other areas). In turn this also means that if the strength of the government decreases this will also come back to the government to further decrease its strength.

Statement 1: Government investments in education, infrastructure, and the private sector will in turn result in gains for the government.

Statement 2: Corruption/misappropriation of funds, and the inability of government staff to execute policies lead to a decrease in the effectiveness of government investments and policies.

Now let's turn our attention to the bottom half of the model which focuses on the community aspect. We first see a block of local factors that come from the community that have a negative effect on education. To see exactly how these factors affect education see figure 6. To make education stronger these factors need to be weakened. We also see that the private sector can adapt technologies to local needs which makes them much more attractive and useful for the community. This combined with an improved and more affordable infrastructure leads to better access of ICT for the Zambian community. In this model we can see that only a top-down or bottom-up approach will not suffice. Efforts will have to be made on both government and community levels to bridge the digital divide. Finally it must be said that HIV/AIDS can be seen in this model as having a negative effect on education. However it also affects the private sector and the government, by weakening the workforce and consuming a large part of the government budget.

Statement 3: Local factors such as HIV/AIDS, gender discrimination, poverty, and collectivism harm the access, quality, learning outcomes, and effectiveness of education (which is needed to bridge the digital divide).

Statement 4: Efforts need to be made on both government and community levels to bridge the digital divide.

9.1 Validation

The information and models presented in this chapter have not (yet) been subjected to testing in the target area which is Zambia. In this thesis an abstraction has been made from the situation in Zambia regarding ICT (informal) to a model that represents this situation (formal). Therefore we need to be able to verify that the information that is presented in that thesis, and the models that are the results of this information are a good and complete representation of the reality in Zambia. For this verification an expert on ICT4D who has project experience in Zambia has been consulted throughout the writing of this thesis. This expert has commented on drafts of this thesis, and has indicated elements that needed to be

added or changed. This expert has also stated that the information and models that are now presented in this thesis do (in his opinion) give an accurate and complete view of the situation in Zambia. [12]

Another part of the validation is showing that the models that are created as a part of this thesis are useful. The main purpose of these models is to function as a reasoning tool. They function as a visual representation of the information presented in this thesis. They show the important elements, and the way in which these elements interact with and affect each other. In chapters 6 through 8 the models were used to draw conclusions, but also to do further reasoning and to identify areas that need further research. This last point is one of the things that makes using the models in these chapters particularly interesting. Two examples of this come from the models in chapter 6 on education (see 6.4.1). The first comes from figure 4. Here we can see that the training of teachers and staff on the one hand has a positive effect on the abilities of teachers to maintain the schools ICT, but on the other hand has a negative effect on the retention of teachers. This of course is a difficult situation to which solutions need to be identified. We can see that the models in chapters 6-8 do not contain the loops that we have found in the model in this chapter. This is unfortunate because these models can have an amplifying effect that has been discussed in the previous part of this chapter. The reason for this is probably that these models have a stand alone topic, instead of being connected to the other two subjects (education, infrastructure, government policy). We see that when these subjects are connected that the loops emerge. Further reasoning has also identified a potential loop in figure 3. This would create an amplifying loop on the subject of teacher motivation, which is a very important factor (see 6.4.1 for more information on this potential loop). By using these models to reason further we can identify points that are serious problems (such as the previously mentioned retention issue), but we can also identify important opportunities (such as the potential loop for teacher motivation) which can be researched further and put into practice. The model presented in this chapter has also been used for this further reasoning. An example of this is that we have found that causal links coming from the government always come back to the government (either positive or negative; see the first part of this chapter for further clarification).

This reasoning and these models can be used as input for future research by identifying interesting aspects that can be focused on. These models can also be used in a more quantitative way (as opposed to the qualitative way they are used now). In this case actual numbers are added to the model, such as the strength of a causal links and elements. Then simulations can be carried out to show the actual outcomes of particular actions, changes, and situations. This will be interesting future research. In order to realize this the elements and causal links will need to be quantified, and the sub models will probably need to be turned into one (very) large model. We can conclude that this research is valid as we have shown that the information and models are both correct and complete, as well as useful.

10 Conclusion

This concluding chapter will be used to answer the sub questions and main questions posed in the first chapter of this thesis. As a reminder the four sub questions are as follows:

1. In what form should ICT be applied in a developing country?
2. How should education be used to create a sustainable ICT environment and how can this be achieved?
3. What infrastructure is necessary to create a sustainable ICT environment and how can this be achieved?
4. What should governments contribute to create a sustainable ICT environment?

The answers to these questions should lead to the answer to the main question which is:

How can ICT successfully be put to use in a developing country?

As has been stated in the first chapter we are specifically discussing Zambia in this thesis. For this reason all these questions are answered specifically and only for Zambia. The theoretical framework (chapters 2-4) has provided information from around the world regarding these topics. Sub question 1 has been answered in chapter 5, sub question 2 has been answered in chapter 6, sub question 3 in chapter 7, and sub question 4 in chapter 8. Chapter 9 has been used to answer the main question. As the concluding sections of these chapters have already provided the detailed conclusions of the research and thus the answers to the research questions this chapter will serve as a summary of these conclusions. The next section of this chapter will provide a discussion and possibilities for future research based on these conclusions.

Let's begin by recapping the answers to the sub questions. The first sub question asked in what form ICT should be applied in a developing country (Zambia in this case). The answer here was that efforts should be taken on both a government and a community level. The form ICT should take is a form that is relevant to the lifestyles of the people in a particular community. It should take the ICT4D2.0 or appropriate ICT approach. These should be small scale local approaches facilitated by local volunteers and focused on what the intended users want. The focus should also be on sustainability. The private sector should focus on creating ICT that is relevant and affordable for Zambian people. These solutions should consider Zambia's climate, culture, languages, and the needs and wants of the people. Furthermore ICT can be very useful in Zambia in terms of healthcare, environment, and politics/government (see chapter 5 for specific uses). Efforts on the side of the government are also necessary. We will discuss government investments in education, infrastructure, and private sector later. Here the focus is on the government's role in raising awareness among the Zambian people in terms of the usefulness and importance of ICT, but also of the reliability and security of information stored on and shared through ICT.

How should education be used to create a sustainable ICT environment and how can this be achieved is the second sub question. This question has been answered in chapter 6. The fact is that in Zambia education alone is a problem even without considering adding ICT to the curriculum. There are a number of local factors in Zambia that negatively impact the quality, access, and impact of education. These are important problems to address before including ICT in education. The factors that affect the quality and access to education are

poverty, HIV/AIDS, gender discrimination, and corruption. The factor that negatively impacts the effect that education has on people and the community is collectivism. Considering this it is important that community acceptance and awareness of the importance of education is increased. Another important aspect is adult education, as literate adults have more appreciation for the importance of education for their children and are also more likely to be able get themselves out of poverty. When these local factors have less of an impact on education, education has a greater chance of being successful. Teacher training plays an important role in the successful implementation of ICT in education. It is very important that teachers have sufficient knowledge and motivation to use ICT in teaching their students. Furthermore using ICT for information and knowledge sharing between teachers has been shown to increase knowledge and motivation in teachers. It is also important to have skilled people and funds for maintenance, and to purchase technologies that are affordable and cost effective in the long term. This contributes to the sustainability of ICT in schools.

The answers to the last two sub questions both have to do with government policy. The third sub question asks what infrastructure is necessary to create a sustainable ICT environment and how can this be achieved? We have determined that infrastructure for both telecommunications (including internet) and electricity need to be in place. As the conclusion in chapter 7 states liberalization, privatization, political stability, and effective regulations are key variables in achieving improved and affordable access to the infrastructure that is necessary for ICT. These variables will lead to FDI and competition. Effective regulations will require the presence of people that have the necessary skills to create and execute these regulations. An autonomous, reliable, capable, and credible regulator should see to the execution of these regulations. The government should ensure (through regulations and the regulator) that all parts of the country are connected, even those that are not economically viable. Wireless technologies such as solar panels can be a solution for those areas that are not (yet) connected to the power grid.

The fourth and last sub question asks what governments should contribute to create a sustainable ICT environment. We have discussed what the government should do to create ICT infrastructure in the last sub question. For this sub question the private sector is the main focus. The government should ensure that investors feel confident in setting up their businesses in Zambia. Examples of how this can be done are financial incentives (e.g. tax cuts), improving education to increase the amount of properly trained workers, enforcing rule of law, and protecting investors and their investments. The Zambian government lacks people that have the necessary skills to execute policies (especially those related to ICT). This calls for training of government staff and a specialist ICT department for the execution of these policies. Furthermore misappropriation of funds and corruption stand in the way of budget being available to execute policies. Legal procedures and procedures for obtaining matters such as licenses should be easier and less time consuming. This is due to the fact that these procedures being such a hassle leads to corruption. Education should be improved to provide sufficiently skilled workers for the private sector. Finally it should be noted that HIV/AIDS poses a threat to both government budgets and the availability of skilled workers.

Now for the main question: how can ICT successfully be put to use in a developing country? Better yet: how can ICT successfully be put to use in Zambia? In chapter 9 we have made

four statements that sum up the conclusions to this chapter, and the answer to the main question. The first statement is that “government investments in education, infrastructure, and the private sector will in turn result in gains for the government.” The second statement is related to the first statement and says that “corruption/misappropriation of funds, and the inability of government staff to execute policies lead to a decrease in the effectiveness of government investments and policies.” From this we can conclude that in order to achieve better results for education, infrastructure, and the private sector the government needs to improve itself. The government needs to become stronger and employ/train people who are capable of creating and executing necessary policies. The government also needs to fight corruption and misappropriation of funds. If the government becomes stronger education, infrastructure, and the private sector will also become stronger, and this in turn will lead to further strengthening government. Statement 3 is that “local factors such as HIV/AIDS, gender discrimination, poverty, and collectivism harm the access, quality, learning outcomes, and effectiveness of education (which is needed to bridge the digital divide).” On a community level efforts need to be made to both weaken the effects of these local factors, and also to increase the awareness of the importance of education. Education is an important factor in the successful implementation of ICT in Zambia and therefore needs to be more accessible and more effective. Finally statement 4 states that “efforts need to be made on both government and community levels to bridge the digital divide.” As we have learned from the first two statements the government plays a large role in bridging the digital divide. We have learned from the third statement that community factors have a negative impact on education. We also know that ICT needs to be appropriate and sustainable on a community level. Therefore we conclude that efforts need to be made on both levels in order to bridge the digital divide.

10.1 Discussion/future research

In this section the results and conclusions will be discussed and areas where more research is necessary will be identified. Many questions will be posed in this section. It is these questions that require further research as they are important issues in bridging the digital divide. For chapters 6-8 the discussion/future research section is already present in the chapter itself. Therefore the highlights of these sections will only be briefly summarized in this section. For more a detailed discussion the relevant chapter can be consulted. For chapter 5 (sub question 1) no discussion was included. This is because the results and conclusions for this chapter were quite straightforward. For the main question (chapter 9) there was a little bit of discussion in the chapter, this will be further elaborated on in this chapter.

For the “education” chapter three main discussion points were identified. The first was the dilemma between training school staff and retention of staff. This due to the fact that training leads to more opportunities elsewhere which causes staff to leave the school to pursue other (more attractive) opportunities. For this reason ways of retaining staff after training need to be identified. A possible opportunity also arises in this chapter because a possible reinforcing loop is identified. It is known that teacher interaction, ongoing learning, and knowledge sharing leads to increased teacher motivation, which leads to the question if increased teacher motivation also leads to teachers wanting to learn even more. This is a plausible statement, and if true would create a reinforcing loop for teacher motivation. This makes the variables involved very important for increasing teacher motivation, which in turn is very important

for the success of ICT in education. The last and largest point of discussion on education is the local factors problem. The question is if these local factors will ever allow real improvements in education and if they will allow education to have a real effect on students and the community. This issue will be discussed further later on in this section. For infrastructure there is one main discussion point. In order to increase access to infrastructure for all parts of Zambia infrastructure will need to be available and affordable even in areas that are less economically viable. In a free market this infrastructure will not become available in these areas. We also know that government interference in natural market processes has a negative effect on competition and attracting FDI. This poses a dilemma as the government will have to interfere to ensure universal access, but a way needs to be found to do this without disturbing natural market processes. In the government policy chapter three discussion points were identified. The first was based on the fact that theoretically there is a lot the government can do to increase investor confidence. We also know that the Zambian government lacks means to execute policies. Therefore it seems plausible that the government being more able in executing policies (that are attractive to investors) will this also make Zambia more attractive to investors. The second question is if it can be stated that e-government solutions that can detect the misappropriation of funds can be a practical solution for this problem. This is questioned because corruption is (in part) a cultural factor and it is not known if these solutions will actually be used to serve their purpose. Finally it is questioned if all the tax cuts that Zambia offers investors at the moment are worth it. Certain companies in certain areas are exempt from paying taxes on dividends and profits for 5 years, which seems extreme and also costs the government tax income. Is it possible to decrease these tax cuts and still achieve investor confidence, for the purpose of generating more income for the government.

Now on to the discussion on the conclusions to the main question. This discussion revolves around the mitigating blocks in the model presented in chapter 9. The following statement is made about these blocks in chapter 9: "Notice that the links between these blocks and government and community are not labeled with a plus or a minus. That is because we cannot be sure what the exact relationship between these elements is. Therefore we cannot say that a stronger (or weaker) government or community will have a positive or negative influence on these mitigating factors. What we do know is that these factors are a part of/stem from the government and the community. Therefore these links are represented by an unlabelled arrow." This means that we have a bit of uncertainty in this model. We know that these blocks have a negative impact on education, infrastructure, and the private sector, but we cannot say what it will take (from the government and community) to weaken these negative influences. It seems that these factors are very much embedded in Zambia and its culture and that makes it difficult to achieve changes on these factors. Therefore we cannot identify what needs to happen in the community or government to weaken or get rid of these factors. This is very unfortunate because these factors have such a negative impact on efforts to bridge the digital divide. Many of these factors are cultural or have something to do with cultural factors. The question is can cultures change. In the Netherlands and many other western countries we have seen that the culture has changed (quite a lot) in the past century. This had much to do with people not accepting the way things were and consequently making an effort to create change. Therefore we know change in culture is possible, but is it possible in Zambia. Can the way people think about gender roles, community, corruption, and HIV/AIDS change? More importantly, is there a desire for change? We know that Zambia scores low on long term

orientation. This means that it a country in which it is difficult to adjust traditions according to the situation and context of the current day and age. This means achieving step one of Lewin's three step model of change management (unfreezing; see 3.1.1) will be quite difficult. Taking this step (an the other two) is necessary for achieving long term change. Furthermore the people in these countries are after quick results, which makes stating goals for the long term a problem. As the digital divide will not be bridged overnight working towards long term goals will be necessary.

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