

A country ICT survey for Mozambique



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The Mozambique ICT environment is just in its infancy, but it is nonetheless rich and complex. As a result, we may have misunderstood some issues resulting in errors or omissions in this report. For these we take full responsibility.

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Executive Summary

Background and Objectives. Sida is a long-term and major donor in Mozambique. Although ICT projects have not been a primary focus, Sida has funded a number of projects with significant ICT components. These have included ICT projects at Eduardo Mondlane University, support for government finance, statistics, audit and legal systems, ICT expertise as well as rural electrification and community radio.

A new country strategy for development cooperation between Sweden and Mozambique is under preparation with the overall aim of poverty reduction and a focus on democratization, sustainable economic growth and social initiatives. It is increasingly evident that ICTs can be effective tools in many aspects of poverty alleviation, and certainly ICTs are an important part of a country's economic infrastructure. Accordingly, this Country ICT Survey was commissioned to investigate the state of all aspects of ICTs in Mozambique, and to identify areas and issues that warrant particular focus. The survey was strongly supported by the Mozambique Ministry of Science and Technology. The recommendations are broadly targeted at all donors as well as in-country stakeholders including the Government of Mozambique (GoM).

Rather than focusing on quantitative issues and statistics, the report identifies key initiatives that will help Mozambique fight poverty, develop its critical infrastructure and develop an effective ICT sector. Although any of the subjects discussed in this report could easily be the target of a study of its own, time and resources forced this survey to identify a small number of key areas that will help Mozambique in substantive ways.

Overview of Mozambique and ICTs. Although Mozambique is still one of the world's poorest countries, there is a small but reasonably advanced ICT presence, mostly centered in the capital city of Maputo. The telecommunications market is robust but not without problems. The vast majority of medium-long distance local communications and most international communications use satellite instead of terrestrial cable, fibre or radio. The rest of the ICT sector is relatively weak. Software development and project management skills are in very short supply, and demand correspondingly high salaries. Grid-based electricity is available only in larger centres, and the reliability and quality is variable.

Focal Point Analysis. In the process of conducting the survey, a number of areas were highlighted. Although quite varied, the common theme is

that they are areas where there will be large benefits or paybacks from ICT investment, or areas which will inhibit the use of ICTs if not addressed in the short term.

Healthcare. Mozambique's healthcare service covers just 40% of the population and the level of service provided to many of those covered is poor. Although inadequate funding and staffing is part of the problem, archaic processes and inadequate communications make it far worse. ICTs could be used to address many of these core infrastructure problems.

Justice. The entire justice system, ranging from complaint through investigation, arrest, trial, sentencing and jail is complex, cumbersome and manual. Many people suffer, particularly the poor. There is a new reform effort involving all five governmental units responsible for aspects of the justice system. A committee has been struck to investigate how a technology-based system can help address these problems.

Poverty Alleviation. The GoM PRSP (2006–2009) – PARPA II recognizes ICTs as a cross-cutting issue with the potential to be effective in various poverty alleviation programs. Although specific programs have not yet been outlined, one can expect specific ICT applications to be proposed over the coming years.

Ongoing Government Reform. The GoM approved an ICT Policy in 2000, followed by an ICT Implementation Strategy in 2002. The strategy was quite ambitious resulting in delays in some areas. Nevertheless very significant progress has been made in many projects including a government network, a government personnel system, a financial management system, a land registry and an electoral management system. The financial management system (SISTAFE) and the land registry (DINAGECA) will have profound impact on the government and the services it delivers. Following recent elections, the newly formed government has deemed that the Ministry of Science and Technology be a cross-cutting ministry, supporting all of the traditional ministries.

ICT for the People. There is a small but well received effort to make technology accessible and useful to rural people in Mozambique. This effort which includes computers, Internet access, a business centre and community radio has been particularly effective.

Corruption. Corruption, ranging from petty extortion and bribery up through major fraud is still common in Mozambique. Technology can be part of the solution, making various forms of corruption noticeable, traceable and auditable.

Poverty Reduction Strategy Paper (PARPA II). Mozambique's new 2006–2009 PRSP identifies ICTs as a cross-cutting issue with the potential to affect outcomes in many aspects of poverty reduction. Although not specific in its applications, this is an almost revolutionary position for a PRSP to take, and implies that innovative uses of ICTs will begin to appear in targeted poverty alleviation programs.

Post-Secondary ICT Education. Both public and private post-secondary institutions provide Bachelor's level training in computer science, but there was universal agreement among employers that the graduates did not have the skills needed for software and application development. The schools tend to focus on more theoretical aspects and/or use tools that are not generally used in the private or public sector.

ICT Salaries. As is true virtually everywhere, ICT professional command high salaries in Mozambique. The fact that computer science graduates lack the specific skills required only makes the situation worse. Unfortunately, the public sector is not allowed to pay the market salaries

that are paid by the private sector and donor-funded government projects. As a result, public sector technologists either leave once they are trained, or stay but focus their energies into private consulting contracts. As new ICT systems such as SISTAFE come online, these poorly trained or un-motivated employees will be expected to operate, maintain and enhance these critical systems.

Secondary Schools. Of the 280 public secondary schools in Mozambique, 75 currently have computer labs, with just 25 of them connected to the Internet, primarily due to the high connectivity costs. There are plans to use the labs for both ICT training and computer aided training in traditional subjects. It is critical that secondary school graduates be ICT-literate, as they will form the basis for ICT integration in all aspects of society.

Telecommunications Sector. The telecommunications sector in Mozambique is thriving, but with few exceptions, costs are extremely high. The high prices are at least partly due to much internal and most international communications relying on expensive satellite links. Even where terrestrial links are available, they still tend to be priced comparably to satellite. The prime exception is mobile telephones, where true competition combined with a very rapidly growing market has resulted in acceptable pricing. Internet access is moderately priced, but performance often is poor due high bandwidth costs. Residential and business broadband Internet access is now available from several sources. Deregulation is proceeding, and within two years the traditional telephone company will no longer have a monopoly over voice traffic. By most standards, the regulator is enlightened, but relatively weak, and there is some confusion over what is legal and what is not.

Electricity. Electricity is generally available in Mozambique's cities and all provincial capitals. It is scheduled to reach all district capitals by 2020, but even then only 20% of the population will be covered. The central/north region of the country is linked to the southern grid only by a line through South Africa. Long-haul transmission problems have been a problem, but significant efforts have greatly improved the situation. The quality of delivered 220v power is highly erratic and a significant problem in some areas. Some fibre has been laid along power lines for internal communications and control purposes, and there are thoughts about providing access to those outside of the electric company.

ICT Sector. With the exception of telecommunications, the ICT sector in Mozambique is relatively weak. There are relatively few companies present, and there are many structural and policy impediments to their growth and to the creation of more small and medium size enterprises. This weak sector impacts Mozambique's ability to use ICTs effectively.

Donor Issues. There is some donor cooperation and communications in Mozambique, but there is a need for increased coordination, particularly on targeted projects. ICTs have become a prime focus within the government, but it is felt that many donors are not staffed to address ICT projects.

MICTI. The Mozambique Information and Technology Institute is a multi-faceted initiative aimed at addressing many of the problems associated with the lack of skills, post-secondary education and the weak ICT sector. It does not address the root problems, but rather by-passes them for a small segment of the market. If it proves successful, MICTI may encourage changes to fix the root problems, but that will be a long-term effect.

Recommendations. There is no doubt that the position taken by the GoM with respect to ICT is correct; ICTs will be a crucial component in addressing many of the countries critical problems. A major challenge will be in deciding where to focus efforts and funding. In a country such as Mozambique, there are many opportunities to use ICT. However, both absolute costs and cost-effectiveness must be considered when deciding where to allocate funds and technical resources. The report identifies areas where investments in technology have a good potential for generating substantial benefits. In addition to the direct benefits, they all help lay good foundations for future improvements. There are also several areas where organizational or policy issues need to be addressed in order for Mozambique to most effectively benefit from ICT investments. Depending on the context, the recommendations are aimed at donors, the GoM, or both. The recommendations are not in priority order.

1. Extend SISTAFE functionality where applicable, and place a major focus on ensuring that its decentralized capabilities can be fully utilized in the provinces and districts.
2. Use ICTs to streamline the justice system increasing citizen's access to justice.
3. Use ICTs in innovative, cost-effective ways to support poverty alleviation measures.
4. Create an integrated government Geographic Information System.
5. Design, build and implement a health information system to help manage health information and delivery. Use ICT-based tools to address specific healthcare delivery problems.
6. Enhance the integration of computers and the Internet into the secondary school system and curriculum.
7. Ensure that post-secondary ICT training addresses the operational needs of the private and public sector.
8. Create a Unique Person ID system along with the corresponding birth, marriage and death registration infrastructures ensuring that all life events are recorded.
9. Provide access to high-speed, reasonable cost communications throughout Mozambique. Methods should be found to provide particularly favourable access to government, education and health-care facilities.
10. Continue the rural electrification program, but also address quality issues at the local distribution level and as well as network and computer security. Consider whether the electricity transmission right-of-way should be used for data transmission facilities.
11. Expand the program installing rural Community Multimedia Centres integrating telecentres and community radio. In locations where a telecentre is not yet practical, community radio should be considered.
12. Investigate ways in which ICTs can be used in the fight against corruption.
13. Ensure that the public sector has access to staff that can properly operate, maintain and enhance critical ICT-based systems.

14. Institute reforms such that the communications regulator can be both effective and enlightened.
15. Adjust government policies to remove inhibitors to the growth of a vibrant ICT sector.

There are no doubt many other worthwhile and important applications of ICT, many of which should be pursued with good results. Nevertheless, it is strongly recommended that these focus areas be addressed with due haste by both donors and the Government of Mozambique.

1. Background and Objectives

Sida has traditionally supported the integration of ICT in developing countries in order to improve communications and the exchange of information. Increasingly, it is being recognized that ICT can be used as a tool to address various aspects of development including poverty alleviation. Moreover, it is an enabler which can increase the effectiveness and efficiency of other forms of change. In Mozambique, ICT has been explicitly identified as an important tool for development.

Although Sida has been a long-term and major donor in Mozambique, ICT projects have not been a primary focus. However, there have been a number of investments in which there have been ICT components and in some cases, direct ICT objectives. These include:

- Several ICT projects at or in conjunction with Universidade Eduardo Mondlane (UEM) – See Appendix 3 for details;
- Support of the newly announced Mozambique Research and Education network;
- Support of rural electrification;
- Support of a system enabling government financial reform – SIST-AFE (Sistema de Administração Financeira do Estado);
- Support of the National Statistics Institute (INE – Instituto Nacional de Estatística) which includes ICT components;
- Study on Soft ICT Infrastructure (performed by Statskontoret);
- Support for the Finance Inspector General (IGF – Inspeção-Geral de Finanças) which includes ICT components;
- Support for a new IT system for the Administrative Tribunal;
- IST resident experts at the Ministry of Education and at UEM;
- Support of the recently announced Mozambique Research and Education Network (MoRENet);
- Support of community radio initiatives in conjunction with UNESCO.

A new country strategy for development cooperation between Mozambique and Sweden is now under preparation. The overall aim of the present Swedish Mozambique development cooperation is to reduce poverty and is being concentrated in the areas of democratization,

sustainable economic growth and social initiatives. It has long been understood that ICTs can be effective tools in improving communications and in re-engineering business and administrative processes. It is increasingly evident that ICTs can also help to alleviate many aspects of poverty.

This Country ICT Survey is intended to investigate the issues related to the effective use of ICTs in Mozambique. The study was performed with the support of the Embassy of Sweden in Maputo, and at the request of the Mozambique Ministry of Science and Technology. The primary objectives are:

- To serve as an input to the new Sweden-Mozambique development cooperation strategy currently under preparation.
- To provide the Swedish embassy and Sida, as well as stakeholders in Mozambique, with an assessment of the ICT situation in Mozambique.
- To propose possible future areas of Swedish and other donor ICT support.¹
- To suggest areas central to Swedish development cooperation that would benefit from ICT integration.

By design, this report will focus more on qualitative issues than a pure quantitative analysis of ICT statistics. Moreover, time and resource constraints mean that the analysis cannot cover *everything* that is happening in the country, but rather that it try to identify the most important issues.

¹ During discussions with the Embassy of Sweden in Maputo, it was decided that the report should not focus specifically on Swedish interventions, but to target donors in general.

2. Methodology and Key Issues

The project team consisted of two experts from Canada and the United States. Between them, they have 85 years experience with computing and communications technologies and over 40 years experience working with developing countries.

The team reviewed a number of documents including those related to Swedish development cooperation in Mozambique, Government of Mozambique (GoM) plans and strategies and prior ICT assessments. Some documents were made available prior to the site visit, but most were collected on site. A list of the major documents can be found in Appendix 4.

A number of key indicators were reviewed and are presented in Appendix 1.

A site visit to Maputo was carried out from January 22 through February 5, 2006. The interviews spanned a wide range of stakeholders including key individuals in the government, public sector, private sector, education and the donor community. In all, 39 interviews with 56 subjects were carried out.

Interviews typically lasted one to two hours. In addition to discussing topics that were specifically relevant to each stakeholder, many respondents were also ICT users in their own right. As such, they were asked to comment on the strengths and impediments of using ICTs in Mozambique. Although not limiting the discussions, there was a particular focus on the major issues of human resources, telecommunications and electricity.

3. Mozambique

Overview

In 1992, Mozambique was listed as the poorest country in the world with a per capita GDP of \$80² and inflation rates as high as 50%. Since that time, significant progress has been made. The per capita GDP has increased to over \$215 with minimal inflation while at the same time poverty and illiteracy have been slowly decreasing.

Nevertheless, Mozambique is still among the ten poorest countries in the world. It is estimated that 60% of the population has no access to medical care, 14% of the population is HIV positive, over 70% of children do not complete primary school, and 60% of the population is illiterate.

These statistics notwithstanding, the availability and use of ICTs are growing at very rapid rates.

	1998	1999	2000	2001	2002	2003	2004	CGR (3 year)
Cellular Telephones ('000)	7	12	51	153	255	436	708	67%
PC ('000)	40	50	60	70	82	96	112	17%
Internet Users ('000)	4	10	20	30	50	83	138	67%
Internet Hosts	141	162	112	16 ³	1,925	3,249	7,169	93% (2 year)

Source: <http://www.itu.int/ITU-D/ict/statistics/>

Both cellular phone subscriptions and Internet users are growing by 67% per year. Despite the large *rate* of growth, in 2004 there were still only 4 telephones per 100 inhabitants, so there is no reason to believe the growth rate will decrease significantly in the near future. PCs require a much larger capital expenditure, but the number of PCs is still growing at a very respectable 17% per year. The number of Internet hosts is nearly doubling per year in recent years.

A sampling of other facts will give some insight into the confusing world of ICT in Mozambique:

- Of the approximately 15,000 Internet subscriptions, close to half have cable or other high-speed connections.

² All \$ figures cited in this report are in US dollars.

³ This is not a typographical error in the table – all Internet Hosts figures are transcribed as reported in ITU reports. But it is clearly incorrect. This clearly demonstrates the difficulty in obtaining good statistics.

- Banks have adopted ICTs to the extent that some say that if they do not have electricity in a rural location, they will not open a branch.
- Virtually all data communications and most voice communications within Mozambique is via satellite – often even for moderately short hops. There is only one major long-haul fibre-optic link supporting the public networks.
- The government is building a world-class financial system using the state-of-the-art methodology and equipment, but there is only an extremely limited ICT sector in Mozambique.
- In contrast to the average per capita GDP \$215, a computer programmer with a few years experience can earn \$20,000–30,000 per year.
- Some companies say that they are limited by current telecommunication regulation – others say that the regulation doesn't really matter, because they simply ignore the rules.
- Universities and other institutions are producing increasing numbers of ICT graduates, but virtually all employers say that the graduates have none of the software development skills they need.
- Telecentres, which have been moderately unsuccessful in terms of benefits to the communities and long-term sustainability in many developing countries, seem to be a real success in Mozambique.

In Maputo and other major centres, technology is becoming visible, if only because of the visibility of ubiquitous satellite dishes. Progress in more rural areas is far less evident – not particularly surprising given that most of those who can afford to use ICTs live and work in the major towns.

In 1998, the Government chartered the ICT Policy Commission to develop an ICT Policy which was approved in 2000. The Commission then elaborated an Implementation Strategy, which was approved in 2002. A small technical implementation unit (UTICT) was created under the Commission to oversee the implementation of the strategic projects and to have full control over several wide-ranging and critical projects.

Much of the detailed survey findings are focused on the areas of:

- Human Resources and Education
- Telecommunications
- Electricity
- ICT Sector
- Donor Issues

These will be addressed in sections 4–8. The following sub-sections will address sector and country-wide issues which, while important, do not warrant report sections of their own.

3.1 Healthcare

It is estimated that Mozambique's health service covers just 40% of the population. Infant mortality is 150–200 deaths under age 5 per 1000 live births, and life expectancy at birth is just 42 years. While the quality of statistics about the incidence and outbreaks of malaria is extremely poor, it is nevertheless estimated that malaria accounts for 30% of all recorded deaths.

There is no doubt a great shortage of both money and healthcare practitioners, but it is clear that there is also a great deal that must be done organizationally to ensure that the available resources are used well. As a trivial example, it was reported that healthcare practitioners often have to fill out multiple forms for a single treatment, with the end-result that either the appropriate reports are not properly made, or more time is spent on the reports than on the treatment.

Communications between health centres at all levels is also lacking. It was reported that even if mobile telephones were available to communicate between a local practitioner and the regional health centre, they were not used due to the government not covering the costs⁴.

The lack of more progress is not due to the lack of study, as there have been many studies, including those on how ICTs could be used to address some of the problems. There have been some donor-funded ICT projects, but nothing that can come close to addressing the global problems.

3.2 Justice

The process from receiving a complaint to investigation to arrest to trial to sentencing to prison is complex, cumbersome and manual. Corruption within the justice system is also deemed to be a major problem. Examples of the resultant problems include:

- Nothing is accurately tracked – cases under investigation, court cases, prisoners
- Prison sentences are supposed to be reviewed at the ½ way mark to consider reducing the sentence or parole – sometimes they are, sometimes they aren't.
- People may be temporarily put into prison but their case is never heard due to the file being misplaced. So they stay there.

Although there have been some targeted ICT-based improvements, it has been generally accepted that a system-wide solution is needed. Accordingly, a group has been formed which includes the Ministries of Justice and Internal Affairs, the Attorney General and the Administrative and Supreme Courts – the Coordination Council for Legality and Justice (CCLJ – Conselho Coordenador de Legalidade e Justica). This group has been charged with analysing the requirements and proposing a system-wide solution.

3.3 Ongoing Government Reform

Government reform, including all aspects of e-government, is a major focus of the GoM. Although there is some cynicism regarding the reluctance of the establishment to really allow change, it is clear that in at least some circles, there is a strong will to force such change.

The ICT Implementation Strategy adopted in 2000 included a significant e-Government component. The following table lists the projects, target implementation dates, and the current development and production status. Like most such first plans, it was clearly over-ambitious based on the resources available.

⁴ Telemedicine is often thought of as requiring sophisticated video and imaging equipment. However, a local nurse using a mobile telephone to consult with a doctor at a district health facility is a perfect example of inexpensive and very effective telemedicine.

Project	Target completion	Implementation status	Production status	Notes
GovNet	2005	Being implemented	Partial production	Scope expanded from original plan
State Personnel Information System (SIP 2000)	2003	Implemented	In production for some functions for some ministries	Plan to phase out this system as it is incomplete in many ways
Financial Administration System (e-SISTAFE)	2004	Partially implemented	In production for some functions for some ministries.	
Computerized Land Registry (DINAGECA)	2004	Being implemented	In production for some functions	
Civil Identification System	2004	Still in discussion		
Development Portal	2003			Funds allocated for planning, but not implementation. Partial prototype developed by UTICT
Health Information System	2005	Study performed, but no further action		
Electoral Management System	2004	Implemented	Full production	Used for past two elections. Perhaps needs to be upgraded to improve functionality, scalability and auditability
One-stop Shop ⁵	2004	Planned	Some in production	Some one-stop shops implemented, but not fully computerized and not offering all planned services

It has since been recognized that the original implementation strategy only partially addressed e-Government needs and a new cohesive and integrated e-Government strategy is being developed.

3.3.1 SISTAFE

One project in particular warrants further comment. This is the new financial management system – SISTAFE (Sistema de Administração

⁵ One-Stop-Shops will be physical establishments throughout the country. Through the use of ICTs in addition to traditional delivery techniques, they will provide services such as the payment of bills for water, electricity, telephone; requests for certificates, identity cards, drivers' licenses, passports, visas; the filling out of forms to pay taxes and other fiscal fees; the identification of business and investment opportunities, etc. The projected benefits include an increase in efficiency and efficacy of the services availed by state institutions, faster decision making, lower corruption and increased satisfaction for.

Financeira do Estado)⁶. The project started in 2002 with the decision to reform the government's accounting system. Upon analysis, it became apparent that rather than needing just an accounting system, they needed an integrated system encompassing accounting, budget, treasury, audit, taxation, human resources and payroll. The estimated cost of the base system was \$30,000,000. A new system with such a complex description, a very high price-tag and minimal local expertise is typically an invitation for disaster. However, it would appear despite some delays, the project is on track and being implemented to the highest professional standards. Moreover, it has been designed and implemented to allow for a phased in approach, recognizing that different ministries would be integrated at different times. Decentralization is a major thrust of current government reforms. The system is designed to be used by provincial and ultimately district governments as well, but clearly for many of these governments, it will be a long time before they are ready to fully use the new system.

Among other things, the system will ultimately allow the consolidation of 12,000 bank accounts into 1, and will for the first time, allow Mozambique to know how much money the country has! Although no system will eliminate corruption, the system will make some types of corruption somewhat more difficult or at least auditable.

SISTAFE has demonstrated a number of important concepts:

- Large software developments can successfully be undertaken in Mozambique. Although significant international consultants contributed to the project, this was the first major project conceived and implemented in Mozambique.
- With sufficient preparation and training, people and departments with virtually no computer experience can become ICT-functional.
- A key government investment such as this will have many benefits other than the ones intended in its design – for instance, this project will push ICT into provincial capitals and eventually districts far in advance of normal expectations.

Despite this very positive picture, there are some rather onerous issues that will be discussed in section 4. There is also the very real danger that one major successful project such as SISTAFE can result in over-confidence on following projects – a deadly problem.

3.3.2 DINAGECA

The DINAGECA (Direcção Nacional de Geografia e Cadastro – National Directorate of Geography and Cadastre) system will computerize all aspects of land management and particularly will replace the century-old land registry system with a modern one. Problems in identifying land ownership have been identified by banks and others as a major impediment to investment in Mozambique. The replacement of archaic, inaccessible and poorly indexed paper registers with a networked database system will be quite revolutionary. Moreover, the resultant computer-based data can be used for other purposes as well (see section 10.3).

3.3.3 Integration of Science and Technology

Looking to the future, in the new government, the Ministry of Science and Technology has been deemed a cross-cutting ministry. This means

⁶ The terms SISTAFE and e-SISTAFE are used interchangeably.

that it has implicit responsibilities across all sectors and conversely, the targeted Ministries such as Finance and Industry and Commerce have responsibilities to support the needs of Science and Technology. This philosophy is exactly correct, but it remains to be seen whether all of the other players in the government will be able to sustain this type of matrix management. To date, there have been examples of good cooperation in some areas, and territorialism in others.

3.4 Banking

The banking sector, both private banks and the Bank of Mozambique use reasonably current technologies. Both suffer from the problems associated with telecommunications and electricity described later in this report. Perhaps the conversion to technology-based banking is a bit too successful, as some banks will only open a branch where there is a viable electricity supply, making access to traditional banks impossible for the majority of the population. It is hoped that as mobile telephony becomes more widely available in rural areas, virtual bank applications can use this telephony infrastructure as is being proposed and implemented in other countries.

3.5 ICT for the People

Mozambique is a country where the majority of the people live in rural areas, are not literate and cannot speak or understand a language that is supported by most computers. Given the desperate need for food, safe water, healthcare and basic education, one can question the importance of making high-end ICTs accessible to the population at large, but at best, it is a very long-term goal.

However, some ICTs are accessible and usable. Approximately 55% of the population lives within range of mobile telephony, and this is expected to reach 95% within several years. 90% of the population is within range of a radio transmitter, and 50% of households own a radio⁷.

There are a small but growing number of community radio stations. Community radio, like mobile telephones, can use indigenous languages – even those with relatively small populations. Moreover, local content generation can make these facilities both very useful and help develop a real sense of local ownership and control.

In most developing countries, telecentres⁸ have been viewed as the way to get more sophisticated technology out to the people. In many cases they are also a local information resource and what in the developed world would be called a business centre (phone, fax, photocopier). Success has been rather variable, and rarely have they been successful in making technology usable to the community as well as being sustainable over the long term. In Mozambique the telecentres and more recently UNESCO's program for Community Multimedia Centres (CMC), the merger of a telecentre with a community radio station, has been particularly successful. To date, eight CMCs have been set up with more coming online in the next year. This local telecentre success seems to be the result of leadership that focuses on key social issues and a very pragmatic implementation plan. It remains to be seen whether this early success will last, but there are good reasons to believe that it will.

In addition to the telecentres and CMCs in rural areas, there are about 10 full Internet cafés in Maputo and other large towns, as well as 37 *Digital Agen-*

⁷ Given the lack of electricity, as in many developing countries, batteries are a large expense.

⁸ The term telecentre has been used to mean many different things. Its usage here refers to a physical location with a few computers (preferably Internet connected), telephone(s), and perhaps a photocopier and a fax. The telecentre must be staffed so that it can be used by *relatively* untrained people.

cies run by the telephone company (TDM). Each Digital Agency has a couple of Internet connected computers available for public use.

3.6 Corruption

Corruption in all of its forms has been a constant companion in Mozambique for the last two decades, ranging from major graft and fraud down to petty extortion and bribery. The GoM has identified corruption as one of the prime obstacles hindering development. ICTs certainly can play a role in reducing corruption if there is truly a desire to do so. In some cases, the reduction in corruption would be a free bonus when systems are implemented for other reasons, and in other cases, the technology would be there solely to reduce corruption. A few examples are:

- SISTAFE should make it substantially more difficult to falsify orders and invoices without leaving trackable audit trails. Of course, for any benefits to be realized, these trails must, at least sporadically, be tracked.
- Making information freely available via telephone, telecentre or one-stop-shops can help ensure that people don't have to pay for free information, but more important, allows them to know what their rights are.
- Video and audio surveillance can help reduce petty bribes and pay-off requests, if there is a belief that someone may be watching who does not condone the activity.

3.7 Poverty Reduction Strategy Paper – PARPA

In 2001, the GoM approved its first Poverty Reduction Strategy Paper – PARPA (Plano de Acção para a Redução da Pobreza Absoluta – Action Plan for the Reduction of Absolute Poverty) for the period 2001–2005. Like most PRSPs, it made almost no reference to ICTs⁹.

PARPA II – 2006–2009 has a specific focus on ICTs. ICTs are treated as a *cross-cutting* issue, with the potential to affect outcomes in all ministries and sectors. Cross-cutting issues are defined as those that cannot be dealt with in isolation; the strategies and actions depend on a concerted and integrated approach of the various stakeholders. If cross-cutting issues are not addressed it can constrain the success of the strategies and programmes defined for the other sectors. The other issues defined as cross cutting are a rather interesting collection of forces for both good and bad: de-mining, environment, natural disasters, HIV/AIDS, gender, food security and nutrition and rural development.

The PARPA does not focus on particular uses of ICT, and the potential uses of technology are not as present throughout the paper as one could have hoped. So it remains to be seen just how large a role ICTs will play in the various poverty alleviation programs. Nevertheless, until now, virtually all PRSPs have either not mentioned technology, or simply referred to it as a sector that could ultimately generate wealth. PARPA II is one of the first PRSPs to accept that ICTs can be a part of the general poverty solution. As such, it not only signals the commitment of the government to use ICTs as one of the tools to combat poverty, but it also gives donors the motivation and mandate to fund ICT-enabled poverty alleviation programs.

⁹ There were two brief sentences about expanding ICT access in rural and educational settings and a mention of the proposed IT Policy, but no real mention of using ICTs as tools or mechanisms in poverty reduction.

4. Human Resources and Education

4.1 Skills and Post-Secondary ICT Education

In response to some questions, the survey team received a wide variety of often conflicting replies. However, in response to the question “Do computer science graduates of universities and technical institutions have the skills that you require?” the answer was a unanimous “No”. The detailed answers referring to software development skills were particularly revealing. Among them were:

- They do not have the skills we need.
- They have skills on paper only – when we test them – nothing.
- We have stopped hiring local people – we go to South Africa for new staff.
- We expect to have to train them for 3–6 months on our company-specific technology, but we consider 2 years training just too much.
- We avoid computer science graduates – it is easier and faster to train secondary school graduates or motivated non-CS university graduates.
- Universities provide a good base but not practical knowledge – new employees need 2 years training after university – then they leave for higher pay.
- Computer Science students have too much theory and little practical experience.
- Project management is not understood here.
- They are taught none of the tools that we use (examples were Visual Basic, Java, Windows, SQL, Object Oriented tools).

Depending on who was asked, sometimes UEM was deemed to be better than the private institutions, and sometimes vice-versa. There was general agreement that the training in IP network skills was good and useful. As virtually all network training was done according to Cisco Academy methodology and curriculum, this is not surprising.

The reasons for the general, non-networking skills to be so unacceptable to employers is relatively easy to understand. UEM and the private school ISCTEM (Instituto Superior de Ciências e Tecnologia de Moçambique) are generally accepted as the two best post-secondary ICT schools. UEM is working to craft itself into a research university and naturally has a focus on a curriculum that is rigorous and with a theo-

retical bias¹⁰. To exacerbate the problem, UEM revises curricula at most once every five years, so there is little ability to respond to changes in the tools and methodology that the non-university world is using. Moreover, the undergraduate program does not allow for any elective courses. All students take exactly the same set of courses and even those with a preference for more practical, applied subjects have no option to select such courses.

ISCTEM has recently revised its entire Computer Science curriculum and perhaps this will eventually address the needs of the software development community. Their prime focus was to ensure that their program meets EU and American standards for computer Science Education. Given that in those communities, there is no unanimity about the extent to which computer science programs should be theoretical or applied, or whether they should be driven by employer needs, it is not 100% clear that these changes will meet the needs of the user community.

Both schools use Linux instead of Windows in some cases. While this is both academically and financially a sound decision, it does nothing to help potential employers who use little Linux. Neither school has created an advisory board including the potential employers of their students to help them understand what the needs of this community are.

The Mozambique Research and Education Network (MoRENNet) has just recently been announced. MoRENNet will link 25 institutions. It is being sponsored by the Ministry of Science and Technology and hopefully will have the functional support of several fibre-optic operators. It will increase the accessibility and speed of Internet access to institutions throughout Mozambique. MoRENNet ties in well with another recent initiative of six American foundations to boost international Internet bandwidth at African universities and with the proposed African research and education UbuntuNet Alliance. MoRENNet will facilitate cooperative research between institutions within Mozambique and between Mozambique and other countries. As important, it will allow sharing of critical resources amongst institutions – resources such as research journal access, courseware and of course raw Internet access.

4.2 Salaries

The shortage of people with software development and other ICT skills has generated another severe problem – that of salaries and the disparity between what the public sector will pay and what is available in the open market.

A programmer in the public sector with minimal experience will earn about \$400 per month. This may go up to \$500 per month with considerable experience. The same person working for industry would start at no less than \$800 per month and if working on a donor-funded government project would receive \$1500–2000 per month. A monthly salary of more than \$3000 is not uncommon for top-grade people.

The combination of insufficient skills upon post-secondary graduation, and these high salaries puts the public sector, including state universities, in a near impossible situation.

- It takes up to two years to train new staff so that they have the needed skills.

¹⁰ UEM has recently launched an MSc program which includes Software Engineering and Project management, but that will not address the large-scale needs of the business community.

- Once they have the skills, it is very common for them to leave the public sector and take a job with industry or with the government through one of its donor-funded development projects and multiply their salary by 4 or 5 or more.
- Those that choose not to leave often take on various free-lance projects, probably using government or university resources, and severely reducing their focus on their primary job.

As a result people employed in the public sector are often being trained, or are focusing much of their attention on their private work. Either way, productivity is very low and the public sector is crippled in its ability to effectively use ICTs.

Public sector ICT salaries are particularly problematic in relation to major projects such as SISTAFE. As a donor-funded project that uses contract and consultant services, SISTAFE pays its technical staff commercial-level salaries. Due to the magnitude and complexity of this project, they likely pay salaries at the higher end of the commercial scale. The real problem will occur at the end of the project. There are two issues, one easily resolved, and one not. The easy issue is what to do with the people working on this project after it is complete, and the answer is, there will be more projects which can use their expertise and pay their salaries. The much more difficult problem is how does the government operate, support and do incremental enhancements to the production system. The standards used in its design and implementation are far from those that are readily supportable with existing public sector staff at public sector salaries. As SISTAFE is just the first of many such systems, this is a major and growing problem. There is a real danger that within the current public sector environment, it will not be possible to support, enhance, or even run these systems according to the necessary standards.

4.3 Secondary Schools

There are 280 secondary public schools in Mozambique. Student population is typically between 1,000 and 2,000 with some going as high as 4,000. A plan is currently in place to install a PC lab with 20 computers plus 4 for administrative and staff purposes in every secondary school in the country. All new and renovated schools must have such an installation. Currently 75 of the schools have these ICT facilities, of which 25 are Internet connected. Internet access is theoretically available anywhere there is power, but the cost is excessive – about \$500 per month for 64kb. This “Schoolnet” project started at the Centro de Informática at UEM (CIUEM) and was later transferred to the Ministry of Education.

It is recognized that having a critical mass of ICT-trained teachers is critical. There is a particular focus on upgrading the physical facilities and curriculum in teach-training institutions – there is at least one per province. For existing secondary school staff, selected teachers are trained with the expectation that they will train others on return home.

Electricity has been a major problem, both reliability (outages) and quality (voltage control, spikes, noise). They lose a lot of equipment due to electrical problems. About 20–30% of the 280 schools are in areas which have no regular electrical power.

For labs with no Internet connectivity, the main uses are productivity tools (word processing, spreadsheets). Connected labs also use the computers for research and cooperative projects with other schools in Mozambique and abroad – often Brazil or Portugal.

There are plans to introduce both ICT-focused programs as well as to use the labs for computer-aided support of traditional subjects. Potentially suitable pedagogical software for some subjects has already been identified in Brazil.

The number of computers per school is fixed at 20 and is not dependent on the student population, number of ICT-trained teachers, or the amount of ICT integrated into the curriculum. This is already a problem for the larger schools, and as computer access is integrated into the various curricula, it will grow in importance. If not addressed, it will severely limit the number of students who can benefit from these new programs.

In several rural locations, the schools have teamed up with the local CMC, thus allowing the high costs of equipment, power and telecommunications to be shared, creating a win-win situation for both.

5. Telecommunications

The Mozambique telecommunications industry is in a state of flux. The Telecommunications Act of 1999 began the process of deregulating and privatizing the state telephone provider Telecomunicações de Moçambique (TDM), a process which is not yet complete. TDM is still largely government owned. As the various TDM monopolies end over the coming two years, things will no doubt become even more chaotic – not necessarily a bad thing, but there are potential dangers.

There are two mobile telephone providers, one of whom is jointly owned by the government and TDM. Mobile phone service is growing fast – nearly doubling the number of subscribers every year, while the number of fixed-line subscribers is slowly decreasing. Current coverage is just over 50% of the population. Service is at times erratic¹¹.

There are about a dozen ISPs, providing dialup, cable-TV, leased-line and wireless services, with ADSL¹² just being introduced. Two of the largest ISPs are partially owned by TDM.

For reasons to be described in section 5.4, the regulator, Instituto Nacional das Comunicações de Moçambique (INCM) is generally well regarded but has questionable effectiveness.

Both voice and Internet domestic communications rely heavily on satellite. There are TDM land-links (cable, fibre or radio) in the Maputo area and the south, as well as in some areas of the central and northern regions. However, the bulk of the domestic backbone is via satellite. International links are nearly all satellite with the exception of some voice microwave to South Africa¹³. International bandwidth costs approximately \$3000 per megabit per month.

The government has convened a committee with representatives from all infrastructure providers (electricity, communications, roads, railroads, pipelines) with the intent that they cooperate and reduce redundancies. For instance, it would make sense that if a new road were to be built, that they lay fibre-optic cable, or at least conduits while the work was in

¹¹ During the site visit, the evaluators experienced a wide range of problems with mobile coverage including failed international roaming, inability to reach subscribers from outside Mozambique, internal calls not completing for various reasons, and quality problems when calls do complete. These problems were discussed with executives from the mobile companies, and they candidly acknowledged such problems and added several anecdotes of their own.

¹² ADSL (Asymmetric Digital Subscriber Line) allows data to be transmitted at moderately high speeds over a traditional voice line, allowing the simultaneous use of voice.

¹³ The microwave link does carry 128kb of Internet traffic for private companies.

progress. There is great merit in this concept, but some parties expressed great doubt that the traditional independence of these various players could be overcome.

5.1 Telephone Providers

5.1.1 TDM

TDM has undergone significant changes over the past 6 years due to a combination of deregulation, the rapid growth of mobile telephony and the demand changes in telecommunications.

Technically, TDM has been privatized, but the stock is still wholly owned by the government¹⁴. It still has a monopoly on fixed voice telephony. The monopoly ends in December 2007. Although not correct, many people seem to believe that TDM also has a monopoly on the resale or lease of fixed-line data services as well.

Although TDM does not operate any mobile telephone service, cable TV, or (until a month ago) ISP services, they are partial owners of the largest suppliers of all of those services. Due to the success of these services provided by both TDM's subsidiaries and their competitors, TDM's own business has been slowly decreasing.

Much of the communications within Mozambique, and most of the external bandwidth is via satellite. There is one undersea fibre run from Maputo to Beira. There is a microwave facility to South Africa as well as a currently dark fibre link. The intent is to use the fibre to interconnect with the SAT-3 submarine cable to West Africa and Europe. Development is underway to extend the terrestrial backbone (via fibre or radio) to all provinces by December 2007 – the same date that they lose exclusivity for land-line voice service.

TDM is a signatory to the EASSy (Eastern Africa Submarine Cable System) Memorandum of Understanding, but the future and timing of that project is still an unresolved question with successive delays to commitment of implementation being the pattern to date. Moreover, since the original EASSy ownership was primarily the traditional national telecom operators, it is not obvious that even if built, it will result in significantly lower prices. Recent activities may result in EASSy ownership being widened, allowing for more competitive pricing.

TDM is struggling with how to survive in this changing world. Their workforce has been reduced from a high of 3000 to 2000, primarily due to outsourcing and not greater efficiency. Their ultimate target is 1200. To counter the shrinking and competitive market for fixed voice and data transmission services, they are trying to transform themselves into a “solution provider”. Their ADSL service was launched March 1st, 2006, a service which will have them competing head-on with their subsidiary cable TV supplier. They are also looking at using point-to-point wireless technology for the “last mile” for fixed telephony, an option also being considered by others once they can do it legally in January 2008. TDM is a major player in the Government's GovNet project linking ministries to provincial capitals and perhaps ultimately district capitals.

TDM services are generally accepted as being reliable (even by its competitors), but very costly. The belief that TDM's charges are too high is almost universally held, even by some of TDM's own subsidiaries. How this will be resolved once TDM's monopoly ends in December 2007 will indeed be interesting.

¹⁴ Officially, 20% of the stock is reserved for future ownership by TDM employees, but no action has been taken to implement this.

5.1.2 mCel

mCel was started as a subsidiary of TDM in 1997. Originally there was a German partner which was bought out in 2000. In 2003, mCel was officially split from TDM and is an autonomous company with TDM owning 74% and the government owning the remaining 26%.

Although the initial user-base growth was impressive, the introduction of a prepaid service in 2000 has allowed phenomenal growth with an annual increase of 67% in recent years. There were approximately 1 million subscribers by the end of 2005. Over 90% of all users are pre-paid.

mCel claims that they currently cover about 45% of Mozambique's territory and 55% of its population. They have approximately 400 base stations with 80–90 being added each year. They estimate that by the end of 2007, they will have “most” of the population covered. They use TDM infrastructure where possible, and many rural areas are served by satellite connections. They estimate that over the next 4 years, most areas will be served by terrestrial paths – a combination of fibre and radio.

Despite their monopolistic telecom background, mCel has been aggressive in both marketing and technology deployment. They are in the process of deploying GPRS/EDGE¹⁵ technologies nationwide, and have plans for very interesting and presumably profitable applications based on this technology.

5.1.3 Vodacom

Following the 1999 telecommunications reform act, a tender was issued in 2001 for competitive mobile voice services. Vodacom, a pan-African company owned principally by Telkom South Africa and Vodafone won the bid. It took 18 months to come to acceptable interconnect terms with the existing carriers, and Vodacom Mozambique went live in 2003.

Vodacom's coverage is approximately 75% of mCel's. Their policy is to be largest provider in every country they operate in, and to be the leader in technology. At the moment, they are meeting neither goal in Mozambique, given that mCel had a large head-start in terms of coverage and market share, and that Vodacom has yet to decide whether they will deploy GPRS/EDGE.

Vodacom provides most of its own transmission facilities within Mozambique (satellite and microwave), and has its own international gateway (satellite). They do lease some facilities from TDM.

5.2 Internet Service Providers

There are about 10 ISPs in Mozambique. The range of services includes:

- Dialup access
- Leased lines (ISDN and ADSL)
- 802.11 (Wi-Fi) access
- Medium to high speed VSAT access to Maputo or Europe
- Medium to high-speed via cable TV

Some ISPs use international access provided through TDM but many have their own international satellite access. One ISP offers satellite service that goes directly from the user to Europe in a single satellite hop.

¹⁵ GPRS stands for General Packet Radio Services and EDGE stands for Enhanced Data GSM Environment. The two complimentary services provide moderately high speed data transmission for GSM mobile telephones. They can be used as the basis for many value added service ranging from Internet access to banking.

Wi-Fi access is becoming increasingly popular due its lack of required physical infrastructure. The base station is often served by point-to-point wireless. It is unclear if such ISPs require a license for this wireless service, but the services are nonetheless being offered, often using power levels above those generally considered legal. Wireless access is generally unencrypted and potentially subject to snooping and security violations.

The largest service centre is Maputo, but public dialup Internet access is also available in all ten provincial capitals and about ten additional districts. In addition to corporate and government Internet connections, there are about 14,000 subscribers to the various ISPs offering public service. About 50% of them are individual users, and the rest small businesses.

There is an Internet Exchange (IX) connecting all but one of the ISPs, allowing local traffic to be traded without going outside of the country. It is expected that in the near future, all ISPs will connect to the IX. An attempt has been made to form an ISP association, but to date there has been little interest.

As noted in the section on TDM, they have just entered the ISP market with an ADSL offering.

5.3 Other Communications Providers

5.3.1 Cable TV

TV CABO was created in 1996 as a joint venture of TDM and the Portuguese Visabeira Group. Although partially owned by TDM, TV CABO seems to see itself in no-holds-barred competition with TDM. They started operating in 1999 with a customer base of about 2000. TV CABO provides both analog and digital cable TV service in the Maputo and Matola (just west of Maputo). They currently have 15,000 customers – about 50% of the homes in Maputo¹⁶. They plan to ultimately provide service nationwide.

Internet service speeds vary from 256Kb to 1Mbps. The monthly fee for basic Internet service is \$65 on top of the \$20 or \$25 cable TV fee. The \$65 fee was \$75 until recently. Despite normal ISPs not being regulated, TV CABO is prohibited from lowering their monthly Internet service fee. One third of their customers have Internet service. TV CABO's Internet service has put a lot of competitive pressure on the traditional dial and even wireless ISPs. Some ISPs have reported customer losses as high as 30% per year. It is not known to what extent TV CABO will be hurt by the new TDM ADSL service.

5.3.2 Point-to-Point Services

Many companies and institutions install their own point-to-point services – mainly via VSAT. There are also several non-Internet service providers offering point-to-point services, generally via VSAT. In some cases, TDM facilities are used and resold. One of the largest such providers is a TDM subsidiary which offers value added services on top of the basic communications channels. The relationship is confusing in that they purchase some services from their parent, but also operate VSAT services which they then sell to their parent.

The issue of the prevalence of VSAT stations has several perspectives. On one hand, the ability to erect a VSAT station without having jumped through regulatory hurdles has allowed the spread of moderate speed telecommunications in ways that would not otherwise have been imagi-

¹⁶ One can begin to understand the concept of poverty in Mozambique based on this statement. There are about 30,000 "homes" in Maputo, which has a population of 1,000,000 to 1,500,000.

nable in such a vast country with almost no terrestrial communications infrastructure. On the other hand, VSAT communications are limited by cost, hop-delay and the technology's inherent difficulty to efficiently scale. It has been said that the communications infrastructure in Mozambique is still in a "war configuration" – relatively little investment in physical infrastructure that can be readily destroyed by the opposition.

Although not a current provider, the Mozambique Railway, Caminhos de Ferro de Moçambique (CFM), has extensive right-of-way along its tracks that could be used for communications infrastructure. CFM has no interest in developing such facilities, but is willing to provide access to its right-of-way. They are reportedly in discussion with TDM and potentially others.

5.4 Regulator

Under the Telecommunications Act of 1999, the regulator, INCM, was given responsibility for the telecommunications sector including licensing; advising the government of policy and regulation; interpretation and enforcement of regulations; and spectrum management. This oversight did not cover VSAT or Internet ISP services, but these do require licenses¹⁷. INCM reports to the Minister of Transport and Communications, but is not organizationally part of the Ministry.

There are two types of licenses, telecom and infrastructure. Telecom licenses are granted only to formal telecom carriers such as TDM, mCel, Vodacom and TV CABO. The granting of an infrastructure license is simply a financial transaction (that is, no regulatory criteria). Infrastructure licenses can resell services, except for service types that are the exclusive domain of telecom operators (such as voice services).

INCM collects initial and annual license fees. As well there is a levy of up to 3% of gross revenue that licensees must theoretically pay. INCM's budget must be approved by the government but there is no clear directive linking its budget with fees collected. The 1999 Telecommunications Act created a Universal Service Fund¹⁸, but how it should be funded and used is still under discussion.

Based on the interviews conducted during the site visit, it would appear that both INCM and the regulations which govern its actions are in need of a substantial overhaul. There is significant confusion over exactly what the rules are. In some cases the rules are sufficiently vague or out of date that they are subject to variable interpretation – that is, INCM interprets them differently at different times and for different licensees, and the licensees interpret the rules differently from other licensees and INCM. By their own admission, INCM does not have the all of the skills and equipment to effectively carry out their technical and policy duties. Based on their staff allocation, they have more administrative and finance people than they should need if they had up-to-date technical administrative systems.

The following were representative of the statements that were made by INCM (paraphrased) which show the need for revision of their mandate, organization and regulations as well as their good intent:

¹⁷ ISPs do not technically require a *license* but an *authorization* – the differences are obscure and in general the word *license* is often used.

¹⁸ A Universal Service Fund can be funded by donors, general government revenue, or a tax on some communications services. It is typically used to subsidize communications costs in rural areas.

- Is a license required for wireless? It depends on the situation. Technology is moving faster than the regulatory environment, but we try to make reasonable decisions.
- We do not have the resources (manpower, skills and equipment) to effectively do our job. Part of the problem is that licensees are not paying their fees, thus creating a budget shortfall.
- We need to regulate services and not technologies.
- We want to use contacts with other countries to understand how they have are dealing with evolving issues.
- TDM is supposed to have a monopoly on fixed voice telephony. We know that Voice over IP (VoIP) is being used, reducing TDM revenue. We will have a policy regarding this after full deregulation (December 2007) – until then, we are effectively ignoring it.
- We need to harmonize regulation across the region.
- We welcome support on how to deal with emerging technologies.

From the licensees the comments curiously mesh:

- We were told that we needed a license for wireless, but that it would not be granted, so we ignored them and operate the service anyway.
- We know we could offer service in new regions, but INCM refuses to sell us the required licenses (related to a different type of wireless service)
- INCM has to come to us to borrow test equipment, because theirs doesn't work.
- INCM does not have the equipment to effectively monitor or detect spectrum usage violations.
- INCM is dynamic and pushes technology, it does not throttle it.
- INCM tends not to dictate but to get buy-in.
- We comply “when reasonable”.
- INCM is dynamic and is assisting economic growth.
- Despite occasional differences, we are happy with INCM.
- Although it was never explicitly stated, there were implications that INCM treats some customers better than others.

There is significant confusion and disagreement regarding the levy on gross revenue:

- Most ISPs were involved in the discussions that led to the levy, with most not raising objection at that time.
- The levy is “up to 3%”, but no one could clearly and concisely explain how the percentage was set for each company.
- If all of the fees assessed were actually collected, INCM would be extremely cash-rich.
- There was disagreement on whether it applied to all revenue, or only that derived from specific services.
- Some companies have dutifully paid the fee, others have simply refused – among them some of the largest telecom providers.
- There was some belief (apparently incorrect) that the levy is only for wireless services.
- There was some belief (apparently incorrect) that the levy was funding the Universal Service Fund.

- The Minister has recommended that the fees be revised – no schedule was given.

Overall INCM seems to be well thought of, and it is reasonably clear that they have not been a major bottleneck to progress as regulators in some other countries have been. But it is clear that they must be strengthened in a number of ways:

- Better ability to advise on policy and create regulation, factoring in regional efforts, but not modelling themselves on their less enlightened counterparts.
- Better ability (both technically and legally) to enforce regulations
- Better financial model ensuring that the processes are sufficiently well funded, but not using fees as a cash-cow for themselves or the government.

6. Electricity

Electricidade de Moçambique (EDM) is the state electrical utility. They do not have a monopoly on electrical distribution, but they do supply the vast majority of power. Independent distributors supply power mainly in areas not yet covered by the national electrical grid.

From an ICT perspective, electricity is a major issue in Mozambique. There are three perspectives to this: availability, reliability and quality. EDM's vast physical infrastructure which will ultimately reach all districts means that EDM could *potentially* be a major communications provider as well.

6.1 Availability

Discussions about electricity in Mozambique usually focus on the electrification program – the extension of the electrical grid to all provinces and districts. With the help of significant donor contributions, major investments are being made in rural electrification. The major thrust is to connect most areas to the national electrical grid, and where applicable, identify alternative electrical sources for areas too remote to be connected. Mozambique already has large hydro-electric generation facilities and the potential for growth in this area.

Grid-based electricity is now available in all 10 provincial capitals with about 80% coverage per town. There are, in fact, two major grids in Mozambique, currently not directly connected. There is a grid that connects areas in the central and north regions on Mozambique. It includes the majority of the country's hydro-electric generation facilities, and the bulk of the power leaves the grid via a major transmission facility to South Africa. The grid feeding most customers is in the south centred on Maputo and receives its power from one local hydro facility and a major feed from South Africa. In fact, this is a portion of the power generated in the north of Mozambique that must transit South Africa to get to the south of the country – such are the problems of distance and geography in Mozambique.

There are plans to unify the grid and reach all districts and many towns by 2020. However, it is important to note that even at that point, it will reach just 20% of the population.

6.2 Reliability

The electrical power is moderately reliable in Mozambique. Depending on who you talk to, it is either getting better or getting worse. In Maputo,

there are sporadic, but not regular, power failures. Failures typically can last a few hours. Outside of Maputo, power is less reliable. Most grid-connected places in the country are served by a single transmission facility, so when there is a failure, the entire area is out of service – perhaps for a considerable time. If the failure is in a main feeder line, the area involved may be very large. The problem is made worse because, as a cost-saving measure, several transmission facilities were built without lightning protection. It was reported that these transmission facilities are particularly prone to failure, and the design of the towers does not allow them to be retrofitted with lightning protection.

Currently, there are no control and communications facilities integrated with most transmission facilities – most command and control actions are via dedicated radio to personnel stationed at (or must travel to) the remote sites. EDM is constructing two new, modern control and dispatch centres, the first of which will be operational in Maputo by the end of 2006. As computer control of the grid becomes a reality, EDM expects that they will need to increase their computer and network security infrastructure to protect from hackers, viruses and such.

6.3 Quality

There are two dimensions to the quality of electrical power. The first is the quality of power as it is being transmitted over long-haul transmission lines. The second is the quality of local 220 volt customer distribution. Long-haul quality issues have been the focus of intensive study, monitoring and facility upgrading. This explains why the overall reliability of the EDM network has increased in recent years.

Quality of the local electrical distribution has not received a lot of attention. For most users, this is a relatively minor irritant. From an ICT perspective, it can be a significant problem. In reply to questions about the quality of electrical power, even within Maputo, a number of conflicting answers were received:

- We lose a LOT of equipment and even UPSs due to power problems. (many occurrences of this answer)
- We virtually never have problems. (many occurrences of this answer)
- We have two buildings – one has regular problems, the other none, but in the second building, we installed our own transformer.
- We have monitored the power. There are significant under- and over-voltage occurrences – in one case the nominal 220 volt line was 350 volts for 20 minutes. There are many high-voltage spikes as well.

Voltage fluctuations and spikes can often damage computing and networking equipment. There were also unverified reports of distribution problems causing massive failures of refrigeration and other equipment in private homes in specific areas of Maputo. It is impossible to determine if such stories are true or not, but the readiness at which most people believe them indicates that there is indeed a problem.

It is clear that there are many quality problems, but they are likely very dependant on what sub-station the customer is connected to, on load fluctuations of those connected to the same sub-station section, and on noise generated by “neighbours”.

The problem is probably not entirely related to EDM. Specifically, there is good reason to believe that in many cases, there is also an electrical ground (earth) problem. This problem may be variously due to

problems in the design or installation of building electrical systems. Properly grounding circuits for high-end electronic equipment is not easy, and there are very few engineers, contractor or electricians who truly understand all of the issues.¹⁹

Regardless of the source of the quality problems, few people, whether customers or within EDM, seem to be inclined to solve the problems or even to truly understand them.

6.4 Fibre-Optics and Power-line data

A few of the newer transmission lines between sub-stations in the southern region of Mozambique have optical fibre installed along with the power lines. Currently eleven such links are in place with one more planned. The fibre was installed for use by EDM in controlling their grid and for other internal communications. One of the links served with fibre is the main power feed from South Africa. In addition to power distribution use, this fibre also provides Internet connectivity from South Africa for the sole use of EDM.²⁰

EDM has expressed interest in installing more fibre along their transmission lines with the intent of using it not only for substation and generation control, but as a telecommunications facility to be used for the common good or for profit. A study funded by Sida has just been commissioned to look at how such a facility could be used.

In addition to looking at installing its own fibre, EDM is in discussion with TDM on how the two organizations can cooperate, potentially allowing TDM to use towers or right-of-way, or perhaps leasing transmission paths over EDM-owned fibre.

Around the world, some electric utilities are investigating the possibility of using their transmission facilities for data traffic for delivery to customer premises. EDM has no such plans at the moment.

¹⁹ This is as true in developed countries as in developing countries. Many sporadic and non-reproducible problems with high-end computer, network and telephone equipment have been ultimately traced to problems in the design or installation of power grounding.

²⁰ This Internet connection via fibre arguably gives EDM the best Internet connectivity in the country!

7. ICT Sector

With the exception of telecommunications vendors, the ICT sector in Mozambique is weak. This is unfortunate, because a robust and productive ICT sector is a prerequisite for using ICT as a tool and enabler in government reform, poverty alleviation, education and healthcare.

There are a number of contributing factors which together make it difficult for small and medium size ICT companies to both start-up and flourish:

- The process of creating any type of company is long and complicated – typically taking in the order of six months.
- Salaries for competent technical people are very high – above that affordable by small businesses.
- Low-paid public sector technical staff work in off-hours as free-lance consultants, often using public sector equipment and resources, making it very difficult for a small company to be competitive.
- All equipment must be imported and is subject to import duties. Although duties have been significantly reduced in recent years, they are still a major burden on high-technology equipment which is priced so high by Mozambique standards. As duties also apply to unassembled and spare parts, there is little incentive for local manufacturing to be developed.

All of these issues are well understood, but until actions are taken on at least some of these issues, the ICT sector is likely to remain unchanged.

There are plans to build a technical incubator facility. Companies that locate there will likely be subject to preferentially lowered duties, perhaps other tax or monetary incentives, and will have the services of a “help desk” to help them through the cumbersome process of establishing a business in Mozambique. This is an encouraging development, but the same services should be available far more widely if the ICT sector is to really grow. Further information can be found in section 9.

CIUEM is effectively one of the strategic players in the ICT sector, as they are often brought in to consult on leading-edge projects. Although this is a common happening in developing countries as it was in developed countries when the IT revolution was just starting, CIUEM seems to have been particularly effective in playing a start-up role and then turning responsibility over to the proper owners once things are working.

8. Donor Issues

There is significant donor cooperation in Mozambique, at least partly driven by the large percentage of donor funds going into both general and targeted budget support. However, there was almost universal support from both donors and the government for further cooperation at all levels. Moreover, there is a real need for not only cooperation, but for coordination of targeted projects.

In general, cooperation seems to be either at the highest levels of the donor delegations, or between program officers working in the same sector. At times, this can result in anomalous situations. For instance, although competition in the telecommunications sector is considered a good thing, the review team was told that donors were helping to fund rural fibre optics networks in the same region through both EDM and TDM, and there was great frustration expressed that valuable donor funds were being used to create duplicate, redundant infrastructure.

Although there will no doubt be occasions where donor countries and agencies disagree on what projects should be funded, it is important that communication lines exist to ensure that conflicting directions are understood and intentional.

PARPA II has identified, at least in a general way, that the GoM is interested in exploring how ICTs can benefit all development activities. There is a feeling that at least some embassies do not have the resources to focus on the uses of technology in non-traditional areas.

9. MICTI

MICTI, the Mozambique Information and Technology Institute, is a key initiative of the government, under the leadership of UEM, designed to address a number of problems described in this report. The following summary may not do justice to MICTI's 80 page business plan, but hopefully will convey the general intent. MICTI has several main components:

Learning: A multi-faceted program of courses aimed at end-users, technologists at all levels and those who manage ICT projects or businesses. The intent is to establish high-quality education at all of these levels which other institutions in the country (or region) could then replicate.

Research: ICT research including MSc and ultimately PhD level study, but also including independent research groups. One focus will be MICTI itself to ensure that it is meeting its targets and goals.

Technology Incubator: The incubator's mission is "To assist small and medium sized ICT businesses, through the provision of high quality facilities and services, to develop into successful and economically viable entities that will contribute to the economic and employment growth of Mozambique". A large component of the incubator will be to isolate companies from many of the problems inherent in starting an ICT business in Mozambique, including streamlining government interactions, business planning, and providing high quality physical and communications infrastructure. Relief from taxes or other financial incentives could also be available.

Science and Technology Park: A longer-term project than the incubators, the Science and Technology Park, to be located in a campus setting about 50 km from Maputo, will be a high-profile development integrating business as well as academic and research aspects. The MICTI campus will include learning, research and incubator components. There will be learning and incubator units in other areas of Mozambique as well.

If successful, MICTI will be a start at eliminating many problems limiting the growth of ICT in Mozambique. Ultimately, the examples set by MICTI may be replicated at other universities and schools. In fact, one cannot help but believe that a major aspect of MICTI is that it will allow the government to implement changes in teaching, learning and business management without getting buy-in from existing institutions or making perks such as tax relief or high-bandwidth communications universally available. Given the difficulty in getting institutions (and particularly institutions in Mozambique) to change, this aspect of MICTI may fully justify its existence.

10. Recommendations and Key Focus Areas

There is no doubt that the position taken by the GoM with respect to ICT is correct; ICTs will be a crucial component in addressing many of the country's critical problems. A major challenge will be in deciding where to focus efforts and funding. In a country such as Mozambique, there are many opportunities to use ICT. However, both absolute costs and cost-effectiveness must be considered when deciding where to allocate funds and technical resources. This section of the report identifies areas where investments in technology have a good potential for generating substantial benefits. Moreover, in addition to the direct benefits, they all help lay good foundations for future improvements. The costs range from almost zero to those requiring major, long-term funding.

In addition to the potential investment areas, there are several areas where organizational or policy issues need to be addressed in order for Mozambique to most effectively benefit from ICT investments.

Depending on the context, the recommendations are aimed at donors, the GoM, or both. As these recommendations typically have different targets and radically varying costs, they are not arranged in priority order.

10.1 Financial Information System

Based on all reports, SISTAFE is being managed and implemented in a professional manner, and the prognosis for success is good. There will no doubt be additional components that need to be added as the implantation progresses. A careful approach monitoring current progress is recommended, ensuring that new phases are implemented expediently, but not beyond the administration's ability to absorb the change.

Ongoing support for this system will be a challenge, and will be addressed in section 10.13.

SISTAFE is designed to facilitate government decentralization, a key initiative of the GoM. Although decentralization is generally deemed to be a good concept, the actual implementation will be a great challenge on many levels. Among these challenges is ensuring that provincial and ultimately district personnel have all of the skills, infrastructure and motivation to take responsibility. To accomplish this will require a phased-in approach and significant, possibly long-term, human resources development and training.

Recommendation: Assuming ongoing successful implementation, consider additions to SISTAFE to enhance its functionality. Support programs targeted at helping regional personnel to absorb decentralized responsibilities.

10.2 Justice Information System

The justice system in Mozambique is in need of reform, and it would appear that this is a case where technology can be a major instrument for change. The government has recognized that to address justice problems, a concerted effort will be required with the full cooperation of the courts, the Ministries of Justice and the Interior and the office of the Attorney General. The CCLJ coordination council is beginning to look at how technology can be part of this change. The potential benefits are large, with significant human rights implications and a clear benefit to the poor – the class of people most likely to be caught up in the existing disorganization. The use of technology to track cases throughout the justice system also has the potential to reduce corruption within the system.

Recommendation: Support the CCLJ activities leading to the use of ICTs in streamlining the justice systems and increasing citizens' access to justice.

10.3 ICTs for Poverty Alleviation

PARPA II calls for the use of ICTs to help alleviate poverty. It is reasonable to expect that over the coming years specific programs will be instituted by the GoM using ICTs in innovative and practical ways to address poverty issues.

Recommendation: Donors should be receptive to poverty alleviation programs that credibly incorporate ICTs.

10.4 Geographic Information Systems

Governments collect a lot of data, and as ICT systems are built in various parts of government and the public sector, there will be even more data available. Often this data is difficult to use effectively. When summarized to be more readily understood, much of the potentially important detail is lost.

A Geographic Information System allows data to be overlaid on a map. Even a single class of data presented on a GIS can be quite revealing. When multiple types of data are combined, the results can often be illuminating. As a perhaps trivial example, the government no doubt has figures on poverty, healthcare and education on a provincial and district basis. One can imagine insights gained by displaying this data on a map, showing how the various relationships between the various statistics.

There are a number of GIS systems used within the government, including several that are large and quite sophisticated. Each of them is separate from the others, with little data commonality. New or enhanced applications of GIS result in additional acquisitions, data collection and processing. Moreover, for units not currently using GIS²¹, there are large thresholds to overcome, reducing the likelihood that they will use GIS effectively.

The cost of GIS systems has dropped in recent years, and their capabilities have increased. A GIS system usable by all branches of government with wide access to government databases could be of great use. By integrating data across multiple sectors, GIS substantially aids

²¹ Such as the Ministry of Health which currently makes virtually no use of GIS.

planning, measurement and control. Such an integrated GIS approach can help the government benefit to the fullest as ICT-based processes in government, education and healthcare start to generate more data.

Recommendation: Support an integrated GIS and once in place, support activities which generate useable and useful data collection and analysis.

10.5 Healthcare

It is estimated that the healthcare systems covers only 40% of the population, and it is clear that the level of care provided to even these people is often lacking. Technology is not a magic bullet to cure this massive problem. However, it can be used to effectively track all manner of health statistics, to help ensure that the data quality is high, to analyse and understand them, and to thereby help ensure the resources that are available are deployed to maximize benefit.

This must be done in a thoughtful and rational manner. Despite its importance, data collection requests could overwhelm already overworked medical personnel. Done properly, ICTs can be used to facilitate data collection and *reduce* the medical administrative load. Good communications between health centres can also improve patient care, often at modest costs.

To date, there has seemingly been relatively little interest in addressing this problem. There is some indication that perhaps this is about to change.

Recommendation: Support a serious, committed and pragmatic program to design, build and implement a health information system, and to build the personnel and process infrastructure to make it usable and useful. Support ICT-based projects that address focused problems in delivering medical care.

10.6 Education

The percentage of children graduating from secondary school in Mozambique is unfortunately small. Nevertheless, the future of ICT development in Mozambique will depend on this core group, those who have graduated from secondary school, being computer-literate.

Mozambique has 280 secondary schools; equipping them all with computers and ultimately Internet is a reasonable and achievable target. Unfortunately, the problem is made more difficult by the absolute need to make sure that there are ICT-literate instructors in the schools, and that the installation is sustainable. Internet connectivity is a problem due to the high cost of data connections. The Ministry of Education seems fully aware of the issues, and is therefore taking a conservative approach – perhaps a bit too conservative. Consideration is being given to both ICT courses, and using computer-mediated courseware in other subjects. Consideration should be given to using Universal Service Funds to subsidize secondary school connectivity.

The implementation of computers in schools should be aggressively pursued, along with curriculum changes to ensure that all graduating students are exposed to computer technology, and preferably the Internet as well. The current target of placing 20 computers per school does not factor in the number of students per school (typically 1,000–2,000 but ranging up to 4,000) or the number of ICT-related courses. This number should be adjusted to better suit the real needs of each school.

Recommendation: Support the rational integration of computers into secondary schools including physical infrastructure, teacher training, and opportunities to leverage other country infrastructure investments to help provide school Internet access.

10.7 Post-secondary ICT Education

Current post-secondary ICT education does not meet the needs of the business community. Although it is important in the long term to have ICT education that meets international standards and prepares students for graduate work, it is equally important to meet today's needs for ICT-skilled practitioners. Mozambique has shown that this issue is understood for Internet networking skills, but that is not the case for software development and project management skills.

There are a number of efforts to introduce MSc degrees as well as diploma and certificate courses which may more closely meet employers' needs. However, it is essential that the traditional computer science and engineering schools also address these needs in their degree-granting programmes, and that they begin to do so very quickly. Such redesign need not endanger professional certification or the theoretical rigor of such courses. An effective technique is to create advisory groups made up of representatives from potential employer groups and to provide sufficient elective courses so that students can opt for more theoretical or practical courses. Mozambique's ability to quickly and effectively start to use ICTs widely depends on a steady stream of computer literate practitioners trained in the tools that industry and government are using. MICTI is a good project that will address the problem, but for only a limited number of students. More general and parallel solutions must also be pursued.

The recent announcement of a research and education network in Mozambique is extremely encouraging. MoRENet will not only enhance existing network use and applications, but will facilitate new ones, particularly for those schools or libraries where access was previously very limited.

Recommendation: Schools should aggressively move to redesign Computer Science Bachelor's degree curricula to meet commercial needs. Developed countries should make available resources including models of programs elsewhere which successfully meet commercial needs.

Both the government and donors should support MoRENet and applications built upon it.

10.8 Unique-Person-ID and birth/marriage/death registration

Mozambique does not currently have any reliable mechanism for keeping track of its citizens, and particularly for registering marriages, births and deaths. There are a number of sociological and physical reasons for this including the history of wars and events carried out according to traditional practices, but regardless of the root causes, it means that Mozambique has insufficient knowledge of the composition of its population. More important, significant numbers of citizens are disenfranchised because of lack of proper registration. Unregistered marriages may impact the woman's rights. Unregistered births may impact a child's ability to access education, health services and poverty relief services. In all cases, non-registration implies that statistics and demographics are not accurate.

Unique-Person-IDs will become increasingly important as ICTs are used within the various parts of national, provincial and district governments. If a single national system is not developed and implemented quickly, there is a risk of multiple non-compatible and non-communicating systems being developed as has happened with Geographic Information Systems, and at substantial cost. Unique-Person-IDs can also be

effective tools in combating corruption as they can, in theory, definitively identify the people who are party to a specific transaction.

Recommendation: A Unique-Person-ID along with a comprehensive system of registering births, marriages and deaths should be developed and implemented in such a way as to ensure that the database covers virtually all such events in the country. All living inhabitants should be similarly included in such a database, and the database should be universally used for government-related transactions.

10.9 Telecommunications

Telecommunications is thriving in Mozambique. There is abundant competition and opportunities for competition will increase post December 2007. The regulator needs additional support, but is not generally viewed as being an impediment to progress and competition. Nevertheless, costs for data transmission are impressively high and there is little concrete evidence that this will change in the near future. The reasons certainly relate to Mozambique being a vast, extremely poor, sparsely populated country which has relied exclusively on satellite communication.

An immense amount of physical infrastructure will be needed to effectively span the country. Given that fibre-optics provides very high capacity and that the overall usage in poor, sparsely populated regions will be low, it is not clear that traditional competition is likely to be the solution to this problem. Recent government efforts, and to a lesser extent, corporate efforts, to encourage cooperation between the various infrastructure players is encouraging. More is needed. Models such as the Sida-Ericsson initiative to build shared-access mobile infrastructure in Tanzania should be considered. Such models are not only applicable to mobile telephony, but to the development of point-to-point fibre and radio connectivity in conjunction with highway, railroad, pipeline and electrical transmission right-of-way.

Recommendation: Government, public sector, private sector and donors should cooperate to ensure that valuable resources are not wasted purely in the name of competition, and that the target be availability of high-speed, reasonable cost communications throughout Mozambique. Methods should be found to provide particularly favourable access to government, education and healthcare facilities.

10.10 Electricity

There has been considerable focus on electrification in Mozambique, ensuring that utility-supplied electricity will ultimately be available in all districts and towns. Reliability of the electrical supply has also been a focus, as has been quality at the high-voltage distribution level. By all reports, the situation is slowly improving.

There are quality issues with the electrical supply at the local distribution level – over- and under-voltage as well as high voltage spikes. Any of these issues can damage equipment of all sorts, but high-end ICTs are particularly sensitive to them. There is a perception that the problem is all due to EDM, although it is likely that in at least some cases, there are problems with the local premises wiring and infrastructure as well. To the extent that the problems are within EDM domain, there is a perception that they have no interest in addressing the problems.

Control and dispatch centres are being built which will help all aspects of power distribution, but will introduce vulnerabilities due to computer and network security which EDM is not currently able to address.

It may be economically possible to use the EDM right-of-way to build a fibre-based telecommunications infrastructure which could be directly marketed, or used by other telecommunications providers. There is currently a study underway to evaluate potential ways to exploit such an infrastructure.

Recommendation: Continue to enhance both the reach and the quality of the electrical distribution system, but there should be an additional focus on quality issues at the local distribution level. Studies should be done to better understand what is causing the customer-perceived problems, and how they can be addressed (whether by EDM or customers). The results of the studies should be readily available to allow customers and EDM to take effective action to shield ICT equipment from line problems. The need for computer and network security expertise must be addressed in the very near term.

Should the EDM fibre infrastructure study indicate that there are significant benefits to developing a communications network based on EDM right-of-way, consideration should be given to encouraging such an endeavour but with the caveat that it should not take resources and focus away from its electricity distribution role.

10.11 Community Multimedia Centres and Community Radio

The community multimedia centres as implemented by the UNESCO-funded program in conjunction with CIUEM have been particularly successful. Although not fully self-sustainable, the combination of radio station and technology centre has not only been effective in introducing and using ICTs in rural areas, but has created real benefits for the communities involved. The number of CMCs that are currently committed is quite modest, and could be substantially expanded without introducing quality problems. In locations where a full CMC is not practical at the moment, the creation of local community radio stations should still be considered.

The issue of self-sustainability needs additional focus. The Mozambique CMCs are beginning to use innovative ways to raise funds, and this must be encouraged and continued. In particular, partnerships with government and businesses should be considered allowing the CMCs to deliver services for these entities with appropriate remuneration. Strong consideration should be given to using the Universal Access Fund to help support CMCs. Moreover, if CMCs can shown to truly benefit their communities, consideration should be given to considering them part of the country's poverty alleviation infrastructure in much the same way as education and healthcare are, allowing them to be eligible for government support and/or to subsidized communications.

Recommendation: CMCs have a modest cost and, as implemented in Mozambique, have great potential. All avenues should be pursued to provide capital funding for additional CMCs, and to use creative financing to ensure that they are sustainable. In areas where a CMC is not possible in the short to medium term, community radio should be a priority.

10.12 Corruption

Corrupt practices can range from small payoffs which can cost individual citizens a fraction of a dollar to large scale graft and fraud costing donors many millions of dollars. Technology is not a magic solution to eliminate corruption, but it can be used to reduce opportunities for all forms of corruption, and forensically to detect and attribute corrupt practices after the fact. For a government that is serious about attacking all forms of corruption, ICTs can be interesting and effective tools. In some cases, the ICT investments can be very large with anti-corruption

effects being just one small part of the benefits; SISTAFE is one such case. At the other extreme video and audio surveillance in key areas can solely target corruption and can have quite moderate costs. In all cases, openly and consciously focusing on the problem and the actions being taken can both combat corruption, and increase public faith that the problems are being focused on.

Recommendation: The government should be pro-active in investigating opportunities to reduce corruption through the use of ICTs and donors should be receptive to such activities.

10.13 Public Sector ICT Salaries

Salaries for computer professionals employed by the private sector and by the government for donor-funded projects are typically two to six times those paid to regular public sector employees.

The result is that people either leave the public sector once they are trained, or that they stay and supplement their income by freelancing, often putting much of their energy into their more lucrative private contracts. This under-the-table activity can also unfairly compete with small ICT businesses, endangering their ability to succeed and grow.

Moreover, once a major, donor-funded government project is completed, the high-paid designers and programmers move on to other projects. The ongoing operation and maintenance of the systems are left to the under-paid and disinterested public service employees, endangering the long-term viability of these systems.

Some method must be found to reconcile these problems. Possible alternatives include:

- a) Significant increases in public sector ICT salaries with the implicit requirement that the higher salaries be based on skills and performance.
- b) The creation of a parastatal organization that would not be subject to normal public sector salary and promotion regulations.
- c) Outsourcing system operation and support to the private sector.

Option (c), and to a lesser extent option (b), would still require that there be *some* technically skilled people within the government, and they would have to be paid at private-sector levels.

In the longer term, as top-quality ICT skills become less rare, the problem will lessen, but experience in developed countries indicates that it will not disappear.

Recommendation: Despite the difficulty in addressing public sector salary issues, this issue must be resolved in a timely and effective manner prior to the completion of the SISTAFE and similar projects or their medium to long term viability may be endangered. The parastatal solution is the one that is most likely to be viable.

10.14 Telecommunications Regulation

Mozambique's telecommunications regulator, INCM has overseen the start of the transition from a traditional monopolistic telecommunications structure to one that is now partially deregulating, quite competitive and by most measures, thriving. However, it desperately needs to be realigned to allow it to serve the country well over the coming years.

Compared to regulators in many developing countries, INCM has been quite enlightened, allowing the industry to grow, and therefore to provide vital communications services to other sectors of the economy.

That must not change. However, by its own admission, it needs the staff and tools to be able to address the rapidly changing and growing telecommunications sector. The rules under which it operates must be clarified, so that there is no ongoing misunderstanding of what they are. Once clarified, the rules must be enforced uniformly provide a level playing field for all. Their operating budget must be sufficient for them to oversee this important sector, and should not be tied to the licensing fees. Moreover, process must be put in place so that licensing fees and related telecommunication taxes do not become a government “cash-cow” with the resultant inflation of communications prices.

With the skills and tools to effectively advise on telecommunications policy and regulate the sector in an environment of increasing competition, INCM will be in a better position to ensure that telecommunications will lead Mozambique’s ICT revolution instead of being an inhibitor.

Recommendation: INCM should be reformed as necessary adjusting its structure, budget, skills and resources, with required changes to telecommunications regulations, to allow INCM to be an effective and enlightened regulator.

10.15 ICT Sector Growth

With the exception of telecommunications, there is minimal growth in the ICT sector in Mozambique. This can be attributed to a number of factors including the overall low absorption of ICTs, the shortage of people with practical skills and the high cost of telecommunications. The overall difficulty of setting up a business in Mozambique and the high entry cost of investing in ICT equipment are also significant factors. MICTI and the ICT incubator projects will address many of these problems for those start-up companies that are eligible to operate in the new environments, and that chose to do so. The projects will do nothing in the short to medium term to address the problems for those companies that already exist, do not meet the project criteria, or have a need to be located elsewhere. For such companies, the root problems must be addressed in order for them to grow.

The issue is important, because Mozambique has identified ICTs as a key enabler in its efforts to reduce absolute poverty as well as to reform many aspects of government. For these ICT-based efforts to succeed there must be a thriving, active and growing ICT sector in Mozambique.

Recommendation: Removing the inhibitors to the growth of a vibrant ICT sector should be considered a high priority. Moreover, there should be specific incentives such as tax and import duty relief aimed at this sector.

11. Conclusions

Despite the poverty in much of Mozambique, ICTs are beginning to make their presence felt in many sectors, and are beginning to address both operational and poverty-related issues. The government has shown a desire and willingness to start to address many core problems within Mozambique; if this trend continues, ICTs will play an increasingly critical and visible role.

Given the magnitude of the work to be done, and the desire of all governments to make visible progress during their mandate, care must be taken to prioritize the needs. Moreover, there are specific problems that must be addressed at a policy level in order that they do not become major inhibitors to the use of and growth of ICTs in the public or private sectors.

The country survey identified fifteen focus areas. Some are high priority needs that must be addressed in the near future. Others are opportunities with reasonable costs and high payoffs that should be addressed. The full list of ICT endeavours in current and under-development ICT strategies is far longer than the above list, and there is no question that many of the additional targets are viable, of great use and achievable. As such they also deserve attention. However, the items identified in this country survey are either crucial to long-term success, or will have such high returns that they demand immediate focus. They are (not in priority order):

1. Extend SISTAFE functionality where applicable, and place a major focus on ensuring that its decentralized capabilities can be fully utilized in the provinces and districts.
2. Use ICTs to streamline the justice system increasing citizen's access to justice.
3. Use ICTs in innovative, cost-effective ways to support poverty alleviation measures.
4. Create an integrated government Geographic Information System.
5. Design, build and implement a health information system to help manage health information and delivery. Use ICT-based tools to address specific healthcare delivery problems.
6. Enhance the integration of computers and the Internet into the secondary school system and curriculum.

7. Ensure that post-secondary ICT training addresses the operational needs of the private and public sector.
8. Create a Unique-Person-ID system along with the corresponding birth, marriage and death registration infrastructures ensuring that all life events are recorded.
9. Provide access to high-speed, reasonable cost communications throughout Mozambique. Methods should be found to provide particularly favourable access to government, education and health-care facilities.
10. Continue the rural electrification program, but also address quality issues at the local distribution level as well as network and computer security. Consider whether the electricity transmission right-of-way should be used for data transmission facilities.
11. Expand the program installing rural Community Multimedia Centres integrating telecentres and community radio. In locations where a telecentre is not yet practical, community radio should be considered.
12. Investigate ways in which ICTs can be used in the fight against corruption.
13. Ensure that the public sector has access to staff that can properly operate, maintain and enhance critical ICT-based systems.
14. Institute reforms such that the communications regulator can be both effective and enlightened.
15. Adjust government policies to remove inhibitors to the growth of a vibrant ICT sector.

Appendix 1

Demographics and Key ICT Data

	Mozambique	South Africa	Sweden	Source	Year
Demographics					
Population (,000,000)	19.0	45.2	9.0	ITU	2004
Literacy %	48	86	100	CIA	2003
GDP (US\$/person)	217	2293	33586	ITU	2003
Operators					
Number of fixed lines telecom operators	1			Site	2006
Number of mobile line telecom operators	2			Site	2006
Number of Internet Service Providers (ISPs)	~10			MST	2005
Number of cities/town with Internet Point of Presence and dial service	20				
Total Telephones					
Total Phone subscribers (,000)	786	24,321	16,175	Calculated	2004
Total Phone subscribers per 1000 inhabitants	41	538	1,797	Calculated	2004
Fixed Line Telephones					
Number of fixed lines (,000)	77.6 (See note 1)	4821	6873	ITU	2004
Number of fixed lines per 1000 inhabitants	4.2	104	766	ITU	2004
Number of fixed lines per 1000 inhabitants – CAGR	-2.5%	-5.0%	1.0%	ITU	1999-2004
Number of fixed lines per 1000 Households	17	224	>1000	ITU	2003
Percentage of digital switchboards	100%	100%	100%	ITU	2003
Mobile Telephones					
Number of mobile phone subscribers (,000)	708 (See note 2)	19,500	9,302	ITU	2004
Geographic coverage of mobile networks	45%			Site	2006
Population coverage of mobile networks	55%	96%	N/A	ITU – See note 3	2004
Number of mobile telephone subscriptions per 1000 inhabitants	37	431	1,032	ITU	2004
Number of mobile telephone subscriptions per 1000 inhabitants – CAGR	125%	30%	13%	ITU	1999-2004
Expansion rate: number of new subscriptions last year ('000)	272			ITU-A Calculated	
Percentage of mobile subscribers that are prepaid	94%	76%	N/A	ITU	2004
Internet					
Number of Internet subscriptions ('000)	14	1,000	3,215	ITU	2004
Number of Internet subscriptions per 1000 inhabitants	1	22	357	Calculated	2004
Number of Internet Users ('000)	138	3,566	6,800	ITU	2004
Number of Internet Users per 1000 inhabitants	7	79	755	ITU	2004
Expansion rate: number of new users last year ('000)	55			ITU-A Calculated	
International Internet bandwidth (mbps)	19	882	157,636	ITU	2004

	Mozambique	South Africa	Sweden	Source	Year
International Internet bandwidth per inhabitant (bits per person)	1	20	17,493	ITU	2004
PCs ('000)	112	3,740	6,861	ITU	2004
PC per 1000 inhabitants	6	83	761	ITU	2004
Number of Internet hosts ('000)	7	351	1322	ITU	2004
Number of Internet hosts per 1000 inhabitants	0.38	7.75	147	ITU	2004
Number of new Internet hosts last year ('000)	4	122	379	ITU-A	2004
Number of towns with a Point-of-Presence	33			Site	2005
Number of Internet cafés, Multipurpose Community Centres	~10, ~15			MST, Site	2005
Communications Prices					
Telephone call cost, fixed line – Initial installation (\$)	17	38	125	ITU	2005
Telephone call cost, fixed line – typical monthly cost (\$)	8	13	16	ITU	2005
Telephone call cost, fixed line \$/minute (day, local)	0.14	0.18	0.15	ITU	2005
Telephone call cost, mobile – Initial connection fee (\$)	2	23	13	Site (MZ) ITU (ZA, SE)	2005
Telephone call cost, mobile – Local call per minute (\$/minute)	0.20	0.41	0.51	Site (MZ) ITU (ZA, SE)	2005
Cost Internet subscription – Dial (\$/month)	30			Site	2005
Cost Internet subscription – Cable/ADSL (\$/month)	65			Site	2005
Cost Internet usage at an Internet café (\$/hour)	1.20–2.50			MST	2005
Radio/Television Access					
Households with a radio	50%	73%	93%	ITU	2003
Population with radio coverage	90%	95%	100%	ITU	2003
Households with a television	6%	54%	100%	ITU	2003
Population with television coverage	N/A	91%	100%	ITU	2003
Electricity					
Electricity consumption (million kWh)	10,460	197,400	131,800	CIA	2003
Electricity consumption per person (kWh)	551	4367	14644	Calculated	2003
Sources and Footnotes					
ITU: World Telecommunication Indicators 2004/2005, November 2005, v1.01, ISBN 92-61-11331-1					
ITU-A: http://www.itu.int/ITU-D/ict/statistics/					
CIA: The World Factbook – 2005 (updated January 2006) – http://www.odci.gov/cia/publications/factbook/					
Note 1: EDM reports this number of lines for 2003, with 69.7 for 2004, so presumably, some ITU reported values are one year off.					
Note 2: Estimate for March 2006 is 1.5 million mobile customers.					
Note 3: The ITU says that 95% of the population of Mozambique is covered. The largest mobile phone provider says 55%. The latter is more believable.					

Appendix 2

Interview Subjects

Government	
Organization	Interview Subject
Bank of Mozambique	Esselina Macome, General Manager
ICT Policy Commission – ICT Policy Implementation Technical Unit (UTICT)	Lourino Alberto Chemane, ICT Chief Technical Advisor
INCM – Instituto Nacional das Comunicações de Moçambique (Communications and Postal Regulator)	Hilário José Tamele, Director of Radiocommunications and Technologies
	Lúcio José Cardoso, Legal Affairs
	Adriana Pedro Rafael, Head of Postal Department
	Rafael Almoço
Ministry of Education	Kauxique Manganial, Head of Department of ICTs and Schoolnet Mozambique Coordinator
Ministry of Finance – UTRAFE – Unidade Técnica de Administração Financeira do Estado	Carlos Jensen, Director
Ministry of Health	Elias Mangujo Cuambe, Deputy National Director of Cooperation and Planning
	Ercilia Almeida, Head of Information Systems
Ministry of Justice – CCLJ – Conselho Coordenador de Legalidade e Justiça (Coordination Council for Legality and Justice)	Gaspar Moniquela, Executive Secretary
Ministry of Science and Technology	Venâncio Simão Massingue, Minister
	Marcelino E. Sales Lucas, National Director for Planning, Statistics and Cooperation
Ministry of Transport and Communications	Stélíos Papadakis, Advisor to the Minister
	Ema Chicoco, Head of Communications Department
Telecom	
Organization	Interview Subject
GS Telecom; Ownership: Private	Silvio do Carmo, Area Manager, East Africa
mCel; Ownership: TDM and Government	Rui Fernandes, Chairman

Telecom	
Organization	Interview Subject
TDM – Telecomunicações de Moçambique (Landline telephones, traditional monopoly); Owership: Mainly Government	Salvador Adriano, CEO
Teledata (ISP); Ownership: Part TDM, part private	Júlio Ruas, Commercial Directorate Carlos Barreto, Client Manager
TropicalWeb (Dial and wireless ISP); Ownership: Private	Marco Mondego Marques, Technical Director
TV CABO (Cable TV, Cable ISP); Ownership: Private and TDM	Carlos Vale, CEO Rui Ribeiro, IT Manager
Vodacom; Ownership: Private	Alistair Maclean, Executive Head of IT & Billing
Non-Telecom Parastatal	
Organization	Interview Subject
Caminhos de Ferro de Moçambique – CFM – Railway	Avito Francisco de Cruz Jequicene, Director of IT Services Raimundo B. Gulube, IT Manager
EDM – Electricidade de Moçambique	Giovanne Massinga, IT Technical Director Augusto de Sousa Fernando, Member of the Board Anders Cajus Pedersen, Economist (specialist from Danida)
Private Industry	
Organization	Interview Subject
BIM – Banco Internacional de Moçambique	Octávio Jerónimo Lucas, Director, Exploração e Infra-estruturas
EXI (Consulting company)	José Murta, Managing Director
Pandora Box, Lda	Fernanda Cabanas, Director General AntónioTeixeira, Development and Production
Education	
Organization	Interview Subject
ISCTEM – Instituto Superior de Ciências e Tecnologia de Moçambique	Sérgio Castro Neves, Secretary General Paulo Machado, Director of Information and Communications Services Americo Muchanga, Director, Centro de Informática UEM
UEM – Universidade Eduardo Mondlane	Francisco Mabila, Deputy Director, Centro de Informática UEM Polly Gaster, CMC Project Coordinator Orlando A. Quilambo, Vice-Rector, Academic Affairs
Donors	
Organization	Interview Subject
Danish Embassy	Lola López, Programme Officer
Embassy of Finland	Olli Sotamaa, Counsellor Anton Johnston, Counsellor, Head of Development Cooperation Division
Embassy of Sweden	Lisbeth Söderling, Programme Coordinator João Jussar, Program Officer
Royal Norwegian Embassy	Carlos Rafa Mate, Programme Officer

Donors	
Organization	Interview Subject
Swiss Agency for Development and Corporation – SDC	Nicolas Randin, Deputy Country Director
UNDP	Jussi Hinkkanen, Programme Officer
	Narue Paulilo Shiki, Strategic Partnerships Specialist
	Benoît Sossou, Representative
UNESCO	Zulmira Rodrigues, Programme Specialist
	Nina Bull Jorgensen, Communications Officer
	Tomás Vieira Mário, Media Project Coordinator
	Noel Muchenga Chicuecue, National Programme Officer
USAID	Timothy W. Born, Trade and Investment Program Team Leader
	Dimitri Pepper, Health Sector Specialist
	Abuchahama Saifodine

Appendix 3

Sida Projects at UEM

Since 2000, Sida has directly or indirectly funded a number of projects at or in conjunction with Universidade Eduardo Mondlane. These include:

- Fibre-optic backbone on main campus
- Eight wireless, point-to-point links to remote campuses and locations
- Eight LANs and student computer labs
- Training for IT personnel
- Four PhD students studying in Sweden
- Two MSc students studying in Sweden
- Internet Exchange (IX) – jointly funded with DFID
- Mozambique Open – Computer labs and wireless access
- Voice over IP – central server, 40 terminal adapters, 10 Cisco handsets

Appendix 4

Prime Reports and Documents Reviewed

CIUEM, MICTI – *Mozambique Information and Communications Technology Institute – Business Plan*

CIUEM, Various published documents related to the CMC scale-up initiative

EDM, *Qualidade Técnica de Serviço da Rede de Transporte 2004*

EDM, Various unpublished documents describing current and planned electricity infrastructure

Government of Mozambique, *Action Plan for the Reduction of Absolute Poverty, 2001–2005 (PARPA)*, April 2001

Government of Mozambique, *Action Plan for the Reduction of Absolute Poverty, 2006–2009 (PARPA II)*, November 2005 (Preliminary English Translation)

Government of Mozambique, *Information and Communication Technology Policy – Implementation Strategy*, June 2002

Government of Mozambique, *Mozambique Science, Technology and Innovation Strategy – DRAFT*, January 2006

Government of Sweden – Statskontoret & CIUEM, *Mozambique's Soft ICT Infrastructure – A Pilot Study*, June 2002

ITU, *World Telecommunications Indicators – 2005/2005 – v1.01*, November 2005

KTH, *Mozambique Open – Final Report*, January–May 2002

Mail & Gaurdian Online, *Not so EASSy*, March 2006, http://www.mg.co.za/articlePage.aspx?articleid=267024&area=/insight/insight___economy___business/

Malaria Journal, *Analysing the quality of routine malaria data in Mozambique*, 2004, 3:3; B. Chilundo, J. Sundby, M. Aanestad; <http://www.malariajournal.com/content/3/1/3>

Sida, *A Country UCT Survey for Mozambique*, Miller Esselaar and Associates, November 2001

Sida, *ICTs for Poverty Alleviation: Basic Tool and Enabling Sector*, Alan Greenberg, November 2005, SIDA4937en, <http://www.eldis.org/fulltext/sidaictpoverty.pdf>

Sida, *Mozambique – Sida Country Report 2004*, April 2005, SIDA4698en
UNESCO, *Community Multimedia Centres around the World – A Global Directory*, November 2005

USAID, *Tax Reform and the Business Environment in Mozambique*, Nathan Associates, December 2004

Appendix 5

Acronyms and Abbreviations

Acronym/ Abbreviation	English	Portuguese
ADSL	Asymmetric Digital Subscriber Line	
CCLJ	Council for Legality and Justice	Conselho Coordenador de Legalidade e Justica
CFM	Railways of Mozambique	Caminhos de Ferro de Moçambique
CIUEM	Center for Informatics of Eduardo Mondlane University	Centro de Informática da Universidade Eduardo Mondlane
CMC	Community Multimedia Centre	
DINAGECA	National Directorate of Geography and Cadastre	Direcção Nacional de Geografia e Cadastro
EASSy	EASSy (Eastern Africa Submarine Cable System)	
EDGE	Enhanced Data GSM Environment	
EDM	Electricity of Mozambique	Electricidade de Moçambique
e-SISTAFE	See SISTAFE	
GoM	Government of Mozambique	
GPRS	General Packet Radio Services	
GSM	Global System for Mobile Communications	
ICT	Information and Communication Technology	
IGF	Finance Inspector General	Inspecção-Geral de Finanças
INCM	National Communications Institute of Mozambique	Instituto Nacional das Comunicações de Moçambique
INE	National Statistics Institute	Instituto Nacional de Estatística
ISCTEM	Superior Institute of Sciences and Technology of Mozambique	Instituto Superior de Ciências e Tecnologia de Moçambique
ISP	Internet Service Provider	
IX	Internet Exchange	
MoRENet	Mozambique Research and Education Network	
PARPA	Action Plan for the Reduction of Absolute Poverty	Plano de Acção para a Redução da Pobreza Absoluta
PRSP	Poverty reduction Strategy Paper	
SISTAFE	State Financial Administration System	Sistema de Administração Financeira do Estado
TDM	Telecommunications of Mozambique	Telecomunicações de Moçambique
UEM	Eduardo Mondlane University	Universidade Eduardo Mondlane
UTICT	ICT Policy Implementation Technical Unit	Unidade Técnica de Implementação da Política de Informática
VoIP	Voice over IP	

Appendix 6

Survey Terms of Reference

1. Background

Sida supports the integration of ICT in developing countries in order to improve communications and the exchange of information. Sida's policy is outlined in the document "Strategy and Action Plan for ICT in Development Cooperation" (see www.sida.se)

In Mozambique ICT has been identified as an important tool for development. Sida is now commissioning a Country ICT Survey for Mozambique as a first step for the integration of ICT in the Swedish development cooperation. The survey should include information regarding key ratios, connectivity, access, the human resource situation, key institutions, policy and regulatory framework. The aim of this survey is to provide the embassy and units within Sida, as well as stakeholders in Mozambique, with comprehensive information of the ICT situation for the planning of future ICT related projects.

A new country strategy for the development cooperation between Mozambique and Sweden is now under preparation. This Country ICT Survey will serve as an input to the coming country strategy process. The overall aim of the present Swedish Mozambique development cooperation is to reduce poverty and it is being concentrated in the areas of democratisation, sustainable economic growth and social initiatives.

2. Objectives

- Serve as an input to the new country strategy process.
- To provide the Swedish embassy and Sida, as well as stakeholders in Mozambique, with information and assessment of the ICT situation in Mozambique for the planning of ICT related development activities.
- To provide an overview of past/present ICT projects supported by Sida, as well as propose possible future areas of Swedish ICT support.
- The study will provide areas central for the Swedish development cooperation that would benefit of ICT integration.

3. Scope of the Services

The Consultant shall make a Country ICT Survey for Mozambique. The survey shall include:

- a description of the ICT situation in the Country,

- an overview of the ICT development of the Country
- a basic analysis of the factors of major interest for the promotion of use of ICT for development purposes.

The descriptive part shall cover items and questions set out in Appendix 1 “Questions and areas to be covered”. The description shall include information on forecasted changes and developments in the near term, where applicable. Name of key persons and other relevant institutional data (size, ownership etc.) should be listed in the reports. Sources must be given for key ratios. Key data shall be gathered as completely as may be reasonable in terms of cost and time and be summarised in an Appendix (see Key Ratios in Appendix 1).

The analysis should include a discussion of existing and lacking prerequisites for the implementation of ICT in development cooperation activities in Mozambique. It should address the following questions:

- Which major trends and possible initiatives can be observed in the country regarding the use of ICT?
- Which are the main obstacles for increased use of ICT?
- Which are the main opportunities to increase the speed of ICT integration?
- Which type of interventions would be most strategic for development cooperation?

The analytical part could serve as a first step to identify major areas of interest for a dialogue between Sida and Mozambique for a future integration of ICT in the Swedish development cooperation. The analysis should include a discussion of advantages and risks of supporting ICT implementation, mainly from the perspectives of poverty reduction and democratic governance (including transparency, democracy, human rights etc.).

The survey should also provide an overview of past/present ICT projects supported by Sida, as well as propose possible future areas of Swedish ICT support.

5. Methodology

5.1 Methodology

The Survey shall be made in close cooperation with stakeholders in the country where the study will take place. Local contractors may be subcontracted. Preferably the Swedish embassy, the Mozambique ministry of Science & Technology and the co-consultant need to assist in suggesting and facilitating meetings for the main consultants during their visit in Mozambique

Data gathering for the survey is supposed to be done from sources available internationally and from a field visits. Such a field visit is estimated to be 2 weeks.

6. Reporting

6.1 Written Reports

The following reports will be produced in English by the consultants, and be delivered to Sida in electronic format:

1. A draft version of the Country ICT Survey.
2. A final version of the Country ICT Survey.

The Country ICT Survey is expected to be approximately 40 pages.

The final version will be delivered to Sida no later than 2006-02-28.

The consultant must also provide an end verbal report for Anton Johnston and also some related embassy staff; with preliminary main findings and conclusions.

Appendix A

Questions and areas to be covered

Policy Environment

– IT awareness

Where in the process of formulating a national ICT policy or the equivalent does the country stand? What steps have been taken, when?

– Computer literacy

What level of computer literacy/awareness exists in the key segments of society (central government administration, financial sector, private business, universities)?

– Regulatory environment

What kind of political and regulatory framework exists concerning the regulation of telecommunication operators, Internet Service Providers, data communication to and from the country, etc?

What changes could be expected in the near future concerning regulatory matters as a result of decisions, plans and discussions?

Connectivity/access

– Presence of national Internet exchange

Is there an Internet exchange present in the country or is the Internet traffic channelled through the USA or Europe?

– The Internet market from an Internet user perspective

Number of Internet Service Providers? Key data on major ISPs. What kind of services do they offer? What is the price for the services offered? In what parts of the country are services of different qualities and prices offered?

– The fixed line telecommunication from a user perspective

Number of operators? Key data on operators. What kind of services do they offer that is relevant for data communication (dial-up connections, ISDN, DSL...)? What is the price for these services? In what parts of the country are services of different qualities and prices offered?

– The mobile telecommunication market from a user perspective

Number of operators? Key data on operators. What kind of services do they offer? What is the price for these services? In what parts of the country are services of different qualities and prices offered?

– The market for data communication media other than telecommunication networks from a user perspective

Do other alternatives for connections to national or international ISPs exist (satellite, Bush radio, cables etc)? What are the costs? What kind of permissions are needed (if needed) for direct external communications?

– *Access to IT services (maintenance, software development)*

– *Access to electricity in the countryside*

Identify the geographical areas covered by fixed electricity networks.
Information on the forecasted expansion rate for the next few years.

Human Resources

– *Higher ICT education*

Number of universities and higher education institutions with education programmes in ICT. Key data on institutions and the education programmes (focus, quantity, quality, and facilities)

– *Training of ICT technicians*

Number of institutions for the training of ICT technicians? Key data on institutions and the training programmes (focus, scope, quantity, quality, and facilities)

– *ICT education at primary and secondary school level*

Information on ICT education in primary and secondary schools

Institutions

- Identify the commercial stakeholders in the different markets (fixed line telecommunication, mobile telecommunication, data traffic, other data communication media, ISP/retail, ISP/major customers).
- Presence of major domestic and multinational companies delivering ICT services, ICT hardware and ICT software.
- Identify the public stakeholders and their roles (ministerial level, government administration for telecommunication regulations, telecommunication operators, universities and other higher education institutions with ICT education etc)? Description of the stakeholders (size, experience capacity)
- Identify other stakeholders as a local chapter of the Internet Society or other similar organisations, professional organisations and individual champions.

Local Content Development

- Software and content development produced locally
Quantity and quality of local websites and other related IT services (government information, libraries, e-commerce, portals and gateways)

Key Ratios

– *Operators*

Number of fixed lines telecom operators

Number of mobile line telecom operators

Number of Internet Service Providers (ISPs)

Possible alternative suppliers of bandwidth

Number of Internet Point of Presence (total amount, in how many cities)

International bandwidth

Number of cities with local modem pools for dial-up

– *Users*

Number of fixed lines

Number of fixed lines per 1000 inhabitants

Expansion rate: number of new lines a year (present situation, plan for next coming years)

Percentage of digital switchboards

Number of mobile phone subscribers (divided on operators)

Geographical coverage of mobile networks

Number of mobile telephone subscriptions per 1000 inhabitants

Expansion rate: number of new subscriptions a year (present situation, forecasts)

Number of Internet subscriptions

Number of Internet subscriptions in the capital (and other major cities)

Number of Internet subscriptions per 1000 inhabitants

Number of new Internet subscriptions last year

Number of Internet hosts

Number of Internet hosts per 1000 inhabitants

Number of new Internet hosts last year

Number of Internet cafés and Multipurpose Community Centres respectively

– *Price*

Telephone call cost, fixed line \$/minute (day/night, local/regional)

Telephone call cost, mobile

Cost ISDN

Cost DSL

Standard cost Internet subscription

Standard cost Internet usage at an Internet café

– *Plan documents*

National ICT plan (name, date)

National telephone expansion plan (name, date)

National electricity expansion plan (name, date)

Appendix B

Suggested Interview Areas

- Swedish Embassy
- Ministries of Science & Technology, Education & Culture, Transportation & Communication, Health, Energy and Agriculture
- Communications Regulator – INCM
- ICT Agency – UTICT
- Smart City or Techno-park initiatives
- Post-secondary educational institutions
- Telecommunications providers (fixed line, mobile, ISPs, Television cable)
- Commercial ICT providers, software developers
- Major ICT users (banks, railway, government)
- Donors and International Development agencies

Halving poverty by 2015 is one of the greatest challenges of our time, requiring cooperation and sustainability. The partner countries are responsible for their own development. Sida provides resources and develops knowledge and expertise, making the world a richer place.



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