A Country ICT Survey for Rwanda

Final Report

Miller Esselaar and Associates
November 2001

Sida

SWEDISH INTERNATIONAL DEVELOPMENT
COOPERATION AGENCY

Department for Research Cooperation – SAREC

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Executive Summary

Sida commissioned this survey as part of its ongoing programme to support the use of ICT in developing countries. The information gathered will be used by Sida and its partners to assess the interventions that may be useful in Rwanda. It is intended that the study methodology be repeated in other African countries.

The project team used a combination of desk research and interviews of about thirty key stakeholders to establish preliminary results, which were then presented at a workshop of the interviewees and other interested parties. At that workshop, the participants applied an assessment tool called 'Readiness Guide for the Networked Society' to assess the state of ICT in Rwanda.

In ***Chapter 1***, the report briefly examines both African and international trends with particular reference to information society initiatives in Sub-Saharan Africa.

Chapter 2 deals with the socio-economic situation of Rwanda today, highlighting its largely agrarian nature, young population (60% under the age of twenty), and low per capita GDP.

Chapter 3 describes the history of the ICT Policy Process in Rwanda and the publication of three important policy documents initiated by the UN Economic Commission for Africa as part of the African Information Society Initiative (AISI). The final document 'An Integrated ICT-led Socio-Economic Development Policy and Plan for Rwanda 2001 – 2005' summarises previous policy decisions and tables a comprehensive and ambitious 5-year plan for Rwanda, describing the establishment of two key institutions, the National Information Technology Commission (NITC) and the Rwandan Information Technology Agency (RITA).

The telecommunications industry comprising fixed and mobile lines and Internet access is described in ***Chapter 4.*** The monopoly fixed line provider, RwandaTel has installed a fully digital backbone and with other infrastructural improvements is positioned to support the growth of the industry. The growth of the cellular industry in Rwanda has been impressive and, with 49 000 subscribers, it has, in less than two years, provided access to twice the number of people that are connected to the fixed network. There is a small but active Internet industry and the establishment of a dozen Internet cafes in Kigali is encouraging. The telecommunications industry is effectively a monopoly with respect to all services, but plans have been tabled to liberalise it.

The 1994 genocide was particularly disruptive of the Education system, and the effects are still very much in evidence in Rwanda. The primary and secondary schools, with over 1 500 000 pupils and a pupil/teacher ratio of over 50:1, lack both infrastructure and qualified teachers. The National University of Rwanda at Butare (NUR) and the Kigali Institute of Science and Technology (KIST) both have active ICT programmes, remote access to the African Virtual University and a growing network of internet-enabled computers. The Ministry of Education, along with other stakeholders, has been examining the potential use of ICT within the Education system; this initiative is at an early stage.

Chapter 6 deals with the structure of the ICT Sector and the major users. The ICT sector is small (estimated at US$ 25 - 30 million), with parastatals responsible for over half the total revenue; the private sector is presently hampered by restrictions and bureaucracy that are being addressed. ICT usage is generally unsophisticated, with little networking taking place, a lack of skilled resources, reliance on outside development support and important applications missing in cornerstone industries such as banking (e.g., local credit card clearance, automated cheque clearing, an effective ATM network).

Chapter 7 deals with aspects that are perceived by the consultants as being of interest to Sida. The fact that Rwanda has an undeveloped ICT industry is counterbalanced by the active and enthusiastic support of the President of Rwanda and by extensive plans that have been developed with the assistance of the Economic Commission for Africa. Human resource development is much required and support to schools (SchoolNet), existing tertiary institutions (e.g. NUR and KIST) or new initiatives (e.g. Tumba Institute of Electronics) could all be very beneficial.

Other potential projects include an Electronic Government pilot project, projects to increase the productivity of the private sector, the coordination of donor funding, support for the establishment of rural ICT centres and the investigation of appropriate measurement tools to monitor progress of the 5-year plan.

Chapter 1. Background

1.1 Reason for report

Sida supports the rapid integration of ICT in developing countries in order to improve communications and the exchange of information. It thus intends to expand its support to ICT related projects in partner countries in Africa and funds have been allocated for ICT pilot projects. The quality of information about the ICT situation in African countries, however, differs from country to country, and in general is limited and fragmented. Therefore Sida has taken the initiative to produce country ICT Surveys that should include information regarding key ratios, connectivity, access, the human resource situation, key institutions, policy and regulatory framework.

This current study sets out:

- To gather information and make an assessment of the ICT situation in Rwanda;
- To provide the results to Swedish embassies and units of Sida, as well as stakeholders in the countries concerned; and
- To develop a suitable methodology for surveys for other developing countries, and for the updating of key information.

1.2 Study Methods and Outcomes

The methods used to achieve the objectives of this study were straightforward. The project team used desk research to obtain background socio-economic information on Rwanda, followed by the collection of previous studies of ICT in Rwanda in order to obtain reliable baseline data. The country-specific information could then be placed in the context of African and global activity in ICT.

A local consultant in Kigali was appointed to contact major stakeholders in ICT in the public and private sector and set up times for semi-structured interviews.

These interviews were designed to supplement and confirm the desk research, to obtain relevant publications such as Annual Reports, and to tap subjective opinions as to prospects for ICT in the country. A two-person team conducted approximately thirty interviews of over an hour each.

The data that was obtained in this manner is summarised in the Appendices, and includes Key Ratios that relate to the Rwandan economy, but with an emphasis on the ICT Sector.

Preliminary results were presented at a workshop to which all interviewees and selected others were invited. Twenty interviewees and other stakeholders attended. In particular the participants in the workshop were asked to apply a current assessment tool known as the ***"Readiness for the Networked World: A Guide for Developing Countries"*** to assess the state of ICT in Rwanda.

The Guide is intended to provide a rapid means of positioning Rwanda against a fully prepared and networked country. It uses five categories of indicators: [1]

- ***Network Access*** – What are the availability, cost and quality of ICT networks, services and equipment?
- ***Networked Learning*** – Does the educational system integrate ICTs into its processes to improve learning? Are there Technical training programmes in the community that can train and prepare an ICT workforce?
- ***Networked Society*** – To what extent are individuals using information and communication technologies at work and in their personal lives? Are there significant opportunities available for those with ICT skills?
- ***Networked Economy*** – How are businesses and governments using information and communication technologies to interact with the public and with each other?
- ***Network Policy*** – To what extent does the ICT environment promote or hinder the growth of ICT adoption and use?

The results of this assessment by the workshop group can be found in ***Appendix 4***.

This report represents the summarisation of the project to date and assessment of the utility of the methods used.

1.3 Brief Overview of African and International Trends

1.3.1 International Developments

There is extraordinary interest in ICT throughout the world. One country after another is carrying out surveys, policy studies, programmes and projects to help exploit ICT for social and economic benefit, maintain competitive position or avoid suffering the widening of the so-called "digital divide." There is certainly no doubt that major organisations throughout the world are benefiting from ICT-supported business processes, to the extent that for instance the protracted economic boom in the United States is attributed in major part to use of ICT. "Electronic commerce" is the phenomenon of the times, and "electronic business" and increasingly "electronic government" are already supplanting that term. While there are genuine fears that ICT will accentuate the economic advantage of the electronic "haves" over the "have-nots," there are also analysts who argue that the developing world will be the major beneficiary of the "death of distance."

On a global level the United Nations strongly emphasises the potential of ICT and has launched projects such as a volunteer corps called the United Nations Information Technology Service ('UNITeS'), to train groups in developing countries in the uses and opportunities of the Internet and information technology; the Health InterNetwork, to establish 10,000 on-line sites in hospitals and clinics in developing countries and provide

[1] Readiness for the Networked World: A Guide for Developing Countries: Centre for International Development at Harvard University, p7

access to up-to-date medical information; and a disaster response initiative, known as "First on the Ground," which will provide mobile and satellite telephones as well as microwave links for humanitarian relief workers in areas affected by natural disasters and emergencies. The World Bank's InfoDev programme funds large numbers of in-country ICT projects such as "e-readiness" assessments and e-government studies.

In July 2000 The group of G8 countries issued its Okinawa Charter on the Global Information Society, and passed a resolution to set up the Digital Opportunities Task Force (DOT Force) and tackle priority areas including fostering policy, regulatory and network readiness; improving connectivity, increasing access and lowering cost; building human capacity; and encouraging participation in global e-commerce networks. The first substantive report from the DOT Force has been released.

1.3.2 Developments in Africa

In Africa, the Economic Commission for Africa launched its African Information Society Initiative (AISI) in 1996 and since then has been supporting several country projects to enhance National Information and Communications Infrastructures (NICIs) (see below for its impact on Rwanda). The ECA also hosted the major African Development Forum '99 focusing on ICT. A post-ADF Forum of Heads of States is due in September 2001 and will propose ways forward in four key areas: ICT Policies and Strategies, ICTs and Health, Electronic Commerce, and ICTs for Youth and Education. The Common Market for Eastern and Southern Africa (COMESA) recently held an expert workshop to identify opportunities to foster electronic commerce within its community, of which Rwanda is a member. The Southern African Development Community (SADC) is fostering information society initiatives within that region, including the signing of a telecommunications protocol and formation of a Telecommunications Regulators' Association for Southern Africa (TRASA).

In addition to the significant steps that Rwanda is taking in ICT—discussed in a subsequent section—at the individual country level in Africa, South Africa has published long range scenarios for ICT, put in place an ICT Sector Development Framework, is finalising e-commerce legislation and is in the throes of telecommunications liberalisation; Namibia recently commissioned a study to produce a draft ICT Policy for that country; Mauritius is working through its National IT Strategy Plan and has promulgated e-commerce legislation; Senegal is pursuing a national ICT strategy and is noteworthy for widespread presence of phone shops; Ghana has opened telecommunications to competition and privatised Ghana Telecom; and Mozambique is in the process of implementing a national ICT Policy.

Given the worldwide "hype" surrounding electronic commerce, it is worth noting recent studies of the potential of e-commerce in Africa. They reveal very significant obstacles in many African countries to traditional commerce in physical goods over the Internet—primitive banking systems, poor logistics systems and time-consuming customs formalities. This points to more promising areas for e-commerce such as off-line teleservices (Data capture, digitisation of architectural drawings), and on-line teleservices (Call Centres). It also encourages an emphasis on business-to-business transactions and government procurement over the Internet, rather than business-to-consumer activity.

Chapter 2. Introduction to Rwanda

2.1 Rwanda Today

The country's current population is now estimated at 7.9 million with the majority (94%) living in rural areas and the majority of those living in urban areas in Kigali. The country's population is relatively young with 60% of the population under the age of twenty. Women constitute 54% of the population and the majority of its labour force, particularly in agriculture. At 273 people per sq. km (in 1997), Rwanda has the highest population density in Africa. The annual population growth for Rwanda is estimated at a high 3.6%.

Rwanda's economy has suffered bitterly from the ethnic-based civil wars and genocide. It is predominantly subsistence farming with over 90% of the working population actively involved in the Agricultural sector. The country depends on coffee and tea for most of its export earnings. Only 1.7% of the working population are in the Industrial sector and 7.2% in the Service sector of the economy. The 2000 GDP of Rwanda is estimated at US$ 2 billion and the per capita GDP, US$ 237. The country's total exports as a percentage of GDP is very low. In 1998 the figure was estimated at 5.6% of GDP and most of that was agricultural products.

According to the 1999 Rwandan Development Indicators, industrialisation in Rwanda started in 1978, with manufacturing (mainly for import substitution) done on very small scale and involving mainly medium size enterprises (Beer/Soft Drink, Cement and Textiles). Most of the manufactured units were for domestic consumption. The industrial sector depends largely on external supplies for raw materials. In 1998, industry contributed about 19% of GDP and provided employment to only about 10,000 people. According to the Public Investment Program 1999-2001, the development of Rwanda's industry is handicapped by: the high cost of factors of production and of imported equipment; the shortage of infrastructure and human resources that are qualified and experienced; the absence of information on existing opportunities and potentialities; inadequacy of a national framework and institutional mechanism for promotional activities; lack of a promotional structure and mechanism for exports; and low internal financing capacity and lack of entrepreneurship.

Nevertheless, Rwanda has made a remarkable recovery from the low point of 1994, with the total value of goods produced by the Primary Sector nearly doubling between 1994 and 1998[2], from 115-billion Frw to 205-billion Frw, and many other indicators showing strong growth, albeit off a low base.

The production of Electricity (hydroelectric) has grown from 31 million Kwh in 1994 to a high of 154 million Kwh in 1997, before reducing somewhat to 127 Mkwh in 1998.

The main towns in all prefectures are currently supplied with electricity from the national grid.

[2] Rapport Sur L'Evolution Economique et Financiere du Rwanda, 1997-1998: Banque Nationale du Rwanda

Chapter 3. The ICT Policy Process in Rwanda

The formal ICT Policy Process started in Kigali at a National Workshop on "Information and Communication Technology and Strategy" November 30-December 3 1998. The Ministry of Transport and Communications organised the event together with UNECA as part of its AISI programme, and with funding from UNESCO, USAID, UNDP and the Carnegie Corporation of New York. Subsequent to that a consultant was appointed to carry out a basic study of ICT in Rwanda and start a process of formulating and Implementing an ICT Policy and Strategy.

A UNECA mission to Rwanda took place August 2-29 1999 during which the process of a national dialogue with national leaders and stakeholders on the role of ICTs to support the socio-economic development process of Rwanda was initiated. This led to an October 1999 report entitled *An Integrated Framework for Socio-Economic and ICT Policy and Plan Development and Implementation for Rwanda.* This was followed in February 2000 with: *An Integrated Socio-Economic and ICT Policy and Strategies for Accelerated Development:* A GOR Policy Document for the Realization of the Vision Rwanda—To Transform Rwanda into an Information-Rich Knowledge-Based Society and Economy within Twenty Years.

Further consultations took place and culminated in a report presented to the President of Rwanda in March 2001, entitled: *An Integrated ICT-led Socio-Economic Development Policy and Plan for Rwanda 2001 - 2005.* The report represents the second phase of the Plan process and summarises the ICT policy previously tabled together with the first of four National Information and Communication Infrastructure (NICI) 5-year Plans. This, the 1st NICI Plan, is based on an eight-pillar set of strategies to be implemented over the period. The document suggests a notional budget of US$ 500 million together with broad timeframes and responsible government departments. Planned for May 2001 is a national consultative workshop to set priorities and commit responsible departments to action.

In the meantime, legislation is going through Parliament to establish an independent regulator for ICT (and other utilities) and to prepare the way for a liberalised and privatised telecommunications sector. In line with previous recommendations, key enabling structures including the National Information Technology Commission (NITC), and the Rwandan Information Technology Agency (RITA) have been established and appointments are being made. RITA is intended to act as the national implementation and coordination body and will administer the National Computing Centre, seen as being the main income generator for RITA.

The Planning Process has been thorough and provides a roadmap that can be used to realise Vision Rwanda. Implementation within the suggested timeframes represents a huge challenge that will need as much external support as possible.

Chapter 4. Connectivity and Access

4.1 Fixed Line Access

The installation of fixed lines (including wireless fixed lines) is the preserve of the monopoly operator, RwandaTel. The take-up of fixed lines has not been as fast as predicted; in the 1999 Financial Report the predicted number of fixed lines by the end of 2000 was about 54 000;[3] in fact by early 2001 only 24 612 lines[4] were installed, of which nearly 5000 were temporarily inactive mainly for reasons of non-payment. This shortfall in fixed line installation has been compensated for by the successful rollout of cellular communications (see later section).

The Telecommunications infrastructure is modern in that it consists of a fully digital backbone with microwave links to Ruhengiri, Gisenyi, Nyabisindhu, Cyangugu, Gikongoro, and Butare from Kigali. The protocol used is Synchronous Digital Hierarchy (SDH), a family of ITU standards created in an attempt to unify the different digital hierarchies at rates above 155 Mbps. In addition, RwandaTel has introduced a Wireless Local Loop (WLL) capability based on Lucent Technology and the Code Division Multiple Access (CDMA) standard. CDMA has advantages over previous wireless technologies, including Voice Activity Detection (VAD), which allows an increased number of calls to be overlaid when no activity is detected on a line. The local loop in many areas, however, still consists of copper wire.

RwandaTel has also modernised its switching capability with the introduction of Nortel (DMS 100) switches that have a capacity of 100 000 lines and can provide a variety of services such as Call Forwarding, Calling line Identification (CLI) and Teleconferencing. The plan for the year 2000 included opening a new inexpensive voice service (Voice over Internet Protocol); this does not appear to be operational yet. A new service implemented by RwandaTel is the pre-paid service account and the pre-paid card account, bringing the very successful pre-paid services pioneered by the cellular industry to their fixed line network.

According to the Annual Reports, internal efficiencies at RwandaTel have been improved by introducing computerised after-sales services, a new billing system and improved debt recovery. An over 95% increase in debt recovery is claimed, although this is not evident from the Annual Reports. Over the period 1997 to 1999 the Net Profit Before Tax (NPBT) compared to Total Revenues is as shown below (millions).[5]

[3] RwandaTel S.A. Annual Reports 1993 - 1999
[4] Personal communication, Commercial Director, RwandaTel
[5] Ibid, p 7 -10

Table 1. Net Profit Before Tax (NPBT) compared to Total Revenues, 1997 to 1999.

	1997		1998		1999	
	Frw	**US$**	**Frw**	**US$**	**Frw**	**US$**
Total Revenue (TR)	5 131	12.0	5 814	13.6	6 017	14.0
Net Profit Before Tax (NPBT)	3 664	8.5	3 221	7.5	2 753	6.4
Ratio NPBT/TR (%)	71.4		55.4		45.7	

The Net profit Before Tax is well in excess of that which could be obtained in a competitive environment, even though it has been dropping since 1997 (largely as a result of an increase in Total Operating Expenses and Depreciation).

4.2 Mobile (Cellular) Network

MTN RwandaCell is the only mobile operator in Rwanda; RwandaTel has a 28% stake in the company, with the balance being held by MTN, a South African cellular operator. RwandaCell has installed a Global System for Mobile Communications (GSM) network across the country, covering all prefectures and main towns. Although this does not provide complete coverage (i.e. there are 'dead spots'), it nevertheless covers the great majority of the population. The GSM System remains the most extensively used digital system in the world, providing handset compatibility and allowing 'roaming' to many countries. Currently RwandaCell has approximately 49 000 customers, of which about 10% are dormant at any one time. The average spend per user is approximately 15 000 Frw per month,[6] giving total revenue for RwandaCell as roughly 675m Frw. RwandaCell plans to install up to twenty new Base stations in Rwanda during 2001, of which thirteen will be in Kigali to handle the additional volumes and seven will be in the other prefectures to provide improved quality and cater for the anticipated tourist trade.

4.3 Internet Service Providers (ISPs)

Officially RwandaTel is the only commercial ISP in Rwanda, although both KIST and NUR provide such services with the approval of RwandaTel. KIST and NUR both use Very Small Aperture Terminals (VSAT) technology to provide their International bandwidth of 128k uplink and 256k downlink in each case. RwandaTel has an additional 1mb of international bandwidth.

The rates for the various available telecommunications services are presented in the Appendix. The two tertiary institutions complain about high charges for fixed line connection. Presently the price for a 64k leased line is US$ 2 500 per month, well in excess of the rate in developed countries; the commercial sector, on the other hand, believes that both KIST and

[6] RwandaCell, personal communication

NUR are parastatal organisations subsidised by the government and should not be offering ISP services on a commercial basis.

There is presently no peering point in Rwanda (where communication between local ISPs and their customers can be routed locally to avoid having to route overseas, usually to the USA). Because of the small size of the market and the lack of effective competition this is not much of a problem at present but it will need investigating as competition is introduced. There are over a dozen cybercafés in operation, mostly in Kigali. Direct Satellite access has been permitted via KIST and NUR but not via other institutions; at present a licence has to be obtained from the Department of Justice.

4.4 The ICT Industry in Rwanda

The estimated size of the industry is US$ 25 - 30 million, of which about half the revenue accrues to RwandaTel. Although no reliable figures exist, the overall growth of the industry was probably in excess of 10% in the year 2000 with much of that coming from RwandaTel and particularly RwandaCell. Most businesses are providing distribution services for multinational companies or are providing routine installation services. There is no manufacturing or assembly evident although first level maintenance is performed by some organisations.

The Structure of the ICT Industry is covered in more detail in ***Chapter 6***.

Chapter 5. Human Resources

5.1 Primary and Secondary Schools

There are 2 142 primary and 363 secondary schools in Rwanda, where 29 000 teachers teach approximately 1 500 000 pupils giving an average student : teacher ratio of 1:52. Very few schools have electricity. Apart from one private school in Kigali that has a computer lab of approx twenty machines, there is hardly any deployment of computers in Rwandan schools. The vast majority of Rwanda schoolchildren have not been exposed to computer technology in any way and no schools use computers for teaching. No public schools in Rwanda have access to the Internet and there are no trained computer teachers who could be deployed to teach basic computers in the schools. There are, however, plans to use World Bank funding to establish one secondary school in each prefecture as an ICT centre with about six computers.

5.2 Colleges and Universities

5.2.1 National University of Rwanda

The National University of Rwanda (NUR) has well-structured short, medium and long term plans to dramatically advance computer and information literacy among its students. It has several computer laboratories and requires all students to undertake basic computer training. There are approx. 4800 students enrolled and a ratio of one machine to twenty students. NUR also offers Internet access via its VSAT satellite and is in the process of linking various units across the campus via wireless connections. There is also a RwandaTel leased line connecting Butare and Kigali, but it is not in use at the moment and is very costly (US$ 2 500 a month).

Because of bandwidth limitations (256k), Internet access has to be carefully managed and is normally only available to the more senior students. NUR has a computer centre to manage all its computing facilities and provide first level technical support. Practical training programmes at NUR include network engineering, supported via the Cisco Networking Academy, and database management, supported by Oracle.

The University commenced a Bachelor of Computer Science degree programme and should graduate about eleven students next year and about thirty the year after. NUR is also a node for the African Virtual University and receives academic material from the AVU. NUR has a new campus in Kigali specifically to offer a part-time MBA programme in collaboration with Uganda's Makerere University. Thirty students are enrolled and pay about US$ 2 000 a year for tuition.

5.2.2 Kigali Institute of Science, Technology and Management (KIST)

The Kigali Institute of Science, Technology and Management (KIST) was founded in 1997 and has grown rapidly to a student enrolment of over a thousand and a faculty of 137. It has linkages with several institutions elsewhere in Africa and abroad. KIST has a Faculty of Technology and within that a Department of Computer Engineering and Information Technology. It has several computer laboratories comprising more than 200 PCs and offers

courses from basic computer literacy to diploma level training programmes in computer studies. A degree program in computer science has been launched. Student enrolment is 70, 45 and 31 in 2nd, 3rd and 4th year respectively. It will graduate its first students next year.

KIST also acts as an ISP, supporting several companies via leased lines, some modem-based home users and three or four cybercafés in Kigali. It has started a pilot project on computer maintenance and has a couple of students training in that area. KIST is a node for the African Virtual University, although there appear to be logistical and academic problems that limit the use of the facility.

5.2.3 Other Institutions

The Kigali Institute for Education trains teachers. It is working together with KIST on a project to train technical teachers. It is also engaged in a project funded by the African Development Bank to offer pre-service and in-service distance learning to secondary school teachers at ten centres around the country. KIE is also starting courses in basic computer literacy and train-the-trainer programmes.

There are eleven primary school teacher training colleges in Rwanda and IMF funding has been earmarked to establish ICT training in each one. There are also plans to use World Bank funding to revive the TUMBA Institute of Electronics and use it to offer higher-level computer technician training.

On November 14 2000 the Rwandan Ministry of Education hosted a workshop on ICT in Education in collaboration with the above institutes as well as the DFID Imfundo team, RITA and other role-players. It set out to determine educational priorities for the application of ICT and assess and cost a limited range of options for using ICT. There were several outcomes including the formation of a steering committee to consult with and advise MINEDUC and RITA, an associated Technical Committee including a secretariat, and the decision to form a high-speed national education network to be known as RWEDNET. First priority for the network was to be linking KIE and its ten secondary school locations. [The full report on this workshop is available on request].

Chapter 6. Structure of the ICT Sector and Major Users

There are not many formal organizations that facilitate, support or use ICT in Rwanda. They have been categorized as follows:

1. ICT Sector;
2. Major Users, including government ministries/departments; and
3. Institutions/Organizations that will play a central role in the Industry

6.1. ICT Sector

There are probably less than a dozen companies of significance in this sector. As far as we can ascertain, apart from RwandaTel and MTN RwandaCell, there are no ICT companies employing more than fifty people in Rwanda. Those two companies constitute a large part of the total ICT sector, which in most respects is very undeveloped.

There is clearly a significant shortage of technical staff (computer scientists, engineers, programmers, systems analysts) and most development is done out of the country. Although it is possible to 'leapfrog' technologies by installing the latest hardware and operating system software, the experience of using sophisticated applications such as Enterprise Resource Planning, Supply Chain Management, Document Management, etc. is almost entirely lacking and the user community has limited ability to take advantage of such applications.

The regulatory environment for Electronic Commerce is not yet in place, and most companies have no prior experience with Value-Added Networks (VANS) or Electronic Data Interchange (EDI), which help to create an environment where Electronic Commerce is readily accepted. Rwanda is a predominantly cash-based economy and the movement towards electronic transactions will be a profound change for most of her people.

There are no incentives in place to promote private sector investment in the ICT industry; rather a number of disincentives such as an unwieldy importation system, low levels of understanding in the community at large and a government procurement system that operates largely on price.

The private sector is particularly under-developed and needs a great deal of encouragement if it is going to form the engine for future growth of this industry. Some prominent companies in the ICT industry include: Axiom Computers, Computer Applications Limited, Afritel and Someca Rwanda. In addition to those companies, the Indigo Business Directory – Rwanda 2000 lists approximately twenty companies in the 'Computer' or 'Telecommunication' Sections. Conspicuously absent are subsidiaries of the major multinationals. For a complete list of these companies see Appendix 5.

Major brands that are sold and/or supported in Rwanda include:

Compaq /Alcatel/ IBM/ De la Rue/ Hewlett Packard/Canon/Epson

Sharp/Panasonic/Microsoft /Apple/Siemens/Packard Bell/Dell

6.2 Major Users

No large networks (> 250 on-line terminals) were identified in Rwanda. ICT companies such as RwandaTel and MTN RwandaCell are relatively heavy internal users of ICT. Other major users are Governmental or Parastatal and include:

Social Security Fund

The Fund has 85 PC's connected on a Local Area Network (LAN), responsible for administering social security benefits; a number of other applications (financial, personnel, stock control, purchasing) are also supported.

United Nations Development Programme(UNDP)

UNDP has 120 PC's on a LAN, all with Internet access, out of a total of 150 people in the organization. They run applications such as Accounting, Procurement and Investment.

National Bank of Rwanda (NBR)

The NBR is responsible for Central Bank functions such as monetary policy, collection of financial statistics, monitoring of the health of the banking system, etc. They have about 150 PC's on a LAN. There is as yet no Automated Clearing Bureau to clear inter-bank cheques; reconciliation is performed manually between individual banks**.**

Bank de Commerce de Development et D'Industrie (BCDI)

The only bank in Rwanda to have Automatic Teller Machines (ATM's) as well as a Smart Card application; the size of the in-house department is not known.

Kigali Institute of Science, Technology and Management (KIST)

KIST is making extensive use of PC's in its courses. Along with its status as an ISP and its support of cybercafés it is a major user of this technology.

6.3 Institutions and organizations that will play a central role

Rwanda is probably unique in that it has the active support of the President, the Hon Paul Kagame, in the vision of turning the Rwandan economy into a knowledge-based economy by the year 2020. An extensive planning exercise was recently completed[7] and led to a 5-year Development Plan for Rwanda[8]; this plan has proposed structures that are central to the effective pursuance of ICT development. The plan process has been dealt with in ***Chapter 3: The ICT Policy Process in Rwanda.*** The most important structures that will drive the implementation of Policy are:

[7] An Integrated Socio-Economic and ICT Policy and Strategies for accelerated Development, GOR, Feb 2000

[8] An Integrated ICT-led Socio-Economic Development Policy and Plan for Rwanda 2001-2005, GOR, April 2001

The National Information Technology Commission (NITC)

Intended to lead the process of creating the Rwandan information society and economy, the Commission will be made up of the President of Rwanda, the Prime Minister, senior Cabinet Ministers and representatives from the private sector, academia, labour and civil society. The Commission is not yet operational, although a number of appointments had been made at the time of writing.

The Rwandan Information Technology Authority (RITA)

RITA is to act as the national implementation and coordination body under the supervision of the NITC. Among its functions are to:

- Co-ordinate the development of ICT policies, strategies and NICI plans
- Co-ordinate the implementation of components of the projects as described above
- Promote and co-ordinate standards and procedures
- Co-ordinate a comprehensive HR Development Programme
- Develop and administrate the National Computer Centre (NCC), the key income generator for RITA, with the objectives of providing, inter alia:
    - Advanced ICT Education and Training
    - ICT Consultancy
    - Computer Bureau Service Provision
    - Technical staff to repair and maintain computer and network systems and to develop network systems

    And being responsible for

    - Developing and maintaining the GOR Web-site
    - Setting-up and administering GOVNET, the Government intranet
    - Promote co-ordinate and implement National ICT Awareness campaigns

For a further description of the functions of the NITC, RITA and associated structures, see the Development Plan.[9]

Private Sector Institutions

Although some private sector institutions do exist, they do not have the same ICT focus and co-ordination as is evident from government. The most important one appears to be:

Federation Rwanda du Secteur Prive (FRSP)

This is effectively a Chamber of Commerce with fourteen associations as founder members, including an Association of Information and Communication companies. The latter

[9] Ibid, p 284 - 292

association does not appear to be very active and was only mentioned once in our discussions with the private sector. FRSP was born out of a government-sponsored Chamber of Commerce and Industry in 1999 and although a move in the right direction, it will need to involve the ICT industry more directly if the Rwandan vision is to materialize.

There are other associations that may be relevant e.g. an association to promote the use of ICT in the Financial Sector. At this stage they appear to be largely fledgling organizations and it is not clear what role they will play in future.

Chapter 7. Major Areas of Interest for Sida

7.1 Present Situation

The most acute problems confronting Rwanda are political and cultural, and clearly many factors can adversely affect the ability of the ICT Industry to help propel Rwanda to its vision of an information-rich society. Although the political history of Rwanda is not the concern of this report, nevertheless the consequences of that history have an acute bearing on the ability of Rwanda to take maximum advantage of ICT. Even assuming a relatively smooth political future, there are numerous variables that need to be considered. The factors that are of particular importance are:

- Very uneven development between Kigali and most of the rest of the country with respect to all aspects of infrastructure and human resource development. This is highlighted when using the Readiness for the Networked Society assessment model where rural areas rate a 1 (unprepared) on every category and Kigali (and to a lesser extent Butare) shows progress on many;

- Even within Kigali, the concept of treating information as a resource is foreign to most people and the organic and evolutionary growth that characterises the development of ICT in Western Europe and the United States has not happened;

- An appreciation of the implications of the 2001-2005 5-year NICI plan is limited to a small elite group within Government. It is the opinion of the consultants that Rwanda has seriously under-estimated the effort needed to develop the necessary human resources to fulfil the 5-year NICI plan, particularly bearing in mind the present state of education within Rwanda; and

- For a considerable time (at least 5-10 years), the impact of ICT in most rural communities will be close to zero and the pressing problems of those communities will not be solved using ICT. The high emphasis on the service sector versus the agricultural and industrial sector as stated in the Vision for Rwanda runs the risk of further exacerbating the urban-rural divide in the short-to-medium term.

7.2 Developments

The active and enthusiastic support of the President of Rwanda for an ICT-led development process is an extremely strong positive factor but carries the danger of a top-down approach where unrealistic targets are not questioned and cannot be implemented. Our assessment of the planning process to date is that it is **not** an inclusive process and that the necessary understanding and buy-in on the part of most of those responsible for implementing the programme has not happened. It may be that Rwanda has neither the time nor the resources for such an inclusive process; that must, however, exacerbate its chances of failure.

7.3 Main Obstacles: Issues Outside of the Industry

The government of Rwanda has recognised the key development challenges facing the country; those are enumerated in the Policy document of February 2000 [10]. From the perspective of the ICT industry, the main issues in the short-to-medium term are seen to be:

- Lack of sufficient and appropriate education at secondary school and tertiary level, leading to an inadequate supply of scientifically and technically trained people, especially for technical support of equipment and software;
- A user community with little experience of ICT opportunities and in particular in the automation of business processes;
- Poor supporting infrastructure. Industries that could take advantage of ICT to market their products (e.g. Tourism) have many other hurdles to overcome;
- A weak private sector;
- Poor and/or inexperienced institutional capacity; and
- The banking system, in particular, is seriously undeveloped and needs to be upgraded so that the widespread use of credit-card facilities, cash withdrawal from ATM's and, in the longer term, the adoption of Internet banking can be effected.

7.4 Main Obstacles: Issues within the Industry

i) ***Lack of regulatory certainty and poor communication of the status of Regulations/Legislation***

Although there is a general commitment on the part of the GOR to deregulate the telecommunications industry, for example, there appears to be no clarity as to how this deregulation will be managed. The process has not been transparent in that most role players are unfamiliar with or are misinformed about the status of various laws or decrees. This is coupled with a general lack of regulation within the industry at present, encouraging short-term opportunistic behaviour.

ii) ***Importation of Product***

The present SGS system is slow, clumsy and expensive and is not appropriate for a fast-moving industry such as the ICT Industry.

iii) ***The Government Tender Process***

In common with many countries, the Tender process is paperbound, bureaucratic and slow. Officials on the Tender Board usually have no or little appreciation of ICT leading to, at times, inappropriate purchases based on price.

[10] An Integrated Socio-Economic and ICT Policy and Strategies for accelerated development, GOR, February 2000, p 3-4

iv) ***Lack of trained ICT personnel across the board***

7.5 Main Opportunities

In this environment there are many interventions that could be attempted. In discussions with Sida,[11] we understand that projects should fulfil certain criteria, viz.:

They should not be very resource demanding on Sida personnel because of the lack of on-the-ground presence.

The interventions should have a high probability of success.

Although linked to objectives within the NICI process, they should be able to provide a positive outcome independent of the success or failure of this process, since Sida can have limited influence over it.

Bearing the above in mind, the consultants see the main opportunities in the following areas, elaborated on below:

1. Human Resource Development;
2. Pilot Projects within Government;
3. Private Sector support;
4. Donor Coordination;
5. Rural ICT Centres; and
6. Plan assessment methodologies.

7.5.1 Human Resource Development

There are a number of specific interventions that would have a positive effect, including:

- Increasing the capacity of existing successfully operating institutions. Here the two major higher education institutions, KIST and NUR are obvious candidates. Both institutions require:
    - Additional equipment
    - Staff training
    - Curriculum support
    - Supporting new training initiatives

  Here a prime candidate is the proposed Tumba Institute of Electronics situated just outside of Kigali, where the express intention is to train numbers of ICT technicians in skills that will be much in demand as the NICI Plan is implemented. Other options

[11] Bengt Oberger, personal communication

are to support computer education targeted specifically at government departments by providing funding for curriculum development or providing internationally recognized certifications such as the International Computer Driving License (ICDL).

- School networking programmes such as the SchoolNet initiative operating in South Africa and Namibia (already funded by Sida) and now throughout many other countries in Africa participating in SchoolNet Africa.

7.5.2 Pilot Projects within Government

One clear difficulty is the lack of model projects that can provide experience and inspiration to grow ICT into Rwanda. In particular, the Ministry of Public Works, Transport and Communications (MINTRACO), which is the lead Ministry in the development of the NICI Plan, has little practical experience of the territory.

A promising intervention could be the introduction of a Government-to-Business Electronic Commerce Pilot in this department, whereby suppliers would be encouraged to transact with an electronic procurement system.

A further intervention could be support in establishing the Government Intranet (GOVNET) mentioned in the NICI Plans.

The planned introduction of a GOR Web-site through RITA is another bounded project that could be supported

7.5.3 Private Sector Support

Various projects would have a positive spin-off here, including

i) A project to examine the current importation system and to propose a comprehensive plan to streamline it.

ii) A project to investigate the banking system in Rwanda and to propose steps to increase productivity in this sector.

iii) Funding and Support for FRSP to ensure that Government/Private Sector interaction is optimised.

7.5.4 Donor Coordination

In an environment where there are many urgent projects to implement and where a high proportion of the necessary funding is coming from the donor community, Rwanda can ill afford the wasteful use of resources that uncoordinated donor funding implies. Sida could take the lead here and offer to define, establish and motivate a Donor Council that would address this.

7.7.5 Rural ICT Centres

Here the experience of other countries in the establishment of a variety of centres that endeavour to bring some of the benefits of ICT to under-privileged communities can serve as

the basis for supporting a project in Rwanda. The establishment of a Universal Service Agency and Fund, for example, is a possible means of providing for the financing of such projects.

7.5.6 Plan Assessment Methodologies

A clear requirement going forward is the need to measure the impact of the NICI process as it unfolds. Without agreed baseline measurements, this is going to be difficult to do. There are now a number of assessment tools on the market, of which the assessment tool used in this survey is but one. A project to identify the most suitable assessment tool to use in Rwanda would be beneficial.

APPENDICES

Appendix 1: Key Ratios

Description	Value
Operators	
Number of fixed line telecom operators	1
Number of mobile line telecom operators	1
Number of Internet Service Providers	3 (RwandaTel, KIST, NUR)[12]
Possible Alternative Suppliers of Bandwidth	Satellite, but restricted[13]
Number of Internet Points of presence	Not available
International Bandwidth	1.5 mbps
Number of cities with local modem pools for dial-up	Not available
Population of Rwanda	7 900 000
Users	
Number of Fixed Lines installed	24612
Number of Fixed Lines per 1000 inhabitants	3.1
Temporarily inactive	4996
Active Fixed Lines	19616
Expansion Rate: Number of new lines/year	2001: 30 000[14]
Percentage of Digital Switchboards	100
Mobile	
Number of mobile phone subscribers	49000
Geographical coverage of mobile networks	Major towns in all 13 prefectures
No of mobile telephone subscribers per 1000 inhabitants	6.2
Expansion Rate: number of new subscriptions/year	Dec 98 – June 2000: 19 000 June 2000 – April 2001: 30 000
Internet	
Number of Internet Subscriptions	2720[15]
Number of Internet Subscriptions in the Capital	2500[16]
Number of Internet Subscriptions per 1000 inhabitants	0.34
Number of new Internet Subscriptions last year	N/A
Number of Internet Hosts	362[17]
Number of Internet Hosts per 1000 inhabitants	0.05
Number of new Internet Hosts last year	103[18]
Number of Internet Cafes	12
Number of Multipurpose Community Centres	N/A
Education	
Number of Primary Schools	2142
Number of Secondary Schools	363
Teachers	29 000
Students	1 500 000
Student/Teacher Ratio	51.72
Tertiary Education:	
Students (NUR)	4800
Students(KIST)	1030
Students in Final Year of ICT Courses:	Not available
NUR:	11
KIST:	31
Student/Academic Staff (KIST):	8:1
Other: Electricity Production (Million Kwh)	127 (1998)

[12] KIST and NUR are closely associated with RwandaTel
[13] Private Sector needs permission to use Satellite
[14] RwandaTel, personal communication, Finance Director. Unlikely to be met
[15] Baseline Survey performed by KIST students from Dec 2000 to Jan 2001
[16] Estimate based on above report
[17] Using January 2001 data from www.isc.org
[18] Based on difference between Jan 2000 ISC Survey and Jan 2001 ISC Survey

Appendix 2: Costs of Telecommunication Services

Service	Installation		Ongoing Costs		
	Frw	**US$**	**Period**	**Frw**	**US$**
Fixed Line	14 500	33.80	For 1st 3 mins	14	0.03
			For subsequent 2 mins	14	0.03
Fixed Wireless	38 000	88.58	As Above		
Leased Line (64k)			Monthly charge	1 072 500	2 500
ISDN	13 800	32.17	Monthly charge plus call charges as above	10 000	23.31
Internet Accounts			Monthly charge plus call charges as above	20 000	46.62

Appendix 3: Costs of Mobile Calls (per minute)[19]

From Mobile to	Time Band	Plus[20]		Extra	
		Frw	US$	Frw	US$
Fixed	Peak[21]	95	0.22	126	0.29
Fixed	Off Peak[22]	64	0.15	97	0.23
Mobile	Peak	85	0.20	115	0.27
Mobile	Off Peak	64	0.15	97	0.23
Mobile	Discount[23]	40	0.09	40	0.09
Regional	Peak	442	1.03	442	1.03
Regional	Off Peak	442	1.03	442	1.03
Monthly Access		12 000	27.97	5 000	11.66

[19] MTN RwandaCell Tariff Sheet, The New Times, April 16 – 19 2001
[20] Plus and Extra are two Tariff Plans; both are available as Prepaid or Postpaid
[21] PeakTimes: Monday to Friday, 0700 to 1900
[22] Off Peak Times: Monday to Sunday, 1900 to 2300; Public Holidays
[23] Discount Times: Monday to Sunday, 2300 to 0700; mobile-to-mobile only

Appendix 4: Readiness for the Networked World

The Table below represents the result of an assessment carried out by participants in a workshop in Kigali on the 2nd May 2001. Small groups of 2 - 6 people were given aspects (e.g. Network Access) to assess. The results are representative of informed opinion in Rwanda and represent, with some small variations, the consultant's views as well[24].

Note that the rating in the 'Kigali' column applies to the entire category, and that the ratings are on a scale of 1 to 4, where 1= unprepared and 4= fully prepared.

In the assessment guide, suggested values for the Key Performance Indicators are contained in the text e.g. to be rated a '4' or fully prepared in the Information Infrastructure Aspect, Teledensity would need to be 40 + mainlines per 100 people and mobile penetration would be 14% of the population or more.

Aspect/Category	Key Performance Indicators	Kigali
Network Access		
Information Infrastructure	Teledensity Mobile Penetration	2+
Internet Availability	Inhabitants/ISP Public Internet Access Competitive leased Line Providers Connection Reliability	3
Internet Affordability	Rates vs Income Competition	3

[24] A full description of the Assessment Methodology can be found at: www.readinessguide.org

Aspect/Category	Key Performance Indicators	Kigali
Network Speed and Quality	Success Rate Dropped Connections Faults/10 Mainlines Xfer Speeds – Dial-up Xfer Speeds – Leased Line Backbone Capacity Packet Loss	3
Hardware and Software	Local Vs Imported Affordability	2-
Service and Support	Mainline Installation Time Problem Resolution ICT Personnel	3
Networked Learning		
Educational Access to ICTs	Access at Different Levels Computers/Student Availability of Computer Labs Latest technology Networking Access to Internet	2
Enhancing Education with ICTs	Training of Teachers Use by Teachers/Pupils Sophistication of Use Included in Curricula	2+
Developing the ICT Workforce	Opportunities for Training Scope of curricula On-Line Learning	2

Aspect/Category	Key Performance Indicators	Kigali
Networked Society		
People and Organisations Online	Awareness of Internet Use of Internet (%) Gender of Users Domains/1000 people Extent of advertising in traditional media	2
Locally Relevant Content	Number and Dynamism of local websites Use of Local languages Sophistication of Use Web-Based Training Opportunities	2
ICTs in everyday Life	Telephone Access and Usage Household commerce use Public Internet Access Options	2
ICTs in the workplace	Efficiency Gains through use of ICT Networking Extent Employee Internet Access Own e-mail accounts Publicise e-mail addresses	2
Networked Economy		
ICT Employment Opportunities	Requirement for Technical Skills Economy based on 'Knowledge Worker' ICT seen as Strategic by Organisations	1+
B2C Electronic Commerce	Use of Websites by Business Volume of online Retail	1

Aspect/Category	Key Performance Indicators	Kigali
B2B Electronic Commerce	Efficiencies in B2B Electronic Commerce Incorporation of Web into Key Processes Order processing and delivery executed electronically Electronic B2Blarge and growing	1
E-Government	Ministries post key Information on Web Interactive Government websites Procurement/other interactions online	2
Network Policy		
Telecommunications	Liberalisation Universal Access Options for Services Incumbent networks open to competition Competition in mobile Value-Added Services	2
ICT Trade	Tariffs on ICT equipment Trade in services liberalised No additional tariffs on e-commerce Foreign Direct Investment	2

Appendix 5: Companies in the ICT Sector

Other Companies listed in the Indigo Business Directory (Rwanda 2000) under 'Computers' are:

Afriplus	Dwarkesh Holdings
Alpha-Soft	F.M. Informatique International
Arkay International	Kalyankole and Sons
AZ Impex	Multilink
Business Machines and Office Products	Rwandex S.A.
BCS Informatique	SDV – Transintra
Compec Rwanda	Sofitec
Compulec Rwanda	Someca Rwanda
Creacom	Typomeca
	Venus Engineering

Companies listed under Telecommunications Equipment not already mentioned are:

Entregele

Intersec Security

MTN Rwandacell

N.A.H.V. Rwanda

Socomerwa – Groupe Chanic

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