



2007 Rwanda
Telecommunications
Sector Performance Review
a supply side analysis of policy outcomes

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Rwanda

Executive Summary

The following report presents the status of ICT development in Rwanda as an outcome of the national policy regulatory environment and measured in terms of indicators for access and penetration resulting from policy and regulatory measures. The report is part of a wider continental study undertaken by Research ICT Africa! Network and should be read in conjunction with the comparative analysis of the country reports available at <http://www.researchICTAfrica.net>.

Rwanda is amongst the few African countries that embarked on developing an integrated ICT Policy in the late 1990s with a clear vision of making ICT an integral part of its global socio-economic development plan, with the hope that the country would move from an agricultural-based economy into a knowledge-based economy through the development of competitive service-based industries.

The country has gone through major economic reforms, including telecommunications reforms, that aimed at increasing the competitiveness of the telecommunications industry and attracting foreign investment. Amongst those reforms was the establishment of an independent regulatory body known as the Rwanda Utility Regulatory Agency (RURA). The main mission of RURA is to promote fair competition, improve quality of services, create an enabling environment to attract investors with the intention of improving the provision of services to citizens in accordance with the Universal Access obligations set by the International Telecommunication Union.

Despite a high level of political commitment to take ICT development forward as a priority, the current trend in the sector's development reveals several gaps that need to be addressed if the country expects major returns within the coming 20 years. Those gaps are related to issues of access to and affordability of ICT services in addition to weak institutional capacity, as well as institutional structural challenges. Meanwhile, in order to address those gaps, a number of programmes and projects are underway within the National Information and Communication Infrastructure Plan (NICI II Plan) framework. These focus on increasing network access around and outside the country over satellite and fibre technologies, increasing the efficiency of government service provision through a variety of programmes, and establishing applications in support of good governance and poverty alleviation, with special attention

to the development and transformation of the rural communities through the adoption and usage of ICT.

The report is structured as follows: It starts with a general overview of Rwanda and its macro economic environment. It breaks the environment down to explain the social, economic and political context of the Telecommunications sector in the country. This is followed by an examination of the regulatory environment through the use of a perceptions survey methodology referred to as the Telecommunication and Regulatory Environment (TRE). Some current initiatives to improve access to ICTs are reviewed before the conclusions and recommendations are presented.

Background

Rwanda envisages its economy becoming middle income by the year 2020 through transformation of the economy from predominantly agricultural to one that is information rich and knowledge based. The Government has decided to use ICT as a tool to reach this developmental goal. The vision document has been made operational through the national policy document widely known as the National Information Communication Infrastructure Plan (NICI 1 (2001-2005)). Rwanda is currently implementing NICI II (2006-2010).

Although African policymakers have broadly accepted the developmental potential of ICT, there has been hardly any data or analyses on which to base informed decisions. The research that has been undertaken and used in order to understand policies and ICT programmes has been based on what has worked in developed countries, where the context is very different from reality in the developing world.

This research seeks to review performance in order to measure the impact of policy and regulatory strategies against national ICT objectives for Rwanda. In general, this paper explains the relationship between policy and regulation frameworks and the development of information society in Rwanda.

STUDY METHODS AND OUTCOMES

The methods used to achieve the objectives of this study are straightforward. The researchers used desk research to obtain background socio-economic information on Rwanda, and then proceeded to review previous studies of ICT in Rwanda in order to obtain reliable baseline data. They contacted major stakeholders in ICT in the public and private sectors and set up times for semi-structured interviews. Interactions with major telecommunication operators, the Regulator, as well as the Ministry of Finance and Economic Planning, allowed the researchers to gather the various data needed in this report. Lastly, there were data and analyses that inspired the researchers, including reports from David

Butcher from New Zealand and the World Bank reports on ICT development in Rwanda.

COUNTRY BACKGROUND

Rwanda is a small, landlocked country, situated south of the Equator, at a latitude between 1.04° and 2.51° south and at 30.53° longitude east. It is located in the Great Lakes region in East Africa. According to the general population and housing census of Rwanda (2002), the total population is 8 128 553. Rwanda is still one of the most densely populated countries in Africa with an extremely high growth rate of about 3%. The per capita GDP of Rwanda is US\$230 with 60% of the population living below the poverty line. Rwanda's economy is largely agricultural, accounting for about 46% of GDP whereas the input of industry and services are 20% and 34% respectively. The main export products are tea and coffee.

According to the Ministry of Finance's statistics, GDP growth has recovered from 0.9% in 2003 to 4% in 2004 despite significant energy shortages. The recovery has mainly been driven by growth in the construction, transport and information and communications sectors. Rwanda has greatly benefited from Highly Indebted Poor Countries (HIPC) debt relief which has led to a reduction in the debt-to-export ratio to 150% by the end of 2003. Additional debt relief will be forthcoming under the Multilateral Debt Relief Initiative (MDRI). Relief from both the World Bank and IMF under the MDRI has resulted in a further reduction of Rwanda's debt-to-export ratio to 58.5% by the end of 2005. However, given its low export base, the country remains heavily burdened by debt and will definitely require grant financing for a period of time.¹

Rwanda faces an enormous challenge from the lack of skilled manpower and lack of reliable electrical and water supplies which have adversely impacted the health and education sectors. This makes it difficult to serve the most vulnerable poor people. The illiteracy rate is estimated to be about 50% among adults living in rural areas. 83% of the population lives in rural Rwanda. The emerging private sector is rapidly growing, particularly in the fields of construction, telecommunications infrastructure, and ICT. Rehabilitation of the banking sector, the easing of restrictions on trade, the establishment of a streamlined accounting system, strengthening of the independence of the central bank and increasing privatisation, all coupled together mean hope for Rwanda's current challenges.²

1 [Online]. Available. www.minecofin.gov.rw .

2 [Online]. Available. www.statistics.gov.rw .

Policy and Regulatory Environment

As in many other sectors, the time line for ICT sector development in Rwanda in general and telecommunications in particular can be divided into two major periods: the periods before and after 1994. The first period is characterised by a centralised and government-based telecommunication sector, where the Ministry of Telecommunication played both the role of service provider as well as the regulator until 1993 when a government-based company known as Rwandatel was established with a semi autonomous status.

After the civil war and genocide in 1994, the main challenges in telecommunications development were to rehabilitate the telecommunications infrastructure damaged during the 1994 war and rebuild the government-owned company from scratch, as many of its employees had been either killed or exiled. Rwandatel was the only telecom player on the ground until 1998 when MTN Rwandacell entered the market with Rwandatel as one of the main shareholders as well as the host of the main switches and related equipment. (See Annexe 1 for the milestones that occurred during the period from 1994 to date as well as some projections for 2007 based on interviews made with policymakers as well as the managers of major telecom companies.)

POLICY FRAMEWORK

The ICT sector is seen in Rwanda as an engine to support economic growth. The government of Rwanda has embarked on a series of policy and regulatory changes in the ICT sector in the hope that the country will take the lead in transforming its traditional trends from an agriculture-based economy to a service-based economy within the next 20 years.

The ICT-2020 policy sets out the elements of the government's ICT policy and strategies within the context of the Government's broad socio-economic development objectives in the 20-year time frame in Vision 2020. In formulating its ICT 2020 policy the government is guided by the principle that, if Rwanda is to take full advantage of the opportunities of the information age and develop a vibrant multi-sector information and knowledge economy, it should not be just a consumer of ICT goods and services but also a producer and developer of the technology.

The Government will implement this ICT Policy over a period of 20 years (up to 2020) through the implementation of five-year NICI Plans in four phases. The first, second and third NICI Plans will emphasise the exploitation and utilisation of ICT products and services to support the delivery of government services and the activities of various sectors of the economy. The fourth NICI Plan puts emphasis on the production, development and delivery of ICT products and services. Each of the NICI Plans will therefore have elements of ICT utilisation and exploitation as well ICT production and development. The first, second and third NICI

Plans focus on programmes, projects and initiatives that promote the utilisation and exploitation of ICT in the society and economy while the fourth NICI Plan changes the emphasis to programmes, projects and initiatives targeted at accelerating the development of the ICT production sector's production of ICT goods and services for the domestic and the export market.

The adoption of socio-economic development policy in respect of the ICT 2020 policy framework will facilitate the realisation of the Vision for Rwanda by developing Rwanda's information society and economy. The Government is therefore fully committed to implementation of this integrated socio-economic development and ICT policy within the context of the Vision for Rwanda. By the year 2020 Rwanda's predominantly agricultural economy will be transformed into:³

- A middle-income economy dominated by the trading in ICT products and services;
- An economy characterised by a large commercial service sector with a reasonably large and vibrant ICT service sub-sector and industry;
- An economy in which the majority of the working population is either directly or indirectly involved in information and communications related activities;
- An economy in which a reasonably large proportion of the population has access to information and communications technology products and services.

NATIONAL INFORMATION AND COMMUNICATION INFRASTRUCTURE PLAN II (NICI PLAN II)

The Second NICI plan is based on the Vision for Rwanda (VfR) with three components:

- (1) Improving the standard of living of Rwanda by enriching social, economic and cultural well-being through the modernisation of the economy and society;
- (2) Developing Rwanda into a middle-income country by Year 2020; and
- (3) Modernising the Rwandan economy and society by using ICT as an engine for accelerated development, economic growth, national prosperity and global competitiveness.

Eight strategies are articulated to implement the mission and sub-missions of the policy:

- Transform Rwanda into an IT literate nation;
- Encourage the deployment and utilisation of ICT within the economy and society;
- Improve the efficiency of the Civil and Public Service;
- Improve the information and communications infrastructure of Rwanda;

³ http://www.rita.gov.rw/laws/ict_policy.html

- Transform education using ICT to improve accessibility, quality and relevance;
- Improve human resource capacity to meet changing needs of the Rwanda economy;
- Develop the laws, institutions and regulations to support wide use of ICT;
- Facilitate national reconciliation and reintegration through ICT interaction.

The expected quantifiable results from these strategies are:

- A progressive reduction in the contribution of agriculture to the economy from the current 75% to about 50% by 2015 and 40% by 2020; and
- At the same time an increased contribution from the services and industrial sectors. (The ICT sub-sector was estimated in 2000 at about 10% of the economic contribution of the industrial sector).

In summary, the goal is to make Rwanda a Predominantly Information and Knowledge Economy (PIKE), thereby reducing the role of the agriculture sector as a major contributor to the economy.

Regional and International Policy and ICT Initiatives

Following a long struggle starting in 1996, Rwanda has finally been admitted to the EAC this year (2006). Kenya and Uganda are key trading partners for Rwanda and it therefore makes sense to formalise these ties through EAC membership. Rwanda is also a member of the Common Market for Eastern and Southern Africa (COMESA). It benefits from membership in the Association of Regulators for Information and Communication in Eastern and Southern Africa (ARICEA) and from the COMESA ICT policy that was developed to serve as a policy model for the harmonious development and application of ICT within member states with the view of turning COMESA itself into an information society. The policy framework focuses on providing affordable, ubiquitous and high-quality services, building a competitive regional ICT sector, and creating an enabling environment for sustainable ICT diffusion and development (Butcher 2006). However, the regional framework does not provide guidelines and approaches for broadcasting, Internet and postal services, nor applications such as e-commerce, e-education, e-government, e-agriculture and e-health.

In order to achieve the above objectives, member states including Rwanda are encouraged to adopt new approaches that can enable interconnectivity between all operators and service providers within the region, promote universal service/access, encourage competition in the sector through the removal of barriers to entry, and establish an appropriate licensing regime that is transparent and conducive to investment

in the sector. However, these official efforts towards developing harmonised policies and integrated markets have been pre-empted by commercial initiatives to remove roaming charges in the East African region and treat all calls in the region as local calls.

As part of its admission to the EAC, Rwanda will be required to negotiate with members on key areas such as market access and hence ICT policy. One of the major ICT initiatives that is supported under EAC is the East African Submarine Cable System EASSy project which will be discussed in detail below.

LEGAL FRAMEWORK

The current Telecommunications Law in Rwanda was passed by the Transitional National Assembly in 2001. This Law is comparable to laws in many other countries passed at, or close to, that time. It grants the Republic the authority to regulate Telecommunications and sets up a regulatory board to carry out that function. It requires all operators of telecommunications services to be licensed and creates individual licences and standard licences. Significantly, it allows the Regulatory Board to make alterations and additions to licences and notes that some services do not need licences. The Law requires operators to provide any natural person with connection to a public telephone service and sets a deadline within which connections must be provided.

INSTITUTIONAL ARRANGEMENTS

The key institutions in the Telecommunications Sector in Rwanda are:

MININFRA:

This is the government ministry in charge of telecommunications and is known as the Ministry of Infrastructure. Its main priority in 2006 has been to review the Telecommunications Law of 2001.

RWANDA UTILITY REGULATORY AGENCY (RURA):

The agency began operations in January 2003. Its main objective is to regulate operators that supply telecommunication networks and/or services. RURA is a multi-sector regulator also responsible for the regulation of energy, transport, communications, water and waste management utilities. RURA's activities in ICT have been associated with issuing radio communications and telecommunications licences and tariffs as well as analysing interconnection compensation between MTN Rwandacell and Rwandatel. This board acted as mediator to help the two operators find an intermediate solution to that problem. In addition, the board decided that each operator shall contribute 2% of its turnover towards the Universal Access fund (UAF).

RURA has an alarming shortage of human capacity to be able to fulfill its mandate. It is worth mentioning that for the last 12 months RURA has had only one person working on telecommunications issues. It needs more skilled personnel from all fields of expertise to staff this division.

RWANDA INFORMATION TECHNOLOGY AUTHORITY (RITA):

RITA was established to serve as a national coordinator to support the development and the implementation of the NICI Plans. It has responsibility for coordinating any other ICT initiatives and projects that aim at achieving the main objective of transforming Rwanda into an information rich society.

These key institutions demonstrate that Rwanda is determined to succeed through its firm decision to use ICT as a tool to achieve its developmental goals. The open competitive telecommunications market being developed, the emphasis on taking a proactive approach to developing trade relationships, the effective participation in regional and multilateral organisations and the ICT strategic plan leave no doubt that there is a very bright future and a hope that the underlying core goals will be achieved.

Market Structure

Telecommunication services in Rwanda have been provided by one fixed and one mobile company. However, the Rwandan Government through RURA has now issued a mobile licence to Rwandatel and a fixed licence to MTN Rwandacell. The following section presents the current services offered by each telecommunication company in Rwanda.

Sub Heading RWANDATEL: This company has been the government-owned incumbent fixed-line operator since 1993. Currently the company belongs to Terracom, an American-based company that was created in 2004 as an Internet service provider in Rwanda. Terracom's core business has been to lay fibre optics across the country and install wireless Internet in many schools and communities. The company is rolling out a nationwide CDMA network that will allow provision of both Internet and mobile services.

Sub Heading MTN RWANDACELL: Initially a mobile operator, Rwandacell mainly deals with supplying mobile services and is now offering Internet services via its cellphone network (GPRS). The operator is ready to begin the roll-out of wireless broadband data services through WiMax. With its new fixed-line licence the company has started offering fixed-line services as well.

Sub Heading ARTEL COMMUNICATIONS: This operator has mainly been involved over the last four years with rural telephony through its satellite communications network. The company is now shifting to Internet service provision targeting big consumers. The company, through government funding, is planning to acquire around 100 MBps capacity over satellite from Intersat this year and will be selling bandwidth to other ISPs and government institutions at a very competitive price according to the Minister of Communications and Energy (New Times, 15 January 2007).

TABLE 1: SUMMARY OF THE STATUS QUO OF THE TELECOMMUNICATIONS SECTOR AS AT 2006

Telecommunication services	Policy
Fixed lines	Rwandatel/Terracom has been the major telecom operator in Rwanda providing voice telephony and Internet services. MTN Rwandacell has also been licensed to offer the fixed-line services. Artel was a “universal access” based company providing fixed-line telephones and the Internet over satellite mainly in remote areas. The government is investing in Artel to make it a whole sale Internet company servicing government institutions as well as other ISPs by offering bandwidth at low price.
Mobile Services	MTN Rwandacell is the main private cellphone company established in 1998. In October 2005, a new mobile licence was awarded to Rwandatel when it was privatised.
Internet Service Providers (ISPs)	Rwandatel/Terracom is the major Internet Provider. Three other players are in business: MTN Rwandacell; Artel, (licensed to provide voice and Internet in underserved areas); ISPA, a small ISP launched in 2005 with the main focus on wireless connectivity for corporate customers. Two academic institutions (Kigali Institute of Science and Technology and the National University of Rwanda) have also been issued free licences to provide Internet services over VSAT for academic and research purposes.
Cyber Cafés and Community Centres	500 Cyber cafés are estimated to be operational throughout the country with 75% located in the capital, Kigali. There is no licence required to operate a cyber café. Community Information Centres (CIC) are being deployed in remote areas and are heavily supported by both the government and international organisations.
Call Centre Services	MTN Rwandacell and Electrogaz, the power company, have call centres for their own customers. In addition, Business Communication Service (BCS) has a call centre business which is used to service Tuvugane and its own taxi business as internal clients. It is looking for other companies locally to develop a larger customer portfolio for the call centre.
VSAT	20 Broadband VSATs are operational in Rwanda. The major owners are international organisations, ISPs and higher educational institutions. The licence fee is US\$5 525 per year plus 15% of the monthly satellite segment fee. Around 400 narrowband VSATs have been deployed by Artel Communication Company in the countryside.
VoIP	VoIP is not legal. The current licences allow MTN and Terracom to use and offer VoIP services, as their licences are all-encompassing. However the legalisation of VoIP by the regulator is still at the preliminary ideas stage.

Investment and Market Share

This section studies the market share and market investments in the ICT sector in Rwanda. Furthermore, it discusses access to ICT services and the cost of ICT usage in the country. The table below provides an overview of telecommunications investment growth and generated revenues as well as direct job creation. The data was collected from MTN through annual reports and from Rwandatel through interviews. The interviews cannot be fully validated since significant changes were occurring within Rwandatel at the time they were conducted (the company was being integrated into Terracom). When the mobile data is considered alone, the level of investment has been significant, especially in the expansion of the mobile network backbone around the country as well as the reinforcement of the base stations in the main cities like Kigali. On the other hand, the company is making a significant return on investment despite power shortage issues that have negatively affected the telecommunication infrastructure around the country.

The main issue for operators today is linked to the low level of penetration, especially in the semi-urban and rural areas. Current mobile penetration rate is around 3%, far behind the average rate in the region (eg Uganda, Kenya). The city of Kigali records 60% of mobile subscribers; however, it only covers around 10% of the population. “Tuvugane” public phones were used as a strategy to open up access to remote areas using mobile technology but 90% of Tuvugane dealers operate in the major cities or semi urban areas.⁴

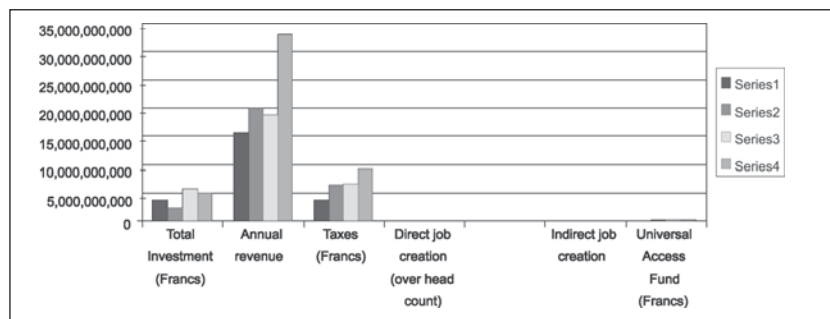
TABLE 2: SOCIO-ECONOMIC PERFORMANCE OF THE TELECOMMUNICATIONS SECTOR IN RWANDA

Socio Economic Indicators	2003	2004	2005	2006
Total Investment	3 723 085 000	2 306 143 000	5 665 153 000	5 026 461 000
(RW Francs)	(US\$6.8 million) ⁵	(US\$4.2 million)	(US\$10.3 million)	(US\$9.1 million)
Annual revenue	15 663 469 000	20 056 201 000	18 812 518 000	33 144 313 000
(RW Francs)	(US\$28.5 million)	(US\$36.5 million)	(US\$34.2 million)	(US\$60.2 million)
Taxes	3 735 804 213	6 512 211 986	6 607 008 574	9 121 399 468
(RW Francs)	(US\$6.8 million)	(US\$11.8 million)	(US\$12 million)	(US\$16.6 million)
Direct job creation (over head count)	428	481	545	352
Indirect job creation	N/A?	N/A	N/A	5 820
Universal Access Fund	N/A	171 774 695	166 202 866	295 344 085
(RW Francs)		(US\$0.3 million)	(US\$0.3 million)	(US\$0.5 million)

Source: RURA
N/A? means “Not Available”

⁴ This was from an interview with the Distribution Manager MTN Rwanda.

⁵ Approximate values only, based on 1US\$=550RWF



ACCESS TO ICTs

The availability of services involves aspects of both access and affordability.

MOBILE AND FIXED

The main telecommunications services currently available in Rwanda are limited to mobile, fixed and the Internet. While the fixed services have declined over the past 10 years, mobile service has grown rapidly from its launch in 1998 with an annual subscriber growth rate between 40% and 60% from 2003 to 2006. Meanwhile the mobile teledensity is still very low at 3%, one of the lowest in the region.

The issuance of a second mobile licence in 2005 was expected to increase the rate of mobile subscribers by bringing competition between the two mobile operators, MTN and Terracom-Rwandatel. Despite its very competitive price (relative to MTN, but still high by continental standards), Terracom-Rwandatel mobile services have not yet taken off. Only a few thousand subscribers have been recorded since May 2006 when the company launched its new mobile services over CDMA technology.

TABLE 3: INCREASE IN THE NUMBER OF MOBILE AND FIXED SUBSCRIBERS

Company	Service	2001	2002	2003	2004	2005	2006
Rwandatel	Fixed Lines	21 458	25 105	25 565	22 972	23 903	21 197
	Public Telephones				3 933		
MTN Rwandacell	Mobile Lines	44 117	82 391	97 261	137 271	219 657	303 612
	Public Mobile phones				1 457	3 500	5 000
ARTEL		0	60	304	452	490	490
TOTAL		65 575	107 556	123 130	166 085	244 050	330 299

Source: RURA Annual Reports 2004, 2006

Teledensity is estimated at 2.09 per 100 people

For the fixed network: 0.3 per 100

For the mobile network: 2.9 per100

INTERNET AND DATA MARKET

The Internet is likely to be the major emerging service over the coming five years. Infrastructure development is increasing around and across the country with MTN Rwanda and MTN Uganda to connect over fibre, and the EASSY project. More Internet service providers are likely to enter the market and offer a variety of services and applications in support of the implementation of the NICI Plan II.

The demand for data services as a whole and the Internet in particular has grown over the past few years and is expected to be even bigger over the coming years. This is due to the fact that the implementation of NICI Plan II is focused on e-government applications as well as network infrastructure development. The major operators, MTN and Terracom-Rwandatel, are involved in developing national infrastructure backbone using fibre optic, WiMax and CDMA technologies. In terms of subscriber growth, the number of individual subscribers has not yet taken off despite the numerous technological options available as alternatives to traditional dial-up subscriptions over copper, which is limited due to the shortage of fixed land-lines.

Interesting to note is the fact that in the absence of cheaper fixed broadband technologies and services the demand from individual users has moved to wireless for those who can afford to acquire laptops. Two main technologies are currently available: EVDO over CDMA provided by Terracom-Rwandatel and GPRS provided by MTN. The total number of wireless subscribers for both providers is estimated to be 3 200 with the majority of subscribers on EVDO due to its high capacity bandwidth compared with GPRS, even though the monthly fee of US\$70 a month is high.

The major increase in Internet use comes from public access such as Cybercafés and telecenters. Cybercafés have been very successful in the major cities and semi-urban areas. The total number of Cybercafés is estimated to be 500 with a great number in Kigali, the capital of Rwanda. The lower average access rate is 10 clients per day (semi-rural areas) while the highest average access rate is 90 clients per day.

National network coverage for data traffic has grown rapidly over the last two years with the establishment of Terracom as a new Internet service provider in 2004. The company has made tremendous efforts in terms of building high-capacity network infrastructure around the capital city Kigali, as well as from Kigali to Butare, where the National University of Rwanda (NUR) is located approximately 130km from Kigali. After the acquisition of Rwandatel through privatisation, Terracom has built a CDMA network on top of existing Rwandatel network facilities around the country and now offers Internet and mobile services over CDMA technology mainly in Kigali city and major urban areas.

After the issuance of a new licence to provide data services, MTN Rwandacell is currently involved in building a data network infrastructure, starting in mid-2006. MTN began Internet service with GPRS accessed by

mobile phone or laptop. GPRS, however, has so far demonstrated its limitations due to limited bandwidth – maximum bandwidth is 148 KBps despite the availability of access over the MTN network. MTN is also offering WiMax technology targeting corporate customers. Major new network infrastructure development is due to happen in the next two to three years with a variety of projects on board such as the Electrogaz fibre optic project and the Artel's new project to expand connectivity through the Karisimbi Mast, targeting government institutions as well as lower income customers.

Rwanda still relies on satellites for international bandwidth connectivity. The private sector has invested heavily in international bandwidth within the last three years due to high demand for Internet access from government institutions, such as the central government, education, and health sectors which are the major institutions requiring high bandwidth capacity. In addition, with the increase of public access points such as Cybercafés or Telecentres, the need for high bandwidth for public access is becoming a big challenge. The following table shows the increase of bandwidth offerings over the last three years.

TABLE 4: INCREASE IN INTERNATIONAL BANDWIDTH FROM THE OPERATORS' PERSPECTIVE

Company	2004 (MBps)	2005 (MBps)	2006 (MBps)
RWANDATEL – TERRACOM	8	16	52
MTN Rwandacell	2	4	5.5
ARTEL–New ARTEL	2.5	2.5	2.5 (projected 100 before the end of 2007)
ISPA	*	*	3
TOTAL	12.5	22.5	63

Source: Interviews with Telecom Operators

* ISPA was launched in 2006

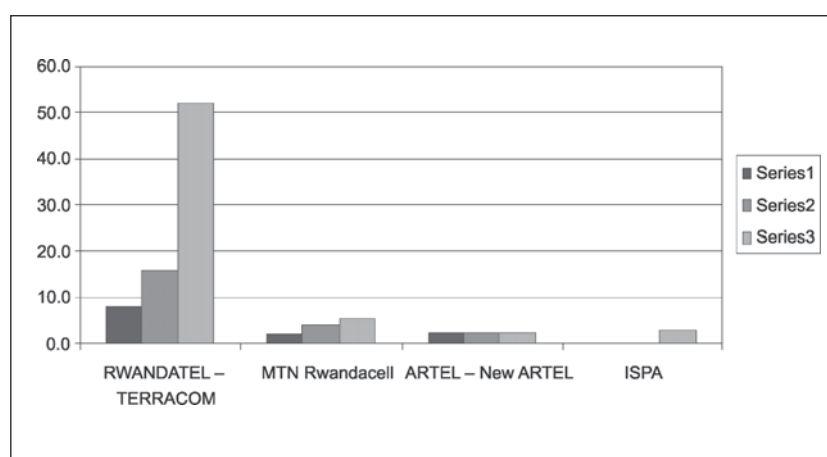


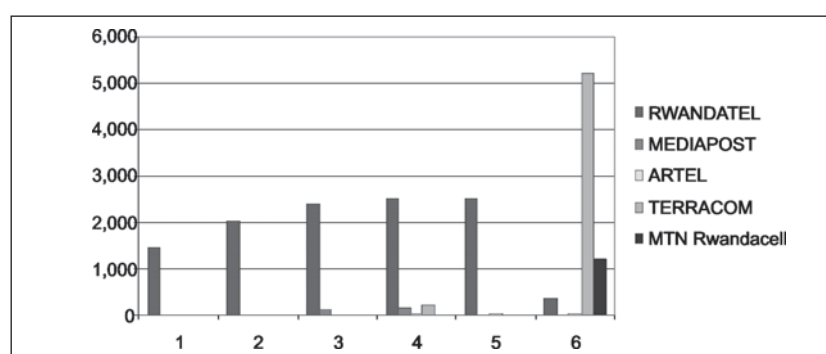
TABLE 5: INCREASE IN THE NUMBER OF INTERNET SUBSCRIBERS

Company	2001	2002	2003	2004	2005	2006
RWANDATEL	1 482	2 047	2 378	2 497	2 484	3500
MEDIAPOST	0	0	114	130	*	*
ARTEL	0	0	12	28	28	37
TERRACOM	0	0	0	220	**	5 200
MTN Rwandacell	0	0	0	0	0	1 200
TOTAL	1 482	2 047	2 504	2 875	2 512	6 787

Source: RURA Annual Report 2004

* No longer in operation as an ISP

** No data available for Terracom in 2005



Subscribers and users are not necessarily one and the same. For example, a subscriber has a formal relationship, like a contract or account, with an operator. There may be any number of users under a subscriber's account. An Internet café may be one subscription. There may be dozens of people who use the café. In 2000 there were only 5 000 Internet users with one Internet service provider, Rwandatel. By 2004 the number of Internet users had increased from 5 000 to a reported 25 000.

The use of the Internet for educational purposes is currently limited to the higher learning institutions such as the National University of Rwanda (NUR), Kigali Institute of Science and Technology (KIST), the Kigali Institute of Education (KIE) and the Kigali Health Institute. Computers and the Internet remain underused in the school system. While many schools now have computers, most schools have no reliable electricity or telephone connectivity. The Government started to provide telephone and Internet connectivity in 2004 but access to electricity remains a problem.

UNIVERSAL ACCESS

A number of policies have been adopted by the Government to ensure access to telecommunications facilities especially in underprivileged areas. To that effect, there is a Presidential order that obliges each operator to pay 2% of their turnover (total sales return) exclusive of taxes and interconnection fees, to create a fund to be used to expand access to rural areas.

The government plans to decrease the average distance to access a public phone from 15km to 2km (or a radius of 2km) within the next five years. In addition, the government has decided that all ICT equipment (including electrical equipment/generators and solar panels) will be exempted from import taxes. This is all aimed at increasing ICT usage and more importantly reducing the cost of ICT-related activities, hence increasing the affordability of these essential services as we move into becoming an ICT hub for the region.

Looking further at the initiatives made to address the challenge of rural connectivity, a company called BCS runs a GSM public payphone network called Tuvugane (Let's Talk), launched in April 2004. It was established with the main objective of bringing mobile communication to rural communities. It offers per second billing. This project became more successful than anticipated in terms of revenues collected, as depicted in the table below. It has over 4 000 payphones and is the only company offering this service in Rwanda. It buys airtime from MTN and the revenue is split as follows: Phone partner: 20%; BCS: 13%; MTN: 67%.

According to the distribution manager of MTN Rwandacell, 90% of the revenue collected is from Kigali, implying that the main objective of bridging the digital divide has not been achieved. However, there are other initiatives in the pipeline to address this issue; for instance, MTN is introducing a project called the "Village Phone" which is to focus on the rural areas only, in partnership with the Bangladesh-based Grameen Foundation.

COST OF ICT USAGE

Tariffs must by law be cost-based. Transparency is the predominant control mechanism. Rules are set out relating to the setting of tariffs and the Regulatory Board does have powers to intervene. Ongoing tariff control is confined to the dominant operator.

TABLE 6: AFFORDABILITY OF ICT SERVICES

Affordability	Rwanda		Low-Income	Sub-Saharan
	2000	2004	Group	Africa
			2004	2004
Basket for fixed line (US\$ per month) residential	8.4	7.9	6.6	8.5
Basket for Mobiles (US\$ per month)		24.8	11.6	13.5
Basket for Internet (US\$ per month)		66.8	45.5	54.8
Price of 3-minute call to the United States: (US\$)	11.23	2.45	1.95	2.43

¹ Source: World Bank ICT at a Glance

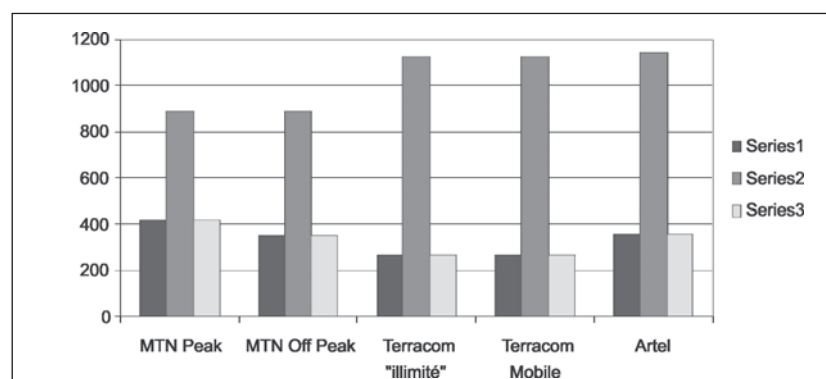
²

To test the effect of lack of controls on prices the World Bank ICT at a Glance affordability data is compared to the figures for other parts of Africa. The drop from US\$8.4 to US\$7.9 places Rwanda 19.6% above the Low-Income Country Group average of US\$ 6.6 but below the sub-Saharan African Region level of US\$8.5. For mobiles the Rwanda basket was US\$24.8 per month, 112% above the Low-Income Country Group average of US\$11.6 and 84% above the sub-Saharan African Region level of US\$13.5. A similar pattern existed for the Internet where Rwanda was at US\$66.8 per month, 47% above the Low-Income country group average of US\$45.5 and 22% above the sub-Saharan African Region level of US\$54.8.

TABLE 7: SELECTED TARIFFS RWANDA

	Prepaid Mobile to MTN – 3 mins	Prepaid Mobile to Nairobi – 3 mins	Prepaid Mobile to Fixed – 3 mins
MTN Peak	417	885	417
MTN Off Peak	354	885	354
Terracom “illimité”	264	1 125	264
Terracom Mobile	270	1 125	270
Artel	360	1 140	360

1 Source: MTN (web site), Terracom (web site), Artel (interview)



Despite requirements that costs be priced based, using the OECD basket for low mobile users to measure RIA!’s comparative analysis of pricing across several African countries demonstrates that prices in Rwanda are the fourth highest of the 17 countries reviewed, although Rwanda’s combined mobile prices appear very low in nominal terms when adjusted for purchasing power parity, which provides a real assessment of affordability.

There are obvious caveats to the pricing in the table, as all markets are not evenly liberalised or tariffs rebalanced. So the very low prices in Ethiopia, for example, accompanied also by very low penetration rates are unlikely to reflect cost-based prices.

TABLE 8A: COMPARATIVE ASSESSMENT OF MOBILE PRICING ACROSS 17 AFRICAN COUNTRIES

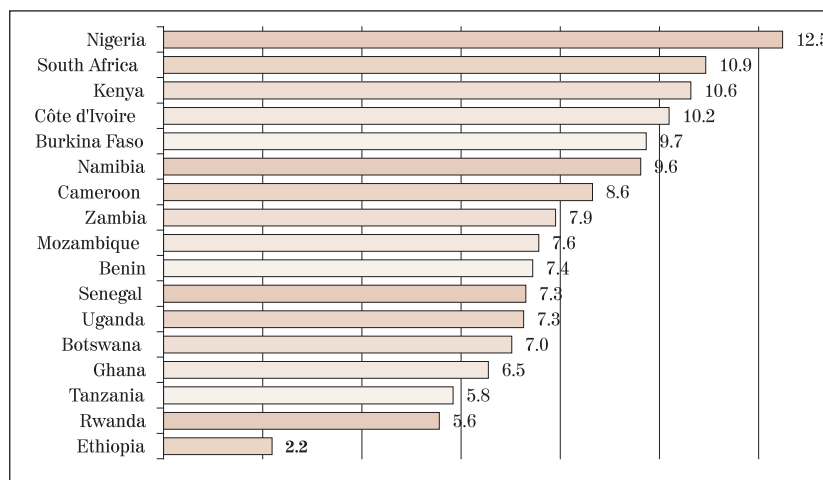
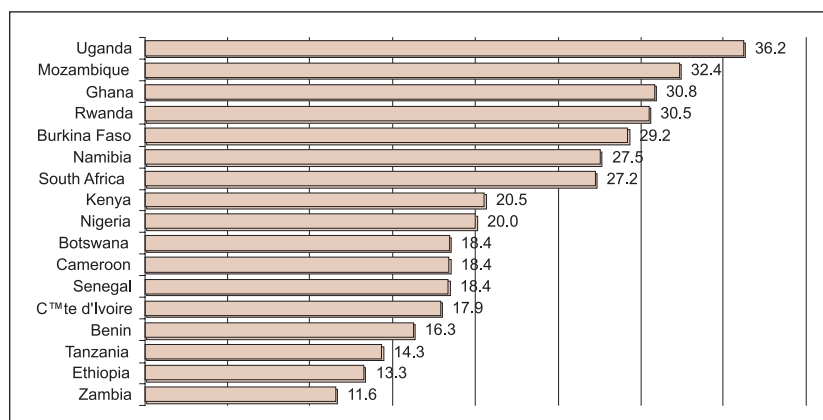


TABLE 8A: COMPARATIVE ASSESSMENT OF MOBILE PRICING ACROSS 17 AFRICAN COUNTRIES



Source: Esselaar, Gillwald and Stork (2007)

For a 3-minute call to the United States there was a dramatic decline in prices between 2000 and 2004 and Rwandatel rebalanced prices. The price fell by 78% and is now comparable with the prices in the Low-Income Group (US\$2.45 compared with US\$1.95 or 26% higher) and virtually equivalent to the sub-Saharan level of US\$2.43. The absence of price controls has not prevented the prices of calls to the US from falling by 78% as a result of competition between the two major competitors, MTN and Terracom and the usage of VoIP specifically for outgoing calls to the US. Fixed-line charges have fallen by 6%, placing them just above the Low-Income Group average and just below the sub-Saharan average. The table contained no prices for the Internet in 2000. In 2004, Internet

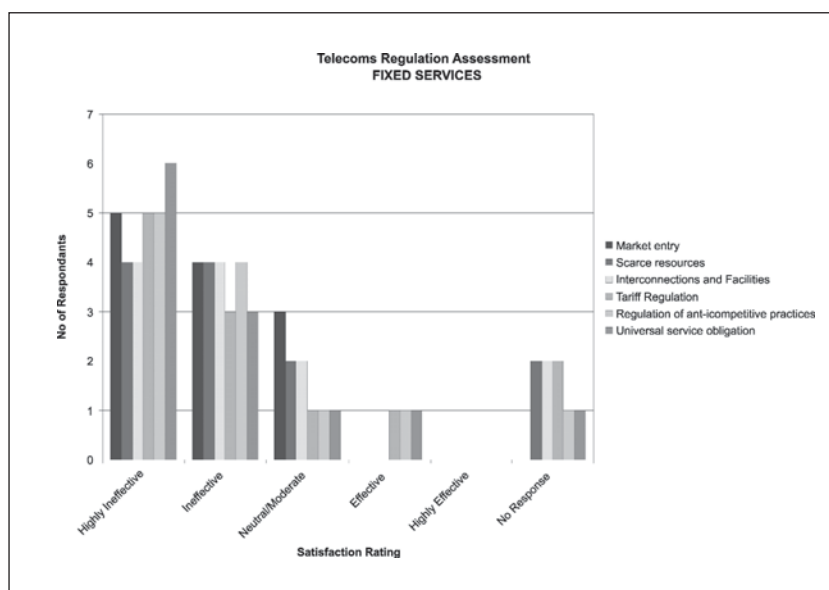
prices in Rwanda were well above the average for both of the other groups. However, it should be noted that prices in Rwanda have fallen since 2004, but this has probably also been true elsewhere.

Telecommunications Regulatory Environment

A policy and regulatory perception analysis drawing on the Telecommunication Regulatory Environment (TRE) methodology developed by LIRNEasia was conducted among Rwandan industry stakeholders.⁶The telecommunications regulatory environment survey seeks to assess not just the regulator, whose ability to reduce regulatory risk and enable market development is to a significant degree determined by the policy and legal framework.

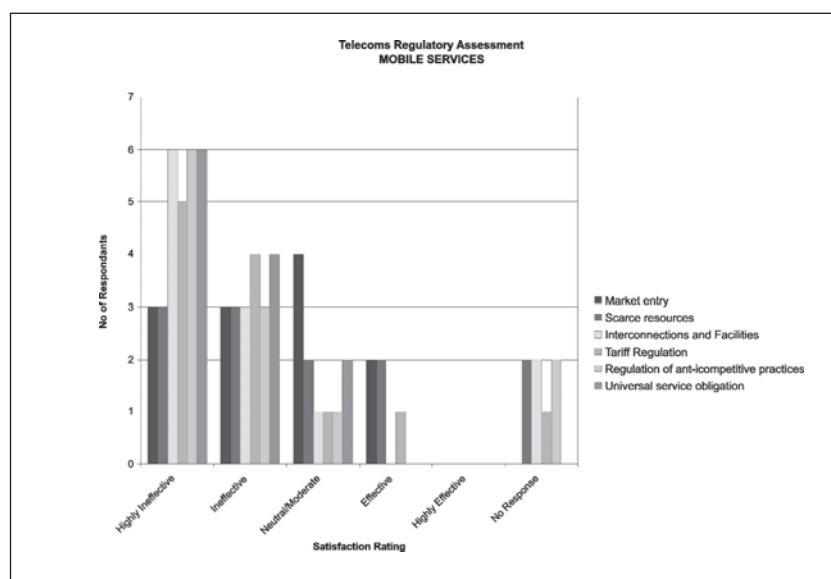
Twelve interviews were conducted with representatives from telecom operators, ISPs (MTN Rwanda, Terracom and Rwandatel), government institutions (RITA, Ministry of Infrastructure) and academic institutions (NUR and KIST). They were asked to rank the Telecom Regulatory Environment on a scale of 1 to 5, with 1 being highly ineffective and 5 being highly effective. The three broad areas covered were Fixed, Mobile and Value Added Network (VANs). The following table gives a summary of the responses. Note that only results for Fixed and Mobile appear in the table below as there are currently no regulations in place for VANs.

TABLE 9: TELECOMMUNICATIONS REGULATION ENVIRONMENT ASSESSMENT



⁶ Studies using this method have, subsequent to the Asian studies, been carried out in Chile and Guatemala (see www.regulateonline.org).

TABLE 9: TELECOMMUNICATIONS REGULATION ENVIRONMENT ASSESSMENT



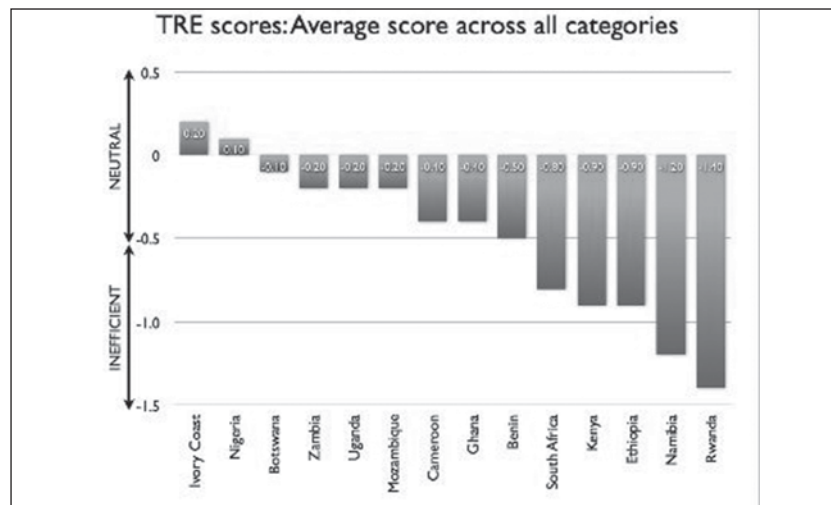
The overall telecommunication regulatory environment in Rwanda is negatively perceived, due to the following factors:

Lack of understanding of the respective roles of each of the key players in making the regulatory environment more transparent and effective. The inception of the Policy framework for regulation appears to have been more donor driven and therefore has lacked participation of local stakeholders to raise the ownership;

Delays in action by RURA, the multisector regulatory authority. RURA has been understaffed and lacking in capacity, and the previous years have seen rapid changes in the telecom environment, which required rapid responses. The lack of capacity to respond to regulatory issues in a timely fashion have allowed incumbents to continue with certain anti-competitive practices and weakened perceptions in the industry;

Failure of fixed line services to respond to the growing demand in the last 12 years. The demand at some points has been even higher than the existing phone lines in operation while the incumbent was regulating the sector, while for mobile services, MTN has enjoyed its monopoly for many years with a very high cost of access and usage coupled with low penetration rate. This situation alone explains the bad perception that is recorded as far as mobile services are concerned.

In comparison with other African countries the negative perception of Rwanda was the highest. Of the 14 countries in which perception surveys were conducted. Rwanda however was not alone. Only two countries, Nigeria and Côte d' Ivoire were viewed positively.



Source: Esselaar, Gillwald and Stork (2007)

The main regulatory challenges can be described as follows:

REINFORCEMENT OF THE REGULATORY LAW

The Rwanda Utility Regulatory Agency needs to be legally supported in such a way that it is more independent, thereby strengthening its authority. This is of paramount importance if we are to see its management deliver. Furthermore, the country is moving towards full competition in mobile, fixed and Internet services; however, a number of contentious issues continue to arise amongst the players. Revision of the existing law that will provide the regulator with more power to act and respond to emerging issues is needed. This would create more faith, confidence and trust in the regulator by all key players and the community of users in particular.

IMPLEMENTATION OF UNIVERSAL ACCESS OBLIGATION

As stated above, universal access in theory has all the required legal support needed including laws and a Presidential order. The main challenge is to put the universal access obligation into action to help address the market access gap that the country is facing. The ongoing consultancy in this regard and consultative meetings amongst the stakeholders based on the final report are expected to provide a road map towards real implementation of universal access in Rwanda.

INTRODUCTION OF NEW TECHNOLOGIES SUCH AS VOICE OVER INTERNET PROTOCOL (VoIP)

The emergence of new technologies and services such as VoIP brings up regulatory challenges for which RURA needs to provide guidance and solutions. The current situation is that VoIP is not yet regulated and yet

is being used by numbers of providers. While the main telecommunication operators such as MTN are complaining about what they call abuses, the main Internet Service Provider Terracom is also complaining against MTN for blocking IP traffic.

ACCESS AND AFFORDABILITY GAP BETWEEN URBAN AND REMOTE AREAS

Previous studies, including the household survey made in 2004 and the current data available from the major telecommunications companies, reveal the disparity of the level of access between urban and rural areas. As an illustration, the current MTN Network is estimated to cover 75% of urban areas and main roads in the town. Remote sites outside the above geographical locations are not yet covered. Estimated penetration of mobile is 60% in the capital city of Kigali and 40% for the rest of the country.

There is a need to expand network coverage as well as increase penetration, especially in the areas that are relatively populated with little economic activity that can integrate communications services in their strategies and daily businesses. Traditional fixed services over copper or wireless have declined over the past ten years. Decline is likely to continue over the coming years. The only possible alternative will be the introduction of the Voice over Internet Protocol (VoIP) in addition to wireless local loop.

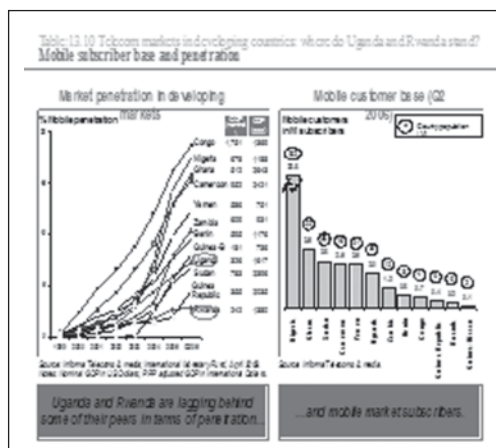
Appropriate technologies such as solar energy, as well as wireless local loop through WiMax or Wifi could be useful in remote areas that have suffered from the lack of basic infrastructure such as electricity and connectivity, to have faster access to communications. The introduction of VoIP in remote areas can only succeed if the telecommunications market is restructured with a clear separation between network infrastructure providers and service providers. The proposed segmentation of the market could therefore allow either small-scale private or community service providers to enter into the market, especially in the areas where the major telecommunications companies are not likely to operate as service providers.

The above scheme will require review of the regulatory licensing regime and will bring in provisions to support and facilitate the establishment of small-scale enterprises in remote areas to provide a range of services like voice, data and other related applications to promote the creation of an information-based society in underserved areas. The financing mechanism, one of the major challenges, has to be studied carefully to ensure that the cost of infrastructure investment as well as its operational cost will allow a service pricing scheme that is affordable and sustainable over time, despite the withdrawal of external financial support. The main and initial source of funding is obviously the Universal Access Fund

(UAF) that is contributed by the telecommunications companies. The UAF could be complemented to some extent by a low interest loan from any development bank such as the Rwanda Development Bank (BRD) or Micro Credit/ Micro Finance Banks.

As Table 8 demonstrates, affordable telecommunications services are critical to developing countries in general and sub-Saharan African countries in particular. A recent study carried out by MTN group has shown a correlation between the number of subscribers and GDP of a given country. A close look at the graph below reveals that the lower the GDP of a given country the lower will be the mobile penetration. However, a country like Guinea, whose GDP is lower than that of Rwanda, has a high mobile penetration level. In the case of Rwanda, only 10% of the population lives in the urban area and 60% of the mobile subscribers are in the urban area. The implication of this is that the mobile penetration is only 3% country-wide, which is the lowest in the region.

TABLE 10: TELECOM MARKETS IN DEVELOPING COUNTRIES: WHERE DO UGANDA AND RWANDA STAND? MOBILE SUBSCRIBER BASE AND PENETRATION



Source: MTN Rwanda

The Government is undertaking various projects that will solve these challenges. The following section details the major projects that are being carried out both in the public and the private sectors to address the access and the cost of usage issues.

² Source: www.mcel.co.mz

Implementation of ICT Policies and Projects: Current Status and Ways Forward

There are a number of ICT Policies and related projects that are currently being implemented in Rwanda, including the following:

RWANDA INTERNET EXCHANGE POINT

The high cost of international bandwidth for the Internet has limited the growth of Internet in developing countries. At the same time the quality of Internet services is undermined by traffic delays. One reason is that ISPs in developing countries use international bandwidth for their national as well as international traffic. If there is local interconnection, where traffic originating from one local ISP intended for another local ISP does not have to leave the area or country to reach its destination, the problem is resolved.

This switch providing local interconnection is referred to as the Internet Exchange Point (IXP). RINEX was a project that established an Internet Exchange Point in Kigali and connected as many ISPs as possible. Peer connection between ISPs without passing through international links would enhance the quality of Internet services and save bandwidth and money. It was implemented successfully as part of the Communication Systems Design 2004 course at the Royal Institute of Technology (KTH) in Sweden and sponsored by the Swedish International Development and Cooperation Agency (SIDA). All the local ISPs in Rwanda are connected and a full mesh has been implemented. A sustainability plan has been produced and the ISP staff have been trained to manage the IXP.

E-RWANDA PROJECT

In June 2005 the Government of Rwanda approached the World Bank to fund an e-Rwanda project, designed to help implement components of the NICI Plan II. It was decided that a stand-alone project was preferable because of the special skills required. Accordingly, the Bank has agreed to fast-track the project provided the GoR can provide the necessary counterpart resources. The Project has been refined to four components:

- **Strengthening Government Effectiveness.** This component aims at improving key governmental internal systems which are considered critical elements for the implementation of the overall development strategy of the Government. The main focus of this component will be complementary support for the development and deployment of a modern integrated public financial management system that provides timely and accurate information about the use of public resources and for the implementation of a public procurement and

assets management system that is in line with international standards.

- **Service Delivery Improvement for Citizens and the Private Sector.** This component will assist government to deliver improved services to citizens and the private sector. It will target primarily business licensing and citizen's life cycle events such as birth, marriage and death certificates. These services will be subjected to a re-engineering process with the goal of improving access and service standards.
- **Improving Physical Access to Services through enhanced Infrastructure in Energy and Telecommunications.** This component will assist government in developing and refining the basic regulatory and institutional infrastructure required for the use of modern technology by the public and private sectors. It will particularly promote the provision of competitive and affordable telecommunications access for remote areas of Rwanda.
- **Project Management.** The component will assist government to establish a project management system for the change process triggered by the implementation of the aforementioned reforms. Support will focus primarily on the Ministry of Infrastructure which will lead the implementation of e-government reforms and on its implementing agency RITA. The project will also cover the setting up of an adequate quality assurance mechanism to accompany the implementation of the reforms as well as the development of a monitoring and evaluation system for e-government reforms.

All the above will have a direct impact on the social fabric of society by addressing the service delivery and information needs of the rural population and strengthening the underlying legal and regulatory framework for development of Vision 2020. The project is World Bank funded and was declared effective in August 2006. It is currently being implemented under the RITA structure.

GovNET

This is a private network interconnecting the Local Area Networks (LANs) of individual government ministries, agencies and various Public Service Organisation (PSO) networks within Kigali. Currently, fibre optic cable is employed by GoR units in different clusters, such as Kacyiru in the District of Gasabo and downtown Kigali in the District of Nyarugenge, with wireless bridges interconnecting the clusters. Currently the hardware is in place, but the software and system management are not yet in place. Complete end-to-end connectivity between government units in Kigali and local authorities in the provinces is the next phase planned for GovNET's development.

ICT PARK

In view of the various activities in Rwanda, it is apparent that the country must evolve into a knowledge society if such a transformation occurs at the planned pace indicated. In his address at the WSIS summit, His

Excellency Paul Kagame stated “it has become abundantly clear to us in Africa that ICT is an indispensable tool in the achievement of our development goals.”⁷

Therefore, one can believe that a vibrant ICT private sector is paramount for Rwanda to harvest the promise of a national ICT Plan. Although government leadership is necessary, only private sector firms can help Rwanda successfully compete in ICT. In May 2006, Rwanda’s leadership made the bold decision to establish a Rwanda ICT Park in Kigali. A catalyst for innovation, this ICT Park will become the platform for Rwanda’s nascent ICT private sector. From its original building, Telecom House, Rwanda ICT Park will evolve into a multi-hectare ICT hub with several office buildings, ICT training institutions and outsourcing amenities located at the heart of Kigali. Rwanda ICT Park will ultimately become the main driver of Rwanda’s evolution into an ICT society and will mature into a regional hub for ICT innovation.

ICT Park aims to become a vibrant ICT centre that provides ready access to world-class ICT products and services for Rwanda and the region, facilitate Rwanda’s participation in the development of new and emerging ICT products and services, focuses on serving as an incubator for promising start-up ICT firms and finally, facilitate Rwanda’s leadership in ICT research and development. There have been about 10 companies selected that are already operating in the park.

NATIONAL COMPUTING CENTRE (NCC)

This is one of the technical directorates of RITA, established and supported by the Swedish Government, providing ICT technical support, applications development, detailed short-term professional training, consultancy services and research and development in software engineering.

NCC hosts the National Data Centre that provides a useful clearing house for government entities. Furthermore, it runs critical government applications systems such as the National ID card platform, SmartGov, human resource systems as well as offering feedback and information about government services and information to citizens. NCC hosts government websites, web portal and email services for civil servants.

NATIONAL ICT INFRASTRUCTURE DEVELOPMENT

With the Rwandan economy undergoing rapid change and competition among enterprises, there is a trend toward the construction of proprietary networks. Typically these networks are designed to carry only the owner’s calls, including terminations of calls from other networks. Currently, however, there is some sharing of facilities.

7 http://www.gov.rw/government/president/speeches/2003/remarks_geneva_speech.html

Duplication of networks can create excess capacity due to the limited number of customers, design limitations and the cost of management, maintenance and repairs, which may make service unit costs high. Unused capacity increases the cost of providing network services in two ways: (1) investment takes place above the level necessary to meet consumer demand, increasing the capitalisation of the sector (and lowering the overall rate of return on capital), and (2) by reducing the potential business available to each network below the level used to justify the investment. Both of these effects increase the real cost per unit of transmission and limit the scope for price reductions.

TELEMEDICINE NETWORK

Telemedicine Network is a backbone network linking national referral hospitals and laboratories throughout the country. Development of the telemedicine network is included in the NICI plan II with the objective of expanding accessibility to health services and enabling unlimited exchange of data between different hospitals. Institutions affected include:

- University Central Hospital of Kigali;
- University Central Hospital of Butare;
- King Faysal Hospital, Kigali;
- Cyangungu Hospital;
- National Pharmaceutical Laboratory;
- Ruhengeri Hospital.

RWANDA EDUCATION AND RESEARCH NETWORK

The Rwanda Education and Research Network is a high capacity network over mainly fibre optics linking local area networks of various higher learning institutions and research centers for common internet connectivity, general research exchanges, administration and e-learning. The first phase affects public higher learning institutions and research centres as follows:

- National University of Rwanda (NUR), Southern Province;
- Kigali Institute of Education (KIE), Kigali;
- Kigali Institute of Science and Technology (KIST), Kigali;
- Kigali Health Institute (KHI), Kigali;
- Higher Agriculture and Veterinary Institute (ISAE), Northern Province;
- School of Finance and Banking (SFB), Kigali.

In addition, there are two research centres which are:

- Institute of Agricultural Science of Rwanda (ISAR), Southern Province;
- Institute of Research in Science and Technology (IRST), Southern Province.

Private higher learning institutions (about 10) spread across the country are also being considered for inclusion in the second phase of the Rwanda Education and Research Network.

KARISIMBI PROJECT

The GoR has launched various projects for fibre optic deployment notably the fibre deployment exercise running parallel with electrification of Mount Karisimbi summit. As at February 2006, a total of over eight kilometres of ADSS aerial and underground fibre segments had been deployed by Terracom (the subcontractor). The underground segments run through a national park for safety and environmental reasons. Further segments are expected to be deployed in the Mount Jari area. The GoR's fibre is shared by multiple stakeholders (ORINFOR, Terracom, MINADEF, and MTN Rwandacell).

The existing tower at Karisimbi is being rehabilitated to prepare it for being used in efficient ways by different stakeholders and operators, mainly Orinfor (eg usage of the Orinfor tower at Karisimbi as a CDMA and transmission site).

ELECTROGAZ FIBRE OPTIC PROJECT

The electricity utility which is referred to as Electrogaz needs communications among its staff to enable the efficient provision of power and water supply to its customers. Currently there is an Intranet Private Branch Exchange (IPBX) that provides services between the headquarters and eight branch offices. There is a need for networking to support the performance, monitoring and control systems of the power/water transmission and distribution networks. For instance, a Supervisory Control and Data Acquisition (SCADA) system is planned to span the main power distribution network with technical user interface points at different power stations, substations and control centers.

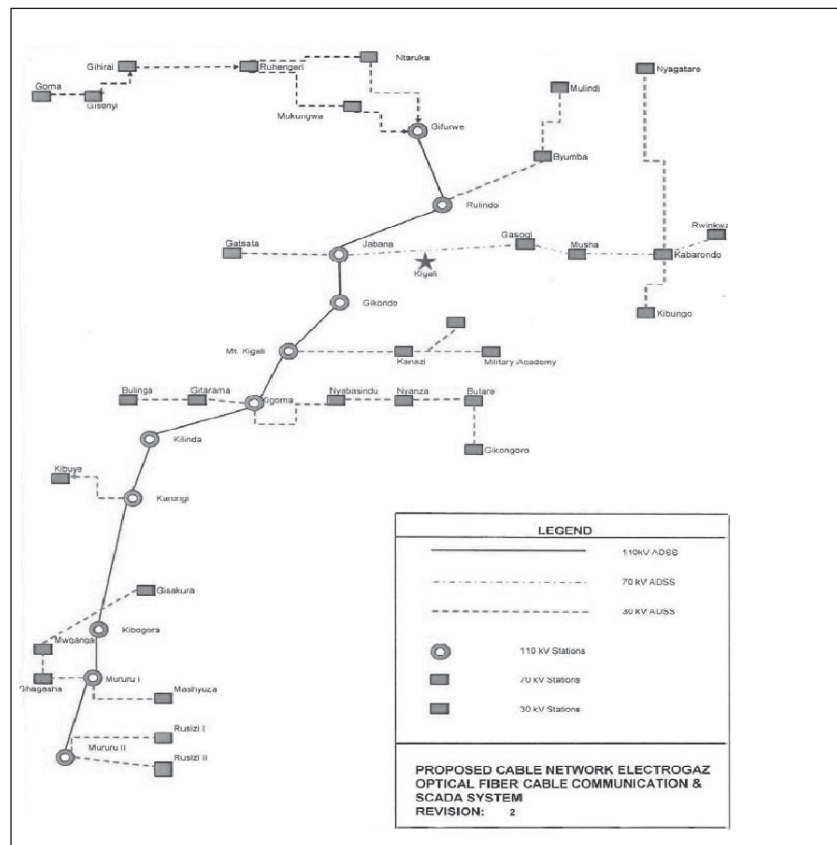
In March 2006 Electrogaz signed a contract based on a technical proposal from Draka Comteq Telecom BV. The contract depends upon both grant and commercial funding. The contract will become effective and construction will begin when grant financing has been arranged, non-grant financing has been authorised, the advance payment received by Draka, and bank guarantees finalised. If all conditions are met 825km of Synchronous Digital Hierarchy (SDH) fibre will be deployed across Rwanda using Electrogaz's power transmission network, shown in Figure 1.

The network will connect 21 existing power generation plants and all substations, including the control centre at Gikondo. It will provide IPBX telephones and related power supply, also SCADA and Internet Message Services (IMS). In the proposal, Optical Ground Wire Cables (OPGW) are suggested for the high voltage (110 kV) routes (from Gifarwe to Mururu II via Mount Kigali stations, total 372km), while ADSS cables would be placed on the medium-voltage (30 and 70 kV) routes (connected from Gifarwe, Jabana, Mount Kigali, Kigoma, Karongi and Mururu I/II stations, total 404km).

Extension and electrification of the communication system of the national electricity transmission grid will mean implementation of an

Optical Ground Wire (OPGW) Scada control system on the entire 110 kV and 70 kV transmission system with extensive excess capacity.

FIGURE 1: ELECTROGAZ FIBRE NETWORK AS PROPOSED BY DRAKA



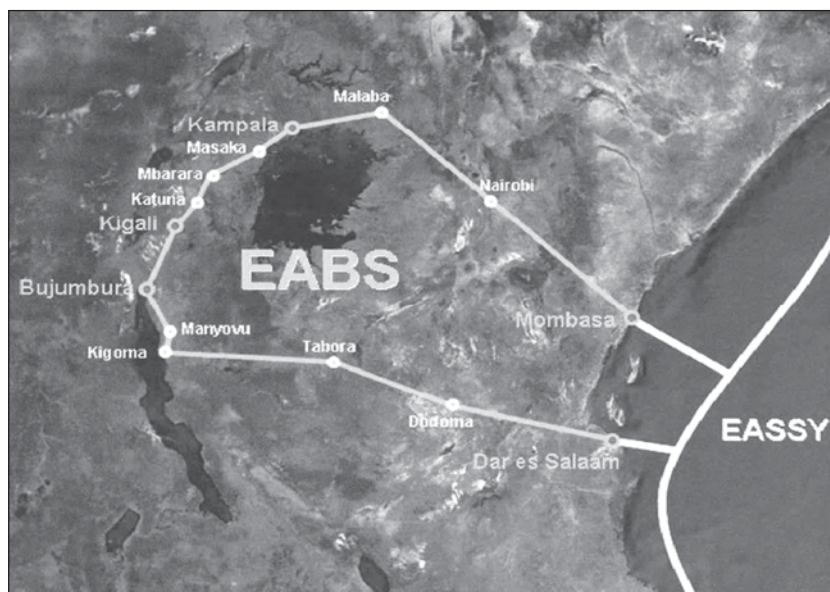
EAST AFRICAN SUBMARINE CABLE SYSTEM (EASSy)

EASSy is a proposed project to link seven coastal countries in East Africa, including: Djibouti, Kenya, Madagascar, Mozambique, Somalia, South Africa and Tanzania (the “EASSy anchor countries”) with a fibre optic cable. In addition, 15 other East African countries, including Rwanda, wish to connect to EASSy through terrestrial cables. Rwanda will be connected by the East Africa Backbone System (EABS) shown in Figure 2. The estimated cost of EASSy is US\$300 million and an additional US\$300 million for the connection of the 15 inland countries. The GoR has agreed to commit US\$10 million to the project.

The initiative will improve the connectivity of the region to the rest of the world for both voice and data communications. Instead of paying high charges for international connection through a transit point, operators in the region can establish direct connections, which promises decreases in operating costs for international telecommunications. This further implies other important benefits to the ultimate African consumers and

businesses through substantial price reductions for both voice and Internet services. In the longer run, the benefits of improved connectivity and improved competition will foster the economic and social development of the region through increasing its competitiveness and its attractiveness to foreign investors. EASSy's main problem for Rwanda is that when the initial designs of the project were being considered Rwandatel was still a state-owned entity. It would have been the logical counterpart for the project. Now the position is not so clear. In fact, so far MTN is the only party to commit formally to the project. Meanwhile the "new" Artel company supported by the government is likely to be the main counterpart for EASSy especially since the company's main focus is the development of network infrastructure and its deployment to government and non-government institutions on a wholesale basis at affordable prices.

FIGURE 2: THE PROPOSED EASSY EABS



Assessment of National Infrastructure Development Projects

RWANDA SHARED OPTICAL BACKBONE

The design for a Rwanda Shared Optical Backbone (RwaSOB) network has not yet been completed. The situation in the private sector is changing rapidly and if the Electrogaz contract with Draka is brought to fruition, it could drastically alter the requirements of a RwaSOB and could even make a whole new network redundant. Similar problems arise with respect to EASSy.

The principal question to be answered is: having extracted itself from investment in telecommunications at the retail level, how far does the government want to go to re-enter the market at the wholesale level? Should the government decide that investment in a RwaSOB is a good idea? Another element to be considered is the network-sharing model desired by each stakeholder. Issues that will arise include governance arrangements (including RwaSOB, Electrogaz and the private sector), tariff setting as well as interconnection arrangements, capital expenditure and/or operating expenditure sharing, shared revenues from leased excess capacity, payment for network transmission services or one-off payments and management arrangements, with options including self-managed, independent carrier-managed provisioning and joint venture arrangements.

Any investments made in unserved areas where the potential number of customers is small should be handled within the framework of the UAF policy already announced and enshrined in Ministerial Decree No 5 of 15/03/2004 determining the functioning of the Universal Access Fund. This study has to deal with the reality that Rwanda will soon have two or even three nationwide mobile telephone and broadband networks offering a full range of services. The critical issue is to ensure cost minimisation (or efficiency of investment), seamless interconnection and high quality services.

PUBLIC SECTOR

While the proposed development of the sector provides a range of possibilities in the future, the current situation with respect to physical and commercial access is as follows:

GovNET

So far interconnection arrangements are not in place, but when up and running GovNET will require access to backbone infrastructure for national and international services. This is a private venture, but it is focused on government services.

TELEMEDICINE NETWORK

Developing this network is in the NICI II plan. It is not clear which service will finally comprise the network offering. It is anticipated that data transmission over leased lines, or wholesale capacity, will be the main service, with limited capability for international traffic. Interconnection will be required but is unlikely to present particular problems.

RWANDA EDUCATION NETWORK

As a high capacity network linking networks of various higher learning institutions for general research exchanges, administration and e-learning, the critical element is bandwidth. Access to the backbone is likely to be commercial and not controversial.

OTHER SIMILAR NETWORKS

Networks to cover all service areas are expected for the nationwide justice/court system and security forces. They are separate from Government to Business (G2B) networks. Currently, the government is expected to look at the Electrogaz network to provide this service and interconnection is unlikely to be an issue.

MOUNT KARISIMBI

The Government's fibre is being shared by multiple stakeholders and there appears to be no particular problem of access to either the Terracom or MTN networks. Commercial arrangements have determined relationships so far.

ELECTROGAZ

Electrogaz's 825km of fibre infrastructure will be the largest single contributor to the backbone. However, interconnection, governance, commercial arrangements and technical management will determine the extent to which it is used by the private sector. As it will be a wholesale to business only, there will be an incentive to interconnect with all available customers.

PRIVATE SECTOR

TERRACOM

Commercial considerations will lead Terracom to consider leasing circuits from either RwaSOB or Electrogaz, particularly on main trunk routes. The commercial access arrangements will be the deciding factor. As a company offering both wholesale and retail services it has an incentive to market wholesale service, but deny access for competitors to retail customers, particularly across the local loop. The wholesale marketing department will face pressure from the customer services (retail) business to favour their needs over the needs of competitors. Even regulatory provisions requiring access can be frustrated by the inevitable conflict of interests.

MTN-RWANDACELL

To develop services MTN will need to lease circuits in major population centres that close microwave rings, increasing protection against network failure. If high quality Service Level Agreements (SLAs) can be relied upon, then the leasing circuits from any provider of backbone services would be commercially attractive to MTN. Currently MTN possesses very little fibre, but will need to install more if access is denied, obstructed or unreliable.

ARTEL COMMUNICATIONS

Artel currently needs to expand the reach of its existing VSATs or configure them into a mesh network by combining the use of VSATs with terrestrial broadband wireless and fibre-optic backbone. Financial outlay

and potential return requirements are critical issues. The option of leasing circuits from any backbone provider is considered feasible. Similar arrangements exist already with microwave circuits leased from TerraCom and MTN Rwandacell. The company is heavily invested in satellite connectivity and is planning to acquire around 100 MBps bandwidth to serve their ISPs as well as government and non-government institutions. The company will also invest in terrestrial network backbone in order to reach out its customers. The key issue is the regulatory changes that are needed to introduce horizontal licensing in order to facilitate the emergence of wholesale and retail markets.

Conclusion and Recommendations

The overall performance of the sector can be characterised by two major aspects. Significant progress has been made both in policy and regulatory reforms that locate ICT as an engine for poverty eradication as a whole and a catalyst for socio-economic development across the various sectors of the economy in particular. Important issues and challenges to increase access, penetration and usage of ICT, however, remain across the various segments of society.

The reforms adopted have seen a number of changes in the telecommunication market with the entrance of new players and introduction of new technologies and services to meet market demands. Public and private investment in network infrastructure development have significantly increased and are expected to grow over the coming five years within the framework of the NICI II Plan.

Accessibility indicators shown in this report, however, remain very low despite the emphasis on increasing accessibility and usage of ICT in the country. The major reasons for such gaps are primarily related to the high cost of setting up network infrastructure and its maintenance, particularly in the current context of shortage of electricity that leads to the high price of access as well as usage, especially for mobile and internet services.

Rwanda Information Technology Authority (RITA) has begun a dialogue with major telecommunication operators initiated by government, which aims to define an innovative model of sharing network infrastructure. This sharing model is expected to reduce considerably the cost of network access and therefore will allow new service providers to enter into play with the hope that the price of usage will decrease, thereby increasing the number of users providing services especially in remote areas. The NICI II Plan has ambitious programmes and projects to support the increase of ICT access and usage around the country. The main target is to allow the central and local governments to communicate through ICT means in order to enhance good governance as well as to provide efficient services to the general population through Internet based applica-

tions. However, the main concerns remain the lack of institutional capacity and expertise to support the implementation of the NICI II Plan. The main public and private agencies faced with these challenges, including RITA, RURA and ICT service providers, still face severe shortages of personnel with the technical skills and expertise required to achieve the goals of the NICI II Plan.

In view of the above, the following would be the proposed course of action to address these issues. Above all there is need to strengthen institutional capacity. The current circumstance of the major institutions involved in ICT development leave a lot to be desired. A number of changes must be made in order to make them more competent to accomplish their mandates and responsibilities on a daily basis.

The main challenges to overcome include the implementation of a clear demarcation between the Ministry in charge of Communications and Energy, RURA and RITA in order to streamline their respective interventions in accordance with the laws and policies that govern ICT development in Rwanda. The redefinition of roles and responsibilities of each of the above institutions will help to identify skills and expertise needed for each one to fulfill its mission in line with the NICI II Plan, as well as help to strengthen their relationships with each other in order to provide better services.

The issue of access to and affordability of ICT services will be addressed by the development of network infrastructure across the country supported by private and public initiatives. This is an important milestone towards the realisation of wider access to ICT services for the general population. The cost of network access remains the main challenge to increasing ICT usage and penetration. It is therefore paramount to put in place a proper procedure for the sharing of network infrastructure amongst the major telecommunication operators, in order to reduce the cost of access and hence encourage new service providers in an open and competitive environment.

Furthermore, to improve ICT access for low income and remote areas, there is a need to increase participation of the community in the development and deployment of ICT in the country. The process will involve promoting great awareness of the potential benefits of ICT as a cross-cutting tool to support development in the various sectors of the society, as well as poverty eradication. The full participation of the community in the management and maintenance of ICT services can provide an alternative for increasing ICT access and usage for low income and remote areas in general. This will require a number of regulatory reforms to allow small scale enterprises to get involved in the areas where major service providers are not present and will also require significant changes in the provision of licences to facilitate access to the networking of services on a cost based model. □

ANNEXE 1

Major Milestones in the ICT Sector Development in Rwanda

	1994 – 1997	1998 – 2000	2001 – 2006	2007 – 2010
Law			Law N 39/2001 of 13/09/2001 creating the Rwanda Utilities Regulatory Agency (RURA) Law N 44/2001 of 30/11/2001 establishing Telecommunications Laws: The law grants the Republic the authority to regulate telecommunications and set up a regulatory board to carry out that function *Law N 32/2002 of 02/10/2002 creating the Rwanda Information and Technology Authority (RITA)	Review of the Telecommunications Law of 2001 by the Ministry of Infrastructure in 2006
Policy	* No stated policy as such. Rwandatel is the only telecom operator. Tried to recover the telecom infrastructure and replace damaged equipment	ICT 2020 Vision NICI Plan I as the policy instrument.	Review of the NICI Plan I Drafting of NICI PLAN II Poverty Reduction Strategic Programme (PRSP) *EDPRS (Drafting)	Implementation of the NICI PLAN II.
Regulation	The Ministry of Transport and Communications and Rwandatel take up the role of regulator	The Ministry of Transport and Communications and Rwandatel take up the role of regulator	*Establishment of the Rwanda Utility Regulatory Agency (Multi-sector regulation)	
Market Structure	Monopoly	Entrance of a mobile operator Rwandatel runs an ISP Public monopoly on fixed private lines Monopoly on mobile service.	Entrance of three ISPs (Terracom, ISPA, Artel) Establishment of Artel communications as a Telephony over VSAT Provider MTN obtains fixed and Internet licences Rwandatel privatised and owned by Terracom	New National Backbone and Carriers to come on board Artel to become a full ISP Electrogaz (power company) to establish a utility to manage the fibre MTN to become a data carrier using its fibre backbone as well as WiMax
Number of Players	One player: Rwandatel	Two major players: Rwandatel and MTN Rwandacell	Four major players: Rwandatel, Terracom, MTN Rwandacell and Artel	Potential new entrances: 1. ISP 2. Carrier 3. ASP
Services	Fixed telephony	*Fixed, Mobile and Internet	*Fixed, Mobile and Internet	Potential new services
Average Subscribers	14 000	-Fixed: 19 000 -Mobile: 42 000 -Internet: 1 200	-Fixed: 21 687 -Mobile: 304 000 -Internet: 6 814	Projections: Fixed: 32 000 Mobile: 800 000 Internet: 20 000

Sources: RITA, RURA, MININFRA, Rwandatel

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