The Case for "Open Access" Communications Infrastructure in Africa: The SAT-3/WASC cable

Senegal case study

Ben Akoh[1]

ASSOCIATION FOR PROGRESSIVE COMMUNICATIONS (APC)

APC-200805-CIPP-R-EN-PDF-0047

ISBN 92-95049-49-7

COMMISSIONED BY THE ASSOCIATION FOR PROGRESSIVE COMMUNICATIONS (APC)

GRAPHICS: COURTESY OF AUTHOR

[1]Ben Akoh works extensively in the development and use of Free and Open Source Software in Africa and African content creation and knowledge management. He is also active in the development of policy and advocacy for favorable ICT environment in West Africa.

Table of Contents

List of Tables

List of Figures

1 Overview of report

This report examines the impact the submarine fibre optic cable known as South Atlantic 3/West Africa Submarine Cable (SAT-3/WASC) has had on the telecommunications market in Senegal. It is one of four similar reports commissioned by the Association for Progressive Communications (APC) in November 2006 – the three other countries researched being Cameroon, Ghana and Angola. A briefing that synthesizes the results of the four studies is available for download from APC's website (www.apc.org).

This report focuses solely on the 'Africa section' of the submarine cable - i.e. South Atlantic 3/West Africa Submarine Cable - which also includes a South African-Far East connection (SAFE). (In its entirety, the rather cumbersome acronym for the cable is SAT-3/WASC/SAFE).

Following a brief overview, it presents data gathered through in-country interviews with various market players and stakeholders, including performance indicators such as subscriber numbers for different types of services, usage figures and pricing.

The report also looks at the environment for access to the SAT-3/WASC cable in terms of regulation, and the general business environment in Senegal's telecoms sector. Interviewees included the national operator, Sonatel, the mobile operator Sentel, the regulator, and other service providers, including cyber-cafés. Regional operators were also consulted to better understand how Sonatel works with neighbouring countries, especially landlocked ones.

Throughout the process of this study, it was extremely difficult to access data in any form from the telecommunication operators. This was contrary to our expectation that data and information would be readily available, especially from large corporations such as Sonatel, and that certain historic data may exist on websites. Attempts at scheduling interviews and discussions with several officials also proved difficult, if not impossible. It took over two months to meet the first Sonatel official for an interview. Most of the questions posed during the interview, especially those related to earnings, expenses and SAT-3/WASC-related figures, were not answered. Other requests for data were also not forthcoming. This report therefore acknowledges this unavoidable shortcoming.

2 Background

2.1 Brief country profile

Senegal, with a geographic area of 196,840 sq km, is bordered by the Atlantic Ocean, Mauritania, Mali, Guinea, Guinea-Bissau, and Gambia – which penetrates more than 320km into Senegal. Well-defined dry and humid seasons result from northeast winter winds and southwest summer winds.

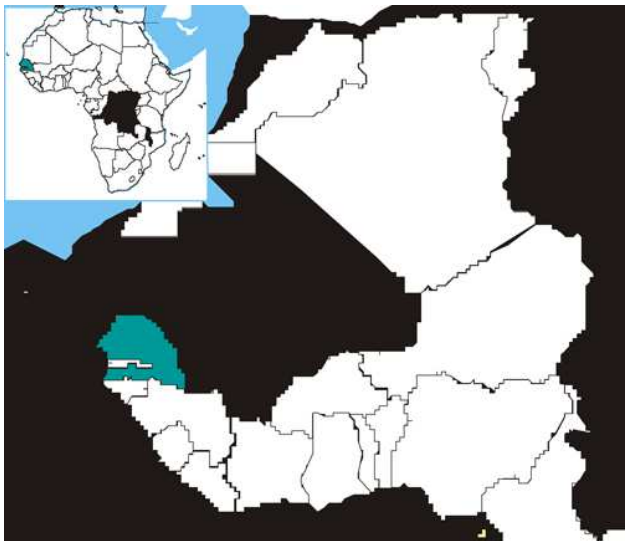

Figure 1: Senegal

The country's Gross Domestic Product (GDP) is approximately $10.7-billion, with an annual growth rate of 3% in 2006. Per capita GDP was estimated to be US$709 in 2005, with a purchasing power parity (PPP) of US$1,758. Senegal is ranked 156 in the United Nations Development Programme's (UNDP) 2004 Human Development Index. It falls in the list of the 50 least developed countries (LDC), benefiting from the Heavily Indebted Poor Countries (HIPC) Initiative (HIPC, 2004). The average life expectancy in the country is 59.25 years; 57.7 years for men and 60.85 for women.

In January 1959, Senegal and the French Soudan merged to form the Mali Federation, which became fully independent on June 20, 1960. Due to internal political difficulties, the Federation broke up on August 20, 1960, resulting in two independent countries - Senegal and Soudan (renamed the Republic of Mali). Leopold Sedar Senghor, internationally known poet,

politician and statesman, was elected Senegal's first President in August 1960.

Current estimates put Senegal at 11,987,121 inhabitants. The country's population can be described as youthful and highly urbanised. Urban migration (because of impoverishment in the rural areas) has resulted in an urban population that accounts for approximately 58% of the total population. Of this 58%, about a quarter live in Dakar and the surrounding areas. Besides Dakar, the largest cities are Thiès, Kaolack, Saint-Louis, Rufisque, Ziguinchor and Diourbel. In rural areas, population density varies from about 77 per sq km in the west-central region to two per sq km in the arid eastern section. Youths account for 58% of the total population. 47% of the youth are below 15 years.

The population is made up of numerous ethnic groups. Most prominent are the Wolofs (35%), Peulhs (20%), Sérères (17%) and Diolas (10%). There are also the Mandingues, Soninkés and Bassaris. About 50,000 Europeans (mostly French) and Lebanese reside in Senegal, mainly in the cities. French is the official language, but is used regularly only by the literate minority. All Senegalese speak an indigenous language, of which Wolof has the largest usage.

Senegal continues to play a significant role in regional and international organisations. Its current president, Abdoulaye Wade, has advanced a liberal agenda for the country, including privatisation and other market-opening measures. He has a strong interest in raising Senegal's regional and international profile. The country, nevertheless, has limited means with which to implement ambitious ideas. The liberalisation of the economy is proceeding, but at a slow pace.

A multi-party system has been in existence in Senegal since 1974. The media is free and diversified, although media freedom has recently been threatened – media practitioners are frequently interrogation by the police, some foreign journalists have been evicted, and a privately-owned radio station, Sud FM, has been periodically shut down. There are a number of daily newspapers, and weekly and monthly magazines, some of which have an online presence.

A number of private and community radios exist along with the national radio and television service, the Radio Television Senegalaise (RTS). Local

TV channels are beginning to appear, although legislation dealing with audio-visual media remains unclear. Senegal is open to foreign media, and a number of international satellite TV channel services operate.

Civil society is very active in Senegal, with a range of local and international non-governmental organisations dealing with human rights issues.

2.2 Overview of Senegal's telecommunications industry

Telecom reform in Senegal began in 1981. Prior to this, the telecommunications sector was managed by the postal service. From 1981, there was a clear separation between national and international telephony. National telephony remained the prerogative of the Office of Post and Telecommunications (OPT), while external communications (international telephony) was entrusted to TéléSénégal, a company that had just been created.

In 1985, during a period of World Bank and International Monetary Fund structural adjustments programmes and reforms, privatisation of public structures was the standard recommendation across most countries in Africa. Senegal was required to modify its legal environment to accommodate these recommendations. As a result, a distinction and eventual separation was created between the post sector and the communications sector. OPT was transformed into a post and savings entity and then ceased to deal with telecommunications issues. The telecommunications sector, including national and international telecommunications, was entrusted to a new company, the Société Nationale des Télécommunications (Sonatel), which was charged with managing the sector. It remained under the control of the state as a national company. TéléSénégal was absorbed into Sonatel.

Twelve years later, in July 1997, Sonatel was privatised. The strategic partner was France Cable Radio through its multinational subsidiary company France Telecom. Sonatel presented an occasion for the signing of a convention of concession which gave the company the sole rights and monopoly on fixed and international telephony. This monopoly conferred by the State lasted until 2004. According to Amadou Top, Director of the research institute Osiris, the process of privatising the telecommunications sector in Senegal was done without true preliminary dialogue by local actors:

> … [The privatisation] process was led in a totally opaque state in spite of the good direction, and a sense of national and international interests…A number of consultation[s] were organised preventing the citizens, civil society, political parties, and even the private sector from deliberating and deciding the future of this strategic sector. One result of this action was that the issue of Africa's empowerment was completely neglected – the option to find a "strategic partner" among the large telecommunication operators from the north as opposed to a pan-African organisation whose ownership and capital base is largely African. Instead, Sonatel was transformed into a private company with Senegalese ownership, but with capital held mainly by a foreign entity – France Telecom. Moreover, by granting [it] monopoly rights with regards [to] fixed and international telephony, the Senegalese state has for seven years delivered to a foreign entity rights on matters that it prohibits its own citizens. It is as if we have returned to colonial times. (Amadou Top, 2004)

Sonatel is one of the most important and significant companies in Senegal with a staff base of more than 1,600 people. In 2006, it recorded sales turnover of FCFA398,6-billion (about US$800-million) and a total after-tax profit of FCFA146,6-billion (about US$300-million). Sonatel was listed on the regional securities exchange – the Bourse Régionale des Valeurs Mobilières (BRVM) – in 1998 and its performance has strengthened from year to year. According to Maro Rennard, the chairman of the operator, it remains one of the most active securities. (Sonatel, 2006)

The shareholding of Sonatel as represented in Figure 2 below indicates that France Telecom holds 42.33% of the capital in the company, the Senegalese government 27,33%, institutions and general public 20%, and employees and former employees 10%. (Sonatel, 2006)

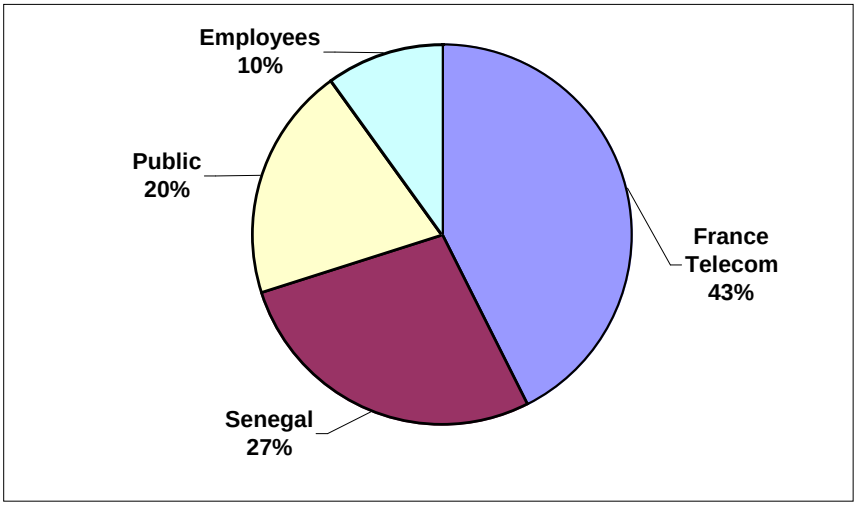

Figure 2: Sonatel shareholding structure

Until 1998, Sonatel was the only telecommunications operator in Senegal. However, in April 1999, Sentel, a subsidiary of Millicom International Cellular (MIC), was granted a licence to provide cellular telephony. In October 2000, the (Wade) government probed Sentel's licence, which had been granted during the administration of Abdou Diouf, the second president of Senegal. Key areas of contention were Sentel's alleged non-compliance with the terms of its licence, including low levels of investment, failures in terms of quality and coverage of its network, absence of information relating to financial and technical management of its licence, and a debt of FCFA579-million (about US$1.2-million) owed to the state. Sentel had remarked at the time that it had "satisfied all its obligations in accordance with the licence", and that "all the evidence was transmitted on time to the authorities contrary to the allegations made". The probe was eventually resolved via a 'private' arrangement and Sentel continued its activities normally (Osiris, 2005). Amongst things, it is claimed that the cost of the licence to Sentel was below its value.

Senegal enjoyed relatively good telephonic infrastructure prior to the implementation of SAT-3/WASC. At the beginning of 2002, the country was already connected to Atlantis-2 – a fibre-optic cable initiated in 1997 and inaugurated in May 2000. Atlantis-2 connects South America to Europe, passing through Cape Verde and Senegal. It cost a total of €370-million (US$457-million), and is owned by a consortium of operators, among them Embratel, a Brazilian operator with the largest investment of €100-million, and Sonatel with €10-million. Atlantis-2 offers 5Gb/s out of two pairs of optical fibres, 2,5Gb/s apiece. This permitted Sonatel a 45Mb/s link to France

(the equivalent of 240,000 simultaneous telephone communications). Atlantis-2 succeeded Atlantis-1, which was an analogue cable launched in 1982. There were also other submarine cables such as Antinea and Fraternity. Antinea, installed in 1977, connected Dakar to Casablanca with 640 circuits including 160 linked to Sonatel. Fraternity, installed in 1978, connected Dakar to Abidjan with 480 circuits, including 56 linked to Sonatel. Fraternity and Antinea were also analogue cables. Prior to SAT-3/WASC, there were and still exist satellite earth stations situated in Gandoul, with two large antennas, 1186 circuits and concurrent Intermediate Data Rate (IDR) connections.

Technical index card: Atlantis-2	
Project date	1997
Initiator	Embratel
Cost	€370-million
Commission date	May 2000
Points d'atterrissage	Las Toninas (Argentine), Rio de Janeiro (Brazil), Fortaleza (Brazil), Dakar (Senegal), Praia (Cap Vert), Medano (Icanary Island), Madère, Conil (Spain) et Lisbonne (Portugal)
Cable length	12,000 km
Cable supplier	Alcatel, Pirelli, Cable and Systems
Technology	WDM
Flow	Five Gb/s upgraded to 20 Gb/s
Financement	Individual investment, non public
Participants	Telintar, Embratel, Sonatel, Cabo Verde Telecom, Telefónica, Marconi, Telecom Italia, FranceTelecom,DeutscheTelekom.

Table 1: Atlantis-2 index card
Source: (C. Brun, 2000)

In 1999, Senegal's total bandwidth capacity was 2.048Mb/s (in addition to a 64Kb/s initial connection in 1996, the year in which the internet was introduced to the general public). There was no significant bandwidth improvement between 1997 and 1998. The capacity at this time was 1.024 Gb/s (plus the 64Kb/s initial bandwidth). This period marked the beginning of advocacy by Internet pressure groups, who approached Sonatel, the only telecommunications service provider at the time, about the constraints and limiting effects that the total existing bandwidth capacity offered. According to Métissanaca, the first West African-based Internet cyber-café, "Sonatel/France Telecom [had] imposed a cap on Senegal's total bandwidth capacity to a maximum of 2Mb/s" (M. Mavros, 2002). This contributed to Métissanaca's inability to supply the total bandwidth demand for its clients.

In 2002, before the inauguration of the SAT-3/WASC services, there were 215,000 fixed-line subscriptions, 550,000 mobile phone subscriptions (for both operators, Sonatel and Sentel) and about 13,000 Internet subscriptions with very low bandwidth. The telephone tariffs were between FCFA1,000 (US$1.9) and FCFA1,500 (US$2.8) for three minutes of peak-period international call time depending on the destinations, and between FCFA500 (US$0.95) and FCFA800 (US$1.5) during off-peak hours. The cost of Internet access for 20 hours of connection was approximately FCFA6,000-7,000 (US$12.45) prior to Asymmetric Digital Subscriber Line (ADSL) services, which were non-existent at the time (ADSL services were introduced in January 2003, after the commissioning of SAT-3/WASC).

Today, in 2007, five years after SAT-3/WASC, there are 283,000 fixed-line subscriptions, 3,500,000 mobile phone subscriptions, more than 20,000 individual Internet subscriptions, with the majority ADSL connections. Telephone tariffs are FCFA450 (US$0.84) for three minutes of peak-period international call and FCFA400 (US$0.74) for three minutes during off-peak time. All call costs are charged at the same rate to all international destinations without discrimination. One month unbounded 512Kb/s ADSL link costs less than FCFA15,000 (US$30).

The Internet subscription rate did not experience significant growth between both periods (there were approximately 7,000 additional subscriptions post-2002). A number of factors may have contributed to this slow growth rate. The cost of acquiring a computer was largely beyond the reach of the average Senegalese. At the same time, ADSL, being a relatively new technology, had to 'win' the favour of dial-up users, which, to an extent, met their Internet requirements. Moreover, the cost of the ADSL services for one month on the surface appeared double the usual monthly 20 hours Internet access, which was otherwise sufficient for the average dial-up home user. ADSL's 20,000 individual subscriptions were mostly new users acquired fresh from the market.

	Pre SAT-3/WASC (Before 2002)	**Post SAT-3/WASC (After 2002)**
Fixed line	215,000	283,000
Mobile phones	550,000	3,500,000

Internet	13,000	20,000
Phone tariff	US$1.9-2.8 (Peak time)	0.84 (peak time)
	US$0.95-1.5 (off peak)	US$0.74 (off peak)
One month Internet connection	US$418.32 (charged at US$12.45/20hrs/month)	US$25.00

Table 2: Situation report pre- and post-2002

2.3 History of the SAT-3/WASC cable in Senegal

France Telecom is one of the major investors in SAT-3/WASC with an investment of US$96-million, 15% of the total US$640-million cost of SAT-3/WASC (Rédac-Info, 2002). This investment incorporated the needs of France Telecom and those of its acquisitions Sonatel, Côte d'Ivoire Telecom and Mauritius Telecom. Sonatel is one of the 36 member SAT-3/WASC consortium.

Aïssatou Dieng, Sonatel's Director of Operators and International Operations, mentioned in personal communications (May 2007) that the discussions for the implementation of SAT-3/WASC started in 1994. She also insists that SAT-3/WASC is not a monopoly:

> Contrary to popular belief and 'strictly speaking', there is no monopoly situation with SAT-3/WASC. SAT-3/WASC is a consortium of telecommunications companies which gathered at a given time (and after several meetings) decided to construct a cable that will facilitate communication. Each company expressed its needs, relative to its target objectives of telephone calls, Internet bandwidth, etc. It was based on these needs that the total cost of construction was estimated, and a construction and maintenance agreement signed (CMA). One cannot speak of the cable as a monopoly or even talk of an end of monopoly when the contract permits access by operators as needed. [The agreement] respects the national telecommunication legislations: If in a country, there is a global operator [operating] international[ly] it can have access to the cable, by addressing its needs through Sonatel (for Senegal), or by addressing itself to the administrator of the cable on the [agreement] plan of the consortium.

While in principle this alludes to a spirit of cooperation, in practice what occurs are de-facto monopolies in each country with a landing station.

The construction of SAT-3/WASC was spread over two years. According to the financial agreement, the cost of the landing point to Senegal was US$24-million. Maintenance costs were distributed annually to each participant and according to the level of their shareholding. Maintenance is carried out by cable-laying ships which are responsible for very precise maintenance zones in the ocean. For SAT-3/WASC, there are five such cable-laying ships from the North Atlantic up to 2000 km south of Dakar. There are also a certain number of ports which have warehouses of cable reserves in case of breakdowns. Dakar is one of the cable reserve ports, along with Brest, Vigo, Las Palmas, and a number of others.

International access in Senegal is still dominated by Sonatel. It is the only company that offers connectivity to international bandwidth. At a media briefing in May 2006 (S. Niang, 2006a), Saër Niang, Director of Human Resource and Regulation at Sentel, deplored the monopoly status enjoyed by Sonatel. According to him, the estimated market value of international access in Senegal is US$140-million (with a potential of US$187-million) which all accrues solely to Sonatel. Presently, Sentel pays royalty to Sonatel for all international calls from its mobile network (S. Niang, 2006b). In addition, all Internet Service Providers (ISPs) are obliged to pass their international traffic through Sonatel. In a study conducted in 2005, Osiris's Olivier Sagna noted that despite the government's announced intention to liberalise the telecommunication sector and allow other operators to provide fixed-line and international access, no major change has taken place in the sector (Olivier Sagna, 2005). This remains true today, as plans to license a Second National Operator (SNO) appear to have stalled.[2]

[2] However, the Council of Ministers in April 2007 mentioned that a Saudi group expressed interest to acquire a mobile telephony licence. This interest was also expressed by the China Telecom Group (Jeune Afrique, 2007). Morocco Telecom and Telkom South Africa (SA) are also in the fray for some piece of the Senegalese telecom market. However, there are no official statements as to which of these companies will be awarded an SNO or third mobile operator licence.

2.4 The impact of SAT-3/WASC in Senegal

Quite clearly, Senegal has made significant inroads into establishing accessible telecommunication infrastructure with the associated benefits for the general population. Internet cafés (telecentres) dot every street corner of Dakar where a large population of the country reside. Mobile phones are also in abundance. International call costs have been standardized irrespective of distance or destination, making international calls more affordable for many citizens. Broadband is available with ADSL, even though the process of connecting could take weeks.

Senegal also delivers connectivity to its neighbouring countries. Mali, The Gambia, Guinea Bissau, and Mauritania access international bandwidth through the Dakar SAT-3/WASC landing station. Internal country fibre backbone has been developed in most of these countries to permit them to connect and further extend the connectivity to their citizens. However, the connectivity costs between these countries are high and largely restrictive, even though the respective telecommunication agencies consulted during this study have applauded the rather 'cordial' relationship between them and their service provider, Sonatel.

The table below compares the current bandwidth capacity of a few of the SAT-3/WASC member countries to landlocked and non-consortium member countries. In the table Senegal currently has the highest capacity, even when compared to existing members of the consortium with direct access to a landing station (Benin, Cote d'Ivoire and Ghana). The table also indicates the weak level of international bandwidth capacity of countries without a landing station (Burkina Faso, Mali and Cape Verde).

Country	Total bandwidth prior to SAT-3/WASC	Total bandwidth since SAT-3/WASC	Member of SAT-3/WASC consortium?
Senegal	42Mb/s	1,24Gb/s	Yes
Benin	2Mb/s	47Mb/s	Yes
Côte d'Ivoire	33Mb/s	45Mb/s	Yes
Ghana	4Mb/s	40Mb/s	Yes
Burkina Faso	1Mb/s	12Mb/s	No
Mali	1Mb/s	12Mb/s	No
Cape Verde		8Mb/s	No

Table 3: Bandwidth comparison of SAT-3/WASC countries

In an intervention by the European Social Forum, in November 2004, Philippe Drouot, the Director of Association Africa Computing, recalls that "landlocked countries have very weak bandwidth capacity because of their recourse to connections via satellite (VSAT) which European and American operators invoice at astronomical amounts". He raised the example of Sonatel, and described the total bandwidth to Niger as equivalent to the total capacity of four ADSL subscribers in Senegal (Grenouille, 2004).

The bandwidth evolution in Senegal resulted in an increase in the quantity of bandwidth available per capita. It was only 3.8B/s in 2000, a couple of years prior to the inauguration of SAT-3/WASC. In 2002, the year of inauguration, it was 5.3B/s and two years after SAT-3/WASC, in 2004, it was 44B/s per capita. Today, in 2007, the bandwidth available per capita is 103B/s. This remains far behind countries with good bandwidth per capita such as Denmark (35Mb/s), the Netherlands (20Mb/s) and Sweden (17.5Mb/s), but well ahead of the majority of most African countries.

However, total bandwidth in Senegal has progressively increased from 42Mb/s, in May 2002, the time of the launch of SAT-3/WASC, to 1024Gb/s in 2007, five years after inauguration of SAT-3/WASC. As of June 2003, bandwidth had increased from 42Mb/s to 53Mb/s and then to 90Mb/s a few months later. It increased by over 3.5 times to 310Mb/s at the beginning of October 2003, and then to 445Mb/s a year after (October 22, 2004). By November 2004, it was 512Mb/s. The bandwidth has, as a result, been upgraded over 11 times between the inauguration of the cable and November 2004. The last upgrade, in October 2006, doubled capacity to 1.24Gb/s.

Currently Sonatel offers 512Kb/s, 1024Kb/s and 2048Kb/s ADSL connections and the cost of access has reduced over time.

3 Performance indicators – successes and failures

Senegal's focus on developing its telecommunictions sector is due to the political will of the Wade administration. President Wade has ensured that technology and telecommunications is often referred to in the country's national development plans and has played a leading role in advancing technology at international levels, including setting up a digital solidarity fund at the World Summit on the Information Society in Geneva, to reduce the digital divide (DSF, 2003).

Senegal operates a five-year cycle development plan which is constantly being re-evaluated. The plans form the basis by which the public evaluates the government's development objectives. Historically, most of the objectives in the development plans are achieved within the stated period. As with previous plans, the current 10th cycle (for the period 2002-2007) development plan includes a section on ICTs.

The state's efforts in making the development plans available to the public may have been to stimulate a consultative process on issues of national importance. It seemed, however, that Sonatel's investment in the SAT-3/WASC consortium was not subject to any such public debate, and there are no records to indicate that fora were created to discuss this investment. However, decisions were made that resulted in monopolistic bias in favour of the incumbent as the sole owner and operator of the SAT-3/WASC asset.

The same applied to the recent re-branding of Sonatel, where there was little public debate beyond trade union discussions. The rebranding was largely criticized, especially by the telecommunication's trade unions. The decision in favour of rebranding was eventually made amidst very opaque circumstances. Ibrahima Konté, former secretary general of the national trade union of telecommunications workers, and a representative on the board of directors of Sonatel, described the introduction of the Orange brand as a "swindle." Although the negotiations were such that France Telecom bore all the expenses of the re-branding (technical expenses, advertising, etc.), Konté declared that it will be necessary to renegotiate in 2008. For instance, Sonatel is required to pay a management fee, whereas, according to Konté, this fee should not be a requirement. He argues that the sales turnover of the Alizé brand (now Orange), estimated at FCFA120-billion (about US$224mllions), is an "accumulation of work from 1997 to date", and that it

is just not fair to "remunerate somebody [else] on the basis of work towards which they did not make any historical contribution".

In November 2006 the Sonatel group adopted the Orange trademark of France Telecom, its major shareholder. From this period on all other brands of Sonatel (Alizé, Keurgui TV, Sentoo and even Ikatel, a mobile operator in Mali) were unified under the banner of the international Orange brand present in more than 150 countries. According to Sonatel, this change, which was opposed by trade unions from the start, aims at "making consumers alive [to] the best opportunities offered by the convergence of mobile, Internet and television through a single brand". The group also says it wants to "place at the disposal of the customers the most advanced technologies and services, and to simplify their lives".

However, in December 2005, at a meeting to decide the final trademark name with representatives of Sonatel, France Telecom, the state and workers, the national trade union of post office and telecommunications workers, SNTPT, refused the change, asserting that France Telecom did not have Sonatel's best interest at heart and that "we are with a multinational which only…considers [Sonatel] a milking cow, because it requires that 1.6% of the sales turnover of Sonatel goes to France Telecom after the establishment of the Orange brand, a sum equivalent to FCFA5-billion of our resources." (Le Quotidien, 2005a) Later, the director general of Sonatel, Sheik Tidiane Mbaye, disputed the FCFA5-billion royalty announced by the trade unions, explaining that the royalty would actually be only FCFA1.6-billion. The December meeting then decided to contract the services of international consultants to continue to study the case and to examine the advantages and disadvantages of the adoption of the brand name. All that, however, perhaps did nothing but delay the name change process since, finally, the group adopted the Orange brand with slight concessions to trade unions. It is unclear how an agreement was reached. (APS, 2006)

Box 1: Sonatel becomes Orange

3.1 Subscription, usage and capacity utilization

The rapid increase of Senegal's total bandwidth over a short period of time since the implementation of SAT-3/WASC indicates either the need to meet bandwidth demands or an anticipation of projected future needs. Whatever the case might be, it seems that the current bandwidth capacity (as at the last upgrade) has enabled services to be extended to several other neighbouring countries, including Mali and Guinea Bissau. Currently, Ikatel routes most of its mobile phone traffic through Sonatel in line with the Orange agreement.

Growth in fixed lines has increased considerably (by about 176%) from 160,000 subscribers of residential and business telephones three years prior to SAT-3/WASC, to 283,000 subscribers three years later.

Mobile phones subscriptions have grown exponentially by over 4,000%; from 84,000 subscriptions three years prior to SAT-3/WASC to over 3.5-million subscribers in 2007. Telecentres have also increased in number, from 7,000 in 2001 to over 18,500 in 2007. Telecentres can be found on every street corner of the major cities, and in certain rural areas, and they offer local phone calls at FCFA65/unit (US$0.13).

The start of SAT-3/WASC services coincided with the development of a number of Internet services, in particular call centres, telemarketing and remote data entry centres, which require a considerable amount of bandwidth for their operations. It is undoubtedly the availability of SAT-3/WASC that has catalysed the development of these services.

According to Dieng, Sonatel utilises most of the capacity on SAT-3/WASC and the last two cable upgrades were necessary to meet new and general increases in demand. The most recent cable upgrade was in 2006. Given the current growth in demand, it is anticipated that more infrastructure may be required within the next 10 years. The traditional lifespan of the cable is approximately 25 years. But with the rapid rate of advancement in technology, this tends to be shorter. Dieng postulates that due to obsolescence of the cable and the high maintenance cost, most telecoms operators would prefer to invest in new cable infrastructure, integrating new technologies.

Generally, SAT-3/WASC has made it possible for Senegal to make in-roads into universal access targets. Principal indicators, including the number of phone boxes or access points to the Internet per capita, the total percentage of fixed lines, and network coverage, have increased since the cable became operational. Currently, there are 267,000 fixed telephone lines (December 2005), 16,245 public lines and more than 22,000 telecentres (2004). In addition, the combined number of mobile subscribers (Sonatel and Sentel) is 3,500,000 (2007). These figures place Senegal in a good position compared to other West African countries; and, indeed, most African countries south of the Sahara.

International bandwidth	1,24 Gb/s (since October 2006)
Total number of leased lines	146
Total number of ISPs	13
Total Internet contracts	20 000 (31 Dec 2005)
Total ADSL contracts	18 000 (31 Dec 2005)
Total Internet user base	200 000 (Figures by extrapolation)
Total declared '.sn' domains	1516 (Jan 2004)
Currently available online sites	387 (Jan 2004, sites in .sn)
Total Number of Internet access points	> 150

Table 4: Internet: basic data

Fixed phone	
Number of operators	1 (Sonatel)
Number of contracts	283.000 (Jan 2007)
Number of public lines	16.251
Number of telecentres	7 000 (for 17,000 phone lines, year 2007)
International calls	130 FCFA/min (0800 to 1800) - US$ 0.24/minute
	150 FCFA/min (0800-2300 and 0700h to 8h) – US$ 0.28/min
	100 FCFA/min (de 23 h à 8 h) - US$ 0.19/minute
Mobile phone	
Number of operators	2 (Sonatel and Sentel)
Number of contracts	3,500,000, including 2,275,000 for Sonatel (Jan 2007) and 1,225,000 for Sentel
International calls by Sentel	240 FCFA/minute (US$ 0.45/minute)
International calls by Sonatel	200 FCFA/minute (US$ 0.38/minute)

Table 5: Fixed and mobile services: basic data

3.1.1 Internal infrastructure: terrestrial cables

In addition to the underwater cables and satellite network, Sonatel has a network of terrestrial cables which allow a direct connection with Mali and Mauritania (via fibre optic cable on the Manantali dam, managed by SOGEM, the electricity company of Mali, within the framework of a maintenance agreement), as well as regional radio-relay systems with Guinea financed by operators in both countries. Terrestrial cables between Senegal and Gambia and Guinea Bissau are also being developed.

3.2 Costs and tariffs

The cost of access has reduced almost in direct proportion to increases in bandwidth capacity. Sonatel has offered a number of tariff reductions over the years, especially in its ADSL services. The cost for Internet access was reduced by 15% in February 2003 to US$87 for ADSL 256. Further price

reductions were experienced in May 2003, with the introduction of ADSL 512Kb/s, and a tariff reduction of 48.7% on ADSL 256Kb/s. April 2004 saw another drop of 39% and a further 50% on the cost of ADSL 256-1024KB/s. There were other promotions in October 2004, and a lot more recently in May 2005, during which the following reductions occurred:

- Drop by 54% for ADSL 256Kb/s and 512Kb/s, and a tariff reduction of 49% on ADSL 1024Kb/s;
- Monthly subscription for 256Kb/s and 512Kb/s lines fell by 22% and 60% respectively;
- Drop by 74% on the monthly subscription for ADSL 1024Kb/s;
- Introduction of ADSL 2048Kb/s: a customer subscribing to 1024Kb/s can benefit from 2048Kb/s bandwidth while paying less than 44.70% of his/her invoice;
- Tariff for 512Kb/s made equivalent to cost of 256Kb/s.

In May 2006, price discounts of 30% were offered by Sonatel, and 20% by Sentel, for 1024Kb/s and 2048Kb/s. This particular price reduction raised the subscription rate to 20,000 ADSL subscribers from the previous listing of 18,000 (90% of Internet subscriptions) as at December 31, 2005.

The table below indicates the current price of ADSL as offered by Sonatel/Orange.

	Royalty - line	Royalty - ISP	Total
ADSL 512	FCFA13,500	FCFA6,400	FCFA19,900
ADSL 1024	FCFA28,000	FCFA11,200	FCFA39,200
ADSL 2048	FCFA56,000	FCFA16,000	FCFA72,000

Table 6: Current price of ADSL as offered by Sonatel/Orange

Note: The cost of installation is payable only once at a amount of FCFA11,500 (US$22) for ADSL 512, FCFA103,000 (US$193) for ADSL 1024 and 2048

Price reductions were also experienced for international connections. In May 2002, price reductions of 47% for 64-128Kb/s and 58% for 256-2048Kb/s were offered on IP numbers. In April 2003, the cost of 64-128Kb/s was reduced by about 30%, 256Kb/s by 40%, and 512Kb/s and 2048Kb/s by 45%.

There were further price reductions of between 21-55% in November 2005 for 64, 128, 256, 512, 1024 and 2048Kb/s, from an initial price of FCFA450,000 (approximately US$900). Price reductions were also noted on leased lines: a 20% reduction for 64Kb/s, 25% for 128Kb/s and 256Kb/s, and 30% for 512 – 2048Kb/s.

It certainly could be said that the development and use of Voice over Internet Protocol (VoIP) contributed to the lowering of tariffs on international communications, perhaps contributing to the price reductions.

May 2002	12% tariff reduction of phone calls outside of Africa
April 2003	15% tariff reduction during peak time
June 2004	33% tariff reduction and passage to a single tariff irrespective of destination
May 2005	11% tariff reduction per minute in peak time; 6% reduction in off-peak; 37% between 11pm and 8am
May 2006	18% price reduction on international calls and harmonization of times

Table 7: Reductions in international tariffs

National communications also underwent price reductions, although to a lesser extent than experienced by international services. For example, in May 2005, Sonatel offered a 23% reduction on fixed-to-mobile calls, and 6-23% on mobile-to-mobile, depending on distance. In May 2006, there was a further reduction of up to 14% for mobile-to-mobile during peak time. These price reductions were mostly offered by Sonatel, the monopoly owner of the SAT-3/WASC facility; but Sentel has also offered some impressive price reductions.

Interconnection rates and conventions have also been modified; first between Sonatel and Sentel (modified on July 19, 2005), and then between Sonatel and Sonatel Mobile (July 23, 2005). These modifications were promoted by changes in mobile termination taxes and tariffs for external calls coming from outside Senegal. However, the tariffs for routing community traffic services remained unchanged.

3.2.1 Comparison of ADSL costs and international communications

Orange (the umbrella organisation for Sonatel and Ikatel), offers connections in Mali via ADSL services launched in September 2006. ADSL 128Kb/s costs

US$43 per month, compared to US$38 per month in Senegal for ADSL 518Kb/s – twice the capacity. International communications are zoned in Mali, costing US$0.28/minute for calls to Zone 1 (African countries)[3] and US$0.37/minute for calls to Zone 2 (rest of the world).

Call Origin	Sonatel (mobile)	Sentel (mobile)	Sonatel fixed-line
Alizé (now orange)		HP = 63 FCFA (0.13 US$) HC = 44,1 FCFA (0.09 US$)	
Sentel (now Tigo)	HP = FCFA63 (US$0.13) HC = FCFA44,1 (US$0.09)		HP = FCFA 63 (US$0.13) HC = FCFA44,1
Local (Sonatel)	HP = FCFA23,6 (US$0.044) HC = FCFA14,8 (US$0.027)		
Simple transit (Sonatel)	HP = FCFA52 (US$0.09) HC = FCFA32,5 (US$0.06)		
Double transit (Sonatel)	HP = FCFA70,9 (US$0.13) HC = FCFA44,4 (US$0.08)		
International exit (via Sonatel)	HP = -11% (compared to public price) HC = -8,5% (compared to public price) FCFA84,75 (Night Tariff: 11pm-8am)		
Transit to other mobile networks through Sonatel	HC = FCFA15,6 (US$0.03) HC = FCFA9,8 (US$0.018)	HC = FCFA15,6 (US$0.03) HC = FCFA9,8 (US$0.018)	
From Sonatel to	Sonatel Mobiles	Sentel (Mobiles)	
International entry (via Sonatel)	FCFA63 (US$0.11)	FCFA63 (US$0.11)	

Table 8: Call costs
Note: HP = Peak time, HC = Off Peak
Source: Report on the Senegalese Telecommunication market in 2005 (ARTP)

In Senegal, the tariffs to international destinations, which were extremely high a few years ago (between US$0.74 and US$1.3/minute depending on destinations), are today US$0.24/minute to all destinations during off-peak hours, and US$0.20/minute from 18h00 to 23h00 and 07h00 to 08h00. During 'night hours', tariffs are US$0.10/minute (from 23h00 to 07h00). It is evident

[3] Benin, Burkina Faso, Ivory Coast, Cape Verde, Gambia, Ghana, Guinea Conakry, Guinea Bissau, Liberia, Niger, Nigeria, Senegal, Sierra Leone, Togo, Mauritania and South Africa.

that international tariffs are very competitive compared to those offered by the same service provider network in Mali.

However, since Sonatel commenced ADSL services in Senegal, the price of connectivity could and should be more affordable than the current figures show. The table which follows indicates the differences in monthly costs for an ADSL user in France and Senegal. It should be noted that these costs are tariffs from 'the same' company, Sonatel being a subsidiary company of France Telecom with an ownership of 42,33%. The cost of 1Mb offered by Sonatel is 240% more than France Telecom. This price does not include the cost of initial installation of $193.

ADSL offering	Sonatel	France Telecom
ADSL 1Mb/s	US$74	US$31
ADSL 2Mb/s	US$134	NA
ADSL 8Mb/s	NA	US$37

Table 9: Price comparison of Sonatel vs. France Telecom

3.3 Other services

3.3.1 General Packet Radio Service

Other services are also being offered to consumers in Senegal. General Packet Radio Service (GPRS) is a relatively new service, with unstable levels of quality (ARTP, 2006) and high costs. The table below indicates the cost of GPRS for various flow rates. According to the test on the quality of GPRS services conducted in 2006 by ARTP, there were delays experienced in activating GPRS on existing phones. Sonatel recently launched a promotion to increase access to its GPRS service by providing free subscriptions to new clients (Sonatel, 2007a). This promotion was scheduled to last till August 30, 2007. It is unclear if this new resolve addresses the delay in subscribing. The subscriber base remains low. Another reason for the slow pace of consumer acceptance of GPRS service is that Internet access is readily available at telecentres or in homes. At the same time, the "business everywhere" (Sonatel, 2007b) culture that is being promoted by Orange has still not taken hold in Senegal. With Internet access readily available, users prefer to reference sites or refer to their web-ready e-mail boxes sitting behind a client's PC, than to download pages onto their mobile devices.

Flow	Settlement costs (US$)	Monthly Cost
64Kb/s	1,215	718
128Kb/s	1,215	116
256Kb/s	1,215	1,303
512Kb/s	1,870	2,002
1024Kb/s	1,870	2,513
2048Kb/s	1,870	3,298

Table 10: Tariff of GPRS connections within the same local district
Note: Exchange rate: US$1=535 FCFA

3.3.2 Leased line

Leased lines are still in operation in Senegal, and are still relatively expensive.

Flow	Settlement costs	Monthly costs
64Kb/s	842	488
128Kb/s	842	575
256Kb/s	842	638
512Kb/s	842	798
1024Kb/s	842	1,510
2048Kb/s	842	2,588
4096Kb/s	842	4,916
8192Kb/s	842	9,341

Table 11: Cost of leased line in 2007
Note: Exchange rate: US$1= FCFA535
Source: ARTP (2005)

4 Analysis of access to SAT-3/WASC

4.1 Legislation and regulation

The Agence de Régulation des Télécommunications (ART) was set up by an act of legislation with a mandate to ensure healthy and fair competition to the benefit of consumers, operators and the economy. The 2001 Telecommunication Code was modified in 2006 and the mandate of ART was extended to cover the postal sector. As a result, Agence de Régulation des Télécommunications et des Postes (ARTP) regulates both the telecoms and postal sectors as a publicly-owned establishment with legal expertise and financial autonomy, but as an institution placed under the authority of the president of Senegal.

ARTP's mission includes:

- The supervision of competition and regulating anti-competitive practices, in particular the abuse of a dominant market position;
- The annual auditing of network owners and telecom service providers;
- Fixing of royalties accruing to network owners;
- Approval of universal service tariffs and tariffs for telecoms services within monopoly regimes.

The regulator is a political appointment and its independence has limits. Some have suggested that it is certainly biased in favour of Sonatel. However, since 2006, there have been signs that ARTP wants to establish some degree of neutrality. Perhaps to prove this neutrality, Sonatel was twice reprimanded and penalised: first, in March 2006, when it was requested to pay FCFA6-billion to the treasury for an interruption of traffic on its network; and, second, in January 2007 when it was told to pay FCFA3.2-billion (i.e. 1% of its sales turnover) for insufficient cellular network coverage in certain parts of the country, and in the capital Dakar.

The extent to which ARTP has a mandate to regulate the pricing on international gateway access is unclear.

4.2 Dispute resolution mechanisms

4.2.1 Performance of the mobile network

With respect to performance of the mobile networks, a quality of service study was recently conducted in 2005 under the aegis of the regulator. The study showed that the "level of quality of mobile communication is at 70%, whereas the standard is 90%". The study showed that the "two [mobile] networks have known failures, especially with regard to echoes and noise on lines which inevitably have an impact on the quality of communication". With respect to interconnections, "[with] Sonatel-to-Sonatel (Orange), there is a rate of quality of 63% whereas it is 57% between Sentel calls. But the quality is hugely degraded during interconnection of fixed-to-mobile, ranging from 11% to 21% depending on the direction of the call". (Le Quotidien, 2005b)

A second investigation into the quality of the networks was carried out in November 2006 by Directique, a France-based telecoms quality research organisation. Even though the quality of service had improved slightly, this new study showed that the coverage and the audio quality of the two networks was lower than networks measured in France and Morocco (Enquête Qualité, 2006). With regard to short message services (SMS), the performance, which is 94% reception rate on Sonatel and 92% on Sentel, is below standard. In France, 99% of SMS messages arrive at their destination, while 96% arrive at their destinations on Moroccan networks.

Interconnection also had its problems. The study reveals that "failures are massive and relate more to Tigo (Sentel), but also impact Orange (Sonatel)".

It is likely the dropped calls and failed SMSes resulted from fewer cell coverage areas, handoff between cells, imbalance of traffic between cell sites, or a low technical capacity of staff at Sonatel, rather than poor bandwidth.

4.3 Investment and business environment in Senegal

According to the US Department of State, in a report compiled in 2006, Senegal offers investors political stability, an advantageous geographic location, low inflation, a currency pegged to the euro, easy repatriation of capital and income, abundant semi-skilled and unskilled human resources, and advanced telecommunications infrastructure (StateGov, 2006).

Such a climate allows for investment in all sectors, including telecommunications. For instance, there are opportunities for call centre-type services.

However, issues that impede foreign investment include overly rigid and demanding labour laws, a lack of clear title to property outside the greater Dakar area, and an inefficient, and occasionally corrupt, judiciary. Judicial, tax, customs and regulatory decisions are frequently inconsistent, tardy and non-transparent. Although Senegal does have a 'one-stop' investment agency, APIX (APIX, 2007), it can take well over a year to start a business.

4.4 Politicization of the sector

Progress in the telecommunications sector in Senegal has been made without the presence of a coherent ICT policy framework. One major impact the policy vacuum has had is in the area of regulation. ARTP was created as late as 2002, when it was needed much earlier to regulate the sector, including Sonatel and its SAT-3/WASC asset. While there have been several ministerial cabinet reshuffles in the last couple of years, the ARTP has had three directors in five years, with each replacement being nominated for unclear political reasons.

Another highly politically sensitive area is the protracted delay on the choice of an SNO. The campaign for the SNO was launched and withdrawn two years ago, and there have been no comments or progress in this direction since. Yet Sonatel continues to benefit from the delay. It would seem that the culture of public debate on national infrastructure has given way to one-on-one, corridor-type discussions on issues that are of high national interest and priority.

4.5 Human resource capacity

Telecommunication operators in Senegal employ 1,815 people (2005) – 1,680 for Sonatel (1,431 for fixed telephony and 249 for mobile telephony) and 135 staffers for Sentel. If one adds the other telecoms actors (telecentres, teleservices etc.), close to 40,000 people are employed in the sector.

Sonatel has always been run by locals in the majority of the top management positions, except for the offices of the chairman of the board of directors and the assistant director general, which are occupied by French nationals.

Several national institutions provide the technical capacity requirements of the telecommunications industry. A number of students are graduated each year from the Ecole Supérieure Polytechnique (ESP) at the University of Cheick Anta Diop, in the fields of ICTs, data processing, networks, programming, artificial intelligence, expert systems, and design and maintenance of information systems, amongst other things. The University of Gaston Berger in St. Louis has an applied science and technology department that offers courses in mathematics, data processing and physics. Ecole Supérieure Multinationale des Télécommunications (EMST), a technology school, also offers courses and awards telecommunication degrees.

5 Conclusion

According to Fatimata Sèye Sylla, data processing specialist and president of the non-governmental organisation Bokk Jang Senegal, the participation of Sonatel in SAT-3/WASC has actually made it possible for Senegal to make significant advancements with respect to universal access. However, she says the company could have performed better:

> The cost of access, especially in the rural zones, is exorbitant compared to the available disposable income and purchasing power of the potential users, who in general are not in a position to afford such costs. Sonatel should meet its universal service obligations by lowering the cost of access, especially in rural areas… The state, within its strategy of accelerated growth, should invest sufficiently in universal access services, especially in the areas of capacity building and content creation. (personal communications, May 2007)

Most interviewees suggested that Sonatel should not be the only operator with gateway access to international bandwidth. It is important to have a second operator on the fixed network, so that healthy competition can be established. This would ideally put a downward pressure on pricing, especially regarding national communications. Indeed, for the past seven to eight years there has been no significant change in the pricing of local calls.

Compared to its neighbours, Senegal has exhibited considerable foresight in partnering in SAT-3/WASC. Its communication infrastructure and capacity is now being offered to countries such as Mali, the Gambia and Guinea Bissau.

Although Senegal's prices compare favourably to most countries in the sub-region, and the rest of Africa, universality of costs should be seen globally rather than within a smaller context. The tariff comparison between Sonatel and France Telecom suggests the distance Senegal still has to go to be internationally competitive. Moreover, universal service obligations of companies such as Orange should force it to consider lowering costs to increase coverage, market share and the teledensity of its market in developing countries. After all, the theories of economies of scale stand to benefit such companies.

Although such arguments contradict shareholders interests, goods and service which are in the public interest must, when delivered in a market where purchasing power may be limited, consider local realities such as the buying power of the society to which the goods or services are being delivered. Issues such as the public good should also be considered, alongside returns on investment.

Does Sonatel's bandwidth capacity make it possible for it to offer pricing that is much more competitive, affordable, and comparable to those offered in Europe and other countries? Sonatel has upgraded capacity on SAT-3/WASC several times and, as mentioned by Dieng, these capacity upgrades were required to meet an increase in demand. However, this capacity is also being offered to neighbouring countries, and the total capacity being consumed by Senegal alone is unclear. It is also unclear if the need for the most recent upgrade was a result of demand or the result of projected future needs. It could also have been a strategic marketing ploy to further Sonatel's interests in neighbouring countries. A more independent and neutral ARTP could help to clarify at least some of these questions.

6 Glossary

3G	Third Generation (mobile technology)
ADSL	Asymmetric Digital Subscriber Line
CDMA	Code Division Multiple Access
DSL	Digital Subscriber Line
E1	A bi-directional (full duplex) 2Mb/s link
EDGE	Enhanced Data Rates for GSM Evolution
EV-DO	Evolution – Data Only (CDMA)
FDI	Foreign Direct Investment
FL-LRIC	Forward-Looking Long Run Incremental Costs
GPRS	General Packet Radio Service
GSM	Global System for Mobile communication
HSDPA	High Speed Download Packet Access
IMF	International Monetary Fund
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
ITU	International Telecommunication Union
Kb/s	Kilobits per second
LAN	Local Area Network
Mb/s	Megabits per second
MIU km	Minimum Investment Unit kilometers
NLOS	Non Line of Sight
PDH	Plesiochronous Digital Hierarchy

RIO	Reference Interconnection Offer
SAT-3/WASC	South Atlantic 3/West Africa Submarine Cable
SDH	Synchronous Digital Hierarchy
SNO	Second National Operator
UAF	Universal Access Fund
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network
VSAT	Very Small Aperture Terminal
WAFS	West African Festoon System
Wi-Fi	Wireless Fidelity
WLL	Wireless Local Loop

7 Bibliography

1. Ahmadu Top, Electronic review of Osiris, Batik (No 54, January 2004), Osiris is a Civil society organisation that acts as an Observatory on information systems, networks and information highways in Senegal.
2. APIX, http://www.investinsenegal.com/US/apix.html, last accessed, August 18, 2007
3. APS, 22 novembre 2006: "L'intersyndicale de la Sonatel refuse la marque Orange"; Le Quotidien, 9 décembre 2005, "Les 'Sonatéliens' refusent l'Orange"; Wal Fadjri, 10 mai 2007, "Ibrahima Konté: la marque Orange est une arnaque"
4. ARTP, 2005, "Rapport sur la marche des télécommunications en 2005",
5. ARTP, 2006, GSM, quality of service report in Senegal, October/November, 2006. http://www.artp-senegal.org/page_inter2.php?idmenu=5&id=10104&sid=10104&art=103&label=News&page=Enqu%EAte+Qualit%E9+des+R%E9seaux+GSM+au+S%E9n%E9gal+%96+Octobre%2FNovembre+2006), Last accessed, August 15, 2007
6. CFAO, http://www.cfaogroup.com/index.php?langused=uk, last accessed August 18, 2007
7. Christophe Brun, IRD, Institut de recherche pour le développement (2000)
8. DSF, 2003, http://www.dsf-fsn.org/cms/content/view/93/120/lang,en/, Last accessed August 19, 2007
9. Enquête Qualité de service des réseaux GSM au Sénégal, Octobre-Novembre 2006, Directique/ARTP, http://www.artp-senegal.org/page_inter2.php?idmenu=5&id=10104&sid=10104&art=103&label=News&page=Enqu%EAte+Qualit%E9+des+R%E9seaux+GSM+au+S%E9n%E9gal+%96+Octobre%2FNovembre+2006),
10. Grenouille, 2004, http://africa.grenouille.com/article22.html, last assessed in 2004
11. HIPC, 2004, http://www.un.org/special-rep/ohrlls/ldc/HIPC.pdf, last accessed, August 18, 2007
12. Ibrahima Konté, Wal Fadjri newspaper, No 4542, Thursday, 10 May 2007

13. Jeune Afrique, published April 27, 2007

14. Le Quotidien Newspaper, December 9, 2005

15. Le Quotidien, July 26, 2005

16. Metissacana, http://www.agencetopo.qc.ca/dakarweb/dakar/metissacana.html

17. Olivier Sagna, National Report/Ratio on the level of ePreparedness: Situation and potential of development of electronic commerce in Senegal. Study conducted for the Center of International Commerce, (CCI, CNUCED/OMC, January 2005).

18. Osiris, 2005, website, Osiris http://www.Osiris.sn/article1624.html)

19. Press Release of Cybercafe Le Métissacana, by Michel Mavros, November 2002

20. Rédac-Info, an electronic review of France Telecom, June 19, 2002

21. Saër Niang, 2006a, Wal Fadjri newspaper, May 27, 2006 edition

22. Saër Niang, 2006b , Press briefing organised by CATIA (Catalysing ICTS in Africa and Panos Institute of West Africa) PIWA)

23. Senegal Investment climate, http://www.state.gov/e/eeb/ifd/2006/62378.htm, last assessed May 14, 2007

24. Sonatel 2007b, Business Everywhere, http://www.orange.sn/entreprise/njelbeenbumaag,djoumtou,3,11,67,674,ay, last accessed, August 15, 2007

25. Sonatel, 2006, Figures of the 2006 Annual report. See http://www.sonatel.sn/xamxam,1,2,le), http://www.sonatel.com/documents/rapportannuel2006_anglais.pdf, last accessed August 4, 2007

26. Sonatel, 2007a, GPRS, http://www.orange.sn/entreprise/njelbeenbumaag,djoumtou,3,4,66,715,ay, last accessed, August 15, 2007

27. Stategov, 2006, Senegal Investment climate, http://www.state.gov/e/eeb/ifd/2006/62378.htm, last assessed May 14, 2007

28. Tidiane Seck, Director, ADIE, 2006, "Senegal goes Open Source to cut software costs", on an online article, February 1, 2006 putting

PC cost at $1500.
http://www.infoworld.com/article/06/02/01/74993_HNsenegalopensource_1.html, Last accessed, August 4, 2007

29. USGOV, 2007, http://www.state.gov/r/pa/ei/bgn/2862.htm, last assessed April 19, 2007

30. Various Sources, Sonatel (www.sonatel.sn), Osiris (www.Osiris.sn), Index Mundi, Senegal Government website (http://www.demarches.gouv.sn/)