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

Cameroon case study

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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 Cameroon, with a particular focus on international and Internet services. It is one of four similar reports commissioned by the Association for Progressive Communications (APC) in November 2006 – the three other countries researched being Angola, Ghana and Senegal. A primer 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 at the retail and the wholesale level. Detailed comparisons are made to satellite as an alternative means of access to international bandwidth, and the report identifies how the two mediums have influenced each other in terms of pricing and subscription levels.

The report also looks at the environment for access to the SAT-3/WASC cable in terms of regulation and licensing, and considers the general business environment in Cameroon's telecoms sector. In particular, it examines existing and planned national backhaul infrastructure as a prerequisite for distributing the SAT-3/WASC bandwidth throughout the country.

Amongst others, interviews were conducted with the fixed-line incumbent Camtel and its subsidiary Camnet, two other major Internet Service Providers (ISPs), six small ISPs, both mobile operators in Cameroon and the telecommunications regulator, ART. The interviews took place during the period February to April 2007, and were carried out by Peter Lange and Gerard Mbouyap. ISPs are quoted anonymously, as requested.

2 Background

2.1 Brief country profile

Cameroon is situated on the west coast of Africa, bordered by Nigeria, Chad, the Central African Republic (CAR), the Democratic Republic of the Congo (DRC), Gabon and Equatorial Guinea. The modern state of Cameroon was created in 1961 by the unification of two former colonies, one British and one French. Yaounde in the interior is the capital city, while Douala on the coast is the largest city and the industrial centre of the country.

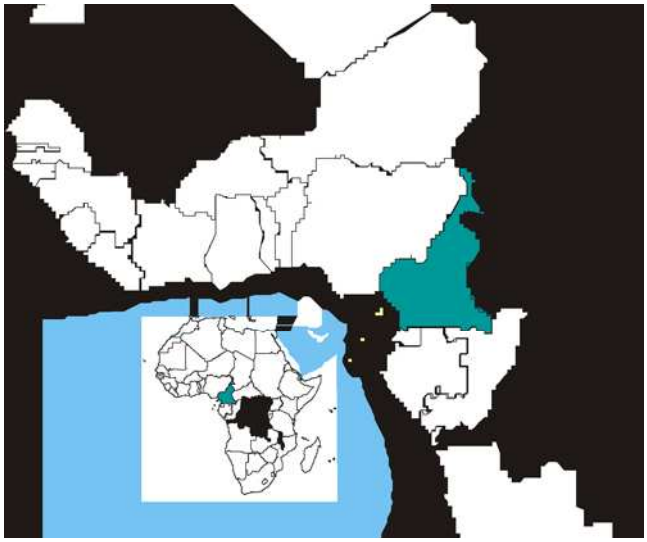

Figure 1: Cameroon

Despite facing many of the serious problems confronting other underdeveloped countries, Cameroon has shown steady GDP growth of around 4-5% over the past several years. However, the country's progress is hampered by a level of corruption that is amongst the highest in the world. Cameroon's GDP per capita classifies it as a low-income country by global comparison. The economy is dominated by agriculture, while modest oil reserves make up more than half of all exports. Timber is also a major export.

Population (e)	18.2-million
Land area	475,000 sq km
Capital	Yaounde

Local currency	CFA Franc (FCFA), US$1 = FCFA540
GDP at current prices (e)	US$18.5-billion
GDP per capita	US$1,006
GDP real growth rate	4.2%
Government	Multiparty presidential regime

Table 1: Cameroon country statistics 2006
Source: DFAT

2.2 Overview of Cameroon's telecommunications market

The development of telecommunications in Cameroon has generally been slow, although in some areas the country has taken a lead over other African countries, notably in the provision of the continent's first GSM mobile service in 1993.

Number of national telecom operators	1
Number of mobile operators	2
Number of ISPs	ca. 25 plus many informal ones
Fixed-line penetration	0.6%
Mobile penetration	14.5%
Internet user penetration	1.4%
Internet subscriber penetration	<0.1%

Table 2: Cameroon telecom market statistics 2006
Source: BuddeComm, www.budde.com.au

While the fixed-line network remains underdeveloped and unable to keep pace with demand, the country's two mobile networks, MTN Cameroon and Orange CM, have experienced phenomenal growth in subscribers since the introduction of competition in 2000. Mobile subscribers passed the number of fixed-line users in early 2001, and in early 2007 cellphones constituted more than 95% of all telephone lines in the country.

The telecom market was liberalised in 1999 and a separate regulatory authority was established. Cameroon Telecommunication Company (Camtel) is the country's incumbent fixed-line operator. It is in the process of being privatised following several previous unsuccessful attempts. The company's mobile unit was sold to South Africa's MTN in 1999 as part of an aggressive privatisation programme instituted by the government, but it was re-established in 2006 as the country's third mobile player under the name Cameroon Mobile Telecommunications (CMT). However, CMT's launch has been delayed by uncertainties regarding its licence status.

The Internet was officially launched in Cameroon in 1998, but the development of this sector has been hindered by the country's poor fixed-line infrastructure. It is estimated that less than 2% of Cameroon's population had access to the Internet by early 2007, with virtually no access in many rural areas. Douala and Yaounde, together representing about 40% of the country's population, have more than 90% of all connections (BuddeComm, 2007).

There are many signs of convergence in the Cameroonian telecommunications market between fixed and mobile voice and data services. The fixed-line incumbent is re-entering the mobile sector, while the existing mobile operators are establishing themselves as leading ISPs by introducing mobile data services and acquiring existing ISPs. The mobile operators are also among the bidders in the privatisation of the fixed-line incumbent. The existing ISPs are combining their forces by merging and preparing to offer Voice over Internet Protocol (VoIP) services through wireless broadband networks.

2.3 The regulator

The Ministry of Post and Telecommunications was responsible for regulating the telecom sector until 1998, when legislation was introduced that called for reform and the establishment of a telecommunications regulatory board. The Agence de Regulation des Telecommunications (ART) was then established and became operational in November 1999. Its responsibilities include:

Fostering competition;

Licensing;

Managing the radio spectrum;

Managing the numbering plan;

Market surveys;

Monitoring network operators and service providers;

Dispute resolution;

Overseeing the interconnection of networks, and standardisation;

Regulatory co-operation on the international level.

The regulator is, however, not regarded as entirely independent, since it reports to the ministry and is managed by a board that is appointed by the head of state.

ART frequently receives complaints from end users and consumer associations, as well as ISPs, about the high cost of telecommunications and the poor quality of service.

2.4 Cameroon Telecommunication Co. (Camtel)

Camtel is a member of the SAT-3/WASC consortium. Besides being the fixed-line incumbent, it provides data and satellite services, pre-paid calling cards, as well as Internet and broadband services through its subsidiary Camnet. The company also operated a GSM mobile network until 2000, when it was sold to private investors, with MTN of South Africa becoming the majority shareholder.

Camtel was created by Decree No. 98/198 in September 1998, following a merger of the Department of Telecommunications at the Ministry of Post and Telecommunications and the International Telecommunications Company of Cameroon (Intelcam). The new company was issued with a capital of FCFA50-billion (about US$92-million), which is currently held 100% by the Cameroonian state. Camtel is currently re-entering the mobile market as the third operator with it eyes on the planned (and already twice stalled) privatisation process.

2.4.1 Privatisation of Camtel

The government first attempted the privatisation of Camtel and its mobile unit Camtel Mobile in 1999. However, while the mobile unit was successfully sold to MTN South Africa, the sale of a stake in the fixed-line operator proved much more problematic. A joint venture between South African operator Telecel and Egypt's Orascom was the highest bidder during the

initial process with an offer of US$144-million. However, this was later retracted over worries about Camtel's outstanding debt and the poor state of its fixed network, so the transaction fell through. Another attempt failed in June 2002 when state-owned Tunisian operators, Tunisie Telecom and Sotetel, pulled out of an agreement to take a 51% stake.

Meanwhile, the fixed network continues to deteriorate with lack of investment for both extension and maintenance. Worried that potential investors have not found Camtel a sufficiently attractive investment on its own, the government decided to offer a third national mobile licence to the successful bidder as well.

In May 2003, the World Bank and International Monetary Fund (IMF) granted Cameroon's government a two-year moratorium for the privatisation of Camtel. This allowed the government more time to restructure and streamline the company. The aim was to improve performance before turning Camtel over to private ownership.

Privatisation plans were revitalised in November 2003 with the signing of a provisional concession between Camtel and the government for management of the fixed network and services for a two-year period (renewable for a further two years). In return, Camtel was required to connect 40,000 new lines and increase the number of public payphones throughout the country. The contract gives Camtel up to four years of exclusivity on the provision of fixed-line services in order to achieve its growth targets.

In February 2005, the government re-iterated its intention to privatise Camtel, despite having missed its own deadline for doing so by October 2004. Following approval by the IMF of a three-year US$26.8-million loan under the Poverty Reduction and Growth programme, the government received 11 bids for the 51% stake from investors based in Europe, the Middle East, Africa and Asia. The presence of Cameroon's mobile operators MTN and Orange in the bidding process indicates a drive towards converged services, as do their recent ambitions to acquire local ISPs.

An investment of MTN or Orange in Camtel, however, would conflict with the company's new mobile ambitions. In order to make the privatisation more attractive to investors, the government issued Camtel with the country's third mobile licence, and CMT was officially established as the new mobile arm in May 2006.

The new company was equipped with an operating capital of FCFA600-million (about US$1.1-million), with the National Investment Corporation (SNI) owning 10% of the shares. In August 2006, however, it was reported that the launch of CMT's new mobile service had been blocked and that the company was still waiting for its licence. This unexpectedly long delay is rumoured to be due to the fact that the government wants to see Camtel privatised before rolling out a mobile network that competes with Orange and MTN.

There seem to be no plans to separate the SAT-3/WASC asset from Camtel prior to privatisation (as has been attempted during the recent privatisation of Nitel, the incumbent in neighbouring Nigeria), so the cable rights in Cameroon may soon, at least partially, be in new hands. However, no progress in the privatisation process has been reported since September 2006.

2.5 History of the SAT-3/WASC cable in Cameroon

The SAT-3/WASC cable became operational in Cameroon in 2002, with Camtel as the local partner in the international shareholder consortium. Under the existing monopoly on fixed-line services, the company was given exclusivity on the provision of SAT-3/WASC bandwidth in the country. Our research has lead to no findings that indicate any kind of public debate took place which could have enabled other Cameroonian companies to become involved in the operation of the cable.

Camtel invested US$20-million into the SAT-3/WASC at project inception in 1999, amounting to about 3% of the total project cost. This investment bought the company a (confidential) number of Minimum Investment Unit kilometers (MIU km), a measure that is also used to determine how much distance-based capacity each consortium member may use.

Camtel's success in marketing SAT-3/WASC has been very limited. For the first three years of operation it was used mainly for international voice services and the company's own limited Internet services. To date, only a small number of retail customers are buying SAT-3/WASC bandwidth; the first wholesale customers gained access to the facility only in 2005.

In December 2006, Camtel bought additional MIU km to stock up its SAT-3/WASC capacity by about 30%, and has stated it was using 60% of its allocated capacity in March 2007.

2.6 The impact of SAT-3/WASC in Cameroon

Despite the monopoly situation it has created on international fibre bandwidth in Cameroon, and the corresponding high prices, the SAT-3/WASC cable has had a number of positive effects on competition in the country's telecoms sector as a whole. It has helped to drive down prices in various segments of the market and has enabled, or at least stimulated, the introduction of a range of new products and services. Nevertheless, prices for most services have remained high by international comparison.

Gaining access to SAT-3/WASC bandwidth has been a long and tedious process for service providers other than Camtel and Camnet. Smaller players have been discouraged completely by the non-transparency of regulations and procedures and the level of politicisation of the sector, to the extent that they are not even attempting to gain direct access, and prefer to operate in a grey zone of legality.

Full utilisation of the cable has also been hampered by Camtel's inadequate national backhaul infrastructure, and regulatory barriers against alternative infrastructure. However, various network expansion programmes and new infrastructure initiatives are promising to bring some improvement in the near future.

3 Performance indicators – successes and failures

3.1 Subscription, usage, and capacity utilisation

Camtel is connected to one of four fibre pairs which can carry up to 2.5Gb/s, but this capacity is shared with a number of other countries in the SAT-3/WASC shareholder consortium. While capacity is allocated to the consortium members in MIU km, when a consortium member wants to implement a link to another member country, a defined number of MIU km are deducted from its balance. Additional capacity can be obtained on demand by consortium members out of a pool of spare capacity.

Camtel has shifted 90% of all traffic from satellite to SAT-3/WASC, which has lead to significant cost savings and quality of service improvements. Only a few satellite links remain, including to the UK, France and the US. Direct interconnection via SAT-3/WASC now exists with Benin, Cote d'Ivoire, Gabon, Ghana, Nigeria, Senegal and South Africa. Calls to countries with no direct interconnection (e.g. Angola, due to a lack of demand) are routed via Portugal, Paris or Montreal. There is also no direct interconnection to any countries on the SAFE cable (the extension of SAT-3/WASC from South Africa to the Far East), including India, due to a lack of demand.

The capacity of the remaining satellite links is limited, so they don't serve as full redundancy for SAT-3/WASC. The reliability of the cable is virtually 100%, but neighbouring Nigeria, for example, has already been struck at least once by a severance of its SAT-3/WASC link by a passing ship which lead to a service cut of several weeks. While Nigeria has invested in an alternative terrestrial route to the landing station in Benin as a back-up, Camtel is currently not planning such an alternative link to SAT-3/WASC via one of its neighbouring countries in case its own landing station or its branch to the main cable fails. Instead, it is planning to use the proposed West African Festoon System (WAFS), or other future submarine cable projects, for this purpose. In the meantime, the company is doing its best to disguise the exact location of the landing station, in order to protect it from vandalism. Vandalism, mainly with the aim of copper theft, is a massive problem for telecom operators all over Africa.

Camtel itself still is by far the biggest user of SAT-3/WASC capacity in Cameroon, using 50% of the allocated capacity which corresponds to more than 80% of all used capacity (given the utilisation rate of 60% stated by the company).

The bulk of the remaining capacity is used by only a handful of large companies that are connected directly to the cable, while other, smaller companies are connected via routers:

MTN, the second biggest user of SAT-3/WASC capacity in Cameroon after Camtel. MTN uses four E1 links (2Mb/s full duplex) on SAT-3/WASC for international voice traffic on its GSM mobile network, which it, however, compresses at a ratio of 16:1 so that an effective capacity of 64 E1 links results. In addition, MTN's subsidiary, MTN Network Solutions (MTN NS), one of the country's leading ISPs, uses 49Mb/s on SAT-3/WASC as Internet bandwidth, of which 45Mb/s are connected to Belgium and 4Mb/s to South Africa;

Orange, the smaller one of the country's two GSM mobile operators, with around 42% market share in late 2006. Orange uses only one E1 link on SAT-3/WASC but, like MTN, compresses it 16:1 to yield an effective capacity of 16 E1 links;

Sonel, the national power utility, uses two E1 links to the UK;

Pecten, a Cameroon-based oil company. Estimated usage 1Mb/s;

Schlumberger, the diversified technology company. Estimated usage 1Mb/s;

SITA (Societe Internationale de Telecommunications Aeronautiques), for its global flight booking system.

Camtel currently has between 100 and 150 customers with leased lines less than 2Mb/s, typically companies, small ISPs and cyber-cafés.

Camtel's available international Internet bandwidth was upgraded from 34Mb/s (2003, 2004) to 155Mb/s in 2005, of which it is currently using 105Mb/s. Another 155Mb/s is planned to go live shortly, feeding directly to Yaounde, about 250km inland, and the country's second-largest city, following the launch of the Douala-Yaounde fibre.

3.1.1 Wholesale

Apart from the two mobile operators, only two companies are currently buying wholesale SAT-3/WASC bandwidth from Camtel, which they use to provide Internet services to customers.

Matrix Telecoms is the result of a recent merger between two of Cameroon's leading ISPs - Douala1 and ICCNet – and an emerging converged

telecommunication services provider. The new company was formed as a counterweight against an impending dominance of the ISP sector by MTN Network Solutions (MTN NS), following the latter's takeover of another ISP, Globalnet, in mid-2006. 34Mb/s of SAT-3/WASC bandwidth through a fibre link between Matrix and Camtel went live in September 2006. Prior to this, since 2005, each of the two ISPs had 4Mb/s of SAT-3/WASC bandwidth connected by microwave links and Digital Subscriber Line (DSL). However, the reliability of the new fibre link is superior, especially compared to DSL.

Another one of Cameroon's leading ISPs, Creolink, established a 34Mb/s connection to SAT-3/WASC at the beginning of 2007. Creolink was initially the third member in the group of companies that was to form Matrix Telecoms, but pulled out later in the process. Cameroon's second mobile operator, Orange, has been rumored to be interested in acquiring Creolink, following MTN NS's takeover of Globalnet.

3.1.2 Retail customer-base development

Despite the monopoly situation it has created on international fibre bandwidth in Cameroon, and the corresponding high prices, the SAT-3/WASC cable appears to have had a positive impact on the uptake of Internet services in the country, as evidenced by the number of Internet users. Following the official introduction of the Internet in Cameroon in 1998, the user base quickly rose to 40,000 (ITU, 2006) within two years, believed to consist mainly of the corporate and academic sectors. After this, growth slowed considerably, but accelerated significantly from 2002 when SAT-3/WASC was launched.

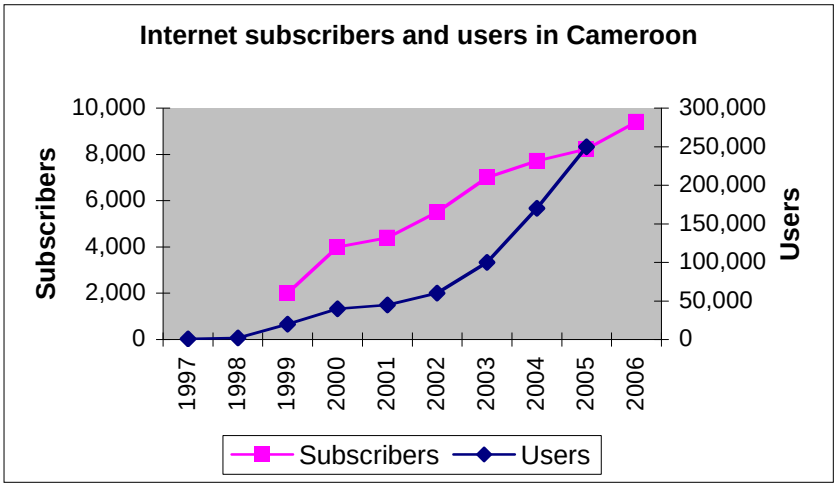

Figure 2: Internet subscribers and users in Cameroon, 1997 – 2006

Source: ITU for Internet user figures and Internet subscribers 1999 – 2003, rest of subscriber figures estimated based on company information

The number of Internet subscribers, however, has not risen at the same pace as the number of Internet users following the arrival of SAT-3/WASC in Cameroon. This suggests that prices for individual Internet subscriptions remained beyond the reach of most Cameroonians, who instead used their workplaces or one of the many cyber-cafés in the country to access the Internet.

Figure 3: A typical small business wireless Internet customer in Cameroon

MTN NS estimates the total market for Internet subscriptions in Cameroon to be 400,000 households, which have the basic prerequisites like literacy and electricity. About half of these are currently actually addressable, having an income that enables them to afford the service, as well as a PC.

3.1.2.1 Replacement of dial-up with broadband

While the introduction of SAT-3/WASC in 2002 has not lead to an accelerated uptake of individual Internet subscriptions in Cameroon, its availability to ISPs as a source of wholesale bandwidth from 2005 onwards has enabled them to offer broadband services on a larger scale. Even though the vast majority of customers are still subscribing to services with more dial-up-like speeds of 64Kb/s or 128Kb/s, packages up to 2Mb/s are already being offered, and will eventually become more affordable, to a wider customer base as prices continue to decrease.

The following graph shows how the dial-up subscriber base of 'ISP1' started decreasing and migrating to wireless offerings when the company connected to SAT-3/WASC at the end of 2005.

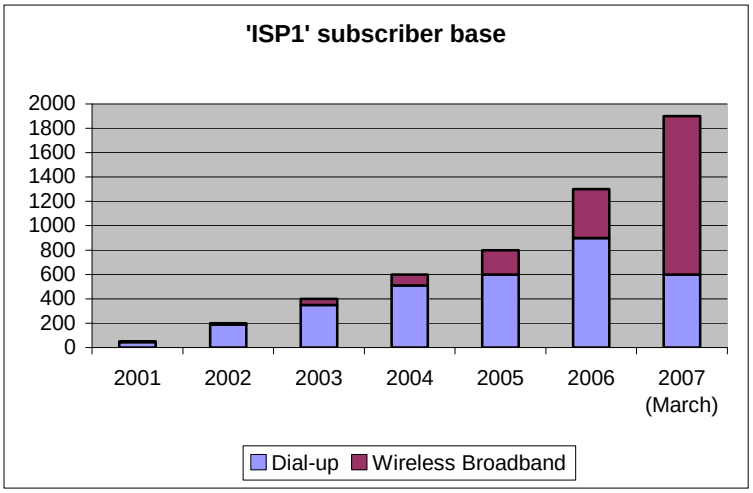

Figure 4: 'ISP1' subscriber base breakdown, 2001 – 2007
Source: Company interview

ISP1's SAT-3/WASC bandwidth was only 4Mb/s initially until it was upgraded to 8Mb/s in mid-2006. At that time the company stopped signing up new dial-up customers, but continues to serve existing ones while encouraging them to migrate to wireless services. The number of wireless subscribers then more than tripled in the first quarter of 2007 alone, following an upgrade to 45Mb/s of SAT-3/WASC bandwidth. The company has a target of reaching 5,000 customers by the end of 2007 and 10,000 by the end of 2008. It is currently using about 50% of its available bandwidth and planning the next upgrade at 70%. This rapid development indicates huge pent-up demand for broadband services that absorbs high-quality fibre bandwidth immediately as soon as it becomes available.

A similar picture is emerging for 'ISP2'. In addition to its own wireless broadband offerings, this company acts as a reseller of Camtel's Asymmetric Digital Subscriber Line (ADSL) service, which it launched in early 2006.

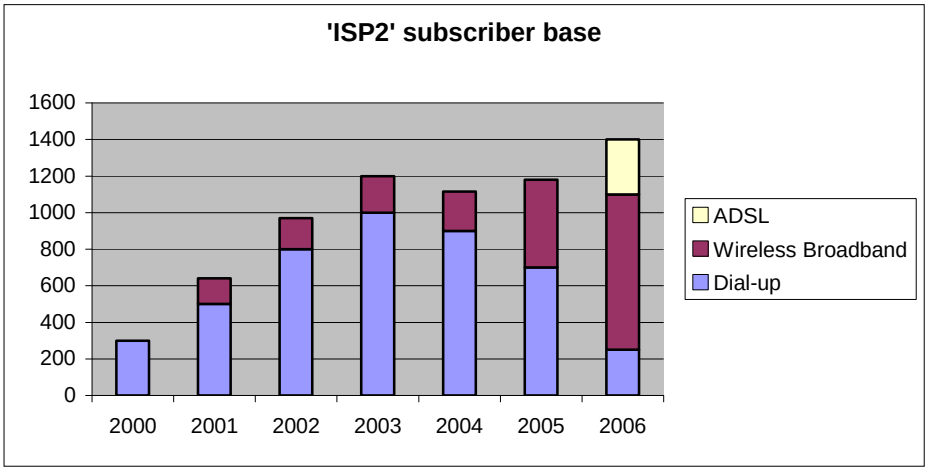

Figure 5: 'ISP2' subscriber base breakdown, 2000 – 2006
Source: Company interview

The roll-out of wireless broadband services by alternative ISPs has also triggered an acceleration of Camtel's own broadband initiatives. After a slow start with only a few hundred subscribers in its first year since launch in late 2005, the incumbent's ADSL service reached 1,500 subscribers in the first quarter of 2007. Its dial-up subscriber base decreased from 4,000 in 2000, to less than 3,000 in 2005. 4,000 ADSL ports had been installed by March 2007, with an additional 6,000 imminent. It set a target of 40,000 by 2008, including many areas outside of Douala and Yaounde.

Additional competition to dial-up has come from the many small cable TV operators in the suburbs who distribute analogue TV to homes from a central satellite receiver. Many of them have started offering Internet access as well, which is, however, low bandwidth and only good enough for e-mail and basic web browsing (i.e. a dial-up replacement).

The number of Wi-Fi hotspots in Cameroon is another indicator for the increasing demand for and availability of broadband services.

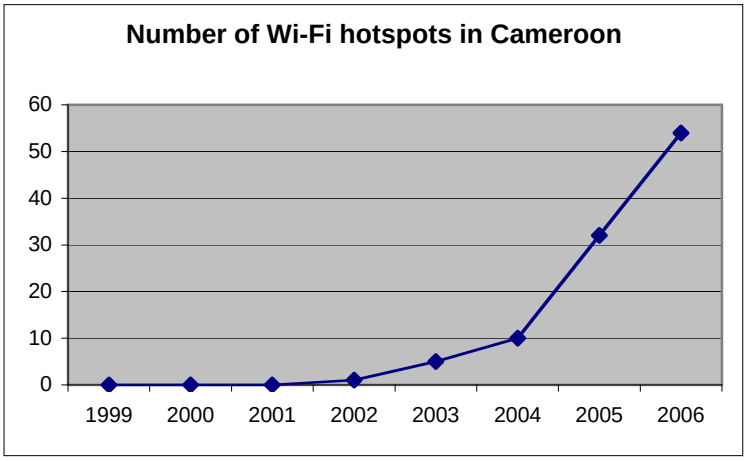

Figure 6: Number of Wi-Fi hotspots in Cameroon, 1999 – 2006
Estimate based on company interviews

Wi-Fi hotspots started appearing in Cameroon in 2002, the year the country gained access to the SAT-3/WASC cable. A significant acceleration can be noted from 2005, the year SAT-3/WASC bandwidth became available to ISPs other than Camnet on the wholesale level.

3.2 Cost and tariffs

3.2.1 Wholesale cost of bandwidth

Despite its monopoly on international fibre bandwidth in Cameroon and the high prices by international comparison, the SAT-3/WASC cable has had a positive effect on the bandwidth market as a whole by stimulating competition among satellite service providers, as can be seen in the graph below.

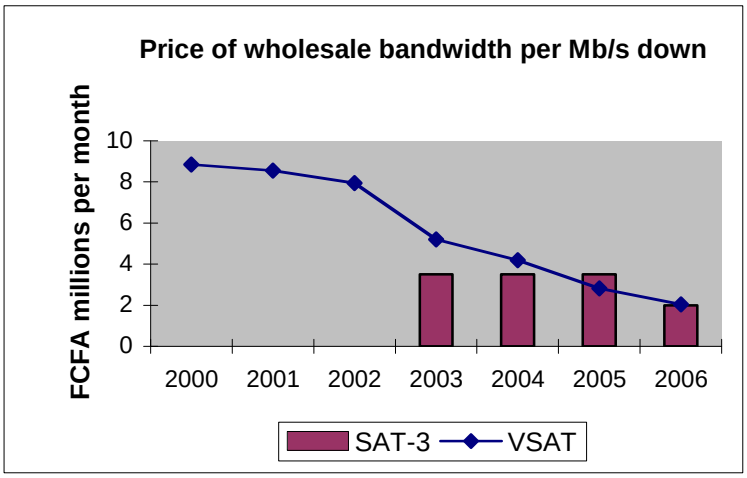

Figure 7: Price of wholesale bandwidth, SAT-3/WASC vs. VSAT, 2000 – 2006
Source: Interviews with major ISPs with access to SAT-3/WASC bandwidth

Note 1: Not fully comparable due to different service characteristics, see text.
Note 2: Part of the reason for the declining VSAT cost is that the US$ lost around 25% of its value against the FCFA between 2002 and 2004.

Prior to the arrival of SAT-3/WASC in 2002, satellite was the only way of getting international bandwidth into the country. Despite competition between various international providers in the Very Small Aperture Terminal (VSAT) sector, prices remained high; around FCFA8-million to FCFA9-million (approximately US$11,500) per month for a 1Mb/s downlink and 512Kb/s uplink. Most ISPs in Cameroon at that point in time were too small to be able to afford a 1Mb/s VSAT link and purchased smaller packages of shared bandwidth from resellers.

Even though Camtel only connected the first wholesale customers to SAT-3/WASC in 2005, it has been offering the service at FCFA7-million (around US$12,500) for an E1 link (2Mb/s full duplex) from 2003. The VSAT providers reacted by reducing their prices by approximately 35% to around FCFA5-million in 2003. Camtel's FCFA7-million for SAT-3/WASC compares favourably to this, considering that it provides twice the downlink bandwidth and four times the uplink bandwidth, and is a better quality product with higher reliability and lower latency than satellite.

Nevertheless, the VSAT providers were able to maintain a price margin above Camtel's SAT-3/WASC pricing until 2005, the time when the incumbent finally signed up the first actual customers for SAT-3/WASC wholesale bandwidth. This three-year delay in the utilisation of the cable for wholesale bandwidth provision was due to a number of factors:

Most ISPs in Cameroon were still small and could not afford a full E1, the smallest unit of SAT-3/WASC bandwidth sold by Camtel;

Many ISPs in the country are very small and operate in a grey zone without a licence. They therefore hesitate to approach Camtel and prefer operating with their independent VSAT links;

Camtel's national backhaul infrastructure was insufficient to effectively distribute fibre bandwidth beyond Douala where the SAT-3/WASC landing station is located.

As soon as Camtel connected the first wholesale customers to SAT-3/WASC in 2005, the price for dedicated VSAT bandwidth undercut Camtel's 'equivalent' (see note above) SAT-3/WASC pricing for the first time,

prompting a more than 40% price cut by the incumbent in 2006 to FCFA4-million per month for an E1. Furthermore, as some ISPs gained more bargaining power through organic growth, as well as mergers and acquisitions, discounts of up to 40% on this list price have been achieved. As 'little' as FCFA2.4-million (US$4,400) per month is currently paid for a SAT-3/WASC E1 (2Mb/s full duplex). The VSAT providers, in return, are now offering 1Mb/s downlink for as little as FCFA1.1-million per month.

While this downward trend is very positive and likely to continue, it has to be noted that prices for international fibre bandwidth in Cameroon, as elsewhere in Africa, are still extremely high by international comparison.

3.2.1.1 VSAT connectivity for small ISPs and cyber-cafés

Following the launch of SAT-3/WASC in 2002, VSAT remained the preferred method for most ISPs and cyber-cafés to connect to the international Internet backbone directly. The number of international VSAT data gateways in operation continued to grow, and came to an abrupt halt only after the introduction of ADSL and SAT-3/WASC wholesale bandwidth in 2005.

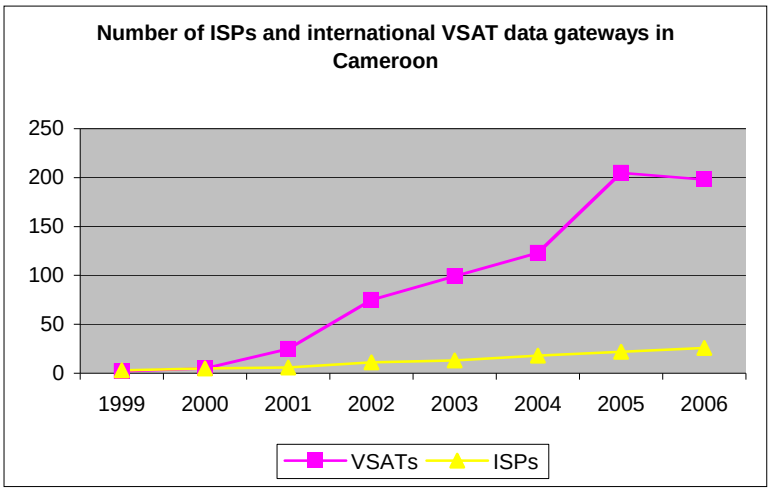

Figure 8: Number of ISPs and international VSAT data gateways in Cameroon, 1999 – 2006
Estimate based on company interviews

The growing spread between the number of ISPs and the number of international VSAT data gateways also gives an indication of the growing number of 'informal' ISPs (estimated at around 25) and cyber-cafés, estimated at around 700 in early 2007. In addition, many cyber-cafés are obtaining their bandwidth through wireless connections to larger ISPs.

There are many informal wireless ISPs in Cameroon that are very small, serving only a local area, often with one base station only. Like many of the country's cyber-cafés, they typically use VSAT bandwidth from resellers, packaged into bundles of as little as 64Kb/s shared among 10 users, which leads to extremely poor throughput for the end-customers at peak times.

The cost of this kind of bandwidth experienced a very sharp drop - of around 75% within two years - after the arrival of SAT-3/WASC in 2002. This has been partly aided by a weak US$, which lost around 25% of its value against the FCFA during this period.

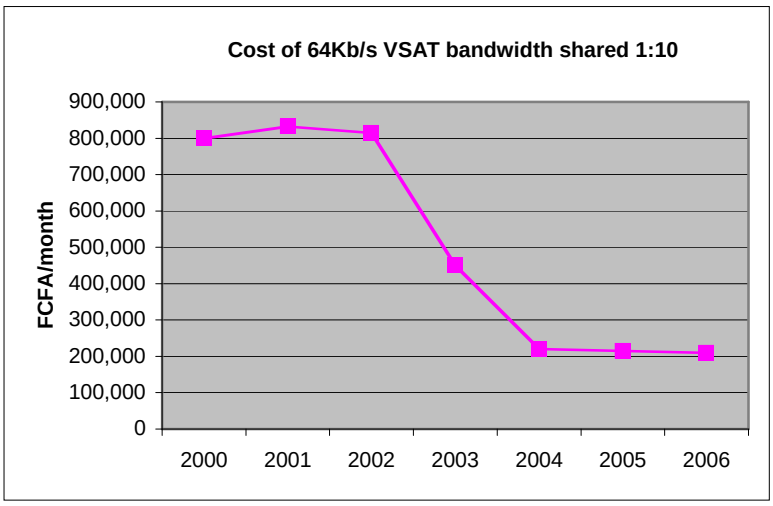

Figure 9: Cost of 64Kb/s shared VSAT bandwidth in Cameroon, 2000 – 2006
Source: Interviews with small ISPs
Note 1: Cost is shown excluding international money transfer fees.
Note 2: Part of the reason for the declining cost is that the US$ lost around 25% of its value against the FCFA between 2002 and 2004.

A not insignificant additional cost factor in using VSAT lies in the fact that most providers are based outside of Cameroon, so payments to them incur an international money transfer fee which currently amounts to around FCFA30,000 (about US$55) per month. Furthermore, the service is typically paid for three months in advance.

3.2.2 Retail prices

Despite the monopoly situation it has created on international fibre bandwidth in Cameroon, the SAT-3/WASC cable has helped to drive down retail pricing in the two areas most directly affected by international access: Internet services and international calls.

3.2.2.1 Wireless Internet services

Wireless Internet services only became available in 2001, so available pricing information starts in 2002, the year SAT-3/WASC arrived in Cameroon. To date, most customers are still subscribing to lower-cost services with dial-up-like speeds of 64Kb/s or 128Kb/s, since current pricing of real broadband packages is out of reach for the majority of customers.

	64Kb/s	128Kb/s	256Kb/s	384Kb/s	512Kb/s	1Mb/s	2Mb/s
Uncommitted	25,000	45,000	90,000	135,000	180,000		
1:4	115,000	200,000	380,000		720,000	1,300,000	2,500,000
1:1	300,000	550,000	990,000		1,760,000	3,300,000	6,160,000

Table 3: 'ISP1' wireless pricing (FCFA/month) for different speeds (full duplex) and contention ratios
Source: Company interview

Small grey-zone ISPs charge as little as FCFA12,500 (about US$23) per month for uncommitted 64Kb/s wireless access, about half the cost of the equivalent speed from 'ISP1'. Further discounts are possible for multiple accounts.

The following graph shows a steady decline of the average retail price for wireless 64Kb/s Internet connections with dedicated bandwidth as well as shared bandwidth; and, in an interesting comparison again, the price of shared VSAT bandwidth which most small ISPs are currently using.

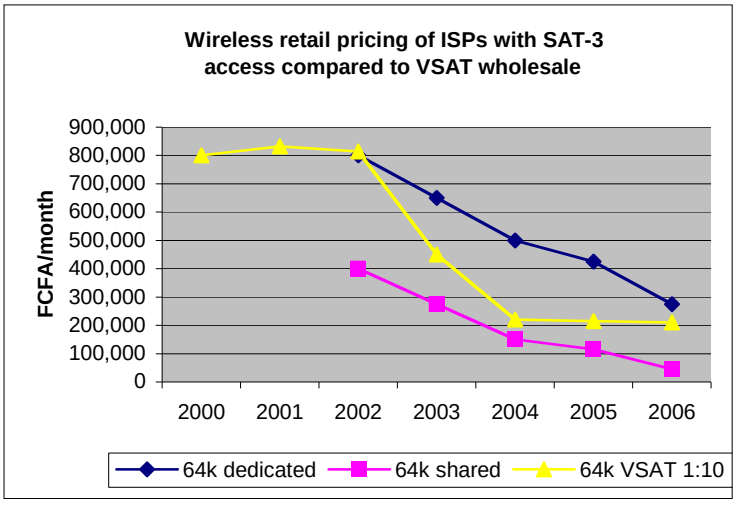

Figure 10: Wireless retail pricing of ISPs with SAT-3/WASC access compared to VSAT wholesale, 2000 – 2006

Source: Company interviews
Note 1: Cost of shared VSAT bandwidth is shown excluding international money transfer fees.
Note 2: 64Kb/s of dedicated VSAT bandwidth still cost FCFA900,000 per month in 2006.

The retail price for both dedicated and shared wireless Internet access from major ISPs with SAT-3/WASC bandwidth has declined steadily since the introduction of such services in 2001. As mentioned, part of the reason for a particularly steep decline between 2002 and 2004 is the fact that the US$ lost around 25% of its value against the FCFA during this period. The decline was slightly slower during the following year, but accelerated again in 2006 after the first major ISPs had finally gained access to SAT-3/WASC wholesale bandwidth from Camtel.

One-time installation charges have declined in line with this, from FCFA1.5-million (about US$2,700) in 2002 to FCFA600,000 in 2004, and FCFA400,000 (about US$740) in 2006.

Shared bandwidth wireless Internet access was introduced at a retail price far below the wholesale price for comparable VSAT bandwidth in 2002 (FCFA400,000 vs. FCFA800,000 per month). This triggered a particularly steep price decline for the VSAT product – which in turn caused the price for the shared wireless product to decline much faster in percentage terms than the price for dedicated wireless bandwidth. However, the retail price for 64Kb/s shared wireless bandwidth has always remained below the comparable VSAT wholesale price, which makes it surprising that more small ISPs haven't changed from using VSAT bandwidth to using SAT-3/WASC bandwidth via wireless connections from larger ISPs under wholesale arrangements. All of the larger ISPs in Cameroon with SAT-3/WASC access currently have only a handful of small ISPs as wholesale customers. This situation is indicative of an environment in Cameroon where many small ISPs operate in a grey zone, without a licence.

The price for shared VSAT wholesale bandwidth appears to have reached a bottom at about FCFA200,000 (about US$370) per month, where it has stayed since 2004. At the same time, the comparable wireless retail product continued its price decline to reach FCFA45,000 (about US$83) per month in 2006 – a mere 20% of the VSAT price. The price gap can be explained by the fact that wireless connectivity from the large ISPs is only available in certain areas at this stage, while VSAT can be set up virtually anywhere. This is expected to change once the ISPs expand their wireless networks and achieve more contiguous area coverage. This is especially the case since the retail

price for 64Kb/s dedicated (not shared) wireless bandwidth has already reached a level only 30% above the shared bandwidth price for the VSAT product (around FCFA275,000 per month), while offering up to ten times the bandwidth and being superior in terms of quality and reliability. 64Kb/s of dedicated VSAT bandwidth still cost FCFA900,000 (about US$1660) per month in 2006.

With the current trends continuing, dedicated wireless bandwidth would become cheaper on the retail level than shared VSAT wholesale bandwidth during 2007. This may finally lead some of the small ISPs to come out of the grey zone and dump their VSAT connections in favour of SAT-3/WASC bandwidth through a local wholesale ISP.

Cyber-cafés, which operate in somewhat less of a grey zone than small ISPs in Cameroon, have already been more willing to take up the option of wireless connectivity through one of the major ISPs instead of VSAT, as the example below shows.

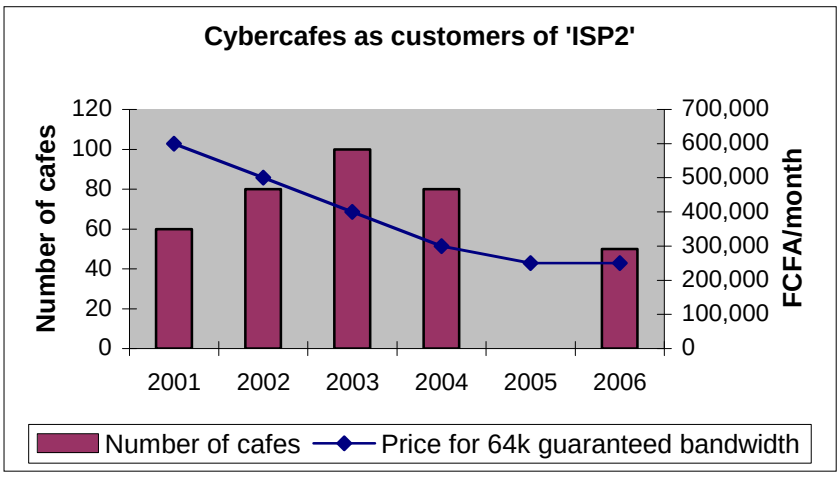

Figure 11: Cyber-cafés as customers of 'ISP2', number and pricing, 2001 – 2006
Source: Interview with 'ISP2'
Note: Number of cyber-cafés was not available for 2005

'ISP2' gained access to SAT-3/WASC wholesale bandwidth from Camtel in 2005. The connections typically used by cyber-cafés provide up to 128Kb/s, of which 64Kb/s is guaranteed. A comparison with the previous graph shows that cyber-cafés have always been able to get significant discounts off the retail rates, but that this price gap has narrowed in recent years. The drop in the price payable by cyber-cafés also stopped in 2005 after ISP2 gained access to SAT-3/WASC wholesale bandwidth, which indicates that demand for the higher-quality SAT-3/WASC bandwidth (compared to VSAT bandwidth previously) justified no further price reductions.

The trend of declining customer numbers in the cyber-café segment is not unique to 'ISP2', but is mirrored in data collected from other ISPs as well. The reason for this development is twofold. Firstly, an increasing number of customers have wireless access at home, at work or at school, and consequently use cyber-cafés less frequently. Secondly, cut-throat competition between cyber-cafés has lead to average prices for Internet access of FCFA500 per hour – and as little as FCFA200 in some cases – driving many of them out of business.

3.2.2.2 ADSL

Camnet launched ADSL at the end of 2005. At least one other ISP acts as a reseller of the service. ART has reviewed the resale agreement and approved it on the grounds that it was not exclusive, meaning that any other ISP can sign the same agreement with Camnet.

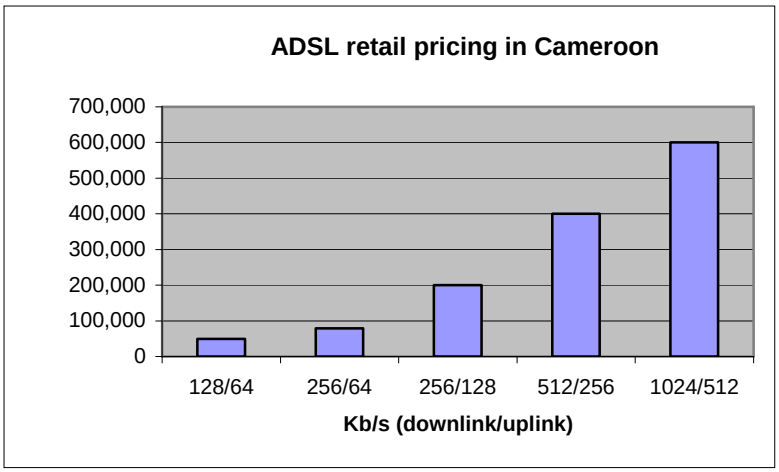

Figure 12: ADSL retail pricing in Cameroon for different bandwidth packages
Source: Interviews with service providers

The low-end 128/64Kb/s package for ADSL is the most commonly used one. The top three packages are virtually exclusively used by the corporate sector. A one-time installation fee is typically around FCFA100,000 (about US$185), and the modem is rented (i.e. it remains the property of the service provider).

While ADSL pricing in Cameroon is very expensive by international comparison, it compares favourably with all other access options described above (wireless and VSAT), both on the retail level and as a wholesale bandwidth option for small wireless ISPs and cyber-cafés. However, the quality of service is regarded as poor. Like with wireless access to ISPs with

SAT-3/WASC bandwidth, the problem with ADSL access in general is also the limited availability and geographical reach of the service at this stage. Camtel has, however, embarked on a major expansion programme for its ADSL network.

3.2.2.3 Dial-up

The cost of dial-up Internet access in Cameroon has decreased twice: Once in 2002, the year the country got connected to SAT-3/WASC, and in 2006 after SAT-3/WASC bandwidth became available on the wholesale level.

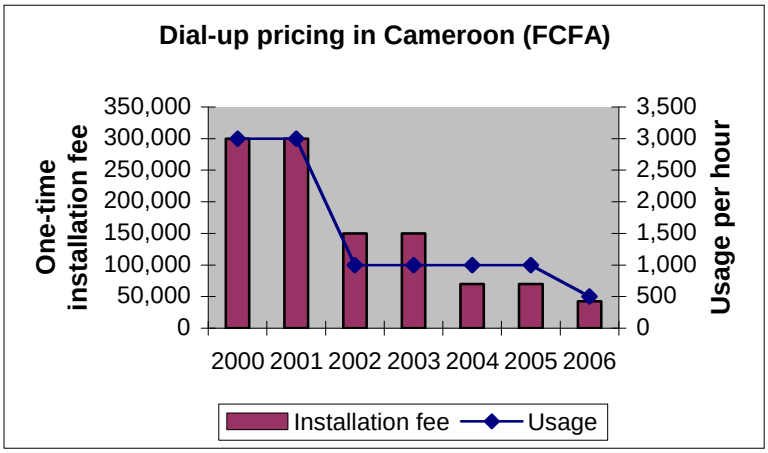

Figure 13: Dial-up pricing in Cameroon, 2000 – 2006
Note: Usage cost is exclusive of Camtel telephone charges

However, the relevance of dial-up as a connectivity option is now fading as wireless options and ADSL increasingly becoming available. Many residential households also terminated their dial-up subscriptions when Internet access became available at the workplace.

3.2.2.4 International calls

The mobile networks in Cameroon are allowed to operate their own international gateways as part of their licence terms, which has helped to drive down prices for international calls and to align international tariffs on the mobile networks with those on Camtel's fixed network. The pricing of mobile international calls in Cameroon is actually very competitive, even by international comparison.

The impact SAT-3/WASC has had on international call tariffs in Cameroon has been twofold. For one, the cable's arrival in 2002 has actually brought the

trend of decreasing international tariffs to a temporary halt. Tariffs had halved between 2000 and 2002, but remained virtually flat in the following three years to 2004/2005. This can possibly be explained by the higher quality of international connections becoming available, using Camtel's SAT-3/WASC capacity, compared to satellite. The incumbent, facing a dwindling or stagnant customer base at best, has been desperate to counter falling revenues by raising tariffs or at least keeping them constant. Renewed downward pressure on international tariffs only came in 2005 when the mobile operators themselves gained access to SAT-3/WASC bandwidth.

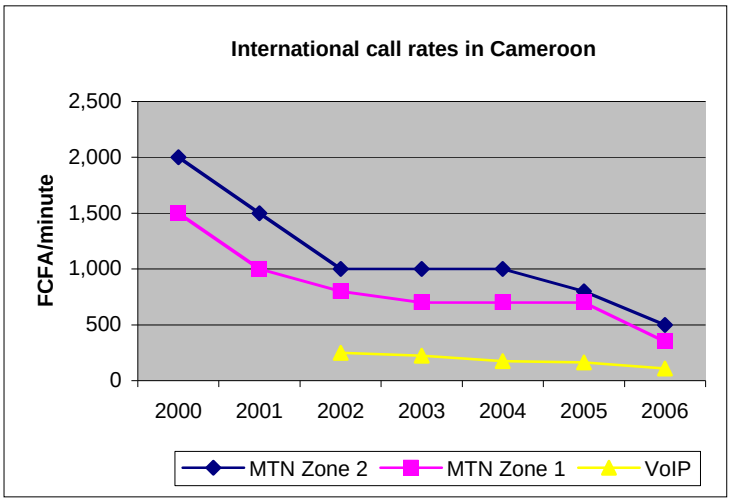

Figure 14: International call rates in Cameroon, 2000 – 2006
Source: MTN and various VoIP service providers in Cameroon.
Note 1: MTN Zone 1 = France and USA, Zone 2 = Rest of world.
Note 2: In 2006 MTN introduced a special rate of FCFA200 per minute to other MTN networks in Africa.

Secondly, the arrival of SAT-3/WASC in 2002 has enabled the larger scale introduction of VoIP services, hand-in-hand with the introduction of wireless broadband services. Prior to this, the use of VoIP in Cameroon was very limited due to the typically insufficient quality of the dial-up and satellite links used for connectivity, by ISPs as well as cyber-cafés. International VoIP calls to most destinations were offered for around FCFA250 (about US$0.46) per minute from 2002, about a quarter of the then current rates for conventional calls on the fixed and mobile networks to the most popular destinations. VoIP rates have declined steadily to as low as FCFA100 per minute by 2006 (including Camtel's own calling card service), at which time conventional calls, both fixed and mobile, cost between FCFA300 and FCFA400 to the most popular destinations.

The downward trend in international tariffs has also helped to push down national and local tariffs, despite efforts by the incumbent and the regulator

to curb this development. It became difficult to justify charging high prices for domestic calls while tariffs for international calls continued to decrease. Mobile calls to any network are now available for FCFA200 to FCFA150 per minute (about twice as much as the equivalent prices of calls from the fixed network) and as little as FCFA100 at off-peak times, or under special plans. On the downside of this development, the many public payphone micro-entrepreneurs crowding Cameroon's streets are finding it increasingly difficult to make any kind of profit margin and to find customers, given the level of competition between them. The going rate on the street is now FCFA100 per minute, and the profit on this comes entirely from a volume discount of about 30%; but it takes the average small entrepreneur a long time to sell such volumes.

Figure 15: Stormy weather for Cameroon's many public payphone micro-entrepreneurs

3.3 Increasing international traffic and new services

Telephone traffic statistics are hard to come by for Cameroon. International Telecommunication Union (ITU) statistics show a linear increase of outgoing international traffic, documented with figures for 2001, 2003 and 2004 only. In addition, there is a significant grey market for international calls as well as Internet traffic that has developed through the many VSAT gateways operated by small ISPs and cyber-cafés, many of them unlicensed. Many other findings in this report allow the conclusion that the arrival of SAT-3/WASC – in particular its availability on the wholesale level from 2005 onwards – has lead to an accelerated growth in traffic demand.

All ISPs interviewed for this study have confirmed that they are seeing increased levels of VoIP usage on their networks, including Skype (which none of them are currently banning), since SAT-3/WASC has enabled lower latency VoIP service compared to satellite. Skype alone cannot necessarily be used as an indicator for an enabling effect on VoIP by SAT-3/WASC, because Skype's worldwide popularity started rising dramatically in 2004 for other reasons too. It has also had various service quality problems of its own at different times since then. Generally though, VoIP services (including Camtel's own calling card service) started appearing in Cameroon in earnest with the arrival of SAT-3/WASC in 2002 and have had a significant effect on call tariffs since then.

In general, SAT-3/WASC has enabled or aided the introduction of a wide range of new products and services in Cameroon. Wireless services with true broadband speeds (up to 2Mb/s – even though the pricing for these currently still puts them out of reach for a broad customer base) were introduced only after SAT-3/WASC bandwidth became available wholesale to ISPs other than Camnet in 2005. This was followed hastily by the incumbent's launch of ADSL services at the end of that year. Similarly, the proliferation of Wi-Fi hotspots in Cameroon appears to be linked to the availability of SAT-3/WASC bandwidth.

4 Analysis of access to SAT-3/WASC

The telecommunications market in Cameroon is characterised by a dominating incumbent with far-reaching monopoly rights and a lack of clarity of relevant legislation and regulations. In an atmosphere of mistrust towards the authorities, many market players prefer operating 'under the radar', without even attempting to go through the procedure of obtaining licences. As a result, most of them have remained small, local operations only, often operating in a clandestine fashion under consequently non-optimal conditions in terms of costs and technologies used, including access to international bandwidth.

This situation is probably not unique to the country's telecommunications sector alone, and has its roots in the high level of corruption which has propelled Cameroon into the top ranges of various global corruption rankings. In a typical chicken-and-egg situation, the status quo is fuelling further corruption.

4.1 Legislation and regulation

Current legislation dating back to the formation of Camtel in 1998 gives the incumbent exclusivity on the provision of fixed-line services in Cameroon, including national transmission and international infrastructure, both in the terrestrial and space segment. The country's two mobile operators, MTN and Orange, are both operating their own international gateways under their licence terms and have built extensive national microwave backbone networks. However, they are currently not allowed to sell capacity on those networks freely. Anyone requiring a connection, be it within Cameroon or internationally, must first approach Camtel. A service may be provided by a third party, like one of the mobile networks, only if the incumbent is unable to provide the service. This should, however, also happen through Camtel and not between the other two parties directly. Failing this, the option exists to apply for a licence to set up and operate an independent facility for the required service.

Camtel itself has been leasing capacity on the mobile network operators' microwave transmission networks when it didn't have its own infrastructure in an area, or existing infrastructure was out of order. At least some of these leases have been done 'on credit', without actual money flows – paid for with the provision of 'free' SAT-3/WASC bandwidth to the mobile operator.

No specific new legislation was passed with regard to the SAT-3/WASC cable; the right to its ownership and exploitation was given to Camtel under the existing monopoly regulations. Neither does any public debate appear to have taken place that could have enabled other Cameroonian companies to become involved in the operation of the cable, despite the fact that the two mobile networks had started operating their own international gateways before the cable was launched. However, the initiation of the SAT-3/WASC project and the start of its construction in 1999 had occurred before MTN and Orange entered the market.

4.1.1 Licensing

There are three types of telecommunications licences in Cameroon:

Concessions for voice services;

Authorisations (e.g. for Internet services, ISPs);

Declarations (e.g. for equipment vendors, setting up private Local Area Networks (LAN) etc).

An Authorisation involves a one-off licence fee of between FCFA150,000 (US$277) and FCFA500,000 (US$925), plus regular monthly fees (e.g. a spectrum fee, if applicable, and 2% to 2.5% of revenue must go towards the Universal Access Fund (UAF)).

VSAT and VoIP are grey areas with conflicting or non-existing regulation, but the consequences appear to be tolerated for the time being. VSAT licenses are granted at a cost of FCFA40,000 (US$74) per month, even though they open the door for independent carriage of international traffic into and out of the country. This includes voice traffic in the form of VoIP, for which no specific regulations exist at this stage. In view of the trend towards converging technologies and services, ART is considering a unified licensing regime.

Even though the licence fee structure appears to be relatively affordable for an ISP business in Cameroon, considering the pricing structures, there are many small ISPs in the country that prefer operating without a licence. The consensus seems to be that it would at best take "years" for a licence to be issued, but more likely that it would not be issued at all. This view is probably an exaggeration of the reality, but it gives an indication of the deep-

rooted social and economic problems of the country as a whole, and the telecommunications sector in particular.

As a result, most ISPs in Cameroon have remained small, local operations only, many of them operating in a clandestine fashion under non-optimal conditions in terms of costs and technologies used. Wi-Fi technology is commonly used for the simplicity of operating in unlicensed spectrum, but with the known consequences of short-range coverage and possibly degraded service quality due to interference. There are also cases of unlicensed use of spectrum that is subject to licensing, which also leads to interference without frequency coordination.

For access to international bandwidth, most of these small ISPs prefer their own independent VSAT rather than 'officially' connecting to Camtel, or to a local major ISP through which they could have access to the higher-quality, more reliable and also more cost-effective SAT-3/WASC bandwidth. It has to be acknowledged, however, that the current regulations are not entirely clear as to whether such wholesale provision of SAT-3/WASC bandwidth by larger ISPs would be legal.

The situation appears to be tolerated at all levels, and many small ISPs have been operating in a clandestine fashion for years without detection, or at least without being confronted about it – despite the fact that their installations are often very visible.

Figure 16: A typical small wireless ISP in Cameroon

Our interviews unveiled the general expectation among ISPs that if there should be a confrontation one day, there would be a way to make some sort of arrangement that would allow for operations to continue, "because this is Cameroon" – an attitude that reflects the general business environment in the country.

4.2 Universal Access Fund

Licensed operators and service providers pay a percentage of their revenue as a contribution to the UAF, designed to fund infrastructure projects in otherwise economically unattractive or unviable parts of the country. The fund was created in 1998 and was initially managed by ART, but a new law handed over control of it to the government in 2005 (with apparently conflicting interests between the Ministry of Post and Telecommunications and the Ministry of Finance). It is unclear how much money is currently in the fund and what projects it has been used for.

4.3 Barriers to access

The concerns of small service providers, as described in the previous chapter, are not entirely unfounded, though. The process of gaining access to SAT-3/WASC bandwidth has been long and tedious for those larger ISPs who have set out to pursue it. We were given three different accounts of such undertakings during our survey. The time it took from the initial application to finally getting connected varied from six months to two years. This is much longer than the average 37 days it takes to establish a business in Cameroon according to the Index of Economic Freedom published annually by the Heritage Foundation and the Wall Street Journal, which indicates that the telecommunications sector is even more restrictive than other sectors in the country's economy. Regulations appear to be applied unevenly, and our conversation partners could not help feeling that delay tactics had been applied because the ISPs were initially seen more as competitors rather than wholesale customers or partners. When a connection was finally established, it was not with the requested capacity and required further pressure, up to the highest level within Camtel, to be completed as agreed. Once fully operational, however, the experience with the SAT-3/WASC connections has been very positive in terms of quality and reliability.

Apart from the bureaucratic hurdles, the main reason why small service providers do not connect to SAT-3/WASC is that most of them cannot afford

the smallest unit of bandwidth sold by Camtel. A wholesale market of smaller units of SAT-3/WASC bandwidth sold through the major ISPs has not developed.

4.4 Dispute resolution mechanisms

The tasks assigned to the regulator include arbitration and reconciliation in cases of disputes regarding telecommunications, raised by both operators or end-users, before the issues escalate further (e.g. go to court).

4.4.1 Interconnection

Interconnection, a key issue that often leads to disputes between operators, seems to have gone relatively smoothly for the mobile operators in Cameroon. MTN signed an interconnection agreement with Camtel in early 2000, immediately after its licence was issued and well before the launch of commercial services in September that year. MTN and Orange have been directly interconnected since 2002, and there have been no reports of interconnection disputes.

The story of Pastel on the other hand is a different one. This company applied to ART in 2003 to become Cameroon's second national operator (SNO). According to ART, however, the application was for an authorisation only and not a voice concession. In December 2003, Pastel was licensed to provide VSAT, data and Internet services, and Virtual Private Networks (VPN), but was denied interconnection to the public network as the regulator regarded it as an ISP only. An application by Pastel for the assignment of a numbering plan was turned down on this basis. The company complained that it would be limited to only a small part of the corporate sector without interconnection to other networks. Nevertheless, it launched services with two VSAT links in October 2004, and by early 2007 was providing international VoIP calls through around 300 public 'phone boxes', but had only a handful of Internet subscribers.

Camtel and ART review a Reference Interconnection Offer (RIO) every year. SAT-3/WASC was included in the RIO for the first time in 2006. ART attempts to use a cost-based approach, following the FL-LRIC model (Forward-Looking Long Run Incremental Costs) to determine fair pricing, but the regulator admits that all it can do is accept what Camtel is suggesting since the SAT-3/WASC shareholder agreement is secret and ART has not seen it.

4.5 Investment and business environment in Cameroon

With an average score of 54.4 out of 100, Cameroon ranks relatively poorly in the Index of Economic Freedom, considering the country's relatively high GDP in regional comparison: 117th of a total of 157 ranked countries worldwide, and 22nd of 40 countries in sub-Saharan Africa (where the regional average score is 54.7).

Ongoing problems include bureaucracy, an unreliable legal system, widespread corruption, and the country's inadequate and poorly maintained infrastructure. Government intervention in the economy, including state ownership of utilities and industries, as well as onerous regulation, hinders foreign investment and economic growth, resulting in a relatively small net inflow of foreign direct investment (FDI) which is below 2% of GDP (Heritage Foundation, 2007).

4.6 Politicisation of sector

The telecoms sector in Cameroon is highly political due to the dual position of the government as a) a facilitator of a conducive environment for more widespread and affordable services, and b) the sole shareholder of Camtel with an interest to maximise the company's profits and its value with regard to the planned privatisation. As pointed out, the regulatory authority the government has set up is not regarded as truly independent from the government. The recent award of the country's third mobile licence to Camtel in preparation for privatisation, apparently without a proper tendering process, is a further example of the non-transparency characterising the sector.

The politicisation of the sector includes the SAT-3/WASC cable, possibly more than any other sub-sector. With the high prices it still fetches for bandwidth, it is potentially one of very few money-makers for the ailing incumbent. On the other hand, the government should have an interest in bringing down the cost of international access, particularly with regard to the Internet, which can bring fundamental value to the population, including education and information. It can also make Cameroon's economy more competitive on the international level.

4.7 Human resource capacity

Cameroon's universities and engineering schools started establishing dedicated telecommunications departments with more specialised curricula in 2000, the year competition and private investment was introduced into the country's mobile sector. Since then, the mobile networks have played a dominating role in the country's telecommunications market in terms of subscriber growth, innovation and productivity. While Camtel has remained overstaffed with around 2,000 employees serving a mere 100,000 customers, the privatised mobile industry has set new productivity standards with close to 3,000 customers per employee, with the total number of subscribers exceeding three million in early 2007.

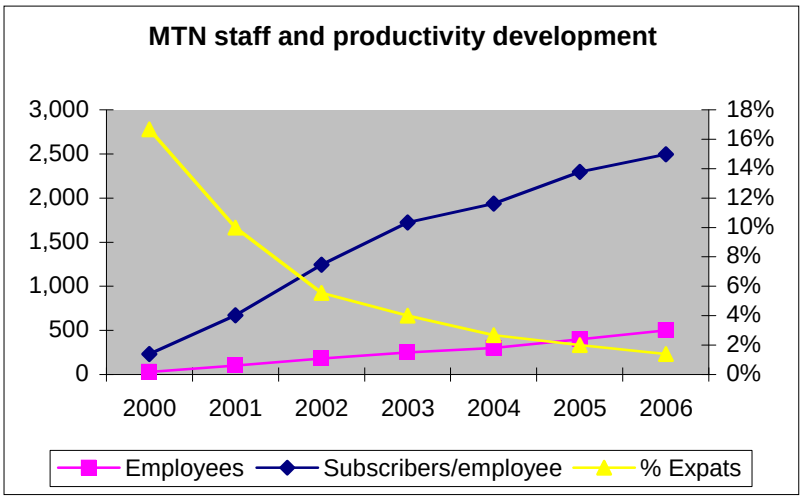

Figure 17: MTN Cameroon staff and productivity development, 2000 – 2006
Source: Company interview and annual reports

The number of expats exployed has been decreasing steadily with emphasis being placed on know-how transfer and staff training, including courses taking place abroad. From the start, only a relatively small number of key positions in the mobile companies were filled with expatriates, which indicates that qualified personnel were already available in the country. MTN had the additional advantage of taking over a staff base, with experience in GSM network design and operation, from Camtel Mobile in 2000. This may also explain why the company had been paying significantly higher salaries to engineers than its competitor, Orange, until recently.

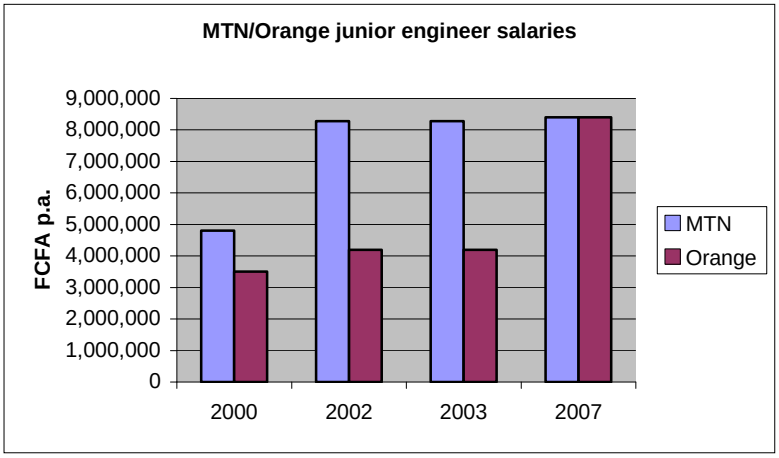

Figure 18: MTN/Orange annual junior engineer salaries, 2000 – 2007
Source: Company interviews

It seems Orange only started closing the salary gap when new competition appeared on the job market in the form of the third mobile operator, CMT, which began preparing for a national network roll-out. Both of the established mobile operators are making efforts to retain staff as their networks are still growing very fast.

Most ISPs in Cameroon have remained relatively small, with a few tens of employees at this stage, but they are making an important contribution to the development of the human resource capacity and capability of the sector by experimenting with a variety of new wireless technologies, such as TD-CDMA and OFDM/WiMAX, different frequency bands, including Line-of-Sight as well as Non-Line-of-Sight (NLOS) systems, and unlicensed 2.4GHz spectrum (e.g. Wi-Fi).

5 National backhaul infrastructure

The SAT-3/WASC landing station is located just outside Douala, Cameroon's largest city and economic capital, with about four million inhabitants. For the first five years of its operation, direct access to the cable was limited to this city, where a fibre ring has been installed, due to the lack of adequate transmission infrastructure for transporting and distributing fibre bandwidth around the country. A major step forward was made in early 2007 when a fibre optic cable was completed between Douala and Yaounde, which has about three million inhabitants. The two cities together account for about 40% of the country's population. Fibre links to other parts of the country, which will also eventually reach the border of neighbouring Chad, are under development.

Fixed-line incumbent Camtel and the two mobile operators, MTN and Orange, have built nationwide microwave transmission backbone networks, but their capacity for additional broadband applications is limited. MTN is also planning to roll out a fibre backbone in cooperation with the national power utility company.

The access network level is dominated by the two mobile networks which provide coverage to more than 80% of the population, and 15% of the land area. Camtel's fixed-line network is at a very low level of development, which has also impeded the development of the Internet sector. Camtel is trying to improve access through a Wireless Local Loop (WLL) system and has embarked on a major expansion program for its ADSL network to extend broadband capabilities to more parts of the country. The mobile networks have also begun to develop broadband access capabilities with the launch of General Packet Radio Service (GPRS) and Enhanced Data Rate for GSM Evolution (EDGE), but plans to introduce Third Generation (3G) mobile technology are still at a preliminary stage.

Other wireless broadband coverage in Cameroon is almost exclusively limited to Douala and Yaounde, and even in these two cities it is patchy at best, with major players in this field only just emerging.

5.1 International infrastructure

Prior to the arrival of SAT-3/WASC, Cameroon's international traffic was handled by the satellite earth station in Zamengoe, near Yaounde. Terrestrial

international infrastructure includes a fibre link under construction along an oil pipeline, which will ultimately reach the border of neighbouring Chad.

5.2 National fibre projects

Camtel launched an underground fibre optic cable between Douala and Yaounde (via Kribi and Edea) in January 2007, following the main roads between the cities, and the oil pipeline which runs from Kribi to the border with Chad. It has a capacity of 2Gb/s. 155Mb/s of international SAT-3/WASC Internet bandwidth for Yaounde were to be connected shortly at the time of our survey in March (2007).

Figure 19: The Douala-Yaounde highway with fibre buried on the left hand side

A continuation of the fibre along the oil pipeline is already in place all the way to the Chad border via several towns in central and eastern Cameroon, but transmission equipment has not yet been installed. The link would give landlocked Chad access to SAT-3/WASC bandwidth. Negotiations about this already started in 2004.

Camtel planned to launch another fibre from Douala to Bafoussam via Nkongsamba before the end of 2007. The projects are implemented under an agreement with Cisco Systems.

MTN plans to roll out a fibre link from Yaounde to Douala and on to Nkongsamba, Bafoussam and Bamenda, following the power lines, in cooperation with Sonel, the national power utility. There are also plans to

close a fibre ring back to Yaounde from Bafoussam, but there are no suitable power lines along this section.

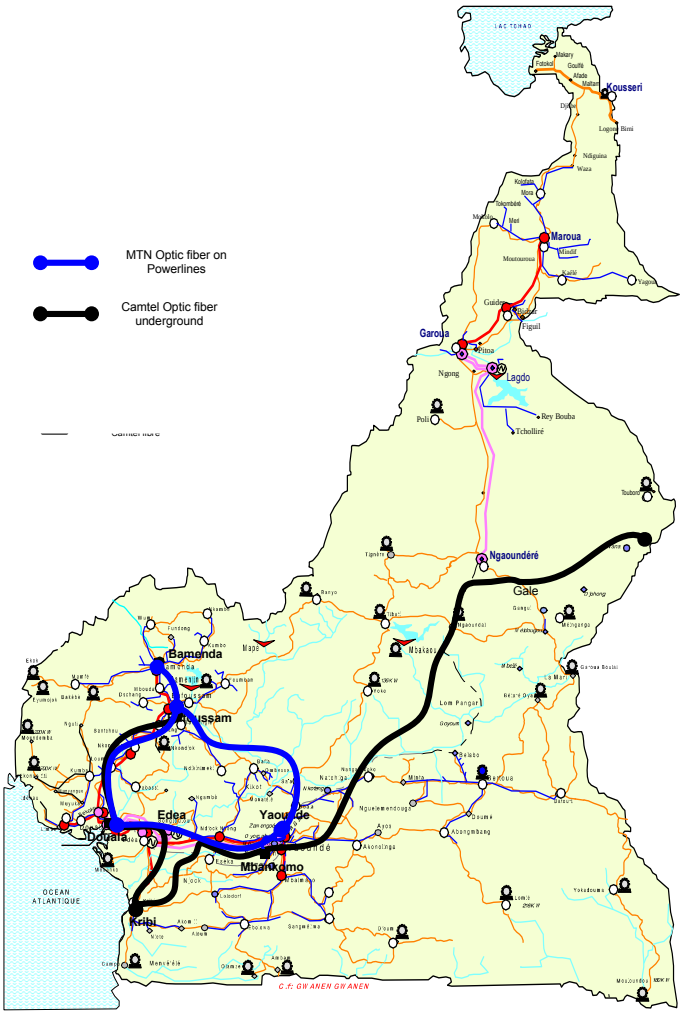

Figure 20: Existing and planned fibre projects in Cameroon
Note: Red and purple lines are other existing power lines

Sonel is already authorised to use the fibre for its internal communication and it is also connected to SAT-3/WASC in Douala with two E1 links. However, the regulatory environment for alternative public infrastructure, independent from Camtel, is currently not entirely clear.

5.3 Microwave backbone networks

5.3.1 Camtel

Camtel has an extensive national microwave backbone network connecting most parts of the country, comprising 50 transmission centres and 75 relay

stations. Capacity between Douala and Yaounde is 34Mb/s, which is dwarfed by the 622Mb/s that MTN has between the two cities.

Camtel has introduced Synchronous Digital Hierarchy (SDH) on some of the links in 2005, but most of the network uses Plesiochronous Digital Hierarchy (PDH). SDH offers a number of advantages, such as better scalability and flexibility in terms of interfaces, network topology and management.

VSAT satellite links are used to connect rural and remote villages or individual customers where no other access methods exist, through a hub station in Zamengoe (near Yaounde), using C- and Ku-band space segment and two other satellite telecommunication stations in Bepanda and Garoua. Camtel purchased 200 new VSAT terminals in 2006 and had already installed around 70 of these by early 2007.

5.3.2 Mobile network backbones

Both mobile operators, MTN and Orange, have built extensive microwave backbone networks throughout the country, using SDH on the main links and PDH on the fringes. The capacity of these backhaul networks is many times higher than Camtel's, given that the number of mobile subscribers in Cameroon (2.854-million in September 2006) is approximately 25 times higher than the number of fixed lines in the country. MTN for example has transmission capacity of 622Mb/s between Douala and Yaounde, compared to Camtel's 34Mb/s. Even when counting in Camtel's 155Mb/s on the new Douala-Yaounde fibre, the mobile networks still have much more transmission capacity. This capacity, however, is largely absorbed by mobile voice traffic and would need to be upgraded to carry additional broadband applications.

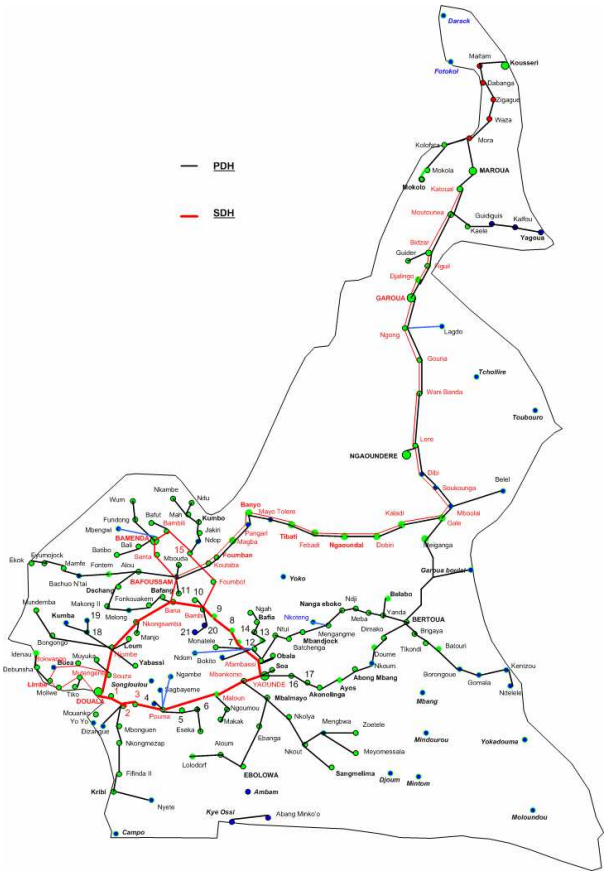

Figure 21: Mobile operator microwave transmission network, 2006

5.4 Access networks

The access network is the 'last mile'; from the nearest exchange or base station to the subscriber device, finally distributing the bandwidth to the end-user. In Cameroon, as elsewhere in Africa, most end-users are connected through the mobile networks, given the poor state of the fixed network. However, until 3G mobile technology is implemented, the mobile networks do not support true broadband transmission speeds.

5.4.1 Fixed-line access network

In general, Cameroon's telecom infrastructure is at a low level of development, with long waiting lists for fixed telephone lines, and a very low fixed-line teledensity, which has also impeded the development of the Internet sector.

Year	Fixed lines	Teledensity

Year	Fixed lines	Teledensity
1995	65,600	0.49%
1996	70,600	0.52%
1997	75,200	0.55%
1998	93,900	0.67%
1999	94,600	0.64%
2000	95,000	0.64%
2001	106,300	0.70%
2002	110,900	0.72%
2003	97,400	0.60%
2004	99,400	0.58%
2005	110,000	0.62%
2006 (Sept)	112,300	0.62%

Table 4: Fixed lines in service and teledensity, 1995 – 2006
Note: Data do not include CTPhone
Source: ITU, ART

Around half of all fixed access lines are in Douala (BuddeComm, 2007). Neither the arrival of SAT-3/WASC in 2002, nor the introduction of ADSL in 2005, have lead to an increase in the number of fixed-line subscribers.

A total of 153,800 fixed lines have been installed, and the switching capacity of the network is 140,900 lines. Camtel has 76 hubs to provide telephone services to rural areas with a capacity of 10,940 lines.

The network in Douala and Yaounde was converted from analogue to digital in 1990 and Integrated Services Digital Network (ISDN or RNIS) services were subsequently introduced. Camtel is continuously upgrading exchanges in other parts of the country as well. By early 2007, 25 of the company's 47 exchanges were digital, including those in Douala, Yaounde, Garoua and parts of the south and southwest of Cameroon. Where old analogue systems

remain, reliability is poor and some towns are sometimes impossible to reach by telephone or fax for days at a time.

5.4.1.1 ADSL network

Camtel launched ADSL at the end of 2005 and had 4,000 ports installed by early 2007, with 1,500 customers connected. A project for the installation of an additional 6,000 ports was launched in March 2007, with a target of a total of 40,000 ports installed by 2008. ADSL equipment will be installed at exchanges across Camtel's entire fixed network, including many areas outside Douala and Yaounde.

5.4.2 Wireless Local Loop

Following trials with 10,000 lines in Yaounde and Douala in 2004, Camtel launched a Code Division Multiple Access (CDMA)-based wireless network in September 2005, under the brand name CTPhone, to complement its fixed-line network. Chinese equipment manufacturer Huawei supplied 20,000 lines in a first phase, which was later expanded to cover some other towns in the south and west of the country as well. Uptake has been good, with around 28,000 customers signing up within the first year of operation, already representing 20% of Camtel's total fixed subscriber base.

Since the CDMA network supports mobility, Camtel also plans to use it to compete with MTN and Orange in the mobile sector.

With the current CDMA2000 1x technology, CTPhone supports voice and data rates of up to 230Kb/s. However, an upgrade to EV-DO (Evolution – Data Only) is planned which would enable broadband speeds of up to 2.4Mb/s.

5.4.3 Mobile coverage

While Camtel's fixed-line network has been unable to cope with demand, the two mobile networks have taken over as the providers of basic telecommunication services. Their degree of coverage - more than 80% of the population - far exceeds that of the fixed network. However, the mobile operators have not yet added true broadband capabilities to their networks. MTN has implemented GPRS throughout its network, which supports dial-up-like data rates, and EDGE in Douala, Yaounde, and selected other major

towns, supporting up to 384Kb/s (with actual download speeds typically lower than that).

The introduction of 3G technology would take the subscriber data rate up to 2Mb/s (with typical download speeds of several hundred Kb/s), and up to 14Mb/s with a High Speed Download Packet Access (HSDPA) upgrade. However, none of the mobile operators in Cameroon have announced plans yet for the introduction of 3G. The cost of the infrastructure upgrade would be substantial, which typically leads to higher prices for bandwidth compared to other (non-mobile) broadband technologies.

6 Conclusion

Our analysis shows that while the SAT-3/WASC submarine fibre optic cable has had a number of positive effects on the market, it has been drastically under-utilised, especially in its first three years of operation, and has failed to truly transform the market until now.

The benefits of the cable have not been able to unfold fully in Cameroon due to the level of politicization of the telecoms sector, a lack of transparency of regulations and the high level of corruption in the country in general. The monopolisation of access to the cable has resulted in high prices for international bandwidth and, consequently, an under-utilisation of the cable.

Despite this, SAT-3/WASC has had a number of positive effects on competition in the country's telecoms sector as a whole. It has helped to drive down prices in various segments of the market and stimulated the introduction of a range of new products and services.

Nevertheless, prices for most services have remained high by international comparison. True change will only come through competition between multiple fibre carriers in combination with an improved national backhaul infrastructure. In the absence of infrastructure competition, a regulated open access regime may be helpful as an interim solution.

7 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

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[i] Peter has extensive experience in the global telecoms industry, and with particular emphasis on European and African markets. He has completed several consulting and market studies in Africa.