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**Case Study**

**Empowering Socio-Economic Development in Africa  
Utilizing Information Technology**

**A Critical Examination of the Social, Economic, Technical and Policy Issues in:**

**Senegal**

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## **1. Introduction**

Thanks to the digital revolution, there has recently been an unprecedented acceleration in the evolution of both information and communication technologies, driven by the ever closer convergence between the two.

On the one hand, the services offered by telecommunication operators increasing use of the technology of information; on the other, informatics, having to incorporate transmission costs in charging for services, lays claim to the control of such costs, whereas previously they were in the hands of the telecommunications operators.

The interest of the new 'client-server' architecture, which generates networks and readily defines pathways for the informatics industry, is to strengthen the demand for liberalization of transmission. However, the telecommunications sector has been slow to respond, with solutions often considered too rigid and expensive.

In the world economy, information technology has a market share twice as large as telecommunications; however, whereas the information technology market is showing signs of stagnation, the telecommunications market seems to be expanding - but only at the sharp end of the sector, precisely where telecommunications and information technology meet. Important developments in this area illustrate the point:

- Telecommunications operators are merging to achieve greater power;
- Industrial telecommunications operators are forging alliances with suppliers of information technology so as to increase their competence and hence their competitiveness.

As a UNESCO study has shown, what is needed as a prerequisite of development is a radical review of the telecommunications pricing structure and a lowering of operating tariffs.

Conscious of what is at stake, Senegal has set the following agenda:

- To exploit the geo-strategic, human and technical assets already at its disposal;
- To reform tariffs, regulations and the conditions governing the use of telecommunications, especially at the international level;
- To develop graduate or postgraduate education in areas of relevance to both telecommunication and informatics;
- To provide controlled opportunities for operators, Senegalese or foreign, wishing to exploit the range of new technologies in Senegal;
- To speed up the implementation of projects already in the pipeline and to design new ones.

## **2. Evolution of Information Technology**

### **2.1 Telecommunications**

By creating the National Telecommunications Corporation SONATEL (Société Nationale de Télécommunications) in October 1985 the Government of Senegal adopted a course which seemed problematic at the time but in the event has proved to be the correct one, namely, to separate the management of posts from that of telecommunications. SONATEL was formed by merging TELESNEGAL, which was given responsibility for international telecommunications, with the Office of Telecommunications of the Bureau of Posts and Telecommunications, OPT (Office des Postes et des Télécommunications). This unit was made responsible for national telecommunications.

The objectives of this structural change were:

- To extend and modernize the telecommunications network;
- To improve the quality of service to users;
- To minimize the cost of telecommunication services;
- To provide all Senegalese with easy access to telephones.

A decade later an evaluation of SONATEL has shown that it has exceeded its objectives in the economic, as well as the social and technical sphere.

However, new perspectives on the horizon again call for a spirit of anticipation to guarantee continuity, and to build on the country's achievements in the telecommunications sector.

#### **2.1.1 Evolution of the Sector from 1985 to 1995**

The last decade has witnessed exceptionally rapid growth in the telecommunications sector despite an unfavourable economic and social climate.

The main aspects of this rapid development have been:

- A qualitative and quantitative improvement in telecommunications services;
- Satisfactory financial results.

#### **Qualitative and quantitative improvement of services**

Three converging policies have been adopted in planning enterprises and investment programmes, which have facilitated:

- The modernization of the network;
- The extension of services;
- An improvement in the quality of service.

#### **A modernized network**

The rate of digitization of the infrastructure reached 76.1% in July 1995, making Senegal one of the best performers in Africa and ensuring that the country was in line for entry to the information highways.

This modernization took the form of:

- Digitization of switching exchanges of nine out of Senegal's ten regions.
- Digitization of most of the main transmission lines: more than 2000 km of fibre optic cable were installed along the northern artery.
- Digitization of the international network: two international transit centres and some international linkages have improved the efficiency of international communications.

### **Expansion of services**

- Networks have been expanded in all regions. There were 3.5 times as many main telephone lines in operation in October 1995 (80,173) as there had been in 1985 (22,163), and the number of lines per 100 inhabitants rose from 0.37 to 0.95 over the same period.
- In 1988 a packet-switched network, SENPAC, was introduced. It offers companies access to data banks and interconnection with foreign networks.
- A cellular telephony network, MERCURE, came into operation.
- The development of public payphone booths was facilitated in all regions, 2,000 being currently operational. These have improved access to telephones and have created 4,000 jobs.
- The VIDEOTEL network was set up, enabling clients possessing a Minitel to have access to the electronic directory of subscribers and to professional and scientific information services.
- In November 1995 the INFOTEL network began operation, giving access to voice services.

### **Improvement in the quality of services**

Investment in staff development and in rehabilitating and modernizing the network, has led to a significant improvement in the quality of technical services.

- In 1987 the fault rate per telephone was 132.2%, i.e. each telephone was liable to be out of order every nine months. Today the rate is 39.56%, the likelihood of a fault occurring every two and a half years.
- In 1987 for local or inter-urban calls the completion rate was 34.7% and 28% respectively. These two indicators had improved to 58.90% and 45.14% by 1995.

#### **2.1.2 Infrastructure**

In the period 1985 to 1995 the Senegalese communications network made significant strides forward.

From having been based entirely on analog technology it has moved to being almost 80% digital.

Transmission equipment by underground or overhead copper-based cable was entirely replaced by microwave links and later by fibre optic cable. This equipment is today 69% digital, and will be 100% so before the end of the decade.

Switching equipment is 92% digital and will be fully so in 1997.

The most striking feature of the evolution of the Senegalese telecommunications network is, however, the significant increase in the number of telephone lines. From 30,080 in 1985 the number grew to 105,180 by 1994.

Rates of satisfaction of requested telephone lines increased from 72% in 1986 to 88% in 1994, despite the explosion in demand.

SONATEL is experimenting with subcontracting to private Senegalese businesses the upkeep of existing subscribers' telephone lines so as to increase its capacity to take on new subscribers.

It was intended to set up a pilot 'wireless' distribution network in the course of 1996 so that new subscribers could more easily be connected.

#### **2.1.2.1 The national network**

- International Transit Centre: 1976, with 452 international circuits.
- Project Submarine Cable ANTINEA-FRATERNITE: 1978, interconnects West Africa-North Africa-Europe through 640 and 480 international circuits.
- Dakar Northern Artery Project: 1981
  - . Automation of the St. Louis and Louga regions: 8 automatic exchanges
  - . Modernization and extension of the Dakar network: urban centre DKM3 and CTN
  - . Move from five to six figure numbers
  - . Inter-urban transmission by HF Dakar-Thiès-Louga-St Louis-Matam.
- PANAFTEL-ACDI Project:
  - . Inter-urban transmission by HF Kaolack-Tambacounda-Kidira towards Mali.
- ATLANTIS Submarine Cable Project: 1982, with interconnection Africa-South America-Europe: 1380 and 2580 international circuits.
- Project "19SR": for the network of Dakar lines: 5 152 PRT and 28 112 PD.
- Panaftel-CEDEAO (INTELCOM I - B) Project: 1987.
- Project ZKT: 1988
  - . Automation of the Zinguinchor, Kolda and Tamba regions: 9 provisional exchanges.
- Project PNAM: (Plan National d'Amélioration), National Improvement Plan.
- Project TFK: 1991, for the modernization of the telecommunications network in Thiès, Fatick and Kaolack, with two provisional exchanges.
- Dakar-Northern artery with fibre optic cable: 1992.
- Project Northern Artery 2: 1992. modernization of the telecommunications network in the St. Louis and Louga regions.

#### **2.1.2.2 International network**

The integration of the national network into a global one is achieved through a transit centre of 787 international circuits connected to various transmission systems:

- HF earth systems on the PANAFTEL network for the countries of the sub-region;
- Submarine cables in three directions:
  - . North Africa and Europe
  - . South America
  - . Côte d'Ivoire and Nigeria
- Satellite system via a standard A earth station for access to the rest of the world.

### **2.1.2.3 Special networks**

In addition to the telephone network SONATEL uses several other networks

#### **Telex and telegraphy**

The very slow transmission speed characteristic of these networks accounts for significant migrations in the last ten years towards networks which are faster and easier to exploit.

The number of telex terminals rose from 870 in 1985 to 1045 in 1988 before falling sharply to 685 in 1994 - a decrease of 34% in five years.

#### **Packet-switching network for data communications**

Since 1988 Senegal has had a packet-switching network entitled SENPAC, built around a large switch with remote sites at Yoff, Thiaroye and Thiès.

This equipment provides a public data communications service with 332 switching centres, accessible either directly or via the switched telephone network.

Both for the public and for the private sector, this network is an important tool. It has provided a dedicated route for communication among computers in Senegal, as in other parts of the world.

However, the rapid and massive growth in the use of local networks by business computers, and the growing need to interconnect them, calls for a capacity greater than the 64 kbs originally allowed for by this network.

The need to move to other solutions has become apparent, for SENPAC can no longer deliver adequate interconnection among local networks.

SONATEL has chosen the option of taking SENPAC to the limit of its capacity while waiting for the stabilization of systems using greater bandwidth.

#### **Cellular telephony**

An analog cellular network of the type RADIOCOM 2000 was installed in Senegal in 1993, pending the development of digital systems. It does not have a bright future. SONATEL, in collaboration with SIEMENS, is introducing the GSM digital cellular network which is expected to come into operation around September 1996.

In general, the mobile cellular system is seen as a 'wireless' distribution system for linking stations to the general telephone network, and thus constitutes an alternative to the fixed line system.

#### **Message handling service X.400**

The X.400 network is a message handling service which integrates functions such as an Electronic Data Interchange - EDI (Echange de Données Informatisées). This, in association with a protocol of the EDIFACT type, achieves a considerable gain in productivity in national and international data exchange. The X.400 network is expected to become operational in 1996.

#### **VSAT**

There are no VSATs (Very Small Aperture Terminals) in Senegal.

SONATEL has decided to deal with this matter in two stages:

- A joint venture with a VSAT operator who already has an international network and the offer of local benefits on behalf of the subscribers.
- A network of its own when the (sub-regional) market will warrant it.

## **ISDN**

The Integrated Services Digital Network, is at an experimental stage. It provides opportunities for businesses and users of value-added services. It will become available in the course of 1996 in the Dakar, Thiès, Kaolack, Louga, St. Louis and Fatick regions.

## **Intelligent network**

In a competitive environment the swift availability of new services is an index of competitive advantage.

With the advent of an intelligent network in 1997 not only SONATEL, but also users of value-added services will have enhanced their performance.

### **2.1.3 Services**

#### **2.1.3.1 Basic services**

Basic services comprise the following:

- Services accessible to the general public;
- Services closely associated with the permanent network supplying services to the general public;
- Competing services liable to harm the development of services to the general public;
- Services requiring government control in order to achieve strategic objectives (economic, social, security, etc.)

## **Urban telephony**

The main telephone users in Senegal used to be the Government and business enterprises.

In recent years urban households have taken the numerical lead. Average consumption, however, has fallen, so that there are lower profit margins from new subscribers.

Furthermore, the cumulative rate of cancellation by new subscribers has approached 20% in the past two years.

## **Rural telephony**

Rural telephony has improved considerably in both quality and quantity in recent years.

From having been a service added on to postal provision, where there was any, telephones have become the object of independent demand.

Demand has risen as a result of the introduction of 'phone-points' in the form of self-operated payphone booths, where there is evidence of local interest. Another factor in this demand is the yearning for contact with their families by rural menfolk who have migrated to the cities.

SONATEL has steadily devoted more than 6% of its investment to rural telecommunications, honouring the provisions of its contract-plan with the Government. Out of a total of Senegal's 11,000 villages, some 230, including 146 larger rural centres, are linked to the telephone network. By the year 2000 all larger

rural centres will have been linked. However, the low profits from telephone investment in rural areas, call into question the possibility of comprehensive coverage.

### **Mobile telephony**

Mobile telephones are supplied by SONATEL through its analog cellular telephone system.

Potential customers seem to be discouraged by the high prices set by the approved companies.

Despite evident need, the service has few subscribers.

The cellular radio service using CSM standards, expected to become available in 1996, is likely to meet the same fate, unless a terminal policy is established.

In countries where the demand for main telephone lines has been met, new subscribers are interested mainly in mobile cellular telephones.

### **Specialized low throughput connections**

Low throughput special connections have been available for some time.

There are still some special telegraphic connections (50 bauds) for press agencies, as well as special telephone connections for voice and data (up to 9600 bps)

The basic infrastructure of the network makes it possible to provide this service.

Digitization and the lower cost of the telecommunication infrastructure imply a move towards a throughput of at least 64 kbps.

### **Specialized high throughput connections**

The availability of high throughput specialised connections arises from two phenomena:

- Digitization of the global network and reduction in the cost of infrastructure.
- The emergence of a parallel service, thanks to the operators of the VSAT networks, where this is possible.

This service is underpinned by the big multinationals, which, having globalized markets, seem to have opted for 'one stop shopping'.

These connections are not yet available in Senegal. The signs are, however that they soon will be.

Their effect is likely to be to lower the turnover of SONATEL, which, however, supplies Radio Télévision du Sénégal (RTS) connections at 3424 mbps to carry the television signal.

#### **2.1.3.2 Improved services**

There is enormous scope for improving services using existing networks and basic services.

Requiring little material investment they provide customers of basic services with a 'plus' in various ways.

Apart from the private Telecentres initiated by SONATEL in 1991 improved services have made little headway in Senegal.

They can be classified as follows:

- Value-added services based on 'living' activities, involving either a human presence or complex machine processing;
- 'Colder' information services requiring only computers to control interactive data bases.

In Senegal the provision of improved services is an open field.

### **2.1.3.3 Value-added services**

#### **Public payphones**

Since 1992 SONATEL has encouraged private investment and ownership of public payphones throughout its network.

This service is much appreciated and benefits the owners, the customers, SONATEL and the State.

Public payphones were one of the initiatives of SONATEL to facilitate the general public's access to the telephone. The public at large was much in need of telephones in daily life.

Until 1994 precise rules, established by SONATEL, governed the establishment of such payphones.

Since 1995 they have been liberalized; anybody can become the owner of a payphone, on condition only of subscribing 250,000 CFA Francs per line, and possessing a trader's licence.

Some of the paybooths have recently been fitted with the Minitel videotex database information service. It was supplied free of charge by SONATEL, to enable the public to have access to videotex on-line data services, installed by SONATEL and information services companies.

There are currently more than 2000 payphone booths in Senegal, of which 1200 are in the Dakar region.

These payphone centres have generated more than 4000 jobs, an achievement which should be encouraged.

#### **Teleservices**

Teleservices are more or less inexistent in Senegal, despite the fact that it is a sector well suited to private initiative, the most important resource being 'grey matter'.

Among various categories of teleservice one might mention:

- Functional services: tele-secretarial services, tele-data entry tele-translation etc...
- Tele-informatics, tele-project study and development, tele-back up, tele-software development, tele-installation, remote maintenance etc...
- Tele-management of infrastructure: tele-security surveillance, tele-surveillance of transport networks, tele-recording, etc.,

### **2.1.3.4 Information services**

With the introduction of 'kiosk' functions SONATEL has laid the foundations for simple provision of information services.

## **Videotel**

Videotel (or videotex) permits the imputation of the price of consulting an information data base in videotex format to the telephone account of the caller, the provider being subsequently refunded the corresponding amount.

Thirteen on-line data services have been installed since 1994.

However, the alternative to Videotex presented by the Internet makes it unlikely that Videodex services will be developed any further.

## **Infotel**

Infotel (or voice kiosk) functions on the same principles as videotex, with voice information. Eight on-line data services were in operation in 1995.

### **2.1.3.5 Other services**

#### **Telegraphy**

The telegraphic service has witnessed a steady decline of activity in the last ten years.

This service is heavily reliant on human resources. It is due for modernization in 1996, within the framework of the message handling service project X.400.

#### **Private radio usage**

Services to licence holders remain an important activity because of the use of the frequency spectrum. They cannot be entertained outside the control of public authorities.

The standardization of mobile telephones of the cellular network should reduce the need for private radio usage.

#### **Maritime radio services**

Formerly essential for maritime traffic and life-saving at sea, this service has now to face serious competition from the installation on board ship of Inmarsat terminals.

It would be difficult to find the necessary foreign investment to upgrade the service; it is no longer considered a high priority.

#### **Press Services**

Hosting the headquarters of the Pan-African News Agency (PANA) Senegal provides transmission and reception of information services between Dakar and regional centres.

This activity operates at a loss and is served by an obsolescent infrastructure.

PANA is considering the use for its own needs of a network of satellite antenna to replace the existing service.

Senegal provides facilities to journalists and to the press in general in accordance with international conventions.

The development of cellular telephony (terrestrial or by satellite) may put an end to this no longer useful service.

### **One-way radio paging**

One-way radio paging services are not handled by SONATEL. They are one of the services already open to regulated competition.

The service appear to satisfy its customers and is attracting increasing attention from operators in the economic sector.

### **Access to the Internet**

Commercial access to the Internet became available in March 1996, with an initial three month experimental period.

This service, which is in its early stages in Senegal, evokes genuine interest among users, who are connecting to it in large numbers.

### **2.1.4 Regulation of Telecommunications**

Telecommunications occupy a strategic position in the economy, defence and security of a country. Their development has a ripple effect on almost all sectors of the economy and has proved to be a key factor of success in many areas.

The ever more important role played by telecommunications in the globalization of the economy led Senegal to undertake, in 1985, a first institutional reform, based on Law No. 72-39 of 26 May 1972, which regulated telecommunications.

This reform resulted in the total separation of postal services and telecommunications, and in the creation of a national regulatory authority, SONATEL, entrusted with the development and regulation of telecommunications.

The main objectives of this reform were:

- To improve services to users by implementing as a matter of priority a programme of upgrading the national communications network;
- To increase the tele-density, which was comparatively low (5 lines per 1000 inhabitants).

An evaluation of this first reform established that the following results had been achieved:

- A tripling of the number of main telephone lines (from 23,000 in 1985, to 72,000 in 1995)
- Steady growth in turnover and hence in the operations of SONATEL.

It is worth noting that, between 1985 and 1996, SONATEL raised its nominal capital from 3 billion to 50 billion CFA Francs, which placed it at the forefront of national companies in Senegal. However, the financial strength of SONATEL was detrimental to the services industry which did not progress beyond toying with videotex kiosks. The weakness of this sector can be laid at the door of SONATEL, which was far more preoccupied with its turnover than with promoting private industry.

It is evident that, in the ten years since this reform was instituted, the national and international telecommunications environment has undergone dramatic change.

An analysis of the international context reveals that the world is experiencing its third revolution: the information revolution, characterized by the fusion of the technologies of information, telecommunications and the media.

The new power of information has produced a model for a new architecture, with new cultures, new markets, new players and new organizational structures.

At the national level, the teledensity of Senegal (8 lines per 1000 inhabitants) remains relatively low, with high demand in relation to supply.

An analysis of this new environment has persuaded the Government to undertake a second institutional reform of telecommunications, with the following strategic objectives:

- To accelerate the development of the communications sector in order to increase the contribution of the sector to the Gross National Product by the creation of jobs and wealth through private enterprise.
- To facilitate the work of public utilities by improving access to the telephone in rural areas.
- To promote the development of a local telecommunications equipment industry.
- To continue to guarantee the availability in Senegal of a reliable, open communications network, connected to the world's information highways, and taking into careful account all aspects relating to security, the protection of state communications and national defence.

These objectives were translated into action in 1994 by the establishment of the Directorate of Research, Development and Regulation of Posts and Telecommunications (Direction des Etudes et de la Réglementation des Postes et des Télécommunications). It was given the responsibility of making regulation policy and monitoring the activities of telecommunications operators. Until this institution was established, SONATEL was responsible for the regulation and development of the network, which acted as a brake on the growth of value-added services.

Two other policies were adopted: sale of shares in SONATEL to enable it to adapt to an increasingly competitive environment; and liberalization of certain segments of the telecommunications market.

The new legislative and regulatory telecommunications framework which came into force in January 1996, distinguished clearly between networks and services, unlike Law No.72-39.

The framework envisaged three modes of operation:

- Services and networks which are the exclusive prerogative of the State. These are: provision of telecommunications networks open to the public (with the exception of radio-electric networks); provision of telephone services between fixed points; and the telex service.

These exclusive rights can be conceded as a whole or in part to one or more individual or legal entities under public or private law.

Concessions are subject to regulations contained in a book of specifications annexed to the convention and approved by decree.

- Services and networks subject to controlled competition. In this category are radiocommunications open to the public (notably cellular telephony, one-way radio paging, radio networks dedicated to data and telepoints) and independent private networks, or networks shared by a closed group of users (micro-wave links, mobile satellite services, independent radio-electric networks, shared radio networks).
- Services and networks open to competition. All other networks and services fall under this category, in particular services with a high value-added component.

Subject again to conformity of radio installations, the following can be freely set up:

- Internal networks
- Independent networks other than radio ones, with terminals of a range of less than 300 metres and with links of capacity of less than 2.1 megabits per second.

- Radio installations made up exclusively of low power, short range transmitters. Categories of these are defined by a joint decree of the Ministers for the Armed Forces, Interior and Telecommunications.

Operators are exclusively responsible for the establishment and operation of networks and services.

The Directorate of Research, Development and Regulation of Posts and Telecommunications was established by Decree No. 94-816 of 5 September 1996. The Directorate was given responsibility for making telecommunications regulation policy and for the general management policy of telecommunications networks; SONATEL's mission was restricted to those of an operator with the duty of protecting the interests of the State.

The duties of the Directorate were:

- To undertake preliminary studies for the definition of the said policies, notably those relating to the protection of the strategic interests of the State and the promotion of private enterprise;
- To create and maintain conditions encouraging dynamic and loyal competition with the prerogative of determining prices.
- To monitor the economic activity of operators and to ensure that they respect the mandate of the Directorate.
- To promote the sector and keep abreast of technological developments.

Dispute settlement will continue to be handled by an Inter-ministerial Telecommunications Coordinating Committee, chaired, because of its inter-ministerial composition, by the Secretary-General of Presidential Services.

With regard to SONATEL's privatization, it will have the following objectives:

- To allow SONATEL to continue indefinitely in a competitive environment, operating under clearly defined rules;
- To respond on a continuing basis to telecommunications needs with a popular and cheap telephone service;
- To ensure the functioning of telecommunications public utilities;
- To gain a market share at the sub-regional level.

The sale of shares in SONATEL is expected some time during 1996. The Government will hold at least 33% of the capital, other shareholders being private nationals, small savers, the employees of SONATEL, an African public operator, and a strategic partner.

## **2.1.5 International Relations**

### **2.1.5.1 Joint projects**

#### **West African submarine cable**

A draft agreement for a fibre optic submarine cable involving Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea Bissau, Guinea Conakry, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo was signed in Dakar 12 April 1995 by Benin, Cape Verde, Guinea Conakry, Mauritania and Senegal.

The basic configuration of the project has landing points at Dakar, Conakry, Abidjan and Lomé.

The aim is to cope with the saturation capacity of analog submarine cables laid in the sub-region in the years 1971/1980.

### **ATLANTIS 2 (CABRAL) submarine cable**

Expected to become operational in 1999, the link will be extended towards Europe and South America by the ATLANTIS 2 (CABRAL) submarine cable, to make the connection with the global digital network.

The agreement in principle to lay a submarine fibre optic cable Brazil-Senegal-Spain-Portugal was concluded in Dakar 11 May 1995. The signatories were Argentina, Brazil, France, Portugal, Senegal and Spain.

ATLANTIS 2 is expected to come into operation in 1999. It will replace the analog system ATLANTIS 1 (Brazil-Senegal-Portugal) which was launched in 1982.

### **Regional African Satellite Communication System (RASCOM)**

In common with all other African countries Senegal participates in this project of making satellites available at the regional level. Senegal has been a member of the Board of Directors since 1994.

With its various projects to digitize satellite and submarine cable systems, SONATEL will acquire efficient means of providing services, through the Digital Network Integrating Services, RNIS (Réseau Numérique à Integration des Services); Senegalese users will also gain easier access to information highways.

SONATEL could also be the driving force in African telecommunications, especially in the subregion. It will have the necessary means to realize this ambition, underpinned as it is by Senegal's geographic position. Unlike most other countries in the subregion Senegal has great connective potential both within and beyond the continent.

The current arrangements at the level of African telecommunications organizations already confer this role on SONATEL, for Senegal, like Côte d'Ivoire and Nigeria, is a regional transit centre for intra- and inter-African traffic.

These projects, in association with those which are already operational, constitute examples of network integration on the sub-regional scale. Among the latter are:

- Submarine cable projects with Côte d'Ivoire, Morocco, Brazil and Portugal;
- The PANAFTTEL/ACDI network, linking Mali, Burkina Faso, Niger and Benin;
- The INTELCOM 1, phase B, Lot 1 network, linking Senegal, Gambia and Guinea Bissau;
- The INTELCOM 1, phase B, Lot 2 network, linking Senegal and Guinea Conakry.

#### **2.1.5.2 Global projects**

The influence of SONATEL in joint regional projects enables it to take part in telecommunications activities at the global level. SONATEL participates in organizations such as INTELSTAT, INMARSAT and ICO GLOBAL COMMUNICATIONS.

#### **International Telecommunications Satellite Organization (INTELSTAT)**

This intergovernmental organization is a consortium of 136 countries operating 24 satellites across the four oceanic regions: Atlantic, Pacific, Indian and Atlantic/Pacific. SONATEL uses and invests in INTELSTAT.

The coming privatization will reinforce the financial potential of this organization, while giving it a structure more capable of responding to the exigencies of an increasingly competitive market.

## **International Maritime Satellite Organization (INMARSAT)**

This intergovernmental organization groups 75 countries and enables SONATEL to use mobile telecommunications by satellite.

## **ICO Global Communications**

This project, initiated in 1995, is due to come into operation in the year 2000.

It groups some forty countries. Through a single network comprising a dozen satellites. ICO Global Communications spans the entire globe with a cellular system. For SONATEL it will be a complement to the existing network, enabling the company to provide total access to the world network, extending to the level of the rural sector.

As Sonatel will be able to make use of a satellite access node and to provide a global service, it will play an important role as a user of this network. At the same time SONATEL will gain many technical and economic advantages.

### **2.1.6 Strengths and Weaknesses**

Ever more rapid technological advances in the communications sector have thrown telecommunications operators throughout the world into turmoil.

In order to have the means to take advantage of the situation the Government of Senegal will be adopting the following policies:

- Sale of shares in SONATEL to enable it to adapt to the new competitive environment;
- Progressive liberalization of the telecommunications services market.

Arising from these policies the following main lines of action will characterize the telecommunications sector in years to come:

#### **2.1.6.1 Major assets for the development of telecommunications services**

##### **Keeping abreast of new technology**

One of the evident strengths of the telecommunications sector in Senegal is the capability of the national operator to modernize the network. The following are about to come into operation or are in progress:

- Expansion and digitization of the network;
- Digital cellular telephone services using the GSM technical standard;
- The Integrated Services Digital Network, ISDN, enabling voice, data and images to be transmitted using a single cable;
- Message handling services, ensuring an electronic mailing service with all the necessary peripherals and security precautions (electronic post boxes, acknowledgement of receipt, etc.);
- The Internet network, which will give Senegal greater access to information highways;
- Techniques for optimizing the distribution network, based on the WLL or HDSL standards, which allow, respectively, the 'wireless' connecting of subscribers, or specialized digital links at low cost and without additional engineering work;
- Consolidation of Senegal's strategic position in international submarine cable links (West African fibre optic submarine cable link and ATLANTIS II);
- Membership of INMARSAT to gain access to various mobile communications services by satellite.

## **A telecommunications market**

There is a wealth of untapped business potential in the telecommunications market of Senegal, today even more than yesterday. A large part of it derives from international organizations and diplomatic representatives.

Firstly the business clientele is increasingly interested in multiple services, as factors both of excellence in management and of growth in activities.

Secondly as the telecommunications network reaches a critical mass, residential customers can benefit from interesting 'club' effects. The 'club' becomes more attractive as the size of the network increases, which explains why individuals who do not attach much value to telephones are interested in communicating with a growing number of potential partners.

## **The quality of human resources**

One of the essential reasons for the increasing dynamism of the telecommunications sector is undoubtedly the spirit of enterprise and the great ease of assimilation of new information technologies displayed by the providers of services.

In recent years these providers have reacted very favourably to offers from the national operator of high level infrastructure projects. Witness the existence of a system of radio messaging (beeper network), the multiplication of videotex data and especially voice services, the installation of automatic ticket machines, the first experiments with electronic document management, the interconnection of business networks, etc.

Moreover, beyond the areas sending out favourable echoes from providers of value-added services, there is virgin territory. Techniques for optimizing private business networks will lead to a better supply of basic infrastructure projects, and thus to economies in investment.

## **Future market uncertainties**

The telecommunications market in Senegal will inevitably be a competitive one. That is the will of the authorities, but it is equally the new opportunity on the planetary scale.

However, some problem areas must be considered, to ensure that the market will profit the country and its people.

## **The freeing of the telecommunications sector: a factor in the flight of traffic towards the big international operators**

There is a strong world-wide tendency for the networks of big operators to have only one gateway. British Telecom was a forerunner in this respect. These networks enable multinationals to establish direct satellite communications with all their subsidiary companies by installing at each site a small VSAT antenna, barely larger than a parabolic one.

Unfortunately the risks entailed by such systems are not confined to direct loss of turnover. There are also serious dangers of diversion of traffic. The enterprises involved could, through their installations, act as transmission nodes for neighbouring enterprises.

Similarly certain foreign enterprises established in our country could take advantage of differences in international tariffs by means of on-line automatic pass through voice services. Thus communications are always established unilaterally beginning with the country with the lowest tariffs.

### **Turnover largely dependent on international traffic**

The more the drawbacks underlined above entail uncertainties about international traffic, the more is it necessary to question the permanence of the substantial revenue obtained by the national operator on a balance of traffic which has been favourable for some years, to the order of 75% of SONATEL's turnover.

In plain language, more in-coming calls are received from abroad, especially from developed countries, than are sent out. Senegal therefore benefits from a positive balance of payments from charges. However, recently these charges are being challenged and already certain countries are beginning to limit their calls to Senegal. This poses a serious threat to the financial health of SONATEL, which is coming under pressure to develop new substitute products.

### **Direct versus indirect subsidies in the provision of universal service in an open market**

A characteristic of the telecommunications market, shared by all markets dependent on a network, is that it concerns the State, as guarantor of the public interest and of equality of opportunity among its citizens, only if a maximum number of users can access the services being provided.

It is a fact which often escapes notice, that developed countries, protagonists of a total freeing of markets in the communications sector, have achieved a state of almost universal telephone service.

For several decades, one of the constant objectives of the Federal Communication Commission, the regulatory body of the sector in the United States, was to encourage AT & T to expand telephone services as much as possible.

Historically, universal service preceded the competitive era in these countries. How will it be in developing countries? Will there be efficient and balanced regulatory mechanisms among the future operators of an open market, to ensure that they make the unprofitable investments previously undertaken by the national operator?

In the same line of thinking, might there be objections to cross-subsidies, whereby certain segments of the market (professional users) contribute more to the revenue of the telecommunications services than it would cost these users to constitute a closed group of subscribers?

The mechanism for calling this into question again will proceed directly from the interest and particular care which all operators in a competitive market will bestow on this segment of users.

### **Inexperience of private promoters**

In the earlier context of a monopoly, the performance of SONATEL was detrimental to private entrepreneurs who were denied the opportunity to develop expertise in providing value-added services.

## **2.2 Informatics Development Policy**

Up to the 1970s, information technology in Senegal was based on large systems located in a few government centres and in the parastatal sector. Giant computer manufacturers such as IBM, Bull, and Burroughs, which became UNISYS, established themselves in the country at that time.

The 1980s, noted for the micro-computer explosion, saw the advent of numerous computer services companies and training schools. The first micro-computers made their appearance in Senegal in 1981, using the CPM operating system.

The establishment, in 1987, of the Commission for Informatics Development, DINFO (Délégation à l'Informatique) provided a means of creating the building blocks for the strategic development of information technology.

The following important projects were launched:

- Land Taxation Register aimed at increasing the rate of recovery of land tax by a quantitative and qualitative improvement in output and in the system of distributing tax notifications;
- Automation of personnel administration records, with the aim of managing automatically in a single file the pay, administrative, and current management decisions relating to staff of user ministries;
- Automation and archiving on optical numeric disk, of data held by the Registrar General;
- Automated management of customs transactions, dealing with customs clearance and manifests.

This information technology explosion took place in the public, parastatal and private sectors, and resulted in the installation of a host of automatic dispensers and widespread office automation.

In the current context of government modernisation a number of projects aim to improve communications technology, and put it to better use. These are:

- The Inter-departmental Network of Voice and Data communication;
- The National Network of Scientific and Technical Information RNIST (Réseau National d'Information Scientifique et Technique), a system of scientific and technical information interchange and dissemination. Its development led to the creation of data bases in the fields of agriculture, industry, trade, transport and administration;
- Videotex applications in certain ministries on an experimental basis (Tourism, Justice, Education etc.);

The total complement of computers in Senegal today is estimated at one thousand minis and mainframes, and 12,000 micros. Growth is very rapid and is estimated at 2500 units a year.

### **2.2.1 Informatics Policy**

Although national action on computerization goes back to the beginnings of independence, with the Ministry of Finance applications, the key year was 1972, when the National Informatics Committee, CNI (Comité National Informatique) was formed. It was responsible for formulating and coordinating national policy.

Internally this policy produced various plans and standards; externally it led to active participation in various organizations and committees at continental and international levels.

#### **2.2.1.1 Internal policy**

The following are the main elements of internal policy:

- Automation of the main functions of government;
- Education and training;
- Promotion of indigenous computer services companies;
- Promotion and management of government informatics personnel;
- Promotion of informatics in development sectors;
- Definition of strategic aims in the parastatal sector;
- Enactment of legislation on informatics.

#### **Automation of the main functions of Government**

Informatics, if used only as an auxiliary to administrative procedures, risks being downgraded and deprived of its incomparable role as a management tool.

Administration of development implies that the Government does not confine itself to sound financial management of the public and parastatal sectors, but accepts responsibility for the most fundamental functions necessary for development.

In response to this concern the Government initiated an Informatics Master Plan in 1979, which, in its first phase, analyzed the then existing Senegalese information system.

The analytical method consisted of breaking down the system into sub-systems and groups of entities, such as:

- Ground, superstructure and networks
- Individuals and corporate bodies
- Goods and services
- Science and technology etc.

For each subsystem the following aspects were considered:

- Characteristics
- Duties of the administration
- Management practices
- Nodes (agencies)

The first two subsystems were given priority.

The second phase was devoted to the establishment of an administrative data bank, by integrating the results of computerizing the functions mentioned above. The objectives of the data bank were, among others:

- Development of a governmental systems chart;
- Development of a systems chart for public enterprises;
- Provision of to all users from all sectors of information and data of which they were previously unaware.

Among the projects implemented under the 1979 Master Plan were:

- The informatics component of the National Land Management Plan and the updating of village records;
- Development of files on individuals and computerization of national identity cards.

Network superstructure materialized much later, and only with the land taxation register component.

### **Education and training**

In the field of professional education the following steps were taken:

- Launching of an engineering programme at the National University College of Technology, ENSUT (Ecole Nationale Supérieure Universitaire de Technologie) in 1988/89; the University Diploma in Technology DUT (Diplôme Universitaire en Technologie), had come into existence in 1980.
- Establishment of an Informatics Master's degree course and of a diploma, (DEA, Diplôme d'Etudes Approfondies) in Informatics at the Faculty of Sciences of the Cheikh Anta Diop University, Dakar.
- Foundation, in 1990, of the University of Saint-Louis, with a Department of Informatics and Applied Mathematics.

Several centres provide training. At the Ministry of Economy and Finance there is a centre in the Directorate of Automation of Information, DTAI (Direction du Traitement Automatique de l'Information) another at ENSUT and another at the African Centre for Higher Education in Management, CESAG (Centre Africain d'Etudes Supérieures en Gestion). There are also a few private schools which offer information technology training for programmers and program analysts.

## **Promotion and conditions of service of government informatics personnel**

The components of informatics policy mentioned above can be implemented only if the Government has at its disposal a significant body of experts who can be entrusted to carry out applications, as well as advocacy and coordination missions.

This presupposes an adequate staffing structure for government informatics personnel.

A first step was taken in 1980 when recruitment, pay and conditions of service for such workers were determined. Further measures are under consideration, with the following main aims:

- To ensure more rigorous management of government and agency informatics personnel by a detailed and thorough definition of the qualifications, experience and responsibilities of each employee, according to his grade.
- To ensure centralised control of government and agency informatics organs so as to guarantee a match between the skills required for a task and the qualifications of the person performing it.

### **2.2.1.2 Regional and international cooperation**

Senegal has always maintained a policy of active regional and international cooperation, as can be seen from the following initiatives:

- Participation in the establishment, in 1971, of the African Informatics Institute IAI (Institut Africain d'Informatique) at Libreville, within the framework of OCAM (Organisation Commune Africaine et Malgache). This Institute, which at first trained only program analysts, launched a computer engineering course three years ago;
- Membership, since 1975, of the Intergovernmental Bureau for Informatics, IBI. Senegal hosted the Regional Francophone Africa Centre, CRIBI (Centre Régional pour l'Afrique Francophone) of IBI, until 1987, when the latter was disbanded.
- In 1992, Senegal played a key role in the implementation of the Regional Informatics Project for Africa, RINAF, linking African public sector academic institutions. Some twenty countries participate, under the aegis of the UNESCO Intergovernmental Informatics Programme, IPP.
- Lastly, Senegal participates in the network of the Centre for the Exchange of Computerized Data for Investment, Trade and Technology, SITTEDEC (Centre d'Echanges des Données Informatisées en matière d'investissement, de commerce et de technologie), established within the framework of the Group of 15 (G15), with headquarters at Kuala Lumpur, Malaysia.

The National Centre for Scientific and Technical Documentation, CNDST (Centre National de Documentation Scientifique et Technique) is the focal point of the network of which the participating institutions are the Chamber of Commerce of Dakar, CICES, the National Society for Industrial Research and Promotion, SONEPI (Société Nationale d'Etudes et de Promotion Industrielle), the Unit for the Encouragement of Business Enterprise, the External Trade Directorate, and the Directorate of Statistics and Forecasting.

### **2.2.2 Computerization agencies**

Included here are the agencies involved in various aspects of the use of information technology: coordination, advocacy, education and training, development of applications and processing, provision of equipment and technical support.

#### **2.2.2.1 Coordination and promotion**

The National Informatics Committee CNI (Comité National Informatique), established in 1972, is the main agency for coordination and promotion of informatics in Senegal.

The CNI is responsible for the coordinated development of informatics policy mentioned above.

The Secretariat of the CNI is provided by the Commission for Informatics Development, DINFO, which was established in 1987 with the following terms of reference:

- To oversee the implementation of informatics policy as defined in the terms of reference laid down by the President of the Republic;
- To supervise the computerization of Government and parastatal institutions;
- To promote the application of informatics in the economy.

#### **2.2.2.2 Training, education and research**

In addition to ENSUT informatics courses are also offered at Senegal's two universities, as noted in 2.2.1.1.b above.

The vast majority of high level professionals are trained abroad, mainly in France and at the IAI in Libreville.

It should, however, be noted that the CNI had in the past organized special training courses for engineers within DTAI; some ten engineers were thus trained in two batches in 1975 and 1980.

Research is at present non-existent, despite repeated initiatives. This situation is likely to change as a result of the ENSUT and University of Dakar computer engineering programmes.

The absence of university research coordinating mechanisms is to be deplored.

#### **2.2.2.3 Data processing or computer centres**

Centres exist in the public sector, in banking, commerce, industry and scientific research.

The main centres, however, are Government ones, comprising:

- The Directorate of Automation of Information, DTAI. This is by far the most important centre. Its computer resources and human potential make it one of the foremost centres in Africa.
- The Department of Records Automation, DAF, of the Ministry of Interior.
- The Customs Informatics Centre, which, since February 1996, houses the most powerful government computers, with two 4381s, models R92 and P91. The operating systems of the DTAI and Customs have been upgraded from MVS/SP to MVS/ESA.
- The National Centre for Scientific and Technical Documentation, CNDST (Centre National de Documentation Scientifique et Technique), also the national focal point of international networks of information exchange.
- The Dakar-Thiaroye Centre for Oceanographic Research, CRODT (Centre de Recherche Océanographique de Dakar-Thiaroye). This is the main focus of development of informatics research, in cooperation with the French Institute for Aid to Scientific Research, ORSTOM (Institut Français de la Recherche Scientifique en Coopération)
- The Land Taxation Registry, which has installed a U6000 computer using UNIX and ORACLE data base management systems, for the management of land taxes. This equipment is intended to form the nucleus of the future Informatics Centre of the Directorate-General of Taxes and Public Property. This configuration will house all tax applications which are now on the DTAI computer.

#### **2.2.2.4 Suppliers of computer equipment**

The world's major computer and microcomputer manufacturers are represented in Senegal, some having been active in the country for several decades.

There are about fifteen of them, beside some dealers. They sell their very latest products, and have no difficulty in installing them.

In the past these products have become operational in Senegal no later than elsewhere in the world.

- 1980: Installation of the IBM 43XX at the National Development Bank of Senegal;
- 1982: Operation of the IBM MVS system at the DTAI, the first of its kind in Africa;
- 1985: Installation of Bull microprocessor application cards for the automation of customs procedures;
- 1990: Operation of the RISC 6000 IBM within the framework of the National Network of Scientific and Technical Information, RNIST.

#### **2.2.2.5 Computer services bureaux and consultancy Services**

A study undertaken in 1990 for DINFO, revealed the following information:

- About 15 companies active in this sector have a local presence;
- Others, without a local presence, operate on contract, sometimes in association with local companies;
- These companies provide, the following services, with varying degrees of success:
  - Data processing based on machine hours
  - Implementation of applications
  - Consultancy
  - Education and training

#### **2.2.2.6 Computer associations and clubs**

Most of these subscribe to the same objectives, namely:

- Popularization of informatics
- User education
- Technological development and current awareness

Among the most active of these are:

- Association of Microcomputer Clubs of Senegal;
- Association of Alumni of IAI;
- Association of Alumni of ENSUT;
- Youth Association for the Development of Informatics in Senegal.

#### **2.2.3 Weaknesses**

- Many information technology projects have been conceived and developed independently, with no interface with other existing systems, especially in the public sector. This lack of connectivity between systems is a weakness of Senegalese informatics.

The integration of systems would have avoided the multiple input of the same data in several applications. Integration would have enabled institutions to have the right information at the opportune moment. These deficiencies stem from difficulties in implementing the national informatics plan. They are due partly to insufficient funding of public sector institutions and partly to the flouting, by some entities, of Decree No. 87-402 which conferred on the DAI the duty of controlling inter-ministerial projects.

- In the specific domain of development of applications there are practically no service and engineering design companies capable of delivering high technology systems. The few companies active in this field are not up to date with recent information technology and telecommunications developments.
- The cost of computers is high in comparison with the purchasing power of the population. The lowering of customs duties could put computers within the reach of many more people.

- The development of value-added services is slow because SONATEL has established high tariffs, to recoup its investments quickly; this does not apply to Internet, for which the charges approach international levels.
- With regard to education and training, there are numerous schools more interested in financial profit than in quality of teaching. Some of these establishments have even admitted students without the requisite entrance qualifications to the program analysts' course

Today, with the introduction of the Technicians' Higher Certificate, BTS (Brevet de technicien supérieur), instituted to standardize training, irregular recruitment is on the decline.

- The public sector institutions managing informatics in Senegal lack the means to carry out their missions. The DAI in particular is unable to assist the many ministerial departments clamouring for equipment.

A fundamental requirement for the promotion of informatics in these departments is access to a development fund.

- In the parastatal sector, too, automation has not been an unqualified success. Heavy investments are often undertaken without considering whether they are commensurate with the anticipated return.

### 3. Areas of Convergence

Given the quality and ease of processing facilitated by technological breakthroughs, and, arising from these, the growing demands of users, telecommunications systems are increasingly evolving towards digital signals - the prevailing standard used in informatics.

The development of telecommunications has led to a proliferation of networks of different kinds (cellular telephone, satellites, fibre optic links, etc.) the linking of which necessitate computerised processing procedures.

Telecommunications offer a range of new products: on-line data and other services, computerised data exchange, electronic mail, 'kiosks' whose operation requires computer programmes connected to telecommunications networks.

For its part, information technology feels the need to narrow its focus, and at the same time to expand; it is no longer confined to the organization and processing of information. It is engaged in delivering it to the office or home of the customer, dispersed or mobile, by means of networks connected to central servers. To do this, information technology naturally borrows the tried and tested technologies of telecommunication: transmission lines, networks, satellites, radio, etc.

The proliferation of computers of every kind, every origin, every design, and every shape and size, puts a premium on finding ways to interconnect them. For data interchange, information systems must develop standardized protocols, facilitating interfaces between informatics and telecommunications, and supporting the usual procedures for information exchange.

#### 3.1 Value-added Services

##### 3.1.1 Telematic 'Kiosks'

In 1994, in the area of convergence between informatics and telecommunications SONATEL launched a videotex kiosk which enables private promoters to sell access to data banks. The cost of the information, as well as the telephone charge is directly billed and recovered by SONATEL, who in turn remunerates the owner-promoter of the data base.

It must be acknowledged that the videotex kiosk has not turned out to be a popular success in so far as the promoters have not regularly brought out new data bases.

By contrast the voice kiosk, launched in 1995, and used mainly by the press and commercial banks, has gained rapid acceptance, owing to the relevance of the information provided.

In terms of regulation, the operation of the kiosks is subject to a contract between SONATEL and the operator of the on-line service. The role of the Information Commission is to be the regulating body and to ensure that the needs of the users are taken into account.

##### 3.1.2 Internet

The Internet came into service in Senegal as a result of a government initiative following the Addis Ababa Symposium on Telematics in the Service of the Development of African Countries. The Symposium created strong awareness of Internet, and led the authorities to commission a study which has acted as Senegal's strategic plan with regard to information highways.

The study, which anticipated the initiatives of the United Nations Economic Commission for Africa, had a decisive influence in propelling Senegal towards a better development of value-added services.

### 3.1.2.1 Configuration of the local network

The international provider of access to the Internet is the American company, MCI. Senegal is linked to the Internet MCI point by a 64KB/S link, made up as follows:

- 1 router for access to Internet
- 2 routers for access via the RTC switched network
- 1 router for access via RNIS and X.25
- 1 router by dedicated links (suppliers of services)
- 1 SUN work station for protection of the network'
- 1 SUN work station for the WEB SONATEL on-line data service
- 1 SUN work station for the operating system.

### 3.1.2.2 Service providers

As soon as Internet became operational, there was a spontaneous flurry of initiatives. They will need guidance and direction, to increase their Senegalese content. Mention may be made of:

#### **The African Network for Integration and Development (RAPIDE)**

Developed by the Pan-African News Agency (PANA) jointly with two Senegalese computer engineering companies, the RAPIDE network has the regional duty to ensure that there is a significant African presence on the Internet network.

This presence will be achieved by the integration of various nodes, both national (one for each African State) and regional (inter-governmental and non-governmental African organizations or international institutions) so as to create a continent-wide network representing the whole of Africa.

The RAPIDE network supplies various services, among them electronic mail, file transfer, consultation of African or foreign data bases, creation of a home page for businesses, public institutions and organizations, as well for management of data bases.

RAPIDE is thus an excellent means of promoting an African dimension on the Internet. By using it to launch a publicity campaign, Africa will gain visibility in 100 connected countries. Once the projected link with the PANA server in North Carolina will become operational RAPIDE expects to reach a volume of traffic of 5000 connections per day.

#### **The Research-Education Network**

The main objectives of the Research-Education Network are to make use of Internet and information networks to:

- facilitate the flow of scientific and technical information;
- encourage a partnership between laboratories in the North and the South;
- promote the emergence and growth of the African scientific community.

Until recent times access to Internet was through a star shaped topology. The main node of access to the RIO (Réseau Intertropical d'Ordinateurs) network is the Dakar computer installed at the ORSTOM Centre in Dakar-hann. The same structure is preserved by the REFER network of the Canada-based Francophone Agency for Higher Education and Research, AUPELF-UREF. The REFER network is installed at the Cheikh Anta Diop University, Dakar, (UCAD), linking Senegal's main nodes to the Francophone System of Publication and Distribution, SYFED (Système Francophone d'Édition et de Diffusion).

Several WWW services are working in research and education. There is the AUPELF-UREF of the Polytechnic College, ESP (Ecole Supérieure Polytechnique) and UCAD. ESP is producing a WWW

service devoted to tourism in Senegal, which has been operating locally since December 1995. Eventually a WEB service can be envisaged also for an institute or school.

There are numerous projects using the WAIS and GOPHER on-line data services. It is a question of making all the bibliographic data bases in the field of Senegalese education and research accessible on the Internet, through the WAIS on-line data service. For example the installation of ORSTOM's WAIS service will provide access to the Horisen data base (3,500 references). Another data service is being developed by the AUPELF-UREF, in collaboration with UCAD. It will provide access to the bibliographic data base of works available in the UCAD Library, as well as to all research papers in faculties and colleges (M.A. and Ph.D. theses etc.).

The Research-Education network operates in a sector of great importance which can be accessed by means of Internet.

Whereas only a few years ago a link to the network would have been an advantage, the absence of a link is today a major handicap, delaying development and evolution.

### **Project Africa On-line Information Technologies**

This project was initiated by a Senegalese computer engineering company called SILICON VALLEY. Among its objectives is to provide a 'Facilities Management Centre' and access in real time to existing information highways such as Internet, Prodigy, America On Line, Compuserve, and to ones in process of development, such as Microsoft's Marvel network.

Initially the project will propose to companies in industrialized countries that it is to their advantage to transfer some of their informatics work to other locations, by using information highways accessed through local telephone calls.

The range of work appropriate for relocation includes:

- Inputting
- Program analysis to order
- Design, production and conversion or adaptation of software
- Data processing: processing of enquiries, statistical data processing, developing document data bases, tele-secretariat.

To individuals the project provides the opportunity of total access in real time to information highways, at costs generally within their reach.

This Senegalese project acts as a bridge between the African network and the global planetary information infrastructure. The project will be more than a diffusion beam for the whole continent; it will be a compulsory point of passage for every decision maker, organization, enterprise and institution having to defend itself by acquiring in Africa some sort of position in a globalized, knowledge-based economy, in which information is at an even greater premium than capital.

Because of its important component of export of value-added services; the creation of its own satellite transmission network for data, serving as a relay station for national telecommunications for the proposed services; the instant and total connection of Senegal to the information highways; and the staged connection of other African countries to the information highways via Senegal - for all these reasons this project will undoubtedly place Senegal in a position of leadership.

The project will be implemented within the framework of the new regulatory environment characterized by the liberalization of the telecommunications sector in Senegal. This project could be a token of success of liberalization, for experience has shown that projects using the VSAT technology have enormous difficulties in developing, because of the partial or total state monopoly of telecommunications, justified

by the will of the African States to preserve the profitability of their national telecommunications corporations.

### **Project 'Senegal' on Internet for Promotion of the Economy and Tourism**

The objective of this project is the implementation of a service for the promotion of the economy, trade and tourism of Senegal. The service will encompass the information needs of all the ministerial departments and of the private sector, with a unique worldwide Senegal address on Internet and eventual links to the WEB.

The project has selected five major themes to integrate all activities, namely:

- Tourism;
- Investment, Trade and the Economy;
- Research and University;
- Art, Culture and Music;
- Health and Education.

In addition to information on these subjects the WEB will provide:

- An administrative and political presentation of Senegal;
- A connection with pre-selected partner data services, when 'INTERNET PARTNERS' will have been launched;
- A category named 'Senegal daily news', a press review supplied by the three national dailies, intended for Senegalese abroad;
- An exchange category named 'Hypernews forum', enabling Senegalese economists, academics and research workers to become better known and better informed in certain fields;
- A service for the promotion of development projects in progress;
- A category named 'What's new in Senegal?' open to everything to do with discovery or news.

The information circulated on WEB Senegal will be generated and kept up to date by the relevant ministerial department or the various transmitting services.

#### **4. Awareness of Decision Makers and Users**

In Senegal decision makers have always been aware of the importance of science and technology in development.

The advent of the new informatics and telecommunications technologies has engendered in decision makers and users an acute awareness of the importance of information and the need to develop the sectors relating to it.

With regard to informatics, by initiating the Informatics Master Plan as early as 1979, the Senegalese authorities had already marked out the road leading to a judicious introduction of information technology into all sectors of the economy. One of the Plan's main characteristics was analysis of the existing information system in Senegal.

Thus all the informatics projects launched in the 80s stemmed from the Master Plan. Concern for better coordination and regular monitoring in the execution of projects led to the establishment, in 1987 of the National Informatics Committee. In a farsighted move, it financed the study for the national packet-switching network SENPAC, which was to open Senegal to the outside world.

As for the awareness and popularity of information technology among users, is unusual to find, whether in the public or private sector, posts where the user is not computer-literate, even if in many cases the computers themselves are not yet available. The lowering of customs duties, which are still so high as to constitute a major obstacle, would increase access to computers among the general population.

Among professionals, and the young unemployed, especially students unable to pursue their studies, some 60% have completed introductory computer courses, if only in the hope of finding a job.

The contribution of business ventures and private schools, which continue to be dynamic sectors, are certainly important indications, and the recent establishment of the Technicians' Higher Certificate in Information Technology should lead to a higher status for information technology training.

At the school level more than twenty state schools in Dakar teach modules in information science. However, the introduction of informatics into the public education system is too slow. There is a pressing need for a judicious acceleration of the process, requiring appropriate teaching skills and the reorientation of the curriculum.

It would appear that, with the Project for the Introduction of Informatics into the Educational System, PIISE (Projet d'Introduction de l'Informatique dans le Système Educatif) Senegal, aware of the stakes, is pursuing a rational policy, despite seemingly limited resources. In reality, however, the Ministry of Education has not integrated this priority sufficiently into its development plan.

In the Telecommunications sector, the authorities, under the influence of political decision makers, separated Posts and Telecommunications in 1985. The sector was thus able to develop and restructure, and could respond to the numerous requests from businesses and householders for telephone lines and new services.

Among other significant initiatives the following deserve special mention:

- The establishment in 1981 of the Multinational Telecommunications College (Ecole Supérieure Multinationale des Télécommunications), to enable member States (six countries) to train high level telecommunications personnel, capable of developing and promoting the telecommunications sector;
- The formation of a Telecommunications Coordinating Committee to monitor at the highest level all matters affecting international telecommunications, and to resolve conflicts and litigation arising from the sector;

- The establishment in 1994 of the Directorate of Telecommunications and Postal Research, Development and Regulation. This initiative transferred to the State in perpetuity the prerogative of regulating the sector, thus removing from SONATEL the role of judge in its own case, which acted as a brake to the development of new services;
- The definition of a new, liberalized telecommunications regulatory framework, which could adapt to the new world context governing telecommunications;
- The privatization of SONATEL, to give it the means, financial and technical, to face increasingly aggressive competition.

## **5. Projects in Progress**

### **5.1 National Projects**

Since 1969 Senegal has set itself the goal of reaching the rank of semi-industrialized country by the year 2000, when its 9th Development Plan comes to an end. This ambition cannot be accomplished without reference to science and technology, the main engines of development.

In its development strategy Senegal has directed its programmes and projects towards satisfying human needs. This requires mastery of the new information technology, which has developed at great speed through the convergence of informatics and telecommunications - hence the various projects being implemented.

#### **5.1.1 Scientific and technical information policy: National Network for Scientific and Technical Information RNIST (Réseau National d'Information Scientifique et Technique)**

RNIST aims to provide Senegal with a vast automated network for the collection, processing and dissemination of scientific and technical information.

Through RNIST information generated by both the public and the private sector has been de-compartmentalized. The network encourages a fruitful interchange between the various sources of information and the user. RNIST intends to put at the disposal of the general public multidisciplinary data banks, conceived and developed in tandem with sectoral networks in higher education, agriculture, trade, industry and technology, public authorities, research and town planning, housing, transport and sanitation, health and environment.

This national scientific and technical information system is to be the engine of development, and should enable Senegal to:

- Satisfy the information needs of potential users, who are the decision makers, research workers, partners in development and the public at large;
- To be a full participant, thanks to its links with the great global networks, in tomorrow's human adventure, which will ride on the information highways.

A partially decentralized architecture has been adopted, resting on a network around a central server located at the National Centre for Scientific and Technical Documentation, CNDST (Centre National de Documentation Scientifique et Technique). It will put at the disposal of the public, multidisciplinary data banks which were conceived and developed in collaboration with the sectoral networks corresponding to priority development sectors of the economy.

These networks are already in existence around the CNDST server. The equipment consists of an RISC 6000 and a network manager (PILOT) linked to the other sectoral networks by the public packet switching network (SENPAC).

RNIST has accomplished the following:

- Six industrial and commercial data bases;
- One agricultural data base;
- Six data bases in progress:
  - town planning data
  - legislative and regulatory records
  - register of theses submitted to the University of Dakar
  - legislative and regulatory texts on the environment
  - data on transportation
  - the Scientific and Technical Potential

### **5.1.2 Introduction of Informatics into the Educational System, PIISE (Projet d'Introduction de l'Informatique dans le Système Educatif)**

The project is concerned with primary and secondary education. PIISE's aims are:

- To be a catalyst for innovation in education at all levels, through research and development of computer teaching aids;
- To train trainers in the use of microcomputers for computer assisted learning;
- To evaluate courseware according to an evaluation grid to be tailored to Senegalese requirements;
- To establish computer education programmes;
- To control the process of introducing information technology into the educational system by defining the re-orientation required at each stage.

### **5.1.3 Inter-ministerial Voice and Data Network (Réseau Inter-administratif de Voix et Données)**

The main objective of the Leased Inter-departmental Communications Network (Réseau Privé de Télécommunications Inter-Administratif) is to improve inter-departmental communications at no additional cost.

The aim is to offer all government agencies a dedicated system of telecommunications with good traffic flow. It should also improve the availability of public telecommunication lines, allowing users faster access to government offices.

This network will be a communications tool offering an electronic mailing system and access to data bases. The topology is articulated round a central node situated at the seat of Government, to which five secondary centres will be connected.

It will be a network with distributed architecture in a multi-PABX environment.

### **5.1.4 Civil registry and modernisation of the great state registers**

Some government agencies are the custodians of important information which must be permanently preserved. This applies to the Register of Births, Marriages and Deaths, and the Land Register. These have, over time, accumulated a significant body of information in paper format.

Today these documents are gradually deteriorating as a result of heavy use and the vagaries of climate. They are also at risk from natural disasters such as fire and flood.

To preserve this rich information resource, DINFO is taking advantage of the new information technology to initiate a major project of electronic archiving on optical numeric disk at the Rufisque Civil Registry Office. This experimental project falls within the framework of modernization of the great registers of State. The objectives of this programme are:

- To halt the degradation of State registers;
- To improve the quality of public service;
- To make better use of staff time.

This project is of interest also to planners in other branches of Government who hold vast quantities of documents and face problems of preservation and exploitation.

With promising results emerging from Rufisque it is intended to consolidate the gain by putting the information to practical use at the enquiry desk. It is hoped to raise the project to national level, by providing all provincial capitals with a computerised centre of civil registration and by providing the National Registry with a system enabling it to centralise all civil status data.

### **5.1.5 Land Taxation Register**

In the context of the policy to improve mechanisms for the mobilization of resources, Senegal has for some years been pursuing an extensive programme to establish a Land Taxation Register. This is intended to improve considerably the land tax base and tax retrieval.

Modern methods are being used to establish the base. These range from aerial photography to representation in digital format, by means of ground surveys, dimensional models, and questionnaires. It should eventually bring about a quantitative and qualitative improvement in procedures and thence in tax receipts. With this tool local authorities will be able to:

- Achieve a more comprehensive census of properties;
- Determine the composition of places and evaluate them;
- Identify precisely who is responsible for the tax, whether owner or occupier.

### **5.1.6 Preservation of, and access to the cultural heritage**

This project aims to preserve and increase access to ancient documents, in view of the massive documentary deposits preserved under difficult conditions by the Research Institute of Black Africa, IFAN (Institut Fondamental d'Afrique Noire) and the National Archives, institutions which previously held a sub-regional brief. A centre for conservation, dissemination and consultation, using the new technology, would enable academic staff and research workers from Senegal and other countries which were formerly part of French West Africa, to have easier access to their common heritage.

Optic technology has opened the way to computer facilities of enormous capacity and longer life. Faced with the need for mass archiving and conservation, and given the slow access afforded by present means, as well as the alarming rate of deterioration of paper records, new solutions have been devised. They integrate information technology, digitization, and the optical numeric disk. These new technologies, along with the development of telecommunications networks, augur well for the future. The pilot scanning experiment of the civil register gave convincing results, exceeding all expectations.

### **5.1.7 Regional development information units**

This project, initiated under the aegis of the Ministry of Interior, will provide access to information data bases on various sectors of the economy indexed at regional administrative level.

The project will be built around a network architecture, utilising a central server which will be linked to all regional administrative authorities, opened to the global network, and with Internet. Among the services offered will be consultation and transfer of records and the processing of images in the fields of town planning, school infrastructures, feminist groups, economic interest groups, medical groups, agricultural data on areas cultivated and crops developed, etc.

## **5.2 International Cooperative Projects**

### **5.2.1 RINAF**

The Network for the Exchange of Information among Institutions in Africa, RINAF (Réseau d'Echanges entre Institutions en Afrique) aims to help African countries to overcome obstacles to the flow of scientific, technical, economic and cultural information.

It will promote exchanges among universities, research institutes etc., by inter-computer communication in Africa. Priority is to be given to existing data networks by developing communication interfaces.

The topology is based on regional and national nodes, chosen from among university institutions, research institutes, and agencies concerned with scientific and technical information. The selection of sites takes

into account the diversity of geographic regions and is based on the human and technical potential of each site. Each country's national academic teaching and research institutions will be grouped under a national node, and the national nodes will together form the regional one.

### 5.2.2 SITTDEC

The Centre for the Exchange of Computerized Data on Investment, Trade and Technology (Centre d'Echange de Données Informatisées en Matière d'Investissement, de Commerce et de Technologie), aims to promote economic development in countries of the South.

The main objectives are:

- To provide an information data base and information services on the economic climate, markets, products, research results, essential resources, organizations and other data needed for investment, trade and technology in G15 member countries;
- To provide negotiated access to relevant data base services from governmental and non-governmental organizations in other countries;
- To promote the exchange of information on investment, trade and technology among member countries of SITTDEC by providing technical assistance, training and consultancy services;
- To organize exchange of experience programmes on the use of the SITTDEC information system for investment, trade and technology, through workshops, seminars etc in member countries;
- To provide expert consultancy services to member countries in cooperation with national correspondents, which are organizations designated by governments, and are responsible for the collection and dissemination of the relevant information.

The central site of the information network is in Kuala Lumpur, Malaysia. It will be linked to national focal points in the G15 countries.

This network, based on the new information technologies should make available to governments and other users reliable information on activities in the field of development.

SITTDEC is an opening to the outside world of the National Network of Scientific and Technical Information, RNIST, which is being established, and jointly steered by the Commission for Informatics Development, DINFO and the National Centre for Scientific and Technical Documentation, CNDST.

Senegal thus makes a considerable technical contribution to SITTDEC, because of the convergence of its objectives with those of CNDST. Senegal will be able to access, in real time, data bases situated in any G15 country.

Because appropriate technological choices have been made, Senegal is able to tap external markets within and outside SITTDEC to promote the services of the country's computer engineering and telecommunication companies.

### 5.2.3 INFOTERRA

Senegal is an active participant in the worldwide INFOTERRA network. Initiated by the United Nations Development Programme, UNDP, it makes environmental information available to governments, industry, research workers and decision makers in 155 countries, representing 99% of the world's population.

In 1977 Senegal established a focal point for INFOTERRA in the National Scientific and Technical Information Centre, CNDST. The focal point was so effective that in 1995 it was designated the INFOTERRA Regional Services Centre for West Africa. With the support of Canada's International Development Research Centre, CRDI, it is now working on a West African network of environmental information, sponsored by Senegal.

#### 5.2.4 PADIS

The Pan African Development Information System, PADIS, aims to develop African national information systems and to facilitate their interconnection.

Senegal's contribution to PADIS, via CNDST is as follows:

- Contributing to the PADIS data base;
- Contributing to the BIBLIO data base;
- Contributing to the Directory of Experts and to the Directory of Institutions.

PADIS's activities in Senegal include:

- Organization of a national seminar on PADIS's methodology;
- Organization of a seminar on the CDS/ISIS software;
- Contributing to the evaluation of the National Scientific and Technical Policy by the selection of an expert;
- Selecting a Senegalese consultant to study the impact of electronic mail in research institutions.

#### 5.2.5 Islamic Network (OICIS-NET)

The OICIS-NET Project is the information systems network project of the Islamic Conference Organisation, of which Senegal is a member. Initiated by the Islamic Development Bank, OICIS-NET aims at promoting cooperation and coordination among member states in the framework of socio-economic and technological development. The Project's specific objectives are:

- To improve the flow, exchange and distribution of information resources;
- To improve access to and use of information services.
- To foster the formation of data bases in priority sectors such as trade, industry and agriculture;
- To encourage efficient communications between private and public sector institutions;
- To promote the application and use of information systems and services in general.

The solution chosen by OICIS-NET for the telecommunications network was to use the SCITOR-SITA global network, which is available in most member countries. This company was selected by the Islamic Development Bank to equip OICIS-NET with a telecommunications platform with virtual management. The aim of this strategy was to make OICIS-NET autonomous. Users pay for the services received by virtue of their membership subscription. Membership is freely available, and subscription fees are low, considering the savings and advantages derived from membership.

The impact of OICIS-NET on member states will be considerable as soon as its services come to be fully and adequately utilized. Their undoubted value will stimulate use. OICIS-NET will play a vital role in supporting the development of member countries. In particular, OICIS-NET will:

- encourage the development process by providing up to date information to decision makers, planners, executives, research workers and scientists in government, as well as public and private organizations, enterprises and institutions.
- accelerate the exchange of information in commerce, industry, agriculture, food supply and other vital sectors of development;
- promote commercial exchanges between countries, presently at a low level, by opening commercial perspectives, and by facilitating the computerisation of commercial transactions.
- support efforts to establish information systems and networks at national, regional and sub-regional level;
- facilitate transfer of technology and know-how among member states;
- improve cooperation and coordination, minimizing duplication of development effort.

### **5.3 Promotion of New Services**

#### **5.3.1 Gateway Project**

A "Gateway" is a centre of advanced telecommunications used for the exploitation of information processing services. It attracts customers because of low charges and high quality service, and suppliers by the opening it provides to the outside world. This "open door" for exports has been made possible by the designation of a reliable specialized communications zone which is cheap in the exporting country. The gateway must satisfy commercial ends, measurable in terms of jobs created, foreign currency earned and technology transferred.

The advantages Senegal enjoys with regard to this project are its key geographical location for contacts between Africa and America, and its connections with the whole of West Africa. With its efficient telecommunications infrastructure, considered among the best in Africa, Senegal should be able to play a pioneering role in the computer services industry on the continent.

This project is still at the preliminary, market research stage, enquiring into offers from Senegalese beneficiaries; demand by foreign clients (in nature and volume); lessons to be learnt from similar experience elsewhere (Asia and the Caribbean in particular). Integrated in the services offered by the Dakar Technopole (see below), the "Gateway" should be of use to Senegalese computer services companies. It should provide them with an opportunity to exercise their skills in an international environment, accessible through the extraordinary advances of telecommunications.

#### **5.2.2 Technopole Project**

The Dakar Technopole Project aims to create and organize an economic space where the speculative intelligence of the designer can come face to face with the practical intelligence of the entrepreneur. This new economic institution will participate in the development of a dynamic private sector by creating an economic and technological environment oriented towards creativity, innovation and the creation of wealth, leading to stable employment.

The activities of Technopole will be of four kinds:

- An agro-food complex;
- An environment and energy complex;
- A complex for service and animation;
- A telecommunications and information technology complex, comprising a telecommunications centre, the Telecommunications College, and the Gateway Project, in connection with the establishment of an advanced telecommunications zone.

## 6. Needs and Opportunities

In the last ten years telecommunications have developed at lightning speed, characterized by a proliferation of data, image and sound networks; the appearance of value-added services; and important changes in the regulation of the sector. As a result there is likely to be much innovation in the development of networks in future years.

For Senegal, the new needs and opportunities are the following:

### 6.1 Telecommunications

#### 6.1.1 Needs

The needs are:

- Establishment of a local industry of goods and services able to respond to national demand for telecommunications equipment, especially the local manufacture of communications interfaces;
- Substantial reduction of telephone charges, so as to make local enterprises more competitive, and attract foreign investors;
- Provision of telephones in rural areas at very low cost;
- Diversification of existing networks and liberalization of the cellular, which has become a necessity in the development of inter-professional activity;
- Reinforcement of the process of modernization of the national network by digitization of all telephone exchanges, the installation of optic fibre throughout the network, and the introduction of new services (electronic data interchange, message handling X.400 etc.);
- Advocacy for the establishment of a highly marketable network like the Digital Network Integrating Services, RNIS, capable on the one hand of carrying data, image and sound, and on the other, of meeting the needs of economic operators in the framework of their commercial transactions; participating in the development of certain activities which are not financially viable, but are vital for the country's development (tele-teaching, tele-medicine etc.);
- Implementation of a leased network supporting voice and data for administrative communications so as to improve, at low cost, the quality of communication in the public sector;
- Development of a network devoted exclusively to the protection of State communications, its security and defence.
- Placing at the disposal of all potential callers, especially companies, cheap means of access to Internet to enable them to seize business opportunities.
- Development of private initiatives in the provision of value-added services;
- Development of an effective management structure capable of:
  - creating and maintaining the conditions for loyal and dynamic competition;
  - monitoring operators in the future national telecommunications market;
  - enforcing respect of public utility missions; and
  - promoting the telecommunications sector and current awareness of technological developments.

#### 6.1.2 Opportunities

Opportunities are:

- At the national level, the existence of a vast market of financially solvent applicants: presently the rate of telephone coverage is one telephone per 100 inhabitants. If the networks and services were to be diversified, and the tariffs were to come within the financial reach of the population, the rate could easily reach more than 2% by the year 2000.
- At the sub-regional level, the existence of a vast market which Senegal could reasonably exploit, thanks to the available expertise and the experience of SONATEL in developing networks.
- The existence, notably in the informal sector, of considerable national savings, which could be mobilized and oriented towards the telecommunications sector.

## **6.2 Informatics**

- Consolidate the main projects (Customs, Taxation, Land Taxation Register, Treasury, Civil Service) so as to improve substantially the management of Government income and expenditure.
- Develop data bases and value-added services which can be exported.
- Carry out periodic audits of the information systems in the para-statal sector, to measure the effectiveness of services rendered in relation to investment.
- Encourage the establishment of efficient information services and computer engineering companies, which would be capable of gaining a market share at the sub-regional level. They should receive financial and material development assistance.
- Introduce financial incentives to encourage wider access to computers.

## **7. Conclusion**

The challenge to telecommunications and informatics is essentially economic. In view of the quality of Senegal's human resources and of its geo-strategic position, it can justly lay claim to a share of the services market, which occupies an ever more important place in world trade.

However, certain deficiencies are apparent in practice. Promoters and beneficiaries of services often face difficulties of access to institutions prepared to finance their activities.

The new regulatory framework, operative since January 1996, is characterized by liberalization of telecommunications and privatization of SONATEL. With the advent of this framework Senegal should be able to develop a favourable climate for the emergence of new services.