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Telecommunications in Yemen Republic

T. H. CHOWDARY

10.1 Introduction

Yemen was a vital land from about 1000 B.C. until immediately after the rise of Islam in the middle of the seventh century, when it sank into obscurity; the centers of Islamic civilization shifted to Damascus and Baghdad in the north, and to Cairo and Spain in the west. Yemenis provided much of the soldiery for the Muslim Arab conquest of the whole of North Africa, the Middle East, Central Asia, and parts of Europe. The nation has again been rising into prominence in the second half of this century, reaching a height of international significance with a seat in the Security Council of the United Nations in the years 1990 and 1991.

Because the two parts of Yemen were under two fundamentally different political and economic systems until May 1990, telecommunications in the two parts developed differently. In general, the North has an advanced and more extensive national and international telephone system, whereas the South, despite a better and vaster inheritance from Britain, has a technologically backward, inadequate, and poorly performing system. The first task of the unified state was to modernize the South to the national level, expanding and integrating its system with that of the North.

This chapter will first describe telecommunications in the North and South separately and then discuss the master plan (1992–2007) that was prepared in 1990 and 1991 by International Telecommunication Union (ITU) experts. The conclusion will discuss initiatives taken in the mid-1990s to improve telecommunications in the country and obstacles to further telecommunications development.

10.2 Background

Yemen, in the southwest corner of the Arabian peninsula, is a land of 550,000 square kilometers with two islands, Socotra (3,500 square kilometers), approximately 250 kilometers off the mainland in the Arabian Sea, and Perim (300 square kilometers), situated at the entrance to the Red Sea. About two-thirds of the land is desert.

Until 1990 there were two states, the Yemen Arab Republic in the north, with an area of 220,000 square kilometers and a population of about 9 million and the

Marxist People's Democratic Republic of Yemen (PDRY) in the south, with an area of 330,000 square kilometers but just 2.5 million people.

There are 7,600 villages in the North and 2,200 in the South. Urban population is 25% in the North and 35% in the South. The North has 11 governorates, and the South has six. Sana'a (population 600,000) and Aden (population 370,000) were the capitals of the North and South, respectively, but Sana'a is the nation's post-unification administrative capital, where the Parliament sits and ministries are located. Aden is designated the nation's commercial capital, and a free-trade zone is planned for that city.

Ten percent of the population in the South and about 5% in the North are nomads (Bedouins). Literacy is under 25%. Average life expectancy is under 45 years; health care and hospitals are minimal.

10.3 Economic History

The land of Yemen has very little mineral or other natural resources. Rainfall is scant, and most of the land is desert or desertlike. Agriculture for food grains is confined to the central highlands, a strip of about 500 kilometers in length and 30 to 80 kilometers in width, north to south. Neither North nor South could produce sufficient food for the people of Yemen.

There is virtually no manufacturing. About 10% of Yemeni people (30% of working-age people) in both parts used to work in Saudi Arabia and the oil-rich Gulf states, remitting up to \$1 billion a year to help to finance the import of food, merchandise, and machinery. The oil-rich Arab states used to give almost as much aid, and this was used for impressive road, hospital, and school-building programs in the North. Much of the foreign aid the South received was from the Communist bloc and was spent on armed forces and internal security, with the remainder for roads. The North has had a free-enterprise, market-oriented economy; in the South's state-capitalist economy, even housing and shops were taken over by the state.

The North made impressive gains with the per capita income (PCI) reaching up to \$600, whereas the South, with a larger initial PCI, raised it to about \$400 only by the time of unification in 1990.

10.4 Economic Prospects

Oil was discovered in both the North and South in the 1980s. The former, with the collaboration of a U.S. company (Yemen Hunt), is already exporting crude oil and refining enough to meet domestic need. Exploration is on in the South without exploitation, but after unification, the Soviet concessions were reallocated to Western companies. These companies began oil production in 1993.

With sufficient investment coming, Yemen can become an oil-rich country like its Gulf neighbors and have a tremendous economic boom. The two worries are the population growth at 3.6% per annum (it was 2.3% in the South, where women's equality and education were officially enforced), and the need to reinte-

grate about a million Yemenis sent back from the Gulf states because of Yemen's support of Iraq before, during, and after the Gulf War.

10.5 Evolution of Telecommunications

Telecommunications in the two parts of Yemen developed differently in line with the type and nature of their government and the economy that they subserved.

10.5.1 In the North

In the North, the former Yemen Arab Republic, the Imamate which freed itself from the Ottoman Turkish empire after the First World War, did not want any communications with the outside world. It had an ancient German-supplied telephone system in Sana'a, the capital, and a Turkish-installed telegraph link to the Imam's seat in Taizz to the South. Both facilities were not for the general public but only for the use of the Imam and his officers.

There were no international connections at all. The Imam did not want his people to be polluted by the devil's (foreign, especially Western) ideas. It is said that during the Second World War, the Imam confiscated the few radios some people had, and, as there were no newspapers, the Yemenis did not know that a world war was going on, even in a country as near as Egypt across the narrow Red Sea!

The situation changed dramatically after the 1962 revolution when the Imamate was overthrown and a republic was proclaimed. There was civil war between the Republican forces (backed by Egypt) and Royalists (backed by Saudi Arabia) for the next six years. The civil war saw military communications using radio while there were hardly any communications for the public. When the civil war ended (following the Egypt-Israel war of 1967), peace slowly came to pass. The first priority of the Sana'a government was to extend its rule over all the sheikhs, so roads and telecommunications were given very high priority. During the Imam's time itself, Russians, Chinese, and Americans were invited to build the first modern roads linking in a triangular fashion the three chief cities, Sana'a, Hodaidah (Red Sea port), and Taizz. The Republican government extended the Sana'a-Taizz road to the border of South Yemen (still the People's Democratic Republic of Yemen) and built many other roads to link all the remote towns to the capital. Along with roads, safety, security, and order, telecommunications facilities were extended.

The Yemen Arab Republic opened itself to the West and especially established cordial relations with the rich Arab countries like Kuwait, Bahrain, and Saudi Arabia, while the South had border conflicts with Oman and Saudi Arabia as well as with North Yemen.

10.5.2 The Development Plan in the North

A three-year telecommunications development plan was launched for the period 1974 to 1976. The state-owned Yemen Telecommunications Company sought ITU help to prepare a master plan, and a very wise decision was taken to have SPC digital electronic exchanges and microwave radio for intercity links. It was a very

Table 10.1. Growth during the Plans

Years	Investment (\$ millions)	System Capacity (1,000s)
1974-1976	N/A	5
1977-1981	88	25
1982-1986	150	75
1987-1991	100	168

bold and wise decision for a country that had hardly any telecommunications network to leapfrog into the most modern technology and systems. The YAR government secured French aid to purchase CIT-Alcatel's E-10 B digital exchanges. As the terrain was harsh and population centers were few, microwave radio was the best choice to link up the population centers. Also, since electric power was available only with local generation, and in some places during night hours only, many repeaters were powered by photovoltaic solar power systems.

While the big towns were fitted with electronic exchanges, determined actions were taken to extend telephony to rural communities. The choice of system and technology was most cost-effective and appropriate. Electronic PABXs (MITEL) from the United Kingdom were reconfigured to act as dependent exchanges of the main towns. The links used were multiaccess analog radio for connection of the rural branch exchanges to the cities and also for picking up individual subscribers in the villages (these were the then emerging technologies imaginatively used to satisfy Yemen's requirements). Another welcome technology decision was the loop-carrier cable systems that allowed adding more customers on copper wire pairs in existing cables. Credit for all these wise decisions goes especially to Mr. Al Anici, the engineer-communications minister for the YAR.

The YAR showed great wisdom in allowing Cable & Wireless of the United Kingdom to establish, own, and operate the country's international telecommunications through three satellite earth station antennas (INTELSAT'S Atlantic Ocean Region and Indian Ocean Region and the ARABSAT'S Indian Ocean Region in Sana'a). Cable & Wireless owns a 51% stake in Yemen's inherited carrier, Tele-Yemen.

Following the initial three-year plan after the end of civil war and strife in the republic, there were three five-year plans during which impressive gains were made, as can be seen from tables 10.1 and 10.2.

Table 10.2. Telephone Main Line Growth

Year	Main Lines (1,000s)	Year	Main Lines (1,000s)
1974	4.8	1984	58.0
1975	4.9	1985	67.5
1976	9.0	1986	74.3
1977	12.7	1987	81.2
1978	14.1	1988	87.3
1979	15.0	1989	92.8
1980	16.0	1990	100.0
1981	24.2	1991	131.0
1982	38.8	1992	143.0
1983	49.9	1993	162.0

Table 10.3. The Master Plan for 1992–2007

Years	Investment (\$ millions)	System Capacity (1,000s)
1992–1996	312	263
1997–2001	600	440
2002–2007	700	770

These three five-year plans were, effectively, the first 15-year master plan. It is remarkable that by 1989 85% of the exchange capacity was SPC digital electronic (CIT-Alcatel's E-10B) and by 1991 it was 100% electronic, with the retirement of Siemens electromechanical EMD switches. There are no manual exchanges at all. There is nationwide direct distance dialing. International direct dialing is extended to all who want it, about 17% of the customers.

The second 15-year master plan (1992–2007) was prepared by an ITU team just before the unification. This provided for an investment of \$1.6 billion (see table 10.3).

When implemented, the main line density would go up from about 1.2 in 1991 to 5 in 2007. As a result of the first phase of the master plan, a packet-switched data network has been introduced. Also in 1992, an NMT mobile radio network was launched and had 1,550 subscribers within the first year. Future plans under the master plan include trunked private mobile radio, a largely expanded international gateway exchange, and leased international data circuits. Fax was already in use on a bureau basis in Sana'a in the early 1990s.

10.5.3 In the South

Southern Yemen was under Great Britain's rule until 1968. Aden, at the entrance to the Red Sea, commanded the European shipping to the east and was the world's second busiest port after New York. Great Britain endowed Aden with the telegraph in 1871 as a link in the submarine cable to Bombay and to Alexandria. Telephones and wireless services were established, making Aden an important link and transit center in the imperial girdle of telecommunications highways. As Great Britain took little interest in the internal affairs of the sheikhdoms of the hinterland, except to see that the sheikhs were kept from hobnobbing with the Turkish empire in the north, hardly any telecommunications were extended to the interior. Besides Aden, only Mukalla, a minor and primarily fishing harbor to the east, had telephone and telegraph facilities.

When the British quit Yemen after the long drawn-out, Marxist-led insurgency, and the South passed under Communist rule, telecommunications development was not for the general populace but for extending government control and serving its commercial concerns, including the state-owned enterprises of fishing, transport, civil supplies, retailing, and international trade. The Yemen Telecom Corporation, a state-owned enterprise, was set up in 1980 to take over the telecommunications plant and services and to expand and develop them further.

The South received money credits and economic assistance from the Commu-

nist bloc for very outdated telecommunications technologies. The result was, at best, poor local cable networks and long-distance intercity links leading to underutilized exchange capacities and, at worst, some telephone exchanges providing purely local service because they had no links to other towns.

There are more than 2,200 villages and towns in South Yemen spread over six governorates, including the islands Socotra and Perim. Of these, only 450 have a population of more than 500. After independence, the telephone system was extended to cover 17 more towns in addition to the few large ones already served, namely, Aden, Mukalla, Al Qatar, Altaq, Qutan, Al Ghaidah, and Seiyun. By 1991 all these systems except that of Al Ghaidah, the capital of Al Mahra governorate, were interconnected by national analog microwave radio systems. Socotra and Perim have no telephone facilities. Three digital microwave TDMA radio systems (point-to-multipoint) were installed in 1990–1991 to provide telephones for a few villages. (In contrast to less than a score of rural telephones in the South, the North has over 5,000.) As of 1991, the installed capacity of the 25 exchanges in 19 towns in the South was 35,000, out of which about 26,000 were actually working. In some towns connections are not given for want of a local cable network.

Aden is the largest system, with six exchanges, an equipped capacity of 19,600 lines, and 17,000 working lines. Those awaiting service are estimated to be as many. It has a mix of 1954 vintage Strowger step-by-step and Hungarian make (under license from Ericsson) ARF crossbar exchanges.

Mukalla, the chief town of Hadramawt governorate, has two exchanges of a total capacity of 4,400 lines, with 2,800 working. One of the exchanges is the East German ATZ-65 step-by-step crossbar and the other is Hungarian ARF in a container.

Other towns have either the ATZ64 in buildings or ARF in containers. All the exchanges are characterized by poor performance for lack of spare parts and low call-completion rates. The transmission links are of inadequate capacity. So subscriber trunk dialing (national and international) is given to only a few persons (less than one-third). There is an imbalance between the subscribers distribution cable network, the exchange capacities, and the transmission links. Much of this is traceable to the fitful help and supplies from the erstwhile Eastern European socialist countries to the People's Democratic Republic of Yemen.

Prior to unification, an inter-SPUTNIK satellite earth station was set up with the Soviet Union's assistance to provide links to a few Communist bloc countries. With assistance from the Gulf Arab states, an ARABSAT earth station was also set up. An extension of the MEDARAB TEL microwave radio system provided links to Arab countries, chiefly Kuwait, the United Arab Emirates, and Saudi Arabia.

In Aden a crossbar international gateway switch was installed in 1989, which also acts as the national transit switch. This, too, has a limited capacity, especially evident after direct dialing was introduced between South and North and unification effected.

International circuits are provided from the Aden gateway through the MEDARABTEL analog microwave radio link to Africa and Saudi Arabia; three satellite earth stations work with INTELSAT, Indian Ocean Satellite; ARABSAT, Indian Ocean Satellite; and INTERSPUTNIK, the former socialist bloc's satellite system. In 1992 a submarine fiber-optic cable was installed between Aden and

Djibouti and provides connectivity to the South East Asia/Middle East/Western European (SEA-ME-WE) international fiber-optic network. In late 1995 a link from Aden to Djibouti connected Yemen to the SEA-ME-WE 2 cable and provided an alternative digital access to Yemen for high-speed data services.

The INTERSPUTNIK link is good, but traffic was reduced significantly by 1990 and became almost nonexistent in 1991. The South's traffic was mostly to Saudi Arabia, Kuwait, and the United Arab Emirates. Since the Gulf War, when Yemeni workers returned home, this traffic flow dropped to but a trickle. In normal times, there has been an excess of incoming over the outgoing international traffic, bringing in foreign exchange to the YTC. (In the North, also, incoming traffic has exceeded outgoing.)

10.5.4 Crash Plan for the South

Since unification, extraordinary efforts have been made under the leadership of the minister of communications, who is a telecommunications engineer himself, first to interconnect all the telecommunications systems in the South and then to connect them with the telecommunications systems in the North. The crash plan to install 3,200 lines of switching equipment and matching digital transmission systems is one example of this effort.

The exchanges that offered only local service for want of transmission media to connect to the national network are connected to the northern exchanges across the former border by subscribers radio as transport. This is another example of innovative problem solving.

Cables unlaunched because of lack of jointing materials are now being laid and connections given. The south-north traffic has increased tremendously since unification. Circuits are augmented and traffic from the North is switched directly to the transit switch in Aden, bypassing the international gateway in Sana'a. A crash plan to install 32,000 lines of digital switching equipment in the South, retiring all the electromechanical switches in all the governorates (except Aden), and to install 50,000 lines of digital switches in Aden (with Japanese credit and help) has been set in motion. These provide augmentation of the transmission network by digital microwave radio and optical fiber systems. Al Ghaida in the sixth governorate will link to Sana'a via a microsatellite earth station and through it to the national network. Aden will have all of its electromechanical switches, including the international crossbar exchange, retired as well as most of the overaged cables.

10.6 Present Network Architecture

The switching and transmission system adopted very significantly influence the architecture of a country's telecommunications network. The North has been very fortunate in this regard because as a late starter it could choose contemporaneous systems: for switches, Stored Programme Control (SPC) digital exchanges (the French CIT-Alcatel's E-10B) for cities and electronic PBXs for rural use; microwave radio for intercity media; and satellite communications for interna-

tional telecommunications as well as a Med-Arab regional microwave system linking Yemen with Saudi Arabia, Egypt, and Djibouti across the Red Sea. The E-10B system has remote switching units (RSUs) in sizes from 512 to 4,096 lines working as concentrators, connecting local subscribers over PCM links to the parent exchange.

The capability of the E-10B system was skillfully exploited to have main exchanges only in primary cities, Sana'a, Hodaidah, IBB, and Taizz, with RSUs serving smaller towns, Hajja, Marib, and Sada'a, for example. The main exchanges were mesh connected, thus avoiding a hierarchy.

As the demand in a town increases, the RSU is replaced by a main exchange (as in the case of Dhamar in 1991). The Mitel PBXs in the rural communities are progressively replaced by RSUs. Customer pickup in the rural areas is by cable and cable followed by drop wires, loop carriers on cables, and for distant and sparsely populated places, multiaccess radio.

In the South the architecture of the telecommunications network is influenced by the switches and transmission systems the country obtained from its former allies—East Germany, Hungary, and the USSR—as well as by what it inherited from the British when they ruled. All communications were centered around and through Aden. It was only the governorate capitals (Aden, Mukalla, Al Ghaida, and Attaq) and a few smaller towns like Seiyun and Qatan in the Hadrumaut that had telecommunications. The links between the governorate capitals and Aden were through H.F. radio (even today Al Ghaida, the capital of the sixth governorate bordering on Oman, has only a H.F. radio link) until a microwave radio route was established in the 1980s. International communications were through two satellite earth stations both in Aden, one as part of INTERSPUTNIK and others working through ARABSAT and INTELSAT.

The restricted and noncontemporaneous quality of the South's telecommunications could be judged from the status of the infrastructure. For example, as late as 1990 a crossbar switch was commissioned in Aden in a building whose construction (by a Bulgarian organization) stretched over six years, and the Yemeni islands Socotra and Perim did not as of 1991 have any telephones for public service. (Armed forces and security personnel have H.F. radio for their own use.)

The more than 40-year-old Strowger exchanges and life-expired underground cables in Aden are a seriously malperforming system. Similarly, the East German crossbar exchanges in Mukalla and other places will soon collapse for want of spares, as production of such equipment in the former East Germany has likely stopped.

The microwave radio interconnecting cities and towns has not been extended to all towns and has an insufficient number of channels, and the crossbar trunk (national-cum-international) switch has inadequate traffic carrying capacity. The result is that call completion is poor, and a large number of subscribers are simply not allowed long-distance direct dialing. They have to depend upon telephone operators whose services are available during certain daylight hours only.

There is a large suppressed demand for telephones in almost all the towns and even villages. The problem could have been mitigated if privately run telecommunications bureaus had been allowed. Things are bound to change after the unification is implemented fully.

10.7 Master Plan 1992–2007

The master plan prepared by the ITU team in 1990–1991 envisages that the demand in the South will go up to about 190,000 main lines—a growth of about seven times the existing main lines. The switching equipment needed would be on the order of 210,000 lines. Telephone switches would be in 72 towns, compared with the current 19. The rural phones would number about 30,000, compared with under 100 in 1991.

The system capacity projections were 51,100 for 1992, 92,750 for 1997, 133,750 for 2002, and 208,500 for 2007. These figures would give a phone density of 4.85 main lines per 100 persons, nearly the same as in the North, a nearly fivefold increase. The transmission links would be a mix of terrestrial digital microwave radio and optical fiber systems. Besides the Aden-Sana'a corridor, other (two at least) north-south transmission links would be established.

The master plan is estimated to cost about \$400 million (excluding the cost of the crash plan now under implementation). Extensive use of fax is envisaged. Trunked private mobile radio, cellular mobile radio telephony and paging, packet-switched data network, voice mail, conferencing, and data base access services are also envisaged.

10.8 Telecommunications Organization

Domestic telecommunications in the North is operated by the fully state-owned Public Telecommunications Corporation under the control of the Ministry of Communications. International telecommunications were formerly operated by Cable & Wireless of the United Kingdom. This has been restructured as the Yemen International Telecommunications Corporation (YITC) jointly owned by Cable & Wireless and the Yemen government.

In the South the PDRY nationalized Cable & Wireless national and international facilities. The domestic and international telecommunications together had been constituted into one fully state-owned corporation, the Yemen Telecommunications Corporation. After the merger of the two states, one republic-wide, state-owned corporation for domestic communications was formed (the Yemen Telecommunications Corp.). International service is provided by Tele-Yemen, a joint venture between Yemen's General Public Telephone Corporation (GPTC) with a 49% stake in ownership, and Cable & Wireless, which owns the remaining 51%.

The personnel, management, and productivity in telecommunications in the two parts of the country differ. Despite the South's having less than a quarter of the North's telephones, it has as many personnel, about 1,500. The productivity index as number of telephone access lines per employee is therefore one-fourth that in the North. There is greater automation of operations, management, and billing in the North than in the South. The integration of the two systems at different stages of technology and interconnectibility is quite a challenge. There has been large-scale infusion of technology and know-how from France into the North. All installation and designs are carried out by the French, using local per-

sonnel and companies where available, to the overall planning, specification, and management of the YTC. The local cable construction and subscriber installations are contracted in large part to an Indian firm, the Telecommunications Consultants India Limited (TCIL). Germany is offering telecommunications equipment for the rural areas. In the South the planning, installation, maintenance, and operation are all done by the Yemeni engineers themselves.

Considerable progress has been made in the development of indigenous planning and specifications capability in the Telecom Corporation, although a number of foreign experts are still engaged in the crucial areas. There is a very good telecommunications training center in Sana'a. This was set up with the help of the ITU. Besides Yemeni nationals, it also trains telecommunications personnel from some Arab countries.

There is no telecommunications industry in the country. All equipment, including wires and instruments, is imported. A large variety of customer premises equipment, like push-button telephones, PBXs, and fax machines, are brought into the country by private customers and attached to the network. Some type of approval by the Telecom Corporation is needed for attachments.

10.9 Financial Status

As domestic communication is provided by state-owned corporations, there does not appear to be as much financial discipline as one might find in private companies. Although there are statements of profit and loss and a balance sheet, there have been no audited accounts for the last several years. The per line telephone revenue worked out to about YR4,300 (\$350 at the official rate of exchange and about \$120 at the open market rate). This constitutes about 75% of the per capita income and contrasts with the figure of 5% in the developed countries. The revenue per line is more or less equal in the two parts of the republic.

In order to finance the \$400 billion 15-year plan for the united Yemen Republic the prices will have to be increased quite considerably. Currently, local calls are untimed and underpriced. The international calls are heavily overpriced. National long-distance calls are moderately overpriced. Thus, there are heavy cross subsidies. Currently, 17% of customers having International Subscriber Dialing (ISD) are producing 77% of the telecommunications revenues in the North. International revenues accounted for 49% of the total telecommunications revenue in the North in 1989. (Similar figures for the South are not available.)

10.10 Policy-Making Process

In the North there were reasonable democratic freedoms, but due to limited literacy, there was not an "intelligentsia" that could lead thought and formulate public policy, especially in a sector like telecommunications. There were only 80 newspapers (dailies, weeklies, fortnightlies, and other periodicals) out of which only one was in English. Therefore, telecommunications policy has evolved in

the government, Ministry of Communications, and Yemen Telecom Corporation. The government followed a liberal and enlightened policy of sending its engineers abroad for training, and its minister and senior officers visited many countries and familiarized themselves with what was happening elsewhere and could therefore decide what could be done in Yemen. They engaged foreign consultants and advisers and even executives wherever they lacked the necessary personnel. The ITU's assistance has been utilized well.

Both Yemens have ministries of planning, and it is here that policies proposed by individual ministries and companies are examined in relation to the country's needs for telecommunications services and availability of financial resources—mostly grants from the Gulf states and credits from countries such as France, Japan, Italy, and Germany. Neither of the Yemens, it should be noted, took any loans from the World Bank, and thus did not have the benefit of views and experience of the Telecom Division of the World Bank.

Demand continues to increase. Yemen's trading companies and distribution chains want telecommunications. So does the 10% of the population who were working abroad in the Gulf states; they wish to talk to the family members left behind. Oil prospecting and refining companies, Hunt Oil (United States) and TOTAL (France), need world-class communications. They press for and get dedicated communications, mainly radio based, between their different sites.

As there is no manufacture or assembly of any telecommunications equipment in Yemen, influence on telecommunications policy of such a class is not there. But Yemenis returning from the United Arab Emirates, Kuwait, and Bahrain have seen a variety of telecommunications, fax, computer communications, and mobile phones. The better educated and enterprising of the returning Yemenis want to set up telecommunications bureaus offering telephone, telex, and fax services. A number of requests have come forward for authorization to invest in and sell a variety of attachments and provide services like cellular mobile telephones and radio paging. It would appear that groups such as these will apply pressure and influence to liberalize the telecommunications regime.

Radio-spectrum management is supposed to be in the Ministry of Communications but is in practice carried out by the YTC. As the use and users are not extensive, there have been so far no problems or crises. As economic activity picks up and new services like cellular mobile radio, trunked private mobile radio, and a variety of ship-to-shore communications are wanted, a professionalized radio-spectrum management would be required.

10.11 Changes and Issues in the Near Future

The unification of Yemen is a historic event, and it will have considerable influence on the organization, performance, and evolution of telecommunications. The South has a generally higher level of technical personnel, with the greatest asset being familiarity with English. They also have not forgotten the British system of well-developed policy procedures and record keeping. However, there was over-staffing in the South during the Marxist period. For 25,000 telephones in the

South, there are as many employees as there are in the North for about 150,000 telephones.

In 1991 in the South about 20% of the employees were women, in contrast to the North, where no women were working in telecommunications. A big issue will be the employment of the women engineers, technicians, and others in the North.

The malperforming, underdimensioned, and obsolete equipment in the South will have to be retired and replaced by equipment as contemporaneous as that in the North. This will put a severe strain on the expansion of telecommunications as planned in the North when it was a separate state.

Prior to unification, north-south traffic was handled as international and always through international gateway exchanges in Sana'a and Aden. As the political and economic integration of all parts of Yemen is accomplished, the two separate networks will need to be refashioned. North-south traffic will have to be handled through national switches. More north-south direct telecommunications links, such as between Sana'a and Mukalla, Sana'a and Al Ghaida, and Sana'a and Ataq, will have to be established. This will involve construction of new microwave radio routes and new satellite earth stations even for domestic communications in places like Al Ghaida and Socotra Island.

A new constitution for Yemen was ratified in 1991, and democratic elections with wide suffrage were accepted. A number of political parties were also registered; these included the Marxist party of the South, which is now establishing branches in the North, and the ruling party in the North, which is establishing its branches in the South. Highly educated and affluent Yemenis see great potential in Aden and want it to become a free port again, as in the British days. Great developments in construction, manufacturing, industries, and trading are foreseen and are being encouraged by deliberate state policy; Aden is being described as the commercial capital of Yemen. Telecommunications services will therefore require rapid development.

If the Western perception that Yemen is allied with Iraq and Sudan changes and if the anti-American and anti-Western stance of the Marxist Party ceases, then investments from the free world can flow into Yemen—especially into oil-related businesses—and Yemen's economy can resemble that of the oil-rich Gulf states. A teleport in Aden and Very Small Aperture Terminal (VSAT)-based data and voice network for the oil regions would then be needed.

In the mid-1990s the YTC began taking alternative steps to address the dismal state of telecommunications development in Yemen. In 1993 the YTC invited bids for a new telephone exchange in Aden that was designed to add an additional 44,000 lines and had an estimated cost of \$50 million. This project was financed by a Japanese loan. In 1996 Alcatel CIT of France and the YTC announced a project to expand the number of working lines to 310,000 by 1996. The digitalization of the remaining analog portions of the network is also part of this project. The first phase was completed in fall 1995 with an additional 34,000 lines being added, linking a further 20 towns to the network.

If the pragmatism of the North prevails, the great telecommunications opportunities available from other countries will be brought to Yemen. As discussed earlier, France, Japan, India, and Germany are already involved.

With a population reaching about 20 million in the next 15 years, Yemen will be a formidable force—after Egypt the most populous state in the region. That position will warrant more and more modern telecommunications.

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