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South African
Telecommunications:
History and Prospects

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TELECOMMUNICATIONS IN ALGERIA, MOROCCO AND TUNISIA

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1.0 INTRODUCTION

Algeria, Morocco and Tunisia are all former protectorates of France: Algeria from 1830 to 1962, Morocco from 1912 to 1956, Tunisia from 1881 to 1956. All three Maghrebi states share common cultural, linguistic and religious characteristics, and all are classified by the World Bank as middle income countries (see table ? .1). In 1992, per capita gross national product (GNP) was \$1,840 in Algeria, \$1,720 in Tunisia, and \$1,030 in Morocco. Sixty percent of the population of all three states was under 25 years of age in the mid-1980s, and in 1992 their adult literacy rates were 43% (Algeria), 51% (Morocco), and 35% (Tunisia).

Algeria is the second largest country in Africa covering an area of slightly less than 2.4 million square kilometers with a population in 1992 of 26.3 million. Ninety-five percent of its inhabitants live along the narrow northern coastal zone lying between the Mediterranean and the Atlas mountains. Fifty-four percent of its inhabitants live in urban areas, with 12% concentrated in the capital city of Algiers. Algeria is an oil exporting nation. The economy of the southern region is based on hydrocarbons (petroleum and liquefied gas) while virtually all the nonhydrocarbon-related activities of its economy -- including agricultural production, governmental units, services and

industry -- are concentrated in the northern coastal zone.

Morocco covers an area 447,000 square kilometers and in 1992 its inhabitants numbered 26.2 million (almost the same as Algeria). In 1990, 47% of the total population lived in urban areas, and 4% lived in the capital city of Rabat. Unlike Algeria, Morocco is an oil importer whose major export is phosphate, a major source of its resources for socioeconomic growth. Morocco is a constitutional monarchy, in which the king rules with a parliament. Although during the 1960s and 70s, Morocco's King Hassan dissolved parliament and ruled by decree several times during "national emergencies," he has permitted a kind of limited democracy since 1977 and has emphasized institutional continuity and system maintenance. In general, Morocco benefits from greater freedom of the press than Tunisia or Algeria. Tunisia covers an area of 164,000 square kilometers, with a 1990 population of 8.1 million. In 1990, 54% of the total population lived in urban areas, and 20% lived in the capital city, Tunis. Tunisia's population growth increased from 2.1% (1965-80) to 2.5% (1980-89); the projected growth rate for 1990-2000 is 2.1%.

Tunisia covers an area of 164,000 square kilometers, with a population of 8.4 million in 1992. Fifty-seven percent of its total population lives in urban areas, and 20% lives in the capital city, Tunis. Although the petroleum industry used to be Tunisia's leading foreign exchange earner, growth in Tunisia's economy now depends largely on the results of its agriculture sector, textile exports, and tourism. Tourism and textiles provide the greatest proportion of its foreign exchange revenues (about \$1

billion and \$1.25 billion, respectively, in 1990).

2.0 THE PAST

After independence in 1962, Algeria followed a centrally planned or "command" economy approach to development. The Algerian government's guidelines for economic development have been based on the goal of national self-sufficiency in important sectors, including telecommunications. Throughout the 1970s, Algeria's national plans emphasized investment in heavy industry, which has been supported extensively by the export of energy resources (liquefied natural gas and petroleum). The major increase in oil revenues after 1973 made possible large investments in many sectors of Algeria's economy, including telecommunications although a drop in oil prices in the mid-1970s brought lower than expected government revenues. By 1980, almost 95 percent of Algeria's total export earnings (which amounted to approximately 65 percent of total revenues) came from petroleum and liquefied natural gas production. Algeria's burden of debt in 1980 was high (38.7 percent of GNP), but because oil prices were also high its balance of payments was positive.

In 1961, five years after Morocco's independence, King Hassan II, who is both secular and religious head of state, inherited the throne from his father. Historically, Morocco's economic decision making and other broad powers have been centralized in the person of the king and under Hassan's rule there has been a large measure of

government participation in economic development. The Moroccan government has kept close control of transportation and communications, along with many other productive services. Morocco's development strategy has been based on a mixed economy with private ownership of property, private enterprise, and a capitalist form of monetary apparatus.

Morocco's economic development has historically relied heavily on phosphate mining. Phosphates---and to a lesser extent other primary products---have accounted for 90 percent of Morocco's merchandise exports between 1956 and 1976. In 1974, Morocco offset the general increase in oil prices by raising the price of its major export, phosphate, and was therefore able to launch an ambitious public investment program. In the late 1970s, Morocco suffered an economic slowdown as cheaper phosphate sources, such as mines in Florida, took some business away. Between 1973 and 1975, Morocco's GDP growth rose from a two-decade average of 4 percent annually to 7.5 percent annually. But the large public investment expenditures combined with increases in oil import prices and increases in defense expenditures in the western Sahara strained the public treasury. Morocco resorted to considerable foreign borrowings to finance treasury deficits.

Tunisia has oscillated between "reconciliatory" and "mobilization" methods of governance and development since independence in 1956 (Apter, 1964; Hermassi, 1972). During the 1960s, Tunisia attempted to mobilize society with rapid and radical social and economic change through a centrally planned economy. Throughout the

1970s and 80s, however, the government sought reconciliation and compromise among groups and emphasized moderate programs and a mixed economy. On November 7, 1987, the newly appointed prime minister and former minister of the interior, Zine El Abidine Ben Ali, declared long-time President Bourghiba incompetent to rule on medical grounds and proclaimed himself the new president of Tunisia. Most of the people of Tunisia, as well as other national governments, greeted the coup with some relief insofar as Bourghiba's failing health shed doubt upon his good judgment in the final years of his long reign (1956-87), which began with Tunisia's independence. While Ben Ali promised democratic reforms he has been criticized for censoring the press, outlawing the militant fundamental Islamic party, limiting other opposition parties and rigging elections at the municipal and parliamentary levels in the late 1980s and early 1990s.

2.1 TELECOMMUNICATIONS

The telecommunications operating entities of Algeria, Morocco, and Tunisia were all established under colonization and modeled after the French Ministry of Post, Telegraph, and Telephone (PTT), a government-owned department. The majority of telephone service in all three states was provided by the PTT. During colonization and the years immediately following independence, all international telephone calls from North Africa were routed through Paris. Internal communication networks followed only a few main arteries of information exchange, as telephones were concentrated in

urban areas. Most of the radio equipment used before independence in each of the three states came from French manufacturers, most notably the Compagnie Francaise Thomson-Houston and Societe Francaise Radioelectrique-Afrique, which manufactured standard telephone sets at its subsidiary company in Algiers.

Prior to the late 1950s, a maximum of only nine domestic calls could be placed simultaneously along Algeria's north-south axis. To overcome these limitations, the foreign oil companies operating in Algeria began to maintain an extensive local radio system of their to aid in the search for oil in the Sahara (Debbasch et al., 1970; Hermassi, 1972). The public telephone lines operated by the PTT were transmission wires strung on poles. During the national uprising for independence beginning in 1954, these lines were easy targets for Algerians trying to disrupt the long distance communications of the French. In order to overcome this vulnerability, the French developed a new long distance network based on radio communications centrally controlled through the PTT in Algiers.

Algeria's 1976 National Charter declared the associated development of an adequate telecommunications infrastructure to be a prerequisite for achieving the countries' goal of national self-sufficiency. Among the industries established to promote Algerian self-sufficiency in the early 1970s (when analog technology was state of the art) was telecommunications equipment manufacturing.

Although Morocco had a private telephone concession (ending in 1964) in the former Spanish zone, and another in Tangier (ending in 1967) that served about 7,000

subscribers, most of Morocco's telephone service has historically been provided by the state-run PTT. Most of Morocco's 160,000 subscribers in 1969 were concentrated in Casablanca and a few other large cities.

Telecommunications technology played an important role in Tunisia's struggle for statehood--during the revolutionary unrest that led to independence in 1956, Tunisian nationalists used telegrams to organize demonstrations and campaigns throughout the country (Anderson, 1986). By 1968, 83 percent of Tunisia's telephones were in Tunis, the capital city, where 8 percent of the total population resided. Tunisia's rural areas have historically been served by radio telephone, where they have been served at all.

3.0 THE PRESENT: ECONOMIC TRENDS

3.1 Algeria

Algeria's rapid industrialization and overdependence on energy revenues have resulted in a number of problems, most notably, shortages in agriculture and consumer goods and economic instability as a result of changes in oil and gas prices. These economic problems, plus the death of long-time President Boumedienne by natural causes in 1978, inspired a reevaluation of development strategies and a shift toward greater privatization of some economic activities in the 1980s--a trend that continued into the 1990s. National plans since 1980 have encouraged the private sector and called for the decentralization of many government operations in an attempt to stimulate

the economy (Entelis, 1986).

3.2 Morocco

Financial assistance from the World Bank together with considerable economic reforms and an outward-oriented development strategy have helped Morocco reduce budget deficits and improve economic performance since 1983. Morocco's debt-to-GDP ratio dropped from 117 percent in 1985 to about 80 percent in 1991. The debt service ratio over the same period dropped from 58 percent to about 45 percent of GDP. (U.S. Embassy, Economic Section, memo, Rabat, Morocco, 1990). Morocco's economy in the early 1990s was an active, expanding, free enterprise system in which state intervention was steadily declining and private investment predominated in most areas of economic and commercial activity.

3.3 Tunisia

The slow decline of Tunisia's petroleum industry continued in the early 1990s, but through 1992 Tunisia nevertheless remained a net energy exporter. External debt was less than 52 percent of GDP in 1990 (down from 57 percent in 1989). Tunisia began a series of World Bank-IMF structural adjustment reforms in 1987. Among these reforms is the liberalization of laws and administrative procedures regulating foreign investment. Since 1987, the computer market has benefited greatly from reforms, which have lowered import taxes and simplified bureaucratic procedures that

hampered the industry.

3.4. Economic Growth

A factor influencing the three states' ability to sustain telecommunications development is economic growth. On the whole, Algeria, Morocco, and Tunisia experienced economic growth during the 1970s, followed by economic slowdown in the 1980s, and some recovery in the 1990s. Algeria has seen another recent downturn, however. GNP per capita growth (in real terms) between 1980 and 1992 was -0.5 percent in Algeria, 1.4 percent in Morocco and 1.3 percent in Tunisia. In Algeria, growth in gross domestic product (GDP) averaged 4.6 percent between 1970 and 1980, then fell to 2.6 percent between 1980 and 1992. In Morocco, GDP grew at an average annual rate of 5.6 percent between 1970 and 1980, dropped to 4 percent between 1980 and 1992. In Tunisia, GDP growth fell from 6.8 percent (1970-1980) to 3.8 percent (1980-1992); in 1994 real growth in GDP was down to 2.1 percent.

4.0 THE PRESENT: TELECOMMUNICATIONS

4.1 Ownership and Regulation of TC

Post and TC services have been combined in the same organization in all three Maghrebi states throughout the colonial and post colonial periods. In Algeria and Tunisia, however, personnel and financial affairs of post and TC were separated. In

Morocco, these were not separate functions until after the reorganization in 1984. Algeria and Tunisia have had similar experiences with their TC labor unions opposing restructuring the TC entity. In both countries, the labor unions have opposed any change because it will threaten the guaranteed employment clause that exists under current civil service statutes. The fear of unemployment is reasonable concern in these countries. For example, in Tunisia the official rate was 14% (1992) and the unofficial rate was as high as 25%.

Algeria

In Algeria, government ownership of the entity continued after Algeria's independence from France in 1962. Nonetheless, in 1976, the agency was re-organized on a commercial basis with daily administrative autonomy. Hereafter referring to the Ministry of PTT as the Ministry of Post and Telecommunications (P&T), the decree was intended to improve efficiency within the administrative structure.² According to the re-organization, the services of equipment and exploitation (which had been separate directorates) were integrated under the directorate general of TC. Postal and financial services were integrated under a director general of posts. The Director of Finance serving under the Director General of Posts was responsible for computing activities, as well as the definition and design of the accounting system, including cost accounting for both post and TC services. The Directorate of Accounting ("Agence Comptable") who was responsible for post and TC accounts remained

independent as before. The Director of Budget formed a part of the Directorate of General Administration.

The reorganization did not produce all the desired effects, however, and in 1978, the General Director of P&T, Abdelkader Bairi, expressed his support for studies to further improve the organization. Additional organizational changes were introduced with effect from January 1983. Three presidential decrees were promulgated to redefine the functions, responsibilities and the organization of P&T at the level of the Ministry's central administration. The 1983 organization aimed at further improving P&T's efficiency, as well as its programming and planning capability, and at streamlining the Ministry's various branches of activities (see figure 1). It specified that P&T will be headed by a Minister, assisted by a Secretary General, Inspector General and several advisors. There were five Directorates General for: 1) TC; 2) postal services; 3) common services (buildings, transport and procurement), 4) financial and human resources and training; and 5) planning and information systems. Each directorate had subdirectors and bureaus.

Under the authority of the Minister, the Ministry of P&T was organized into a central administration in Algiers and directorates in the "wilayas" (provinces). The directorates were responsible for service to the public in the wilayas and to the "walis" (prefects) who represented the government at the regional level. There was a directorate for post and TC in each of the 31 wilayas headed by a director belonging either to posts or TC assisted by a subdirector of the other branch.

In 1985, the position of Director General for TC was eliminated, and all directorates relating to TC, post, financial and postal services reported directly to the Secretary General. In October 1989 the Ministry of P&T was scheduled to be transformed into a public corporation, the National Office of Post and Telecommunications (ONPT), with government owned shares. Due largely to resistance from labor, however, the re-organization was postponed. The World Bank, which encouraged the re-organization, decided to discontinue loan activities for the sector in 1992. The P&T anticipated that the transformation into a public enterprise would take place within the next few years, but by early 1995 this had still not happened.

Morocco

Since national independence in 1956 until 1984, all public TC, postal and postal/financial services in Morocco continued to be provided by the government department, the Ministry of P&T, established by the French during colonization. The organization of the P&T was of a simple administrative type, with directors of the external services reporting to the Minister, either directly or through the Secretary General of the Ministry. The central administration was organized into three directorates for general administration (including budget, personnel, social affairs, buildings and transport services), postal/financial services, and TC; and three divisions for data processing, international and public relations, and training. Services to the

public were provided by fourteen regional directorates which corresponded to the country's administrative organization.

In 1984, a legally, financially and administratively autonomous public corporation, called the National Office of Post and TC (ONPT) was created by law³ (see figure 2A). (Decree No. 2-84-20, January 10, 1984). ONPT was created, partly as a result of the World Bank's recommendations, with the express purpose of operating on a commercial basis. The overall aim was to reduce central government intervention in day-to-day operations. All operational and contractual responsibilities for TC and postal services, including staff, assets and liabilities, were to be transferred from the Ministry of P&T to ONPT in January 1984. But two years later sector assets and liabilities had still not been transferred to ONPT, and ONPT was still basically a government department in terms of its organization and management. By 1988, four years after the decree, the separation of responsibilities between the Ministry of P&T and ONPT, its semi-independent branch, was clearer (see figure 2b). Staff and budgets of the two were separated: the budget of the Ministry was part of the government budget while ONPT's budget consisted of its earned revenues plus commercial borrowing.

As before the reorganization in 1984, the Moroccan TC entity was governed by an eight member Board of Directors, chaired by the Prime Minister. Its members included the Ministers of Finance, Defense, Interior, Planning, Economic Affairs, Industry and Equipment, and Transport. In 1985, the World Bank reiterated that the

membership of Morocco's public enterprise boards should become more professional and effective by opening them up to people with technical and managerial experience. The Board of Directors determines ONPT's internal organization decree, organization chart and major appointments (director, deputy director and senior executives). ONPT was organized into a General Secretariat and six departments: TC, Posts and Financial Services, Finance, General Administration (personnel, social and legal affairs), Common Services (buildings and transport), and Procurement. In 1988, the French management consulting firms, SEMA-MATRA and SOFRECOM, recommended changes in ONPT's organizational structure and management which were implemented after 1987. These proposals provided for greater autonomy within its principal branches of activity (TC, post, and financial services), while increasing responsibility and accountability at all levels. Regional delegations were also accorded greater operational responsibilities, while policy control at headquarters, in Rabat, were strengthened.

Tunisia

During the colonial period, the Tunisian Ministry of Post, Telephone and Telegraph (PTT) along with various other technical bureaucracies ("directions") including Finance, Agriculture, and Public Works, were formally under the control of the Prime Minister. But in actual practice, it was a separate ministry, controlled and staffed exclusively by French nationals (Anderson 1986). The exclusion of Tunisians

was justified on the grounds that they lacked technical education. Since independence in 1956, the TC entity has remained a conventional government department ("secretariat d'etat") supervised and regulated by the Ministry of Communications and Transportation (see figure 3). In 1987, the PTT gained the right to retain earned revenues for direct reinvestment in the sector; in every other way, however, it remained a conventional government department. In the early 1990s, proposals for restructuring the entity into a public enterprise or other semi-autonomous organization were met with hostility from the PTT labor union. A demonstration in April 1992 by the labor unions opposing greater autonomy measures was met with assurances from the Ministry of Communications that no changes were imminent. Nonetheless, the issue was prominent in the discussions concerning Tunisia's VIIIth National Plan (1992-96). An ITU study conducted in 1990 strongly recommended institutional reforms, specifically restructuring the entity in order to provide legal access to greater financial borrowing sources and the authority to offer competitive salaries to its staff. On April 10, 1995, the Chamber of Deputies (Tunisian Parliament) adopted a law specifying the creation of a national office of telecommunications. This restructuring change the entity from an administrative structure to a public enterprise with industrial and commercial orientation. While the official name of the public enterprise is the "Office National des Telecommunications" or the National Telecommunications Office, the commercial name is "Telecommunications de Tunisie" (Tunisian Telecommunications).

4.2 Financial Health and Independence

Throughout the 1970s and 1980s, the greatest portion of the budget of the telecommunications agencies in Algeria and Tunisia came from the central government (until 1987 in Tunisia). In Algeria, for example, 96 percent of the financial resources came from the public treasury between 1977 and 1986. In Morocco, on the other hand, the greater part of sector financing before the 1984 reorganization came from the private sector (80 percent during the early 1980s). During the years in which each of the telecommunications agencies were government departments, they were required to turn over their revenues to the public treasury and reapply for funds during each national plan period (until 1984 in Morocco, 1987 in Tunisia).

In Algeria, where the agency is still a government department, P&T submits a budget proposal (operating budget and investment budget) for each national plan period. The operating budget is prepared at the wilaya level and reviewed by the budget division of the general administration department and is required to show an overall surplus. The investment budget, on the other hand, was prepared by the central departments of P&T. The first draft budget went to the Secretariat of Plan and required the approval of the Ministry of Planning, and the Council of Ministries then discussed the proposed operating and investment budgets along with the budget of all the other ministries. Both operating and investment budgets were submitted to the National Assembly for approval in October and November of each year; final decisions were made in June 1995. The National Assembly would adopt the budget through vote

and incorporate it into finance law, which detailed expenditures and authorized commitments and borrowing. Algeria financed only about 26 percent of construction requirements from earned revenues or net internal cash generation (NICG) in the early 1970s (1974-76). But increases in tariffs brought this proportion up to over half (57 percent on average) of the investment being financed by NICG between 1983 and 1988.

Like that of Algeria, the Moroccan P&T budget (until 1984) was annexed to the general budget of the state. Annexed budgets were submitted by all government agencies in Morocco that resembled commercial institutions insofar as they had some independent sources of operating revenue (e.g., the private sector). The annexed budgets were linked to the general budget of the state through the transfer of their current surpluses to the general budget resources and through the funding of their current deficits and investment outlays from the general budget expenditures. A draft of the finance law was prepared annually by the Ministry of Finance in cooperation with the planning division of the Five-Year Plan organization. The draft was presented not later than November 1 to the Council of Ministers for their consideration, and approval was then sent to the legislature to be discussed and voted into law. Since the level of sector investment was so low prior to 1984, P&T was able to finance 100% of investment from NICG.

During the period 1980-84, 50% of earned revenues covered all investment costs, another 45% was transferred to government, and the remaining 5% of its

revenues covered the debt service. After 1984, when investment levels rose dramatically, ONPT was able to finance about 57% of total costs and continued to transfer money to the government. In 1991 and 1992, ONPT financed 50% of investments from internal revenues. Between 1987 and 1994, ONPT was expected to collect for the government a 12% surcharge on billings (amounting to DH 3.4 billion between 1987 and 1994). It was subject to a 48% tax each year on its net income (about DH 60 million or US\$7.6 million in 1984; and a total of DH 4.4 billion between 1987 and 1994). Other miscellaneous taxes during the 1987-94 period paid by ONPT to government were expected to reach DH 2.2 billion, and import duties on equipment (approximately 44 percent of foreign exchange cost) would provide another DH 2.8 billion. The total financial resources transferred from ONPT to the government between 1987 and 1994 were estimated to reach DH 12.8 billion (approximately US\$1.4 billion).

The Tunisian PTT requested funding in a manner similar to that of the Moroccan (until 1984) and Algerian entities, that is, submitting the investment and operating budgets to the central government for review and enactment into financial law. But beginning with the VIIth National Plan (1987-91) the Tunisian PTT was granted the right to retain earned revenues for direct reinvestment in the sector, while transferring a portion of earnings to the public treasury. Between 1987 and 1990, PTT transferred TD 3 million (approximately US\$3.3 million). The amount of investment financed by NICG increased steadily throughout the 1970s and 1980s: 33% of total

investment in the mid-1970s, 48% during the Vth Plan (1977-81), 67% during the VIth Plan (1982-86), and 83% (TD 314 million) during the VIIth National Plan (1987-91).

4.2.1 Telecommunications Investment

Telecommunications investment as a percentage of total gross fixed capital formation (GFCF) or total national investment during the 1980s was generally less than 1% in developing countries and about 2% in the advanced, industrialized countries. In Algeria, telecommunications investment averaged 1.44% of GFCF during 1980-89. Telecommunications investments from 1989 through 1991 totaled DA 6.5 million. In Morocco, telecommunications investment averaged 1.6% of GFCF during 1981-85 and rose to 3.1% for 1986-88. In Tunisia, investment rose from an average of 2% of GFCF (1982-86) and 2.5% (1987-91) to 3.3% of GFCF in the VIIIth Plan (1992-96), when telecommunications investment doubled that of the previous plan period (TD 960 million or about US \$1 billion in current prices, as opposed to TD 340 million or US \$ 382 million during the previous plan).

Developing countries invested on average about 0.3% of GDP in the telecommunications sector in the early 1980s, compared with 0.6% for industrialized countries (Wellenius, 1987). Algeria invested on average a higher percentage of its GDP in the telecommunications sector during the period 1972-86 than did either Tunisia or Morocco. But during the 1980s, Algeria's investment was actually lower than Tunisia's or Morocco's as a percentage of GDP (see figure 4). In Algeria, the

average total annual investment in telecommunications (including land and buildings) during the period 1974-82 was 0.58% of GDP, compared with Tunisia 0.45% and Morocco 0.36% for this same period. Algeria invested heavily in the mid- and late-1970s (for the expansion of its domestic telecommunications infrastructure with satellite communications), but for the period 1983-88, Algeria's telecommunications investment dropped to an average of 0.32% of GDP, while Tunisia and Morocco's telecommunications investment increased during this period to 0.44% and 0.5%, respectively. For the period 1988-94, Morocco's telecommunications investment reached 1% of GDP.

Telecommunications investment per capita was highest in Algeria, the richest of the three countries (see figure 5) during the period 1972-86. Investment per capita in Algeria in 1972 was close to that of Tunisia (US\$1.40 in Algeria; US\$1.19 in Tunisia). But by the early 1980s (1980-84), Algeria's per capita telecommunications investment was US\$6.33 compared with Tunisia's \$4.79 and Morocco's \$1.98 per person. By 1986, per capita investment in Algeria had risen to US\$9.21, in Tunisia \$6.50, and Morocco \$4.32. In 1990, Morocco had taken the lead in per capita investment with \$11.90 followed by Tunisia with \$8.90. Algeria's telecommunications investment per capita was lowest of the three states at \$6.80 (all current US dollars).

4.2.2 Rates and Tariffs

The total estimated yearly cost of telephone service to subscribers in the 1980s was

higher in Algeria (US\$316.20 in 1982) than in Tunisia (US\$246.40 in 1982) or Morocco (\$270.47 in 1986). Algeria and Tunisia (since 1981) offered off-peak discount pricing. Morocco had no off-peak pricing. All three states used revenues from urban areas and nonresidential subscribers to subsidize rural and residential services.

In Algeria, telecommunications tariffs are proposed by P&T and require final approval by the Ministry of Finance. Since the 1980s, P&T has been required by law to cover all operating expenses, including depreciation and debt service, from operating revenues (unlike the policy of the 1970s). This has required regular increases in tariffs to cover the cost of providing service. Tariffs were increased in 1965, 1975, 1983 (by 50%), and once during the 1985-89 national plan period. In 1992, the cost of a local call was DA 0.90 every six minutes. An international call (to France) was DA 0.90 every 1.9 seconds. In Morocco, prior to 1986, the telecommunications entity obtained permission to increase charges from the Council of Ministers. After 1986, ONPT had the right to gradually increase tariffs based on the financing requirements of its investment program with no prior approval by the government. Morocco increased tariffs in 1979, 1982 (by 12%), 1985 (by 12%), and 1987 (by 20%). The base charge for a local call rose incrementally from DH 0.50 in 1985 to DH 0.80 in 1992. Local calls were not metered.

The Tunisian PTT proposes tariff increases and obtains final approval from the Minister of Finance. According to a PTT source, tariffs for telephone, telex, and data services tend to more than cover the cost of providing service. Tariffs were modified in

1965, 1975, 1986, 1989, and 1991. The cost of a local call in 1991 was TD 0.070 to 0.100 (US\$0.11), depending on whether the call was made from a subscriber phone or a public phone, respectively. An operator-assisted call to France was TD 2.940 (or US\$3.30) for the first three minutes and TD 0.630 (or \$0.69) for each additional minute. Such a call to the United States was TD 4,200 (\$4.60) for the first three minutes and TD 2,100 (\$2.30) for each additional minute.

4.2.3 Collection of Payments

The authority to collect payments from all users, including government subscribers, was stronger in Algeria than Morocco or Tunisia throughout the 1970s and 1980s. The Algerian P&T had the authority to discontinue service to any customer who was delinquent in payment of bills by more than one month. The 1978 decree states that government agencies can be forced to pay through direct deduction from their treasury accounts, even when budget allocations for telecommunications usage are exhausted. In 1982, the payment deficit was equivalent to only one and a half months of total receipts. The Algerian P&T accounts receivable was described by the World Bank in 1984 as excellent. Nonetheless, some flexibility was shown toward payment delays by various government users. The principal delinquent payers of arrears in 1985 were the Ministry of Defense, the Ministry of the Interior, and the Ministry of Radio and Television (RTA). While the Ministries of Defense and Interior paid, however belatedly, RTA, with arrears of DA 89 million accruing since its initial use of P&T-

controlled satellite channels, did not pay until payment of arrears by RTA to P&T became a condition for a World Bank loan.

In Morocco, the payment deficit of government users in 1986 was fifteen months of billing or 75% of total accounts receivable. While delinquent residential or business subscribers were disconnected after the sixth week, government users were not disconnected for unpaid bills. In 1984, total arrears of government users represented a loss to ONPT of DH 1.2 billion (US\$43 million). Budget allocations for telephone service by public agencies typically fell far short of actual usage. Under pressure from the World Bank, the Ministry of Finance increased allocations from DH 90 million to 160 million per annum to partially cover an estimated annual government telecommunications bill of DH 220 million in 1987 and beyond. During negotiations with the World Bank, the government granted that future telecommunications bills would be paid within three months of billing. Government arrears dropped from DH 800 million 1988 to zero by 1992.

In Tunisia, there was a chronic unrecoverable deficit of payments. The central government estimated telecommunications usage prior to each national plan and paid a fixed sum to the PTT in advance. But these estimates were typically lower than the actual usage by government agencies. PTT was not entitled to collect its due and simply forfeited these revenues, which could amount to several hundred thousand dinars during a national plan period.

4.3 Network Development

As noted above, while nationwide telephone density in Algeria was slightly lower than that of Tunisia, the quality of service was higher and the distribution of service between urban and rural areas was more equitable than in either Tunisia or Morocco.

Nonetheless, both Morocco and Tunisia began to undertake ambitious projects for rural expansion in the early 1990s, and is slowly surpassing Algeria.

4.3.1 Provision of Service

The number of main telephones or direct exchange lines (DEL)⁴ per one hundred inhabitants (DEL density) in Algeria was slightly lower in Tunisia from the early 1970s to the early 1990s (see figure 6). In the mid-1980s, DEL density in Algeria was 2.5% (1986), in Tunisia 2.9%, and in Morocco 1%. The average DEL density for all less developed countries in 1986 was 3%; for the continent of Africa 1 percent. In 1994, DEL density for Africa was 1.6%. Algeria's density was not only below the average for less developed countries, it compared poorly with developing countries with similar economic activity, such as Jordan (7%), Iraq (5.9%), Syria (5%), and Hungary (8%). The Algerian P&T's dependence on local equipment suppliers, who were unable to meet network expansion requirements, slowed growth in the 1980s. Nonetheless, the average annual growth rate in DEL density (1972-86) was highest in Algeria (12%), followed by Tunisia (8%) and Morocco (4%).

In the ten years between 1976 and 1986, Morocco's DEL density rose from

0.64% to only 1%. This is two to three times lower than developing countries with similar per capita income. Algeria generally met a higher proportion of total demand for telephone service during this period (76% in 1986) than either Morocco or Tunisia (59% and 46% in 1986, respectively). The tables turned in the late 1980s, with substantial investment increases in Morocco and Tunisia. In 1990, the DEL density in Algeria was 3.3%, compared with Tunisia's 3.8% and Morocco's 1.6%. The average DEL density among Arab states in 1990 was 7%. In 1992, DEL density had risen in Algeria to 3.5%, in Tunisia to 4.1%, and in Morocco to 2%. DEL density growth rates in the early 1990s jumped to an unusual, but successful, 22% in Morocco and to a more typical 12% in Tunisia. Tunisia achieved an average growth rate of 14.2% during the 1992-96 plan period. By 1994, DEL density in Tunisia was 5.5%, with 7.3% projected for 1996.

A growth rate of 15% is generally considered the peak at which a country can successfully manage increases in subscriber connections. In Algeria, P&T was unable to keep up with subscriber demand in the early 1990s; only 54% of total demand was satisfied in 1992. Tunisia, on the other hand, met 65% of demand and Morocco met 74% in 1992.

During the 1970s and 1980s, the waiting time for telephone connections was lower in Algeria than in Morocco or Tunisia. Between 1972 and 1980, waiting time in Algeria averaged around 31.7 months (or about two and half years). Although this rose to 58 months (about 4.8 years) in the early 1980s, it was still lower than Morocco

or Tunisia at that time. The waiting time for a subscriber connection in Morocco in 1984 was six years. It dropped dramatically after the late 1980s: from eighty months in 1987 (seven years) to thirty-nine months in 1989 to eighteen months in 1991.

Algeria's waiting time for a telephone in the 1990s increased steadily as investment slowed.

4.3.2 Quality of Service

The quality of telephone service, measured by most indicators, was highest in Algeria during the 1970s and 1980s. But by the 1990s, Algeria was surpassed by Tunisia, as shown by several indicators. In Algeria, during the 1970s and 80s, exchange fill was below recommended limits; completed call rates were high; the number of telephone faults (breakdowns) per year per subscriber and the percent of breakdowns repaired within forty-eight hours, although not exemplary, were better than Tunisia or Morocco. In the area of network modernization and digitization, however, Algeria lagged behind Tunisia and Morocco in the 1980s, but was catching up in the 1990s. The recommended level of exchange fill for less developed countries is 85% (Saunders, Warford, and Wellenius, 1983). In general, an exchange fill below 85 percent of network capacity allows for peak hour traffic and transfers and mitigates against circuit congestion.

In Algeria, exchange fill was below 85 percent throughout the 1970s and 1980s; in 1977, exchange fill was only 54%. It rose slowly to 62 percent in 1982 and

reached only 72% in 1986 (see figure 7). Unlike most less developed countries, Algeria had an excess exchange capacity in the network, that is, it actually underutilized switching capacity. Oddly, Algeria still suffered some congestion due to poor network architecture planning, specifically, efficient routing of traffic between cities. Nonetheless, call completion rates were good; during peak hours for local calls in Algeria in the 1980s, and the call completion rate was 95% (nationwide average).

In Morocco, exchange fill nationwide in the early 1980s was below the recommended limit, ranging from 77% to 84%. After 1984, however, exchange fill nationwide crept above the 85% limit, climbing steadily from 86% to 88% in the years 1984-86. In the commercial districts of Casablanca and Rabat, exchange fill was as high as 96% (1986). Call completion rates in these two principal cities were below 60% and 50%, respectively.

In Tunisia, exchange fill was below 85% outside the principal cities but was 88% in Tunis as early as 1969 and even higher in some other urban centers in the early 1970s (Sfax, 96%; Sousse, 93%; Nabeul, 92%; Moknine Ksar Hellal, 87%). Exchange fill in Tunis was still high at 86% in 1978. The nationwide average call completion rate during peak hours was 37% in 1984. But in 1982, PTT began major investments in new central switches, and annual gross investments for telephone switching equipment increased 97% between 1982 and 1986. The absolute growth in switching capacity in just those four years was almost 73%. This increased connection capacity brought exchange fill in Tunis down to 77% by 1986 and increased the nationwide

average call completion rate to 65% by 1988. Nonetheless, chronic congestion of downtown sections of the city persisted into the 1990s. Congestion was alleviated with the installation in 1993 of 39 new digital switches for national service.

An acceptable level for telephone breakdowns (faults) is about 0.5 per subscriber per year. None of the three states reached this level in the 1980s or 1990s. In Algeria (1983) the fault rate was 1.2 (nationwide average), in Algiers 0.9. In Morocco, telephone faults dropped from 1.3 nationwide in 1987 to 0.95 in 1990. In Tunisia, faults averaged 1.4 in 1987 nationwide; in Tunis they were 1.1; in the suburbs of Tunis they were 1.9. By 1993, faults dropped to 0.99 per subscriber per year in Tunisia. The percentage of faults repaired within forty-eight hours was 74% in Algeria (1983), 60% in Morocco (1990), and 50% in Tunisia (1993).

The proportion of digitization in the network has traditionally been higher in Tunisia than in Morocco or Algeria. Digitization began in earnest in Tunisia in 1982. By 1993, 75% of the network was digitized. Morocco rose from 5% network digitization in 1983 to 70% in 1992 (with 77% digital switching equipment). In Algeria, digitization got off to a slower start, in 1984, due to its commitment to building a local telecommunications industry as early as 1972 when analog technology was state of the art.

4.3.3 Distribution of Service

Equity between urban and rural distribution of telephone services was greatest in

Algeria during the 1970s and 1980s. Telephone density in the urban centers of Algeria in 1980 was 4.5% while the rural density was 0.9%. Two years later (1982), urban density was only slightly higher at 4.7%, while rural density grew more rapidly to 1.4%. In Morocco, telephone service was highly concentrated in urban areas: 80% of the DELs in service were located in nine large cities and provincial centers with 42% of the population. In 1986, telephone density in the three principal cities of Rabat, Tangier, and Casablanca--with 19% of the total population--was 3%. In the six secondary cities (Agadir, Fes, Kenitra, Marrackech, Meknes, and Tetouan)--23% of the population--telephone density was 0.54%. In the rest of the country--58% of the population--telephone density was 0.24%.

Nonetheless, some form of telecommunications service was available in most provinces and rural areas of Morocco, with only 4% of rural communities without access to a telephone. In 1991, multi-access radio links were part of a major expansion of the transmission network to serve rural areas in southern Morocco. By 1995, ONPT served a total of 10,000 subscribers using TDMA multi-access radio systems. Service was to be extended to an additional 7,000 subscribers in rural areas using remote concentrators. ONPT installed one hundred of these systems by 1995. The trunk microwave network was extended into the thinly populated, mountainous interior of the country with the installation in 1991-92 of a microwave transmission system by Alcatel.

In Tunisia, the capital city, Tunis, and its suburbs (with approximately 8-10% of the total population) had a very high telephone density relative to the rest of the

country, including other cities. In 1977, with a national average DEL density of 1.34%, DEL density in Tunis was 6.6%. The next highest density was 1.2% in the secondary city of Sfax, and density for the rest of the country was just under 0.7%. Between 1972 and 1985, 62% of the DELs were in Tunis. In 1988, with a national DEL density of 3.5%, density in Tunis was 12.7% and in the rest of the country 2.3%. For the VIIIth Plan (1992-96), of the 400,000 new telephone installations, Tunis was allocated 100,000, while the rest of the country was allocated 300,000. But in 1993, Tunis still had three times the DEL density (14%) as the national average (3%) and thirteen times the lowest density in the interior.

Tunisia began a rural communications project during the VIIth National Plan (1987-91), scheduled for completion by the end of the VIIIth Plan (1996). Tunisia awarded contracts to two companies, one French, the other Canadian. A microwave base station in each provincial capital (at a cost of US\$120,000) connects to the PTT switch, linking 640 subscribers per repeater station (US\$15-20,000). In 1992, 700 out of 1,055 planned rural sites were operational.

4.4 Technology Transfer

4.4.1 Technical Expertise

One of the most important institutional changes in the 1976 reorganization of the Algerian P&T was the abolition of the civil service statute. After 1976, P&T offered

competitive salaries and promotion opportunities in order to attract and keep highly qualified expertise and leadership in the organization. As a result, Algeria had a higher proportion of technical to total staff since the mid-1970s than either Morocco (until recently) or Tunisia (see figures 8a, 8b, and 8c). On average, between 1977 and 1986, the Algerian P&T maintained a ratio of 66% technical staff. In Morocco, the proportion of technical staff between 1977 and 1982 (just before the civil service statute was abolished) was 41%. After competitive salaries were introduced, the proportion rose to an average of 59% between 1983 and 1986. In Tunisia, where the civil service statute was still in effect in 1995, the average proportion of technical staff between 1972 and 1985 was 33%. Between 1985 and 1990, the average proportion of technical staff had fallen to about 27% of total staff. In 1992, technical staff was down to 21% of total staff in Tunisia.

The World Bank recommends a ratio of about 20 staff members per 1,000 DELs for adequate staff productivity in developing countries, noting that a larger staff size increases the wage bill without significantly increasing the output of the organization, especially when that staff is clerical rather than technical or managerial. Algeria increased its staff levels during the 1973-77 expansion of the telecommunications network, including domestic satellite service. By 1977, there were forty-two staff members per 1,000 DELs, a ratio which fell within the range of many other developing countries but was high compared with countries with similar staff wage levels. Nonetheless, almost 60% of that staff provided technical expertise. By

1986, staff ratios were down to thirty per 1,000 DELs, with over 65% providing technical expertise, and by 1992 ratios were twenty per 1,000 DELs.

In Morocco, there were twenty-nine staff members per 1,000 DELs in 1986 with 59% technical staff. By 1994 they were down to 18 per 1,000 DELs. In Tunisia, there were forty-four staff members per 1,000 DELs in 1974, and only 12% of total staff were technical experts. By 1992, the staff ratio was a more productive seventeen per 1,000 DELs, but the proportion of technical staff was still very low, at 20% of total staff. The target for 1996 is 14 staff per 1,000 DELs, with a higher proportion of technical staff due to competitive salary structure made possible by the conversion to a public enterprise. While Tunisia's labor force is well educated and literacy is high, technical training is inadequate. The low level of technical expertise in the PTT is a major stumbling block for modernization of the network, but efforts are underway to increase the number of graduates in technical training.

4.4.2 International Services

International services for all three states are provided by undersea cables linking them directly with Europe and with each other and by international and regional satellite systems (Intelsat and/or Intersputnik and Arabsat, respectively). All three states are members of Intelsat, as well as Medarabtel and Panaftel, the regional terrestrial networks of the Mediterranean and African countries, respectively.

Algeria is a founding member of Intelsat and introduced international satellite

communications services via the Intelsat network in 1975, with the installation of a Standard A earth station at Lakhdaria (outside Algiers) operating with an Intelsat IV satellite located over the Atlantic Ocean for communications with countries to its west. In 1976, Algeria installed another Standard A earth station operating with an Intelsat IV satellite over the Indian Ocean for communications with countries to its east. In 1979, Algeria purchased a station operating with the Intersputnik satellite system of the former Soviet Union.

Algeria was the first developing country in the world to use Intelsat for domestic communications. In 1973, in an innovative move, P&T's then Director General for Telecommunications Equipment, Abdelkader Bairi, proposed the design and implementation of a domestic satellite network using 15 small (11-meter diameter), less expensive earth stations (US\$500,000 per station, or about \$6 million for the network of 15 stations in 1974 dollars) and a transponder on an Intelsat satellite (\$10 million per year from 1975 to 1979 on a preemptible basis). In 1974, Algeria contracted with an American company, GTE, to adapt the existing Standard B earth stations to make them suitable to the harsh desert climate of southern Algeria (these modifications meant that the Algerian domestic stations no longer conformed to Intelsat standards). The first stations of the nonstandard domestic network were placed in operation with Intelsat II in the Indian Ocean on 17 February 1975. In 1983, Algeria awarded a contract to another American company, Scientific Atlanta, for two more of the same type of stations. In 1988, a Canadian company, Northern Telecom, won the

contract to expand the domestic network by another 19 stations, which would provide access to a subsequent generation (Intelsat V) of satellites. The network facilitates communication between the major urban areas and population centers of Algeria's northern coast and the natural gas fields, mining areas, and industrial production complexes scattered across vast rural areas of sparsely populated desert in the south.

Morocco (with a Standard A station near Rabat) and Tunisia (with a Standard A station in Dakhila, near Tunis) also use and belong to the Intelsat system for international service. Morocco introduced domestic satellite service in 1983 with the lease of an Intelsat transponder. Neither Morocco nor Tunisia was a member or user of the Soviet satellite system, Intersputnik. In 1992, almost 60% of Tunisia's PTT revenues came from international traffic, and circuits were often blocked due to insufficient switching capacity. Morocco plans to increase international transmission capacity by adding another Standard A earth station to be installed by GTE Spacenet in the late 1990s.

All three states also belong to the Arab satellite network, Arabsat. Dakhila, outside Tunis, is home to the second technical control center of the system. Algeria, Tunisia, and Morocco were initially cool to the idea of the regional satellite (circa 1976), and consequently their investment shares in 1978 were very small: 0.5% for Morocco, 0.6% for Tunisia, and 0.9% for Algeria. Each Maghrebi state purchased its Arabsat earth station in 1985 when the first-generation satellite (Arabsat IA and B) was launched. But for economic reasons Algeria did not transfer its domestic

communications traffic from the Intelsat satellite to Arabsat. Algeria qualified under the Intelsat Agreement Article III b (II) of the Intergovernmental Articles of Agreement as a country that can earn return on investment using an Intelsat transponder for domestic communications because of the geographical barriers typical of international communications (high mountains, large bodies of water, vast distances). Under Article III b, if the implementation of wideband terrestrial facilities is impossible because of natural barriers of an exceptional nature, the provision of domestic telecommunications services via an Intelsat satellite transponder would be considered on the same basis as international public telecommunications services. In other words, the country earns return on investment share "according to use" for domestic as well as international traffic on the Intelsat satellite. This "return on investment share according to use" clause did not exist with the Arabsat network until two years after launch, that is, until 1987. Nonetheless, Algeria continued to use the Intelsat satellite for domestic communications.

4.5 Equipment Manufacture and Installation

All three Maghrebi states have some domestic equipment manufacturing and installation capability (usually through public enterprises) for certain telecommunications equipment, typically telephone sets and transmission cables. Algeria has manufactured switching equipment since the 1970s. Neither Tunisia nor Morocco manufactured switching equipment during the 1970s and 1980s, but in the 1990s both countries

christened joint venture partnerships for the local manufacture of some switching equipment accessories.

The Algerian government placed great emphasis on the development of domestic production capability in telephone and telex technology because it is a large enough domestic market to support a local industry. Transmission cable has been manufactured domestically since 1928 (nationalized in 1968). The Societe Nationale de Fabrication et de Montage du Materiele Electrique et Electronique (Sonelec) was established in 1974 and took over production of cable equipment. In 1978, it began to produce analog switching exchanges at a newly built manufacturing complex in Tlemcen. Sonelec was restructured into several state corporations in January 1984: Entreprise Nationale de Telecommunications (ENTC) for the manufacture of telephone handsets and analog (electromechanical) switching equipment in Tlemcen and Entreprise Nationale pour la Fabrication du Cable (Enicab), located in Algiers, to produce small capacity pair cables and small diameter coaxial cable and to lay and joint cable for P&T. These two electronics manufacturing corporations operated under the supervision of the Ministry of Heavy Industry.

While this local manufacturing industry helped Algeria build its domestic telecommunications infrastructure during the 1970s and 1980s, it also delayed Algeria's transition from analog to digital technology. When Algeria began local production of telecommunications equipment in the early 1970s, analog technology was prevalent worldwide. Algeria established a manufacturing industry and related training programs

around analog switching and transmission equipment. These sunk costs in manufacturing, which meant sunk costs in manpower training as well, made it very costly to retool for the new digital technologies. Moreover, the production levels of the state enterprises (ENTC and ENICAB) were dropping steadily (to about 80% capacity in the early 1980s) through bureaucratic inefficiencies, as P&T demands for switching and transmission equipment spiraled. By the early 1980s, domestic production was clearly insufficient in the long run to meet network requirements. At the same time, digital technology had become more widespread, with such clear advantages as lower costs and greater service options. Therefore, starting in 1984, P&T began importing and installing electronic digital switching and transmission systems into the analog network.

To revitalize local industry and master the new technology, Algeria established a joint venture company called Sitel with Ericsson of Sweden in 1987 for the local manufacture of digital switching equipment. Algeria holds the majority shares in Sitel through the Algerian bank, BEA, and through ENTC and Sonatite (Societe Nationale des Travaux d'Infrastructure pour les Telecommunications). Until production began in 1990, Ericsson sent about 90,000 local lines and 57,000 transit lines to Algeria along with an international exchange and transmission equipment. Sitel began assembling ready-made kits in 1990 at the Tlemcen plant operated by ENTC, with vertical integration expected to increase over time. Initial production levels were expected to reach 50,000 lines per year, increasing to 200,000 lines annually by 1994. The

production of the Pentaconta analog switches (by ENTC) was to be phased out slowly.

The installation of cable and switching equipment and PABXs (private automatic branch exchanges) is the responsibility of Sonatite, a public enterprise under the supervision of P&T. Sonatite is also in charge of the country's private branch telephony, specifically installation, connection, and maintenance of PABXs and other subscriber terminal equipment.

In Morocco, the supply and installation of telephone and telex equipment for government offices and private businesses is privatized and sometimes in competition with ONPT. There is a small telecommunications manufacturing, assembly, and construction industry (urban cable manufacture comprising less than 10% of total purchases), consisting of one government-owned company, Societe Nationale des Telecommunications (SNT), and four small private companies. SNT participates in the construction of ONPT's local and urban networks and has equity participation in the four private firms, which are local subsidiaries of foreign suppliers. Three of these assemble or produce minor switching, radio, teleprinter, and power equipment components. The fourth factory produces cables and fulfills a substantial part of ONPT's need for cables and accessories. SNT installs and maintains private telecommunications equipment, such as PABXs. The Moroccan government has encouraged local private sector entrepreneurs in the installation of cable and subscriber plant (including PABXs, telex, modems, terminal equipment, mobile telephone sets, and facsimile machines). Northern Telecom and its sister company, Bell Canada

International (BCI), have established a partnership with ONPT, but this arrangement may result primarily in transfer of know-how through a training center and does not include local production of switching equipment. BCI has stated that it intends to establish a plant in the future for the production of spare parts. Northern Telecom and Alcatel CIT share the largest shares of ONPT's digital switching orders. Alcatel produces components for its E10-B digital switch in Morocco. Ericsson of Sweden is the third supplier.

In Tunisia, Ericsson has supplied switching equipment since 1959. Its AXE digital switch is imported from Sweden, but AXE-10 cables and connectors will eventually be manufactured locally entirely for re export, and AXE-10 software will be updated by Tunisian engineers. In 1990, Tunisia entered into agreements with both German and French digital switch manufacturers. The Siemens Group (consisting of Siemens AG and Belgian subsidiary ATEA) established the Centre Tunisien des Telecommunications (CTT), to oversee delivery, installation, and cutover of Siemens EWSD digital switches. Initially, only interconnecting cables and accessories were produced locally, but Siemens agreed that, after 1992, about 20% of the value of the EWSD system, including frames and non proprietary line cards, would be produced in Tunisia. PTT may seek to enter into a partnership with the Siemens Group at any time, but its share may be limited to 40%; la Societe Tunisienne d'Entreprises des Telecommunications (Sotetel), a public enterprise created in 1981 under the Ministry of Communications and 51% owned by PTT, may enter into partnership with the approval

of PTT and Siemens. Tunisia also established a joint venture company with Alcatel of France, which has been exporting its E10-B digital switch to Tunisia since the mid-1980s. "Alcatel Tunisie" consists of Alcatel; SAT (a French microwave radio supplier); Youcef Letaief, a local construction magnate; and Tunisien Telecom Electric (a local producer of key telephone systems). Northern Telecom is the most recent entrant into the Tunisian digital switching market.

Sotetel installs the majority of cable for PTT, and carries out research, installation, and maintenance of public switching, local and long distance transmission, mobile telephone, telex, telematic services, and PABXs for PTT. In addition to the 51% PTT share, other shareholders of Sotetel are public authorities such as transport, maritime, electric, construction, and government-owned financing agencies. BIAT, a private bank, also holds a small percentage of shares. At least three other companies install cable and provide civil engineering services: Entreprise Tarchi, Somatra, and Sarrt.

4.6 New Services and Markets

Algeria has liberalized its telecommunications market for certain services and equipment. While there is no import tax on computers, the total number of computers imported is limited. The price for an IBM, around US\$3,000 in 1992, is therefore high. Nonetheless, computers are widely used by government officials, private entrepreneurs, and professionals. The facsimile machine is also very popular. The

private sector is permitted to provide fax as well as desktop publishing services (similar to the Kinko's chain in the United States). Algeria's P&T introduced packet-switched data services in 1991 and cellular telephony in 1990 for the northern coastal area, serving the cities of Algiers, Oran, Constantine, and Annaba, with a capacity for 5,000 subscribers. In 1992, there were already 3,000 subscribers, but the system capacity can be expanded to 10,000. The cost of a mobile phone was about DA 60,000 (or US\$1,500 to \$3,000 in 1992) at the official exchange rate, with a call charge 15 times that of fixed telephone service. There is nevertheless strong demand for this service, especially from the private sector.

The telecommunications market in Tunisia has been liberalized substantially since 1987. During the 1992-96 Plan period public telephone service was opened up to the private sector; the number of public telephones managed by private companies rose rapidly from 1,097 in 1992 to 4,730 in 1994. Facsimile and paging services were also privatized. The import tax in 1992 for computers was 17% and the value-added (sales) tax was the lowest possible at 6%. In 1992, an IBM-compatible computer (386 processor at 25 MHz with 50 Mb hard disk) cost about US\$2,000, including tax. A Macintosh Classic II (80 Mb hard disk) cost US\$3,200, including tax. Regulation of the import of computers has been eased such that a simple import certificate is all that is required of the importing agent. Previously, the agent was required to seek pre approval through the Agency for Promotion of Industry. In 1992, there were about 100 importers of computer and other telecommunications equipment in Tunisia.

Formerly, computer purchases were routed for review through the National Center for Informatics in order to assure "intelligent" choices in the public sector. However, this official procedure caused tremendous bottlenecks in the ordering process and was eliminated.

Growth in the import of microcomputers has been exponential, from a few score in 1980 to over 17,000 in 1992. Just between 1988 and 1991, growth in the number of computers rose 400%. In 1986, approximately 87% of the banking and insurance industry was computerized; trade, transport, and hotel management were only about 9% computerized; and 7.5% of the manufacturing sector computerized. In November 1991, PTT introduced "Tunipac," a packet-switched data transmission network with the x-25 transmission standard (DPS 2500 with Alcatel-CIT of France), which can accommodate up to 1,545 ports. "Tunipac" grew from fifty subscribers in November 1991 to 1,800 subscribers by June 1992, when most of PTT's data service clientele were transferred from the public telephone (circuit-switched) network to the packet-switched network, thereby providing more reliable and efficient service. Import duty on modems was 25% plus 17% value-added tax, bringing the total cost of a typical modem to about US\$1,000 in 1994.

Although the facsimile machine does not enjoy the same low import taxes as computers nor the accessibility of fax in Algeria, it has tremendous popularity in Tunisia. Customs duty on fax machines in 1992 was 27% plus a value-added tax of 17%, bringing the retail price to about US\$800-1,200, depending on the features of the

machine. Until December 1991, only post offices offered fax service; however, the private sector is now permitted to provide facsimile service. The big advantage of facsimile in a country like Tunisia where downtown lines are often congested is that one can avoid the time-consuming exercise of redialing after a busy signal. In 1992, the rates for fax were the same as the telephone, and the typical fax sent a page in sixteen seconds. The number of fax subscribers rose from 50 in 1982 to 15,500 in 1991.

Cellular telephone service in Tunisia, introduced in 1985 and managed by Sotetel, consists of five base stations situated at Bourknine, Bouficha, Sousse, El Jem, and Sfax, covering two-thirds of Tunisia, ranging from Tunis to Sfax with a radius of 50 to 60 kilometers around each of the base stations. The number of subscribers for cellular telephones rose from 50 when it was introduced in 1985 to 2,269 in 1993. In 1991, PTT expanded the mobile telephone network by 100% to accommodate additional subscribers. The cost of cellular phone subscriber equipment has come down steadily over the past five years, but was still high in 1994 at 3,500 TD (US\$3,850). Calling charges were three times that of local fixed telephone service. In 1995, the mobile telephone network capacity was expanded to 10,000.

In Morocco, mobile telephony subscribers doubled between 1990 and 1992 to 1,800 subscribers, located in the urban centers of Rabat, Casablanca, Marrakech, Fes, Meknes, and Kenitra. Like Tunisia and Algeria, Morocco expects to adopt the GSM (groupes de systemes mobiles) European transmission standard for future mobile

telephony. In 1991, Morocco introduced a packet-switched data transmission network, called Maghripac, with transmission speeds of from 300 to 48,000 bits per second. The small satellite antenna market in Morocco was legalized only at the end 1991. The cost of a 1.8-meter dish was high at about US\$2,500 including license fee, in 1991, but subsequent deregulation has dropped costs dramatically. In 1995, a 90 cm dish was only about \$200, and could even be seen in the countryside.

Small satellite receiving dishes have also seen big sales increases in Tunisia, especially after the Gulf War (when CNN was very popular viewing) and the deregulation of the satellite dish industry and ownership laws in December 1991. A 1.8-meter fixed dish cost about \$850, including tax, but excluding the license (\$80) and the support and transport costs (\$45). The fixed dish could receive a maximum of 20 channels on one satellite. A mobile 1.8-meter dish, which could receive up to 60 channels from six satellites, cost about \$2,300, plus license and support and transport fees.

All three countries offer some form of access to the Internet. Algeria, Morocco and Tunisia have dial up access to the Internet. Unlike Morocco or Algeria, Tunisia is an Internet host site registered with the top level domain name system (Internet's Domain Name System). The Institut Regional des Sciences Informatiques et Technologiques (IRSIT) located in Tunis, Tunisia, has offered full Internet Protocol (IP) Internet connectivity since 1991, over the X.25 packet switched network Tunipac to EUnet in Europe based in Amsterdam. Since December 1993, the connection to

Amsterdam is completed via a 19.2 Kilobits per second (Kbps) leased line. Bitnet is accessible through EARN (European Academic Research Network, the European bitnet network). There is one bitnet node in Tunisia, also operated by IRSIT. IRSIT also offers access via Unix-to-Unix Copy Protocol (UUCP) and dial-up IP to users with no IP connectivity. In December 1994, there were 16 full IP sites in Tunisia and about 1000 electronic mail users (UUCP and dialup IP). Of the 16 IP sites, 4 were commercial, 4 academic and 8 non-academic sites. Internet users in Tunisia have access to Email, Telnet, FTP, and Gopher, but not to the World Wide Web, because it requires more bandwidth than is presently available. The charges for Internet access include a \$1,000 installation fee and \$100 per month usage fee.

IRSIT is the only agency in charge of Internet activities in Tunisia, although it is anticipated that the new National Office of Telecommunications will eventually take over this service offering from IRSIT. In 1993, IRSIT was awarded a contract from the Secretary of State for Scientific Research and Technology in the Prime Minister's Office to build a national research network for Tunisia ("Reseau National de Recherche de Tunisie" or RNRT). Phase one of the project has been completed and provides full Internet connectivity to 8 applied research centers around the country (6 in Tunis, 1 in Sfax and 1 in Mednine in southern Tunisia). Phase 2 and 3 of the project consist of interconnecting about 50 additional centers during the course of 1995. In addition, IRSIT is under contract since October 1994 with the United Nations Development Program to install the Sustainable Development Network, which will provide Internet

access for non-governmental organizations (NGOs), and thereby to most of the cities in Tunisia, as well.

Morocco is in the process of setting up IP connectivity. There is currently dial-up access via EUnet based at INRIA in Paris. The center in charge of Internet access, registration and user support, is the Ecole Mohammadia d'Ingenieurs, an engineering school in Rabat. Access in 1995 was through a UUCP arrangement which only accommodated electronic mail since communications via dial to Europe are very expensive. The Moroccan PTT planned to offer Internet service beginning in 1995 with full IP connectivity, and take over the work of the Ecole Mohammadia for user registration and support.

Algeria offers Internet access through the Center for Information Science and Research (CERIST) in Algiers, a governmental academic organization in charge of IP connectivity. CERIST was established in 1985 to promote the exchange of scientific and technical information, new technologies, and networking at the national level and to form a link with outside researchers. Since July 1, 1993 CERIST has maintained a connection to the Internet via EUnet and its gateway in Amsterdam. Subsequently, in March 1994, CERIST initiated a second IP connection to the Internet using a 9600 baud leased line, paid for by the Algerian government, to a gateway host in Pisa, Italy. CERIST hopes to establish itself as an Internet gateway host in the future. CERIST is working on the establishment of a national academic research network with government funding. The first step is to acquire necessary equipment and establish some leased

lines for specific sites. CERIST has received about 500 requests for email service from universities, research centers and other institutions, but only about 10% can actually use email because a great number of the institutions don't have modems and in some cases a telephone line or computer.

5.0 THE FUTURE

All three countries can be expected to become more and more open to foreign investment. Although France is the major trading partner of all three states for historical and geographical reasons, Morocco and Tunisia are placing special emphasis on attracting American investment and American goods. Tunisia's foreign investment codes were all liberalized in the wake of the adoption of the structural adjustment program in 1986-87. The law encouraging foreign investment in the services sector is aimed at data processing, among other services. In 1992, US direct investment was estimated at about \$30 million. Office and computer equipment sales is a small part of this total. In May 1991, a US-Moroccan Bilateral Investment Treaty became final. The treaty provides most-favored nation treatment of foreign investors, free transfer of capital and profits, and internationally recognized standards for compensation in the event of expropriation. In July 1991, Morocco created a Ministry of Foreign Investment to provide foreign investors with information on prospects and regulations relevant to their interests. Telecommunications equipment, including computers and

software, are among the best prospects for foreign suppliers. The prime contractors for the big growth areas of the next ten years, such as installations of fiber-optic connections to France, Spain, Portugal, and the United Kingdom, earth stations, modernization of switching equipment, and a large number of new lines) are likely to be European, Japanese, and Canadian.

The United States may be a supplier of earth stations and subassembly equipment. US products dominate the computer and computer software market, although a large share is purchased from European subsidiaries of US companies. Both Morocco and Tunisia have large tourism sectors that will continue to enjoy priority in national economic planning over the next ten years. The tourism industry is a major user of telecommunications equipment and services. Moreover, switching markets in North Africa are expected to grow significantly over the next ten years. For the entire North African region (which includes Libya and Egypt along with Algeria, Morocco, and Tunisia), the switching market is expected to reach over one million lines per year by the end of the decade. Clearly, local production capability in Algeria, Morocco, and Tunisia is geared for such regional growth.

Algeria will eventually restructure its telecommunications entity, probably into two separate national offices, one for post and one for telecommunications (following the French model, as Tunisia did).

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²Presidential Ordinance No. 76-168, October 24, 1976.

³ Decree No. 2-84-20, January 10, 1984.

⁴ Direct exchange line (DEL) connects a telephone set to the public switched network.