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Telecommunications in Turkey

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Turkey has always been viewed as a gateway to Europe, Asia, and the Black Sea and has long been a pivotal player in global politics. Its 60 million inhabitants, 300,000 square miles of territory, and gross national product of $100 billion make it one of the largest countries in the region.

12.1 History of the PTT and Network Development

12.1.1 Stage I (1923–1962)

The Ministry of Posts was established in 1840 when organized postal services started. In 1882, four years after the invention of the telephone, basic voice service was provided with the establishment of the first exchange in Istanbul, connecting various post offices, government buildings, and affiliated branches. In 1913 three government-owned exchanges were established, followed by an exchange owned by a foreign company. The first international voice service was delivered during World War I, with connections to the Prussian Empire (Germany). Due to the defeat of the Ottoman Empire, international service was cut until 1931 when telephone service to Sofia, the capital of the Republic of Bulgaria, was again resumed.

In 1926 a 2,000-line telephone exchange was introduced in Ankara, the first automatic telephone facility in the Turkish Republic and the Balkan region. Although foreign telecommunications companies played an important role, the government nationalization of public utilities—initiated in 1934 as a part of import substitution policy for industrial development—led to state acquisition of private exchanges owned by foreign firms in Istanbul, Izmir, and Ankara. In 1940, however, Turkey's Post, Telegraph, and Telephone (PTT) acquired new exchanges manufactured by the LMT company and Ericsson.[1]

The first planned attempt to expand the Plain Old Telephone Network (POTN) infrastructure was part of an unsuccessful government project initiated after 1945 at the end of World War II. Because of financial difficulties, the plan was not able to achieve its objectives and resulted in slow development. In 1954 Ericsson

established electromechanical central office exchanges to serve 30 cities. However, providing effective telecommunications services was not the objective of government policies, since low priority was given to telecommunications infrastructure investments. In spite of the early starts of telephony, telex, and telegraphy, telecommunications services, particularly specialized ones, did not exhibit much progress until 1963, when the process of telecommunications infrastructure development based on central planning was initiated.

During the stage I period, the Turkish telecommunication policy was characterized by a traditional scarcity model. The PTT held a monopoly over basic services, telex, and telegraph. Advanced services were not available. The universal service objective was impossible to achieve, and the PTT provided services to favored groups such as governmental agencies, the military, the police, banks, foreign firms, and state-owned enterprises (SOE). Pricing policies were designed to reinforce the vested interest of those favored groups by heavily subsidizing the services. Local services were also heavily subsidized and were inexpensive. As a SOE, the PTT was delivering services at a loss. Capital required for infrastructure development and network expansion was scarce because there was no immediate return on investment capital. In addition, the goal to improve POTN was a very low priority for the central government planners. Telecommunication capital projects had to compete with other sectorial development projects for attention and resources.

Between 1934 and 1967 most telecommunications equipment acquired for the development and upgrading of POTN was still imported. However, the latter government policies designed to upgrade Turkish equipment manufacturing—switches, transmission systems, telephone sets, and public telephone apparatus—and the PTT's demand on the implementation of equipment standardization policies prompted foreign firms gradually to become involved in the Turkish market to set up domestic manufacturing operations.

12.1.2 Stage II (1963–1983)

In 1967 Northern Electric & Telekommunikasyon A.S. (NETAS) was founded as a joint venture company of the PTT and Northern Telecom (NT) to manufacture electromechanical exchanges until 1984 and DMS digital exchanges thereafter. The PTT strategy included merger of its ARLA research laboratories with the Belgian ITT's subsidiary BTM to design and manufacture transmission equipment. In 1983 BTM merged into a new firm, TELETAS, a joint venture between the PTT and Alcatel-BTM, to produce ITT's System 12 digital switching systems.

After 1974, the PTT started partially to replace the shortwave radio telephone network with a line-of-sight network of microwave towers, and then, by terrestrial satellite stations using transponders leased from the International Telecommunications Satellite Organization (INTELSAT). In 1976 fully automatic basic voice services were initiated, followed by similar international voice services in 1979. The international telephone and data services were revamped in 1979 with the installation of an INTELSAT earth station in Ankara.

Turkish Satellite communications networks played a very important role in delivering international and regional communication services. As a member of INTELSAT, the European Telecommunications Satellite Organization (EUTELSAT), and the International Maritime Satellite Organization (INMARSAT), the PTT erected the AKA satellite communications network to connect the public telecommunications network with three international satellite systems. The AKA-1 earth station, erected in 1979, is connected with the INTELSAT satellite in the Atlantic Ocean Region (AOR) and has the capacity of 960 voice circuits and two TV channels.[2] AKA-1 still provides international analog voice, telex, and data services.

As POTN developed gradually into a Public Switched Telephone Network (PSTN) and more users demanded telephone services, the Ministry of Transport and Communications (MT&C) authorities recognized that the PTT could raise prices, generate more revenues, and become profitable and decided to move away from the scarcity model policies. The policy makers viewed the PTT as a natural monopoly providing standardized services to all of its users. The basic voice service was viewed as a commodity but had relatively low political priority. Accordingly, the government planners started to use a "cost-sharing model."

From 1967 to 1983 the PTT was not allowed to retain and reinvest its revenues. The treasury partially transferred some of the PTT's profits and funds to other politically favored development programs. The objectives of the PTT were defined to subsidize favored groups, including urban voters, by keeping local rates low, and by generating cash for the treasury. The PTT continued to provide telecommunications services on a monopoly basis. Advanced services were minimal. The MT&C and the PTT had only moderate clout in government central planning and policy making processes. Local call rates were kept low and long-distance and international call rates were very high. The investment capital was directed to international and long-distance networks, not to the local loop. The PTT started to rely much less on foreign network equipment, and the government encouraged domestic telecommunications equipment production. The PTT policies subsidized all residential users, but urban voters benefited the most. The users of PSTN also subsidized domestic telecommunications equipment manufacturers. With regard to its universal service obligation, the PTT attempted to ensure that there was a telephone in each small town, but the limited capital resources left after the transfer of funds to the treasury flowed to the cities and bigger towns with political influence made this goal elusive. In other words, the opportunity to provide telephone services to the rural areas and provincial towns was aborted because the political interests influencing telecommunications capital programs favored urban centers.

Although some success was achieved in delivering PSTN services and expanding the network after 1967, at the end of 1983 the number of individuals waiting for telephone and telex services was higher than the number of subscribers. Seventy-two percent of villages had no telephones, and modern telecommunications technologies were not used in the network owing to the low priority given to telecommunications projects.

12.1.3 Stage III (1984–1990)

In 1984 the Turkish government drafted a very ambitious national telecommunications plan. The goals were to increase telephone lines, to introduce new transmission systems by developing submarine cable systems and deploying land-based fiber-optic cables, to increase the rate of digitalization of exchanges, to utilize the satellite systems, and to interconnect with the international and regional carriers. In addition, plans included protecting a significant share of the market for domestic equipment manufacturers. The first target was to identify and organize the demand for inputs and components and then to influence other governmental agencies to support the development of a network of national suppliers wherever the economies of scale permitted.

Government leaders and policy makers also started to view the telecommunications industry as a means of promoting economic development and modernization and decided to use the PTT to achieve their goals of social, political, and economic integration. The PTT became a tool of broad industrial policies and was put in charge of expanding PSTN, of introducing new advanced services and network sophistication throughout Turkey, and of anticipating the major contours of the modern public telecommunications network (PTN) of the future. This change in the objectives and direction of the PTT led to the implementation of a monopoly modernization model. For such policies to succeed, the PTT had to invest heavily in new facilities such as fiber-optic, microwave, and satellite transmission systems. These networks were costly and demanded long timetables to put them into operation. Thus, the telecommunications capital projects became the first priority of the government. The PTT operated under the favorable policy and political constraints that made PTT authorities finance new projects out of the bureau's own cash flow. The government funneled funds into these projects not only from domestic sources but also from the international financial community. This financial policy accelerated investments in transmission systems, switching equipment, and the digitalization of exchanges and encouraged the delivery of new services. In addition the PTT not only introduced uniform technical standards and levels of services but also created a highly educated and well-trained workforce in order to achieve its ambitious objectives.

Under the guidelines of 1984, the modern Turkish PTN was started as a part of a need to adapt the PTT's infrastructure to the demands of the information age and the industrialization process. Accordingly, in 1984 PTT authorities attempted to update the existing network to serve as the basis for industry. The objectives were to unify and modernize the PTN by controlling market segmentation and rationalizing equipment supplies. Under this plan, the PTT was responsible for providing authorization for public procurement orders for telecommunications equipment and promoting domestic telecommunications equipment manufacturers. Moreover, the provisions of the PTT plan included the setting of more realistic tariffs and providing funds for investment in the PTN. The PTT's responsibilities were redefined as the implementation and operation of domestic and international telecommunications transmission systems, the development of PTN linkages enabling the integration of countryside to the national system through a

microwave trunk network, and the regulation of network-based services. In addition, the PTT was given a monopoly on the purchase of telecommunications equipment to rationalize the supply of equipment and create economies of scale. The PTT was also assigned the task of developing a telecommunications research and development strategy centered in its laboratories. Consequently, the PTT's long-term strategy for acquiring technological capability in telecommunications, its monopoly purchasing power, procurement and standardization policies, and the government's privatization of telecommunications equipment sector promoted the development of domestic firms such as NETAS, TELETAS, SIMKO, and Turk Kablo.

Until 1987, NETAS and TELETAS formed the backbone of the Turkish telecommunications equipment industry. Both companies developed their product differentiation strategy according to Turkey's desire to be self-reliant in the production of telecommunications equipment. Both firms established a joint venture with the PTT as the majority equity holder and entered into licensing agreements with major foreign vendors.

The companies' business development strategies varied over the years. The product lines of the firms became the main criteria that defined their strategies. In the 1980s NETAS concentrated on the production of only switching systems—crossbar exchanges until 1984 and the DMS series of digital exchanges after 1984—under the Northern Telecom license. NETAS also developed an export strategy for its products. In accordance with its licensing agreement with Northern Telecom, the company exported its products to Asian, African, East European, Central Asian, Commonwealth of Independent States, and Middle Eastern countries.

TELETAS, on the other hand, developed more diverse products. The company's product portfolio included analog and digital multiplex systems, data modems, 34 and 140 Mbps digital microwave transmission systems, System 12 digital exchanges, fiber-optic transmission systems, TDMA rural telephone systems, public telephone devices, and telephone sets. While NETAS relied on only Northern Telecom for technology transfer and licenses, TELETAS used a consortium of providers: Alcatel (switching and transmission systems), Ericsson (fiber-optic systems), SR Telecom (rural radio systems), and Standard Elektrik Lorenz (140 Mbps digital microwave transmission equipment). Although most products were licensed, TELETAS developed a range of telecommunications systems based on its own technology, including 2, 8, and 34 Mbps digital multiplex systems and data modems. Unlike NETAS, TELETAS produced equipment and transmission systems for the Turkish market until 1989. Later, the firm started to export its products to several countries through the agreements established by the government and the PTT.

Siemens AG became the third supplier of switching equipment to the Turkish market in 1986. This firm initially installed ESWD digital exchanges in Ankara, Istanbul, and six other major cities. In 1987 Siemens introduced its local production with a DM40 million investment. The company became a major supplier of transmission equipment by providing 140 Mbps fiber-optic terminals for intraurban links in Istanbul, Izmir, Konya, Adana, and Ankara. It established a fiber-optic

cable production facility in Turkey and participated in the Threcian Underground Fiber-Optic Cable Project (TRAYFOK). Later, the company started to produce locally 2, 4, 8, 34, and 140 Mbps digital multiplexers. AT&T-Phillips Telecommunications (APT) and its parent company AT&T were also involved in the Turkish transmission systems market.

Iskra Telecom Group, a subsidiary of the former Yugoslavian conglomerate Iskra-SOZD Inc., established a joint venture with Turk Telefon A.S. in conjunction with several private Turkish firms. Turk Telefon, in which Iskra holds 61.75% stake, started to manufacture SI 2000 digital central office exchanges and digital PABX systems for public and private applications. Iskra's ability to penetrate the Turkish telecommunications market was a result of its competitive pricing at the low end of the market.

Turkey managed to implement its ambitious 1980s development policies more quickly than originally planned. The first half of a $6 billion, 10-year development plan called for expanding the Turkish PTO network from 1.9 million lines in 1983 to 4.92 million lines in 1988.[3] As a result, the Capacity Development of PTT Network Plan was revised to 5.9 million lines at the end of 1989.[4] The updated plans were again revised to add 1.5 million lines annually for the rest of the 10-year plan. However, the economic conditions in Turkey became a major obstacle to the achievement of the goals set for the the telecommunications industry.

Due to shrinking government funds, the PTT authorities first decreased the rate of planned network expansion to 800,000 lines per year. Second, fiber-optic and submarine cable installation programs were postponed for a short time. However, the PTT continued the installation of the X.25 Packet Switched Data Network (PSDN) and upgraded DMS switches with Northern Telecom for Integrated Services Digital Network (ISDN) services. In addition, at the end of 1988 the PTT completed its rural program by installing at least one phone in every village.

Due to economic conditions in 1988, MT&C and PTT authorities had to reexamine their financing strategies for a network development program. Three options were considered. The first one was multilateral funding. Generally, the PTT relied on domestic sources of revenue and supplier credits to finance its programs. But MT&C was forced to accept funds from international financial institutions such as the World Bank, the International Finance Corp., and the European Bank for Restructuring and Development.

Second, a new financial strategy—private investment—was employed in the installation of equipment for certain market segments on a revenue-sharing agreement basis. Under this financing framework, after covering their investment with a specified profit margin, the private investors were required to share a certain percentage of revenue with the PTT. Paging and extension of the analog cellular network, the Group Special Mobile (GSM) network, and the Very Small Aperture Terminals (VSAT) services were financed in this manner.

The third strategy was the privatization of the PTT's services. The privatization program was designed to take place in three stages. The first stage involved separating the postal services from telecommunications services. The second stage included the corporatization of telecommunications services by establishing the

firm Turk Telefon A.S. The third stage was aimed at the sale of stocks to private investors.

During the privatization of the telecommunications equipment industry in 1987, the PTT sold its shares in NETAS (51%), TELETAS (40%), Turk Kablo (38%), and other smaller firms to the Housing and Public Participation Administration (HPPA). As a result, the equipment market was characterized by the merging of foreign firms with Turkish industrial groups. Siemens merged with the industrial group KOC under the new name SIMKO, Iskra with Turk Telefon Inc., Ericsson with the Cukurova group, and Northern Telecom with NETAS. Under the new policy, to qualify for PTT system bidding foreign firms had to cede 49% of their capital to Turkish-owned groups and develop necessary technology transfer mechanisms for their partnership. The merging of foreign firms with Turkish industrial groups led to the faster transfer of digital exchange technology to Turkish partners.

Due to the effect of the privatization of the switching equipment market and the government plans of 1984, the telephone exchange capacity of 1.9 million lines in 1983 was increased to 7 million lines with more than 6.5 million lines connected to automatic switches in 1990.[5] As the line capacity of digital switches reached 3 million, the digitalization of trunk transmission systems in terms of channel termination reached the level of 86%. Thus, the incidence of automatic telephone switches and digitalization rose to 93% and 46%, respectively, while only 28% of 36,155 villages were connected to PSTN in 1983. In 1990 there were no villages without telephones, and 34,000 villages were linked to automatic switches. As a result of the initiation of the 1984 program Utilization of Rural Type Multi-Access Radio-Telephone System the number of villages and remote areas linked to the PTT's network through this type transmission system exceeded 2,500 in 1990.[6]

Innovation and modernization of the networks, GSM, VSAT services, and the TURKSAT project, were achieved by promoting a revenue-sharing model. The model was used to transform the PTT into a more efficient and profitable service provider in mobile communications, PSDN, and VSAT markets. The PTT extended advantages to medium and large users and reduced subsidies to equipment suppliers, labor unions, and residential users. The pricing policies became less advantageous to vested interests and favored groups. As a result, the PTT became very profitable. Policy makers have planned to move toward cost-based pricing and to reduce cross subsidies. The PTT invested more capital in an effort to penetrate the markets in Central Asian, Middle Eastern, and African countries and sought new ventures to capture a share in these markets. Participating in international consortia and international telecommunications services became the main targets of the PTT's planning. The PTT, too, started to be actively involved in global digital networks and began to plan its telecommunications and information strategies on a global basis. The Pan-European cellular network (GSM) and VSAT services were introduced with foreign partnership on a revenue-sharing basis. Foreign information service providers such as Reuters, NASDAQ, and others were allowed to enter on a competitive basis. The PTT retained its monopoly on basic services, enhanced services (except VAN), and facilities to prevent the duplication of networks in cellular and VSAT services.

12.1.4 Telecommunications in the 1990s

In the early 1990s the Turkish government, pressured by changes in Turkish industrial policy, began to integrate the national economy into international markets and to align the country with the prevalent strategy of OECD countries. To that end, the government implemented the INFORMATICS program, which was designed to transform the industry into information-based sectors. The major thrust of the program was an inversion of factors that tailored telecommunications system specifications to the results of applied research projects. Under the new program, the needs of the national telecommunications system were to orient PTT's and other institution's research and development activities. The new national objectives were (1) to develop a new policy designed to be more selective in the development of new information/telecommunications products, (2) to develop value-added software products jointly with the PTT and operating firms for automation of operational planning and the evaluation and maintenance of the PTN infrastructure, (3) to provide more effective and direct technological and advisory support to the equipment and electronics industries, and (4) to match technological developments (photonics) to the needs of the public network, such as technological specifications and network topology.

The Turkish PTT has built an impressive record of development in the telecommunications industry in the last decade. The PTT's aggressive program Developing Capacity of Telephone Lines led to the installation of 10 million new telephone lines in the decade. It brought Turkey's telephone density from 3.4% in 1983 to almost 20% at the end of 1993 and brought credibility to the telecommunications sector's modernization plans. Telecommunications policies implemented in the 1980s not only established a significant equipment manufacturing capability in Turkey but also eased the difficulty of procuring enormous amounts of new equipment (switching and transmission). Recently, the Ciller administration planned to use corporatization as a subsitute for privatization and competition in services. However, ill-prepared regulatory reforms with the intention of separating regulator and telecommunications services providers were initiated but nullified by the Turkish Constitutional Court owing to Ciller's privatization program, with no timetable, objectives, or regulatory framework on professional staff, leaving the future of PTT privatization uncertain.

In 1993, and again on 23 December 1994, the Turkish Constitutional Court declared unlawful the elements of the privatization program in which the PTT was the centerpiece. The first decision of the Court was announced just two days before the first management board of the separate telecommunications company Turk Telekom A.S. was slated for appointment. In 1994 a plan revised under the recommendations given by the Court and designed to raise $2.3 billion was halted after a series of special government decrees were annulled. Among the actions deemed unlawful was the earlier separation of Turk Telekom A.S. as a state-owned limited company. The establishment of Turk Telekom had been intended as a prelude to an equity sale.

On 4 February 1995 the Constitutional Court further clarified its rulings regarding the equity sale of Turk Telekom A.S. The decision of the Court gives more detailed guidelines on the regulatory framework and judicial adjustments neces-

sary for the completion of the privatization program. It also states that under the existing constitutional framework, the privatization of telecommunications services is only possible with license agreements.

12.1.5 Institutional Framework

The Turkish government retains extensive regulatory authority and supervisory control over the telecommunications sector through the MT&C, and to a lesser extent, the Ministry of Finance and the State Planning Organization of Prime Ministry. The Turkish PTT and its operations are subject to comprehensive regulations by MT&C and the Ministry of Finance. The Turkish PTT is the sole operating entity providing telecommunications services. There is *de facto* no foreign ownership. Telegraph and Telephone Law No. 406 contains the provision for the PTT's monopoly, which includes telecommunications service, installation, operation, and regulation. In terms of competition, all telecommunications services except e-mail, paging, and VAN services are provided under the monopoly of the PTT. The telecommunications law and certain regulations and decrees establish the legal framework for regulation of the industry, but much of the supervision and regulation of the PTT is implemented through the general administrative powers of MT&C. In particular tariffs are established by the Planning Bureau, and regulations are established through the Law and Organization Bureau of MT&C. Recommendations from the International Telecommunications Union (ITU) and the European Conference of Posts and Telecommunication Administrations (CEPT) about tariff policy are also taken into consideration while drawing up broad policy outlines. There has been no major change in the tariff policy since 1982. For data, telex, videotex, VSAT, and mobile telephone services the same tariff policies are used. Both of the bureaus report to the deputy minister of Transport and Communications. Within the MT&C, the directorate general of the PTT supervises the directorates of telecommunications, type approval, frequency management, and standardization.

Faced with rapidly increasing demands for telecommunications services, equipment, and systems, the Turkish government enacted various decrees in 1984 to facilitate the rapid application of new technology and to stimulate the growth of telecommunications services and the information industry. Consequently, subsequent decrees permitted the partial private sector participation in the provision of domestic and international telecommunications network-based services (TNS) through the establishment of management agreements on a revenue-sharing basis with the PTT. Private sector participation in the provision of nonbasic services does not require cooperation with the PTT but does require a license from MT&C and its basic TNS, in cooperation with an organizing entity and the PTT through management agreements or licensees.

12.2 Research and Development Activity

In telecommunications research and development the NETAS laboratory in Istanbul plays the most important role. The laboratory is the research arm of NETAS,

Northern Telecom's joint development and manufacturing venture with the PTT. The lab has two key development teams. The first team develops Central Office (CO) switching and Customer Premises Equipment (CPE) products to meet the specific needs of the Turkish telecommunications market. Researchers have been able to adapt the DMS to local conditions and equip these systems with new features such as custom calling. Additionally, the lab developed a range of indigenous products such as Spacenet and Diginet families of PABX systems, the Elif (analog) and Dicle (digital) DRX-4 group of rural exchanges as well as telephone sets of various types. So successful have these efforts been that NETAS now holds a 70% share of the Turkish public switching market and exports these products to various countries in the region.

The second research and development team focuses on software development for the international version of Northern Telecom's DMS-100 switching system, the DMS-100i. The team recently introduced the BC537i off-stream software release (delivered in 26 weeks), which includes a key variant of the Common Channel Signaling System No.7 (CCSS7) interface for the market to the People's Republic of China. Other markets for this release include Colombia, Guatemala, and Kazakhistan.

12.3 Development of Modern Transmission Systems

12.3.1 Microwave Transmission Systems

In 1985 the PTT introduced microwave radio link transmission systems. The first digital microwave radio link network was installed between Ankara and Istanbul, followed by those now existing in all major cities. In this project the number of radio link transceivers reached 5,200, of which more than 1,650 were digital.[7] In addition, the PTT constructed large-capacity microwave radio link systems with neighboring states such as Bulgaria, Greece, Syria, Iraq, Iran, Azerbeijan, and the former Soviet Union.

12.3.2 Underground Transmission Systems

In 1986, with the objective of increasing the reliability of terrestrial telecommunications network and channel capacity, the PTT initiated an underground coaxial cable deployment project called BAYKOK (Western Anatolia Underground Coaxial Cable System). The activation of all the segments of the system in 1988 not only enabled the PTT administration to provide further telecommunications links among major cities and smaller residential areas in Western Anatolio but also allowed interconnection, at many points, with the existing digital microwave radio link system. In 1990 the BAYKOK system was extended from Istanbul to Edirne by the implementation of a second project called the TRAYKOK (Thrace Underground Coaxial Cable System). As an extension of TRAYKOK, the PTT implemented a fiber-optic cable project called TRAYFOK (Thrace Underground Optical Fiber Cable System). The third system not only connected all major cities and

small towns but also linked the Turkish public network with the Greek telecommunications system.

12.3.3 Submarine Transmission Systems

In 1988, to augment its existing 480-channel capacity, submarine cable link with Italy, Turkey participated in the Eastern Mediterranean Fiber-Optic Submarine Cable Deployment Project (EMOS) as a co-owner holding an 18% share. The project provided Turkey with a 280 Mbps digital link with Greece, Israel, and Italy, extending a three-pair fiber-optic cable to Italy and providing connections from there to France, Spain, Western Europe, and the trans-Atlantic submarine cable networks of TAT-8 and TAT-9. The deployment of another fiber-optic project began in 1995. An additional project, ITUR, will link Turkey with Italy and Ukraine. The project entails the laying of a terrestrial leg up through Kiev and them to borders of the Belarus Republic.

By joining several regional and worldwide cable consortia, the PTT expanded its access to submarine fiber-optic cables. The reasons for investing in these projects are several. First, the estimated per circuit cost is cheaper than other transmission media (both satellite and analog cables). Second, the PTT expects that together with the TURKSAT system the additional international circuits obtained from digital cables, if used with existing digital circuit multiplexer technology, will be sufficient to meet the circuit requirements until the year 2005. Third, these cable systems will give the PTT flexibility in routing international traffic and serve as a back-up system in case of any major failures on other transmission systems, since fiber-optic cables provide higher quality transmission. Finally, submarine fiber systems will enhance the PTT's ability to provide high quality and high capacity digital PSDN services. The PTT has recently fitted a considerable portion of its analog submarine cable circuits with Digital On Super (DOS) group equipment that allows digital signals to use existing analog cables.

12.3.4 Satellite Networks and Services

In July 1986, in addition to the AKA-1 network, an AKA-2 earth station was erected with a capacity of 120 voice circuits and three TV channels, delivering satellite communication services in conjunction with the EUTELSAT system. AKA-2 operates with the most advanced digital satellite technology available and provides direct digital voice, telex, and data services with the member states of EUTELSAT and their affiliated telecommunications networks.[8] The earth station is also used permanently by the Turkish Radio and Television Corporation (TRT) for broadcasting of the European Broadcasting Union's (EBU) TV programs. The AKA-3 earth station, activated in November 1988, operates with the INTELSAT network in the Indian Ocean Region and provides basic voice and TV broadcasting services with Middle Eastern and Far Eastern countries. The AKA-3 is equipped with both analog and digital satellite technology and delivers basic voice services among 18 countries. It is able to establish TV links with 40 countries in

the coverage area of the INTELSAT Indian Ocean Region Primary Path Satellite.[9] Thus, with the establishment of the AKA satellite communications system and its affiliated earth stations, the Turkish PSTN was linked with the continents of America, Africa, Asia, Australia, and Europe and was able to deliver basic voice, data, telex, and direct broadcasting services.

In addition, the AKA system, an ATA maritime communications network with two coastal earth hub stations and 37 coastal stations, was established in 1988 to provide maritime communications services.[10] Two coastal earth hub stations activated in July 1989, ATA-1 and ATA-2, use the INMARSAT Atlantic Ocean Region satellite network and Indian Ocean Region satellite system, respectively.

In September 1990 the PTT also had an eight-year profit-sharing agreement with Communications Satellite Corporation (COMSAT) to deliver INTELSAT business services and point-to-point and point-to-multipoint private voice, data, fax, telex, and video transmission services to Western Europe and the United States at the speed of up to 8.448 Mbps.

In May 1991 in order to provide more effective global coverage for maritime and land mobile communications services and to increase its share in growing market segments of satellite communications services, the Turkish PTT forged another agreement, on a revenue-sharing basis, with the COMSAT Mobile Communications Inc., a subsidiary of COMSAT. In this deal the PTT not only increased the number of coastal earth stations in the ATA maritime communications system but also expanded its coverage by integrating the ATA network into the COMSAT network operating in the Indian Ocean Region. The PTT's ATA network processes COMSAT traffic to and from the Indian Ocean Region satellite and transmits the traffic on the dedicated leased circuits to a COMSAT coastal earth station in Southbury, Connecticut.

12.4 Mobile Communications Services

12.4.1 The Nordic Mobile Telephone Network

In 1986 policy makers suggested that telecommunications services were becoming more specialized and thus required specialized providers. Customization also became an issue for more sophisticated segments of the telecommunications market, such as packet switched data services and mobile communications. To provide analog mobile services, the PTT had to develop networks to respond to specific user demands.

In October 1986 the PTT established the first analog cellular network, partly in response to the needs of growing business users in Ankara and Istanbul and partly to serve the needs of remote areas for which a fixed-line PTN would be an expensive solution. However, cellular communication in Turkey is not cheaper either in terms of usage cost or equipment prices. The PTT's first choice was the Nordic Mobile Telephone (NMT) 450 standard which was not able to use standard frequencies, with the result that both mobile communication infrastructure and terminal equipment were not specifically adopted to the needs of Turkish users by manufacturers.

While utilizing switching functions and quality specifications of the NMT 900 standard, the NMT 450 analog network uses frequencies in the 410 to 430 MHz band, but is complicated by NMT 900 signaling protocols. Use of the 410 MHz band gives the operator the ability to expand coverage widely and cost effectively.

Network transmission for the analog network is provided mainly via existing PTT microwave links. Unique to the Turkish NMT system is Nokia's adaptation of the NMT 450 standard to the 410 MHz frequency band. In addition, all the advanced features of the NMT 900 standard have been implemented on the 410 MHz band for better voice quality, an improved grade of service, and higher capacity than the traditional 450 MHz system.

The analog NMT network was established in six phases. In the first phase of service, the system operated in only Ankara and Istanbul through mobile exchanges with capacities of 2,000 and 4,000 subscribers, respectively, in Ankara and Istanbul. During the second phase, capacity was increased to around 10,000 subscribers, and subscriptions to the network increased rapidly, from 365 in 1986 to 5,101 in 1987. During phase three, initiated in 1988, coverage was expanded in the Ankara and Istanbul areas as well as along major roads. Network capacity rose to 33,000 subscribers, with service cut over every major city in western Turkey and along the south, west, Aegean, Mediterranean, and Black Sea coastlines. In 1989 coverage was further extended to included all highways connecting major cities throughout the country as well as the entire Aegean, Mediterranean, and Black Sea coastlines, parts of northern Cyprus, and the populated areas in eastern Turkey. Phase four construction, begun in 1990, expanded network capacity from 40,000 to 80,000 subscribers. A remote switch was cut over Izmir, and 40 base systems were added to the network, 30 in eastern Turkey and 10 in the greater Istanbul area. At year-end 1990 the network consisted of three exchanges and 255 Radio Base Stations (RBSs), and all major cities and interconnecting roads were covered. The fifth phase expansion was carried out in 1992, and the sixth phase in 1993. These expansions completed coverage of suburbs, increased capacity in the large cities, and filled the gaps in the spur road coverage off of the highways.

Nokia supplied three DX-200 Mobile Telephone Exchange (MTX) switches to the NMT network. Each switch provides functions typical of NMT 900 networks and is able to service up to 60,000 subscribers.

Despite the network's wide coverage, the bulk of the 55,000 subscribers in 1992 originated from and made calls only in and around Istanbul and Ankara. When the network first operated in 1986, growth was modest, but since government liberalization of the terminal equipment market in January 1990, new subscribers joining the network averaged 1,500 per month. This naturally led to chronic congestion and to a high incidence of call cutoff in Istanbul and Ankara. The problems were solved in 1992, to an extent, in two ways. First, in 1991 part of the switch in Ankara was rededicated to manage subscribers from Istanbul when the number of Ankara subscribers themselves required extra capacity. Second, a piecemeal capacity extension was made to the Ankara and Istanbul switches, originally supplied by Nokia Cellular systems. This last network extension was completed in March 1992 and added capacity for 13,000 subscribers to each switch in addition to 400 radio channels. The ceiling capacity of 80,000 sub-

scribers was sufficient until mid-1993. However, there are already indications that current capacity is insufficient.

In 1995 the NMT network operated nearly at full capacity, serving over 100,000 subscribers and providing complete nationwide coverage. With further expansions, analog cellular capacity is planned to reach some 275,000 subscribers by the end of the decade.

In 1995 the PTT's connection charge to the NMT network was $40. There was also a $25 fixed fee per cellular set activation. There is an annual service fee of $90. In 1995 the PTT's land- and airtime charges were $1.40 per minute.

12.4.2 The GSM Networks

As of the end of 1993 there were 30,000 applicant subscribers on the PTT's waiting list for an analog cellular phone. To overcome the capacity shortage in the NMT network and to generate capital for other telecommunications capital projects, the PTT signed two 15-year GSM cellular revenue-sharing agreements in May 1993. One of the GSM networks is operated by the Turkcell consortium, which is 35% owned by Telecom Finland, 15% by LM Ericsson Telekom AS, and the remainder by the local firms Cukurova Holding, Kavala, and Penta Tekstil. The other consortium is Telsim Mobil Telekomunikasyon Hizmetleri A.S., which is led by Alcatel (with a $24 million initial investment), Detecon, Siemens AG, TELETAS, SIMKO, and Rumeli Holding A.S.

Under the terms of the agreements, the two consortia are each investing $100 million and paying 72.1% of annual revenues to the PTT. After the number of subscribers of each network exceeds 150,000, the operators will pay 5% less in the revenue split with the government. The two GSM contractors, Turkcell and Telsim, are currently working closely with the PTT under the arrangement of a revenue-sharing agreement instead of a build-operate-transfer or a license sale, because the regulatory framework currently bans private companies from operating telecommunications networks. As soon as the PTT is privatized, both operators will be asked to nullify their existing agreements with the PTT and to purchase operating licenses from the MT&C. For $500 million each, the revenue-sharing arrangements would be converted into 25-year operating licenses.

The GSM network is currently running in parallel with the existing NMT 450 network. Demand is highest in Istanbul, where total cellular subscriptions are increasing at a rate of over 1,000 per month. Although the overcrowding had caused a severe channel congestion around Istanbul, the problem has now been somewhat alleviated with the introduction of the GSM networks.

The PTT is entirely responsible for the services side of the business. It sets the tariffs and collects the subscriber revenues without involvement from the operators. A monthly subscription costs $6.40, a fraction of the average charge for cellular networks in OECD countries. There is a flat rate charge for calls of $0.05 per minute, but the connection fee to the network remains relatively high at $320.

The installation of the GSM networks is being carried out in three phases and will last until 1997. By the end of 1993 each GSM network had 40 base stations covering the northwestern part of the country. By the end of 1994 the GSM networks

were expanded to include all of the remaining major cities, the coastal areas, major highways, airports, the central region of the country, tourist areas, and remote communities with a minimum of 10,000 subscribers. At the end of 1994 Turkcell had 54,000 and Telsim had 14,000 subscribers. Telsim alone, however, aimed to have 25,000 subscribers by year-end 1994.

By 1997 each operator will be required to provide nationwide coverage on its network. One thousand base stations are expected to be installed on the networks by 1997. By the end of the decade, the two GSM networks are expected to serve 600,000 digital subscribers in Turkey. By the year 2007 the cellular subscriber base in Turkey is forecasted to exceed 6 million. Ericsson and Siemens supplied switching for the GSM networks.

12.4.3 Cellular Handset Suppliers and Equipment Liberalization

In 1990 the PTT liberalized the terminal equipment market, permitting any company to distribute cellular phones by obtaining type approval from the Turkish PTT. The PTT continues to act as a distributor in competition with other cellular phone retail outlets. A variety of equipment is available, such as from Nokia-Mobia, Dancall, Phillips, and Motorola. Nokia-Mobira, with a 40% market share, is the leader in analog cellular phones.

The GSM phones sell for prices that are comparable to, and in some cases lower than, the analog cellular phone prices. The sets are sold competitively by the PTT, the operators themselves, and any other interested distributor. The market for these handsets is also liberalized, and every major brand is sold on the market.

Installation and service inititiation fees add an additional $500 to the cost of Nokia cellular phones. The PTT's connection, batteries, antenna, and installation charges raise the price to $1,700 for Benefon and $2,300 for Dancall sets.

The introduction of competition in the cellular sector is expected to increase the country's cellular penetration rate relative to other developing countries: from a moderate 1.4 subscribers per 1,000 people at year-end 1993 to a high of 13.2 subscribers per 1,000 people in the year 2000. Besides significantly increasing Turkey's cellular penetration levels and allowing for the rapid deployment of a number of new mobile networks, sectorial liberalization in the mobile services segment has had a significant impact on the Turkish government's balance of payments as it struggles with external debt of over $60 billion. Revenue-sharing agreements in total, including those in data networks and VSAT services, is expected to bring approximately $7 billion to the PTT during the 1990s. Subsequently, the ministry is expected to generate an additional $2 billion in revenues from the sale of operating licenses immediately following the anticipated privatization of the PTT.

The privatization of services will also bring about a commerical orientation to the provision of advanced telecommunications services. Without a dedicated marketing unit where consumer research and market analysis can be conducted prior to the introduction of new services, the PTT remains at a disadvantage in assessing the needs of its target customers, in understanding the price elasticity of demand and the maximum revenue yield, and in determining the optimal time to

introduce its services to the market. The operators complain, for example, that the PTT has set the GSM subscriber tariffs too low, thereby not allowing the investor groups to break even for another four or five years.

The sales of GSM operating licenses during the postprivatization period will serve as a model for a number of other upcoming mobile network operating licenses in Turkey, including paging and Personal Communication Services (PCS). Depending on the speed with which the privatization efforts proceed, the PTT may announce a revenue-sharing agreement for a nationwide paging network in 1995 similar to the GSM network arrangements. Following privatization, the agreement would be converted to an operating license, and the existing infrastructure would be sold to the new operators. PCS licenses are also being considered and can be tendered in the coming years, pending regulatory approval, with an estimated license fee of $1 billion being among the winning licenses.

12.5 Switched Data Services

In the early 1980s the PTT recognized that it needed to improve data communications services. Increasing demand by financial, banking, and business groups for data communications services indicated that the current conventional PTT network services were not sufficient to meet the needs of these groups. As a result, in 1986, with the view of providing switched data services, the PTT built the Circuit Switching Data Network (CSDN), called DATEX-1, and synchronous data services with a 2,000-line capacity electronic circuits switching data exchange network (TDX). CSDN services offered the user the exclusive use of a PTT circuit for the duration of a call in which X.21 protocol is commonly used. The telex services also operate over the CSDN. Dial-up Access services over the PSTN operating at speeds up to 9.6 Kbps were started for fax traffic and personal computer communications in 1984.

The X.25 Packet Switching Data Network (PSDN) called TURPAK was activated in 1989 to meet the demand for international PSDN services with its present linkage to over 80 countries through TELENET via satellite. TURPAK utilizes DPN-100 (Data Packet Network) built by NETAS. The DPN system is in service in 59 cities as a part of the TURPAK network.

TURPAK X.25 services enabled further advances in business, particularly in financial and banking services. Point-of-sale (POS) facilities enabled retailers to accept payments electronically from customers with both international and domestic financial and banking services, including credit cards. For the banking sector, the emergence of new X.25 PSDN services, such as the provision of telephone lines tailored to support data communications, triggered examination of how Information Technology (IT) gained a foothold in banking with the adoption of branch automation and computerization of services. While initially the supporting infrastructure was poor—PTN in the form of dial telephone lines and private circuits—infrastructural investment by the PTT during the 1980s in more reliable and advanced services did much to help in overall modernization of financial and banking services.

Consequently, other advances coming on the back of the PTT's networks and services have paved the way for the banking sector, as well as others, to move into new and more competitive markets such as services to international travelers and stock markets. Such innovations in banking products have shown that the PTT has provided a competitive edge for the banking industry.

A vital element in the advance of IT is surely the availability of high-speed digital circuits from the PTT. While the PTN already links major cities with fiber-optics, microwave, Phoesynchronous Digital Hierarchy (PDH), and Synchronous Digital Hierarchy (SDH) transmission systems, the availability of high-speed digital circuits at subscribers' own premises is critical. Without these circuits, the use of sophisticated networks requiring higher speeds—like local area and wide area networks and image and signature verification—is restricted. The PTT recognized the problem and proved its commitment by tenders in 1992 for high-speed digital multiplexers and ongoing trials of ISDN.

In April 1991 the Central Bank of the Republic of Turkey (CBRT) provided another PSDN service called ZENGIN to regulate and monitor the activities of commercial banks. The system was installed by NTT International. The network utilizes Northern Telecom's DPN-100 packet data switching system, supports a new electronic fund transfer (EFT) service with X.25 protocol, and links all the main offices and branches of the members of Turkish Banking Association to the EFT mainframe host computers of the CBRT of Ankara via 9.6 Kbps leased lines to the private X.25 switches located at the CBRT's offices in Ankara and Istanbul. The connection of two X.25 switches is provided by two leased digital lines with a 64 Kbps transmission capacity. The services delivered on ZENGIN are also backed up by 9.6-Kbps links through the TURPAK X.25 network.

The TURPAK network increased the number of foreign PSDNs accessed directly by the Turkish users. The network also has ability to be upgraded to offer frame relay and ISDN services. Currently, the PTT is developing a data packet gateway (DPG) to meet the increasing demand for data transmission. The new DPG is planned to include facilities for frame relay services directly to users, and has requested the MT&C to approve its tariff.

Tariffs for PSDN services are similar to those of PSTN services in that there are fixed charges for installation, rental, and usage. However, the two services differ in that usage charges are split into volume and duration components. The volume charges in PSDN services are based on the number of segments of data transmitted in which each segment is equivalent to 64 lots of eight bit packets. The fixed charges of about $3,460 cover rental of the X.25 connection but exclude installation and equipment rental. The usage charge is $8,400 and includes charges for call setup, call duration, and volume. According to the OECD Basket of PSDN Charges, the total charges are $11,860,[11] some of the highest among OECD countries.

Interpersonal message services such as e-mail are also provided. The service is delivered over the PTN with or without the assistance of a network operator, using a X.400 Message Handling System Protocol. However, despite the fact that the public e-mail services started in 1990, they continue to be unprofitable and unpopular compared with easier-to-use alternatives such as facsmile services, at least for short messages.

12.6 Leased Line Services

Leased line services in Turkey are permanent virtual private circuits provided by the PTT between two geographical points. The range of leased lines offered by the PTT, and their pricing options, vary greatly. The subscriber must pay an installation or connection fee, an annual rental charge, with 15% value added tax, but there are no further usage charges. Leased lines offered by the PTT vary according to transmission technology (e.g., analog or digital), quality (e.g., voice grade or data grade), and bandwidth or speed. The latter varies from 50 bits per second (bps), which is used for telex, to the current limit of 565 Mbps, which is used in fiber-optic networks.

There are three major leased-line services offered. The first is a 9.6 Kbps analog leased line, used for voice, facsimile, and data transmission. The annual charge for this circuit (M1020, two wire voice-grade circuit) is $116,674. The second service provides 64 Kbps leased lines that correspond to basic access (2B+D) under ISDN. Using compression and multiplexing techniques, a 64 Kbps line can carry up to eight voice channels, but data transmission is more common. The annual charge for a 64 Kbps line is $525,036. The third service is a 2 Mbps digital leased line that corresponds to primary access (30B+D under ISDN). The tariff for this service is $2,333,495. Again, in comparison with Purchasing Power Parity (PPP), Turkey has the most expensive tariffs for leased line services.

With its leased circuit volume-sensitive pricing policy, the Turkish PTT has adopted volume-sensitive (usage-based) pricing methods. With this pricing protocol, private networks providing value-added services to closed user groups are subject to extra volume charges for national and international traffic they pass to their customers. Clearly, in Turkey, as reflected in its prices, the PTT is inclined to discourage the formation of private networks.

12.7 ISDN Services

Integrated Services Digital Networks offer the user integrated voice and data services through the same connections. In Turkey ISDN services came in two main groups—basic access (2B+D) at 64 Kbps and primary access (30B+D) at 2 Mbps. ISDN is regarded as the logical successor to the separate offerings of the PSTN, the Circuit Switching Data Exchange Network (CSDN), the Public Switching Data Exchange Network (PSDN), and the leased-line services. However, ISDN services have been so slow in arriving that the "interim" switched data services have become entrenched. Furthermore, it is very expensive for the subscribers to integrate voice, video, and data services.

12.8 TURKSAT and VSAT Services

The Turkish government, aware of the advantages provided by the national satellite networks AKA and ATA and the economic benefits of the services provided, initiated another ambitious program to launch the first Turkish satellite, TURKSAT 1-A, in 1994. The TURKSAT satellite system included two launches, positioning in orbit,

acceptance, insurance, and financing. Two ground stations were provided as well as training for PTT personnel. Aerospatiale was heading a European industrial team that included Alcatel Espace, Arienspace, Execorp, MBB, TELETAS, and various Turkish firms. The objectives of the project included (1) enhancement of Direct Broadcast Satellite (DBS) services, (2) increasing the number of TV channels, (3) prompting the transmission of at least two national TV programs prepared by TRT on the basis of economy and quality to Central Asian and Caucasian Republics and to West European countries, (4) providing special telecommunications services necessitated by the geographical structure of eastern and southern parts of Turkey, and (5) supporting VSAT and basic voice services within the system's three satellite beams over Turkey, Western Europe, and Central Asian Republics.

In order to pursue the objectives of the Rural Area Telecom Services Program, undertaken to provide adequate services to thousands of remote villages scattered through the mountainous region of eastern and southern Turkey, the PTT tested the cost effectiveness and practicality of using existing domestic satellite networks to provide basic services and added circuits to small pilot villages. As a result of the feasibility study, the PTT asked NEC to manufacture 16 remote and four master hub VSAT earth stations as a part of the TURKSAT project. By the end of 1993, in conjunction with TURKSAT, the PTT's rural project led to the construction of an additional three hub stations and 200 VSAT earth stations. The policy of financing the VSAT project included the subscriber investment revenue-sharing agreements. The VSAT services target groups included the Istanbul Stock Exchange and its affiliated members, commercial banks, financial institutions, commercial firms, transportation companies, travel agencies, hotels, and government agencies.

The TURKSAT program is based on a revenue-sharing agreement with the manufacturers of Aerospaitale. The first satellite, TURKSAT 1-A, was lost owing to launch failure of the Arien system. The program was halted until the successful launch of TURKSAT 1-B in August 1994, while construction of the TURKSAT 1-C satellite, originally designed as an on-ground standby, was accelerated. Because of the higher-than-projected demand for TURKSAT services, the launch of TURKSAT 1-B was accelerated as well. The launch of TURKSAT 1-C took place in July 1996, with two coverage areas and eight TV circuits to broadcast TV programs from Western European countries to Central Asian republics. It is reported that the DBS services from TURKSAT 1-C will be intercepted with the 60-cm dishes in the areas of coverage. Turkey's influence in Central Asia increased as its first telecommunications satellite, TURKSAT 1B, began broadcasting Turkish TV programs in the republics of Kazakhistan, Uzbekistan, Turkmenistan, Tajikistan, and Kirgizia. TURKSAT 1B also provides telephone links between Turkey and the republics.

12.9 Tariffs and Interconnection Policies in Network-based Services

12.9.1 Telecommunications Network-based Services and Interconnection Policies

The telecommunications law and the decrees of 1984 state that there can be only two kinds of telecommunications networks: (1) public networks, in which the

number of users is not limited and which is operated in accordance to a concession granted by constitutional law; and (2) private networks, in which the users are the officers of the licensee, the service is restricted to a closed group, and the network provides only Value Added Network (VAN) services. The decrees have also been enforced so that any system that offers a user an indirect connection to another user is determined to be a VAN application, which may be provided by private firms on a competetive base.

VAN services, videotext, and e-mail may be provided by private companies on competitive basis. However, the PTT may require compliance with special terms and conditions related to technical and administrative matters. In practice this means that VAN applications starting with mail boxes are subject to free competition under the condition that they are public network based. The rationale is that a mail box is a data base or text archive used alternately by several users.

VANs that offer more direct connections between users are determined to belong to the PTT's network, and telecommunication legislation is applied to them. MT&C can create competition by granting overlaying concessions. This can occur in geographical or functional sense.

There are two criteria applied to determine whether competitive supply of services will be permitted. If the service in question is deemed to be a telecommunications service, the MT&C decides, by granting overlay concessions, what degree of market competition should exist. If the service in question is deemed to be other than a telecommunications service, it is subject to open competition, if not otherwise stated by law.

Generally, under the telecommunications network-based services market definition, the term "service," rather than technical parameters, pricing policy, or others, is used by the Turkish PTT to differentiate between services that are supplied on monopoly basis and those that are open to competitive supply. Recently, the PTT has stated that the question of the differentiation of the technical elements needs to be taken into account.

TNS services currently offered on a monopoly basis in Turkey are listed as follows: public switched telephone network, packet switching network (X.3, X.25), circuit switched data network (X.21, X.21 bis), mobile telephony (analog), video conferencing, facsimile, teletext, land mobile/cellular radio network, broadcasting links, maritime services, telex network, telegraph and leased circuits. By contrast, videotext, electronic mail, paging, and data bases are telecommunications network-based services offered to the public by non-PTT administration suppliers under the condition that they are public network based. The PTT has stated that no additional service may be provided on a competetive basis in the future.

Private networks can be constructed with circuits leased from the PTT, but these networks can offer services to third parties if and only if services are value added, and the service is restricted to a closed user group. The definition of "closed user group" for these purposes is either a predefined number of users for specific services, especially in the same business area, or instances in which access to the network/system is restricted to a certain customer group that belongs to a particular business area or government group, such as airlines, newspapers, branches of banks, insurance companies, military, or police force. In addition, non-PTT administrations are permitted to offer TNS using leased circuit facilities to closed user

groups, but the service offered must be value added. In such cases, third-party traffic is permitted, and traffic is subject to an additional volume charge. Additional traffic charges for value-added services in the closed user environment is a function of other circumstances, such as international and domestic traffic.

Although the PTT does not permit facilities-based network competition, the leased circuits availability policy permits the leased circuits to be used for national and international services. The lease of these circuits is governed by the provision of the pertinent International Consultative Committee for Telephone and Telegraph (CCITT) recommendations, as well as by certain supplementary provisions of the national legislation prepared by the MT&C. Accordingly, the resale of these circuits is not permitted. The leased circuit availability policy limits the use of national and international leased circuits by stating that these circuits cannot be used by third parties for basic services provided by the Turkish PTT.

Leased circuit and public switched network interconnection policy permits the interconnection between domestic/international leased circuits and public switched networks. However, the PTT requires certain conditions under which interconnection is permitted.

In 1984 the Turkish PTT adopted a definition of "third party traffic on leased circuits" that had regulatory significance. The definition referred to "traffic generated over leased circuits by users who do not directly rent the leased circuits from the PTT." Consequently, third-party traffic is permitted provided that the private network supplies VAN services other than normal transmission facilities. Users other than customers may use leased circuits for any kind of value-added services such as electronic messaging and information retrieval. Leased circuit sharing, leased circuit capacity resale, and leased circuit traffic resale are not permitted.

12.9.2 Tariff Policies

The tariff policy of the Turkish government is to keep tariffs constant in real terms by raising them periodically in line with Turkey's high inflation rate (154% in 1994). Except for the introduction of discounts for weekend, national holiday, and evening calling, tariffs have remained unchanged since 1982. In new services such as GSM, PSDN, and VSAT services, the same tariff policy is used. The PTT's policy of value-of-service pricing is based on the value to the customer of using the service, rather than of the cost to the PTT. The price of services is also set according to principles that are defined by the social and economic policies of the Turkish government rather than the market.

According to MT&C officials, the size of market attained by the Turkish telephone network infrastructure (the number of subscribers and telephone density) and studies undertaken to restructure national tariff policies put the PTT in a favorable position to face future international competition. As a result, the following steps will be taken to develop more competitive tariff policies with respect to local, trunk, and international services in 1996. These steps are the reduction of the weight of distance and, therefore, the slow increase of tariffs with distance and, above all, the reduction in the relationship between the average "sale price" of trunk calls and that of local calls; the generalization of charges based on duration for local calls, which for a long time have been sold by "piece rate" (as a unit)

independent of duration; the extension of the range of tariff reductions during daytime, so as to induce the public to spread traffic out to obtain an optimum use of network equipment; a very large change in tariff levels according to the hour of the day; and the introduction of specific charges that are more economical for large users.

With regard to leased circuits, tariffs are to be restructured so that a differentiation can be made according to type of use. The rate structure is also to be modified in 1996 to compromise a terminal charge and a distance charge. Moreover, the PTT has decided that rates for international and domestic telex services should be reduced.

Recently, the MT&C has advised the PTT that its current policy is that any future adjustment to the PTT's tariff structure will be cost oriented and that such adjustments will not cause any negative impact on the PTT's performance. Under the existing regulatory framework, the PTT pays the Ministry of Finance 15% of revenues from telephone, telex, and telegram services, net of settlement payments to foreign telecommunications service providers. The MT&C has advised the PTT that the current framework will be changed to first the cost-based, then an interconnection tariff under which for a period of 10 years the PTT's taxes will not exceed 25% of the revenues. In addition, the MT&C has stated that the PTT will not be required to pay a universal services obligation upon the expiration of this 10-year period. The PTT also pays and will continue to pay a predefined portion of its revenues (19%) from leased lines. The MT&C has indicated that it will take steps to adjust tariff structure if during the next 10 years there is a more than 10% change in value between the Lira and Special Drawing Right or if, in response to the PTT's agreements with foreign telecommunications service providers, the need arises to adjust tariff structures to promote the growth of international telecommunications traffic in Turkey.

The PTT itself does not directly set the rates charged to end users of its international services. The rates for such services are established by MT&C for voice services originating (and billed) in Turkey. The amounts payable to the PTT by international telecommunications carriers for incoming calls are determined by accounting rates negotiated between the PTT official and such foreign carriers, subject to certain guidelines given by MT&C. During 1994, the rates for international calls in Turkey ranged from approximately $1.15 to $3.95 per minute.

As is typical in developing countries, the volume of incoming calls exceeds the volume of outgoing calls, and as a result, the PTT receives net settlement from foreign carriers. Although the PTT expects this situation to continue, the mix of incoming and outgoing calls is influenced by a number of factors, including rates charged in Turkey and elsewhere for international calls and customer calling patterns. Changes in these factors could increase the proportion of calls between Turkey and other countries that are billed in Turkey. Furthermore, the PTT and other foreign carriers have sought to reduce account rates in recent years, which also could affect the amount of net settlements received by the PTT. The PTT administration anticipates that accounting rates will continue to decline in the future, and the range of accounting rates will continue to narrow.

The fixed charges basket in 1992 averaged $64.82 for business users and $159.10 for residential subscribers, while the OECD average was $186.04 for business users

and $141.72 for residential subscribers. The usage charges basket averaged $775.33 for business users and $212.45 for residential users. If purchasing power parities are taken into consideration, Turkey is the most expensive country in the OECD.

The percentage distribution of telephone service income of the PTT, divided between installation, subscription, and usage charges is as follows: from installation charges, 2.92%; from subscription charges, 11.66%; and from usage charges, 85.42%. In addition, a 12% value added tax is included for all charges.

Due to the PTT's public service obligations, such as universal service, emerging services, and directory inquiries, the practice of cross subsidization is ingrained in the tariff structure.

Cross subsidies between postal and telecommunications services are evident. Cross subsidies between access and call charges, between local and long-distance charges, and between domestic and international charges are large. In particular international, PSDN services, and dedicated circuit rates are the highest in the OECD. Since subsidies became the characteristic of Turkish tariff policies, it is now very difficult politically to lift them. The PTT provides a large number of relatively well-paid jobs with the benefits of pensions and a universal health plan. The PTT is less efficient in terms of lines per employee, and the ratio of employees to sales is very high. The Turkish Labor Law prevents layoffs, obstructing the flexible use of labor. Unions are also opposed to the corporatization and privatization of the PTT's services.

12.10 Type Approval Policies

The pivotal component of Turkish telecommunications regulatory policy has been the type of approval—the control exercised by the PTT over the sale, and attachment to the network, of terminal equipment. This control mechanism is operated by a system licensing of products that are legally sold by suppliers and manufacturers. The PTT's definition of terminal equipment is restricted to the actual physical interface and excludes personal computers behind an integrated modem and local area network equipment used on intracompany private networks. The definition also excludes any software not used for communications via the public network.

The type approval process is mandatory for all telecommunications terminal equipment used in the Turkish public network. Connection of any terminal equipment to the public network without approval is strictly prohibited. Also, no terminal equipment can be imported to Turkey before obtaining approval from the general directorate of the PTT.

Within the type approval process, the PTT administration distinguishes three primary functions as follows:

1. The specification of mandatory and optional requirements for permitting the connection of terminal equipment to public networks with regard to technical standards, safety, and regulation.
2. The testing of equipment from suppliers to assess its conformity with the PTT's standards and requirements. (This function involves checking the manufacturer's own claims about the equipment and its conformity to the PTT's standards.)

3. The granting or refusal of a license to sell, install, and maintain the equipment submitted for approval.

In addition to these three functions, defining, testing, and approving, the PTT carries out two subsidiary functions: (1) hearing of appeals regarding a possible refusal to issue a license and (2) administration of the type approval process.

The 1987 liberalization of the CPE market, however, had three direct implications for the PTT's type approval process. First, it increased the volume of products to be tested and therefore increased the PTT's workload in approving and certification procedures. Second, liberalization caused a more fragmented terminal equipment market in which suppliers offered a more diverse, wider range of products, with shorter life cycles aimed at a highly targeted market. Consequently, the type approval cost constituted a higher proportion of the delivered cost of individual products. Third, liberalization of installation and maintenance services resulted in a dilution of control over the network by the PTT.

The PTT authorities recognize that the present type approval policies have four disadvantages related to the current system. First, the system is expensive for both the PTT and for the equipment manufacturers, with the added costs being passed on to end users. Second, the type approval system is slow and serves as a brake on technological change, product development, and innovation. Third, the current system acts as a deterrent to the introduction of new products and therefore constrains consumer choice. Finally, the system is open to abuse by those who wish to protect the vested interests of preferred suppliers or to refuse imported products.

A number of institutional changes are being discussed in the type approval system, including the separation of type approval from operational functions. The administrative separation of operational and regulatory functions will be a necessary step in the introduction of a more equitable and nondiscriminatory environment. Actually, this separation of functions brings with it certain problems related to the specification of standards and requirements. However, the MT&C has recommended establishment of an advisory board to set technical standards and to recommend the necessary international standards. It has also advised that while the PTT will be an important member of the board, other interest groups, such as users, equipment suppliers, and competitive service suppliers, should also be included. According to the MT&C view, the separation of functions should not obscure the fact that the PTT is the network operator and understands the network and carries the responsibilities for implementing standards. The role of the regulatory body should not be to set the technical standards directly but to ensure that the interest of the various parties are fairly represented in the process and to promote the application of open, international connection standards.

In the case of technical testing, the work is planned to be subcontracted to accredited laboratories and not simply given to the PTT for in-house approval. For the MT&C, the subcontracting of technical testing is not an issue of separation from the PTT but rather of recognition that type approval is regarded as a commercial, self-financing operation, not a bureaucratic, state-subsidized process. In addition, subcontracting is assumed to bring down costs and to reduce delays in the technical testing process.

The recognition of the importance of standards for interconnection in Turkey

means that conformity testing has already become an important policy issue within the type approval system. The MT&C's advisory committee has specified adherence to the open system interconnection (OSI) as a requirement for entry into emerging network service markets. These trends could be interpreted as institutional and regulatory responses to technological change within the Turkish telecommunications industry.

Although the publication of technical standards is essential to achieving clarity of regulation, the standards and requirements are not yet published. Some draft of standards are available both in English and Turkish.

In 1996 the PTT plans to begin accepting suppliers' own test results so that self-certification will contribute to lower costs and shorter delays. Approvals carried out by one of the CEPT countries, or by the U.S. FCC, are recognized but not sufficient.

12.11 The PTT's Role in International Telecommunications Markets

The Turkish PTT is constantly seeking opportunities to provide telecommunications services and technical and advisory assistance to countries in the Middle East, Africa, Asia, Eastern Europe, Central Asia, and particularly in the Commonwealth of Independent States. It also seeks opportunities to participate in consortia to develop a global mobile satellite system (GMSS) and international consortia to develop communications systems in these regions. In August 1990 the PTT won a $200 million contract in Nigeria in a consortium with NETAS and TELETAS. In this Nigerian telecommunications infrastructure development project financed by the World Bank, NETAS provided the equipment and technology for its own indigenously designed Elif (100 digital rural switches with 50,000-line capacity). TELETAS, a license of Alcatel's System 12 and the major supplier of transmission equipment in Turkey, provided a pulse code modulation (PCM) microwave transmission system for a total of 12,000 channels. The PTT acted as an advisor to the Nigerian Telecommunications Authority (NITEL). Continued cooperation with Nigeria is expected.

Under the treaty of cooperation in the field of telecommunications signed in October 1990, the PTT installed an 1,800-channel microwave transmission network between Igdir, Turkey, and Sadara, Azerbeijan. The PTT also provided the satellite transmission of Turkish National TV programs to Azerbeijan. According to the 1992 memorandum of understanding between the governments of Turkey and the Central Asian Republics, NETAS will provide PABX systems, digital central office and rural switching equipment, PSDN equipment, and software. TELETAS will install the microwave and PCM transmission networks. The PTT on the other hand will provide consulting services. In addition, the production of DMS-100 switches in Moscow with NETAS and Northern Telecom started in November 1994. In February 1995 NETAS won another $205 million contract in Russia. In the PABX market, the systems manufactured in Turkey have already been sold to markets in Egypt, Iraq, Syria, Iran, Jordan, Saudi Arabia, Pakistan, Libya, Morocco, Algeria, Bulgaria, and Commonwealth of Independent States, to which

in 1995 the PTT evaluated potential joint ventures with domestic and foreign telecommunications companies to provide services and equipment.

The PTT is also in the process of evaluating several GMMS projects: Iridium, a network sponsored by Motorola Inc.; the INMARSAT P project, a global satellite communication system to be built under the leadership of INMARSAT; Globalstar, a system proposed by Loral Qualcomm Satellite Services; and other systems. In addition to providing accounting authority for Turkish GMSS users, the PTT's main objective is to reach an agreement with a GMSS consortium whereby the PTT would be the exclusive provider of land earth stations in the region. The PTT's investment strategy included the provision of a land earth station and a financial investment in the GMSS consortium to support construction and launch of the satellites, control systems, and other infrastructure systems for GMSS.

The PTT is currently in the process of evaluating an aeronautical terrestrial communications system (ATCS) for use only by aircrafts in the region. In an ATCS, calls from an aircraft are transmitted to the ground station network then forwarded to its destination by the domestic PTO.

With the breakup of the Soviet Union, the sovereign telecommunications authorities in the Central Asian republics preferred nationalist policies and installed their own international gateways. A large portion of their international traffic is rerouted via the Turkish PTT using a satellite earth station in Ankara. The PTT, which plans to be the major transit carrier for traffic between the Central Asian Republics, Western Europe, and the United States, has already donated digital exchanges and associated IBS earth stations to Kazakhistan, Kyrgyzstan, Uzbekistan, Turkmenistan, and Azerbeijan. Uzbekistan established a joint venture with the PTT to install a microwave transmission network.

The PTT has also signed a memorandum of understanding with the Central Asian Republics regarding the construction of Central Asian fiber-optic cable that would link with China in the East and perhaps join onto the Trans-European Line and South-East Mediterranean Cable being deployed across Central Europe and the East Mediterranean.

12.11.1 Business Strategy of the PTT

Since 1983 the PTT has implemented several business strategies designed to strengthen its position as a world class PTO. The first strategy was designed to improve the efficient use of international telecommunications services by increasing its digital switching capacity and diversifying its facilities. For example, the PTT sought to strengthen its flexibility in routing traffic through both submarine cable and satellite transmission systems, including TURKSAT.

The second strategy sought to expand and improve the efficiency of PTN by making investments in certain projects. In order to overcome shortages of public funds, several programs have been forwarded to encourage private sector participation in PTT's infrastructure development. One such program was the joint operation scheme (JOS) between the PTT and other firms, in which private companies invest to operate key projects and share the revenue from such projects with the PTT during the term of the contract. In addition to providing the PTT with a new

source of revenue, these projects were intended to provide reliable high-quality links to its international gateways, thus improving the quality and reliability of the PTT's international telecommunications services. Moreover, the investments were expected to stimulate demand for such services from users in Turkey as access to long-distance and international services was improved.

Third, the PTT embarked on projects to seek opportunities to increase its regional role by assisting PTOs in other countries. These efforts involved alliances with well-established international telecommunications carriers and manufacturers. These efforts were concentrated in (1) small- and medium-sized markets with similar or greater development opportunities, such as Central Asian Republics; (2) large-sized markets in which specialized assistance might be feasible, such as the Russian Federation, China, and India; and (3) markets of the countries politically alligned with Turkey.

The fourth strategy that the PTT undertook was the limited diversification into businesses that complement its core business. With this goal in mind, the PTT sought strategic alliances with international carriers and firms that provided synergistic technology, expertise, and experience. This move allowed it to achieve limited diversification and to improve the PTO's infrastructure and services such as VAN, EDI, GSM, and VSAT.

Finally, the PTT improved its customer rapport and image by increasing the quality of services, delivering new services, and enhancing cooperation with large customers by direct billing services.

12.12 Conclusion

The future demand for telephone service still clears 1 million, and as spending cuts have reduced the installation of new lines, reports have noted an increased demand to around 1.5 million. The 1996 change in government has caused many to question the likelihood of moving forward with plans to privatize the PTT. Meanwhile, GSM has entered the market, and even with high costs, demand has been strong. Despite the uncertainty about future government policy, expectations are that privatization will move forward at a slower pace.

Notes

1. AT&T, 1975, "AT&T Report for the MT&C," p. 174.
2. Directory of PTT, Annual Report, 1990.
3. ITU Year Book, 1992, Geneva: ITU.
4. Ibid.
5. Directory of PTT, Annual Report, 1993.
6. Directory of PTT, Annual Report, 1990.
7. Directory of PTT, Annual Report, 1990.
8. Directory of PTT, Annual Report, 1990.
9. Ibid.
10. Ibid.
11. OECD Report, December 1993, Paris: OECD.