17

Taiwan

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Telephone service in Taiwan has always been good by world standards—extremely good by developing economic standards when that was the category applicable to the island. Taiwan's remarkable post–World War II growth was achieved by many small businesses and industrious people. The government helped this by making a widespread telephone network a priority, although such facilitation was not a goal in itself. Despite being authoritarian, the government did not feel compelled to preclude a public network or usurp resources to build one primarily for its own control purposes—although it did have access to the military's system.

By the 1980s it was clear that technological and other changes required a rethinking of goals and structure. A decade has been spent studying these topics, as discussed later, and in the 1990s something will be done. Taiwan has the need and the ability to utilize the latest in value added network (VAN) services and transmission technologies, but has been slow to implement the former as the decision-making process on the method to be used, has dragged on.

This chapter begins with a review of telecommunications on the mainland from the nineteenth century to 1949. Many of the institutions were moved to Taiwan at that time. Succeeding sections look more closely at historical development in Taiwan, the organizational framework of telecom services, and the services offered. The transition process is discussed in the fifth section, while the sixth looks at some of the specific proposals for structural reform.

17.1 History, Mainland to 1949

The Ch'ing Empire adopted a policy known as "state oversight with private run" to develop telegraph and telephone systems in the late nineteenth century. The government was simply too poor to build them itself. As a result, the earliest telecommunications system in China was constructed by a Danish company—Great Northern Telegraph—in 1871. It ran along the seashore between

Hong Kong and Shanghai (about 1,800 km). From 1873 to 1881 telegraph systems were run primarily by foreigners, and were thus overseen by the Customs General Tariff Office of the Ministry of Foreign Affairs.

The first system constructed by Chinese was a telegraph line completed in 1877 between Tainan and Kaohsiung (about 54 km) in southern Taiwan. In 1879 the governor of Jilin province (southern Manchuria) proposed a line connecting China proper to where talks were taking place with Russia, which was aggressively seeking to seize areas of Asia that had been under Ch'ing suzerainty. A start was made, but the line was not finished. Parts of it were used in China's second domesticly built line, which ran some 1,200 km between Tienjin and Shanghai. It was completed in December 1881. That year the directorate general of telegraph was established in Tienjin as the headquarters of the state-run telegraph company. It had operations in Shanghai and other cities along the route. Within ten years there were approximately 36,000 km of telegraph lines and over 500 new branch offices throughout China.

The first telephone system was introduced by a British trading company in Shanghai in 1881. Companies from Germany, Denmark, France, the United Kingdom, Russia, and Japan were involved in the construction of virtually all major installations through the 1890s. Systems were built in port cities, such as Xiamen, as well as in inland ones, such as Chongqing. Foreign companies operated most of the systems, so, again, administrative responsibility resided in the Customs General Tariff Office.

In 1906, a team of high-ranking officials returning from a foreign fact-finding trip recommended to the Ch'ing Government that it follow the European example and establish a Ministry of Post and Transportation (MPT), nationalize all communications and transportation services—including posts, telecommunications, railroads, and ocean transportation—and establish technical training schools. By 1910 the newly created MPT had successfully converted all private and provincial telegraph operators into government institutions through reimbursement (from subsequent operating revenues) or loan programs, thus laying the foundations for government monopoly. (The railroads also were nationalized in 1910, but ocean transport was not.)

A total of 70,000 km of telegraph line and 239 telegraph offices were taken over by the MPT in 1910. However, foreign companies still held cable landing rights and equipment manufacture patents in some coastal cities, and these companies continued to provide international wire and wireless services.

17.1.1 Legal Foundations

After the founding of the Republic in 1911, the MPT was renamed the Ministry of Communications (MOC). Because large parts of China were occupied by independent military strongmen during the postrevolutionary period, each province had full autonomy over its own telecommunications. When the turmoil came to an end and the nation was reunified in 1927, MOC set up three divisions to integrate all national administrative matters: railroad, telecommunications, and post.

The first Telecommunications Law had been drafted in 1915; with minor exceptions, it reflected the European model of government monopoly. Revisions made in 1929 prescribed that all long-distance and international services be operated directly by MOC. Thus, MOC began to merge telegraph and telephone operations in the 1930s. However, with permission from the central government, local telephone systems could be capitalized and operated by local governments or private enterprises. The 1929 Law also required government permits and payment of a license fee to MOC before installing broadcasting stations or operating radio receiver sets. MOC had a large number of committees working on technical standards, system specification, equipment manufacturing, and research and development. Many university students majored in electrical engineering and an entrance examination system was established to recruit technical staff.

In 1935 MOC formed the directorate general of post (DGP) to operate the postal services. Unfortunately, China fell into war against Japan in 1937 and facilities were seriously disrupted. During the war MOC moved to the western part of the country and began plans to create a unified post, telegraph, and telephone policy and supervisory structure. In 1943, it set up the Post and Telecommunications Department to oversee public policy and supervision. A directorate general of telecommunications (DGT) was established to be responsible for development, operations, and management of telecommunications. Regulation and provision of service have been separated ever since. Unfortunately, the nation fell into more turmoil after V-J day. In 1949 the government moved to Taiwan.

17.2 History, Taiwan

The first telegraph line on Taiwan was constructed in 1877 between Tainan and Kaohsiung. Because of the increasing importance of military defense, efficient communication channels to Taiwan from the mainland and within the island were vital. In the mid-1880s Taiwan was ruled as a prefecture of Fujian province, across from it on the mainland. Under Liu Ming-Ch'uan, governor of Fujian from 1884 to 1891, a number of projects were undertaken to create infrastructure. In 1886 a DGT was charged with laying marine cable along the west coast from Keelung via Tamsui and Tainan to Kaohsiung, and extending land lines to Taipei, Hsinchu, Changhua, Taichung, and Chiayi. Two submarine cables were installed, one from Tamsui to Fuzhou (on the mainland) and the other from Anping to Penghu (an island in the Taiwan Straits). More than 2,200 km of line were in service by 1888.

Taiwan was under Japanese occupation for about fifty years from 1896. Post, telegraph, and telephone systems were constructed and operated under the supervision of the Japanese Ministry of Communications. Facilities were seriously damaged by Allied bombing during World War II. After V-J Day, supervision and operations of Taiwan's post and telecommunications returned to the Chinese government.

After moving to Taipei in 1949, MOC's first step was to divide the operations of the post and telecom services into two separate units: the DGP for post and the DGT for telecommunications. MOC delegated supervisory power to DGT to establish a Taiwan Telecommunications Administration (TTA) for operation and development of regional services and a Chinese Government Radio Administration (CGRA) for international services. This administrative arrangement proved to be effective for recovery and reconstruction; telecommunications in Taiwan was restored to its prewar level in 1952, when there were 39,363 telephones (about 0.49 per 100 people).

17.2.1 Local Telephone Development

Since the 1950s, there has been a high demand for telephone service. Under the government monopoly system, development capital could come either from the government budget or from public loans. The government was in financial difficulty, however, and there was no place for the TTA to get a loan. Given this situation, the government adopted "self-sustainment and self-development" guidelines for all state-run businesses.

In the early 1950s, a study team found that it would cost NT$14,000 to install one telephone line, including NT$6,800 for subscriber line plant and NT$7,200 for switching and transmission equipment. In 1956, with the support of the Taipei City Government, City Council, and Chamber of Commerce, the telephone installation fee in Taipei was adjusted from NT$7,200 to NT$14,000. The higher fee was soon applied to other cities (see Lee 1981). Only business firms and wealthy individuals—the fee was several years' earnings for most people—could afford to apply at this price. Nevertheless, it was a supplier's market and backlog kept building. The fees were part of a series of four-year construction plans TTA launched in the 1950s and 1960s that involved end users sharing construction costs. As incomes increased in the 1970s, the number of residential phones increased.

The first electronic switching system was put in service in 1980. Subscriber toll dialing (STD) services reached 100 percent penetration in 1981. The years 1969–1980 saw annual growth of more than 20 percent for subscriber stations, and density exceeded twenty in 1981. Data are in Table 17.1.

17.2.2 Toll and International Telecommunications

The first microwave backbone toll system was completed in 1963 along the west coast (where most people live). A second backbone system was put in service along the east coast a few years later. Microwave links were soon added and branched to every toll switching office. Carrier cable systems were commonly installed between tandem switching offices. The first digital coaxial cable backbone system, with a capacity of 5,600 channels, was put in service in 1981. Of the total 70,000 long-distance circuits in place at that time, 70 percent were digital. Long-distance construction also enhanced rural development; since 1975, all 231 townships have had telephones, and service reached all 7,239

Table 17.1. Telephone Growth in Taiwan

Year	Stations[a]	Percentage Up[b]	Density[c]	Year	Lines[a]	Percentage Up[b]	Density[c]
1950	33.4	10	0.4	1982	4,356	14	22.5
1960	67.9	10	0.6	1983	4,854	11	26.0
1963	99.5	14	0.8	1984	5,278	8.7	27.9
1966	153	17	1.2	1985	5,653	7.1	29.5
1969	265	26	1.9	1986	6,077	7.5	31.3
1972	596	24	3.9	1987	6,548	7.8	33.4
1975	1,117	23	7.0	1988	7,159	9.3	36.1
1978	2,099	23	12.2	1989	7,834	9.4	39.1
1981	3,820	22	21.2	1990	8,431	7.6	41.6

[a] Cumulative yearend installed base, in thousands.
[b] Percentage increase from previous year shown.
[c] Stations per 100 people.

villages in 1980. By the mid-1980s even people in mountainous areas or on remote islands could easily call each other (see Liang 1981).

The first over-the-horizon troposcatter microwave system—to Hong Kong—was completed in 1967. A Sino–Philippine troposcatter followed shortly thereafter. Telephone traffic grew rapidly and soon reached capacity. The facilities were replaced by satellites and submarine cable communication systems in 1981. That year an AT&T 4-ESS digital switch was installed to serve as an international gateway, providing 700 telephone circuits.

Taiwan's telecommunications entered the space age in 1969 when the Taipei Satellite Communication Earth Station was established in a suburb of Taipei to provide commercial services via the Intelsat Pacific satellite. An antenna was constructed in 1974 to link with the Indian Ocean Region satellite. A second antenna was later built to link with the Pacific satellite. These provide 1,600 circuits to forty locations. International traffic has grown 20–25 percent each year since then.

In 1979 a cable landing station was built at Toucheng, about 60 km east of Taipei, to provide additional capacity. Four coaxial submarine cable systems subsequently have been set up through joint ventures: OKITAI (to Okinawa, July 1979), TAILU (Luzon in the Philippines, Mar. 1980), TAIGU (Guam, May 1981), and SINHONTAI (Singapore, Hong Kong, Oct. 1985). In addition, the International Telecommunications Authority (ITA, CGRA's name from 1981) has actively participated in planning and constructing ten fiberoptic submarine cable systems in the Asia–Pacific region (including two that continue into Europe) and is purchasing indefeasible right of user (IRU) on three Atlantic fiberoptic cables (TAT-9, TAT-10, TAT-11).

A second cable landing station opened at Fangshan, about 60 km south of Kaohsiung, in 1989 as part of long-range planning for replacement of the coaxial cables. Two fiber links are in place: GPT (Guam, Philippines; 1989 Dec) and HONTAI-2 (Hong Kong; 1990 Jul). A third—APC (Asia–Pacific Region,

which will run from Singapore to Japan and to Guam)—will open in 1993. With APC, Taiwan will have seven cable landings. It has IRU circuits on thirteen other cables.

As the international fiber network in the Pacific Basin continues to expand, carriers may cross-invest to ensure route diversity and spread costs. Taiwan will have more cables than Hong Kong, Singapore, or Japan, an important factor in making Taiwan a network center for Asia. As part of this goal, ITA decided to build an earth station at Fangshan in 1990. This will further diversify route options and increase service reliability. A second international gateway switching system has been installed in Kaohsiung. Taiwan now has fiber and microwave backbone loops linking two satellite earth stations and two submarine cable landing stations to two gateway switching systems. This is unique in the region (see Tseng 1991).

17.3 The Organizational Framework

A new Telecommunications Act was drafted and enacted in 1958. At the time the nation was under Martial Law because it faced a military threat. The nature of the government monopoly in the 1929 Law remained unchanged. In fact, the 1958 Act also regulated radio and television services. The Act was revised in 1977 to reflect technical progress in satellite and data communications. Although MOC/DGT proposed the concept of a public corporation and relaxed data regulations, neither proposal was accepted by the Legislative Yuan.

DGT's organizational structure has experience two major changes since 1949. The first was in 1969 when DGT had about 10,000 employees and several big projects—including crossbar telephone switching, microwave backbone systems, and a satellite earth station—were being constructed and put in service. DGT decided to expand the TTA and the CGRA organizations to manage the expanding services. Two new institutions—the Telecommunications Laboratories (TL) and the Telecommunications Training Institute (TTI)—were established for technological development and manpower training.

DGT was responsible for policy guidelines and supervision, while its four subordinate institutions oversaw routine operations. It is interesting to note that from 1968 to 1974 the director-general of DGT was also appointed one of the two vice ministers of MOC as a way to emphasize the importance of the DGT post. At the same time, a senior DGT staffer served as director of the Post and Telecommunications Department in MOC. This arrangement proved to be very efficient.

MOC/DGT submitted a draft proposal for the revision of the Telecommunications Act that involved changes in DGT's name and organizational structure, including making DGT a public corporation. The plan was rejected by legislators. MOC nonetheless ordered DGT to make some structural changes, beginning in May 1981, based on the postal service's 1979 reorganization model. For the next three years, DGT's stability suffered from this transition.

TTA (with about 26,000 employees before reorganization) was divided into

three geographic units—northern, central, and southern—and the Long-Distance Telecommunications Administration (LDTA). CGRA (with about 1,500 employees at the time) changed its name to the International Telecommunications Administration (ITA). These five divisions were responsible for planning, constructing, operating, and maintaining the systems and services. In addition, the Data Communications Institute (DCI) was created to provide the support of data communications services. The resulting organization structure is shown in Table 17.2.

17.3.1 Budget Approval and Procurement Procedure

As a government institution, the DGT budget is submitted first to the Executive Yuan via MOC and then to the Legislative Yuan for approval. Because DGT's director-general is not an official of ministerial level, he cannot be present at the legislature to defend budget requests or recommend policy. This tends to slow implementation of evolving technology.

Procurement is regulated by the government; it is complicated, particularly when foreign firms are involved. Many procedures can be traced back to the 1930s when an audit system was created to cope with major public investment for construction projects. The Ministry of Audit (MOA), which reports to the Control Yuan, standardized practices in 1939. The Statute on Audit and Procurement was revised in 1950, 1955, 1967, and 1972. Open bids are generally specified for procurement.

The International Trade Bureau issues policy guidelines on the status of countries supplying equipment. Although there are no quotas, the supplier list

Table 17.2. Directorate-General of Telecommunications (DGT) Structure*

Abbreviation	Employees June 1990	Operation (major cities served)
Taiwan Telecommunications Administration (TTA)		
DGT	662	Headquarters staff
NTTA	12,971	Northern Region (Taipei)
CTTA	8,028	Central Region (Taichung, Chia-yi)
STTA	8,738	Southern Region (Tainan, Kaohsiung)
LDTA	2,852	Long Distance
ITA	1,851	International (formerly Chinese Government Radio Administration, CGRA)
Other Components		
TL	896	R&D Lab
TTI	372	Training
DCI	309	Data Communication
	36,679	Total

*This structure became effective in May 1981.

is normally favorable to European and North American countries; Japan is excluded in many cases. In general, an international procurement takes twelve to fifteen months from initial request to delivery. It may drag on longer if disagreement emerges among the various regulatory parties.

The procedure for domestic procurement is simpler. To maintain systems and services quality, DGT has ruled that a survey of manufacturing ability must be conducted to see if there is any potential local supplier (DGT 1981). To ensure compatible equipment standards, DGT has centralized procurement procedures for local and long distance telephone facilities. However, in many cases this is very time consuming. If fewer than three suppliers bid, price negotiation with one or two bidders may take place.

Existing procurement policies have caused particular problems for the highly technology oriented telecom services industry. Specifications for procurement put more emphasis on overall systems performance than on individual units. Acquisitions of equipment suffer from substantial delays resulting from government bureaucratic intervention. Proper bidding procedures should focus on lifetime costs rather than on first costs. However, complicated cost analysis, with detailed breakdowns of hardware and software items, is difficult for laymen to understand. Thus, it is usually very difficult for nontechnical auditors to agree on a base price for negotiation. These problems were evident in three years of negotiations with AT&T Taiwan, ITT Taisel, and GTE Taicom on the purchase of switching equipment.

The cumbersome purchasing procedures extend to land acquisition. The market price is almost always much higher than the "official announced land pricing" (assessed) value set by the government. It very hard to convince auditors that a price acceptable to the seller is reasonable. DGT proposed changes to the procurement policy, which would affect transportation projects as well. Finally, the government set out to review the land appropriation system with the intention of instituting uniform standards that "avoid confusion and difficulties between the Government and landowners." The changes are to include revision of assessments to reflect prevailing market prices.

17.3.2 Development

DGT established the TL in 1969 to promote industry development. TL reports to DGT and receives about 2 percent of DGT revenue for R&D. Since the 1950s DGT and TTA have used their purchases to aid development of a domestic equipment industry. In response to a series of four-year national economic development plans, which began in 1953, the TTA signed long-term procurement contracts with a dozen local manufacturers. These included Pacific Cable, Hwashin-Lihwa Cable, Universal Cable and Hawzun Cupro (for cable); Taicom and Far East (crossbar switches); Universal Electric and Tongya (telephone sets); and Vidar (PCM equipment) (see Lee 1989).

While short of natural resources, Taiwan has an abundance of well-educated workers, which is essential to development of the electronics and information industry. The integrated circuit and computing equipment industries began to

emerge in the early 1980s. Many new venture capital companies came to the Hsinchu Science-Based Industrial Park. The complex, opened in December 1980, was an early key piece in government policies to encourage high-tech R&D. Others included such programs as duty free import of instruments, tax deductions on imported material for export products, and loans.

In the early 1970s, the government began to view the United States as a major technology source. In 1973 ITT Telecommunications and GTE International, respectively, created ITT Taisel and GTE Taicom as joint ventures to produce electronic telephone switching equipments. In 1984 AT&T established AT&T Taiwan to produce digital switching equipment. As a major customer, DGT was requested to become a shareholder in all three companies, which it did, as shown in Table 17.3.

When the Executive Yuan told the DGT that the network was to be divided into three regions, it was also specified that each of these three digital switching equipment manufacturers would get the contract for one region. This was intended in part to reduce maintenance costs for each region. With the sixth tender for equipment in 1990 the market was open to competition.

17.3.3 Employee Staffing and Labor Union

Employment practices were defined in the Statute on Communication Business Staffing of 1957. It stemmed from the entrance examination system established in 1934, which was similar to the British civil service system. Two parallel routes are available for employee ranks and job grades. There are six ranks for the two professional ladders—technical and business. New employees have to pass an open examination held by the Ministry of Examination in order to get certification for ranks R2, R3, and R4—depending on their education background. Most TL employees have postgraduate degrees and are hired without passing through the open examination.

The number of DGT employees increased only 10 percent during 1981–1987 despite a 85 percent increase in installed lines. In March 1988 there were 30,082 employees—including 12,763 (42 percent) technical and 4,130 (14 percent)

Table 17.3. DGT Investment in Its Major Suppliers, 1990

Company	Year Founded	DGT Investment		Region Supplied[c]
		NT$[a]	Percentage[b]	
ITT Taisel	1973	164.0	40	Central
GTE Taicom	1974[d]	63.0	15	Northern
AT&T Taiwan	1985	233.7	15	Southern and toll network

[a] Includes subsequent capital increases.

[b] Of total. DGT paid for its shares on an equal basis.

[c] During first five tenders for switches. See text discussion.

[d] DGT investment made in 1978. Siemens acquired GTE's equipment business in 1989.

temporary. DGT traditionally has provided a life-long, stable working environment. Thus, more than 90 percent of DGT employees have stayed at DGT until compulsory retirement at age 65.

The TTI was established in 1969 for career training. The training program consists of orientation for new employees, on-the-job training and advanced studies at various levels. Seminars on operations, management, and special technologies are also often held in the TTI.

As Taiwan moves into the Information Age, DGT is facing several staffing issues: How to recruit employees with advanced degrees? How to assess manpower needs in light of organizational structure expansion? How to differentiate the role of a government employee from that of a business employee (see Chang 1985)? Any attempt at major revision of the 1957 Statute may be complicated. However, a special measure proposed by DGT to recruit research personnel on the basis of higher educational degrees for the TL recently has been approved by the Executive Yuan.

Following the establishment of the government's Council for Labor Affairs in 1987, DGT's labor union was reorganized and became more active. It has asked for certification of temporary employees who were unable to pass the open examination and for a reasonable promotion path and job allowances.

17.4 Facilities and Services

Under the 1977 Telecommunications Act, basic network circuits and services are a DGT monopoly. Development plans initially emphasized installation of local telephones to ease the burden of a long waiting list. During the 1980s, the main goal had been transition from analog to digital switching systems. Between 1979 and 1988 DGT invested the equivalent of 1.06 percent of GNP to improve services. Long-term plans have been formulated for construction of basic networks leading to establishment of ISDN by the year 2000 in metropolitan Taipei, Taichung, and Kaohsiung.

In the toll network, analog microwave links have been replaced by digital systems, and coaxial cable by fiberoptical. There have been three primary centers—Taipei, Taichung, and Kaohsiung—and thirteen toll centers since July 1990. Toll transmission was 92 percent digital and toll switching was 76 percent digital in 1990.

As of June 1990 the number of telephone stations exceeded 8.15 million (40 per 100 people). Almost two-thirds of households had telephones. There were well over five coin telephones per 1,000 people. Total local switching capacity was 7.84 million lines—20 percent digital, 24 percent electronic, 56 percent still crossbar. All local telephone networks are expected to be digital by the year 2000.

The growth rate of telephone density was 18–21 percent during 1965–1980. It then gradually slowed to 7.5 percent, reflecting the larger base and density. Still, compared to many advanced countries that had penetration levels over 50 percent before 1980, the slowdown reveals two problems. The first is the bu-

reaucratic procurement procedure, which caused some delays on major construction projects. The second is that restrictions on nontelephone applications limited demand for second lines.

Cellular service had a capacity of some 145,000 lines in 1991, which was to be tripled by mid-1993 under a contract with Ericsson reported in January 1992. Ericsson also provided switches and radio-base stations for the existing capacity, all of which is analog. Handheld and car telephones were banned until July 1989. That same summer DGT drafted plans for full competition in mobile telephones in 1993.

17.4.1 Data Communications and VANs

Data communications began in 1971 when leased circuits were first opened to the public. Since the Data Communication Institute (DCI) was established in 1981, additional services have been put into operation. Available services are listed in Table 17.4.

Data Communications Rules were drafted in 1981, in accordance with the Telecommunications Act; they were subsequently revised in 1983 and 1986. Domestic data communication services are monopolized by DGT/DCI. Private entities cannot operate or resell leased circuits. There have been numerous complaints about this from both foreign and domestic firms. However, MOC

Table 17.4. Types of Services Available

Date Began	Subscribers 1985	Subscribers 1990	Service
Nov. 1971	4,452	24,556	Domestic leased line data
Jan. 1975	41	222	International leased line data
Dec. 1979	63	212	International Universal Data Access Service (UDAS)
Jun. 1982	115	112	Circuit switching data (CIRNET)
Jan. 1984	103	730	Dial-up data
Jan. 1984	103	92	PIPS[a]
Oct. 1984	531	2,578	Packet switching data (PACNET)[b]
Aug. 1987	—	11,307	Chinese Videotex Service (CVS)[c]
Aug. 1987	—	175	Public message handling (MHS). E-mail.
Sep. 1989	—	177	MVDNET[d]
Nov. 1989	—	326	MARNET[e]

Source: Data Communications Institute.

[a] Public Information Processing System. Subscribers use their personal computers or terminals to access DCI mainframe for information processing.

[b] Can link to international packet networks such as Datapac, Telenet, Tyment, and so on.

[c] Subscribers can use television sets or personal computers to access 165,000 screen pages of data from twelve providers.

[d] Motor Vehical Driver Network. For fleet administration and tracking.

[e] Multi-Access Reservation Network, for airline ticketing.

is concerned about the effect of transborder data flow on national security. In 1988 the government granted special approval for shared usage of data services for international networks such as Citibank, Sita, AP, Reuters, GE, and Swift.

VAN services were opened to competition in July 1989, and thirty-eight private firms had registered as of March 1991. Because the United States and Japan have well-established data base services, eleven of the firms provide links to one or the other of these two countries; twelve have other overseas links, including five to Hong Kong—a reflection of its role as a region telecom center. Many of the systems are dial-up rather than dedicated-line, reflecting low initial traffic volume. Almost every VAN provides information storage and retrieval service. Different names are used, but they are basically videotex. Only one VAN was providing electronic document storage and delivery (a form of E-mail). For the services to expand, we feel further revision of the regulations are required—particularly as the relate to leased circuits (see Tseng 1991). There has been a proposal to allow foreign firms to own 30 percent of VANs, but failure to implement it has led to friction with the United States in particular.

17.4.2 Customer Premises Equipment

Traditionally, all subscriber telephone sets were the property of DGT/TTA; rental charges were included in the monthly bill. Taiwan has become a major exporter of push button telephones since the early 1980s. The Local Telephone Rules were revised in August 1987 to permit subscribers to own telephone sets, thereby opening the CPE market to the public.

Similarly, all data communication modems had been provided by DGT/DCI. In November 1987, this constraint was relaxed to allow customers to provide their own modems for speeds below 2,400 bps. Further relaxation is expected in the early 1990s to allow intelligent communications terminals and modems with speeds up to 9,600 bps.

Private companies are allowed to own PBX equipment and connect it to the public network. No specific rules govern installation and operations of LANs, so the regulation on PBXs are applied. Private companies may design and construct their own LAN; following inspection and approval, the LAN may be connected to the public network.

17.4.3 Rate Structure and Financial Health

DGT policy traditionally combined high installation fees with a low service rate structure. In 1956 installation fees were set to recover virtually all of the cost (including switching equipment) immediately. This provided DGT/TTA with a sound financial foundation from which to launch a series of development plans, with end-users sharing initial construction costs. Even though installation fees were beyond what most people could afford, and the number of installed lines was increasing at double-digit rates each year, the installation backlog grew.

The rate of return for pricing, which must approved by the Legislative Yuan, is between 8.5 and 11.5 percent—with VAN and other new services, such as paging and cellular, allowed a return at the higher end of that range. Any major rate adjustment on basic services must be approved by the Executive Yuan. However, DGT can adjust rates on data communication services or other minor items simply by giving notice to MOC. Rates have been adjusted three times since 1949, based on a "zero effect" principle (i.e., revisions were structured so that the change in overall revenue from the adjustment was 0).

In the immediate postcolonial period, when all calls were connected manually, there was a flat monthly fee—tracking the number of calls made from any given phone was impractical. Automatic switching allowed charging by volume, and this led to the first rate adjustment, which took effect in January 1957. A rate of NT$0.70 was set for calls beyond a base number. A public coin phone call cost NT$1.00 for three minutes.

The second change came in 1976, increasingly the basic call rate to NT$1.00. Monthly rates are dependent on the number of lines in the calling area; the number of divisions has been reduced from four in 1957 to three and then to two. Similarly, long-distance regions (rate bands) have gone from eleven to six to three. These changes resulted in a price increase for local services and a price decrease for long distance.

A third adjustment was completed between November 1987 and January 1988. The basic call rate went to NT$1.10, and installation was reduced to NT$12,000 (U.S.$418), equivalent to a few months of the average wage. Rates for international direct dial calls decreased from 20 to 30 percent. In 1991 basic monthly dial-tone charges were reduced about 14 percent for nonresidential lines and just over 20 percent for residential lines. The additional message unit charge dropped back to NT$1. An urban business line is about U.S.$11.

Domestic long distance is billed in NT$1 increments, with the number of seconds varying with time of day and distance. Under the July 1989 tariff, the highest rate is about US$0.37 per minute (for a call that would cost 21 cents in the United States). The farthest band begins at 140 km, less than half the length of the island.

Financially, DGT and its subsidiaries are dealt with as one unit: international revenue subsidizes domestic service, long-distance subsidizes local, and basic services subsidize data services. Results for fiscal year 1987 showed that less than 2.0 percent of total revenue was from data services. Data on DGT finances are in Table 17.5.

17.4.4 Regional Collaboration

In the 1950s and 1960s, CGRA had exchange visit programs with KDD, RCA, WUI, and ITT for international telecommunications development. The construction of a troposcattering communications system between Taiwan and Japan was a direct result of CGRA–KDD collaboration in the early 1960s. The TTA also had an exchange visit program with NTT for telephone engineering, construction, and operations.

Table 17.5. Directorate-General of Telecommunications (DGT) Operations

Year[a]	Total Revenue	Owner's Equity	Liabilities	Employees	Revenue Per Worker (in NT$ thousands)
	(in NT$ billions)				
1975	7.1	23.2	3.3	18,604	381.6
1980	24.0	64.4	16.0	24,602	975.5
1985	45.6	143.2	15.4	29,798	1530.5
1990	87.2	223.7	31.0	36,679	2377.2

[a] Fiscal year ended June 30 of following year.

The DGT established the International Telecommunications Development Corporation (ITDC) in 1974 to facilitate regional collaboration after Taiwan withdrew from the ITU and Intelsat. With assistance from Comsat, ITDC–ITA maintained international satellite communication operations and services, as well as cable services.

DGT has collaborated with Comsat since 1977, sending research engineers to Comsat to study satellite transmission technology. Advisors from Comsat were invited to assist in the construction of the Taipei Satellite Communication Center. DGT began to lease Intelsat satellite transponders for domestic service in 1989.

The Ato Rengikai was founded in Tokyo when diplomatic ties between Taiwan and Japan were severed in the mid-1970s. Ato has acted as a gateway to maintain DGT–NTT collaboration on systems and technology. (Since privatization of NTT in 1985, Ato has been replaced by NTT International.) DGT has collaborated with many other telecommunications entities such as MCI, BellSouth, Nynex, and Hawaiian Telephone Company.

17.5 The System in Transition

Although MOC/DGT proposed corporatization in 1977, the proposal was not accepted by the Legislative Yuan. Under this constraint, DGT reorganized in May 1981 and continued as a government monopoly. DGT has been hampered by slow budget approval, procurement procedures, and employee staffing systems, resulting in deterioration in DGT's ability to expand and upgrade services.

17.5.1 Studying the Issues

During the 1980s policy makers and parties interested in Taiwan continued to pursue the issues of competition and privatization in a Taiwan context, encouraged by the shift toward competition in telecommunications underway in the United States, United Kingdom, and Japan. When the statute on DGT Organi-

zation was revised in October 1984, the Executive Yuan instructed MOC to restudy the possibility of corporatization. MOC again treated telecommunications like postal services. However, after a two-year study, it concluded the two services have different characteristics. The study group proposed that DGP remain a government department, while DGT should be reorganized as a government-owned or privatized corporation.

In the wake of this and various other studies that indicated an "appropriate" level of competition was beneficial to all telecommunications providers and users, the Council for Economic Planning and Development (CEPD) of the Executive Yuan agreed to study the relevant legal issues. More specifically, the proposal was to consider what policies and laws would support restructuring telecommunications into a competitive industry and to analyze the feasibility of privatization.

The research contract was awarded in 1986 to the China Interdisciplinary Association (CIDA). The team consisted of fifteen members, including consumers, professors, scholars and experts in law, business, mass media, telecommunications, computers, and electronics. After twelve months of work, a final report was issued in July 1987. (One of the authors was secretary general of CIDA at the time and served on the team. His is the lead name on its report: Tseng et al. 1987.)

CEPD studied socioeconomic and legal aspects of competition, and recommended separation of government regulatory and system operations functions through a new legal framework. It also drafted a conclusive recommendation on the legalization of policies.

Since that study was completed, various government agencies have undertaken additional research. MOC studied regulatory administration, and also recommended that DGT be reorganized into corporate organizations. DGT studied managerial and organizational issues of competition, and recommended priorities and procedures to be considered to ensure a smooth transition. Consequently, an ad hoc committee was established in MOC to work out the processes of change, and a DGT seminar was held in September 1987 with the theme, "Liberalization, Rationalization, and Privatization."

17.5.2 Re-evaluation of Policies

In the late 1970s people in Taiwan still studied Chinese keyboard input methods and debated the standardization of Chinese computer code books. In 1980, when the first Information Show was held in Taipei, people began to recognize the computers' ability to stimulate economic growth. With the advent of personal computers, there was a realization that computers could be used to process Chinese characters.

Networks are necessary channels for information flow to every business. In the past, land, energy, and capital served as Taiwan's resources. Information is now the major resource and the information industry is Taiwan's growth engine. The Information Age is the result of the growing interrelation between information processing and telecommunications.

These two industries developed in very different environments. As in other advanced countries, the information-processing industry in Taiwan has always been competitive, while the telecommunications industry has been a regulated monopoly. Introduction of competition in telecommunications may rapidly produce positive results in terms of lower prices, improved services, wider choice and acceleration in the availability of advanced products. The CEPD has argued that the transition to competition would benefit users, enabling them to choose from a wide menu of transmission services and interconnect these as their needs require. A variety of competitive VANs and information service providers would be able to provide network management and data base access. Users would also be able to choose from a variety of cost-effective CPE. Long-distance rates would most likely decrease due to a surge in traffic.

The CEPD also argued that service-oriented businesses could become potential information providers. Computer software houses could expand their scope to provide VAN services as new Type 2 carriers, enabling these newcomers to become the fastest growing segment of the telecommunications marketplace. Their use of network capacity would provide services that would fuel the economy in the 1990s. CEDP pointed out that Taiwan's information industry producers have depended mainly on exports. All 5+ million subscribers in Taiwan, however, are potential consumers.

17.5.3 A Study for Cable Television Development

Taiwan has had three commercial television networks—TTV, CTV,and CTS—since the 1960s. The first community antenna system was approved in 1970 to provide services in rural areas with poor reception. As of 1990, there were over 120 systems with 800 thousand subscribers—a 15 percent television—household penetration. There were also so-called Fourth Channel systems in urban areas to provide programming from video tapes. These often involve obscene and pirated material and in any case are illegal.

CATV is a new direction for television development. In August 1983 an ad hoc working group of the Executive Yuan for cable television development was established in MOC to study CATV systems and services. After eighteen months, the group presented recommendations to the Executive Yuan indicating that it was technically feasible and economically viable to develop CATV in Taiwan. However, the practical issues of program supply, legal restrictions, and administrative workload would present a different set of concerns.

The group recommended selected pilot projects be undertaken to determine market needs and to gain operational experience (see Tseng 1985). When a private entity pursues a CATV pilot project, it may choose a proven coaxial cable technology and aim at a market niche. But when DGT undertakes a project, it may construct fiberoptic subscriber loops and integrate with broadband ISDN development. The study reports and recommendations were submitted to the Executive Yuan in June 1985 via MOC; however, CATV policy was still pending in the early 1990s.

17.5.4 Survey Study on Operation and Organization

During 1986–1987 a CEPD/CIDA team studied three areas—basic network services, CPE markets, and VAN services. To distinguish basic and VAN services, they adopted the international convention of distinguishing a Type 2 carrier as one that provides value added services over circuits leased from a Type 1 carrier (ie, DGT or its subsidiaries). In most cases, Type 2s provide VAN, share-use, resell, and information-processing services.

The study team interviewed about 120 people in November 1986, including those in the industry, scholars, and consumers, asking about perceptions of the optimal organizational structure. Questions addressed both Type 1 and Type 2 service and whether each should operate as a regulated monopoly or a deregulated competitive structure. It broke this down further to analyze whether they should be provided by one national organization, government or private, or by private corporations.

Almost no one felt DGT should retain its existing monopolistic status as a government institution. However, a public monopoly was considered best for Type 1—62 percent gave this response regarding the domestic market, 59 percent for international. (It should be noted the Type 1 questions did not distinguish local and long-distance services.) Almost all interviewees preferred introduction of competition in Type 2 telecommunications (96 percent for domestic, 95 percent international) with private organizations (59 percent, 52 percent) providing services.

17.6 Legal Framework and Organizational Issues

The telecommunications market environment consists of three elements: Type 1, Type 2, and customer premises equipment. In many cases, Type 1 carriers provide both basic circuits and VAN services. Type 2s lease basic circuits from Type 1s to provide VAN services. Type 2s are strictly defined as having no license to construct any wired or wireless transmission lines. Therefore, a Type 2 needs neither a channel frequency allocation from the national radio frequency registration authority or right-of-way permits from the local government. Since a Type 2 does not require public resources, it has less of a social obligation than a Type 1. Customers can purchase their CPE on open markets.

The CEPD/CIDA study team indicated that a new law is necessary to ensure fair play between the monopolist and new competitors. A conceptual framework has been proposed. There are four parts to the proposed business environment:

Part 1: A new "Telecommunications Authority" (possibly still called DGT, but organizationally reformed) is responsible for ensuring fair competition between Type 1 and Type 2 carriers. The objectives are to establish proper operations of public properties, ensure quality services, and protect users' benefits.

Part 2: The basic circuit network is a national infrastructure. It is both an

integral part of the total service industry and the underlying pathway for information flow. The network has a high level of public obligation—including serving senior citizens, remote villages, and low-income households as well as wealthy urban markets. Type 1 operators thus to some extent should be monopolies and be required to pay close attention to new technologies in order to remain cost effective.

Part 3: Type 2 carriers should provide various VAN services at their own risk. Like transportation carriers running on highways, Type 2s offer multiple services in a fully competitive market. The small size of the geographical area in Taiwan may not require Type 2s to divide into domestic VAN and international VAN.

Part 4: Users are in the center of the model and should be given ample opportunities to actively express their requirements. To meet user demand, there are three factors to consider. First, regulation should be kept to a minimum. Next, the basic network should be widespread and of high quality. Third, there should be a large and fair competitive environment.

This legal framework concept implies that the new law should strictly regulate Type 1 carriers and give official sanction to Type 2 carriers. Because it is expected that Type 1s will also provide VAS, an interesting competitive relationship exists between Type 1s and Type 2s. To ensure fair competition, there are two safeguards: a separate accounting system to prevent cross subsidization and fair lease line interconnection.

As of mid-1991 telecommunications was still under DGT monopoly. To implement the new concepts, it is necessary to separate the regulatory and operational functions—that is, to clearly define a "referee" and the "players." It has been proposed to spin-in certain DGT departments to a government body called the Telecommunications Authority or DGT. Other parts of DGT would be spun-off and reorganized as corporations that continue monopolistic operations of various Type 1 networks. An equipment approval institute and a technical standard board have also been proposed within the authority.

17.6.1 Priorities

The first plan of action is developing marketing techniques for telecom services. Data services are a small part of DGT revenue and many households do not have a telephone. Clearly, telephone growth could be increased by encouraging more households to get residential lines and by marketing various data communication services to business users. Under present regulations, the teleinformation processing service market is not effectively open to nongovernmental entities. This is limiting growth.

Conventional services were provided under a concept of "supply orientation" during the monopolistic period. However, data services require providers to use a "market orientation" strategy. In response, a new marketing division was organized within DGT to be responsible for marketing strategic planning, with end-users as the focus.

To open the market for competition means liberalization or deregulation of telecom services. The DGT recommended a sequence of priorities in a 1987 seminar. First, take immediate action to liberalize services, including parts of the CPE market. Next, revise the relevant regulations to support liberalization of some Type 2 services. Third, create a long-term strategy to revise the 1977 Telecommunications Act so DGT's organization structure can be corporatized or privatized, allowing for the time required to pass these revisions through the Legislative Yuan. The first two of these had been done by 1989.

DGT is not only a rule maker but also a player. To separate regulatory and operational functions, the CEPD has urged MOC/DGT to use a spin-in and spun-off. Two regulatory bodies might be created within DGT: Telecommunications Equipment Inspection and Approval Institute and Telecommunications Standard Review Board are proposed names that reflect their function. However, an organizational alternative is to include these functions in the proposed Telecommunications Authority or a restructured DGT.

17.7 Conclusion

Telecommunications policy in Taiwan usually refers to policy made and executed by MOC/DGT. Conventional policy objectives have been relatively simple. Roughly speaking, the main social goal has been to provide basic telephone services. Objectives focused on engineering or construction, with eliminating the backlog of orders a typical goal. It had originally been a supplier's market. In 1981, when every village had automatic dialing and density was over twenty stations, universal service could be said to have been successfully achieved. Taiwan was thus ready to enter a new age of telecommunications, pursuing qualitative improvement and expansion.

The industry changed to a users' market in the 1980s. The decade was spent considering structural changes to how service was provided—with an eye on possible lessons from the spread of privatization and deregulation in Japan, the United Kingdom, and the United States. Many proposals have been made, some of which have been rejected at least once, but which may again be considered.

An ad hoc committee was established in May 1988 in MOC to study all the recommendations. In addition to MOC and DGT officials, people from the electronics and computer industries and other relevant areas are again being asked for input. The ad hoc committee is to propose solid plans for the liberation of telecom services and the organization of the DGT, and to prepare drafts of various legislation (including the revision of existing acts) that will provide the foundation for the creation of a new telecommunications era in Taiwan. It is impossible to know the speed of change or the extent privatization of services and competition will be allowed. The consensus, however, is that this time plans along these lines will be implemented, and Taiwan's regulatory structure and telecommunications markets will be transformed in the 1990s.

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