

Telecommunications in
Singapore: Structure and
Change

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Singapore

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Singapore is a compact city-state of not quite 3 million people and limited natural resources. The economy has long depended on the city's natural harbor and location at the intersection of major trade routes, which helped it develop as a center of trade, shipping, and finance. Due to its small size, the economy is very internationally oriented; its external markets are larger than its domestic markets. (Good brief studies of Singapore are in Krause et al, 1987.)

Singapore was a British colony until 1959. For over thirty years Prime Minister Lee Kuan Yew and the People's Action Party (PAP) maintained an efficient government and political stability. Yew retired as prime minister in November 1990; PAP continues in power. The government believes in long-term planning and implements its development programs as planned. Its strategy can be described as pragmatic and interventionist. As an important component of this, the government makes a conscious effort to attract foreign investment, with the result that up to 70 percent of investment in manufacturing is by foreign firms.

During the 1960s and 1970s Singapore succeeded in an ambitious industrialization, focusing on labor-intensive, export-oriented industries. By the late 1970s and early 1980s Singapore faced severe competition from other developing countries with more competitive labor supplies and wage levels. To sustain growth Singapore had to restructure and embark on a high-value-added, technology-based, knowledge-intensive strategy.

A "second industrial revolution" was thus proposed in 1979 and implemented in the 1980s. It focused on development of banking and financial services, tourism, and high technology. This led to increased internationalization of the economy and greater dependence on multinational companies. Development of information technology and the telecommunication infrastructure played a key role in facilitating the restructuring.

The Telecommunication Authority of Singapore was designated the key institution to pioneer Singapore's information age by developing an efficient telecommunications network incorporating the latest information technologies. Singapore Telecom's role is made all the more significant because Singapore's

strategic physical location has been diminished in a relative sense by modern transportation and communications. Its role as an entrepot has also declined and its competitive edge is now based on its ability to become an international center for telecommunications and services in the region (see Fong 1991).

This chapter presents three major aspects of telecommunications in Singapore. After a brief history, including the evolution of Singapore Telecom, the status of conventional services is discussed. This is followed by a section on new technologies being planned and installed. Finally, analysis of relevant policies, including new policy directions for the 1990s, are presented. (Singapore's fiscal year is April 1 to March 31 and is written as, for example, 1991–1992.)

14.1 History

Telephone service in Singapore began in 1879, three years after Bell's invention. The first exchange, with a simple standard manual switchboard of fifty lines, was operated as a private exchange by Bennet Pell, the local manager of the Eastern Extension Telegraph Company. Three years later, Pell's exchange was bought by the Oriental Telephone and Electric Company (OTEC), which had been registered in 1881 in London and held licenses to develop the telephone patents of Bell and Edison in countries east of Malta. For more than seventy years OTEC's government-granted license enabled it to dominate the colony's domestic telephone service.

In 1955 the colonial government established the Singapore Telephone Board (STB), which took over OTEC's assets and operated the network as a public undertaking. In the meantime, Singapore's international service was provided by The Telecommunication Authority of Singapore (TAS). This structure remained unchanged through the brief period 1963–1965 that Singapore was a part of the Federation of Malaysia as well as after its independence in 1965.

In April 1974 STB and TAS were merged to integrate and streamline the domestic and international telephone networks. The resulting entity was called the Telecommunication Authority of Singapore. (The Authority was referred to as TAS before 1974, then as Telecoms. In April 1989 the name Singapore Telecom formally replaced TAS. Generally, the form of the period is used; when more than one period is discussed, TAS is used.)

Under the Telecommunication Authority of Singapore Act (1974), the new Telecoms held exclusive franchise to provide, operate, and maintain national and international telecom services in Singapore in accordance with international standards and practices. It is the sole regulatory body in charge of telecom services, networks, equipment, and licensing (except broadcasting and television) in Singapore. It has been an active contributor to the country's economic development as well (see, e.g., Chen and Kuo 1985, pp. 240–44).

In 1982 the value of incorporating the postal services, then under the Ministry of Transportation, with Telecoms was recognized. The merger was deemed economically feasible and necessary to improve efficiency and avoid unproduc-

tive competition between postal mail and electronic mail. They are run as separate profit centers with significant administrative and financial autonomy (see Toh and Low 1989).

Singapore Telecom is structurally a statutory board under the Ministry of Communication. The chairman and five to seven members are appointed by the minister. Daily operations are the responsibility of a president and chief executive officer who reports to the minister and the board. Telecoms enjoys greater autonomy than government departments and can thus respond to changing conditions more effectively than other civil service structures.

Since the early 1970s Telecoms has formulated strategies and plans to develop a modern telecommunication infrastructure in line with Singapore's efforts to enhance and consolidate its position as a center of trade, commerce, finance, and communications. Acting as a major catalyst in social and economic development, particularly in the field of information communication, Telecoms has gone beyond providing basic services like telephone, telex, and telegraph. The increasing intensity and complexity of social and business activities in Singapore have generated a corresponding increase in demand for information transfer, which can be satisfied only by a much more sophisticated and efficient telecommunications system.

14.2 Basic Telecom Service

Singapore Telecom provides a range of technologically advanced services and facilities that form a comprehensive and mutually supportive telecommunications system. This section discusses the major basic services: telephone, message, data, private network message switching, radio, and postal services, and the infrastructure for international communications.

14.2.1 Telephone Services

Telephone services were first introduced to Singapore in 1879, and were completely automatic by 1930. The number of lines and the quality and kinds of services provided have grown rapidly. As befits a relatively rich urban area, Singapore has more telephones per person than any ASEAN country. There were thirty-seven lines per 100 persons in 1991, the second highest density in Asia after Japan and about the same as Hong Kong. Over half of telephone revenue has come from international calling. Table 14.1 provides overall data.

Singapore has had trunk service to peninsular Malaysia since 1931. In 1962 subscriber trunk dialing (STD) was introduced. In 1965 STD was extended to 40,000 Singapore subscribers, enabling them to direct dial Kuala Lumpur, Ipoh, and Malacca. By 1977, all lines in Singapore had STD capacity. A year later, all subscribers could direct dial 145 towns in western Malaysia.

In 1979 Telecoms launched a "Push-Button Telephones For All" program to replace all rotary-dial instruments with tone-type ones. Within four years,

Table 14.1. National Telephone Service, 1968–88

Year ^a	Phones Per 1,000 Population	Cumulative Phones Installed	Increase from Prior Year (%)
1968	59.2	119,184	—
1969	66.7	136,267	14.3
1970	77.8	161,310	18.4
1971	89.5	189,847	17.7
1973	102.9	225,684	18.9
1974	115.2	256,973	13.9
1975	128.1	289,784	12.8
1976	143.4	328,749	13.4
1977	170.0	395,200	20.2
1978	201.9	475,167	20.2
1979	235.9	562,358	18.3
1980	267.2	645,028	14.7
1981	294.6	719,817	11.6
1982	321.9	795,737	10.5
1983	347.9	870,503	9.4
1984	372.3	941,489	8.2
1985	399.5	1,022,009	8.6
1986	419.3	1,084,259	6.1
1987	432.0	1,128,749	4.1
1988	447.4	1,170,000	3.7

Sources: Telecommunication Authority of Singapore *Annual Report*, various years; and *Yearbook of Statistics*, various years.

Data after 1988 are not available because of the July 1989 liberalization of first-phone ownership.

^aCalendar yearend through 1971, then March 31 of year shown. Singapore's fiscal year ends March 31, so data here for 1988 are as of the end of fiscal 1987–1988, and so on.

Singapore had become the only country with a 100 percent push-button network, albeit a relatively small one.

International telephone services to Indonesia, Thailand, and the Philippines were established as early as 1934, and international station-to-station service was introduced in 1973. By 1978, international direct dialing (IDD) was available throughout the nation with service to thirty-five destinations. By 1990 Singapore maintained telephone links with more than 200 overseas destinations, of which over 170 could be reached by IDD. In the same year, the number of international phone calls was 77 million, compared to 16.8 million in 1986.

To cope with increasing traffic Singapore Telecom installed a second digital international telephone exchange (ITE) in 1989 in a joint venture with AT&T (as equipment supplier). The two ITE centers, each with 4,000 lines of international circuits, were expected to meet the growing demand for only a few years, and indeed by 1990 a third gateway was installed. The new systems

have brought Singapore a step closer to complete digitalization of its communications network and will allow the network to evolve toward ISDN.

Having installed a network to meet basic voice needs, Telecoms initiated a number of value-added services. The Phone-Plus Service comprising six facilities—abbreviated dialing, absentee message, autoredial, call transfer, call waiting, and three-way calling—has been very popular since it was implemented in 1985. Carphones and IDD/STD Password facilities have proven popular since the late 1980s.

14.2.2 Message Services

Telegraph, telex, telexmail, telefax, and telebox are message services. Telegraph use has been on the decline since the early 1980s because faster, cheaper alternatives for overseas communications are now available. The number of telegrams sent in 1990 was less than one-fourth the 896,000 in 1976–1977. Still, telegraph remains a useful link to destinations lacking more sophisticated facilities such as telex. Such areas include China and India, both of which are important trading partners.

International telex service was introduced in 1959. By 1986–1987 telex messages from Singapore could reach 205 international destinations, 185 on a fully automatic basis. Telex traffic stood at more than 16.5 million messages, while the number of telex connections had grown to 17,895. In 1986, a new S\$21.5 million telex exchange was commissioned to provide telex services for local international users. Singapore, with 6.9 lines per 1,000 population, has the world's highest telex penetration (*The Link* 1988, Mar./May). Facsimile and pagers spread quickly on introduction in the mid-1980s. Telebox, an electronic mailbox, was introduced in June 1984. Besides cutting paperwork, it is considered a cost-effective way to automate office communications without heavy investment.

14.2.3 Data Services

Data communications are very important to businesses in Singapore. The tremendous increase in data-leased circuits since the early 1980s reflects the importance of Singapore as a regional communications center. In response, Telecoms introduced a dedicated digital network in 1988 intended to meet the needs of its most sophisticated customers. The network allows bankers, brokers, and companies in Singapore to make overseas transactions via computer at 140 Mbps. This further boosts Singapore's position as a major financial center. The new domestic service complements digital international leased circuits (also known as Intelsat Business Service or IBS), which have been provided by Telecoms since 1987.

Telepac and Datel, the two major data services provided by Telecoms, allow subscribers access to various data bases and computer banks. Telepac subscribers can use their personal computers to send telexes. This complements Telex Dial-in, which allows telex users to communicate with a computer connected

to Telepac for information retrieval, electronic mail, and other services. Datel provides transmission of data over national and international switched telephone networks. It caters to individuals and businesses whose traffic requirements do not warrant leasing dedicated lines.

Computer Access Service, linking terminals and computers both locally and internationally, was introduced in 1978. Subscribers can gain access to computing services in the United States via the packet-switched value-added data networks of Tymenet and Telenet. Access has been extended to vendors in Australia, Canada, France, Japan, and the United Kingdom.

14.2.4 Private Network Message Switching Services

With the increase in size and complexity of private communication networks in the business community, especially evident among multinationals operating in Singapore, effective control and increased operating efficiency are vitally important. Telecoms offers a spectrum of private network message switching services through PRISNET, commissioned in 1979. It is a computer-controlled system enabling large corporations to set up their own private international networks.

Telecoms provides three types of PRISNET services: point-to-point leased circuit, private user networks, and common interest groups networks. Two popular common-interest networks are Flight Information Distribution Service and Travelnet. These provide instant computerized travel reservations and connect travel agents to the reservation computers of participating airlines.

14.2.5 Radio Services

Three types of radio services provided by Telecoms are of particular significance: Harbourcraft Telephone Service, radio paging, and landmobile telephone. Introduced in 1960, Harbourcraft allows ships to communicate with each other and to and from the shore within harbor areas.

Automatic radio paging, commissioned in 1983, was upgraded in 1987 to include a memo service that can display messages in English, Malay, or any other language using romanized letters. The service has become highly popular. As of mid-1991 there were twelve pagers for every 100 people, a total of over 330,000, compared to just over five pagers per 100 in November 1987.

Landmobile service was introduced in the 1950s, but it was initially limited to special services such as the police and fire brigade. Operator assistance was required. By 1974, the automatic mobile telephone system (AMTS) was introduced and base stations were set up to provide island-wide coverage. AMTS was then restructured into a landmobile service and a Harbourcraft Telephone Service.

The cellular mobile telephone system (CMTS), costing S\$34 million, was introduced in December 1982. It can take up to 6,000 subscribers and makes a range of facilities such as IDD, STD, and other Phone-Plus functions available to its users. By late 1991 there were over 50,000 mobile telephones connected

to the network, compared with about 3,800 at the end of 1987. The number of subscribers continues to increase rapidly.

Telecoms introduced a portable cellular phone system in August 1988 that offers a range of features rivaling those available for both conventional and car telephones. Since April 1989 calls from these telephones can be made or received inside Singapore's underground Mass Rapid Transit stations and trains. According to Telecoms, Singapore was the first country in the world to have a telephone system providing this facility. A CT2 service was announced in 1990 and a contract was signed with Motorola that May; testing of the service, known as "Callzone," involving 1,000 base stations, began in January 1991. Handsets must meet type-approval and be registered with Telecoms, but they can be supplied by any manufacturer.

Another development in Telecoms' radio service involves an October 1987 agreement by Telecoms, British Telecom International, and the Norwegian Telecommunications Administration to install the first worldwide aeronautical satellite telecom service; it enables air passengers and crews to make air-to-ground telephone calls and send telex messages and data to any destination in the world. Singapore's ground earth station on Sentosa will coordinate with similar stations in Goonhilly (United Kingdom) and Eik (Norway) to provide global coverage, using Inmarsat satellites above the Pacific, Atlantic, and Indian Oceans. The network can also be used to enable ground-control points to continuously monitor a plane's position, altitude, engine, fuel, and other operating data.

14.2.6 Postal Services

Despite the advent of telex, telephones, and computers offering instant communications, the postal system remains an important channel for sending messages. About 2.4 million mail items were processed each day by Singapore's postal services in 1990, not quite one item per person per day.

Following the merger of the Postal Services Department and Telecoms in October 1982, Telecoms progressively introduced a series of measures to counter the traditionally labor-intensive nature of the postal service. Computerization of post office counter services was immediately instituted. In January 1986 Telecoms embarked on a plan to install a frontline services computer system (FSCS) with point-of-sales terminals connected to a host.

In 1991, sixty-seven post offices and fifty-four suboffices provided full postal facilities and many agency services. The latter included collection of Telecoms bills, payment of Central Provident Fund and Medisave contributions, payment of civil and police pensions, renewals of licenses for dogs, radio and television, and driving, and sale of revenue stamps and bus concession stamps. Counter services at all post offices were fully computerized by 1990.

14.2.7 International Communications

To maintain and enhance its role as a global telecommunication center, Singapore has built an extensive international communication infrastructure, and has

been investing heavily in upgrading and expanding it. Satellites are an important component. The nation's first earth station was set up in 1971 at Sentosa Island. By 1988 the number of satellite circuits had leaped from 25 to 1,200, and links to other countries increased from five to fifty. The Sentosa station has two antennas carrying traffic between Singapore and the Indian and Pacific Ocean regions. In May 1987 a second, S\$65 million, station in Bukit Timah was officially opened. The station can accommodate as many as five antennas. Its initial 32-m antenna carries traffic between Singapore and twenty-seven countries in the Indian Ocean region through Intelsat. A 21-m antenna installed in 1988 connects with an Intelsat satellite above the Pacific.

In addition to satellite links, submarine cables are also important. The first was established in 1859 between Singapore and Jakarta and other places in Indonesia. By the early 1890s, a worldwide telegraph network was developed. Singapore has been an important submarine cable hub for the region for decades.

An ASEAN cable network links Singapore to Indonesia, the Philippines, Thailand, peninsular Malaysia, and Kuantan-Kuching. The cable to the Philippines connects to systems providing circuits to Taiwan, Japan, and the United States. At the international level Singapore is served by three interregional submarine networks:

1. The Southeast Asia-Middle East-Western Europe (SEA-ME-WE) Submarine Cable Network. Completed in June 1986, it links Singapore to France through landing points in Medan, Indonesia; Colombo, Sri Lanka; Djibouti; Jeddah, Saudi Arabia; Suez and Alexandria, Egypt; Palermo, Italy; and La Seyne-sur-mer, France.
2. The Singapore-Hong Kong-Taiwan (SIN-HON-TAI) Submarine Network. Completed in August 1986. It has a capacity of 1,380 circuits.
3. The Australia-Indonesia-Singapore (A-I-S) Submarine Cable Network. A two-segment system commissioned in July 1984 with a capacity of 1,380 channels; links Perth with Jakarta and Singapore.

Four new submarine cable systems are planned:

1. Singapore-Brunei. This U.S. \$50 million fiberoptic system with a capacity of 1,900 simultaneous conversations will stretch across the South China Sea. When completed, it will form part of the ASEAN-Pacific Optical Fiber Submarine Cable Network.
2. Guam-Philippines-Taiwan (G-P-T). Telecoms will invest \$8.5 million to carry telephone, telex, high-speed data, and video transmission.
3. Hong Kong-Japan-Korea (East Asia) System. Singapore signed an agreement in January 1988 to invest S\$5 million (out of a total cost of S\$324 million) to build and maintain the first fiberoptic submarine cable system in East Asia. The link will stretch 4,500 km and Singapore can hook up to it in Hong Kong through the existing SIN-HON-TAI network.
4. Indian Ocean-Commonwealth (IOCOM). Telecoms' investment in this

helps enhance Singapore's international communication capability and capacity.

Singapore cooperates with and participates in the deliberations of the global telecommunications community. At the international level, this is through membership in the International Telecommunication Union (ITU), International Telecommunication Satellite Organization (Intelsat), International Maritime Satellite Organization (Inmarsat), and Universal Postal Union (UPU). At the regional level, Singapore is a member of the Asia-Pacific Telecommunity (APT), ASEAN Cable Management Committee (ACMC), and the ASEAN Committee on Shipping and Transport and Communications. By 1987, Singapore had become the thirteenth largest user of Intelsat and one of its largest investors as well as the sixth largest investor in Inmarsat.

In early 1990 Telecoms broke tradition by abandoning revenue sharing calls with Brunei. Under a new agreement the originating telco keeps all the revenue. Later in the year a similar agreement was reached with Hong Kong. In both cases the calling balance has been about equal. Other such agreements may follow.

14.3 New Information Technology for an Information Society

Telecoms has long been committed to developing a modern telecommunications infrastructure in line with Singapore's efforts to enhance and consolidate its position as a center of trade, finance, and communications.

Over the years various telecommunications networks have mushroomed, each developed as a dedicated network specifically for a single service and thus each with unique characteristics. Attempts have been made to anticipate integration of future services into existing networks. Since the 1970s and especially during the 1980s, Telecoms has experimented with and developed several new technologies and networks with the potential to augment various existing ones. Significant among these are fiberoptics, Teleview and ISDN.

14.3.1 Fiberoptics

In 1977 Telecoms in cooperation with Fujitsu (its sole supplier of domestic-network digital switches until 1991) launched one of the first fiber optic trials to demonstrate the practicability, compatibility, and reliability of fiber optic transmission. Using feedback and experience gained from this field trial, a nationwide multipurpose fiber optic cable network was planned. It will accommodate growth of junction telephone traffic and serve as a backbone for ISDN.

Installation was carried out in two phases. Starting in mid-1983 the first phase aimed to provide high-capacity links among busy exchanges in Singapore. Telecoms provided the labor to lay, splice, and test the cable while Fujitsu, as cable supplier, handled overall supervision. The project was completed in 1984. With this experience Telecoms proceeded in May 1984 to implement

the second phase without external assistance. This phase, linking remaining exchanges, was completed in July 1987.

Singapore boasts one of the world's highest densities of fiberoptic utilization—over 21.5 km/km² in 1990, when there were an estimated 13,000 km of cable, up from over 10,000 km in July 1988.

Fiberoptics has not only equipped Telecoms with the ability to meet tremendous traffic exchange demand but has also helped relieve the aggravations of expanding underground infrastructure in an urban environment. Moreover, estimated direct cost-savings of S\$3 million was obtained from implementing fiberoptic systems instead of conventional copper cable. Wideband ISDN can be developed only when the copper-cable network is converted to fiber.

14.3.2 Videotex

Televue is the name given the videotex system. It is an electronic information system allowing interactive information retrieval. While working on the videotex principle, Televue uses a television channel for transmission instead of using only the telephone network, as is done in other countries, including Teletel in France, Prestel in the United Kingdom, Telidon in Canada, and Captain in Japan. A user needs an adapter attached to a color television monitor and an antenna connected to both the monitor and the telephone line to access Televue. Messages and instructions are carried over the telephone network, but requested information is returned either through a UHF television channel or the telephone network. The adapter picks up the information from the antenna, then decodes and displays it. This offers two advantages over other videotex systems: (1) using radio waves for transmission gives much clearer screens, and (2) the telephone line is not necessarily tied up once a selection has been made.

Telecoms first developed the concept through a joint research and development effort with an experienced partner, Marconi of the United Kingdom, under a February 1985 contract. This allowed technology transfer through Telecoms staff sent to Britain. It was also expected to generate spinoffs to boost the local information and software industries. With the introduction of Televue, the new market for electronic information is being opened. Companies dealing with information dissemination will gradually emerge to exploit the market. One example is Integrated Information Pty Ltd. (formerly the Yellow Pages Company), which distributes its telephone and yellow pages directories through Televue.

In mid-1988, Telecoms began a two-year field trial of Televue involving about 1,000 business and residential users. On completion of the trial and a determination that the project's benefits are worthwhile, Singapore Telecom launched the service on commercial basis in 1990.

The project has attracted much public attention. Reasons include its ability to provide massive amounts of information and facilitate transactions of various sorts. The fact that it is a national network (the first of its kind) means Televue could have an impact on both businesses and individuals. Business transactions

and organization, family life and community activities, and even the political process of the city-state may be affected. This is an area that warrants close monitoring and careful research by social scientists.

14.3.3 Integrated Services Digital Network (ISDN)

Under the direction of ITU, the world's major suppliers have been cooperating in a worldwide effort to create an ISDN that can interactively transmit voice, high-speed data, and even video signals over one route to a single terminal. The first milestone was an official recommendation from CCITT and ITU in 1980; this was subsequently revised and adopted in October 1984. The idea of merging existing technologies to form integrated systems in Singapore was first explored by Telecoms in 1976.

As the name ISDN implies, the integration of telecom services presupposes the existence of a digital network, and that requires the entire copper-cable network be converted to fiberoptic cable at the subscriber level. In Singapore, digital switching was introduced in 1981, making the network capable of servicing both voice and nonvoice applications.

In December 1984 Telecoms proposed a series of field trials to assess ISDN feasibility. The trials consisted of four stages. During Stage I, which commenced in April 1985, Telecoms supported digital telephone with simultaneous facsimile and other data terminal communications. Stage II, started in October 1985, added nonpacket data terminal communication from ISDN subscribers to subscribers in the packet-switched data network. Stage III, which commenced in January 1986, saw provision of telex/teletex communication from ISDN subscribers to subscribers in the telex circuit switched data networks. The last stage, begun in July 1986, insured provision of packet communication with packet terminals from ISDN subscribers to subscribers in the packet switched data network.

Phone-Plus, introduced in 1979, was one of the new services considered a revenue source for funding ISDN development. Other value-added services included Telepac, Telebox, Flight Information Display Network, and Travelnet. Telecoms' new-business policy places greater emphasis on specialized communication needs of the business sector.

In line with this, Telecoms developed plans for integrated telemetering (automated and remote reading of public utility meters), telealarm (remote fire and burglar alarm surveillance), and telecontrol (remote monitoring of lifts in high-rise buildings and remote control of electrical appliances at home).

14.4 Policy Issues and New Policy Directions

Responding to changing economic and technological conditions, Telecoms has adopted changes to its policies. This section discusses several major issues: revenues and pricing, the National Information Technology Plan (NITP), new policy orientations, and liberalization and privatization.

14.4.1 Revenues and Pricing Policies

The consensus in Singapore is that it is not economically feasible to maintain more than one telecommunication enterprise in the country's small domestic market: The ultimate result would be a natural monopoly after some wasteful competition. Moreover, telecommunications being a basic service, it has been judged necessary to entrust it to a state-run monopoly. The considerations are not exclusively economic. Thus two local economists observe that,

Besides the public good and externality arguments, security and assurance in supply, and avoidance of wasteful competition in terms of scarce resources, especially of land, equity and even profitability may be further rationales. It is also the typical interventionist style of the government to establish public enterprises wherever and whenever private initiatives are deemed lacking (Toh and Low 1989, p. 9).

Singapore Telecom has enjoyed growing operating revenue and generated an increasing surplus over the years (Table 14.2). Thus, in the decade through 1990–1991 operating revenue increased more than 129 percent and total surplus grew over 174 percent. This was achieved in spite of a series of rate reductions. It is obvious Singapore Telecom enjoys a strong financial position, which enables it to be totally self-reliant in upgrading infrastructure and funding R&D.

Telecoms initiated its first major rate reduction in April 1979. In explaining the rationale for the reduction, Ong Teng Cheong, then minister for communications, spoke of reductions in operating costs and highlighted the fact that lowering rates would enable Singapore to remain a competitive provider of

Table 14.2. Telecoms Operating Data, 1981–1990

Fiscal Year ^a	Operating Revenue	Operating Expenditure	Operating Surplus	Total Surplus ^b
1981	917.8	592.1	325.7	396.9
1982	1014.7	718.0	296.7	370.3
1983	1077.1	856.1	221.0	299.3
1984	1215.5	950.4	265.1	369.1
1985	1237.8	996.5	241.3	317.5
1986	1336.2	1045.3	290.9	367.7
1987	1508.7	1160.7	348.0	446.1
1988	1746.0	1252.8	493.2	620.2
1989	1944.8	1230.8	714.0	869.8
1990	2100.3	1271.5	828.8	1086.4

Source: Telecommunication Authority of Singapore *Annual Report*, p. 59.

All data include the postal service, which was merged in on Oct. 1, 1982. Amounts are given in S\$ thousand.

^aFiscal years ending Mar. 31 of following year.

^bTotal surplus is before exceptional items and contributions to the Consolidated Fund. In U.S. terminology, this is total income.

telecom services, thereby helping maintain its attractiveness as a place for investment as well as strengthen its position as a communication center.

It should also be noted that 1979 was the year a new economic policy—known as the “second industrial revolution”—was launched. Reducing rates was part of the new policy, which emphasizes technology upgrading and value-added products and services.

There were ten major rounds of rate reductions between 1979 and 1988, involving tariffs for IDD, telex, postal services, pagers, telephone, modems, and leased circuits. Of these, seven involved telex and IDD. As of 1988, international telephone and telex rates in Singapore were among the lowest in the world. For instance, a standard call to the United States was S\$3.00 per minute compared to the corresponding incoming rate of S\$4.04; for telex, it was S\$3.80 per minute outgoing, compared to S\$5.03 incoming. According to Telecoms, its rate reductions reflected the adoption of principles of equitable charging without cross subsidies between services. Telecoms also reported that the nine major revisions between 1979 and 1988 gave customers accumulated savings of about S\$2.4 billion.

The revision in 1979 saw reductions ranging from 7 to 43 percent for telexes sent to overseas destinations. The charging system for international telex was revised to blocks of six seconds instead of one-minute intervals effective November 1980. In 1988 telex rates to all destinations were an estimated one-fourth of those before April 1979.

IDD rate revisions were slightly more complicated because the structure was converted to a multitier system during the revision of April 1985. Prior to this, rates only varied according to destination, which led to underutilization of services during off-peak hours and weekends. IDD standard rates dropped slightly more than 50 percent between 1979 and 1988, while economy rates went down approximately 70 percent. For instance, an IDD call to Japan cost S\$7.50 a minute before April 1979, but only S\$3.00 at peak hours and S\$2.00 at off-peak hours in January 1988.

Rental rates for items like pagers, telephone extensions, and modems were reduced for the first time in 1985. Rental rates for extensions dropped 17–53 percent. A July 1988 rate revision reduced the price of telephones by up to 70 percent. Rental rates for modems were reduced 5–83 percent while those for pagers dropped 23–52 percent.

Telecoms rate reductions, it should be noted, have not led to reductions of total revenues; instead, they have stimulated traffic. This is especially evident in the case of IDD services; traffic has consistently increased, and revenues grew from S\$188 million in 1980–1981 to S\$365 million in 1986–1987.

Telecoms pricing principles appear to be based on cost recovery, whereby prices are set to insure net revenues cover operating expenditures and development of and improvements to the infrastructure. It has been hypothesized that a “slack pricing policy” is practiced because Telecoms does not necessarily charge the cheapest rates possible but sets them instead according to “what the market can bear, so long as they are among the most competitive” by

international standards (Toh and Low 1989, pp. 9–10). Even though it enjoys a monopolistic position, the authority has to take note of potential competitors in view of national development goals, while at the same time maximizing its surplus.

Until December 1991 domestic calls had no per unit cost. To a chorus of complaints, Telecoms then instituted time-based charges of S\$0.014 per minute (about 0.8 U.S. cents) for peak hours and half that other times. To keep the change revenue-neutral dial-tone charges were cut almost in half: A business line went from S\$290 to S\$150 a year, and residential lines went from S\$190 to S\$100. Telecoms maintains that 74 percent of traffic is generated by the top 30 percent of users, while the bottom 30 percent account for just 2.2 percent.

A residential customer can talk 107 hours a year at peak rates and still save money under the new scheme while for a business it is 166 hours; therefore, two-thirds of the customers are expected to see an overall decline in their bills. The company went as far as to promise to abandon the system if this was not true. The new pricing had been announced earlier in the year and was considered a factor in the decline in PAP's share of the vote in the September 1991 elections. (Opposition delayed implementation several months and led to a reduction in the originally planned S\$0.015 per peak minute rate.)

14.4.2 National Information Technology Plan (NITP)

To understand recent telecommunications policy developments in Singapore, it is important to view the formulation and implementation of the NITP in 1986 as a component of the national economic development program.

Singapore's NITP began as a modest scheme of national computerization. Having identified the computer services industry as a key to growth in the late 1970s, the government appointed a ministerial level Committee for National Computerization (CMC) in early 1980 to formulate a strategic master plan to build up computer expertise and to lay the foundation for an export-oriented software industry. In September 1981, at the recommendation of the CMC, the National Computer Board (NCB) was established under the Ministry of Finance. Its board of directors consisted of representatives from the National University of Singapore, the Economic Development Board (EDB), the Ministry of Education, the Ministry of Finance, the Singapore Computer Society, and the Singapore Federation of Computer Industry. Telecoms, however, was unrepresented, reflecting its limited concern with the computerization plan in its initial stage. Telecoms and NCB began to have cross-representation on their boards only in 1983.

While a national computerization plan was being implemented by the NCB, computer manufacturing still came under the purview of the EDB and development of the telecommunication infrastructure was under Telecoms. It was soon realized that the focus on computerization and the computer industry was too narrow and would be inadequate for fueling growth. Sometime before 1985 there was apparently a conscious policy shift from an emphasis on computerization to a more comprehensive and ambitious integrative plan to promote

information technology (IT) as an integral component of economic development. IT is defined as "the use of computer technology, telecommunications and office systems in all aspects of information flows—from collection and processing, to storage, packaging and dissemination" (MTI 1986). Telecommunications, therefore, became an integral part of the new push for IT development.

Recognizing the increasing importance of IT, a working committee initiated by the NCB that consisted of representatives from Telecoms, the EDB, and the National University of Singapore was set up in late 1984 "to examine and make recommendations for appropriate new policies and strategies on IT to support the economic and social development of Singapore in the next 10 years" (NCB 1985, p. vi; see also Kuo 1988).

NITP was formally announced in December 1986. It centered on two objectives (*Hello* 1986 Sep):

1. Encouragement of creative and strategic exploitation of IT as a tool for increasing productivity in all economic sectors. Companies should computerize and employ IT creatively in securing an edge on their competitors.
2. Promotion of IT as a new growth industry by training and upgrading local staff to a level of expertise sufficient to venture into areas such as applications and systems software services, value-added networks, and product development.

According to the NITP, information communication infrastructure is one of seven "building blocks" collectively forming an integrative IT strategy to achieve the goals of the NITP. (The other six are: IT manpower, IT culture, IT application, IT industry, climate for creativity and entrepreneurship, and coordination and collaboration.) Under NITP, NCB plays the coordinating role, and the plan itself becomes an integral component of the economic and industrial development plan, as spelled out in the report of the Economic Committee (MTI 1986).

While Telecoms was actively involved in the process of defining the NITP, it also went through a process of self evaluation and planning. It was urged to continue providing new services and developing and improving facilities to enhance the information infrastructure. In its five-year plan for 1987–1988 to 1992–1993 Telecoms confirms its support of NITP as one of its corporate strategies.

14.4.3 New Policy Orientations

In 1987–1988 Telecoms formulated development and management strategies and set new goals for development, including objectives and strategies, which have been compiled in its latest five-year plan (April 1987 through March 1993).

The plan begins by reconfirming a number of corporate objectives, including:

1. Make Singapore a communications, information, and knowledge center in the region and in the world.

2. Offer a comprehensive range of information communication services to meet the needs of customers and the public, and at a level of service comparable to the best in the world.
3. Develop telecommunications infrastructure and services to enhance the competitiveness of the business community in Singapore.

To achieve these objectives in a changing social, economic, and technological environment, some new emphases in terms of corporate strategy were identified.

The first significant strategic shift is from a production orientation to a market orientation. This was formally inaugurated in April 1989 with a restructuring (and renaming) of the company. Telecoms' division manager for telephone traffic-public message services marketing, Lim Shyong, traced the shift in marketing focus by pointing out that the "huge demand for basic services like telephone, telegram and telex in the early 1970s necessitated a production orientation. This was replaced by a market orientation [when] enhanced and value-added services came into demand. Simultaneously, a customer-oriented approach became the emphasis" (*Hello* June 1988). This includes plans to bridge the gap between technology and people. Thus, Singapore Telecom is building a demonstration center to give the public hands-on experience with yet-to-be marketed services and state-of-the-art prototypes (*Hello* July 1988).

Aiming to be more market driven, Telecoms is strengthening its international marketing activities to gain access to global markets. This is both desirable and necessary, since the long-run challenge for Singapore Telecom is to look beyond the domestic market for opportunities. One aspect of this is an increasing emphasis on consulting. Since January 1987 Telecoms has had a consultancy department to provide technical and management services. The main target market is overseas administrations and telcos. This is in line with the national aim to promote the services sector through exports of professional services to overseas organizations.

Consultancy services provided by Telecoms are of two main types, planning, and implementation and operations. The former includes corporate, network, equipment exchange, and outside-plant planning, as well as tender proposal and evaluation, engineering, and traffic studies. Implementation and operations includes systems implementation, operations, and maintenance as well as training.

Since consulting began operations in 1987, Telecoms has been approached by Fujitsu International Engineering to train the staff of its client, the People's Republic of China's Telecommunication Authority. Telecoms' training facilities and the Chinese language proficiency of its staff gave it an edge over others. Telecoms also negotiated and signed contracts with AT&T World Services to provide training consultancy services to their clients on specialized telephone switching equipment.

To cope with increased activities and demand for consulting, Telecoms in April 1988 also set up a wholly owned subsidiary, Singapore Telecom Inter-

national (STI), to offer services to its overseas counterparts and telcos. Having a group of multilingual professionals is an advantage, as Telecoms can service projects in various parts of the world. STI will conduct feasibility studies, prepare tender specifications, plan networks, implement, operate, and maintain equipment, and offer training.

Immediate plans are to market selectively in order to gain experience and build up a reputation of having served in less-advanced countries in order to qualify for international projects such as those of the World Bank and Asian Development Bank. Singapore's development experience is part of what Telecoms is selling.

14.4.4 Liberalization and Privatization

When Singapore experienced a recession in 1984–1985, a committee was formed to conduct a comprehensive overview of the economy and make recommendations for future development. Among the recommendations in its final report (MTI 1986) was a renewed endorsement of the philosophy that the private sector should be the main engine of growth.

The report made specific reference to Telecoms and highlighted the potential for the private sector to play a greater role in the sales and maintenance of terminal equipment (p. 185). The report stressed "Telecoms should continue to provide the basic telecommunication infrastructure," while saying "wherever possible, we should privatize the provision of telecommunication services" (p. 178). This privatization and liberalization policy, as it currently stands, does not extend to the management of basic infrastructure, which is to continue in government hands. As a unilateral policy-making body and sole regulator for telecommunication, Telecoms has had to take initiatives to provide momentum for liberalization.

Lam Chuan Leong, former general manager of Telecoms, outlined four key points of the liberalization policy in early 1987 (*Hello Mar.* 1987). These are: (1) customers may own terminal equipment, (2) customers may choose their maintenance contractor, (3) Telecoms will sell selected equipment in competition with other suppliers, and (4) Telecoms will offer services at economical and competitive rates. The policy was noticeable as early as 1986 when Telecoms allowed private ownership of pagers and fax equipment and the active participation of private firms in these markets.

Liberalization means Telecoms has to prove its efficiency by competing with the private sector. This will stimulate innovative provision of a variety of goods and boost growth of the product industry. It is obvious, however, that competition cannot be totally equal and fair because Telecoms still enjoys advantages based on economies of scale and its greater range of existing services and networks.

Effective March 1987 Telecoms allowed owners of PABX, key telephone systems (KTS) and multiline systems (MLS) who had purchased approved equipment from various suppliers to use third-party maintenance contractors.

PABX subscribers can continue to buy approved systems from various suppliers and choose either Telecoms or a third party to service the systems. They can also buy existing extension telephones from Telecoms at depreciated prices or continue to rent them and buy new extension telephones from other suppliers.

Rolm, Northern Telecom, and Philips responded by offering maintenance to their buyers. Northern Telecom built a S\$2 million service center as part of its "commitment to grow as an integral part of Singapore's business community" (*Business Times* May 19, 1987).

According to Telecoms' former general manager Lam Chuan Leong, allowing private maintenance of PABX, KTS, and MLS would mean a first-year loss of about S\$3 million for Telecoms and two or three times that in 1990. Maintenance of these systems generated S\$16.8 million in revenues in 1986.

In a further step toward an open-market environment, Telecoms ceased to rent pagers to new subscribers after February 1987 and introduced a three-year lease to own scheme for fax machines in March 1987. Faxes previously had to be rented from Telecoms; faxes can now also be bought privately.

A policy of liberalization and privatization in telecommunications is being implemented. In March 1987, a report by the Public Sector Divestment Committee (MOF 1987) recommended studies on the feasibility of divesting various operations of four statutory boards: the Public Utility Board (PUB), the Port of Singapore Authority (PSA), the Civil Aviation Authority of Singapore (CAAS), and Telecoms. Telecoms commissioned a foreign consultant to do a feasibility study.

Coopers and Lybrand's report suggested privatization was attractive because of increasing demand for international services. In November 1989 the government announced privatization would occur by 1992. It did not, but the process was underway. The principal incentive seems to be more a desire to increase the activity and capitalization of Singapore's stock market than to cut Telecoms loose from the government, and market doldrums have thus been an element in the delay. Another reason, stressed by Telecoms, is that the company's growth is limited within Singapore and as a private firm it would be in a better position to expand overseas, including joint ventures.

A second set of consultants was retained in 1990 to recommend the best approach to privatization. In spirited competition, Morgen-Grenfell Asia and Touche Ross won. Finally, in April 1992, the proposed structure was made public (Table 14.3).

The new companies will have at least fifteen years of monopoly. The Telecommunication Authority of Singapore Board will be the regulatory authority. It will be headed initially by a permanent secretary of the Communications Ministry and will include union and private-sector members. Nothing definite was said about how the sell-off will be conducted. There will probably be a series of stock offerings with foreigners able to participate. The government is expected to retain majority control.

Table 14.3. Singapore Telecom's Proposed Structure as a Private Company, 1992

MinCom Holdings (initially 100 percent owned by the Ministry of Finance)
will own 100 percent of
Singapore Telecommunications,
which will have the following six subsidiaries (all 100 percent owned except as noted):
Singapore Post (postal services)
Singapore Telecom Investments (portfolio investments)
Telecom Equipment (sales and maintenance of equipment)
Integrated Information (telephone directories and electronic information)
Singapore Telecom International (consulting)
Sembawang Cable Depot (already 40 percent owned by others; storage facilities for submarine cables)

14.5 Conclusion

It is evident that Singapore Telecom perceives its major objective to be to provide users with advanced telecom services that are also reliable and inexpensive. Measured by any reasonable yardstick, it has achieved this objective to the satisfaction of most of its clients. It has not for all, however: In late 1991, with Telecoms' belated support, a users group of some of the company's largest customers was formed to air complaints about customer service—generally centered on concerns with the attitude of Telecom employees and procedures.

Singapore is highly internationalized and the government makes a conscious effort to attract direct foreign investment. In response to the 1984 recession, the Economic Committee set up to review the economic situation and to recommend development strategies reconfirmed in its final report (MTI 1986) the need to develop Singapore as a regional and international center of trade, banking, and services. The government adheres to principles of free market and competition, yet at the same time is interventionist, justifying this on the basis of the nation's small, open, and vulnerable economy.

Telecoms has committed itself to playing a key role in the NITP, which is an integral part of Singapore's economic and industrial policy. This calls for central planning and effective coordination, which are in part possible due to Singapore's small size and the existence of a strong and efficient government.

An example of central planning and effective coordination is the formulation and implementation of the NITP under the National Computer Board, which falls under the purview of the Ministry of Finance. The Economic Development Board, which is responsible for the computer industry, comes under the Ministry of Trade and Industry, while Telecoms is responsible to the Ministry of Communication. To the extent that their defined domains and responsibilities overlap, there are areas of potential conflict and competition stemming from contradictory interest or genuine differences in policy positions. The situation could get complicated if the different ministries and statutory boards involved

strongly push policies that narrowly serve their own interest, possibly as a result of pressure from different economic sectors or interest groups, and if they ignore the interests of other government bodies or even broader national interests—economic, political, and social—as has been the case in many other countries.

In Singapore, the danger of potential clashes has been minimized because development plans are typically formulated centrally through participation of relevant ministries and statutory boards, as was the case with the NITP and the Economic Committee report. Moreover, implementation of such plans is closely monitored. Cross representation by a small number of ministers and chief executive officers on related committees and boards makes communication and coordination easy and effective. Major differences are settled at higher levels as necessary, with the cabinet being the highest of all. The government's role in central planning and policy implementation in the fields of telecommunications and IT development, as in other areas, is quite transparent.

With the liberalization trend in telecommunications, the private sector is certain to respond to expanding market opportunities. Equally important are the social and political implications of a more open and liberalized telecommunications system. These and other emergent issues should be closely monitored and researched while Singapore prepares itself for the twenty-first century and as the telecommunications sector in Singapore undergoes further structural and policy changes.

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In addition, a number of Singapore periodicals have been used that cover Singapore telecommunications on an ongoing basis. These include:

Business Times (newspaper)

Hello (newsletter from Telecoms, published monthly since 1973)

The Link (newsletter of the Union of Telecoms Employees of Singapore, published quarterly since 1982)

The Mirror (from the Ministry of Communication)

Straits Times (newspaper)