The Economic and Political Issues of Telecommunications in the Pacific Islands and the Phillipines

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Pacific Island Nations

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The concept of a Pacific Telecommunity is rapidly becoming a reality with the emergence of a vibrant region of enormous opportunity in business and equally significant potential in the conduct of everyday life. Communication and transportation technologies have globalized commerce and are integrating the countries and remote islands of the Pacific into a vital, synergetic region.

Pacific island nations (PINs) occupy less than 550,000 km^2 of land (about the same as France) scattered over fifty times as much ocean. The combined 1991 population of the Polynesian, Melanesian, and Micronesian islands was around 6.3 million (somewhat larger than Hong Kong), 62 percent of them in Papua New Guinea, which means only some 2.4 million elsewhere (slightly fewer than in Singapore). Many of the islands are north of the equator, although all are commonly called South Pacific; tropical Pacific is more accurate. They range in size from Papua New Guinea (PNG) which represents about 83 percent of the region's total land area, to Nauru and Niue, which are single raised coral islands. They all have growing populations, limited arable land, balanced budget problems, export earnings typically dependent on a single commodity, and burgeoning foreign aid dependency. These development problems have exacerbated the growing restiveness among the young, whose rising expectations are unlikely to be met.

The 1980s saw the rise of more assertive and nationalistic Pacific Island polities. National government is a relatively new concept to these islands. In 1962 Western Samoa became the first to achieve independence; Vanuatu was the last, in 1980. The forms of government vary, but they are largely modeled after those of the former colonial ruler. The governments and residents of the PINs are struggling to chart their own destiny. However, as they are well aware that as at best minor players in a global economy the task is, indeed, daunting.

Pacific Island countries, through such regional and international bodies as South Pacific Forum (SPF), South Pacific Telecommunications Development Program (SPTDP), and International Telecommunications Union (ITU), and through attendance at annual conferences such as the Pacific Telecommunications Council, have made it quite clear that telecommunications improvement

is a high priority. It is equally clear that because of limited resources, financial costs as well as opportunity costs present formidable obstacles requiring negotiation throughout the decision making process.

This chapter first analyzes the relationship between development and telecommunications, then takes up some of the common problems facing PINs, particularly financing development. The second section examines the existing structure and services of specific PINs, with special emphasis on the larger ones, Fiji, PNG, Guam and the Federated States of Micronesia. Restructuring the regulatory regimes of their PTTs is touched on in the third section.

The cost-effectiveness of satellites makes them a very important part of telecommunications for nations widely dispersed across numerous islands. The fourth section details the satellite options available and clarifies some of the supply-push evident in the region as the result of vendors from industrially advanced countries. The final section rounds up the discussion with a look at market expansion in the Pacific based on innovative technology and the changes in regulatory policy that such expansion entails.

9.1 Telecommunications and Development

The relationship between telecommunications and development has to be explored within the social, economic, geographic, and environmental context of the country for which policies are being devised. Numerous correlation analyses made in the 1970s suggest that telecommunications is a necessary part of development infrastructure and as important a component of investment planning as roads, power supply, and irrigation dams. The relationship between per capita GDP and teledensity was first demonstrated by Jipp (1963, pp. 199–201) and has since been known as Jipp's Law. While this provides a general insight into the relationship between economic well-being and telecommunications, correlation does not prove causality. However, most impact analyses have been based on Jipp's Law.

There have been studies in the 1980s to establish an interaction between telecommunications and other sectors that emphasized a specific production-function attribute of telecommunications. Among these, Gille's model (1986) provided a theoretical framework for examining the dynamics of telecommunications supply and demand. Originating from the work of Machlup (1962) and applied to the U.S. economy by Porat (1977), information sector analysis attempts to identify the contribution of the primary and secondary information sectors to gross national product (GNP). (The primary information sector comprises those industries producing or distributing information goods and services. The secondary sector refers to such activity *within* industries and government. Their contribution to GNP is, by definition of GNP, measured by their value added.) The impact of the information sector on the growth of 10 Pacific region countries has been examined by Jussawalla, Lamberton and Karunaratne (1988, pp. 15–63).

Although there is a correlation between the number of phones per capita and

GDP, the direction of causality (if any) is not clear. There are many other factors—such as management expertise, government and business organization, and adequacy of transport—that contribute to progress and prosperity. It is not easy to quantify the direct or indirect benefits of any telecommunications system. This is particularly true of externalities that are indirect and not related to the cost of investment. Studies of value-added by information-related activities to GDP in advanced countries indicate the contribution can be anywhere between 30 and 50 percent.

That there is a link between telecommunications and development is evident; the question is what it is and how it works. The benefits for education, emergency services, and social interaction that telecommunications confer are no longer questioned. The intangible benefits lie in shrinking distances, reducing the disparities between rural and urban areas, and enhancing the quality of life. Dramatic advances in information technology are opening up new opportunities for cultural and socioeconomic development unknown in the past.

Still, telecommunications is often considered a luxury compared to agriculture, water supply, and roads. This attitude is a blind spot in the planning process. The use of telecommunications in generating higher incomes and improving standards of living give it the characteristics of a public good capable of conferring direct and indirect benefits for society as a whole. For example, in PNG the Maitland Commission estimated 5 percent of telephone calls from rural and remote areas are for emergencies and medical reasons. In the South Pacific, the Peacesat network has been used to summon medical teams to deal with cholera outbreaks and to coordinate emergency assistance after typhoons. Losses incurred through lack of communication in some less-developed countries (LDCs) have also been estimated as being 110 times higher than the cost of providing adequate telephone service.

There is a clear-cut need for the development of economical thin-route (low traffic density) systems that will meet the urban as well as rural and remote communication needs of the islands. Developments such as demand assigned multiple access (DAMA) technology, very small aperture terminals (VSATS), and high-powered satellites designed for the Pacific may assist in making a thin-route system that is more efficient and complete and less costly in the long run. This is so because satellite communication per unit of message sent is cost insensitive over distance, and it is less costly than terrestrial channels for thin-route networks.

9.2 Generic Issues and Problems

Public telecom services in most PINs are provided by institutions that are part of government administrations or semi-autonomous enterprises. They generally have a monopoly for all domestic communication services and are responsible for government and regulatory functions such as licensing of private networks and radio spectrum management. Fiji has privatized.

The chief reason that these countries exercise tight control is the fact that

while the fixed investment is high, marginal costs decline with additional subscribers, yielding increasing returns to scale. The multiproduct nature of the monopoly enables it to derive economies of scope and scale. This, in turn, means the rate of return to the economy as a whole is high, sometimes 15 percent or more. Unfortunately, the returns from these monopolies are used to subsidize losses in the postal system or other government agencies; the profits are not ploughed back into modernizing or refurbishing equipment, with consequent deterioration in services.

Local, long distance, and international telephone services account for 80 percent of the sector's investments and revenues. Telex and facsimile services are being added even as telegraph and HF radio are being phased out. Data transmission is catching on with the introduction of Intelsat SuperVista services. Most of the islands invest less than 1 percent of their GDP on telecommunications. In 1986 investment by PTTs in telecommunications as a percentage of GDP was Fiji, 1.12 percent; PNG, 0.95 percent; and Federated States of Micronesia (FSM), 1.4 percent. This is inadequate to meet demand, so new applicants having to wait several years to obtain a connection.

Facilities in the PINs are inadequate even for the low levels of economic activity that currently characterize them. Internal networks between islands and between coastal and inland areas are poor, and high-frequency (HF) radio systems that are still in use are constrained by infrequent contact schedules and unfavorable atmospheric conditions. Teledensity is low. In general, services are clustered in their urban areas. Table 9.1 gives an overview of the region.

Urban–rural dichotomy is quite apparent in the archipelagic island countries. The bulk of the population is in rural areas where there is a chronic shortage of telephones. The PINs, with a total regional density of little more than three telephones per 100 persons, have an average urban–rural dichotomy of approximately 5:1, 7:1 including PNG. PNG rural callers often must travel 7 km or more to reach a telephone. The PTTs are anxious to keep up with digital technology and the emerging ISDN that business communities in the major urban areas desire, but this is only a remote possibility. At the same time, the PTTs are pressed by their respective governments to look for low-cost solutions to meet the POTS needs of the bulk of their largely remote and scattered population.

The institutional setup prefers urban over rural networks and gives preference to those parts of the business sector that actively contribute to the economy, such as trade, utilities, banking, and government administration. In the mid-1980s nearly 85 percent of telephone calls and revenues were generated by production and distribution systems in the economy.

Following the 1973 meeting of the SPF and the establishment of the South Pacific Bureau for Economic Cooperation (SPEC), the interconnection of the metropolitan centers of the island countries to the international telecommunications network had been of paramount importance in order to maintain trade links with major basin partners.

In 1921 Fiji became the first PIN to be connected with the global submarine cable network. With development of microwave radio, other islands in the Pa-

Table 9.1. Pacific Islands Telephones, 1990

Population (in thousands)	Telephones	Density[a]	Wait List[b]	Government Ownership[c]	Country
18.5	2,540	13.7	245	60	Cook Islands
112.0	2,400	2.1	700	100[d]	Federated States of Micronesia
726.0	68,532	9.4	11,500	100[d]	Fiji
68.8	1,130	1.6	133	100[d]	Kiribati
42.1	1,193	2.8	1,500	25[e]	Marshall Islands
9.1	1,600	17.7	160	100	Nauru
2.3	390	17.2	---	100	Niue
3,600.0	73,068	2.0	1,491	100[f]	Papua New Guinea
329.0	5,976	1.8	130	60	Solomon Islands
95.8	3,984	4.2	680	100[d]	Tonga
8.6	150	1.7	60	100	Tuvalu
159.8	6,480	4.1	88	51	Vanuata
182.0	4,335	2.4	2,600	100	Western Samoa

Source: South Pacific Forum *Regional Telecommunications Report* 1991.

[a]Telephones per 100 people.

[b]Length of waiting list for telephone service.

[c]Percentage of telephone operations owned by government.

[d]The telecom authority has been "corporatized" to operate as a state-owned enterprise, generally as part of a process that will lead to privatization.

[e]In December 1991 75 percent of the Marshall Islands National Telecommunications Authority was sold to the public; the government retains a 25 percent share.

[f]The Post and Telecommunications Corp has been an "independent" body since 1982, but the PNG government owns all the shares and appoints all eight directors.

cific developed microwave links, but, for the most part, the availability of communications is proportionate to the distance from urban centers. By 1980 it had become apparent that development without a rural focus was accentuating an already exacerbated urban–rural dichotomy. Therefore, in 1983 the SPF established the SPTDP to upgrade national telecommunications using suitable satellite options and to coordinate the provision of reliable service to rural areas. SPTDP emphasized that undersea cables reach only metropolitan port centers while thin-route communication were consequently being neglected.

As telecommunications becomes more technologically complex and pervasive, it is becoming increasingly difficult to manage. This manifests itself in the lack of skilled local technical and middle and higher-management personnel in most PINs. These countries see a need to change this situation.

9.2.1 *Financing*

Financing is an important issue. There is a wide misconception among PIN governments that telecommunications is a lucrative business able to subsidize other government functions. Use of the telco as a taxing agency for capital rationing should be out of the question for these island nations. Their mission

should instead be to provide basic universal service at low cost to remote areas and to pass this burden on to corporate users through higher tariffs on urban usage. In some of the PINs, even this causes income inequity since urban incomes are too low to bear the cost of subsidy. While privatization may help reduce the cash-cow role, it is unlikely to bring rural areas within the ambit of the networks without government intervention and subsidy support. The major need is to simplify the relationship between the PTT and the government and, as in the case of PNG, contribute to government revenues. The tax base is too fragile even for cross subsidies between classes of services. Taxing company or high-income classes of users is precluded because of their political support of the government.

A major hurdle to infrastructure development is the capital-intensive nature of the technology and the foreign exchange allocations required. One option may lie in sharing hardware costs such as the leasing of transponders on Palapa by ASEAN countries or leasing Intelsat transponders for domestic use.

A further problem is that a large part—generally at least 60 percent—of telecommunications infrastructure investment must be in scarce foreign currency. Export earnings are low and returns on telecommunications investment are received in local currency. Several factors help mitigate this challenge. Telecommunications generate wealth by contributing to economic activity. A dynamic rate of innovation in the industry rapidly drives down both fixed and operating unit costs. Equipment suppliers are aware that LDCs represent a potentially large market, which motivates them to offer favorable credit terms. Additionally, because markets in technologically advanced countries are characterized by surplus supplies, LDC buyers are in a strong position to obtain equipment at lower prices. Nevertheless, LDCs need concessionary financing.

For a commercially oriented operation, users are expected to pay their own way and contribute to general overhead and profit. This is possible in metropolitan centers and for international services, but not for satisfying the communication needs of rural dwellers.

A high percentage of the population in the Pacific Islands do not have access to basic telecom services, which should increase the relative value of new systems reaching them. Even so, the gap between the information rich and information poor may continue to widen simply because the problem is larger and runs deeper than economics. The gap is a function of the utilization of information flows, which in turn is determined by variables like history and culture.

One financial consideration is the fact that cost allocation to different services is a problem that defies solution, especially when a monopoly has to be sustained.

Intraregional trade should not be based on comparative advantage because the islands produce and export similar commodities. Their regional markets need to be integrated with global ones, a development necessitating a reliable communications system.

The major sources have been bilateral government aid, supplier credits, commercial banks, and multinational financial institutions. All of these are limited or come with strings attached. The Japanese government and hardware sup-

pliers have shown interest in funding since the mid-1980s. Both the World Bank and the Asian Development Bank have been reluctant to lend for such technologies as satellite networks, earth stations, and broadcast transmitters. In any case, the World Bank allocates only 2 percent of its loans to telecommunications. Australia is a major contributor—it funds over half of PNG's investment budget. The 1987 coup in Fiji occasioned withdrawal of lending agencies based on fears of political instability and expropriation.

In the World Bank scheme of things about 45 percent of project financing has to be generated by the government or the borrowing entity and it expects the tariff structure in the borrowing country to generate funds for networks expansion. This is next to impossible in the low-income economies of the PINs, where incomes are not high enough to provide revenues for both expansion and cross subsidy even in urban centers.

Under the SPTDP plan, automatic exchange equipment is now being purchased for local networks along with small digital telex exchanges. The UNDP/ITU Manpower and Training Needs Program is providing each PIN with its training requirements for ten years (through the mid-1990s). It is arguably cost effective for PINs to invest in the latest digitized exchanges as this saves on manpower and maintenance costs. Current equipment is generally outmoded and obsolete, and was supplied at the expense of the former colonial government, so scrapping it is not a "loss."

Financial constraints on telecommunications development have also been mitigated by satellite technology. With appropriate organization, PINs can have economical, financially affordable networks. The only missing factor seems to be organization at the government and private sector levels capable of providing the financial and technical inputs needed to use the technology successfully.

Table 9.2 provides data in projects and programs planned in PINs during the 1990s.

9.3 Service and Structure in Specific PINs

This section looks at four PINs—Papua New Guinea, Fiji, Guam, and the Federated States of Micronesia—in some detail, and provides brief background on a number of others. Most PINs have PTTs as monopoly national carriers. They all use Intelsat through earth stations in each country for international communications as shown in Table 9.3.

9.3.1 Papua New Guinea

Located north of Australia and just below the equator, most of PNG is on the island of New Guinea, which it shares with Indonesia. This main island is divided from north to south by a high chain of mountains, giving its two halves vastly different cultures. PNG was granted independence from Australia in 1975. With a population of 3.9 million (July 1991) and a total area of 462,000 km^2

Table 9.2. 1990 Estimates of Expenditures on Telecommunications Projects by Pacific Island Nations to 2000*

Central Office	Outside Plant[a]	Outer Islands	Satellite[b]	Total	Country
740	1,000	2,567	5,600	24,907[c]	Cook Islands
—	—	—	—	41,000[d]	Federated States of Micronesia
3,507	3,987	4,543	4,857	16,894	Kiribati
4,790	6,045	3,796	4,600	19,231[e]	Marshall Islands
86	247	—	—	333[f]	Niue
1,570	864	341	1,570	4,345	Tonga
448	424	240	2,524	3,636[g]	Tuvalu
—	—	6,200[h]	3,200[i]	9,400	Western Samoa

Source: South Pacific Forum *Regional Telecommunications Report* 1991.

*Expenditures given in U.S.$ thousands.

[a]On main islands or in major urban centers; outer islands are in column 3.

[b]Facilities for international and domestic service. Some satellite expenditures are included as outside plant or outer island networks.

[c]Includes $15 million from the Asian Development Bank that will be used mostly for outer island facilities; a detailed breakdown is not available. Excludes compensation to Cable & Wireless for the takeover of its facilities by Cook Islands Telecom in late 1991; the amount is in arbitration.

[d]Loan from U.S. Rural Electrification Authority to FSMTC; breakdown not available.

[e]Includes $18 million loan from US Rural Electrification Authority.

[f]Excludes $510,000 being sought for various purposes, including expanding satellite station capacity from six to twelve international circuits.

[g]To 1998.

[h]Includes a 13-m Standard A earth station under Lome III (the EEC regional aid program), which in 1991 replaced a Std B station.

[i]Proposed project using a Japanese grant to provide 261 phone lines in fifty villages.

(slightly larger than California), PNG encompasses 1,300 islands. PNG has concentrated its telecommunications networks in Port Moresby, the capital.

Domestic operations are a state-owned monopoly of the Posts and Telecommunication Corporation (PTC). The PTC operates as a commercial entity with a ministry in charge of overall regulatory functions. As such, it makes money: For 1985, the return on investment was 9.1 percent with operating profits of 7.1 million kina (U.S.$1 = 1.0 kina in 1985, 1.05 in 1990; unless otherwise indicated, data are in U.S. dollars).

The prospects for liberalization or privatization are mixed. Demand in the thin-route areas is not backed by purchasing power so the beneficiaries of competitive prices are likely to be the urban elite and owners of mines and plantations. Expatriates are more likely to gain from privatization than are local inhabitants. This argues against privatizing PTC.

Services reflect early concentration in establishing a basic network that services mainly government (24 percent of telephones) and business users (47 percent). During the 1990s a surge in demand is expected from the rural, loosely organized cash crop sector. It is primarily involved in the cultivation of coffee

Table 9.3. Intelsat Earth Stations in the Pacific Islands

Country	Location	Type	Installed	Owner
Cook Islands	Rarotonga	Std B	1980	CITC[a]
Federated States of Micronesia	Yap, Chuuk, Pohnpei, Kosrae	Std B	1983	FSMTC[b]
Fiji	Wailoku	Std A	1975 (Decommissioned 1987)	
	Vatugaqa	Std A[c]	1987	FINTEL
Kiribati	Tarawa	Std B	1983	Kiribati Telecom
Marshall Islands	Majuro, Ebeye	Std B	1983	NTA[d]
Nauru	Yaren District	Std B	1975	Directorate of Telecoms
Niue	Alofi	Std D1	1989	Post & Telcoms
Papua New Guinea	Port Moresby	Std B	1985	Post & Telecommunications Corp (PTC)
Solomon Islands	Honiara	Std B	1975	Solomon Telekom Co. Ltd. (STCL)
Tonga	Nuku'alofa	Std B	1975	Cable & Wireless
Tuvalu	Funafuti	Std D1	1990	Telecoms Dept
Vanuata	Port Vila	Std B	1979	Vanitel
Western Samoa	Afiamalu	Std B	1980 (Decommissioned 1991)	
	Maluafou	Std A[c]	1991	Post & Telecoms

Source: South Pacific Forum *Regional Telecommunications Report* 1991.

[a]Cook Islands Telecommunications Corp (CITC) took over the operation of the international gateway from Cable & Wireless in 1991.

[b]FSMTC purchased the four earth stations, which were originally installed and operated by Comsat, in 1988.

[c]New 13-m Intelsat Standard A.

[d]The National Telecommunications Authority (NTA) purchased the two Comsat earth stations in 1987.

in the Highlands area of the main island, where the bulk of PNG's population resides.

The backbone of the network is a series of microwave links providing communications to the main urban centers. Consisting of over 100 towers with solar-powered repeaters on mountaintops throughout the rugged Owen Stanley Range, they are in many cases accessible only by helicopter. The towers are popular targets for attack by villagers with grievances or land compensation claims, as this is one of the few concrete ways they can express their anger with the government. The entire network is thus quite vulnerable. The towers vary in age from obsolete Italian equipment installed prior to 1971 to French equipment installed in 1985.

Telephone service is provided through fifty-two exchanges (1988), the majority of electromechanical designs are no longer manufactured and are thus difficult and expensive to maintain. They provide telephone service to nearly 30,000 subscribers, the majority in urban areas.

National and international STD are available to 97 percent of subscribers. Rural subscribers too remote to connect to the network directly are served by

HF radio telephone links through number of control centers that are manually connected to the network.

International telecommunications are provided by approximately 125 submarine circuits through a connection at Lae and seventy-four satellite circuits through an Intelsat B standard earth station located at Gerehu (near Port Moresby) that became operational in 1985 and was financed by an EEC loan under the Lome II Convention. PNG also utilizes the Intelsat station for direct telephone circuits to twelve domestic destinations.

Perhaps the most obvious change during the 1980s relates to the relationship between the government and the PTC. In June 1982 the then Department of Public Utilities was established as a commercial statutory authority whose functions and objectives were specified in an Act. The immediate impact of this was to free the corporation from the normally bureaucratic budgetary process. Assets and liabilities were transferred to PTC. Private sector expertise at management and board levels was secured, and the government limited its board representation to no more than two of eight members. In addition to its responsibility of providing service, the corporation was also required to operate more commercially.

While there were reservations about some of the elements of the relationship with the government, the impact on PTC has been quite dramatic. The "public sector" mentality has given way to more commercially oriented decision-making processes. This is reflected in profits before interest and taxes, which increased from 6.0 million kina in 1984 to a record 17.2 million in 1988. Increased profitability was achieved with a minimum of tariff increases, and these were below the inflation rate over the same period. Operating costs increased more slowly than revenues, and PTC was able to secure greater utilization of its assets. PTC's financial rate of return increased from 7.8 to 14.8 percent. PTC's capacity to undertake investments, secure commercial loans and service its debts likewise increased.

From nil receipts in 1983, the government received K32.5 million from corporate taxes, dividends and repayment of government advances over the next five years. Dialog between the government and PTC improved dramatically, especially with the submission of and agreements on a five-year development plan for PTC. A host of programs are contained in the plan, including village pay phones, digitalization, trunk and junction upgrades, mobile radio, and data communication.

The number of telephone subscribers grew from 25,179 in 1983 to 30,993 in 1988 while international subscribers increased proportionately from 10.9 to 12.6 percent. Nontraditional services were introduced—facsimile, satellite, mobile, data, and postal money orders.

PNG utilizes the Intelsat system to provide direct telephone circuits to twelve destinations via the Standard B earth station in Gerehu. Inmarsat facilities are available for five remote site applications using land-based, ship-type earth stations. These have been successfully used to support major infrastructure projects in remote centers such as the Misima and Porgera Gold Mine and the British Petroleum oil exploration.

During the early 1990s PTC plans to expand the use of satellite facilities to include rural applications through Pacstar. This project was developed in response to expanded user demand for regional and domestic communications services in the Pacific. A major advantage of the system is its use of highly concentrated spot beams and of smaller, inexpensive, on-premises earth stations at cheaper overall transponder cost for a given bandwidth. The system also uses C band that is largely unaffected by tropical rain and does not require ground stations to track the satellite. The Pacstar project was expected to be operational by 1991–1992, but remains only on paper.

9.3.2 *Fiji*

Fiji is the second largest of the PINS with 744,000 people (1991), not quite one-third of the non-PNG regional total. Among the PINs, it has a relatively diversified industrial base. It is able to supply textiles, paper, chemicals, and metals to the domestic markets. Sugar accounts for almost half of its exports; another 10 percent of export earnings come from seafood, and 9 percent from copra and coconut oil. Tourism is another major determinant of Fiji's prosperity. Indians who originally came to work sugar plantations slightly outnumber ethnic Fijians. Just before the 1987 coups, Fiji's eighth development plan (1981–1985) had provided a blueprint for coordinating national resource allocation with the objective of diversifying the economic base.

The Department of Posts and Telecommunications (DPT), under the Ministry of Works and Communications, handles domestic service. Fiji International Telecommunications Ltd. (FINTEL)—51 percent owned by the government and 49 percent by Cable & Wireless—has provided international service since its inception in 1976.

Fiji has the most advanced system in the region; automatic direct dialing exchanges are available on the main island of Viti Levu, and the outer islands are reached either by microwave trunk telephone or HF radio. Since independence in 1970, the major objectives of DPT have been the expansion and upgrading of telecom services to meet public demand and the improvement and expansion of services to rural areas. Nonetheless, the telephone system is antiquated and stretched to its limits. Moreover, it has only slowly increased telephone connections, resulting in a large unfulfilled, registered demand.

This is partly due to the high level of rehabilitation work necessary after typhoons—five in 1986 alone—and partly to the difficulty experienced in obtaining a suitable make of telephone to replace the model that was widely used previously but is now no longer manufactured. New systems have to be able to withstand sudden climatic changes and power failures.

Major developments envisioned during the 1990s are an annual investment growth of approximately 5 percent, which means an increase of 26,000 lines in exchange capacity, a 14,500 increase in subscribers to reduce the waiting list for telephone service, a 150 increase in telex subscribers, and the acceleration of development and improvement of services in rural areas. The increase in exchange capacity includes opening new automatic exchanges in urban and

semiurban areas and the upgrading of the existing trunk network with the provision of alternative routes to avoid disruption in times of natural disasters.

DPT estimates 73 percent of the capital budget requirements will be generated from internal revenues while the remaining 27 percent will come from loan finance and development grants. However, this ambitious development plan has been put on hold due to the adverse economic conditions resulting from the military coups of May and September 1987. With a prolonged drought that adversely affected sugar planting, a 30 percent devaluation of the Fiji dollar, a decline in investor confidence, a substantial drop in tourism (Fiji's major foreign exchange earner), nonrenewal of expatriate contracts for skilled and managerial personnel, and the withdrawal of a majority of Fiji's overseas direct aid as an official expression of donor disapproval of the coups, developments will likely lag far behind projected growth rates and remain sluggish into the 1990s, although both tourism and sugar rebounded in 1989. (For more on this, see Jussawalla and Ogden 1989.)

9.3.2.1 International Connections

From 1963 to 1964, for technical and strategic reasons, the Pacific section of the Commonwealth round-the-world cable system, Compac, was required to have a shore-based repeating station in Fiji, adding to the island's long-established international links. Compac has given Fiji high-quality links to the rest of the world.

An Intelsat Standard A earth station was built at Wailoku in 1976. In 1987, this then-outmoded station was replaced by a smaller Standard A one in Vatuwaga, with an expected life of fifteen years. Both stations have been built, maintained, and operated by FINTEL.

FINTEL also operates the submarine coaxial cable terminal at Vatuwaga. FINTEL's largest single investment, $7.59 million, has been in the Anzcan trans-Pacific cable, which is owned by twenty-two organizations from fourteen countries with an overall installed cost of more than $300 million. The cable links Fiji to Australia, New Zealand, Hawaii, and Canada. Worldwide telecommunications are provided through direct circuits and utilization of several overseas switching centers. In addition to telephone, telex, and telegraph services, FINTEL also provides leased circuits, data, and facsimile (bureaufax) services.

9.3.3 Guam

Historically, Guam's economy exhibits a boom or bust pattern dependent on military spending levels and on Japanese government policies on trade, how much money its citizens can take abroad, and frequency of flights; hence, it is largely dependent on external revenue and political decisions outside its control.

The public sector employed approximately half the labor force from World War II until 1989. In view of cutbacks in federal spending and a desire to obtain Commonwealth status with the United States, which would eliminate many federal jobs, employment opportunities need to be created in the private

sector, which, at present, appears unable to absorb any major labor shift. However, the basic underpinning of U.S. military expenditures remains strong, and Guam was in a growth phase in the late 1980s.

The Guam Telephone Authority (GTA) became an autonomous statutory agency owned by the government of Guam in 1974. GTA inherited the telephone system created by the U.S. Navy (which administered the island until 1950 when Guam became an Unincorporated Territory of the United States). It was inefficient, undercapitalized and in need of upgrading. Work commenced through the use of a $27.5 million loan form the U.S. Rural Electrification Administration (REA). The result was an 8 percent increase in the number of primary lines in use and a subscriber base of 28,973 (1987).

Due in part to poor planning and underanticipated growth in the Aganan and Tamuning areas, the exchange capacity of these government and business districts was quickly overloaded, resulting in a thirty-minute wait for a clear line into or out of these areas at times during peak business hours. In 1985 total revenues increased by 6.5 percent, but total installations decreased by 0.4 percent, with the reductions coming primarily from business and government lines.

The situation has not improved much since 1985, although GTA received an additional $24 million REA loan to fund projects to increase network capacity and versatility. Some of the planned developments in the 1990s include digital central offices in Agana, Tumon and Talofofo. Automatic number identification digital systems in all central switching offices and extensive line extensions into semiurban and urban subdivisions are also being planned. In anticipation of increased demand for high-quality transmission, a fiberoptic cable loop is planned to connect central switching offices.

Guam, due to its strategic position, has excellent worldwide telecom service through undersea cables (TPC-2&3, and the 40,000-circuit TPC-4 fiberoptic cable that became operational in 1989) and satellite. Overseas connections are provided by RCA Global Communications (purchased by MCI in 1987), which owns and operates the Pulantat earth station facilities, and by Island Telecommunications and Engineering Corp (IT&E), a discount resell service. RCA installed a $3 million international digital telephones switching system in 1985 to increase call capacity some 350 percent. When connected to the local digital system being installed by GTA, subscribers and RCA customers will be able to direct dial without entering authorization codes.

A proposal by McCaw Space Technologies to construct, launch, and operate the Celstar International Satellite System will help keep Guam a hub of international communications, as discussed later.

9.3.4 Federated States of Micronesia (FSM)

A report by the U.S. National Telecommunications and Information Administration (NTIA 1986) focused on the cooperative provision of telecom services to the islands of Micronesia by a nonprofit organization called Sky Channel (Pacific) that was based in Guam. In August 1986, Sky Channel was awarded a $2 million grant from the Public Telecommunications Facilities Program of

the U.S. Department of Commerce and the NTIA to conduct a feasibility study for the improvement of broadcast services throughout Micronesia.

The approach taken by Sky Channel has been to provide broadcasting capacity as well as specialized point-to-multipoint interactive services for Micronesia. The needs determination conducted in the 1980s placed heavy emphasis on instructional uses and provision of health, social services and public safety networks via radio or television.

When it was part of the Trust Territory of the Pacific Islands (TTPI), the telecommunications system in FSM consisted of little more than a group of HF radio links between Saipan (the administrative center) and the outlying districts, supplemented by very small telephone exchanges in the administrative centers and unreliable radio links to the outer island. Dial telephones were introduced around 1970 and international and interstate calls were nearly impossible to make because of overcrowded lines and extremely poor transmission quality. FSM has about 108,000 people (1991) and 100 islands totaling 702 km^2.

The FSM Telecommunications Corporation (FSMTC) was established in 1981 as a public, statutory corporation and became fully operational in 1983 with consolidation of the telephone and telegraph subsystems in each state under its operating organization. FSMTC operates as the sole provider of telecom services within the FSM with the exception of the state-operated radio broadcasting stations. Telephone subscribers total only 1,350 (1986) and are restricted to the main administrative centers of each state.

The exchanges are in varying stages of degradation and in need of modernization, particularly in Pohnpei and Truk, where most of the population resides. Moreover, these exchanges are saturated, making it impossible to serve more subscribers even though there is a demand for additional lines. The exchanges are for the most part mechanical relay switches that are no longer manufactured. Parts required to maintain them are typically cannibalized from other units. In some cases, as in Kosrae, newer, electronic exchanges are in use. However, these units were designed primarily as hotel switchboards and are therefore not equipped with the operational functions essential for proper management, control, and service.

Services to almost all the inhabited outer islands are provided primarily by means of HF single side-band (SSB) radios. This system is divided into three state subsystems with control centers located at the Pohnpei, Truk, and Yap stations.

In 1982 an agreement was entered with Comsat for provision of Standard B satellite earth stations in Yao, Truk, Pohnpei, and Kosrae. The stations became operational in 1983 and linked the FSM to the Intelsat system, providing international connections through stations in Pohnpei and Truk. This has resulted in very high-quality interstate and international telephone service, although international STD is still not available.

Because the terrestrial systems connected to the satellite stations are of poor quality, FSMTC has developed and begun to implement a comprehensive system expansion aimed primarily at providing state-of-the-art service nationwide

by the early 1990s. Major funding is being provided by an REA loan of about $41 million at 5 percent interest for thirty-two years.

The program is expected to expand the subscriber network to accommodate around 7,000 users served by thirty-one digital exchanges, including replacement of the four existing exchanges. Complete replacement of the existing terrestrial system is planned, including the installation of approximately 1,300 km of cable, 650 km of microwave carrier links, twenty-one satellite earth stations in the outer islands, and a large amount of digital radio transmission and subscriber premises equipment.

9.3.5 The Smaller PINs

In the Solomon Islands, Cable & Wireless provides international carrier service through 51 percent-owned SOLTEL. The government owns the other 49 percent. SOLTEL has been operating since 1978. Domestic service is provided by the PTT both through automatic telephone exchanges and HF radio telephone links to all the islands. There are domestic and international (via Sydney) HF radio telephone links.

Since 1984 Tonga has provided domestic services through the Tongan Telecommunications Commission, which is responsible for all domestic services and is part of the Telegraph and Telephone Department. International services are provided by Cable & Wireless under a ten-year franchise to operate the Intelsat earth station. The franchise expired in 1992. The government obtained satellite orbital slot approval from IFRB and in 1991 Tongasat was in business.

Vanuatu (the New Hebrides) Postal Department planned to develop a telephone trunk network in 1970 at a time when only two manually switched HF channels were available between Port Vila and Luganville. Its telecommunications requirements were met by a conglomeration of private, public and government low grade radio networks, mostly HF, developed to meet the needs of commerce, shipping and aviation and public requirements. The government hired W. D. Scott and Co. to provide a study of demand for the islands, and their report was submitted at the end of 1978. The spine link between Vila and Luganville has been upgraded and served by automatic telephone exchanges while HF radio transceivers are used for inland communications. Overseas radio telephone service is provided with links to Australia, Fiji, New Caledonia and, Hong Kong. VANITEL (Vanuatu International Communications Ltd.), established in 1979, is jointly owned by Cable & Wireless and Cables et Radio (France).

In Western Samoa, both domestic and international services are provided by the General Post Office (GPO). Automatic telephone services are supplied in Apia, the capital. HF radio is used to link New Zealand and American Samoa. The Afiamalu earth station is currently overloaded and is scheduled to be expanded.

There are significant disparities in domestic services available in the various current and former U.S.-administered islands. Capacity is adequate in Ameri-

can Samoa. In the former Trust Territory, except for the Northern Marianas, service is poor and falls short of current demand. This is especially so in the Marshall Islands, although it has included provisions for upgrading telecommunications in its long-term plans (OTA 1987). Telephone penetration per capita is low, and there exists a wide disparity between the services available in urban areas and those available in rural areas. Equipment is outdated and poorly maintained. In April 1985 a team from the U.S. government and telecommunications industry visited three of the four former trust territories—the FSM, the Republic of the Marshall Islands and the Republic of Palau—to evaluate existing facilities and to assess the requirements for telecommunications development of these islands (NTIA 1985).

9.4 Institutional Restructuring

The problems faced by these PTTs stem from lack of financial and administrative autonomy, while government ownership prevents tariffs from reflecting costs. On average, an additional telephone line requires a $2,000 investment, over half going to imported equipment. PTTs are denied permission to raise funds in capital markets despite the profitability of their enterprise. Government ownership often results in poor management, high operating costs and poor maintenance of equipment. On the whole, the gap between supply and demand for basic services continues to widen.

The South Pacific Commission (SPC) is well aware that shifts in the institutional setup are called for. A distancing of the PTT from the government and the introduction of private enterprise and mixed or joint ventures with the state will provide greater flexibility and efficiency. The real need has arisen because these islands are opening up to data communications with services like Intelsat Vista and SuperVista, Intelnet, and VSAT technology. Consequently, administrative procedures designed for government are not useful for managing technology intensive, dynamic services. If PTTs are still required to operate like petty fiefdoms, benefits of value-added networks and fiber optics to link rural areas will not be available to them.

In its long-range development plan the SPTDP wishes to avail itself of digitization and sophisticated systems. It has a sizable investment program that calls for greater autonomy and commercial practices for the organizations supplying these services. Such autonomy will enable them to operate more independently within a broad framework of government policy and regulatory guidelines. The main argument favoring autonomy is that the commercially operated supplier of basic and enhanced services will be able to reinvest in telecommunications rather than subsidizing other government agencies. Fiji set a lead in this direction by permitting 49 percent of FINTEL's shares to be owned by Cable & Wireless.

Such an institutional restructuring allows the monopoly supplier to concentrate on the larger task of improving and installing a countrywide infrastructure of basic services and mobilizing additional resources for expansion. Such a

policy will generate higher incomes and employment and also help attract investment to remote areas and stem the tide of migrants to the urban centers.

In the PINs, there is an acute shortage of thin-route telephony. This reflects the fact a subsidy has to be worked into the tariff to provide service in remote regions. Charges should take into consideration the fact telephone tariffs must offer a viable alternative to HF radio, which has so far been used, even if not very satisfactorily.

9.5 The Role of Satellites

Satellite communications in the Pacific Region started with Intelsat's launch of Lani Bird in 1966. In 1989, there were twenty-five commercial satellites, excluding military systems, and more than eighty transponders serving the Pacific Basin.

Most operate in the C band frequency, but it is likely that newer generations will use the higher-frequency KU and KA bands. In general, the higher the frequency, the greater the capacity to carry information. The location of the satellite in geosynchronous orbit and its on-board power dictates the specifications of receiving equipment. Signal loss is greater for satellites using higher-frequency bands, while greater on-board power enables use of smaller, cheaper earth stations for transmitting, and receiving signals.

Pacific nations operate sixteen domestic satellites in addition to maritime satellites in the Inmarsat system. The Pacific Basin has become an ideal showcase for satellite communications. Flexible interconnections in satellite systems render the technology more cost effective than terrestrial systems, while providing the capability to reach geographically difficult terrain and remote islands at the same time. Intelsat uses circuit multiplication equipment so that low income countries can lease circuits at low cost.

Satellite communication is cost-insensitive to distance; earth stations can be located in remote regions because they are not dependent on extensive availability of power and transportation facilities and maintenance costs are lower than for terrestrial systems.

Within a satellite network, savings accrue when circuit capacity is shared among earth stations on a demand assigned multiple access (DAMA) basis. This means that when a transponder is leased, many earth stations can share the operation on a demand basis instead of having to pay dedicated or long-term charges. Such a system is useful for linking remote thin-route areas where traffic is low. Compared with terrestrially carried long-haul systems, satellites can accommodate communication nodes or usage points anywhere within a region to meet changing traffic patterns.

9.5.1 Intelsat

Intelsat has fifteen satellites in its global system, providing two-thirds of total overseas telecom services and linking 170 countries and territories throughout

the world. Internal long distance in twenty-seven countries use leased or purchased capacity from Intelsat. Each year the system handles about 1 billion calls.

There are certain characteristics of the Intelsat network that make it attractive to PINs. It provides global interconnectivity by providing 1,700 earth station-to-earth station pathways, even though over half of these collectively generate only 10 percent of Intelsat's revenues. In other words, low-income users benefit to a greater extent from this interconnectivity.

Thin-route services have gained international attention during the last decade as being particularly necessary for the island nations of the Pacific. Intelsat currently permits the use of small earth stations that are very different from its Standard A and Standard B stations, which call for investments the PINs cannot afford. Stations range in diameter from 75 cm to 4.5 m and cost from $2,500 to $250,000. To assist development of infrastructure in the Pacific Basin, Intelsat has devised several services for small antennas that are not as financially burdensome for these island nations.

The single channel per carrier system (SCPC) first evolved in the international system of Intelsat and was then applied by Intelsat to provide low-cost communications for domestic use. It has been widely used by the Palapa system for difficult-to-reach areas that face problems of climatic severity. Intelsat's domestic leases provided 5,000 SCPC systems in 1986, most of them for thin-route communications.

It can be claimed that Intelsat is the most effective conservator of the Clarke (geosynchronous) Orbit, thereby helping LDCs in two ways. First, they may find it redundant to stake a slot in space and to compete for a suitable one when they may not be able to afford its use in the near future. Second, they can get the same benefits of satellite communications for domestic and international uses at a much lower investment than if they had to commission a satellite for using their allotment of the orbital arc, as Brazil, India, Indonesia, and Mexico have done. The economies of scale and scope available to Intelsat enables the system to offer services at declining unit charge.

The most useful service provided by Intelsat is Project SHARE (Satellites for Health and Rural Education). It was started in 1984 as a sixteen-month experiment during which Intelsat donated free use for health care and education. It can be of great value to the social and economic development of small, growing economies that want to integrate their rural and urban areas and reduce the constant flow of migrants to metropolitan centers. It is used by the University of the South Pacific, founded in 1968 in Suva (Fiji), for audio links to campuses on other islands.

9.5.2 ATS-1 and Follow-Ons

There are many competing vendors of satellite systems to the Pacific Islands. The locals were already conversant with satellite technology and tele-education from more than two decades ATS-1 use. The ATS-1 Satellite linked Peacesat

at the University of Hawaii with several of the PINs until August 1985, when the experimental satellite, loaned by NASA, went out of orbit.

Since 1985 SPEC has been examining several alternatives for a replacement. One alternative has been to shift NASA's Geosynchronous Orbiting Environmental Satellite (GOES) 2 and 3 to 162° East. This option is beset with various bureaucratic procedural hurdles, as GOES is administered by National Oceanic and Atmospheric Agency (NOAA) and the antennas would have to be realigned to service South Pacific Islands.

Another replacement option is use of the tracking data relay satellite system (TDRSS). The satellite's current use by NASA is for collecting weather and scientific data relayed to earth stations mostly located in the United States. The advantage of TDRSS is that it is equipped with moving antennas and three satellites that provide links with twenty-four other satellites. Each TDRSS satellite carries seven communications antennas, four of which can be steered by ground control. In the event of torrential rainfall, these can be moved from island to island to reduce the loss of signals. A 1986 study done by Westinghouse found that the satellites available for use in the Pacific—GOES 2 and 3—are not capable of performing meteorological functions and could be used for data exchange only.

A third possibility is the Pacific Marisat satellite. The islands would be treated as ships anchored in harbor if Marisat service were used and good quality communications would be available at reasonable cost for the ground segment. The disadvantage is that Marisat may not be a good channel for video transmission for television purposes.

9.5.3 Other Ventures

Japan is emerging as a leader in space technology in the Pacific. In 1977 the Japanese experimented with direct broadcast satellites (DBS) by launching the Sakura system. In 1983, CS-2A and CS-2B were launched carrying signals in the C Band. In 1985 the Japanese Satellite Company placed an order with Hughes Communications for construction of a private system called the Jcsat consisting of KU-band satellites for voice, television, and data using small antennas. Japan had captured half of the $1.5 billion market (cumulative) for ground terminals by 1985. It has also designed a launch vehicle called the H-1, a rocket using an indigenous guidance system with a liquid fuel engine. Its fully indigenous rocket, the H-11, is under development.

Since 1982 Japan has been contemplating a regional satellite for the Pacific Islands. The Research Institute for Telecommunications and Economics (RITE), together with Mitsubishi Electric, has conducted studies. Their focus has been on rural and remote thin-route needs for voice, video, and high-speed data. Coverage should not include the ASEAN countries as they are already linked to Palapa.

Aussat is a major player in the developing part of the Pacific. This Australian system has satellites at 156 to 160° East and is made up of three identical KU band satellites accessible by a wide range of earth stations. The South Pacific

Islands may be able to lease transponders for their intra- and interisland requirements, and may choose do so depending on how cost effective AUSSAT is, as well as the quality of the service offered. Whether existing earth stations can be used with Aussat or whether a new network is needed depends on the availability of services from competing vendors and the types of technology offered. OTC of Australia has a hub in Sydney that Pacific Island's VSATs can use for links with Intelsat.

Another emerging player on the Pacific scene is McCaw Space Technologies, based in the United States, where its parent is the major cellular phone player. It has plans to introduce a separate system consisting of two RCA satellites in the KU band: Celstar I, positioned over the Pacific Ocean at 170° East, and Celstar II, over the Indian Ocean at 70° East. The system intends to provide international voice, video, and data satellite services on a selective, noncommon carrier basis (not connected to the public switched network) for business users on either a sold or long-term lease basis. On-board matrix switching circuits will be able to switch any uplink channel in any beam to a downlink channel in any beam. A Guam facility will be used to control telemetry on both satellites as well as to double-hop traffic from one Celstar satellite to the other.

Pacstar is the satellite system that PNG is contractually locked into. ITU, under its present rules, requires that applications for orbital slots be made only by sovereign states. As a commercial organization TRT (now Pacific Telecom) arranged to route the Pacstar application through the PNG government. Pacstar is designed to offer domestic and regional communication using two satellites. One of these will cover Fiji, the Solomons, Japan, Southeast Asia, and PNG. The other will extend to Hawaii, California, and French Polynesia. PNG will receive capacity on one satellite free of charge, but it will not own the system. Pacstar was planned for launch in 1991–1992. However, it has not materialized and PNG leased a transponder on Palapa in January 1991 for its domestic services. If it becomes operational, Taiwan is interested in using Pacstar. Pacstar's failure is one example of how vendors can mislead developing countries.

9.6 Conclusion

The PINs face the dilemma of whether industrialization should precede telecommunications networks. Investment in telecommunications has to marry economic return to social returns, which is difficult to achieve under current conditions of foreign exchange scarcity. It is not acceptable for a single foreign supplier to take over the markets on a regional basis because of political and cultural conditions. Even so, for historical reasons, Cable & Wireless is the largest single supplier of services. There is no production of telecom equipment in the PINs; it is mostly purchased from funds received from overseas direct aid. The area's major suppliers and investors are from Australia and New Zealand. Mining is present in PNG, but it has not improved the living standards of people in the peripheral regions.

PTTs are finding the benefits of natural monopoly eroding as a consequence

of new products and services, rising R&D costs, and shorter cycles of innovation. Fiji's domestic telephone monopoly and the PNG PTC are changing the rules, permitting greater play of market forces. Bureaucracies justifying themselves on grounds of customer protection, and reflecting and effecting static organizations and rigid structures, must address change. Still, despite the movement toward deregulation elsewhere, PIN PTTs are still powerful, and companies seeking to increase their share of Pacific markets will have to deal with them.

The only technology that allows room for private ownership is VSAT, if they are available at low cost and can be owned and operated by rural communities. Because they are digitized, maintenance and operation costs of these receive-only earth stations are much lower than Intelsat's A, B, and D stations. They could initially be used for data transmission and for information on health, agriculture, fishing, disaster warning, and relief to the rural areas. Voice and video channels can be introduced at a later stage.

Cable & Wireless' influence in the Pacific is being challenged by France Telecom. British Telecom, Pacific Telesis, and AT&T are all vying for developing-country markets. This gives decision makers in those countries wider choices of products and prices, and it spurs suppliers to offer credit. If this trend continues, governments will face increased pressures for open access, and PTTs will find their domestic markets attractive to foreign equipment and service providers. Consequently, PTTs may become more protective of their home markets and tighten regulatory pressures. This resistance will result in negative externalities for domestic business users and individuals. The internal dynamics of all this point to a reduction in the monolithic powers of PTTs.

The major crunch comes from financing. Bilateral government aid, supplier credits, commercial banks, multinational financial institutions and, in some cases, countertrade are relied on. It is difficult for the countries reviewed in this chapter to obtain concessional funding and loans for telecommunications on preferential terms. Intelsat's Vista and SuperVista, Intelnet, and Project Share are options being used. U.S. overseas development funds and Australian aid have provided relief, along with REA grants in Micronesia for network development.

The problem of financing is aggravated by rigid control over supplies of services by the public sector. For the Pacific Islands, the problem is being solved by pooling resources into the SPTDP. Training requirements are being met by ITU and the United Nations Development Program (UNDP). The fact remains that all purchases of equipment have to be made in foreign currency, whereas the rate of return on investment accrues in local currency. This makes it difficult for LDCs to meet loan requirements and simultaneously set aside funds for expansion.

The one advantage is that suppliers competing for larger shares of the global market are offering favorable credit terms to the island nations. Pacific Satellite offered a free transponder to PNG on Pacstar, Australia is offering reduced tariffs on Aussat III, New Zealand offered a free television channel to the Cook Islands, and Japan has offered free use of its weather satellite, Hemawari, to

Fiji for hooking up the University of the South Pacific to sites off its main campus.

The future promises a number of innovative options and heralds a degree of competition in services hitherto unknown. The opportunities are exciting and the risks are considerable. Because the geography of the region is island-based, there is a wide divergence in economic development and natural resources, and there will be risks involved.

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Structures and Changes in Korean Telecommunications

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15

South Korea: Structure and Changes

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Since the first century B.C., the Korean Peninsula has been invaded by a series of forces, including those of the Chinese Empire up until the late ninteenth century and the Japanese in 1910. The current Republic of Korea was founded in 1948. During and after World War II, Korea was once again occupied. At the Potsdam Conference, the Peninsula was divided at the 38th parallel into Soviet and U.S. spheres referred to as South and North Korea.

South Korea, or Korea, occupies the southern 29,000 km^2 of the Peninsula. It has a current population of 44 million people. It is one of the more remarkable growth stories in the Pacific with its current GDP at $US 240 billion.

Its remarkable economic growth has been translated into progressive policies in telecommunications. Largely open markets have carried the day at the level of intentions and announced goals, and it has called Korea "the fourth country in the world to introduce competition in basic services" (*Telephony*, July 23, 1990, p. 28). However, actual implementation of such policies has moved slowly. By the mid-1980s the government was taking steps toward privatization of public telecom services by allowing the private sector to participate in the market, which previously had been tightly regulated and controlled by the Ministry of Communications (MOC). A key issue was whether the government-controlled common carrier—the Korean Telecommunications Authority (KTA, now Korea Telecom)—should be privatized and deregulated. The major proponents of change have been large corporations eager to have access to advanced information services.

At the same time, South Korean telecommunications have been virtually revolutionized since 1978 by the launching of a national automatic telephone switching network supporting subscriber demands for voice and data communication services. Total subscriber lines exceeded 15 million in 1990, compared with 10 million in 1987 and just 2 million in 1979.

This chapter examines development of South Korea's telecommunications and information industries and their regulatory structures, with some considera-

tion given the issue of privatization. Sung, in the Chapter 16, analyzes long-term policies.

15.1 Development of Telecommunications

Telegraph service between Soul and Inchon, its port some 35 km away, was begun in 1885, introducing Korea to modern telecommunications. The royal palace and other governmental bodies in and around Seoul and Inchon were linked by telephone service in 1902. After 1910 the Japanese colonial government extended the telegraph and, later, the telephone to previously remote outposts as a way of facilitating trade, production, security, administrative, and political activities. Most of this infrastructure had been destroyed by the end of the Korean War.

Neither political nor practical conditions during the thirty-five years of colonial rule allowed Koreans much participation in the industry—or even access to its services. After the Korean War, there was no make major investment in telecommunications until 1962, when the first five-year economic development plan was launched.

15.1.1 The 1960s and 1970s

Three developments transformed the telecommunications system and industry in the 1960s. The first was construction of basic networks (using imported switches, initially Strowger and then, in 1968, EMD automatic switches). The start of the Korean Broadcasting System (KBS) in 1961 and Mun Wha Broadcasting (MBC) in 1966 was the second. Establishment of the Korean Institute of Science and Technology (KIST) and the Korean Electronics and Telecommunications Research Institute (ETRI) was the third. Along with these developments the government selected telecommunications as one of the strategic sectors for economic development, and subsidized it by providing lower taxes and other financial support.

During the late 1970s, the government began using electronic switches instead of electromagnetic or Strowger switches, and direct distance dialing was introduced in most urban areas.

Beginning in 1969 the ratio of total subscribers to total capacity of switches began to increase, starting at 85.6 percent and reaching 95.3 percent by 1980. The level of unsatisfied demand began increasing during the 1970s as the Korean economy moved into a high growth period. The number of applicants on the official waiting list peaked at 619,000 in 1980. Including potential demand, the number would easily have exceeded 1 million. Not surprisingly, a black market developed. The premium for telephone installation in 1980 was some 1,800,000 won ($3,000) compared to the official installation charge of 420,000 won ($700). (Average monthly wages that year were 176,000 won.) People commonly waited a year or more for service, and delayed installation became a serious social issue.

As can be seen in Table 15.1, the number of telephone lines increased at a moderate but steady rate after 1962 (when the first five-year plan was implemented). The growth continued as the second and third economic plans were launched, and in 1982, when the fifth plan began, about 1 million new lines were added—about equal to the total number of lines in service in mid-1975.

15.1.2 The 1980s

The government launched an ambitious telecommunications investment plan in the early 1980s. The primary motive was to solve the persistent backlog of demand for telephone facilities, with secondary goals of supporting development of the electronics industry and of preparing for the anticipated information society. At the end of the 1970s the Korean government was redirecting its industrial policy focus from heavy industry to electronics, with telecommunications as a closely related concern. In 1980 the government supported the launching of color television broadcasting. In 1981 it also allowed and encouraged subscriber purchase of telephone sets from third-party suppliers for both the first telephone and extensions. There was no requirement to lease or buy from the telephone company.

These policies had their difficulties, however. Typical of many developing countries, Korea had financial problems. Foreign currency, which was desperately needed to purchase foreign switching and transmission facilities, was in short supply. In 1980 Korea experienced poor harvests and, following the second oil crisis, shrinking worldwide demand for its exports, as well as an unstable domestic political climate. Under these circumstances, the government relied on foreign resources to continue its investment in economic restructuring, accumulating external debt at a very rapid pace. It is worth noting that the government maintained its commitment to expand telecommunications facilities, unlike most developing countries, where public telecommunications was a low priority (Saunders, Warford, and Wellenius 1988, pp. 12–18).

Korea also experienced problems with internal financing. To fund construc-

Table 15.1. Number of Subscribers and Unfilled Orders

Year	Lines (thousands)	Percent Utilized[a]	Year	Lines (thousands)	Percent Utilized[a]	Unfilled Orders
1956	64	59.9	1976	1389	91.5	144
1961	123	—	1981	3491	93.4	498
1966	313	87.8	1986	8905	84.5	160
1971	624	89.0	1989	13,354	86.3	0.7
			1990	15,293	—	—

Source: KTA *Statistical Yearbook of Telecommunications* and MOC 1985, vol. 2.

The number of unfilled orders peaked at well over 600,000 in 1979, and was still above that level at the end of 1980.

[a] Subscriber lines as a percentage of switch capacity.

— Not available.

tion and equipment procurement internally, the government had to consider increasing prices or some other form of raising capital, such as 1980, and increasing telephone rates would certainly contribute to an even greater increase in the consumer price index. Nonetheless, the government felt that rates were artificially low and decided users should pay for network expansion, so the rates were raised.

Beginning in January 1980 free calling was abolished, local call prices went from 8 to 20 won, and users were required to purchase a 200,000 won KTA bond at the time of installation. The bond matured in five years and could not be sold for the first three years. (The requirement was dropped in 1990.) A 25-percent "special luxury consumption tax" was added to total telephone charges; revenue went directly to the Ministry of Finance and was not necessarily used for telecommunications. In normal situations this kind of rapid price increase would have met strong resistance from users. Such was not the case—perhaps because people recognized the need to finance new services or were simply willing to take service at any price, without complaint.

During the fifth five-year plan, 1982–1986, telephone service made significant progress. Telecommunications' share of gross fixed capital formation increased from less than 3 percent during the 1970s to 7.5 percent during the plan period. This investment resulted in the implementation of essentially universal service, inauguration of a national automatic switching network, and establishment of networks capable of meeting future sophisticated requirements. The number of telephone lines increased to about 8.8 million in 1986, triple the 1980 number; household penetration went from 68 to 90%. The number of public coin telephones increased from 58,000 in 1980 to 138,000 in 1986. This is 3.3 per 1,000 population. Subscriber penetration rates are shown in Table 15.2.

15.2 Telecommunications Equipment

In the early 1970s telecommunications entered a period of accelerating expansion, particularly the equipment industry, largely as a result of developments in the industry's technology. By the end of the 1970s, KIST had produced a PABX and was experimenting with 44 Mbps optical fiber that could be slipped into existing coaxial cable ducts for low infrastructure costs. Two earth stations for satellite communications were built in 1977, and they resulted in lower transmission costs than those with a marine cable.

Production of wireline and radio telecom equipment grew at an annual rate

Table 15.2. Telephone Density*

1980	7.2	1984	13.5	1988	24.6
1982	10.4	1986	18.1	1990	31.0

Source: KTA *Statistical Yearbook of Telecommunications*, 1991 edition.

*Subscribers per 100 people.

of almost 33 percent over the period 1970–1975, as total output increased from $14.8 million in 1970 to $60.8 million in 1975. Growth then accelerated to almost 35 percent a year despite the larger base, with production reaching $363 million in 1981. Since 1981 the growth rate has declined noticeably due to the limitations of labor-intensive production; production was $1,831 million in 1988. Wireline equipment, such as telephone instruments and switching systems, is the major component. From $14.1 million in 1970 the industry had grown to $1,351 million in 1988 (Data are from the *Korean Electronics Yearbook*). Using a broader definition, production of telecom equipment in about one-third exported (*Far Eastern Economic Review*, Mar. 7, 1991, p. 43).

Exports of equipment and services have increased steadily since 1981, except for 1984, and imports have declined since 1983. The export drop in 1984 can be explained by changes in the U.S. market, including changes in technical standards and exclusion of equipment from the preferential tariff list. There has been a positive trade balance since 1984.

Government encouragement of domestic production of equipment and R&D activities to develop digital switches and optical fiber transmission equipment was, by the mid-1980s, significantly reducing the burden of foreign borrowing (which had provided over 20 percent of investment funds in the early 1980s). By 1987 direct import of switches financed by foreign loans had disappeared.

The government intends to provide producers of facsimile equipment with 14.3 billion won in subsidies during 1989–1994 in a bid to increase local content. The domestic makers are generally allied with a Japanese technology source: Samsung–Toshiba, Goldstar–NEC–Matsushita, Hyundai–Fujitsu, Daewoo–Sanyo, and so on.

15.2.1 The TDX Switch

Switches are a particularly important component of the equipment industry for two reasons. First, they account for a very large part of value added. Second, switching technology has been a major barrier to entry; it involves understanding large-scale network behavior, as well as the production and installation of international networks and operations in other countries.

Switching technology began to change rapidly in the mid-1960s as stored program control (SPC) computers replaced wired circuits and relays. SPC permitted vast increases in flexibility. In the early 1970s digital time-division switching replaced analog electromechanical switches. Korea had to import the switches.

To attain self-reliance in network development, standardize the national network, and prepare for ISDN, Korea considered it crucial to develop a switch that could be used domestically by the public authority and enable the country to compete in the world market.

In collaboration with private businesses, ETRI successfully developed the first exchange, dubbed the TDX-1 (for Time Division eXchange), in 1983. In April 1984 a 2,400-line experimental model was installed as the main central exchange system in the West Taejon office and a 480-line unit went into the

Koryong, and Muju in 1985.

TDXs have been installed primarily in rural areas where large-capacity switches are not needed. Installations include TDX 1As, which have 10,000-line capacity, and TDX 1Bs, with 23,000-line capacity. Korea's domestically developed digital switches, though limited in capacity, enabled the country to become less dependent on foreign technology, and as a result foreign suppliers cut prices for their large-capacity switches. By early 1990 1.4 million TDX lines were in operation.

Given the magnitude of R&D involved, TDX-1 manufacturers Samsung Electronics, Goldstar Semiconductor, Daewoo Telecom and Oriental Telecom (Otelco) have, as intended, sought to enter international markets. While established suppliers based in OECD countries dominate the world market, Korean exchange equipment firms are trying to penetrate Asian and African markets with small exchanges. Sales have also been made to Poland and Hungary. To keep the four producers from undercutting each other, KTA formed KTA International (KTAI) to coordinate marketing and provide system consulting.

The government has provided subsidized financing through Economic Development Cooperation Fund (EDCF) projects. For example, MOC asked that $1 billion be made available for telecommunication loans to LDCs in 1992 at 3.5 percent.

15.3 Telecommunications Regulation and Its Institutional Structure

The Telecommunications Act of 1961 was the basic law governing the industry until the early 1980s. It rested on a tradition of heavy government regulation of equipment, service offerings, rates, and conditions. Policy has since moved under the control of the MOC. A regulatory framework of minimum competition and public monopoly was adopted and implemented by MOC.

In 1983 the Basic Telecommunications Act and the Public Telecommunications Business Act brought about dramatic changes in this regulatory structure. The purpose of these acts was twofold: to separate the functions of policy formulation and business operation and to take a step toward privatization. In addition, these measures were supposed to support:

1. Integrated and efficient control and regulation of the network as a national infrastructure.
2. Consistent policy formulation, industrial development, and technological advancement.
3. A greater degree of competition between manufacturers in the private market.
4. Entry by competitors into telecom services provision.
5. The direction and financing of research and development.

KTA historically had exclusive authority to permit construction of new and additional facilities by Korean carriers, as well as licensing and standard-setting power over other entities seeking to provide basic telecom services over existing or new facilities.

When the Business Act was promulgated in 1983 KTA was restructured as a public corporation with all the stock owned by the government. The Act authorized the creation of a private specialized carrier, Dacom (Data Communications Corporation of Korea). Dacom's main task was to construct a public switched data network (PSDN) that interfaces with the public switched telephone network (PSTN). Dacom had established twenty-one access nodes by 1983 and begun an international service called Dacom-net.

As Table 15.3 shows, various public entities are involved in the development of telecommunication networks before the 1989 reforms, with partial penetration by the private sector.

In addition to these organizations, the Network Coordination Committee in MOC is in charge of computer network projects. The Korean Computerization Agency has also been established for supervising and validating the National Administrative Information System Network, which is in partial use. The Korean Computer and Communications Promotion Association (KCCPA), a private entity, was founded in 1987 to enhance information exchanges between industries and to make recommendations to the government.

In summary, regulatory policy has operated under the principle that common carriers provide public telecommunication services. KTA, as a public corporation, was in charge of basic network services. Dacom was responsible for enhanced network services. Information services such as data processing and information retrieval became more widely open to the private sector.

The 1983 Business Act provided a statutory basis for market liberalization, outlining the activities, obligations, and regulatory structures. Even though KTA was made a corporation and some private companies like Lucky Goldstar, Samsung, and Daewoo began to participate in new services such as VANs, there was no decided principle of competition. Still, the government planned to develop competitive markets.

15.3.1 The 1989–1991 Restructuring

The telecommunications laws were revised again in July 1989 and July 1991. The first primarily involved VANs (discussed later). The second was part of a broader process formalized in March 1989 when the Korea Information Society Development Institute (KISDI), an MOC affiliate, assembled an advisory group from the government, industry, academia, and research institutes to look at the information and telecommunications industries. It reported six months later. Competition, but not all at once in any specific area and not immediately in every area, was the consensus. The areas producing trade friction with the United States—in particular, enhanced services—were recommended for opening first. KTA would have no restraints on its business activities, although it had to practice "fair competition."

Table 15.3. Major Korean Telecommunications Organizations

Supervising Government Body

Ministry of Communications (MOC). Formulates and implements telecommunications policies. Direct and coordinates common carriers. Promotes and supports R&D activities.

General Service Providers[a]

Korea Telecommunications Authority (KTA). Provides telecommunications services. Constructs, operates, and maintains public telecommunications facilities. Renamed Korea Telecom in 1991. 100 percent government. Jan. 1982.

Data Communications Corporation of Korea (Dacom). Originally established to construct and operate public data communications networks as a monopoly. Subsequently designated to compete with Korea Telecom in international calling. 34 percent Korea Telecom, 66 percent owned by twenty-three private companies. 1984 Sep.

Specific Service Providers[a]

Korea Mobile Telecommunication Co. (KMTC). Provides cellular and paging services. 68 percent Korea Telecom, 32 percent private (trades on Korean Stock Exchange). Apr. 1988.

Korea Port Telephone Co (KTP). Provides communication services in harbor areas. 49 percent Korea Telecom; 51 percent private. Jan. 1988.

R&D Institutes

Electronics and Telecommunications Research Institute (ETRI). Carries out R&D in the field of telecommunications, semiconductors, and computers. Promotes the astronomical and aerospace sciences.

Korean Information Society Development Institute (KISDI). Undertakes long-term research for telecommunications development. Work outs progress indicators for the information society.

National Computerization Agency (NCA) Standardizes technologies relating to computer networks. Undertakes feasibility studies and supervises computerization projects run by government or public organizations.

Engineering Services

Korea Telecommunication Authority International (KTAI). Provides telecommunications engineering services. Manages overseas telecommunications projects.

Korea Information Telesis Incorporate (KITI). Maintains and repair telex facilities and equipments.

Public Relations and Education

Information Culture Center (ICC). Publicizes the information society to the public.

Unless noted, the organizations are government-related.

[a]These were common carriers prior to the 1991 restructuring. The date given is when MOC designated the entity a common carrier under the previous regulatory structure. There was a fifth common carrier (designated Feb. 1988): Korea Travel Information Service Company Ltd. (KOTIS), which is now classified as a Value-Added Specific Provider. It provides air travel and tourist information and is owned by Dacom and private interests.

MOC accepted the recommendations, and set out to prepare specific implementing policies. In putting together proposed legislation and regulations, public hearings were held—the last, in June 1990, attracted 300 people, mostly from entities directly affected, as distinguished from the general public. The decisions in the July 1990 Structural Reform Plan included directives that the liberalization of VANs was to accelerate, and that there was to be a duopoly in international and mobile calling and in data. However, domestic long dis-

tance remains a KTA monopoly until the mid-1990s. Telecommunications is divided into three categories, as shown in Table 15.4.

KTA was privatized effective January 1, 1990. Renamed Korea Telecom, part of the stock was to be sold to the public, but this was postponed—although apparently more because of a generally weak stock market than anything else. Korea Telecom was not happy, calling the Korean telecom services market too small to support competition.

Under this liberalized regime, Korea Telecom will face Dacom, which is 34 percent owned by Korea Telecom (the rest is owned by major corporations) and had 1990 revenues equal to just 5 percent of Korea Telecom's. Dacom loses its monopoly on data transmission but does compete with Korea Telecom

Table 15.4. Classification of Service Providers

Type of Service Provider	Network		
	General	Specific	Value-Added
Scope	Telephone Telegraph Telex Data Leased and dedicated circuits Various voice, nonvoice, and mixed transmission service Extension service for telephone network	Paging Mobile phones Wireless phones and data Trunked radio service Port communications Aeronautical communications	(examples) Data base Data processing Data accumulation, processing and transmission E-mail EDI MHS CRS Video conferencing
Entry requirement	designated by MOC	approval by MOC	registration with MOC
Ownership limits	Less than 10% by one individual[a]	Less than one third by one individual[a]	No limitations
Foreign investment	Not allowed	Allowed if does not exceed one third	In stages: 50% in 1991, 100% by 1994
Duties	Establish an efficient national communication system Supply regular and universal service	Appropriate to the type of enterprise	No duties imposed

Source: Adapted from MOC *Annual Report on Telecommunications* 1990, English edition, p. 35.

[a] Or by one corporation or related group.

in international calling (from December 1991). Dacom initially competed just in the Japan, Hong Kong, and U.S. calling markets—but these are 70 percent of outbound traffic. In anticipation of the competition, Korea Telecom reduced international rates, but Dacom priced calls 5 percent under Korea Telecom. It is that expected Dacom will be allowed into domestic long-distance later.

Dacom has been barely profitable since it was created, and this is considered a factor in its selection as the second major carrier. Another reason is a government reluctance (which mirrors popular sentiment) to give the major *chaebol* (business groups) a big piece of any more pies. Dacom has indicated that once it is allowed into the domestic long-distance business it will first concentrate on building an all-digital network for major business customers, and consider a 10-percent market share a reasonable goal (*Telephony*, July 23, 1990, p. 32). In the past, Dacom's network facilities have been leased primarily from Korea Telecom.

15.4 Telecommunication Facilities and Services

In 1983 a fiberoptic system with 45 Mbps shortwave, multimode transmission was installed between Seoul and Inchon (35 km); this system was designed and manufactured under the supervision of ETRI. A similar system was constructed between the ETRI office building and the Taejon Toll Office, a distance of 17.3 km, without a repeater. Based on these experiments, a 90 Mbps system has been established for commercial use. It is capable of simultaneously transmitting 1,300 voice signals. Preparation for the Seoul Olympics was a major motivation for developing this capacity. The long-distance switching system has been fully digital since 1984. In 1990 AT&T was retained by Korea Telecom to help digitize and otherwise upgrade the international service.

Semiconductor development is important in electronic switching systems and other telecom equipment. In 1985 KTA contributed the necessary funds for ETRI laboratory facilities. ETRI subsequently successfully developed custom VLSI chips used by the TDX-1 switching system and other applications.

There is an increasing demand for data communication between computers and between remote terminals and their processors. Though this demand can be met through shipment of tapes or disks, data transfer through telecommunications is much faster and allows interaction between the sender and the receiver. The number of leased data circuits at the end of 1988 was 126,496 channels, a 23 percent increase over 1987. High-speed digital channels were made available for public lease in Seoul, Pusan, and Taegu in 1985, and digital service was extended to eleven cities for use of inter- and intracity data transport. Domestic leased line service has grown rapidly. According to a 1986 survey by the Korean Information Industry Association (KIIA) users were banks and financial institutions (53 percent), general business establishments (31 percent), and administrative and public agencies (15 percent).

15.4.1 Value Added Networks

Several major corporations have their own VANs. An example is Daewoo Motor, which started in 1984 with computer links between five sales offices and its headquarters that by 1989 had developed and expanded the system into a full-fledged VAN that included thirty suppliers. The company has expressed interest in cooperating with other automakers on standards for an industry VAN.

There has been significant resistance to foreign involvement, and the issue has been a major one in Korea–United States trade talks. It is candidly admitted that Korean resistance stems from the feeling U.S. and Japanese technology is so advanced that allowing it in would freeze out most Korean firms (see, e.g., *Korea Business World,* Apr. 1989, p. 46). Joint ventures are actively being sought.

Under July 1989 legislation the registration system for new VANs was theoretically made less stringent. In practice, because the law was silent on what market segments were to be open to competition, not much changed until more than a year later when MOC provided specifics. Data base and data processing were open to international competition in July 1991 and all other areas were to be opened by 1995. Korea Telecom has plans to actively enter the market.

In September 1991, there were more than 130 companies providing value added service (VAS), mostly data base and data processing. This compares to just twenty VAS providers in early 1990, only ten of which were licensed to deal with the general public (the others were intrabusiness-group), even though the KCCPA reported that 143 had licenses.

15.4.2 Data Communication

Improvements in microprocessor technology have increased the capacity and reduced the cost of data communications equipment, including data terminals, modems, and multiplexers. The range of terminals available has expanded to meet the demand of users (e.g., high-speed terminals for high-volume but relatively simple operations; lightweight portable terminals for field communications; and display terminals with graphic capabilities for scientific applications).

The number of facsimile subscribers reached 13,000 in 1986 and 115,000 in 1990. Facsimile uses the same lines as voice service in most cases, thus network charges are the same. Telex subscribers increased from 7,539 in 1983 to 10,304 in 1987. However, the diffusion of telex is stagnating because of incompatible standards in transmission format. It has been predicted that communicating word processors capable of storing, retrieving, and editing text will compete with telex, if not completely replace it.

Videotex as an interactive data communication service enables widespread consumer access and retrieval of computerized information. It is still in the development phase in Korea. Serious experiments are underway using specially adapted television receivers to display information accessed through telecommunication networks. Videotex combines elements of mass and point-to-point communication: The information available from the central data banks is in

many cases identical to that normally distributed through newspapers, magazines, and books. The use of the point-to-point network to access this information, however, allows great selectivity in its retrieval.

ETRI developed a standardized model for Korean-language videotex based on North American Presentation Level Protocol Syntax (NAPLPS) in 1984. ETRI also developed a teletex model and its specifications were transferred to Korean manufacturers in 1986.

In addition to these services, AP Telerate (November 1983) and Reuter Monitor (May 1984) have provided on-line data base services covering interest rates and other financial statistics. These specialized providers of otherwise unavailable data are the only foreigners who have been permitted in Korea's market.

15.4.3 Cellular Service

Carphone service began in 1973 and cellular joined it in May 1984, but the market did not take off until prices were cut July 1988. Initially in Seoul and Pusan, cellular had been extended to seventy metropolitan areas by mid-1991. Korean Mobile Telecommunications Corp. (KMTC), which trades on the Korean stock exchange but is controlled by Korea Telecom, has been the monopoly provider of both paging and cellular service. Korea Telecom has supervised long-term investment and facilities planning, while Mobile Telephone Service Corp. (MTS) has handled installation and maintenance of the cellular system.

Under a July 1990 decision, MOC will select a second carrier by July 1992. To their consternation, equipment producers will be limited to 10 percent ownership of the system; as a group, foreigners can own 33 percent, but may not take part in management. The new entrant will need several years to get a system built and operating, so observers do not see it as much of a threat to KMTC any time soon.

Five local firms produce cellular equipment, including Samsung Electronics, Goldstar Telecom, and Hyundai Electronics. Motorola is also in the market, with an estimated 30-percent share (1989). Service does not come cheap. To make the first call, using the least expensive telephone, cost 1.7 million won (over $2,500) in early 1989. This included the telephone, a number of permits and other set-up fees, plus twenty-five won for the first message unit of calling.

In May 1991 KMTC reported 113,000 mobile telephones and 591,000 pagers in use. The paging system was expected to be nationwide at yearend 1991; the cellular network is restricted from some areas because of military installations. In January 1992 the Korean National Police ordered mobile equipment from an Ericsson–General Electric joint venture, using EDACS, a system not directly compatible with the general public system.

15.4.4 The Koreasat Project

A Korean communications satellite was considered in the mid-1980s, but it was rejected because of uncertainty over profitability. In 1991 Korea Telecom was soliciting requests for proposals for a satellite, and General Electric was chosen

prime contractor (with Goldstar as its local coordinator) that December. During the bidding process, it was made clear that foreign supplies were expected to joint venture with (and supply technology to) domestic firms. However, the launching will be contracted to a foreign entity because no one with the technology has indicated any interest in sharing it with Korea. Five new ground stations will be built to supplement the four currently in operation. With an estimated total project cost of $400 million, launching is planned for April 1995 (*Business Korea,* Dec. 1991, p. 38 and Jan. 1992, p. 61).

Fiberoptic marine cable capacity is also being expanded. Under a February 1992 contract among AT&T, KDD, Dacom, and Korea Telecom, Korea will get its first direct link to Guam, where the new cable will link with the TPC-5 network on to Hawaii and the U.S. mainland. This leg will have 7,560 circuits. In addition, there will be a 15,120-circuit cable between Korea and Japan. Both are to be in operation by 1995.

15.4.5 Related Measures

MOC's policies extended beyond traditional telecommunications to related areas, including electronics and computers. For example, MOC—together with KTA, Dacom, and ETRI—actively participated in 4M DRAM and superminicomputer development projects. Computer technologies obtained during research for digital switches were used in the development of computer networks for the Asian Games in 1986 and the Summer Olympics in 1988.

Some liberalization measures have been instituted. For example, many types of customer premises equipment—including telephone sets, modems, and facsimile machines—can be freely sold and attached to the network without restrictions, subject only to technical-standards approval. In addition, networks for television, telephone, telex, and military and public security have been integrated wherever possible to improve efficiency.

15.5 Cable and Broadcast Television

These areas have been very contentious. In 1990 when the government announced it would license a new over-the-air television broadcaster and CATV operators, it received scores of applications. Seoul Broadcasting System (SBS), the entrant of a medium-size construction company, got the nod to become the third broadcaster (and fifth station). Two of the stations are part of KBS, the third is operated by MBC, and the fourth is educational; all are government owned.

Regarding cable, Korea Telecom awarded a contract in October 1990 to Korea Communications Engineers (KCE) to build pilot projects in two Seoul apartment projects. It began operation in July 1991 by offering seven channels (including four broadcast ones) to 8,400 households. None of the channels operate twenty-four hours a day.

More extensive CATV and broadcast service is set for 1995 when a Korean

satellite is launched. Between 1993 and 1995 the government, through MOC and the Ministry of Information, plans to install interactive twenty-five–channel cable systems in fifty cities. Korea Telecom will oversee building them. The interaction feature initially involves connection to police boxes and fire stations.

Although the government will tightly control the system, there will be competition to supply hardware and programming. Seoul Telecom has been among the more aggressive of the cable firms—signing contracts with CNN and ESPN (a sports network) in 1990, more than a year before service could even begin.

15.6 The Information Industry

In Korea the term *information industry* is used to collectively cover telecom services and equipment manufacturing, data processing, and sometimes even the electronics industry generally. Before 1989 there were no systematic statistics for the information industry. Here the term covers producers of the physical equipment and the systems that drive it (software and firmware) rather than the actual information content, so print media and broadcasting are excluded—although of course much of the equipment they buy is covered. KTA began classifying data for the industry in 1989, specifically breaking out telecommunications and electronics as subgroups.

Korea's electronics industry was inaugurated in March 1959 when Goldstar brought out vacuum tube radio receivers. For the next decade the level of investment and technical development were limited to assembly of imported parts—screwdriver factories. In the mid-1960s, the government launched a policy to attract foreign investment and technology transfer. Foreign investors sought the advantages of low-wage labor in Korea, with American Signetics and Fairchild building manufacturing plants for black and white television sets, and Motorola locally manufacturing transistors and integrated circuits. As a result, total domestic production of electronics increased from 125 billion won ($522 million) in 1962 to 1,640 billion won ($5,115 million) in 1969.

The government's initiation of an eight-year development plan for the electronics industry (1969–1976) was a turning point. Five goals were established by MOC: expansion of export sales, maximum use of domestically produced equipment, rationalization of production and distribution systems, construction of electronics plants, and opening the domestic market to foreign investment. In 1976, as part of the third basic development plan, several special laws were enacted establishing national investment funds, reducing trade and sales tax, and reorganizing small electronic companies by specializing their product lines.

At the start of 1977 the structure of manufacturing industries was reorganized by the fourth basic development plan (1977–1981). The principal objective was to balance overall imports and exports. Whereas production of industrial equipment was intended to supply the domestic market (displacing imports or at least reducing their increase), home electronic items were designated for export.

Proclaiming 1983 as inaugurating "the period of the development of the

information industry," the government selected three strategic fields: computers, integrated circuits (ICs), and telecom equipment. Until the mid-1980s expansion in export markets was led by microcomputers, electronic systems, ICs, and color television sets. Due to competition and increasing pressure from importing countries, several Korean companies such as Lucky Goldstar and Samsung built factories in the United States and Portugal.

15.6.1 The Rise of the Information Industry

The Korean information industry has focused on international markets because of the limited domestic market. Most imported information equipment has been for assembly manufacturers who are oriented toward the international market (i.e., it was re-exported). There was a positive trade balance by 1981. Investment by foreign firms was a key factor in this. Japanese and U.S. multinationals have been the principal sources.

In 1983 the government initiated a policy to promote the flow of foreign capital and investment into the country, changing to a positive list system from a negative list one. (While the former explicitly lists the sectors foreign companies are able to invest in, the latter allows foreign capital in any sector not explicitly listed as off limits). With this measure, investment by foreign information companies started to grow rapidly. For example, IBM became one of the top twenty companies in terms of sales in 1986.

Technology transfer has been regarded as a crucial factor for indigenous development because it influences both the sociocultural characteristics of the importing country as well as domestic production factors and national scientific and technological potentials. During the period 1982–1989 some $3,315 million was paid in royalties for technology transfer such as patents, technical information, and services—a third of it by the electrical machinery, electronics, and telecommunications industries. Technology originating from the United States and Japan has accounted for more than 90 percent of the total since 1977.

15.7 Public Policy for Industrial Development

Five types of broad measures taken by the government are generally considered significant in bringing about the rapid expansion of the information industry since the early 1970s. These include:

1. Encouraging investment in new information technologies,
2. Local manufacturing of products and parts,
3. Establishing research and development sectors and a system for technological innovation,
4. Encouraging new techniques and products,
5. Fostering cooperation of universities and industries.

To encourage investment in information industries, the government decided in 1982 to establish a development fund for electronics with 240 billion won

($300 million at the time). The fund was used for technical innovation and automation of production lines, as well as long-term, low-interest loans. In addition, the government encouraged new businesses, including investment of venture capital, to contribute to innovation in information technologies and services.

The Ministry of Commerce determined a list of electronics products and parts that were desired for indigenization to increase Korea's competitive power in the international market. With this measure, relationships between electronics businesses were streamlined to avoid overlapping investment and overcompetition.

To promote R&D and technological advancement, engineering centers were established abroad that were funded by the government, research institutions, and private enterprises. These centers played an important role in collecting information about recent technological development, training engineers, and recruiting foreign scientists and engineers.

In early 1990 Korea Telecom announced it would invest 3 trillion won ($4.5 billion) in R&D by 2001, starting with 133 billion won in 1991 (about 3 percent of expected revenue), moving up to 6 percent of revenue in 2001. This is to include funding of four research institutes, placement of 28,000 personal computers in 1,230 schools, and distribution of 10,000 monitors to individuals for experimental videotex services.

A committee on technological innovation provided universities and businesses with research projects to develop new products and knowledge. The committee also organized an annual electronics exhibition to display new innovations. To strengthen education and training of engineers and workers, the Ministry of Science and Technology began a program of inviting Korean scientists working abroad and foreign retired engineers to teach and train in Korea. Training centers for electronics engineering also provided a variety of courses to engineers from small factories.

The United States has made an issue of access to the Korean telecom services and equipment market. To avoid retaliation under U.S. trade laws, in February 1992 an agreement was reached to make the market more open. Among other things, registration in value added services is being streamlined and restrictions on investment are being phased out by 1994. Tariffs have been cut, and U.S. firms are given more access to the standards-setting process and government markets.

15.8 Conclusion

After the Korean government launched "the period of development of the information industry" in 1983, telecom equipment makers, computer manufacturers, and other electronics-related firms have enjoyed tremendous growth in revenues and value added services. With stringent, although now falling, barriers to import, and the government as a major buyer of domestic production, the trade balance has improved. Still, research must pay attention to the intri-

cate formal and informal procedures that pervade the decision-making process in South Korea within and between formal telecommunications institutions.

During the 1980s the monopoly structure of KTA and the lack of competition in most aspects of telecommunications were the subjects of debate among administrators, industry, users, and other interested parties. It was pointed out that the bureaucratic administrative structure of KTA hindered provision of services. As a result of these debates, KTA's control over such areas as specification of technical standards for services and equipment has been reduced and the government has confirmed a willingness to liberalize the sector by moving toward duolopoly in long distance and relatively open markets in VAN and VAS.

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