

# 6

## Indonesia

JONATHAN L. PARAPAK

Indonesia is a nation of 6,000 inhabited islands (and even more uninhabited ones) sprawling over 5,000 km along the equator. The population of over 190 million makes it the fifth most populous country in the world. Tying the country together has benefited from modern means, especially satellites—Indonesia was the fourth country to launch a satellite-based communications system. That continues a long tradition—by the fifth century correspondence via letters was common: couriers walked, rode horses, or traveled by sailing vessel. This chapter looks at development of telecommunications in Indonesia; the next chapter expands on the structural changes that began in the 1980s.

### 6.1 History

Sitting astride the sea route between China and India, with a range of exotic products to contribute to trade between the two, the islands have been a trading crossroads for two millennia—and thus in a very real sense have long had good communications with the outside world. For most of its history what is now Indonesia was comprised of many small states, the more powerful ones based either on maritime trade or (on Java) on intensive rice cultivation. Islam was known in the islands by the thirteenth century, but it came to predominate on Java only in the sixteenth century.

Dutch occupation of parts of the archipelago beginning in the seventeenth century resulted in postal service, initially limited to official letters, between Indonesia and the Netherlands. Prior to the 1800s it depended on Dutch East Indies Company trading vessels, and thus cannot be described as regular. Due to uncertain delivery, original letters were normally followed by duplicates. In the 1630s, incoming letters were displayed at city hall after being recorded by the official confiscator. It should be noted that it was the twentieth century before the Dutch had consolidated most of what is now Indonesia, although Java was tightly controlled after 1830. Expanding influence, both geographically and in terms of degree of control, frequently came as a result of Dutch intervention in struggles between local sultans or over succession.

In 1746, the first post office was established in Jakarta (called Batavia by the Dutch) by the governor general of the Dutch East Indies Company. Its purpose was to guarantee the security of the postal service, particularly for letters to people involved in trade. In 1846, postal service was placed under the director of agriculture and civil warehouses. However, the government provided service only between Anyer and Banyuwangi. On all routes, people could send letters by any means they considered satisfactory. The post was made a government monopoly in 1862.

In 1876 the Department of Domestic Affairs took over postal management. The head of the postal service also held the position of Postmaster of Batavia. The Semarang and Surabaya post offices in Java and 17 others outside Java were each headed by a postal supervisor. Auxiliary post offices were headed by auxiliary postal supervisors.

In response to a suggestion by the East Indies Co, the Dutch government introduced telegraph service in 1856, linking Jakarta and Bogor. Initially, facilities were solely for government use. However, after completion of the Jakarta–Surabaya link and its Semarang and Ambarawa branches in 1857, use of facilities was made available to the public. Regulations on use of telegraphic apparatus were derived from those in the Netherlands. No one could offer telegraph services in Indonesia without government permission. The network expanded during the 1860s and early 1870s, and a telegraphist was placed in each post office. Postal and telegraph services were merged in 1875.

The government did not guarantee delivery of telegrams or provide compensation for damage, delay, or loss. Legal sanctions were applied to those who tampered with or destroyed telegraph facilities after the Indonesian Telegraph Administration signed an international agreement concerning the protection of submarine cables in Paris in 1884.

In 1909, a regulation allowing confiscation of telegrams whose contents were considered dangerous to colonial security, or contrary to law and order or to public decency was added. The power to confiscate was also applied to press, maritime, and semaphore communications, and to radio telegrams. Rules concerning secret codes, groups of figures, and abbreviations for official use were also incorporated in these regulations.

Telephone services had initially been organized by a private company in accord with a government decree of July 31, 1881. Inauguration of service in Jakarta took place on October 16, 1882, followed by the building of a line to Semarang in 1884. On September 20, 1906, the telephone network concession expired, and the networks for Jakarta, Gambir, Jatinegara, Semarang, and Surabaya (all on Java) were taken over by the government. Telephone services were merged with the post and telegraphy in November 1925.

### **6.1.1 Structure after 1945**

At independence, Indonesia's telecommunications facilities were very limited. The country had inadequate equipment and lacked the expertise to operate it properly. The situation deteriorated further during the struggle against Dutch

forces trying to restore colonial presence. Service gradually improved during the 1950s after the Netherlands recognized Indonesia's independence.

In 1961 the Department of Post, Telegraph, and Telephone changed its status and name, becoming PN Postel (PN indicates a state-owned company). This was intended to provide more autonomy for the company's financial management.

The Dutch regulatory legacy was no longer considered appropriate because of technological developments, and in 1964 the government promulgated a new law revamping the system. As before, telecommunications was operated and controlled by the government. The law classified telecommunications into three categories: public, special (for government bodies), and those organized by nongovernment institutions.

Although government bodies can be granted special permits to organize telecommunications facilities for their own purposes, the MPTT regulates the control, installation, management, and use of the facilities. The civil aviation, radio and television services, and Pertamina Oil Company have facilities reserved for their exclusive use under these permits.

In 1965 PN Postel was divided into two corporations to manage its rapid development and expanded activities. PN Telekomunikasi took over telecommunications, and PN Pos Dan Giro took over the postal service. The MPTT was given responsibility for supervising their operations.

Further restructuring came as a result of several 1974 laws. PN Telekomunikasi was renamed Perumtel (Perusahaan Umum Telekomunikasi) and was designated the sole provider of public telecom services in Indonesia. Then, in 1991, Perumtel was again renamed, this time to PT Telekomunikasi Indonesia (PT Telkom) and its status changed from a public company to a limited company.

In 1980 the law was amended to make PT Indosat (Indonesian Satellite Corporation) the sole provider of international services. PT Indosat was founded in November 1967 as a subsidiary of International Telephone and Telegraph (ITT); its main responsibility was to operate and maintain the Intelsat standard-A earth station at Jatiluhur. The government purchased all the shares in December 1980.

Responsibility for the operations and technical requirements of each company is determined by government regulations; PT Indosat and PT Telkom plan, develop, and extend facilities and public telecom services in coordination with each other and with government guidance.

### ***6.1.2 Regional and International Cooperation***

The aim of national development is to realize a just and prosperous society in keeping with the material and spiritual focus of the state philosophy—"Pancasila" (Five Principles)—which espouses unity for the Republic of Indonesia as a free, sovereign, and democratic nation enjoying a peaceful, secure, well-organized national life within the world community.

The concept of cooperation among Association of Southeast Asian nations



(ASEAN) (Indonesia, Malaysia, the Philippines, Singapore, and Thailand) in telecommunications was first proposed in 1974 and moved rapidly towards realization. In this regard Indonesia has taken part in development of the ASEAN Submarine Cable Communications System. The ASEAN Philippines–Singapore (ASEAN P-S) cable was completed in 1979, and the ASEAN Indonesia–Singapore (ASEAN I-S) system commenced operations in April 1980. An ASEAN fiberoptic cable is being constructed and segments will be operational in 1995; it had originally been scheduled for completion in 1990. The cable will connect the capitals of each of the five countries to each other and to cables to Japan, North America, and Europe.

The submarine cable project aims to support the Intelsat system, particularly for high-volume routes like the one between Indonesia and Singapore. In keeping with the spirit of ASEAN, Indonesia offered to lease its Palapa satellite transponders to other ASEAN countries for their domestic telecom requirements and television broadcasting. Palapa transponders also have been leased by Hong Kong, Australia, New Zealand, Papua New Guinea, and several other countries.

The government's basic policy on international telecommunications is to support national interests. Links with new international carriers are established if they advance the national interest and benefit Indonesia. Implementation is on a case-by-case basis.

## 6.2 Service Levels

In April 1989 Indonesia had about 1 million phone lines. Clearly, density is very low—at 0.56 phones for every 100 persons, it is even less than the number in China. In Jakarta density is over 4 percent, and levels in four other urbanized provinces are much above the national average. Density in fifteen provinces is below average, while in the other seven it is near the average. This means the country faces a significant challenge in achieving density at the level recommended by the International Independent Commission for Telecommunication Development (IICWTD)—a telephone “within easy reach” of everyone or within less than an hour's walk.

Domestic direct dialing services is provided between 136 cities, and ISD service was available from eight Indonesian cities to more than 130 countries. The telex network has two international gateway exchanges and more than twenty-seven domestic telex exchanges, a 15,297-telex line capacity, and 14,087 subscribers. Gentex (telegraph circuit) service is available from more than 210 offices, and there are currently more than 660 telegraph offices.

Long-term development of infrastructure is oriented toward digitalization of the network. At the end of 1989, 160,000 lines, almost 18 percent of all lines, were digital. Packet switched public data communication is now provided from Jakarta, Bandung, Surabaya, Medan, Bogor, and Ujung Pandang to twenty-one countries.

Modernization has been occurring at a relatively slow pace. Geography and

the huge population require enormous resources and monumental effort to deal with the great gap between supply and demand for services. Development continually seeks to balance requirements for expanding basic services for the general population and providing advanced services for the government and business—services necessary for involvement in the international economy.

### **6.2.1 Satellites**

Indonesia's first satellite earth station for international communications was set up in 1969. Two domestic telecommunications satellites, called the Palapa A series, were launched by the government in 1976. This was the first domestic satellite system launched in a developing country and the fourth by anyone. In June 1983, a second-generation satellite, Palapa B-1, was launched, followed in 1984 by an unsuccessful attempt to orbit Palapa B-2. To replace the unsuccessful B-2, another second generation satellite, Palapa B-2P, was orbited in March 1987. Palapa B-2 was rescued and was relaunched in early 1990 as Palapa B-2R.

Palapa B-4 was the next satellite scheduled for launch, provided by Hughes Aircraft and launched by McDonnell Douglas. Manufacturing costs are \$66.1 million, the launching fee is \$44 million, and insurance is \$21.5 million—a total of \$132 million. Additional earth stations are being built, and the increased capacity will stimulate expansion of telephone, telex, and television broadcast services.

Plans are being made to launch a new generation of satellites, the Palapa-C series, in the later 1990s. Palapa has proven telecommunications infrastructure and can assist the development of the country's trade, industry, tourism, education, and the economy in general. It is also used for regional television broadcasting in Southeast Asia and for communications with neighboring countries including Malaysia, Singapore, and the Philippines.

### **6.2.2 Types of Services**

Public telecom services managed by PT Telkom and PT Indosat consist of telephone, telegraph, telex, leased circuits, television, and facsimile, which are known as the traditional services.

New services are becoming available to the general public through the use of the existing public switched telephone network (PSTN). An international packet service gateway located in Jakarta was completed in 1984 to provide various new data communication services, including database access, electronic mail, computer time sharing, and applications for specialized fields such as tourism, banking and manufacturing.

Indonesia's increasing number of personal computers—estimated at 60,000 in 1988—occasions increasing use of data communications between personal computers and between personal and mainframe computers. An experimental videotex system providing tourist information was installed by PT Indosat at World Expo 1988 in Brisbane, Australia. However, the economic viability of

domestic teletex and videotex services is questioned, especially when comparable services are already provided at lower costs through databases, bulletin boards, and electronic mail. These alternatives are accessible from personal computers through public switched telephone and public switched packet data networks.

### **6.2.3 Rates and Finances**

PT Telkom tariffs consist of basic and special tariffs. Basic tariffs, determined by the MPTT, include the installation fee, monthly charges, and communication charges. Special tariffs are additional amounts that take into account the special circumstances of each region and district. These are determined by PT Telkom in accordance with guidelines issued by the government. PT Indosat rates are approved by the minister.

In principle, tariffs are to cover incurred expenses, while being in line with government policy, sensitive to the market, and providing equitable treatment to all users. The relative weight of each consideration cannot be measured definitively because each is subject to change.

Both PT Telekom and PT Indosat enjoy strong financial health. Budgets of state-owned companies must be in accordance with the government's approved plan and comply with government regulations. The three main components in budget allocation decisions are operation and maintenance costs, the level of dividends provided the government as the sole shareholder, and capital investment requirements. However both Telkom and Indosat have the authority to establish their own financial plans; their capital plans and budget decisions are excluded from the state budget. To expand operations and services or increase paid-in capital requires government approval, however.

Government control is exercised through an annual shareholder meeting, monthly meetings of their boards of commissioners, and government responses to regular reports. Both corporations are also audited annually by government auditors and state supreme auditors.

Day-to-day control of technical matters is exercised through the MPTT while the Department of Finance, as the actual shareholder, oversees financial matters.

## **6.3 Equipment Production**

Telecommunications is one of nine "strategic industries." Domestic telecom equipment manufacturing was started in early 1974 by Industri Telekomunikasi Indonesia (PT Inti) a state-owned company under the supervision of the Department of Tourism, Post, and Telecommunications. PT Inti was established in order to reduce dependence on imported equipment, guarantee timely availability, and ensure continuity of telecommunications development.

To better meet demand for equipment, PT Inti has had a cooperative agreement with Germany's Siemens since 1976 to assemble and manufacture EMD



automatic telephone systems and desk telephones. In 1976, a technical cooperation agreement between PT Inti and Telephone Manufacturing of Belgium (now part of Alcatel) was also signed, covering production of crossbar automatic telephone exchange equipment, telephone sets, PABXs, and pair savers.

The company produces telecom equipment for both domestic markets and export. Its export products include small earth stations sold in Malaysia, avionic systems components sold in the United States, and fire control equipment sold in Italy.

Telecom equipment used in Indonesia includes various types from various countries. No restrictive policies apply; however, technical specifications standards recommended by the Consultative Committee on radio (CCIR) or the Consultative Committee on telephone and telegraph (CCITT) must be followed. In principle, terminal equipment is provided to users by the operating company. However, customers may purchase equipment from distributors as long as it meets standard specifications and has received type approval certification from PT Telkom insuring that it can be integrated into the network.

### **6.3.1 Procurement Policies**

Procurement is regulated by a 1984 presidential decree that was later amended in 1988. The government buys equipment through open bids, limited bids, direct determination, or direct purchase. Indonesian contractors and foreign contractors in joint ventures with Indonesian contractors may participate in bid tenders as long as they submit a certificate of capability. If equipment must be imported, local manufacturers must declare that they cannot produce it. Installation, assembly, and other services must be carried out as far as possible by Indonesians or the Indonesian partners of the equipment suppliers. The obvious effect of this is to require involvement by an Indonesian national in virtually all transactions, if only as passive partner in a joint venture. PT Inti, who provided all of Telkom's and Indosat's switching equipment purchases in 1985–1990, is the largest domestic supplier.

## **6.4 Development**

Telecommunications development is an integral part of the national development plan. The first five-year development plan started in 1969; the fifth, Repelita V, began in April 1989. The main objective of Repelita IV was to facilitate economic restructuring and self-sustained economic growth by reducing dependence on oil production, including creating job opportunities, and developing the manufacturing sector. Repelita V will continue development consistent with Repelita IV.

The telecom sector has been developed under these plans. The major sectoral objectives have been to provide telephone and telex services in the major cities, establish long distance direct dialing and international direct dialing in major cities, expand the networks to larger cities and remote areas through the satel-

lite system, and develop new telecom services. As a result, 523,000 lines were installed during Repelita I through III. Repelita IV called for 950,000 new lines, including 200,000 carried over from Repelita III; actual installation was 350,000. Network coverage in 1989 was 2,069 subdistricts, 58 percent of the total number nationwide.

In its efforts to achieve its telecommunications objectives, Indonesia faces major challenges. At a macrolevel, slow economic growth is the first problem. In 1985 GDP grew only 1.9 percent due to the decline in oil prices and global demand, although the growth rate has subsequently risen and was around 6 percent in the late 1980s and 1990. A second problem is high population growth—2 percent nationwide, faster in the cities because of migration. This contributes to high unemployment.

Telecommunications users are classified into three categories: general public, business, and residential. It will be difficult to satisfy demand in all user categories by the year 2004 so a supply priority has been determined. At present, service is extended only to municipalities and regencies (counties), but not to all villages.

Several tentative long-term (year 2000) objectives have been considered. Telephone service would be provided to villages, but telex, with ISDN would be provided only in urban areas. A target density would be five to ten in urban areas and an overall national average of five (about nine times the level in 1989). Basic phone service would include long-distance direct dialing. Telegrams would be delivered within three days to even the more remote parts of the country—with one-day service in the areas where most people live. In early 1991 Perumtel's president publicly stated it would take 7 million lines to meet demand at the time.

To achieve these targets, several strategies have been adopted. Satellites are an important part. The system has been used for international services since 1969 and since 1976 for domestic services. Digital time division multiple access for international telecommunications was introduced in 1985 and in 1988 domestically. More digital communications satellite technology will come into service in the 1990s, including very small aperture terminals (VSAT), Intelsat's intermediate data rate (IDR), and Intelsat Business Service (IBS).

Much of Indonesia's previous development has been funded from exports of oil and natural gas products, but the early 1980s drop in global oil prices has significantly reduced this revenue flow. To achieve projected telecommunications development levels, the government has had to make a special effort to overcome a shortage of funds. One strategy has been to invite private participation in the financing and installation of telecommunications infrastructure and to allow recovery of private investment through revenue sharing schemes tied to specific projects. Another alternative is to obtain soft loans from foreign countries. These alternatives were both used as ways to achieve the target of adding 2.1 million lines during the 1989–1994 five-year development plan, many of which were installed by thirteen private companies rather than by Perumtel.

The plan originally called for 1.4 million lines, 600,000 from Perumtel and



800,000 from the other companies, but in part because of the November 1990 decision to double the size of a hardware order, the total was expanded. Under the contracts, NEC and a majority-owned subsidiary of AT&T will each provide 350,000 lines of digital switching equipment, including 150,000 to be produced domestically, at a cost of about \$100 million. AT&T's partners are STET Spa (an Italian state company) at 20 percent, and Telefonica de España at 6 percent.

PT Telkom plans to add 15,200 telex lines (for a total of 32,850) and 75,000 pay phones. Other major projects during the 1989–1994 period include extension of telex terminal exchanges throughout the country, a rural and remote areas telecommunications network, a terrestrial transmission network, installation of time division multiple access, a tail link expansion connecting earth stations and telephone exchanges, submarine fiberoptic cable projects, a national data network, microdigital systems, and a national radio frequency monitoring system.

The list of proposals for fiscal 1988–1989 released by the National Development Planning Board (Bappenas) in June 1988 invited donor countries to provide financial assistance for several of these projects. These include improvement of the existing satellite channel, phase III of the remote area telecommunications system, the cross-Kalimantan digital microwave transmission system, a telephone outside plant maintenance center, computerization of the local network records system, extension of the data communication network, facilities for a regional training center, the trans-Sulawesi microwave transmission system, and development of a telecommunications research and development center.

#### 6.4.1 Newer Services

Facsimile service was available through the public switched telephone network by the mid-1980s. By decade end, high-speed service based on the G-4 standard was provided in limited areas via leased lines and in the early 1990s it will be available through the digital PSTN.

Data communications services will be provided mainly through the existing packet switched network called Sambungan Komunikasi Data Packet (SKDP).

In August 1990 Citra Sari Makmur (CSM) began offering VSAT service for data transmission. In the first six months it signed only a dozen customers. By May 1991 thirty-five terminals had been installed and 100 were on order; seven of nine paying customers were banks. The company plans to offer integrated voice service as an alternative to Perumtel's network, but has experienced financial difficulties. In addition, it faces competition. In April 1991 Lintasarta—owned by Perumtel, Indosat, and several banks—received permission to market Vsats. Moreover, Salim, one of the country's largest conglomerates, has permission for an internal system using a transponder on Palapa (*Asian Business*, Apr 1991, p. 16; *Far Eastern Economic Review*, Jun 6, 1991, p. 42).

Cellular land mobile phone service has been expanded to cover cities within a radius of more than 40 km from Jakarta; it has been operational with a 10,000-

line capacity since 1986. In 1990 Perumtel announced it would operate two Motorola-supplied cellular networks with private investors. Radiopaging was introduced in 1987 and is available in several major cities. In 1989 competitors were allowed paging licenses in exchange for 15 percent of revenues.

All these service enhancements are designed to support ISDN development. In the initial stages, narrow band ISDN service will be provided by the digital telephone network. Full-scale introduction of wideband ISDN will not occur until after the year 2000. However, the service will be available to special subscribers on leased lines prior to then.

One measure of productivity is lines per employee. In 1974, Perumtel had eighty-six workers per 1,000 lines. By 1978 this had fallen to forty-eight, to forty in 1988, and thirty-one in 1990. The actual number of employees did not fall—in fact, it increased to 39,000 in 1988, but the number of lines rose much more quickly. The target is to have fewer than twenty employees per 1,000 lines by the year 2000. This target can be achieved by adopting automatic maintenance and operations systems and through the installation of digital equipment, which needs less maintenance and operation work.

#### **6.4.2 Technical Development Strategy**

Recent technological innovations must be carefully examined when making long-term telecommunications commitments. The nation's public networks will have to be integrated into ISDN in the future.

Indonesia's public network at the start of the 1990s included telephone, telex, packet switched public data, and nonswitched leased line networks. Before 1984, only 26 percent of exchanges were automatic. Until 1985 telephone networks primarily involved analog switching. Since 1980 all new switches have been digital. A tentative plan was for 54 percent of switches to be digital in 1989, 72 percent in 1994, 93 percent in 1999, and 100 percent in 2004. In 1990 about 60 percent of switches were analog.

Great distances and the fact the country is an archipelago make the most desirable backbone transmission system a combination of terrestrial and satellite transmission systems. Analysis shows the satellite system is more economical when links exceed 500 km. Roughly 36 percent of circuits were satellite in 1989. This is expected to fall to 25 percent by 2004 as the number of terrestrial circuits increases faster than new satellite circuits.

### **6.5 Development of the Electronics and Computer Industries**

Rapid growth of electronics industries abroad has gradually affected Indonesia's domestic industry. Consumer electronics, manufacturing such products as radio, television sets and tape recorders, has been developing for some time, and there are now hundreds of assembly factories. Of particular importance is the development of telecommunications and office automation equipment man-



ufacturing. PT Inti has moved beyond simple assembly, so that many items now have 70 percent local content.

In an effort to make optimum use of available satellite technology and at the same time promote the domestic industry, the government relaxed its policy on the use of satellite television receive-only (TVRO) terminals. There is currently a growing TVRO terminal-related business for residential and business use.

Locally made computers, particularly personal computers, are a booming business. Computer schools and training programs are emerging rapidly, offering opportunities for high school graduates to take short practical courses that enable them to obtain jobs with reasonable salaries. A substantial amount of foreign software is available, and local software houses are gradually developing to provide customers with tailor-made applications. Enactment of the Copyright Law in November 1987, will encourage the local software industry to develop more rapidly by discouraging pirating—which has been a major problem and complaint of foreign vendors.

A by-product of the computer hardware and software industries is the development of computer database providers. This has also been accelerated by creation of the SKDP Network, the public data communications network, in the mid-1980s. In the late 1980s tourist information was the principal type of database.

The government supports development of local manufacturing with various incentives to attract domestic as well as foreign investment. These incentives take the form of reduced import duties for raw components and concessions relating to initial capital investments. The government gives priority to locally made products in its purchase contracts.

## 6.6 Changing Telecommunications Policy

Historically, all public telecom services have been provided by state-owned enterprises. However, because increasing demand for new services and facilities necessitates large capital investments, gradual policy changes are taking place. The trend is toward allowing private enterprises to invest in certain types of facilities—as well as participate in their management and operation—and to recover their investment through a share of the revenues. This policy was formulated in the Telecommunication Law of April 1989. The new law basically retains the government monopoly over provision and operation of basic services. However, controlled private sector competition is allowed in provision of non-basic value added services.

Cellular and paging systems, including a citizen band communication network, have been licensed to private operators, as discussed earlier. Another example is the construction and financing of central exchanges in association with new residential areas being developed by real estate companies. There are five such licensed projects, involving some 100,000 lines. Typically, PT Telkom receives a percentage of revenue and outright ownership of the hardware after ten years. While this approach is occasioned by government budget con-



straints, it probably indicates a trend toward acceptance of limited privatization of telecommunications.

Private radio broadcasting stations exist in fourteen provinces. A kind of cable television service commenced operation in November 1985. It is a private subscription service on a UHF frequency band and has scrambling capabilities. Programming is mostly advertisements and entertainment. Because of limited coverage, it does not compete directly with existing state-run television broadcasting.

Indonesia has been a pioneer in using satellites, and they are now the mainstay of the system. This means the geographic area covered by the network will expand steadily. The original target of 1.4 million new lines in the 1989–1994 period was lifted to 2.1 million, in part a reflection of the fact 430,000 lines were installed in 1991—a sevenfold increase over 1990. The hope is to have world class (albeit low-end world class) telecom services for commercial users (and tourists) in Jakarta, Bali, and a few other major cities by the end of the 1990s.

#### Bibliography

Directorate General of Posts and Telecommunications. 1982. *History of Posts and Telecommunications in Indonesia*, 5 vols. Jakarta: Department of Transport, Communications, and Tourism.

———. 1985. *The Important Figures in the History of Posts and Telecommunications Development in Indonesia*. Jakarta: Department of Tourism, Posts, and Telecommunications.

JICA. 1987. *Telecommunications Systems*, vols 1 & 2. Jakarta.

Perumtel. *The Public Telecommunications Laws and Regulations*. Bandung.

———. (not dated.) *Telecommunications by the Year 2000*. Bandung.