4-4 Data Communication Subscriber Demand

(1) Estimation by International Trend (Method-1)

To make a forward projection of the amount of demand for the data communication service in Indonesia, a regression model was estimated by the Ordinary Least Squares Method using the data compiled by ITU (pooled time series cross section data of 19 countries and 4 year-periods of 1981-1984).

The data used are taken from ITU's "Yearbook of Common Carrier Telecommunication Statistics", 1986 edition. 19 countries were chosen because telex and in those countries data communication services data are well organized between 1981 and 1984. The 19 countries are Austria, Chile, Cyprus, El Salvador, Finland, France, Germany, Indonesia, Italy, New Zealand, Norway, Panama, Papua New Guinea, Philippines, Singapore, Spain, Sweden, Switzerland and Thailand.

Figure 4-4-1 shows the data plotted on the graph of the telephone density and the data communication service subscribers per telephone service subscribers. As the general trend of the data, the data communication service subscribers increase slowly when the telephone density is low, but the growth rate of the data communication service subscribers is becoming larger as the telephone density becomes higher.

It is assumed that there exists only a small gap between the number of potential subscribers and that of actual subscriber, because none of the countries used for the estimation has a serious waiting problem for the data communication service, not like the telephone service. Hence, the actual subscribers are regarded to represent the potential subscribers. The estimated model is as follows:

$$\log(SD) = -8.7778 + (0.7707 + 0.11487\ TD) \times \log(S) + 3.1724 \times ID$$

$$R^2 = 0.947$$

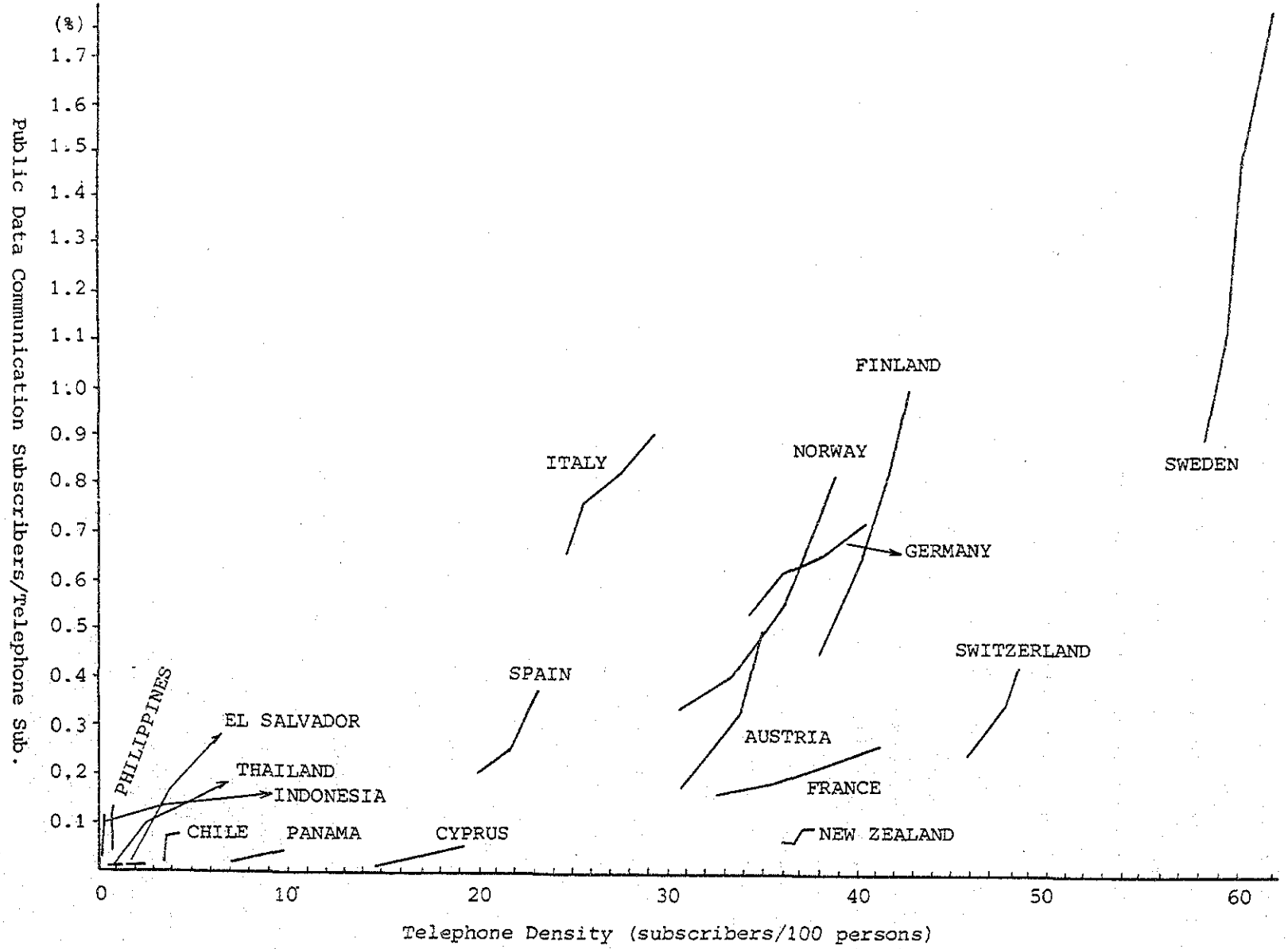


Figure 4-4-1 International Data of Data Communication Service (1981-1984)

where

SD : The No. of data terminals (x1000)
TD : Telephone density per 100 persons
S : The No. of telephone service subscribers (x1000)
ID = 1 for Indonesia
0 for other countries

In order to explain the difference in starting points of prediction, a country dummy (ID) for Indonesia was introduced. By this variable, the initial number of telex subscribers in Indonesia is adjusted to its own figure, not the world average.

As the explanatory variables, no economic variable such as price or income was also significant in this model. This model relates the potential subscribers of the data communication service to the telephone density and telephone service subscribers. In other words, the demand source for the data communication service is the telephone subscribers. And, what percent of this demand source will develop into the actual demand, however, differs in each country. One percent increase in the telephone service subscribers will increase the demand for the data communication service by (0.7707 + 0.11487 TD) percent. Namely, the larger the telephone density is, the faster the demand for the data communication service grows.

Table 4-4-1 shows the summary of the simple forward projections of the data communication service subscribers by the estimated model. There are two cases in the table. The cases assume that telephone subscribers will increase according to the plan 1 and plan 2 discussed in the section of the telephone supply plan.

Table 4-4-1 Projections of Data Communication Service Subscribers

Case 1 (TELEPHONE SUPPLY PLAN 1)					
	1984	1989	1994	1999	2004
TEL. SUB (x1000)	540	1,250	2,100	3,200	4,500
TEL. DENSITY	0.33	0.70	1.06	1.46	1.84
DATA COM SUB	195	750	1,403	2,632	4,345
Case 2 (TELEPHONE SUPPLY PLAN 2)					
	1984	1989	1994	1999	2004
TEL. SUB (x1000)	540	1,450	2,650	4,300	6,200
TEL. DENSITY	0.33	0.81	1.33	1.96	2.54
DATA COM SUB	195	750	2,075	4,448	7,846

(2) Estimation by Japanese Trend (Method-2)

The data communication demand trend was analyzed with the premises that the demand source is on-line computer system holders. Figure 4-4-2 shows the trend of the number of on-line computers between the number of data communication circuits between 1964 and 1983 in Japan. By using this figure, the data communication demands in Indonesia were estimated as follows;

Item	1984	1989	1994	1999	2004
DT by Switched	300	1,200	1,800	4,700	11,200
DT by Leased CCT	600	1,300	3,800	10,000	23,800
On-line Computer	50	100	300	800	1,900

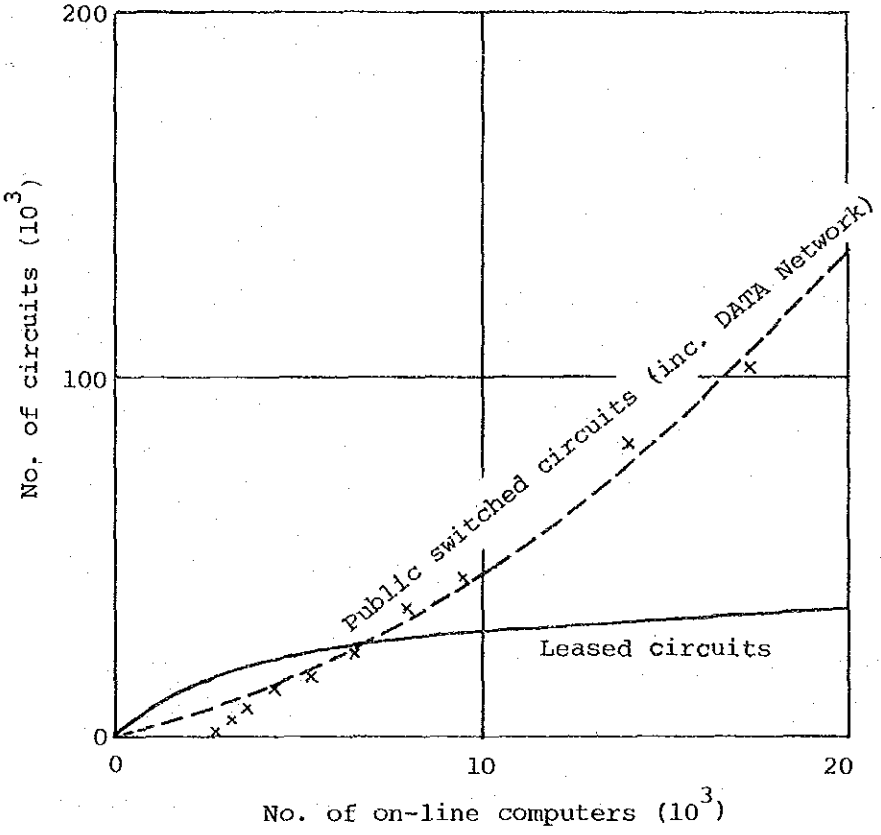


Figure 4-4-2 Correlation between No. of On-line Computer and No. of Dedicated Circuits in Japan

(3) Observations on the Potential Data Communication Subscribers

The data on the number of data communication service subscribers in Japan are shown in Table 4-4-2.

When the same diffusion pattern is assumed in Indonesia, as the initial potential subscribers in the diffusion stages, the following can be regarded as the subscribers;

Switched Data Communication Subscribers:

1) Government Offices
2) Airports
3) Hospitals
4) Hotels
5) Travel Agents
6) Telegraph Offices

Leased Circuit Data Communication Subscribers:

1) Banks
2) Post Offices
3) Telegraph Offices

The number of government organizations as well as private business firms in Indonesia is shown in Table 4-4-3 and 4-4-4. By using these data, the potential subscriber demand for data communication service in Indonesia can be estimated as follows;

Switched Data Communication Subscribers : 7,900
Leased Line Data Communication Subscribers: 3,100

Table 4-4-2 Data Communication Service Subscribers by Business in Japan

Business Category	1965	1970	1975	1980	1984
Manufacturing, Construction	1	12	24	2,246	3,292
Commerce			1	1,463	2,466
Finance	5	17	41	550	658
Security	2	2	2	28	49
Insurance		2	7	43	59
Transportation	4	9	16	15	268
Electricity & Gas			2	25	32
Communication & Publishing		1	3	284	490
Warehouse & Real estate				85	143
Information & Software		2	8	341	548
Government		2	4	106	130
Local Public Entities		2	6	333	454
National University		1	1	48	87
Corporation		1	5	138	384
Others				18	33
Total	12	51	120	5,862	9,093

Table 4-4-3 The Number of Potential Subscribers for Switched Data Communication Service

(1983)

Province	Government Office (1)	Air Port (2)	Hospital (3)	Hotel (4)	Travel Agent (5)	Telegraph Office (6)	Others (7)	Total (8)
D.I. ACHE	121	1	18	8	5	27	54	234
SUMATERA UTARA	187	1	89	28	30	49	115	499
SUMATERA BARAT	143	1	50	12	12	20	71	309
RIAU	88	3	19	6	12	25	46	199
JAMBI	77	1	12	4	4	5	31	134
SUMATERA SELATAN	121	3	41	10	9	6	57	247
BENGKULU	44	1	6	2	0	19	22	94
LAMPUNG	55	1	6	6	2	11	24	105
D.K.I. JAKARTA	195	2	45	62	102	8	124	538
JAWA BARAT	264	4	35	63	24	95	146	631
JAWA TENGAH	396	2	169	37	10	77	207	898
D.I. YOGYAKARTA	66	1	34	12	12	9	40	174
JAWA TIMUR	341	4	134	45	40	96	198	858
BALI	99	1	22	37	29	12	60	260
NUSA TENGGARA BARAT	77	2	13	6	1	11	33	255
NUSA TENGGARA TIMUR	143	3	25	2	3	20	59	255
TIMOR TIMUR	154	8	4	0	0	0	50	216
KALIMANTAN BARAT	77	1	14	2	4	18	35	151
KALIMANTAN SELATAN	121	2	21	1	14	12	51	222
KALIMANTAN TENGAH	110	2	13	9	6	12	46	198
KALIMANTAN TIMUR	88	2	20	16	20	11	47	204
SULAWESI UTARA	77	1	26	6	11	13	40	174
SULAWESI TENGAH	55	2	11	4	5	11	26	114
SULAWESI SELATAN	264	1	78	23	20	5	117	508
SULAWESI TENGGARA	5	1	13	1	1	28	30	129
MALUKU	66	0	19	6	6	25	37	159
IRIAN JAYA	110	9	25	2	9	16	51	222
TOTAL	3,594	60	962	410	391	641	1,817	7,875

Note: Other users are estimated to be 30% of columns (1) through (6) as business use by private companies.

Table 4-4-4 The Number of Potential Subscribers for Leased Circuit Data Communication Service

(1983)

Province	Bank (1)	Post Office (2)	Telegraph Office (3)	Others (4)	Total (5)
D.I. ACHE	32	25	27	25	109
SUMATERA UTARA	94	46	49	57	246
SUMATERA BARAT	46	19	20	26	111
RIAU	29	23	25	23	100
JAMBI	11	5	5	6	27
SUMATERA SELATAN	43	6	6	17	72
BENGKULU	13	18	19	15	65
LAMPUNG	20	10	11	12	53
D.K.I. JAKARTA	166	7	8	54	235
JAWA BARAT	121	89	95	92	397
JAWA TENGAH	132	72	77	84	365
D.I. YOGYAKARTA	16	8	9	10	43
JAWA TIMUR	138	90	96	97	421
BALI	38	11	12	18	78
NUSA TENGGARA BARAT	20	10	11	12	53
NUSA TENGGARA TIMUR	12	19	20	15	66
TIMOR TIMUR	3	0	0	1	4
KALIMANTAN BARAT	37	17	18	22	94
KALIMANTAN SELATAN	14	11	12	11	48
KALIMANTAN TENGAH	27	11	12	15	65
KALIMANTAN TIMUR	34	10	11	17	72
SULAWESI UTARA	26	12	13	15	66
SULAWESI TENGAH	18	10	11	12	95
SULAWESI SELATAN	63	5	5	22	95
SULAWESI TENGGARA	8	26	28	19	81
MALUKU	21	23	25	21	90
IRIAN JAYA	15	15	16	14	60
TOTAL	1,196	598	641	732	3,167

Note: Other users are estimated to be 30% of columns (1) through (3) as business use by private companies.

4-5 Facsimile Service Demand

(1) Facsimile Service Demand in the World

The total number of facsimile terminal equipments installed in the world as of 1981 is estimated to be approximately 734,000. (See Table 4-5-1.) This number is not far behind the number of telex terminal equipments installed, which is estimated to be one million. The reasons why the facsimile service demand sharply increased are mainly twofold. One is the release of the domestic public telephone network for the facsimile service in all countries during the 1970s. The other is the international standardization of facsimile terminal set by CCITT.

Table 4-5-1 Facsimile Terminals in the World

(1981)

Region	No. of Facsimile Terminals
USA & Canada	337,950
Europe	77,000
Far East	319,000
Total	733,950

Source: George Stams Survey

(2) Facsimile Service Demand in Japan

How the number of facsimile terminals and telex terminals changed over time is shown in Figure 4-5-1. The number of telex terminals has been on a down-trend ever since 1977, its peak year of 82,000, while the number of facsimile has been on an exponential upward trend and reached to 730,000 in 1984 with a remarkable high growth rate.

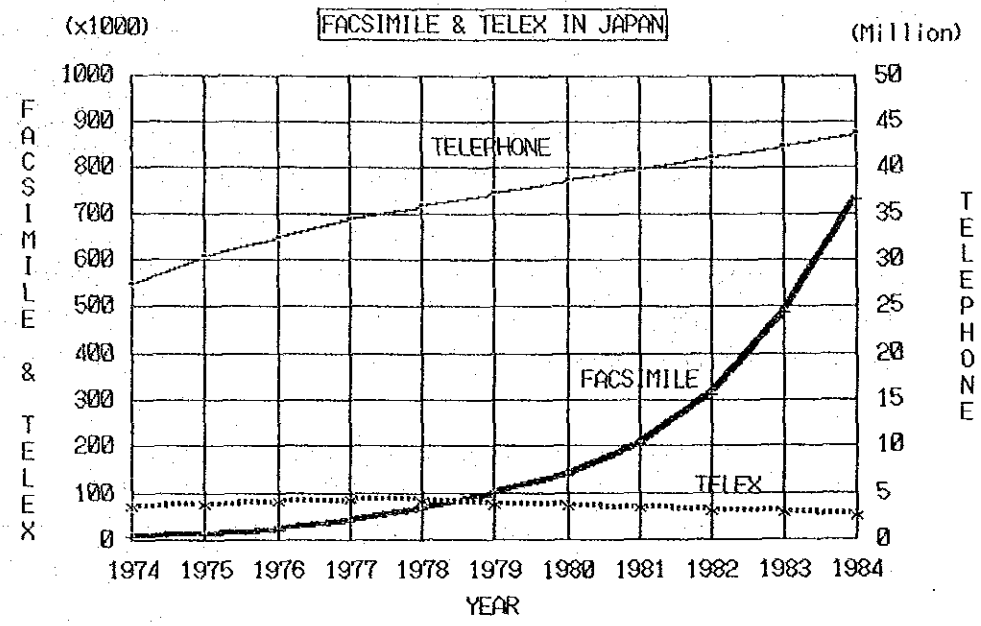


Figure 4-5-1 Number of Facsimile Terminals in Japan

Reasons for this rapidly increased use are;

1) Ability of sending complicated characters such as Chinese Characters,
2) Ability of sending drawings,
3) Easy operation, no keyboard operation,
4) Lower market price due to recent rapid technical progress,
5) Use of telephone network which made communication costs lower.

Any clear correlation between the number of facsimile terminals and that of main telephone lines is not evident as shown in figure 4-5-2; however, the ratio of facsimile terminals to main telephones stands as high as 0.017.

(3) Facsimile Demand in Indonesia

The G-II/G-III specification subscriber facsimile service is already provided by telephone network. The number of terminals is, however, rather small in about 250 (registered by PERUMTEL) in 1985. While public facsimile service (BIROFAX) is provided in 16 regions of the country and to 20 foreign countries, as shown in Table 4-5-2.

Many applications for approval of facsimile equipments have been offered. Some 30 equipments models have been already tested and approved by the Research and Development center of PERUMTEL.

Table 4-5-2 BIROFAX Service Coverage

Domestic		Overseas
Jakarta (Jl. Merdeka Selatan No. 12)		United Kingdom, Korea
Medan	Padang	New Zealand, Canada
Bandung	Semarang	Thailand, Singapore
Pontianak	Balikpapan	Hong Kong, Taiwan
Manado	Ambon	Australia, Switzerland
Pekanbaru	Palembang	Netherlands, Japan
Surabaya	Denpasar	Philippines, India
Banjarmasin	Ujungpandang	Hawaii, Brunei
Jayapura		West Germany
		Fiji Island, Spain

All the advantageous features of the facsimile except the first one discussed in Section (2) can also hold in Indonesia.

The results of communication cost comparison between telex and facsimile under the current tariffs to show the fifth advantage more clearly are shown in Table 4-5-3. From the table, it is noted that the cost of sending a message contained in A4 paper is lower in 8% - 38% by facsimile than by telex.

Table 4-5-3 Communication Cost Comparison between Telex and Facsimile

Item		Telex	Facsimile	Facsimile/ Telex
1.	Installation Fee			
	Terminal eqpt.	5,000,000	5,600,000	
		7,500,000	7,200,000	Same
	Installation Fee (Jakarta)	500,000	500,000	
2.	Monthly Fee	7,500	3,500	50%
3.	Call Fee by distance			
	Case 1 (local) (A4 sending)	Rp. 75x160/12 = Rp. 1000	Rp. 75x30/180 = Rp. 75	8%
	Case 2 (300 km) (A4 sending)	Rp. 75x160/8 = Rp. 1500	Rp. 75x30/4 = Rp. 600	40%
	Case 3 (750 km) (A4 sending)	Rp. 75x160/6 = Rp. 2000	Rp. 75x30/3 = Rp. 750	38%
	Case 4 (750 km, Message of about 100 characters)	Rp. 75x16/6 = Rp. 200	Rp. 75x15/3 = Rp. 375	188%

Under these circumstances, together with expansion of good quality telephone networks, demand prospects for facsimile in the future seem bright.

The results of facsimile demand forecasts in 2004, estimated by using the demand densitites of 0.01 (case 1) and 0.02 (case 2) in relation to the number of telephone service subscribers are shown in Table 4-5-4.

Table 4-5-4 Facsimile Service Demand in Indonesia

(Line Unit)

Item	1984	1989	1994	1999	2004
Case 1					
Facsimile	-	3,630	13,250	32,250	62,000
Fax/Tel	-	0.0025	0.005	0.0075	0.01
Case 2					
Facsimile	-	7,250	26,500	64,500	124,000
Fax/Tel	-	0.005	0.01	0.015	0.02
Telephone Sub.	540,000	1,450,000	2,650,000	4,300,000	6,200,000

Where the number of the telephone service subscribers is based on Supply Plan 2.

4-6 Paging Service Demand

(1) Paging Service in the World

The first paging service began by manual service in 1958 in the USA. In 1962, paging by automatic dialing system started. In Europe, the service started in Britain in 1973, West Germany in 1974 and France in 1975.

In Japan, the service was inagurated in 1968. Figure 4-6-1 shows how the service developed in the past.

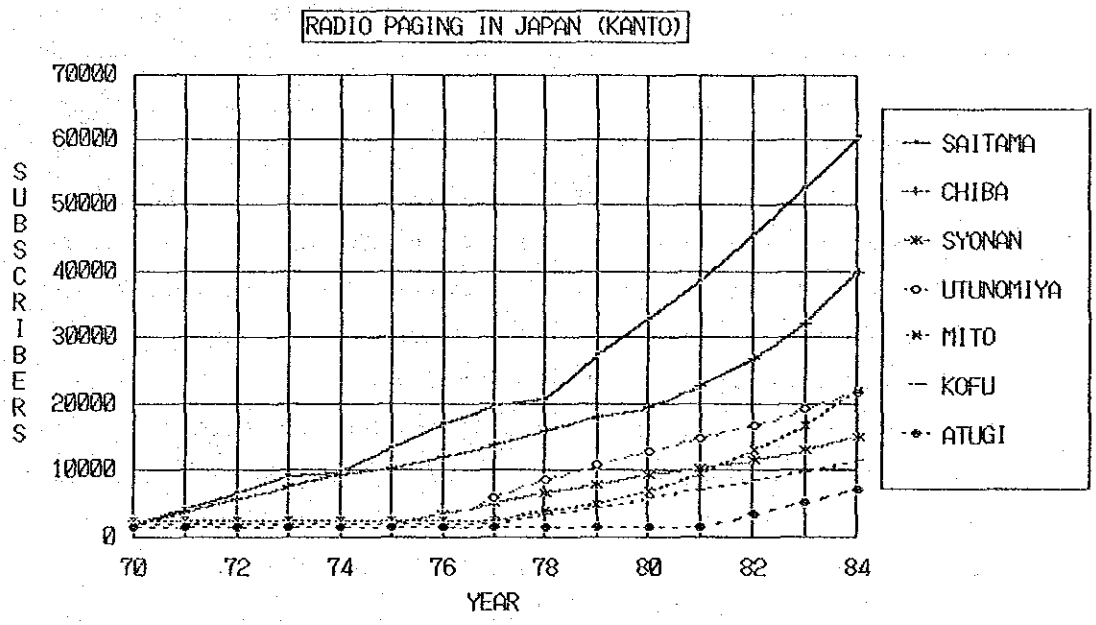


Figure 4-6-1 Radio Paging Service in Japan
(Kanto area except for Tokyo and Yokohama)

The paging service demand is greatly related with the telephone service penetration rate in the service area. Therefore, demand forecast is made by using the number of the telephone service subscribers in the concerned area as its basis.

The paging service user categories differ in the USA and Japan because of the difference in the living environments. In the USA, medical service and transportation business are the major users. In Japan, retail business tops the user category list. In the USA, police and government offices also utilize the public paging service, but in Japan those organizations use their own communication system for paging. (See Table 4-6-1.)

In Indonesia, because of inavailability of complete industry and business statistics data, population of the demand was difficult to analyze. Table 4-6-1 may be applicable when complete industry and business statistics becomes available in Indonesia.

Table 4-6-1 Radio Paging Users by Business Category

USA			Japan (Kanto Area)		
	Sector	(%)		Sector	(%)
1.	Medical Service	19	1.	Retail Sales (except 6.)	26.1
2.	Transportation	15	2.	Construction	18.5
3.	Construction	10	3.	Services (except 10. 14.)	16.7
4.	Trade & Commerce	10	4.	Manufacturing (except 8.)	10.1
5.	Manufacturing	9	5.	Wholesales	4.4
6.	Government	8	6.	Motor Vehicle Sales	4.4
7.	Repair Service	6	7.	Transportation & Communication	3.7
8.	Bank & Finance	5	8.	Printing & Publishing	3.5
9.	Service	5	9.	Real Estate	2.7
10.	Telecommunication	4	10.	Medical Service	2.3
11.	Police	4	11.	Finance & Insurance	2.2
12.	Real Estate	2	12.	Public Utilities	0.8
13.	Personal Service	2	13.	Agriculture, Fishery, Mining	0.2
14.	Public Utilities	1	14.	Broadcasting	0.2
				Others	0.2

(2) Demand Forecast for Indonesia

The relationship between paging service subscribers and telephone service subscribers in the case of the Kanto area in Japan, is shown in Table 4-6-2.

Table 4-6-2 Paging Service Subscribers in the Kanto Area in Japan (1983)

Prefecture	Radio Paging Sub.	Telephone Sub.	Paging/Tel.
Ibaragi	16,700	750,000	0.022
Tochigi	19,100	611,000	0.031
Saitama	52,700	1,779,000	0.030
Chiba	32,000	1,630,000	0.020
Tokyo	254,000	5,642,000	0.045
Kanagawa	77,000	2,315,000	0.033
Yamanashi	9,900	270,000	0.037
Japan Total	1,646,300	42,879,000	0.038

As seen from the table, the ratio of the paging service subscribers to the telephone service subscribers does not greatly vary among prefectures. The Japanese average ratio of 0.038 may be applicable as one of indexes for the paging service subscriber demand forecast in Indonesia.

The result of the paging service subscriber demand forecast by the above index in Indonesia is presented in Table 4-6-3.

Table 4-6-3 Paging Service Subscriber Demands in Indonesia

Item	1984	1989	1994	1999	2004
Paging sub.	20,520	55,100	100,700	163,400	235,600
Telephone sub.	540,000	1,450,000	2,650,000	4,300,000	6,200,000

The paging service subscriber demand for major cities is shown in Table 4-6-4.

Table 4-6-4 Radio Paging Service Subscriber Demand in Cities

No.	KOTA/KOTA ADM	PELITA-IV (1989)	REPELITA-V (1994)	REPELITA-VI (1999)	REPELITA-VII (2004)
1	Jakarta	13,670	25,850	42,549	61,112
2	Surabaya	5,310	7,320	12,043	17,298
3	Bandung	2,570	4,290	7,072	10,157
4	Medan	2,420	4,440	7,311	10,500
5	Semarang	1,150	2,090	3,449	4,953
6	Ujung Pandang	1,030	1,890	3,112	4,463
7	Palembang	750	1,370	2,252	3,234
8	Malang	-	1,300	2,132	2,063
9	Yogyakarta	-	1,100	1,817	2,609
10	Banjarmasin	-	950	1,567	2,250
11	Denpasar	-	900	1,480	2,215
12	Cirebon	-	870	1,425	2,047
13	Solo	-	800	1,327	1,906
14	Tanjung Karang	-	-	1,229	1,766
15	Bogor	-	-	1,077	1,547
16	Manado	-	-	1,055	1,516
17	Padang	-	-	1,044	1,500
18	Samarinda	-	-	936	1,344
19	Pontianak	-	-	903	1,297
20	Balikpapan	-	-	859	1,234
21	Jambi	-	-	838	1,203
22	Pekanbaru	-	-	838	1,203
23	Kupang	-	-	816	1,172
24	Jember	-	-	-	1,016
25	Banda Aceh	-	-	-	984
26	Tasik Malaya	-	-	-	984
27	Tegal	-	-	-	922
28	Ambon	-	-	-	891
29	Kota Siantay	-	-	-	844
30	Sukabumi	-	-	-	781
31	Pekalongan	-	-	-	781
32	Mataram	-	-	-	781

4-7 Land-Mobile Radiotelephone Service Demand

(1) Land-Mobile Radiotelephone Service Demand in Japan

The land-mobile radiotelephone service has a relatively long history in the world. In the USA, the introduction, though by manual system, was in 1946. In Japan, a country of dense population with a large service estimated demand, the service started rather lately in 1979 by "small zone, large capacity system" of 800 MHz band instead of 150 MHz band commonly used in other countries.

The number of the land-mobile radiotelephone service subscribers in Japan is shown in Table 4-7-1. Table 4-7-2 presents a breakdown of subscribers by car types at the end of September 1984, passenger cars top the list, accounting for 94%. Table 4-7-3 classifies subscribers by user category and Table 4-7-4 gives user shares by business.

The population of demand is, therefore, considered to be passenger cars. The forecast is to be made by using the number of passenger cars and its growth rate, as well as the number of cars in all the types.

Table 4-7-1 The Number of Land-Mobile Telephone Service Subscribers in Japan by Year

Area	1979	1980	1981	1982	1983	1984
Tokyo	1,557	4,844	8,822	12,534	16,048	18,812
Osaka	-	1,562	3,947	5,654	7,018	8,317
Nagoya	-	-	506	1,019	1,614	2,207
Fukuoka	-	-	-	303	619	1,007
Sapporo	-	-	-	183	384	477
Hiroshima	-	-	-	45	259	406
Sendai	-	-	-	66	334	582
Kanazawa	-	-	-	-	230	326
Maebashi	-	-	-	-	450	838
Nagano	-	-	-	-	136	331
Matsuyama	-	-	-	-	106	336
Total	1,557	6,406	13,275	19,804	27,298	33,639

Note: Figures in 1984 show the number as of September.

Table 4-7-2 The Number of Land-Mobile Telephone Service Subscribers in Japan by Type

(1984)

Area	Truck	Bus	Passenger Car	Special Car	Total
Tokyo	868	91	17,616	236	18,812
Osaka	442	19	7,773	83	8,317
Nagoya	119	10	2,047	31	2,207
Fukuoka	23	0	971	13	1,007
Sapporo	38	0	439	0	477
Hiroshima	8	0	385	13	406
Sendai	22	1	546	13	582
Kanazawa	16	2	304	4	326
Maebashi	47	12	776	3	838
Nagano	16	4	311	0	331
Matsuyama	22	2	308	4	336
Total	1,622	141	31,476	400	33,639

Table 4-7-3 The Number of Land-Mobile Telephone Service Subscribers by Organization in Japan

(1984)

Area	Government	Public Services	Company	Individual	Total
Tokyo	431	479	14,571	3,351	18,812
Osaka	67	404	7,620	226	8,317
Nagoya	25	131	1,963	88	2,207
Fukuoka	15	82	870	40	1,007
Sapporo	21	14	345	97	477
Hiroshima	14	25	364	3	406
Sendai	20	54	465	43	582
Kanazawa	20	19	296	1	326
Maebashi	18	18	634	168	838
Nagano	8	21	274	28	331
Matsuyama	13	24	285	14	336
Total	632	1,271	27,677	4,059	33,639

(2) Land-Mobile Telephone Service Demand in Indonesia

Table 4-7-4 shows the numbers of land-mobile telephone service subscribers and passenger cars registered in Japan.

Table 4-7-4 The Number of Land-Mobile Telephone Service Subscribers in Japan (1984)

Area	Mobile Telephone	No. of car (sedun)	Mobile-Tel/Car
Tokyo	33,170	5,692,830	0.0058
Osaka	15,032	3,546,640	0.0042
Nagoya	5,221	3,549,390	0.0015
Fukuoka	2,610	2,913,764	0.0009
Sapporo	1,061	1,408,739	0.0008
Hiroshima	1,171	1,559,346	0.0008
Sendai	1,389	2,076,542	0.0007
Kanazawa	747	748,970	0.0010
Maebashi	2,403	1,979,994	0.0012
Nagano	843	1,027,780	0.0008
Matsuyama	819	798,128	0.0010
Japan Total	64,466	25,303,057	0.0025

By using the Land-Mobile Telephone/Car ratios in Japan as indicated in Table 4-7-4, the regional ratios in Indonesia are proposed and used for the demand forecasting. The proposed regional ratios are shown in Table 4-7-5.

Table 4-7-5 Proposed Land-Mobile Telephone Service Subscription Rate in Indonesia

Island	Mobile Tel./ No. of Passenger Cars
Sumatera	0.004
Jawa	0.005
Bali/Nusa Tenggara/T.T.	0.003
Kalimantan	0.003
Sulawesi	0.003
Maluka/Irian Jaya	0.003

The results of the total national demand and its regional distribution are shown in Table 4-7-6 and Table 4-7-7, respectively.

Table 4-7-6 Total Land-Mobile Telephone Demand in Indonesia

	1984	1989	1994	1999	2004
Mobile Telephone	4,311	6,906	9,512	12,105	14,708
No. of Passenger Cars	925,000	1,490,000	2,060,000	2,630,000	3,200,000

The number of passenger cars in the future was estimated by using the actual growth rate of the passenger cars for each Province between 1979 and 1984.

Table 4-7-7 Land-Mobile Radiotelephone Service Demand

PROVINCES	1984	1989	1994	1999	2004	NOTES
D.I. ACHE	25	38	51	64	76	
SUMATERA UTARA	176	260	346	432	517	
SUMATERA BARAT	52	77	103	128	153	
RIAU	38	56	75	93	112	
JAMBI	16	25	33	41	50	
SUMATERA SELATAN	110	164	218	272	325	
BENGKULU	6	8	12	13	17	
LAMPUNG	44	65	87	108	130	
	(467)	(693)	(925)	(1,151)	(1,380)	
D.K.I. JAKARTA	1,609	2,554	3,449	4,444	5,388	Jakarta
JAWA BARAT	762	1,090	1,419	1,747	2,075	Bandung
JAWA TENGAH	362	517	673	829	985	
D.I. YOGYAKARTA	61	87	114	140	166	
JAWA TIMUR	773	1,303	2,035	2,665	3,296	Surabaya
	(3,567)	(5,652)	(7,740)	(9,825)	(11,910)	
BALI	34	80	126	172	218	
NUSA TENGGARA BARAT	10	24	39	53	67	
NUSA TENGGARA TIMUR	10	24	38	52	66	
TIMOR TIMUR	5	12	20	27	34	
	(59)	(140)	(223)	(304)	(583)	
KALIMANTAN BARAT	12	21	30	38	46	
KALIMANTAN SELATAN	28	47	66	85	105	
KALIMANTAN TENGAH	3	6	8	10	13	
KALIMANTAN TIMUR	34	58	83	107	131	
	(77)	(132)	(187)	(240)	(295)	
SULAWESI UTARA	34	75	117	158	199	
SULAWESI TENGAH	7	16	25	34	43	
SULAWESI SELATAN	67	148	229	310	391	
SULAWESI TENGGARA	4	9	13	18	23	
	(112)	(248)	(384)	(520)	(656)	
MALUKU	10	18	26	34	48	
IRIAN JAYA	19	23	27	31	34	
	(29)	(41)	(53)	(65)	(82)	
TOTAL	4,311	6,906	9,512	12,105	14,708	

CHAPTER 5
TELECOMMUNICATIONS SERVICES TRAFFIC

CHAPTER 5 TELECOMMUNICATIONS SERVICES TRAFFIC

5-1 Telephone Service Traffic

(1) The Current State of Telephone Service Traffic in Indonesia

The trend of automatic telephone service traffic in the period of 1980 through 1984 is shown in Table 5-1-1. The share of toll traffic on the total pulses is 70% through 90% while the detailed data is not available.

Table 5-1-1 Telephone Service Traffic (Annual Pulse)

Year	No. of Subscribers	Annual Traffic (1000 pulses)	Annual Traffic /Subscriber (pulse)
1980	369,843	3,353,442	9,067
1981	427,185	4,315,920	10,103
1982	475,459	4,962,409	10,437
1983	503,253	5,147,835	10,229
1984	536,102	5,365,554	10,008

Source: "TRAFFIC" 1983-1984, PERUMTEL

The busy hour traffic (calling rate) in automatic telephone service is summarized by the several study reports as shown in Table 5-1-2. The toll traffic volume per subscriber varies in area by area. This variation will be caused by not only the area characteristic but the supply rate to demand volume in each area.

Table 5-1-2 Telephone Service Traffic (Busy Hour Calling Rate)

Area	Total Originating Traffic/Subscriber	Toll Originating Traffic/Subscriber
Jakarta	approx. 70 mErl.	approx. 5 mErl.
Middle Size City	40 - 50 mErl.	5 - 8 mErl.
Small Size City	10 - 40 mErl.	7 - 30 mErl.
National Average	approx. 60 mErl.	approx. 8 mErl.

In this study, the toll traffic was forecasted as the main objective for the toll circuit requirements and the revenue estimation.

(2) Toll Traffic Forecasting Method (Inter-Province Model)

To predict the inter-Province telephone service toll traffic flow, a regression model was constructed by using the toll trunk traffic flow samples of 17 Secondary and 7 Tertiary Centers in Indonesia in 1984. The toll traffic data from the above exchange offices were at first aggregated for each Province and then adjusted according to the portion of telephone subscribers which is covered by the exchange offices in each Province. Namely, the toll traffic flow from the i-th Province to the j-th Province, XTP_{ij}, is calculated by the following formula:

$$XTP_{ij} = [W_i \times (S_i/SE_i) + W_j \times (S_j/SE_j)] \times XE_{ij}$$

where

XTP_{ij}: The adjusted toll traffic flow (Erl) from the i-th Province to the j-th Province aggregated at the sample exchange office level

S_i : The number of the telephone service subscribers in the i-th Province

S_j : The number of the telephone service subscribers in the j-th Province

SE_i : The number of the telephone service subscribers in the i-th Province covered by the sample

SE_j : The number of the telephone service subscribers in the j-th Province covered by the sample

W_i : $S_i/(S_i + S_j)$. The weight for the i-th Province

W_j : $S_j/(S_i + S_j)$. the weight for the j-th Province

XE_{ij} : The actual toll traffic flow (Erl) from the i-th Province to the j-th Province aggregated at the sample exchange office level

The estimated toll traffic model is given as follows:

$$\log (XTP_{ij}) = -4.31559 + 0.61196 \times \log (S_j) + 0.51539 \times \log (S_i) - (1.7117 - 0.1092 \times D8RS) \times \log (P_{ij})$$

$$R^2 = 0.8280$$

where

P_{ij} : Charged pulse/minute from the i-th Province to the j-th Province

D8RS = 1 if the traffic is between Sumatera Utara, Sumatera Barat, Sumatera Selatan, D.K.I. Jakarta, Jawa Barat, Jawa Tengah, D.I. Yogyakarta, Jawa Timur

= 0 for other Provinces

The estimated model is of the gravity form containing the telephone subscribers of the i and j-th Province and pulse/min between them as the major explanatory variables. The larger the numbers of telephone subscribers of two Provinces become, the larger the toll traffic flow between them becomes.

The charged pulse/min works as a negative factor for the toll traffic flow representing the cost of using the telephone service. However, this negative factor is not large for the 8 Provinces which have 8 large cities comparing to the rest of Provinces. Namely, one percent increase of P_{ij} generally decrease 1.7117 percent of XTP_{ij}, but decreases only 1.6025 percent of XTP_{ij} between the above 8 Provinces, which is captured by - 0.1092, the coefficient of D8RS.

(3) Toll Traffic Forecast Results

Table 5-1-3 shows the summary of the simple forward projections of the telephone service toll traffic by the estimated model. There are two cases in the table. The cases assume that Real GDP in 1975 price grows by 3% and 5% per year and that telephone subscribers will increase according to the plan 1 and 2 discussed in the section of the telephone supply plan.

Table 5-1-3 Projections of Telephone Service Toll Traffic (originating)

CASE 1 (Telephone supply plan-1)				
	1989	1994	1999	2004
TEL. SUB (x1000)	1,250	2,100	3,200	4,500
TEL. TRF (Erl.)	10,135	18,178	29,217	42,902
TRF/SUB (mErl.)	8.1	8.7	9.1	9.5

CASE 2 (Telephone supply plan-2)				
	1989	1994	1999	2004
TEL. SUB (x1000)	1,450	2,650	4,300	6,200
TEL. TRF (Erl.)	11,976	23,622	40,757	61,562
TRF/SUB (mErl.)	8.3	8.9	9.5	9.9

Since time series data are not used for the regression, forecasting errors may become bigger as the forecast period moves away from 1984.

5-2 Telegraph Service Traffic

(1) Forecasting Method

To explain the traffic flow of the telegraph service in Indonesia, a forecasting model was estimated by the Ordinary Least Squares Method with using the data compiled by ITU (pooled time series cross section data of 21 countries and 5 year-periods of 1980-1984).

The data used are taken from ITU's "Yearbook of Common Carrier Telecommunication Statistics", 1986 edition. 21 countries were chosen because in those countries telegraph data are well organized between 1980 and 1984. The 21 countries are Australia, Austria, Belgium, Denmark, Finland, France, Germany, Hong Kong, Indonesia, Italy, Japan, Korea, Malaysia, Netherlands, Norway, Philippines, Singapore, Sweden, Switzerland, Thailand and U.S.A.

Figure 5-2-1 shows the data plotted on the graph of the telephone density and the telegraph volume per 100 persons. As the general trend of the data, the telegraph traffic per 100 persons increase when the telephone density is low, but the traffic per 100 persons starts decreasing as the telephone density becomes higher. Around the value at 20 of the telephone density in the graph seems the turning point.

The estimated model is as follows:

$$TLG = -5.652 + (122.36 + 523.5 \times TD) \times N + (0.33 - 147 \times TD) \times Y - 131.98 \times ID$$

$$R^2 = 0.974$$

where,

TLG : The number of domestic telegrams (10^5)

N : The size of population (10^6)

TD : Telephone density per 100 persons

Y : Real GDP of 1980 price in US dollars (10^9)

ID = 1 for Indonesia

0 for other countries

According to the result, decreasing tendency in the telegraph service begins when the telephone density exceeds about 22 per 100 persons and per-capita income exceeds about 3600 real U.S. dollars. In order to explain the difference in starting points of prediction, a country dummy for Indonesia was introduced. By this variable, the initial level of telegram volume in Indonesia is adjusted for its own figure, not the world average.

(2) Forecast Results

Table 5-2-1 shows the summary of the simple forward projections of the telegraph traffic by the estimated model. There are two cases in the table. The cases assume that Real GDP in 1980 price grows by 3% and 5% per year and that telephone subscribers will increase according to the plan 1 and plan 2 discussed in the section of the telephone supply plan.

Table 5-2-1 Projections of Telegraph Service Traffic

CASE 1 (GDP growth rate 3% and telephone supply plan-1)

	1989	1994	1999	2004
GDP (Billion US$)	55,129	63,910	74,089	85,890
TEL. DENSITY (/100 persons)	0.70	1.06	1.46	1.84
TELEGRAM (x1000)	10,013	12,672	15,435	18,922
TELEGRAM /100 Persons	5.6	6.4	7.0	7.8

CASE 2 (GDP growth rate 5% and telephone supply plan-2)

	1989	1994	1999	2004
GDP (Billion US$)	60,694	77,462	98,863	126,178
TEL. DENSITY (/100 persons)	0.81	1.33	1.96	2.54
TELEGRAM (x1000)	10,191	13,096	16,185	20,104
TELEGRAM /100 Persons	5.7	6.6	7.4	8.2
Population(x1000)	179,000	199,000	219,000	244,000

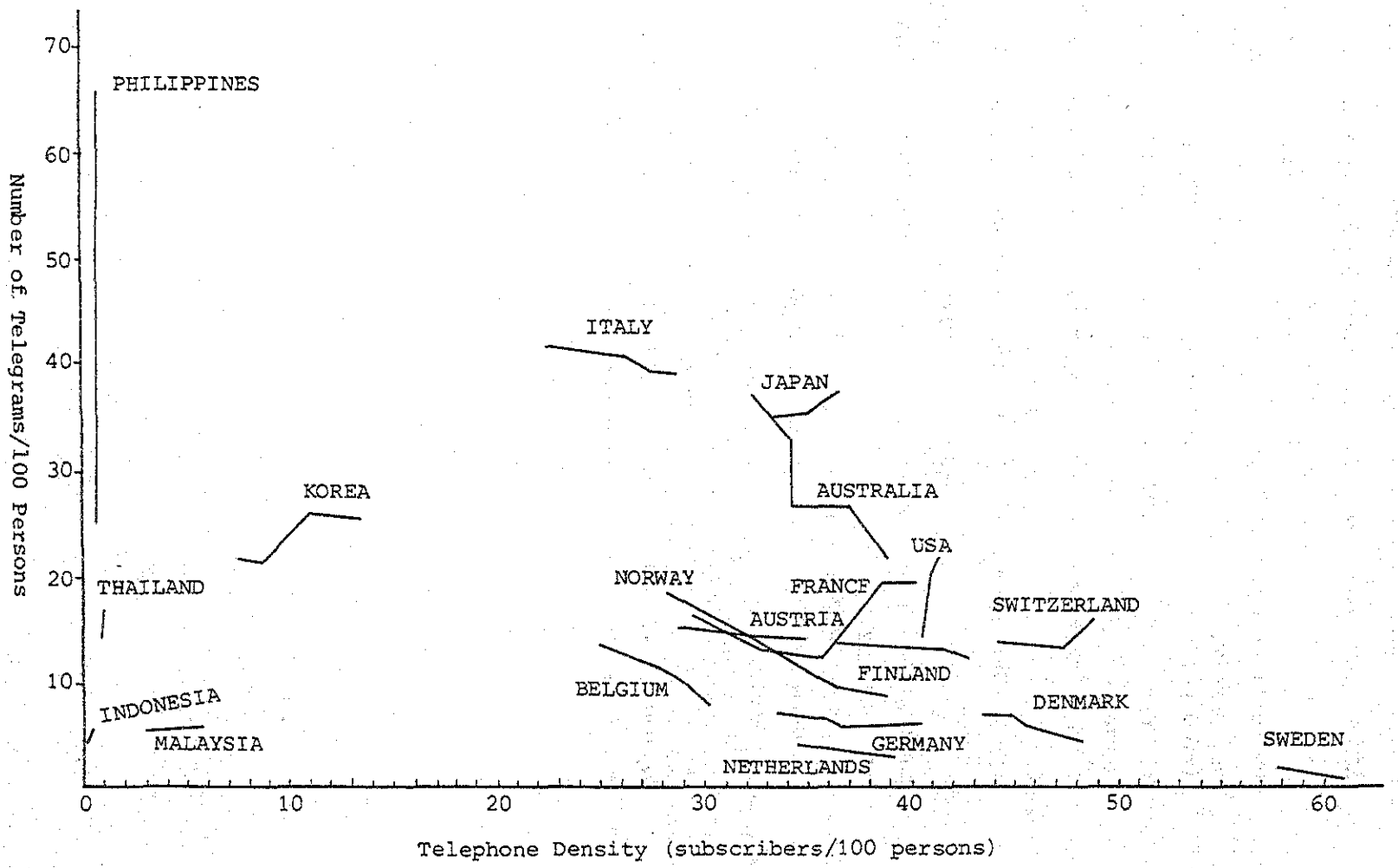


Figure 5-2-1 International Data of Telegraph Traffic (1980-1984)

5-3 Telex Service Traffic

(1) Forecasting Method

To explain the traffic flow of the telex service in Indonesia, a forecasting model was estimated by OLS with using the traffic data of 27 propinsi of 3 year-periods of 1982-1984. The estimated model is as follows:

$$\log (XTX) = 6.2730 + [0.36966 + 0.06061 \times \log (Y/N)] \times \log (SX)$$

$$R^2 = 0.943$$

where,

log : Natural logarithmic operator

XTX : The number of pulses (10^5)

N : The size of population (10^6)

Y : Real GDP of 1975 price in Rp. (10^9)

SX : The number of telex service subscribers

According to the result, the model relates the traffic of telex service with the subscribers of telex service. However, the volume of traffic differs in each propinsi not only by the difference in SX, but also in (Y/N). One percent increase in the telex service subscribers will increase the volume of the telex service by [0.36)66 + 0.07061 x (Y/n)] percent. Namely, the larger the per-capita income is, the larger the volume of the telex service traffic becomes if everything else is unchanged.

(2) Forecast Results

Table 5-3-1 shows the summary of the simple forward projections of the telex service traffic by the estimated model. There are two cases in the table. The cases assume that Real GDP in 1980 price grows by 3% and 5% per year and that telephone subscribers will

increase according to the plan 1 and plan 2 discussed in the section of the telephone supply plan.

Table 5-3-1 Projections of Telex Service Traffic (originating)

CASE 1 (GDP growth rate 3%)

	1989	1994	1999	2004
GDP (Billion US$)	55,129	63,910	74,089	85,890
TELEX SUBSCRIBERS	24,596	32,304	45,964	62,612
TELEX TRF(1000 PLS)	1,019,711	1,230,321	1,578,807	1,949,623

CASE 2 (GDP growth rate 5%)

	1989	1994	1999	2004
GDP (US$)	60,694	77,462	98,863	126,178
TELEX SUBSCRIBERS	24,596	39,182	60,068	83,635
TELEX TRF(1000 PLS)	1,074,811	1,559,943	2,232,033	2,972,924

CHAPTER 6
INVESTMENT STRATEGIES

CHAPTER 6 INVESTMENT STRATEGIES

This chapter examines investment strategies to be taken in the fifteen years between 1989 and 2004 based on the analytical results of the previous chapters and proposes supply plans.

The investment strategies are classified into the service offering strategies, the annual supply plans and the regional distribution plans of capacity. The most appropriate supply plans are chosen among many possible supply plans by examining the international trend of the telecommunications services, the current state in Indonesia, the national policies on development and the managerial situations of PERUMTEL.

6-1 Service Offering Plan

(1) Service Categories

A classification of currently available public telecommunications services categories is presented in Figure 6-1-1 and Figure 6-1-2.

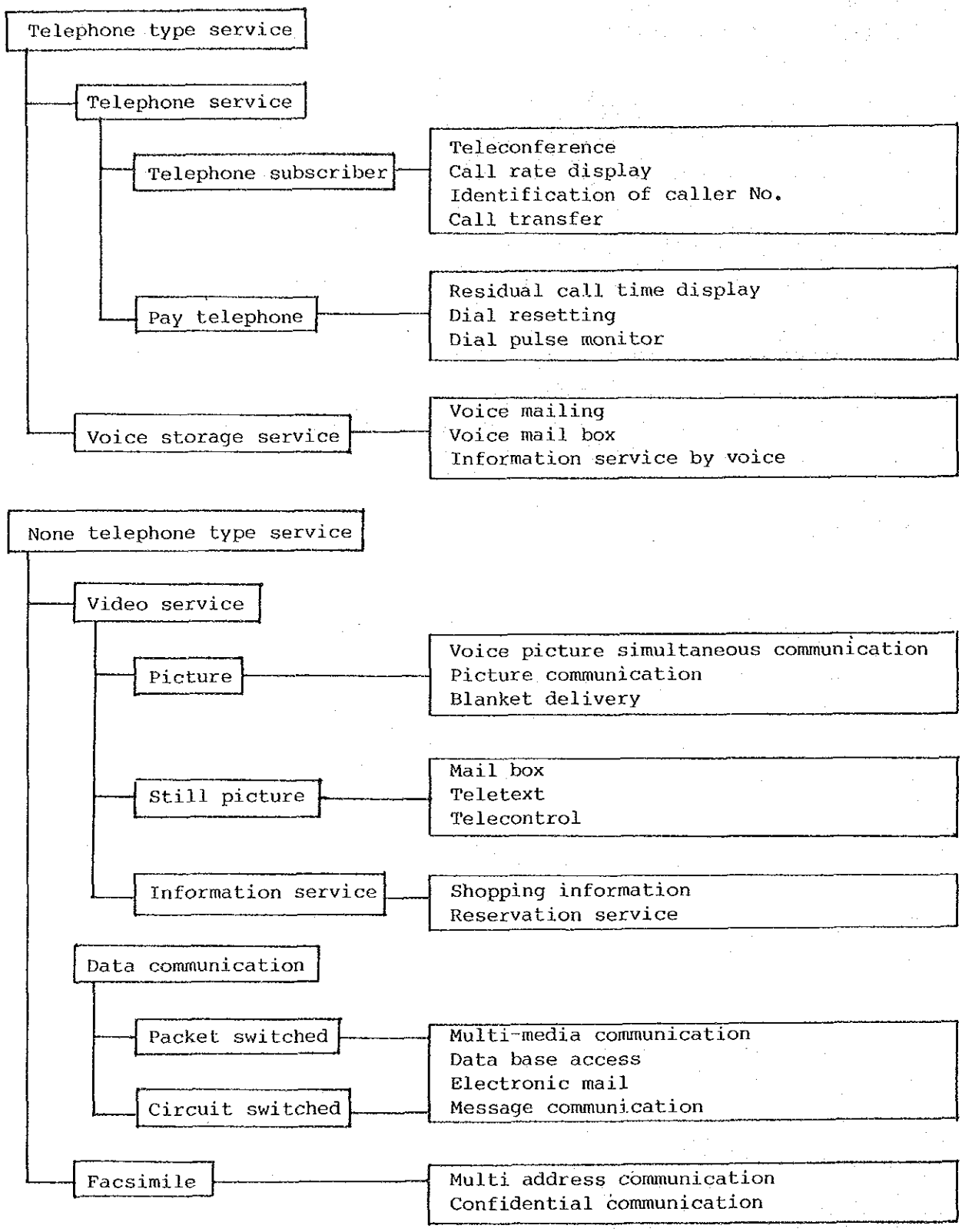


Figure 6-1-1 Telecommunication Services provided by Low Speed Transmission Media

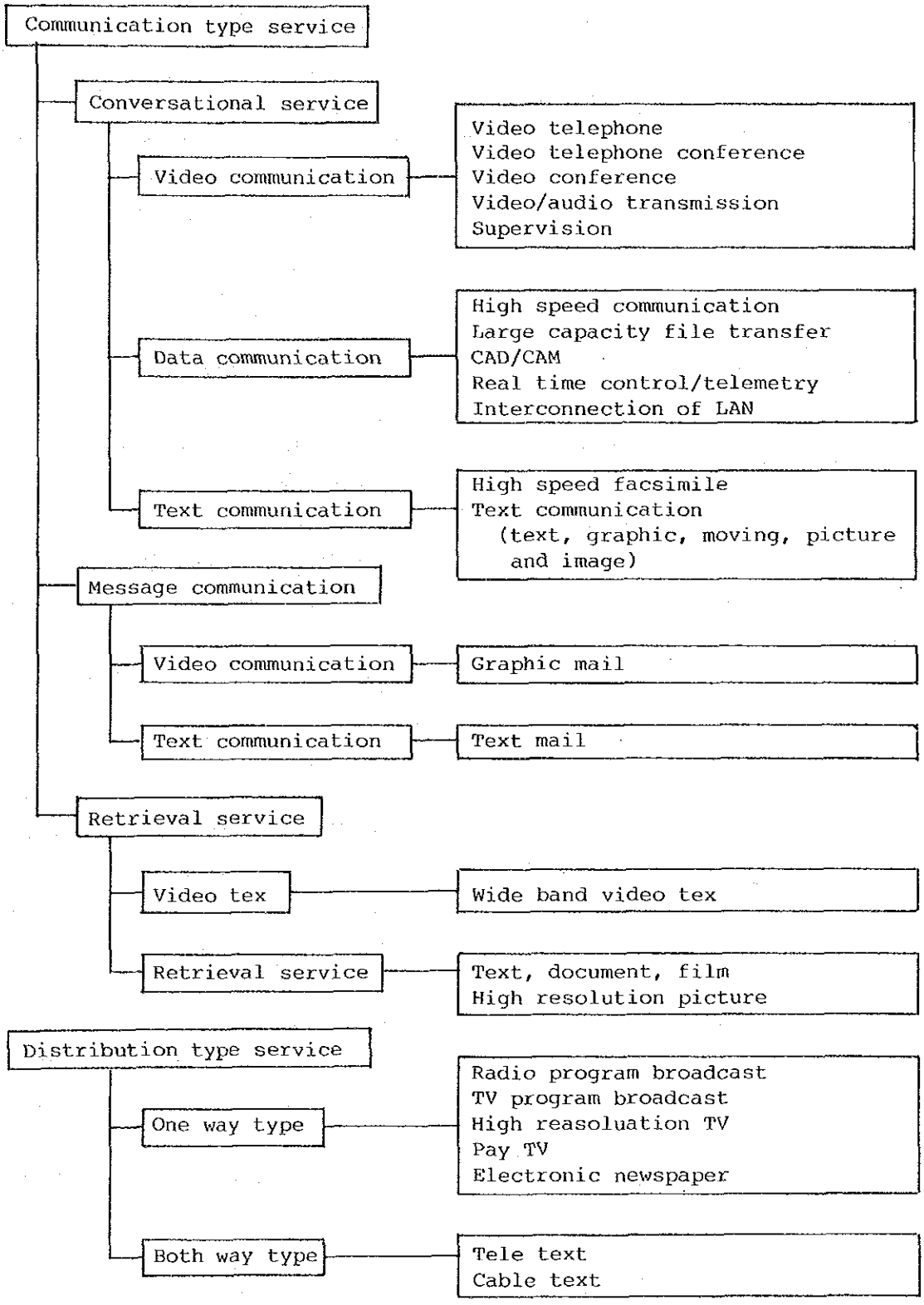


Figure 6-1-2 Telecommunication Services Provided by High Speed Transmission Media

The service categories to be offered in Indonesia by 2004 are proposed as follows;

Telephone service : The ordinary telephone service is provided as a basic service. The following services will be also provided for the areas where digital switching systems are introduced.

- Teleconference service
- Call rate display
- Identification of caller number
- Call transfer

Telegraph service : Quick delivery areas will be expanded so as to make telegraph delivery within 1-2 days possible throughout the country by the year 2004.

For this purpose, the number of telegraph offices will be increased and installation of facsimile or telex terminal equipments will be promoted.

Telex service : In addition to the low speed service by using conventional eletromechanical terminals, high speed service and teletex service in the urban areas will be handled by electronic terminals.

Facsimile service	:	The main service is offered by the G-III standard through the public telephone network. The high speed service by the G-IV standard is to be provided by leased lines. The switched high speed service will be offered by ISDN in the future.
Data communication service	:	The service is to be mainly provided by the existing packet switched network. The circuit switched service will be provided by ISDN in the future.
Radio paging service	:	The service will start in major cities when the demand exceeds 2000 line units.
Land-mobile telephone service:		The service by cellular system will be started in major cities when the demand exceeds 500 line units.
ISDN service	:	At an initial stage, the narrow band ISDN service will be provided by the digital telephone network. Full scale introduction of the wide band ISDN will be provided after the year 2000. Before that, the service will be only provided to special subscribers by leased lines.

(2) User Categories

The telecommunications service users can be classified into the following categories;

1) Administrative and public service users (Public Demand)
2) Business users (Business Demand)
3) Residential users (Residential Demand)

The demand and supply conditions of the present public telecommunications services in Indonesia will make it difficult to satisfy the demands of all the users by 2004.

Therefore, from the viewpoints of national development and PERUMTEL business management, a supply priority is proposed as shown in Table 6-1-1.

Table 6-1-1 Main User Category Expansion Plan

Service Category	REPELITA-V (1989-1994)	REPELITA-VI (1994-1999)	REPELITA-VII (1999-2004)
Telephone	Public Business	Public Business	Public Business Residence
Telegraph	All	All	All
Telex Facsimile Data Com.	Public Business	Public Business	Public Business
Radio Paging Mobile-Tel. ISDN	Business	Business	Business

(3) Network Coverage

Administrative organizations of Indonesia consist of the following 5 hierarchies. Central cities of each administrative hierarchy are evenly located throughout the country;

Categories		Number of Administrative Areas
Province	(Propinsi)	27
Municipality	(Kotamadya)	54
Regency	(Kabupaten)	246
Sub District	(Kecamatan)	3,539
Villages	(Desa)	67,534

At present, the public telecommunications network is only extended to the Kotamadya, Kabupaten capitals and some of the Kecamatan capitals. Therefore, the access to telecommunication service is difficult for many people in the rural areas. In the Kuala Lumpure Declaration made at the ITU Seminar in 1983, the following targets was given "to provide telecommunication service to all persons within a walking distance not exceeding 3 km by the year 2000". Expansion of the network to Desa seems to be essential to promote this target. The network expansion plan in every five years up to 2004 is proposed as shown in Table 6-1-2.

Table 6-1-2 Telecommunication Network Expansion Plan

Service Category	REPELITA-V (1994)	REPELITA-VI (1999)	REPELITA-VII (2004)
Telephone Facsimile	All Kabupaten capitals and main Kecamatan capitals	All Kecamatan capitals	All Desa centers
Telegraph	Main Kecamatan capitals	All Kecamatan capitals	All Desas
Telex Data Comm.	All Kotamadyas	Main Kabupaten capitals	All Kabupaten capitals and main Kecamatan capitals
Radio Paging	Jakarta Surabaya Bandung Medan Semarang	Ujung Pangdan Palembang Malang (new introduction)	Yogyokarta Banjar Masin Denpasar Cirebon (new introduction)
Land-Mobile Telephone	Jakarta Surabaya Bandung Semarang	Same cities as REPELITA-V.	Medan (new introduction)
ISDN	Narrow band service in Jakarta	Narrow band service in Jakarta Surabaya Bandung Medan	Wide band service in same cities as REPELITA-V

6-2 Supply Volume

(1) Telephone service

By examining a supply volume of the telephone services in many countries of the world in relation to per capita GDP, a statistical line which shows an average supply volume of the telephone service for a given level of GDP per capita was estimated for the purpose of setting target levels of development in Indonesia. Figure 6-2-1 shows the statistical line and the position of Indonesia. According

to the examination, the existing supply volume of the telephone service seems well below the average for the given level of GDP in Indonesia. Therefore, a reasonable development objective should be "to catch up with the ASEAN countries standard by the year 2004".

In view of the above policy, two supply plans according to the possible GDP growth rates in the year 2004, are proposed as follows;

Item	Plan 1	Plan 2
Average GDP growth rate	3%	5%
GDP/Capita growth rate	1%	3%
Target density (per 100 persons)	1.84	2.54
Population estimated (x1000)	244,000	244,000
Proposed No. of subscribers (x1000)	4,500	6,200

Supply plans for every five years which are designed to realize the above targets are proposed in Table 6-2-1. The GDP growth rate marked a sharp decline last year. It is proposed that the Plan 2 will be the principal plan in an expectation that the low GDP growth will not continue for long time. The Plan 1 will be proposed as an alternative plan in case of 3% GDP growth rate.

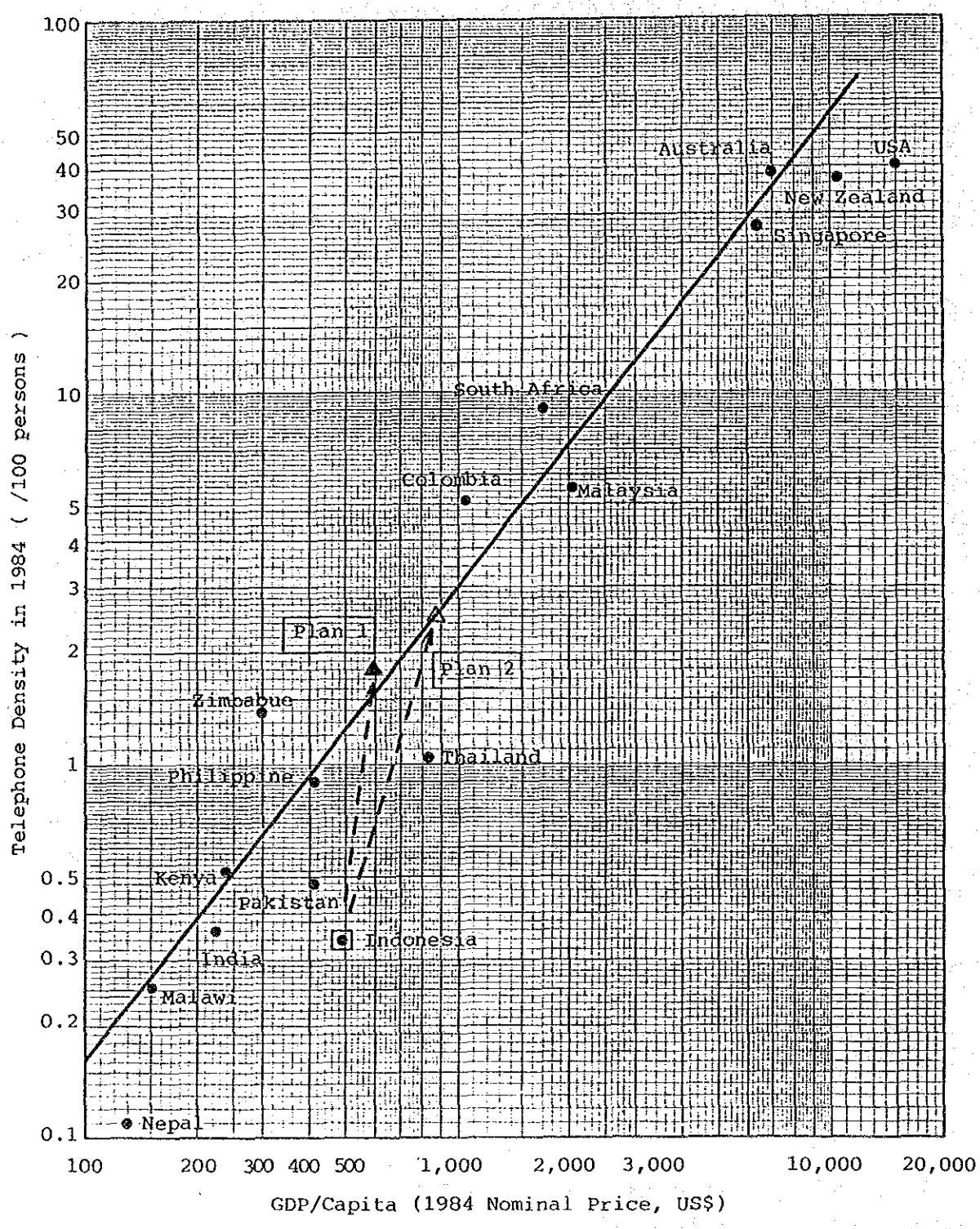


Figure 6-2-1 Telephone Density and GDP/Capita of the Countries in the World

Table 6-2-1 Telephone Service Supply Plans

(Unit: 1000)

Plan	Item	PELITA-IV (1989)	REPELITA-V (1994)	REPELITA-VI (1999)	REPELITA-VII (2004)
1	Telephone Demand	2,330	3,709	5,496	7,633
	Additional Capacity	550	850*	1,100	1,300
	Total Capacity	1,250	2,100	3,200	4,500
	Line Unit/100 persons	0.70	1.06	1.46	1.84
	Capacity/Demand	0.54	0.57	0.58	0.59
2	Telephone Demand	2,584	4,431	6,930	9,872
	Additional Capacity	750	1,200*	1,650	1,900
	Total Capacity	1,450	2,650	4,300	6,200
	Line Unit/100 persons	0.81	1.33	1.96	2.54
	Capacity/Demand	0.56	0.60	0.62	0.63
	Population	179,000	199,000	219,000	244,000

(Note) The figure marked with * includes the volume which will be carried over from the PELITA-IV.

(2) Non-Telephone services

The non-telephone services will be provided to satisfy the demands in the urban areas. The supply plan in case of two different GDP growth rates are proposed as shown in Tables 6-2-2 and 6-2-3.

It is assumed that a part of Telex demands will be shifted to Facsimile services. The shifting portion will be assumed to be 20%, 30% and 40% in 1994, 1999 and 2004, respectively. The consideration of this shifting is already made in the figures with * marks in Tables 6-2-2 and 6-2-3.

Table 6-2-2 Non-Telephone Service Supply Plan
(Plan 1 for 3% GDP annual growth)

(No. of Subscribers)

Service Category	REPELITA-V (1994)	REPELITA-VI (1999)	REPELITA-VII (2004)
Telegraph Office	1,000	2,000	3,500
Telex	26,000*	32,000*	38,000*
Facsimile	13,250	32,250	62,000
Packet Data Comm.	1,400	2,600	4,300
Radio Paging	35,000	60,000	91,000
Land-Mobile Tel.	8,000	10,000	12,000
ISDN	Narrow Band	Narrow Band	Wide Band

Table 6-2-3 Non-Telephone Service Supply Plan
(Plan 2 for 5% GDP annual growth)

(No. of Subscribers)

Service Category	REPELITA-V (1994)	REPELITA-VI (1999)	REPELITA-VII (2004)
Telegraph Office	1,000	2,000	3,500
Telex	31,000*	42,000*	50,000*
Facsimile	26,500	64,500	124,000
Packet Data Comm.	2,100	4,400	7,800
Radio Paging	45,000	80,000	126,000
Land-Mobile Tel.	8,000	10,000	12,000
ISDN	Narrow Band	Narrow Band	Wide Band

6-3 Regional Distribution Plan

The total number of expected telephone line units in each WITEL at the end of the PELITA-IV is shown in Table 6-3-1.

Table 6-3-1 Telephone Capacity Share by WITEL in 1989

WITEL	Population	Tel. Capacity	Tel. Share	Tel/100 persons
I	13,836,000	150,000	0.090	1.09
II	6,771,000	49,000	0.029	0.72
III	16,628,000	83,000	0.050	0.50
IV	9,032,000	543,000	0.325	6.01
V	33,508,000	177,000	0.109	0.53
VI	31,603,000	148,000	0.089	0.47
VII	32,916,000	250,000	0.150	0.76
VIII	10,155,000	69,000	0.041	0.68
IX	8,782,000	77,000	0.046	0.88
X	12,740,000	92,000	0.055	0.72
XI	1,845,000	14,000	0.008	0.73
XII	1,537,000	12,000	0.007	0.78
Total	179,353,000	1,664,000	1.000	0.93

According to the telephone capacity share by WITEL, it is found that a priority of development of PELITA-IV is placed on the following 5 WITELs;

- WITEL-IV Jakarta area
- WITEL-VII Surabaya area
- WITEL-V Bandung area
- WITEL-VI Semarang and Yogyakart area
- WITEL-I Medan area

In terms of the telephone density, the priority is placed in WITEL-IV and WITEL-I. WITEL-V, VI and VII have lower densities than other WITEL.

Since more telephone service demand is expected in the places where there are many existing subscribers, in the future, it may be reasonable to adopt the policy of maintaining the WITEL's subscriber share realized at the end of PELITA-IV (Strategy A2).

When the Strategy A2 and the Supply Plan 2 are adopted, estimated telephone density and IRR in 2004 are shown in Table 6-3-2.

Table 6-3-2 Telephone Density and IRR in 2004
(Strategy A2 and Supply Plan 2)

WITEL	Population	Tel. Capacity	Tel/100 persons	IRR
I	18,981,000	558,000	2.94	15%
II	9,135,000	180,000	1.97	5%
III	30,180,000	310,000	1.03	12%
IV	14,785,000	2,017,000	13.64	70%
V	44,677,000	667,000	1.52	14%
VI	37,396,000	552,000	1.48	21%
VII	39,156,000	930,000	2.38	24%
VIII	13,407,000	255,000	1.90	3%
IX	13,514,000	286,000	2.12	12%
X	17,553,000	341,000	1.94	6%
XI	2,768,000	50,000	1.80	4%
XII	2,356,000	44,000	1.86	5%
Total	243,907,000	6,200,000	2.54	17%

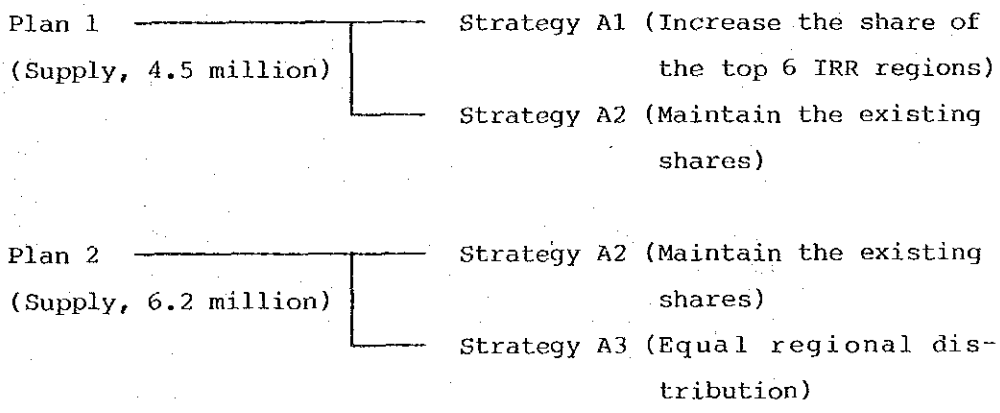
From the above results, the following two regional priority policies as alternatives are proposed;

1) To improve financial performances, the supply amount will be increased by 20% in the 6 highest IRR regions and the supply amount will be decreased by 20% in other regions. (Strategy A1)

2) To realize balanced national development, the supply amount will be increased by 20% in the Jakarta area, and the densities for other regions shall be the same. (Strategy A3)

The proposed regional distribution plans according to the two priorities up to 2004 are shown in Tables 6-3-3 and 6-3-4.

The appropriate regional distributions in case for Plan 1 and Plan 2 are following four combinations;



The simulation results based on these combinations are explained in Chapter 7.

Table 6-3-3 Telephone Supply Density by WITEL (Plan 1)

WITEL	Popu-lation (x1000)	Strategy-A1			Strategy-A2		
		Main Line (x1000)	Share (%)	Tel Dens. (Tel/100)	Main Line (x1000)	Share (%)	Tel/Dens. (Tel/100)
I/1994	15,514	195	9.3	1.25	189	9.0	1.22
II	7,487	54	2.6	0.73	61	2.9	0.82
III	20,266	107	5.1	0.53	105	5.0	0.52
IV	10,668	702	33.4	6.58	684	32.6	6.42
V	36,958	233	11.1	0.63	227	10.8	0.61
VI	33,479	192	9.1	0.57	187	8.9	0.56
VII	34,972	324	15.4	0.93	315	15.0	0.90
VIII	11,148	77	3.6	0.69	87	4.1	0.78
IX	10,132	86	4.1	0.85	97	4.6	0.96
X	14,178	102	4.9	0.72	116	5.5	0.82
XI	2,118	15	0.7	0.72	17	0.8	0.80
XII	1,777	13	0.6	0.75	15	0.7	0.84
TOTAL	198,698	2,100	100.0	1.06	2,100	100.0	1.06
I/1999	17,185	300	9.4	1.75	288	9.0	1.68
II	8,262	77	2.4	0.94	93	2.9	1.13
III	24,520	166	5.2	0.68	160	5.0	0.65
IV	12,418	1,082	33.8	8.72	1,042	32.6	8.39
V	40,267	361	11.3	0.90	348	10.9	0.86
VI	35,194	297	9.3	0.84	285	8.9	0.81
VII	36,771	500	15.6	1.36	480	15.0	1.31
VIII	12,175	109	3.4	0.89	132	4.1	1.08
IX	11,628	122	3.8	1.05	148	4.6	1.27
X	15,700	145	4.5	0.92	176	5.5	1.12
XI	2,399	22	0.7	0.91	26	0.8	1.07
XII	2,036	19	0.6	0.92	22	0.7	1.12
TOTAL	218,556	3,200	100.0	1.46	3,200	100.0	1.46
I/2004	18,981	425	9.4	2.24	405	9.0	2.14
II	9,135	105	2.3	1.15	131	2.9	1.43
III	30,180	235	5.2	0.78	225	5.0	0.74
IV	14,785	1,534	34.1	10.37	1,464	32.5	9.91
V	44,677	513	11.4	1.15	491	10.9	1.10
VI	37,396	420	9.3	1.12	400	8.9	1.07
VII	39,156	708	15.7	1.81	675	15.0	1.73
VIII	13,407	146	3.2	1.09	185	4.1	1.38
IX	13,514	165	3.7	1.22	208	4.6	1.54
X	17,553	196	4.4	1.12	248	5.5	1.41
XI	2,768	30	0.7	1.07	36	0.8	1.31
XII	2,356	25	0.6	1.07	32	0.7	1.35
TOTAL	243,907	4,500	100.0	1.85	4,500	100.0	1.85

Table 6-3-4 Telephone Supply Density by WITEL (Plan 2)

WITEL	Popu-lation (x1000)	Strategy-A2			Strategy-A3		
		Main Line (x1000)	Share (%)	Tel Dens. (Tel/100)	Main Line (x1000)	Share (%)	Tel/Dens. (Tel/100)
I/1994	15,514	239	9.0	1.54	162	6.1	1.04
II	7,487	77	2.9	1.03	78	2.9	1.04
III	20,266	132	5.0	0.65	211	8.0	1.04
IV	10,668	863	32.6	8.09	691	26.1	6.47
V	36,958	287	10.8	0.78	385	14.5	1.04
VI	33,479	236	8.9	0.70	349	13.2	1.04
VII	34,972	398	15.0	1.14	364	13.8	1.04
VIII	11,148	109	4.1	0.98	116	4.4	1.04
IX	10,132	123	4.6	1.21	106	4.0	1.04
X	14,178	146	5.5	1.03	148	5.6	1.04
XI	2,118	21	0.8	1.01	22	0.8	1.04
XII	1,777	19	0.7	1.06	18	0.7	1.04
TOTAL	198,698	2,650	100.0	1.33	2,650	100.0	1.33
I/1999	17,185	387	9.0	2.25	265	6.2	1.54
II	8,262	125	2.9	1.51	128	3.0	1.54
III	24,520	215	5.0	0.88	378	8.8	1.54
IV	12,418	1,400	32.5	11.27	1,120	26.0	9.02
V	40,267	468	10.9	1.16	621	14.4	1.54
VI	35,194	383	8.9	1.09	543	12.6	1.54
VII	36,771	645	15.0	1.76	567	13.2	1.54
VIII	12,175	177	4.1	1.45	188	4.4	1.54
IX	11,628	198	4.6	1.71	180	4.2	1.54
X	15,700	237	5.5	1.51	242	5.6	1.54
XI	2,399	35	0.8	1.44	37	0.9	1.54
XII	2,036	30	0.7	1.50	31	0.7	1.54
TOTAL	218,556	4,300	100.0	1.97	4,300	100.0	1.97
I/2004	18,981	558	9.0	2.94	380	6.1	2.00
II	9,135	180	2.9	1.97	183	2.9	2.00
III	30,180	310	5.0	1.03	604	9.7	2.00
IV	14,785	2,017	32.5	13.64	1,614	26.0	10.91
V	44,677	677	10.9	1.52	894	14.4	2.00
VI	37,396	552	8.9	1.48	749	12.1	2.00
VII	39,156	930	15.0	2.38	784	12.6	2.00
VIII	13,407	255	4.1	1.90	268	4.3	2.00
IX	13,514	286	4.6	2.12	271	4.4	2.00
X	17,553	341	5.5	1.94	351	5.7	2.00
XI	2,768	50	0.8	1.80	55	0.9	2.00
XII	2,356	44	0.7	1.86	47	0.8	2.00
TOTAL	243,907	6,200	100.0	2.54	6,200	100.0	2.54

CHAPTER 7
MANAGEMENT STRATEGIES

CHAPTER 7 MANAGEMENT STRATEGIES

This chapter examines management strategies of PERUMTEL and proposes some management strategies to be taken in the future.

Management strategies are classified into the O&M costs management, tariff policies and revenue management, and investment fund management. They are executed by a combination of management controlled variables. To find out whether given investment plans are feasible or not, a strategies simulation model was employed.

The following three financial statements and indexes will be presented as the simulation outputs;

- Profit-loss statement ..... Operating ratio
- Cash flow statement ..... Internal rate of return (IRR)
- Source and application statement ... Debt service ratio

The following assumptions are made for simulation;

1) No inflation will be taken into account. This means that the expected market price as of December 1986 will be used as the basic price. The tariff as of December 1986 will be used in the analysis.

2) The foreign exchange rate of Rp. 1644 to US$1 will be used in this analysis.

3) The service life of the fixed assets will be 20 years, for the cash-flow analysis. No salvage value will be left for the fixed assets.

7-1 Expenditure Management

(1) Investment Fund Requirement

The required amount of the investment fund to carry out the project was estimated by the following procedure;

1) The fund requirement to cover the construction costs was estimated separately for the urban and rural areas. The urban areas are defined to be Kotamadyas and Ibu Kota Kabupaten (Capital of Kabupaten). The rural areas are defined to be Kecamatans and Desas.

2) For the urban areas, the construction costs were estimated by using the past asset data of PERUMTEL. For the rural areas, the construction costs were estimated by using the regression equation reported in the "Fundamental Study of Rural Telecommunications Network" of JICA (1985).

3) The capacity share ratios between the urban and rural areas during the project periods were assumed to be the same as those of 1989. These are the target figures of PELITA-IV.

4) The construction costs per capacity for the rural areas were at first estimated for each Province; by the following regression model;

$$\log \frac{COSTS_i}{CAPACITY_i} = 2.5779 - 0.18403 \frac{CAPACITY_i}{AREA_i}$$

$$R^2 = 0.92$$

where,

$AREA_i$: The area size of the i-th Province

$CAPACITY_i$: The Switching Capacity size of the i-th Province

The rural area construction costs per capacity for each WITEL were then calculated by taking the average of all the rural area construction costs per capacity for the Province in the WITEL. The rural area construction costs per capacity for each WITEL were assumed to change in only 1989, 1994 and 1999, and not to change during those periods.

The estimated exchange rate and inflation rate of December 1986 were used to transform the estimated costs figures in the December 1986 price basis.

5) The construction costs for the urban areas were estimated by the assets data between 1975 and 1985. The assets data were obtained for the following nine assets;

A_1: Land

A_2: Buildings

A_3: Switching Systems

A_4: Telegraph and Telex Facilities

A_5: Transmission Systems

A_6: Local Cable Network

A_7: Electronic Data Processing System

A_8: Office Equipments

A_9: Motorized Vehicles

The unit construction costs for urban areas are analyzed as shown in Table 7-1-1.

Table 7-1-1 Construction Costs per Line Unit (December 1986 Price)

(Unit: Million Rp.)

WITEL	Land	Building	Switching	Telex-Telegram	Transmission	Local Cable	Data Processing	Office Equipment	Motor Vehicle	Total
I	0.11	0.70	1.15	0.16	1.50	2.00	0.05	0.04	0.02	5.73
II	0.18	1.07	1.48	0.24	1.50	3.00	0.05	0.07	0.03	7.62
III	0.12	0.62	1.32	0.11	1.50	2.00	0.05	0.06	0.02	5.80
IV	0.14	0.27	0.82	0.16	1.00	1.50	0.10	0.02	0.01	4.02
V	0.35	0.26	1.15	0.08	1.00	2.00	0.05	0.06	0.01	4.96
VI	0.12	0.25	1.15	0.10	1.00	2.00	0.05	0.05	0.01	4.73
VII	0.11	0.25	0.99	0.10	1.00	1.70	0.05	0.04	0.01	4.25
VIII	0.19	1.09	1.32	0.15	2.00	3.00	0.05	0.09	0.04	7.93
IX	0.20	1.44	1.32	0.31	2.00	3.00	0.05	0.12	0.03	8.47
X	0.42	0.88	1.32	0.20	3.00	4.00	0.05	0.12	0.06	10.05
XI	0.33	1.83	2.47	0.14	4.00	4.00	0.05	0.12	0.06	13.00
XII	0.61	2.54	2.47	0.17	5.00	5.00	0.05	0.12	0.06	16.02
Total	0.18	0.49	1.08	0.15	1.33	2.06	0.07	0.05	0.02	5.43

The estimated construction costs for each REPELITA are shown in Table 7-1-2.

Table 7-1-2 Estimated Construction Costs

(December 1986 price)

Plan	Item	REPELITA-V	REPELITA-VI	REPELITA-VII
Plan 1 and A2	Expansion Capacity (x1000)	850	1,100	1,300
	Total Cost (Bill. Rp.)	5,267	6,816	8,055
Plan 2 and A2	Expansion Capacity (x1000)	1,200	1,650	1,900
	Total Cost (Bill. Rp.)	7,430	10,217	11,765

(2) Manpower Development Plan

Manpower for maintenance, operation and administration of the proposed telecommunication capacity expansion plans must be well developed to achieve effective management by PERUMTEL. One of the criterion which are generally used in judging efficiency of manpower of telecommunications common carriers is the number of staff personnels involved per 1000 line units.

For Indonesia, the average number of staff personnels per 1000 telephone line units during the period of 1974 - 1984 steadily decreased as 86 in 1974/75, 75 in 1976/77, 48 in 1978/79, 46 in 1980/81 and 42 in 1983/84. Efficiency of manpower was improved by more than two times during the recent ten years.

But, when the figure is compared with those of other countries of the world which have the similar size in line units, the figure of Indonesia seems still high as shown in Figure 7-1-1.

A simple comparison does not represent a real picture. Indonesia's tough geographical situation and needs for creating employment opportunities must be taken into consideration. From PERUMTEL's point of view, the most productive level of manpower has to be employed and maintained in order to realize telecommunications development by reducing the costs in the future.

The target number of staff personnels per 1000 line units in the year 2004 is proposed to be less than 20 from a result of an examination of other countries. Manpower improvement from the present level to 20 staffs/1000 L.U. in the future can be achieved by adopting a non-attended maintenance and improved operation system because digital equipments to be installed in the future need less maintenance and operation work.

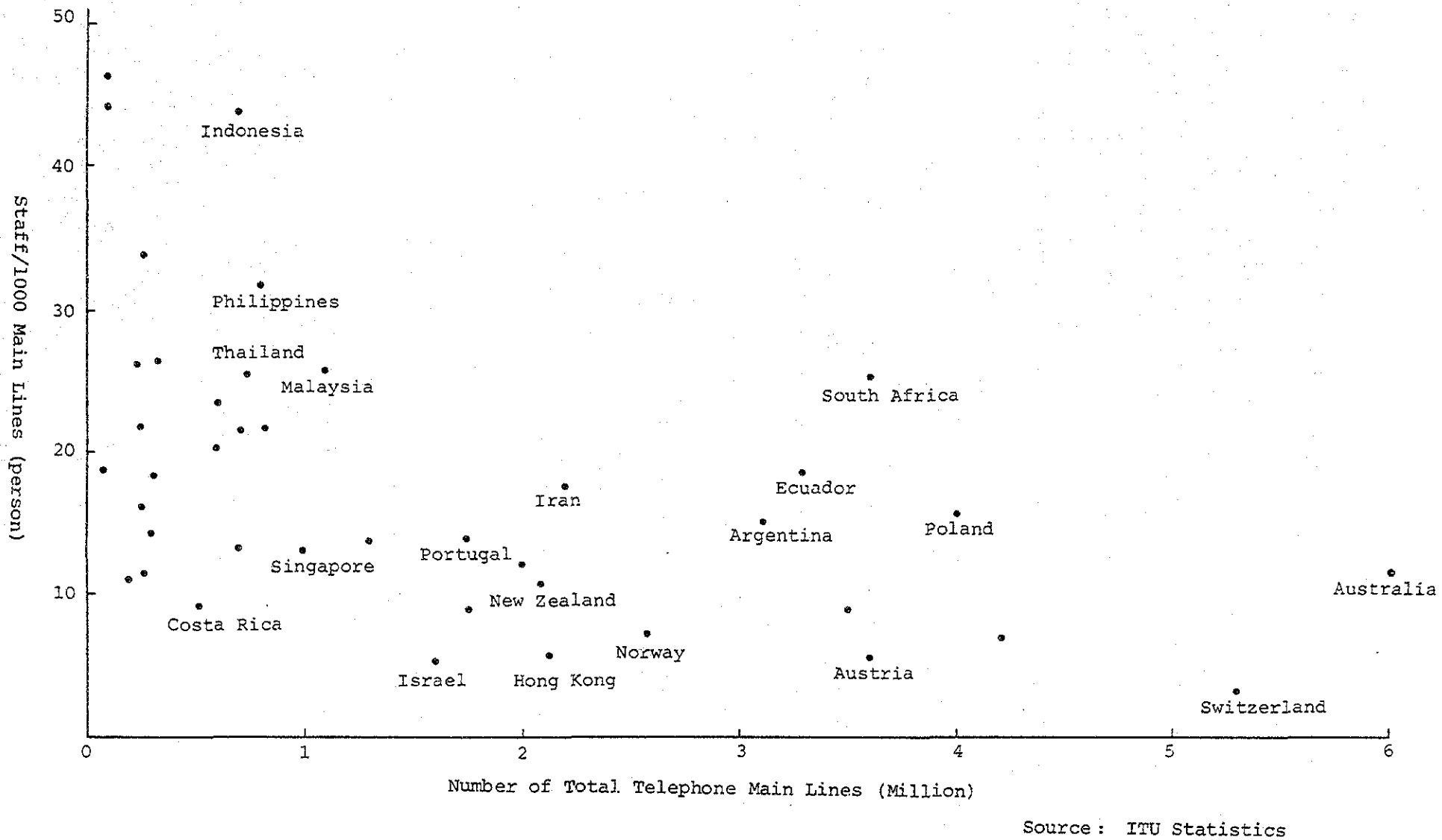


Fig. 7-1-1 Relation Between Total No. of Staffs and No. of Telephones in the World (1983)

(3) Operating Expenditure (Operation and Maintenance Costs)

The current and past situations of the expenditure have been discussed in Chapter 3. The expenditure has been increasing at the rate of 9% per year in real term from 1980 to 1984. On the other hand, the operating revenue per subscriber increased by only 2% per year in real term. If this situation continues, PERUMTEL must increase its tariff rate by 7% per year in real terms to keep a healthy financial situation. This rate is larger than the expected GDP growth rate.

1) Method of Estimation

The operating costs of each WITEL were estimated in two categories by two regression models. They are the personnel costs and non-personnel costs. The estimated models are as follows;

The Personnel Costs (PC)

$$\log PC_{it} = -7.8904 + 0.5814 \log S_{it} + 0.46621 \log TLG_{it} + 0.4933 \log SX_{it} - 2.9141 DHQ + WITEL\ Dummies$$

$$R^2 = 0.96$$

The Non-Personnel Costs (NPC)

$$\log NPC_{it} = -12.1103 + 0.62486 \log S_{it} + 0.87236 \log TLG_{it} + 0.28314 \log PC_{it} - 0.6705 DHQ + WITEL\ Dummies$$

$$R^2 = 0.98$$

where

PC_{it} : Personnel cost in the i-th WITEL in period t (Million Rp.)

NPC_{it} : Non-personnel cost in the i-th WITEL in period t (Million Rp.)

S_{it} : The number of telephone service subscribers in the i-th WITEL in period t

TLG_{it} : The number of telegrams sent from the i-th WITEL in period t

SX_{it} : The number of telex service subscribers in the i-th WITEL in period t

DHQ : Dummy for the PERUMTEL Headquarters

The data used for the estimation are the pooled time-series and cross-section data of 12 WITELs and four years between 1982 and 1985.

Both the personnel and non-personnel costs are explained by the level of the service provision by PERUMTEL. The operating costs are functions of the number of the subscribers of the telecommunication services. The personnel costs are also influenced by the number of telegrams. This indicates the personnel costs of the telegraph service handling operators. The non-personnel costs will increase as the personnel costs increase. The influence of the telex service subscribers is noticeably high in the non-personnel costs. Both costs have been increasing faster than the increase of the customers. If this trend continues in the future, the negative pressure to the financial conditions will become a heavy burden to the PERUMTEL management.

2) Estimated Operating Expenditure

Table 7-1-3 shows the results of simple projections, when PERUMTEL follows the same management policies of the past five years.

Table 7-1-3 Estimated Operating Expenditure

(December 1986 price)

Year	Supply Plan 1		Supply Plan 2	
	Total O&M Costs (Bill. Rp.)	O&M Costs Per Subscriber (Mill. Rp.)	Total O&M Costs (Bill. Rp.)	O&M Costs Per Subscriber (Mill. Rp.)
1989	1,176	0.94	1,335	0.92
1994	2,185	1.04	2,730	1.03
1999	3,841	1.20	5,204	1.21
2004	6,300	1.40	9,053	1.46

The annual growth rate of the O&M costs was assumed to be 11.8% in Plan 1 and 13.6% in Plan 2. The annual growth rate of O&M costs per subscriber was assumed to be 2.7% in Plan 1 and 3.1% in Plan 2. These figures were estimated by the past trend in which the O&M costs increased faster than the number of subscribers.

3) The proposals to reduce the O&M costs

The O&M costs consist of personnel and non-personnel costs. Non-personnel costs are divided into maintenance costs and office operating costs. Personnel costs are calculated as the number of staffs personnels x average wage rate. Personnel costs can be reduced either by laying off staffs or by cutting down their wages. The targeted number of staff personnels is set at 20 staffs/1000 L.U (Case M1). This target, however, may not be easy to achieve because providing a large number of job opportunities to people is one of the most important government policies and the vast land size. Hence, 30 staffs/1000 L.U. (Case M2) and 40 staffs/1000 L.U. (Case M3) will also be examined (Refer to Figure 7-1-2).

		1979	1984	1989	1994	1999	2004
No.of Main Telephone	Plan 2	317,115	536,102	1,450,000	2,650,000	4,300,000	6,200,000
	Plan 1			1,250,000	2,100,000	3,200,000	4,500,000
Strategy Staff per 1000 Sub.	M1 20	84	62	52	41	30	20
	M2 30			54	46	38	30
	M3 40			57	51	45	40
No.of Staff (Plan 2)	M1 20	26,600	33,490	75,400	108,650	129,000	124,000
	M2 30			78,300	121,900	163,400	186,000
	M3 40			82,650	135,150	193,500	248,000
No.of Staff (Plan 1)	M1 20	26,600	33,490	65,000	86,100	96,000	90,000
	M2 30			67,500	96,600	121,600	135,000
	M3 40			71,250	107,100	144,000	180,000

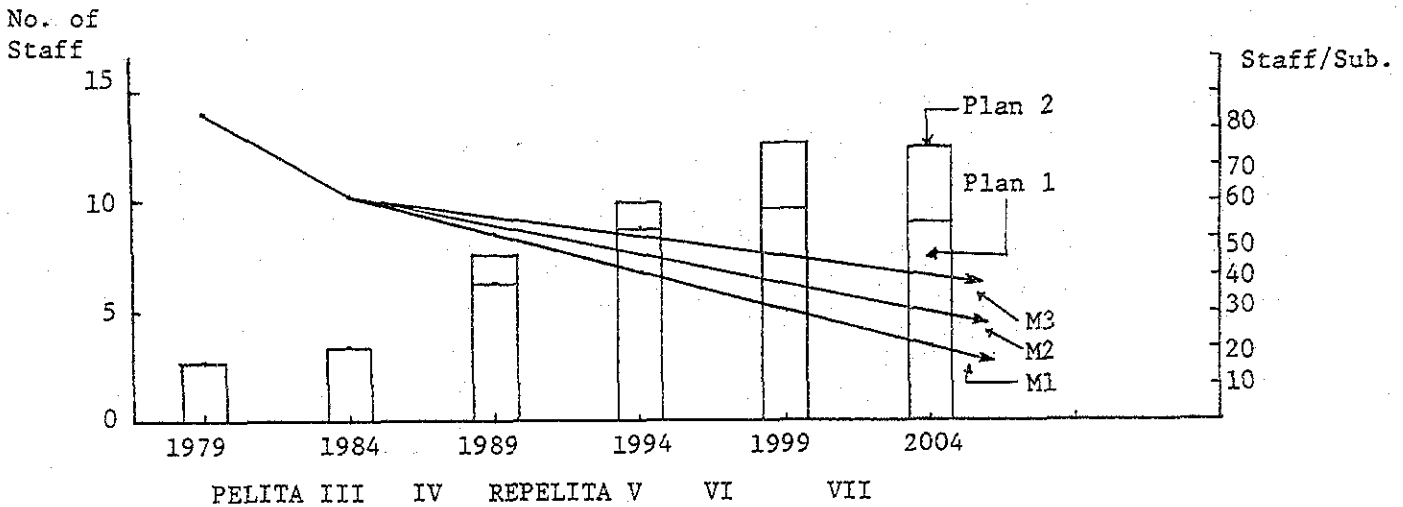


Figure 7-1-2 Proposed Man-Power Plan

Plan 1 expects that GDP will grow at 3% per year. This implies that GDP per capita will grow at 1% per year when population will grow at 2% per year. Plan 2 expects that GDP will grow at 5% per year. This implies that GDP per capita will grow at 3% per year. Hence, wage in real term will grow at 1 % per year in Plan 1 and 3% per year in Plan 2.

Non-personnel costs can be divided into office operating costs which depend on the number of staffs and maintenance costs of offices and equipments. The office operating costs will be reduced if the number of staffs is reduced. The maintenance costs will vary in relation to equipments quality and variety and technical progress.

Non-personnel costs will decrease by management efforts up to a certain number of subscribers but will become constant after that level. The O&M costs per subscriber may be managed in the way the following diagram shows. Figure 7-1-3 shows the analytical result.

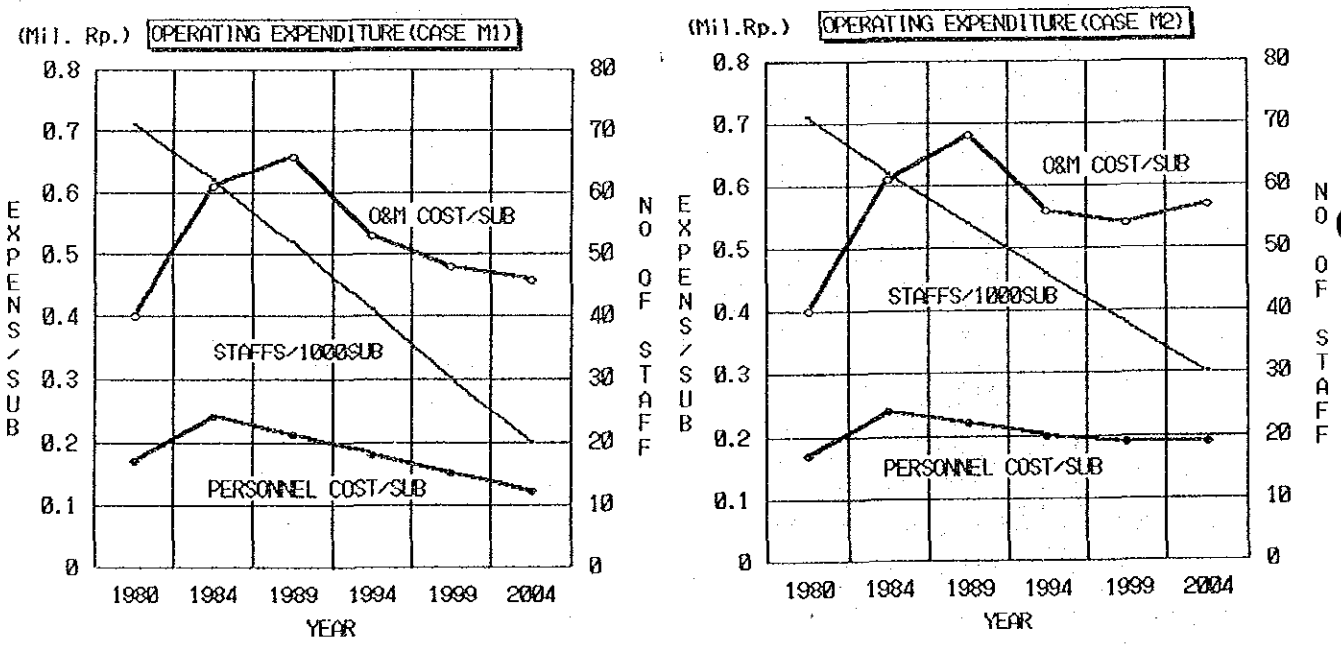


Figure 7-1-3 Estimated Operating Expenditure
(December 1986 price)

The following plans are proposed for the future O&M costs;

Table 7-1-4 The O&M Costs per Subscriber in 2004
(December 1986 price)

(Unit: Million Rp.)

Strategy		Plan 1	Plan 2
M1	20 Staffs/1000 L.U.	0.40	0.46
M2	30 Staffs/1000 L.U.	0.48	0.57
M3	40 Staffs/1000 L.U.	0.60	0.65

7-2 Tariff Policies

(1) The Current Tariff System

1) Telephone Service

The tariff system of the telephone service consists of three fees, i.e., telephone installation fee, monthly rental fee and call fee.

The telephone installation fee is levied on subscribers when telephone service is provided for the first time. This fee includes installation costs to be shared by subscribers.

In Indonesia, the telephone installation fee is divided into seven regional classes. Those classes are determined according to local situations.

The monthly renal fee is levied on subscribers in a fixed amount every month regardless of the number of calls. In Indonesia, the monthly rental fee differs in the type of exchanges, i.e., automatic exchange or manual exchange, and in the number of subscribers accommodated in the exchange concerned. (For details, see Table 7-2-1.)

The inter-local call (manual trunk call) fee is levied on subscribers every month according to the number of originating calls. In Indonesia, the call fee varies according to service distance and call duration. (For details, see Table 7-2-2.)

2) Telegram Service

The tariff system consists of Rp. 10 per word for the basic service and Rp. 20 per word for the emergency service. 10 words will be regarded as the minimum charge.

3) Telex Service

The telex tariff system consists of terminal installation fee, message fee, and terminal rental (monthly rental) fee.

The message fee is Rp. 75 per pulse. This fee is subject to vary according to service distance and call duration as follows;

Distance (km)	Call Duration (sec./pulse)
- 50	12
50 - 300	8
300 - 750	6
750 -	3

Table 7-2-1 Telephone Tariff in Indonesia

Apr.1985

Installation Fee		Extra Additional Fee		Branch Tel. Inst. Fee	Rental Fee / Month Rp.			3 minutes Fee Rp.	SLDD & Interlocal
Classification of Area	Rp.	Rp. (Route)	Rp. (No Route)	Rp.					
I	500,000	50,000	100,000	63,000	AUTO	JAKARTA BANDUNG SEMARAN SURABAYA MEDAN	3,500	Only JAKARTA Subscribers & P.C.O. Rp. 75 : JAKARTA Rp. 50 : P.C.O.	See Table 2-5-14
II	350,000			32,000		Other	2,000		
III	200,000	40,000	80,000	19,000					
IV	175,000			13,000	MANUAL	L.U 500	1,000		
V	125,000	30,000	60,000	10,000					
VI	90,000	20,000	40,000	7,000		L.U 500	2,000		
VII	75,000			3,750					

Table 7-2-2 SLDD and Interlocal (Manual Trunk Call) Fee

Apr.1985

Zone	Distance (km)	Manual Trunk Call	SLDD			
		Fee for one minute (Rp.)	Metering Pulse Interval (sec.)		Fee for one minute (Rp.)	
		Day	Day	Night	Day	Night
		0.600 - 22.00	0.600 - 22.00	0.600 - 22.00	0.600 - 22.00	0.600 - 22.00
-	0 - 25	75	75	75	75	75
I	25 - 100	750	6	12	750	375
II	100 - 200	900	5	10	900	450
III	200 - 300	1,125	4	8	1,125	563
IV	300 - 1000	1,500	3	6	1,500	750
V	1000 -	2,250	2	4	2,250	1,125

(2) Past Telephone Tariff

1) Installation Fee

Table 7-2-3 shows the past installation fee of PERUMEL. During the ten years between 1976 and 1985, the regional discrepancies in the installation fee became small. The class VII area increased its fee by 300%. Other areas except Jakarta increased their fees by 30 - 40%.

The rate of inflation between 1976 and 1985 was 260%. This implies that the installation fee has been at least increased to keep up with inflation.

Table 7-2-3 Past Installation Fee

(1,000 Rp.)

Area	1976	1980	1981	1985
I (Jakarta)	500	350	200	500
II	250	250	175	350
III	150	150	125	200
IV	100	100	90	175
V	75	75	75	125
VI	50	50	50	90
VII	25	25	25	75

2) Monthly Rental Fee

Table 7-2-4 shows the past monthly fee. The rate of annual increment was not kept up with inflation. The rate was fixed after 1981. The rate in the automatic exchange in the five big cities has been set to increase the tariff discripancies than that of other cities from the year 1981.

Table 7-2-4 Past Monthly Rental Fee of Telephone

(Rupiah)

		1976	1979	1980	1981	1985
Automatic Exchange	1	140	1,000	3,500	3,500	3,500
	2			2,500	2,000	2,000
Manual Exchange	more than 500 units		1,500	1,500	2,000	2,000
	less than 500 units		750	750	1,000	1,000

3) Call Fee

Table 7-2-5 shows the past call fee per pulse. The call fee at nominal price was increased by 3.8 times during the past 10 years, while the fee at constant price shows the decreasing tendency from the year 1981. The charging zone classification for the fee has been almost the same since 1976.

Table 7-2-5 Past Call Fee of Automatic Telephone Service

(per pulse)

Year	Nominal Rate	Inflation (1975 base year)	Real Rate (Dec. 1986 price)
1976	Rp. 20	1.20	Rp. 59
1979	40	1.73	83
1980	50	2.00	89
1981	60	2.26	95
1985	75	3.10	86
1986	75	3.57	75

(3) Past Tariff Policies

In general, tariff for a public service is supposed to be set to achieve the following three principles;

1) to maintain certain financial standards of an operating entity,
2) to achieve an efficient use of resources,
3) to achieve a fair allocation of resources.

PERUMTEL has been setting its tariff system which can cover its O&M costs and bring a certain return for its investment; i.e., the first principle of the above three. For example, the installation fee in Jakarta was brought down to Rp. 350,000 in 1980 from Rp. 500,000 of 1975 and then further down to Rp. 200,000 in 1983; however, it was brought up again to Rp. 500,000 in 1985. The new tariff system was implemented to deal with the ever increasing O&M costs and to create an enough internal fund to expand its capacity for elimination of waiting applicants. PERUMTEL paying 35% business tax and borrowing foreign soft-loans from the government at 12% interest rate contributes significantly to the government revenue, too.

The fees are set high (low) in the areas where demand is high (low) and inelastic (elastic). This policy seems to reflect the Ramsey pricing principle to achieve a fair and efficient allocation of resources.

(4) Proposed Tariff System for the Long-term Development Plan

1) The current and past tariff systems have been designed to cover the costs. A tariff system can also be looked into from the demand point of view, which usually improves financial performances.

   Various tariff systems can be designed by combining the cost conditions as the minimum base and the demand conditions as the maximum ceiling.

Table 7-2-6 shows the results of sensitivity analyses of the installation fee based on the WITEL demand function. This table shows how much increase of the installation fee is needed to eliminate waiting applicants. According to the result, 20% (15%) annual increase of the installation fee during the period of REPELITA-V cannot completely eliminate waiting applicants if GDP grows at 5% (3%) per year. The fee in Jakarta can be increased as high as by 55% under Plan 2 (A2) and by 50% under Plan 1 (A2).

2) Business and residential customers can be discriminated in the installation fee. The installation fee for the business customers can be set higher than that for the residential customers due to the differences in their price elasticities.

   As for the return, the waiting period for the business customers can be shortened.

3) The monthly rental fee in Indonesia seems quite cheap in comparison with other countries. A 20% annual increase during the period of REPELITA-V can be a reasonable policy to improve the financial condition of PERUMTEL.

Table 7-2-6 The Results of Sensitivity Analysis of the Installation Fee

Supply Plan 2 (A2)

	20%	25%	30%	55%
WITEL I				o
II				o
III	o	o	o	o
IV				o
V			o	o
VI		o	o	o
VII		o	o	o
VIII				o
IX				o
X			o	o
XI		o	o	o
XII				o

Supply Plan 1 (A2)

	15%	20%	25%	50%
WITEL I				o
II				o
III		o	o	o
IV				o
V			o	o
VI			o	o
VII			o	o
VIII				o
IX			o	o
X			o	o
XI	o	o	o	o
XII			o	o

Note: The Circle indicates the percentage of increase of the tariff rate in December 1986 at which the number of waiting applicants becomes zero.

4) The call fee must be set to cover the O&M costs. If the O&M costs will increase due to inflation caused by devaluate of rupiah in 1986, the call fee must be also increased by the same rate as inflation. If the rate of inflation in 1986 is expected to be around 15%, the call fee must be increased to Rp. 85/pulse from Rp. 75/pulse to keep up with inflation.

5) The charging zone classification has been the same since 1976. It may be needed to reexamine the current classification since regional distribution pattern of the subscribers has been charging, especially between the Jawa island and other islands. A proposed zoning is shown in Table 7-2-7.

Table 7-2-7 Proposed New Zoning Plan

Present			Future		
Zone Class	Distance (km)	Sec/ Pulse	Zone Class	Distance (km)	Sec/ Pulse
I	25 - 100	6	I	25 - 100	8
II	100 - 200	5	II	100 - 200	7
III	200 - 300	4	III	200 - 300	6
IV	300 - 1,000	3	IV	300 - 500	5
V	1,000 -	2	V	500 - 800	4
			VI	800 - 1,000	3
			VII	1,000 -	2

7-3 Revenue Management

(1) Revenue Estimation Method

1) Conditions assumed for revenue estimation are as follows;

Revenue considered by this analysis is of the following three categories, i.e., telephone service revenue, telegram service revenue and telex service revenue.

Besides those three categories of revenue, there are some other miscellaneous revenue sources, e.g., non-operating revenue, such as advertisement revenue. However, in this study, miscellaneous revenue is not taken into account because it is negligible small.

The annual supply volume shall be implemented by the one-fifth of the total supply volume of each REPELITA and the revenue will come into PERUMTEL from the next year after implementation.

Demand and traffic forecasts are made every five years after the year 1989. Thus, annual average growth rates of forecasted demand and traffic for every five years are applied for annual revenue estimation.

2) Annual Revenue for the service categories and for the WITELs are calculated as follows;

Telephone Service Revenue

Installation Fee:

The number of new subscribers of the year x the average installation fee by each WITEL

Monthly Rental Fee:

The total number of subscribers of the year x the average monthly rental fee by each WITEL

Call Fee:

(The mean volume of busy-hour traffic in destination basis x Call fee (per minute) x 60 minutes x 300 days)/traffic concentration ratio into busy-hour

Telegram Service Revenue

The number of total telegrams of the year x Rp. 800

Telex Service Revenue

Installation fee:

The number of new subscribers of the year x the average installation fees by each WITEL

Message tariff:

The total number of pulses in the year by Province x Tariff per pulse (Rp. 75)

(2) Revenues based on the current tariff rate

The annual revenue of the two plans based on the current tariff rate are shown as follows;

Table 7-3-1 Revenue Estimates (Current Tariff)

(December 1986 price)

Year	Total Revenue (Bill. Rp.)	No. of subscribers (1000)	Revenue per subscriber (Mil. Rp.)
Supply Plan 1 (A2)			
1989	1,500	1,250	1.20
1994	2,646	2,100	1.26
1999	4,192	3,200	1.31
2004	6,120	4,500	1.36
Supply Plan 2 (A2)			
1989	1,769	1,450	1.22
1994	3,419	2,650	1.29
1999	5,848	4,300	1.36
2004	8,804	6,200	1.42

The revenue per subscriber will increase by 0.7% every year in the Supply Plan 1 and 1% in the Supply Plan 2. The revenue per subscriber will increase when the supply volume increases, but the incremental rate is not so large. The means to increase revenue are as follows;

1) Increase supply volume
2) Increase tariff rate
3) Change regional capacity distribution pattern
4) Reduction of non-chargeable uses

Of the above four means, the increase of supply volume was discussed already and the other three means shall be described in detail in the next section.

(3) Tariff changes

Tariff rates for the simulation studies were set as follows;

1) Call Fee

Strategy T1 Due to inflation in 1986, the rate is increased to Rp. 85 per pulse and this rate will continue till the year 2004.

Strategy T2 Due to inflation in 1986, the rate is increased to Rp. 85 per pulse during the REPELITA-V period but this rate is reduced to Rp. 80 in REPELITA-VI and Rp. 75 in REPELITA-VII.

Strategy T3 The rate remains unchanged at Rp. 75 per pulse.

2) Installation Fee

Since revenue from this charge is used for construction, the tariff rate should be increased when the fund availability becomes small. The increment of tariff rate is set at 20% per year from 1989 to 1994 in accordance with "WITEL Demand Study" (Strategy I).

3) Monthly Rental Fee

The increase of this rate will be recommended only when the increase of the call fee is not sufficient to cover the O&M expenses. The increment of rate is set at 20% per year from 1989 to 1994 (Strategy R).

(4) Change of Regional Capacity Distribution Pattern

According to "Chap. 6 Investment Strategies", the regional supply plans are formulated as follows;

1) Supply Plan 1: Expand capacity share in the six major WITELs--A1
Maintain the existing shares
(at the end of PELITA-IV) ------- A2

2) Supply Plan 2: Maintain the existing shares ---------- A2
Equalizing the telephone density
among regions ---------- A3

(5) Reduction of non-chargeable uses

It is noted that the government and PERUMTEL official uses of the services are not charged but since PERUMTEL has to operate on a commercial basis to a certain extent, all such uses must be charged as much as possible.

(6) Results of Revenue Estimates

The annual revenue per telephone subscriber of each plans are estimated by adopting the revenue increasing measures as shown in Table 7-3-2.

Table 7-3-2 Results of Revenue Estimates

Supply Plan 1 (Million Rp. in December 1986 price)

Strategy	Year	T3	T1	T1+R
A1	1989	1.20	1.35	1.35
	1994	1.25	1.40	1.47
	1999	1.30	1.46	1.52
	2004	1.34	1.51	1.58
A2	1989	1.20		1.35
	1994	1.26		1.48
	1999	1.31		1.54
	2004	1.36		1.60

Supply Plan 2 (Million Rp. in December 1986 price)

Strategy	Year	T3	T1	T2	T1+R
A2	1989	1.22	1.37	1.37	1.37
	1994	1.29	1.45	1.45	1.51
	1999	1.36	1.53	1.44	1.59
	2004	1.42	1.6	1.42	1.66
A3	1989	1.22	1.37	1.37	1.37
	1994	1.32	1.48	1.48	1.54
	1999	1.40	1.58	1.49	1.64
	2004	1.47	1.66	1.47	1.72

1) The change of the call fee from Rp. 75 to Rp. 85 per pulse increases the revenue by about 13%. The change of the call fee and the monthly rental fee in the REPELITA-V period increases the revenue by about 18% in the Supply Plan 1 and by about 17% in the Supply Plan 2.

2) In the Supply Plan 1, the Strategy A2 produces higher revenue than the Strategy A1. Since the traffic volume of the telephone subscribers in big cities like Jakarta, Surabaya are smaller than that in other cities.

3) In the Supply Plan 2, the Strategy A3 produces higher revenue than the Strategy A2. This is because the larger capacity is distributed to the Jawa Island.

7-4 Financial Plan and Strategies Evaluation

(1) Objectives

The basic objectives of the plan up to the year 2004 are as follows;

1) To establish an ability of financial independence by the year 2004
2) To diversify fund sources
3) To coordinate managerial efficiency as a going-concern and managerial responsibility as a public enterprise.

(2) Structure of Fund Flow

The structure of money inflow and outflow is explained in Figure 7-4-1.

The financial statements such as a profit and loss statement, a source and application statement and a capital budget statement are interrelated to each other.

A profit and loss statement consists of revenue items and expenditure items. Expenditure is classified into operating expenditure, depreciation, and interest repayment.

A source and application statement is classified into sources of fund and applications of fund. Sources of fund consist of capital from the government, loan, depreciation and net profit. In general, the sources are classified into internal fund such as depreciation, net profit and external fund such as subscriber's bond and loans.

The capital budget statement of PELITA-IV is shown in Figure 7-4-2. The share of internal fund was assumed to be around 43%.

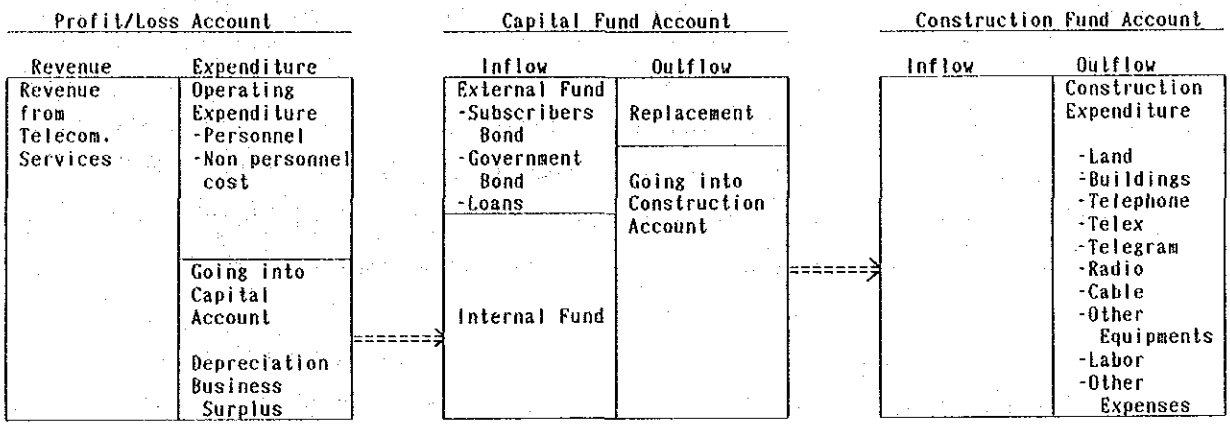


Figure 7-4-1 Fund Flow Diagram

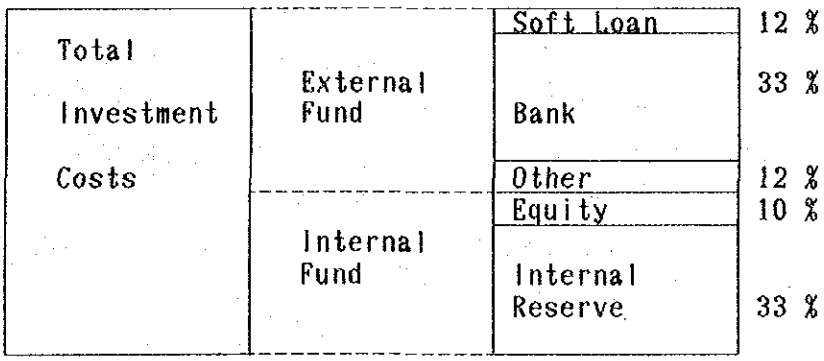


Figure 7-4-2 Fund Procurement in PELITA-IV

A cash flow statement consists of cash-inflow and outflow. Cash-inflow is considered as total revenue derived from the new investment. Cash-out flow is classified into new investment costs and new operating expenditure.

(3) Evaluation Criterion

1) Operating Ratio

This criteria is obtained from a profit and loss statement. This ratio is obtained by dividing total expenditure by total revenue. This ratio should be less than 1.0, which means that total revenue must be larger than total expenditure.

When this ratio is calculated by dividing total operation and maintenance cost by total revenue, the value should be at least around 50-60 (%). The countries which achieved high telephone service supply have relatively lower value in around 30-40 (%). When supply volume increases, the share of depreciation and interest payment will increase. Thus, a measure must be taken to reduce the share of operating expenditure for expansion of supply volume.

2) Internal rate of return (I.R.R.)

This criteria is obtained from a cash flow statement. The value is compared with the interest rate of lending fund from banks and the government. PERUMTEL has procurred its fund by around 18% of interest rate per year on the average. Thus, the value of 18% is considered as a minimum value of I.R.R. for project feasibility.

Cash flow statements are prepared on the basis of the following assumptions;

a) Revenue from subscribers up to 1989 is considered to come from using the existing facilities (PELITA-IV).
b) The concerned period for revenue calculation is 20 years starting from the initial year of each REPELITA.
c) The period of service will be 20 years because of the service life of the equipments. No salvage value should be allowed for the equipments.

3) Debt-Service Ratio

This value is obtained from a source and application statement. This is calculated by dividing Internal reserve (General reserve plus Depreciation) by "Repayment of loan". This value should be at least 1.3 in the telecommunications sector.

The other criteria from this statement is "Accumulated surplus" which must be positive. If this is negative, PERUMTEL must procure the short-term loan, which will create a burden on profits.

The statements are made on the basis of the following assumptions;

a) The fund plan of PELITA-IV will be carried over according to the supply volume. Thus, 45% of the planned fund in the Plan 1 and 20% in the Plan 2 will not be procured.
b) The interest rates of domestic loans and foreign loans are 18% and 12% respectively. The lending period and grace period are 10 years and 4 years, respectively.
c) No short-term loan is considered in this analysis.
d) The value of re-investment and working capital are assumed to remain unchanged.

(4) Fund Plan

The fund plan for the long-term plan is formulated on the basis of the following principles to achieve an ability of financial independence.

1) In each five-year plan, the necessary amount of outside fund will be obtained by deducting the total internal fund from the total necessary fund.

2) The share of Government equity contribution shall be reduced to zero until the year 2004.

3) The outside fund are consisted of bank loans, subscriber's bond and soft loans from foreign countries. The share of soft loans shall be reduced from the view point of industrialization policy (promotion of domestic industry).

(5) Evaluation of Strategies

Table 7-4-1 summarizes the results of simulation. This Table shows the financial results of adopting several management strategies for each investment strategy.

If GDP growth rate is predicted to be 3% per year, choosing Plan 1 as its investment strategy is recommended. If PERUMTEL, then, takes either the strategy A1 or A2 as its regional capacity distribution policy, the strategy M1 for the O&M costs and the strategy T1 for the tariff must be taken to satisfy the financial criterion.

Table 7-4-1 Results of Simulation Study

Investment Strategy		Management Strategy		Financial Indexes			Evaluation
		OM Cost	Tariff Rate	Operating Ratio	I.R.R. (%)	Debt-Service Ratio	
PLAN 1	A1	No Action		1.41-1.50	-6,-,-	1.31-3.83	
GDP		M2	T1	0.98-0.65	18,23,24	1.77-11.01	Feasible
growth		M3	T1	0.99-0.70	17,21,20	1.75-10.77	Feasible
rate 3%							
4.5 mil.	A2	No Action		1.41-1.50	-6,- ,-	1.32-3.47	
Line Unit		M1	T1	0.96-0.60	19,27,29	1.78-15.04	Feasible
	A2	No Action		1.35-1.48	-3,-25,-	1.21-3.43	
		M3	T1	1.02-0.81	16,19,17	1.31-4.36	
			T1+R	1.00-0.78	18,21,18	1.34-4.43	Feasible
PLAN 2		M2	T2	1.00-0.85	17,16,12	1.30-4.40	
GDP			T1	1.00-0.71	17,22,21	1.34-4.40	Feasible
growth		M1	T2	0.98-0.72	17,20,17	1.36-4.44	Feasible
rate 5%							
6.2 mil.	A3	No Action		1.35-1.64	-4,-21,-	0.77-3.43	
Line Unit		M1	T1	0.98-0.85	14,11,17	0.81-3.49	
			T1+R+I	0.97-0.82	18,14,20	0.88-4.74	Feasible

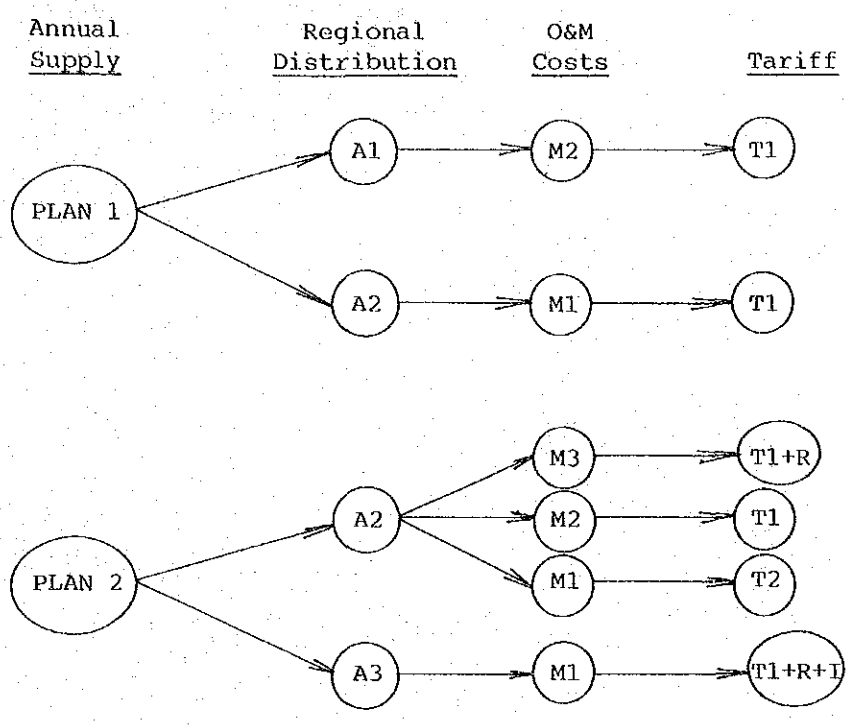
Note M1: OM cost in 2004 is 0.40 million Rp. per Telephone Subscriber in Plan 1
: OM cost in 2004 is 0.46 million Rp. per Telephone Subscriber in Plan 2
M2: OM cost in 2004 is 0.48 million Rp. per Telephone Subscriber in Plan 1
: OM cost in 2004 is 0.57 million Rp. per Telephone Subscriber in Plan 2
M3: OM cost in 2004 is 0.60 million Rp. per Telephone Subscriber in Plan 1
: OM cost in 2004 is 0.65 million Rp. per Telephone Subscriber in Plan 2
T1: Call fee is Rp. 85 per pulse from 1979 to 2004
T2: Call fee is Rp. 85 in REPELITA-V, Rp. 80 in REPELITA-VI and Rp. 75 in REPELITA-VII
R : Monthly rental fee increases by 20% per year in REPELITA-V period
I : Installation fee increases by 20% per year in REPELITA-V period

If GDP growth rate is predicted to be 5% per year, choosing Plan 2 as its investment strategy is recommended. If PERUMTEL takes the strategy A2 as its regional capacity distribution policy, the following three combination of management strategies can satisfy the financial criterion; the strategies M3 and T1+R, the strategies M2 and T1, and the strategies M1 and T2. If PERUMTEL takes the strategy A3 as its regional capacity distribution policy, only one combination of management strategies can satisfy the financial criterion; i.e., the strategies M1 and T1+R+I.

Figure 7-4-3 shows the feasible combinations of the strategies.

The fund plans of the Plan 1 and 2 are proposed as follows.

Plan		REPELITA	Internal Fund (%) PERUMTEL	Internal Fund (%) Government	Outside Fund (%)
Plan 1	A1	V	40	10	50
		VI	70	10	20
		VII	85	0	15
	A2	V	40	10	50
		VI	75	10	15
		VII	85	0	15
Plan 2	A2	V	30	10	60
		VI	45	10	45
		VII	70	0	30
	A3	V	30	10	60
		VI	40	10	50
		VII	70	0	30



Note

A1 : Capacity Expansion in the six major cities

A2 : Capacity Expansion in line with PELITA-IV Capacity Expansion

A3 : Equal Capacity Distribution in all the WITELs except Jakarta

M1 : 20 staffs/1000 L.U.

M2 : 30 staffs/1000 L.U.

M3 : 40 staffs/1000 L.U.

T1+R+1: Increase of the call, monthly rental, installation fees

T1+R : Increase of the call and monthly rental fees

T1 : Increase of the call fee (Rp. 85/pulse)

T2 : Increase of the call fee during REPELITA-V only
(Rp. 85/pulse during REPELITA-V)
(Rp. 75/pulse after REPELITA-V)

Figure 7-4-3 The Feasible Combination of Strategies

CHAPTER 8
TECHNICAL DEVELOPMENT STRATEGIES

CHAPTER 8 TECHNICAL DEVELOPMENT STRATEGIES

This chapter proposes technical development strategies to be considered in the long-term development plan from view points of to recent technical trend, the geographical conditions in Indonesia and the present state of the facilities. This study focused especially on network integration, facility improvement and backbone transmission system.

8-1 Innovations of Telecommunication Technology

In recent years, the speed of technological innovations in the field of telecommunications equipments has been remarkable. In making of a long-term telecommunications development program, the recent technological innovations must be carefully examined.

(1) New technologies in switching system

In the field of switching technologies, the recent technological innovations have been taking place in the following two aspects;

1) Digitalization,
2) Remote switching unit (RSU).

Digital switching system has the following features;

1) Less floor space requirement,
2) Low failure rate due to adoption of less electro-mechanical components and low O&M costs,
3) Provision of various subscriber services (ISDN) by fully digitalized switching system.

By using RSU, the following advantages are realized;

1) Introduction of non-attended maintenance to achieve lower cost construction, operation and maintenance
2) Shortened installation period

(2) New Technologies in Transmission System

The following three items are the main recent technological innovations in transmission system

1) Digital system
2) Satellite communication system
3) Fiber optic system

Digital transmission system provides the following advantages;

1) Easy construction of high quality long distance transmission system in comparison with analog system due to regeneration repeaters
2) Low manufacturing costs as well as higher reliability due to digital components
3) Low construction costs of communication network by IDN with a combination of digital switching system

Satellite communication system, which is suitable in building communication networks to cover wide and isolated areas, has the following features;

1) Recently lowered manufacturing costs for both satellite and ground portions can make remarkable cost reduction possible in construction and operation in comparison with terrestrial transmission systems, when satellite system is used for long distance transmission.
2) Since satellite portions are jointly used by many earth stations, new transmission routes can be created in a short period of time.

Fiber optic system has the following features;

1) It is possible to have a larger capacity than microwave system. Consequently, lower cost per channel is realized when large capacity channel is needed.
2) It is possible to have a longer repeater span of 50-100 km because of the recent technical advance. As a result, notable cost reduction can be obtained in system construction.

These features can be advantageous for long distance inter island communication systems.

(3) Establishment of ISDN Technologies

In the past ten years, a number of research and development on ISDN technologies have been carried out in many countries of the world. At present, ISDN technologies are almost at the stage of practical application. By the application of ISDN technologies, the following achievement can be expected;

1) Diversification of services
2) Provision of variety of new services at low cost

Examples of the proposed new services are;

- Teletex
- Message Handling Service
- Videotex
- High Speed Data Communication
- High Speed Facsimile
- Diversified Service Features by Telephone