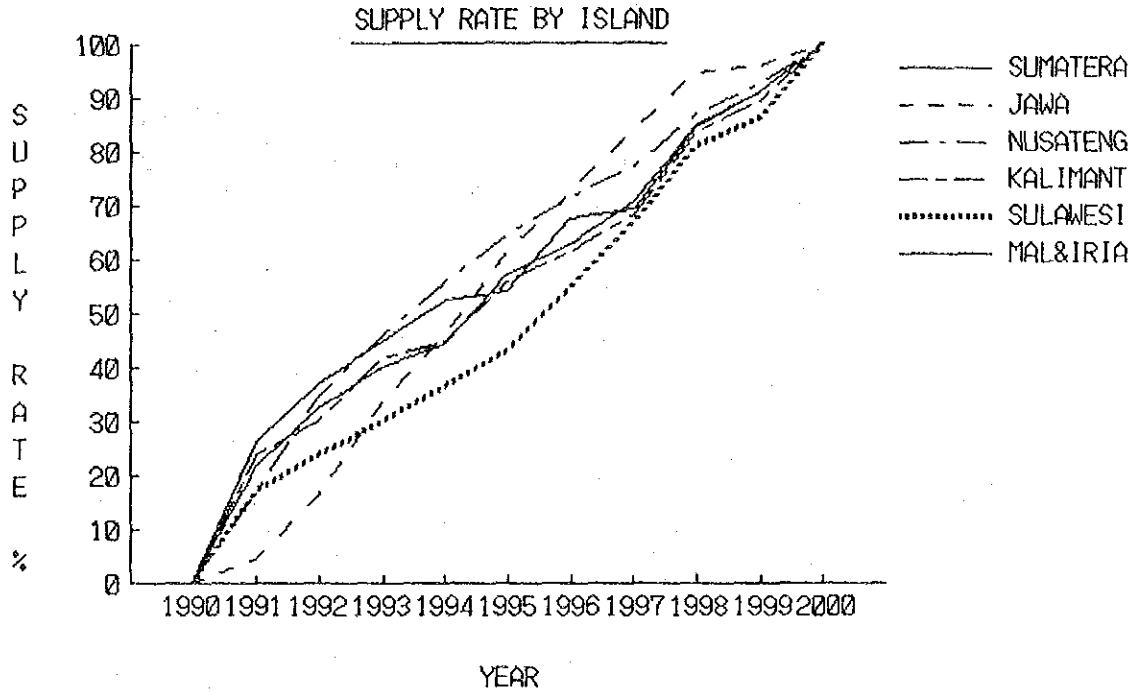


Figure 11 Telephone Supply Rate by Island

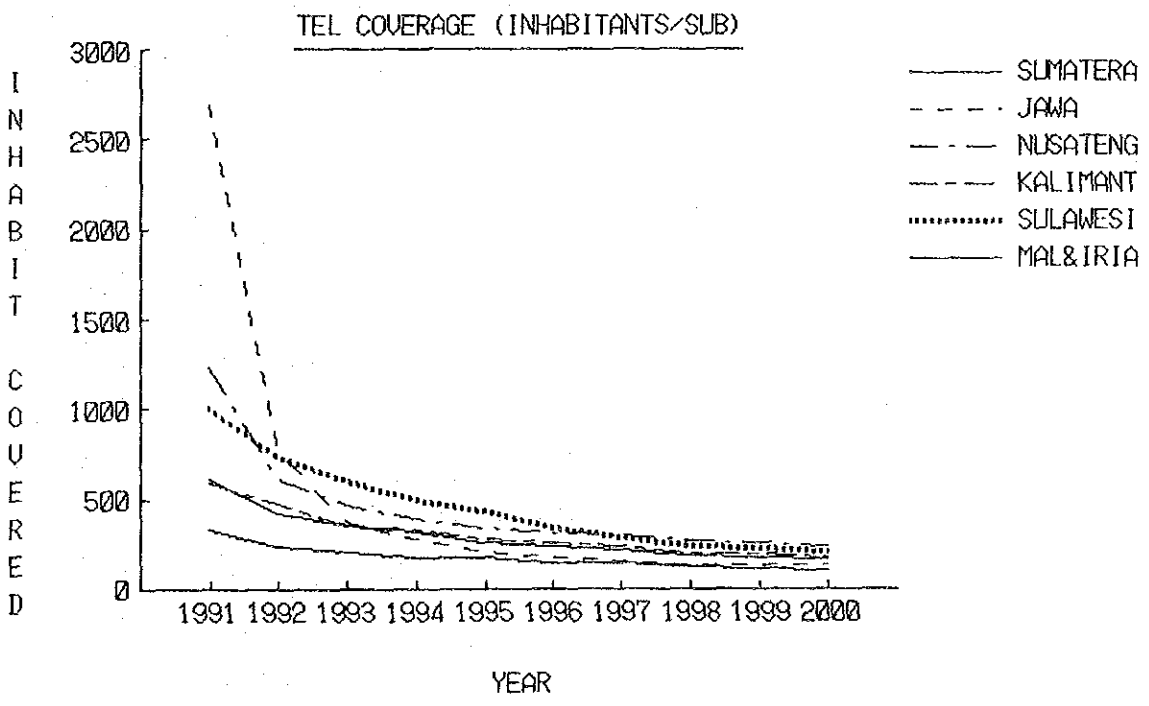


Figure 12 Coverage Population per Telephone Set

2-3 Rural Telecommunications Network Project Implementation Plan

Table 1 and Table 2 describe the implementation plan for the telecommunications network project in Indonesia's 246 Kabupaten, according to the following conditions:

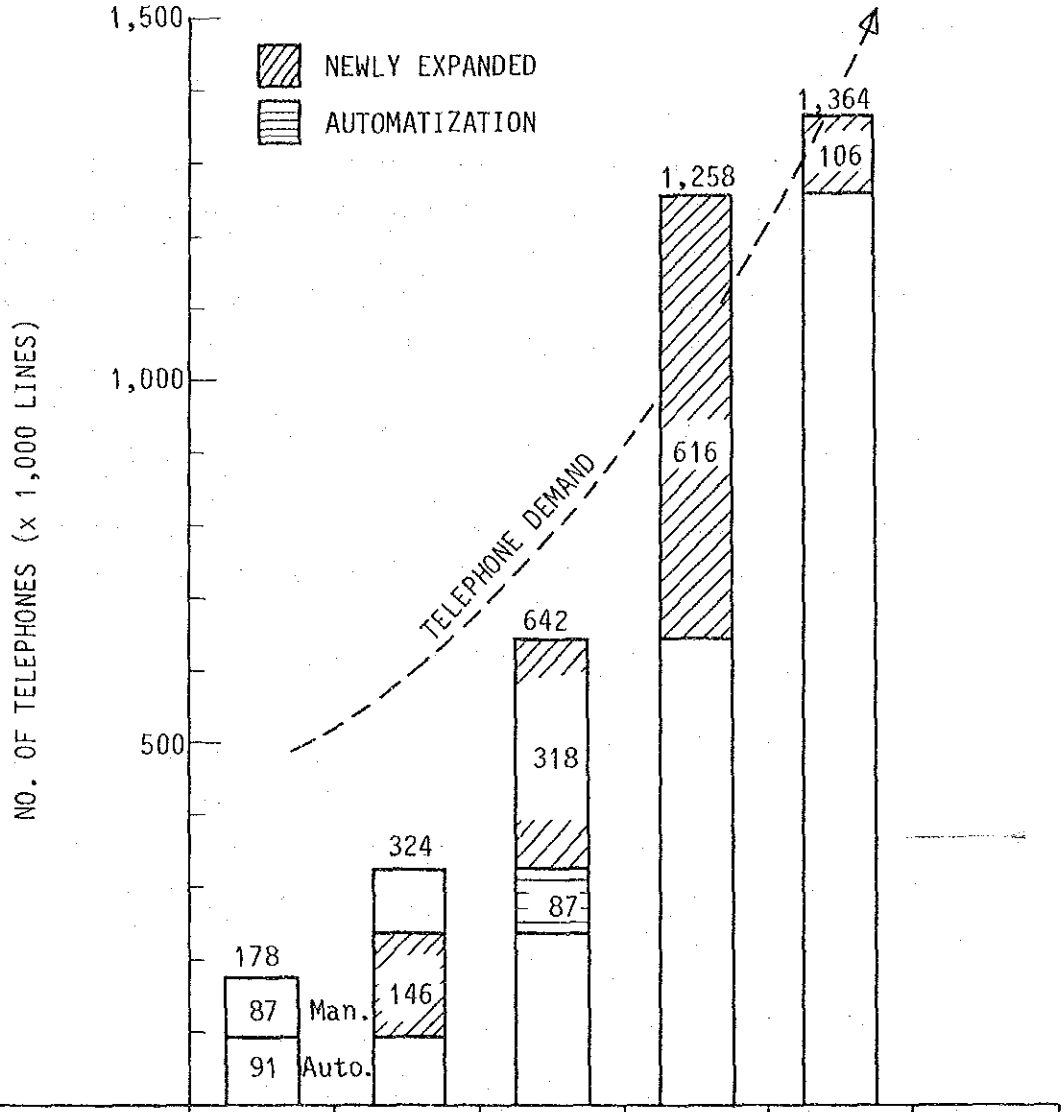
1) Network expansion method 2 (2-stage method for IKK/KEC and Desa) will apply in all Kabupaten.
2) IKK/KEC construction will be divided into 8 phases starting in 1989, with construction to begin in approximately 30 Kabupaten each year.
3) Construction in Desa will be implemented in 3 phases starting in 1997.
4) Annual construction investment will increase by an average of approximately 5% per annum.

Under this implementation plan, by the year 2000 automatic instant telephone service will be provided in all Desa nationwide and the average telephone density in the 246 Kabupaten will rise five-fold from present figures to 7 telephone sets per 1,000 persons.

TABLE 1 IMPLEMENTATION PLAN AND CONSTRUCTION COST

UNIT: BILLION Rp

Year / Project	1 1.989	2 1.990	3 1.991	4 1.992	5 1.993	6 1.994	7 1.995	8 1.996	9 1.997	10 1.998	11 1.999	12 2.000	TOTAL	NO of KAB	Expansion SUB $\times 10^3$
IKK & KEC 1	158	158	158										474	25	127
IKK & KEC 2		130	130	130									390	25	125
IKK & KEC 3			143	143	143								429	25	153
IKK & KEC 4				115	115	115							345	32	113
IKK & KEC 5					159	159	159						477	35	149
IKK & KEC 6						129	129	129					387	38	108
IKK & KEC 7							128	128	128				384	32	113
IKK & KEC 8								108	108	108			324	34	54
DESA 1									372	372			744	(63)	79
DESA 2										197	393		590	(58)	37
DESA 3											367	732	1,099	(125)	69
TOTAL	158	288	431	388	417	403	416	365	608	677	760	732	5,643	246 (246)	1,127



Item \ Year	AS OF 1983	1984-1988 PELITA-IV	1989-1993 REPERITA-V	1994-1998 REPERITA-VI	1999-2000 REPELITA-VII	TOTAL
NO. OF TELEPHONE (1,000 LINES)	178	324	642	1,258	1,364	-
POPULATION OF KAB. (x 1,000)	142,100	157,800	174,800	192,200	199,500	-
TELEPHONE DENSITY (/100 INHABITANTS)	0.13	0.21	0.37	0.65	0.68	-
EXPANSION VOLUME (1,000 LINES)	-	146	405	616	106	1,127
INITIAL INVESTMENT (BILLION RP.)	-		1,682	2,467	1,494	5,643

Table 2 Rural Telecom. Project Implementation Plan

2-4 Financial Evaluation of Project

(1) Financial Income by Region

The project's financial internal rate of return (FIRR) in each Propinsi is shown in Figure 13. The FIRR is high on Jawa and low in part of Sumatera and in Maluku Islands. The principal reason for this variance lies in the diference in initial investment costs. The lower the investment cost per subscriber, the higher the FIRR.

(2) Network Coverage and Financial Return

The relationship between network coverage and overall FIRR and investment cost per subscriber is shown in Figure 14.

Evaluation for Project Objective Area Only:

The FIRR of 6.8% which results if the network is extended to cover the Desa is only one-third of the FIRR of 19.5% which results if network coverage extends to only the IKK. In other words, the FIRR in the Desa is extremely poor compared with that of the IKK and KEC.

Evaluation Nationwide Including Kotamadya:

If the Kotamadya are included, then the FIRR is estimated at 15% even if the network is extended to cover the Desa. It can therefore be judged that **the implementation of Rural Telecommunications Network Project is sufficiently feasible from a financial viewpoint.**

Based on the above discussion, although the FIRR of Rural Telecommunications Network Project in Indonesia varies greatly depending on specific areas and network coverage, it is possible to obtain an adequately sufficient FIRR overall if the low FIRR seen in some areas is compensated using the profits derived in areas with high FIRR.

(Note: The revenue was calculated based upon the existing tariff system.)

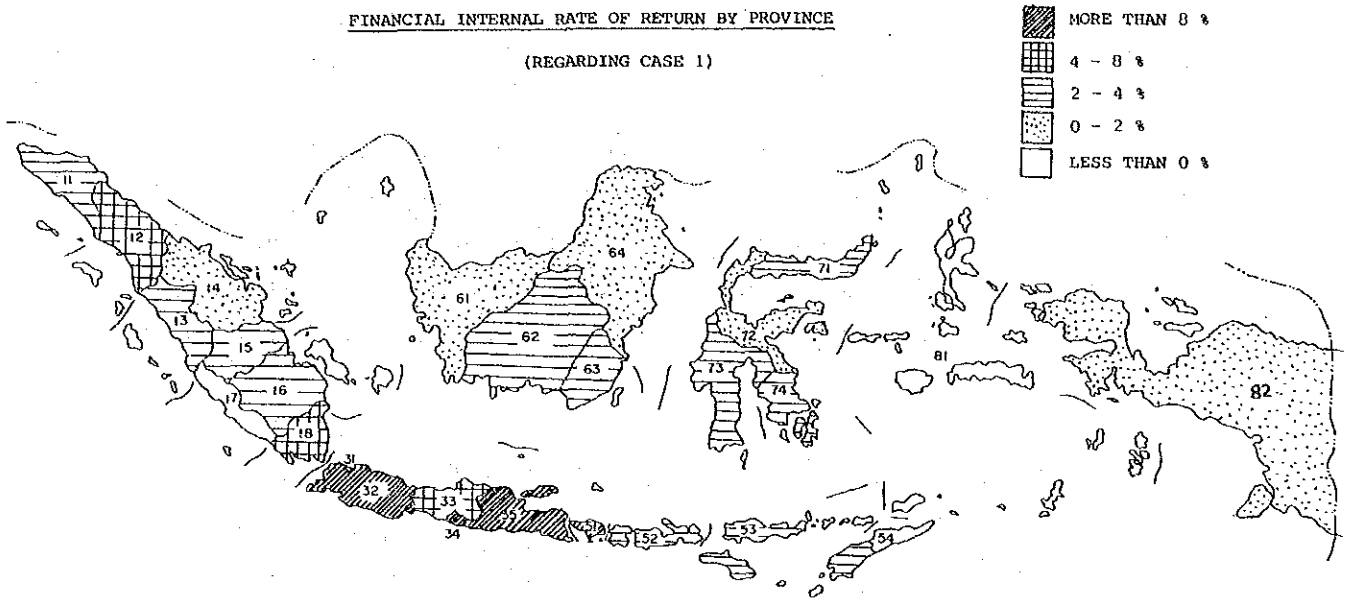


Figure 13 Project FIRR by Province

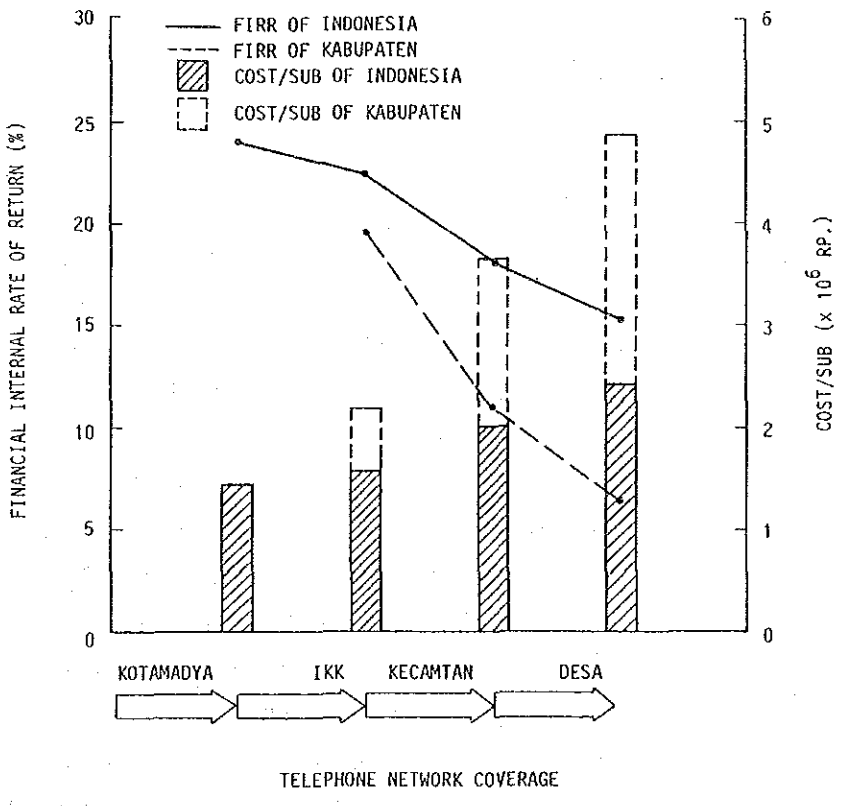


Figure 14 Network Coverage and Overall FIRR

2-5 Economic Evaluation of Project

(1) Consumer Surplus Deriving from Telephone Subscription

The consumer surplus resulting from subscription to telephone service is shown in Figure 15, according to Propinsi. A high consumer surplus is expected in the Propinsi listed below, making it evident that the nation's citizens strongly desire to see an improvement in telephone services.

Propinsi	Consumer Surplus (1975 values)
Kalimantan Timur	Rp.803,000/subscriber
Sumatera Utara	Rp.573,000/subscriber
Bali	Rp.564,000/subscriber
Irian Jaya	Rp.405,000/subscriber

Even in Nusa Tenggara Barat Propinsi at the lowermost end, a consumer surplus of Rp.106,000/sub can be expected. So the benefits of telephone service for the subscriber are higher than the charges paid to PERUMTEL.

(2) Impact of Introduction of Telephones

Figure 16 describes the relationship, by Propinsi, between communication volume by mail, telegram and telephone and GRDP/capita. From the figure it can be seen that Propinsi having large communication volumes also have higher GRDP/capita. For this reason, the introduction of telephones into these areas can be expected to have a strong impact on their economic development.
In the areas at the lower right side of the figure (Yogyakarta:34, Sumatera Barat:13, Bengkulu:17), the level of communication is more developed than the GRDP/capita. In contrast, the areas at the upper left side of the figure (Kalimantan Barat:61, Kalimantan Tengah:62, Sumatera Selatan:16) have lower levels of communication than their GRDP/capita, and development is urgently needed in these regions. Also, because telephones are more cost-efficient than other media, they can be expected to make a large contribution to the development of communications.

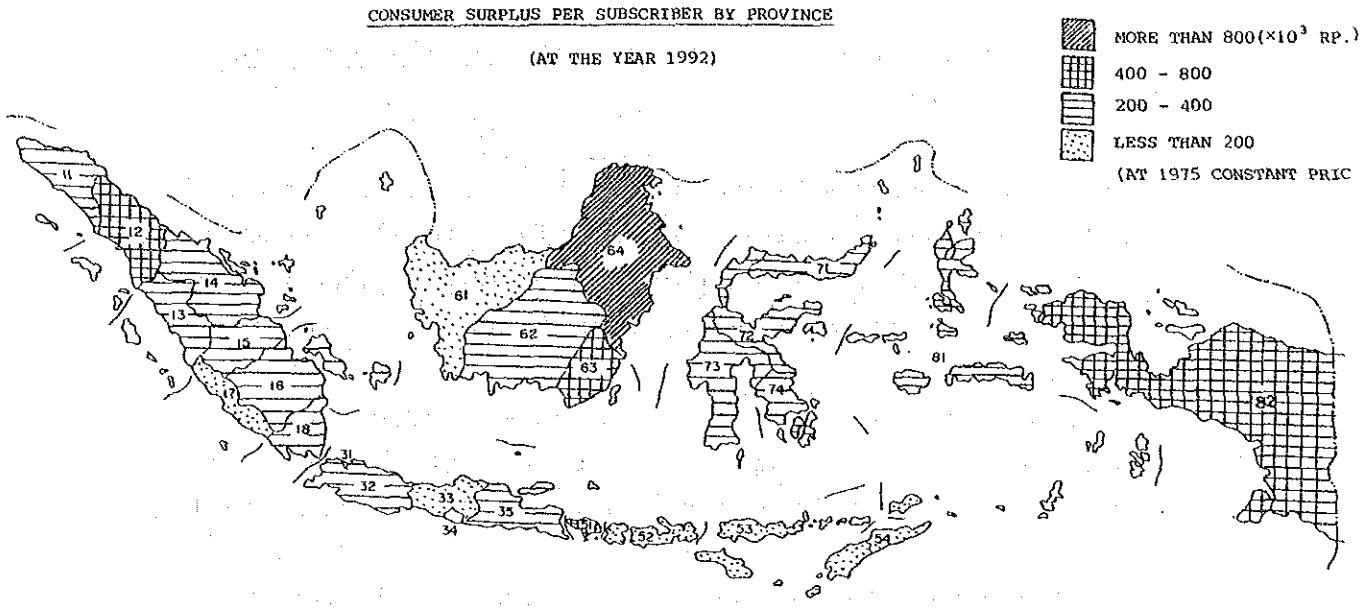


Figure 15 Consumer Surplus from Telephone by Province

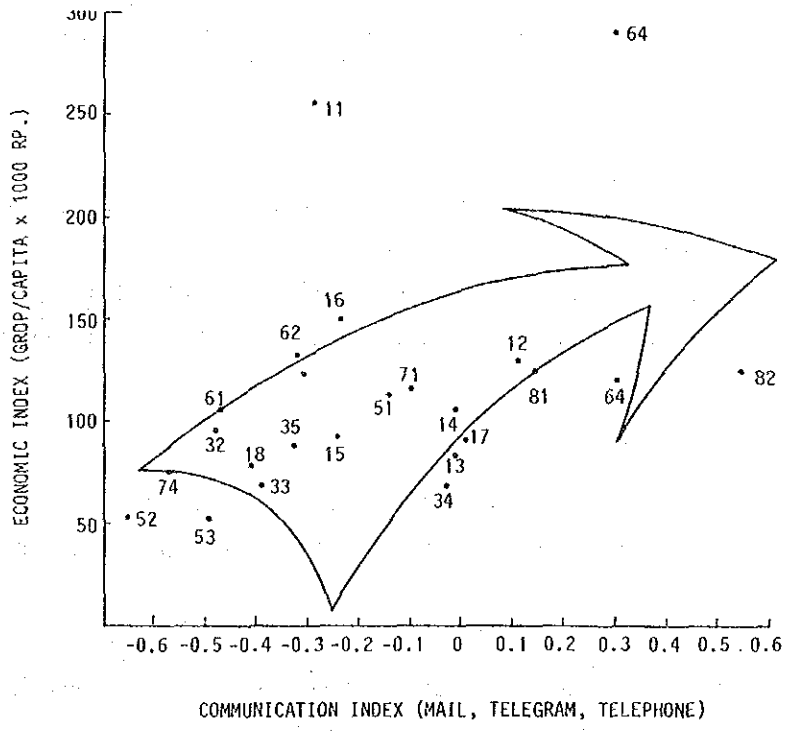


Figure 16 Communication Volume and GRDP/Capita

3. SUBSCRIBER DEMAND AND CALL DEMAND

3-1 Current State of Rural Telecommunications and Need for Telephone Service

The communications media currently in use in Indonesia's rural districts are shown in Figure 17. In all cases, these media lack the conditions which they should normally have:

(1) speed (2) convenience (3) certainty (4) secrecy
(5) economy (low cost)

The introduction of automatic telephone service not only will enable the fulfillment of these conditions but will also bring about the following social and economic benefits:

(1) Administrative Organizations, Social Service Agencies

- Cost reduction through elimination of the existing HF radio system
- Cost reduction through cutback in frequency of officer travel
- Enhanced efficiency in the organization or agency
- Improvement in certainty and speed of information transmission

(2) Industry

- Reduction in information costs involved in corporate and agricultural activities
- Increased benefit through expansion in distribution area
- Shift from economic self-dependency to inter-regional interdependency

(3) Residents

- Expansion in scope of individual life sphere
- Increased speed in communication in times of disaster or sudden illness

The cost comparisons for various media forms in sample areas are shown in Figure 18. Compared with other media, **automatic telephone service offers far greater effectiveness in cutting costs (substitute effectiveness).** This effectiveness also increases with the frequency of communication and with distance.

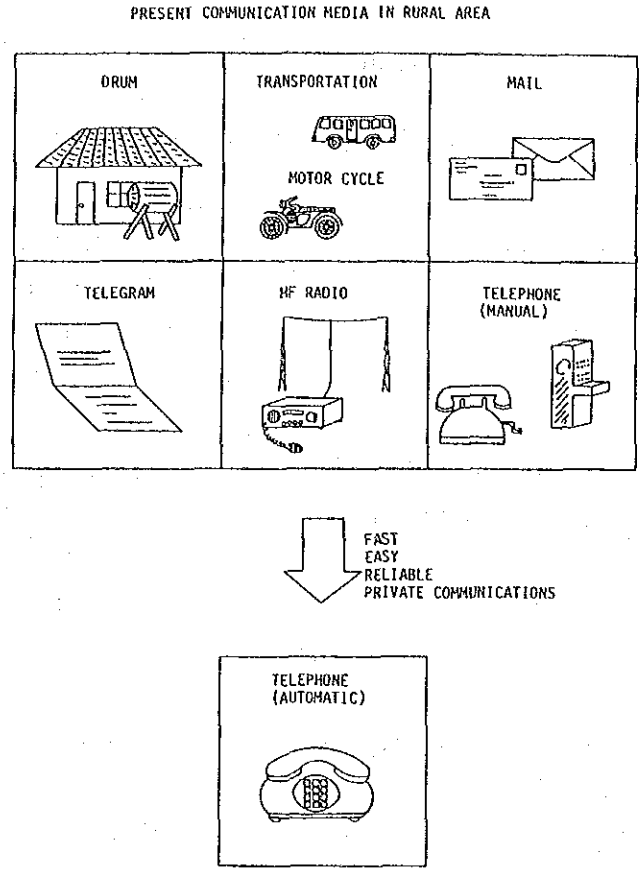


Figure 17 Present Communication Media in Rural Area

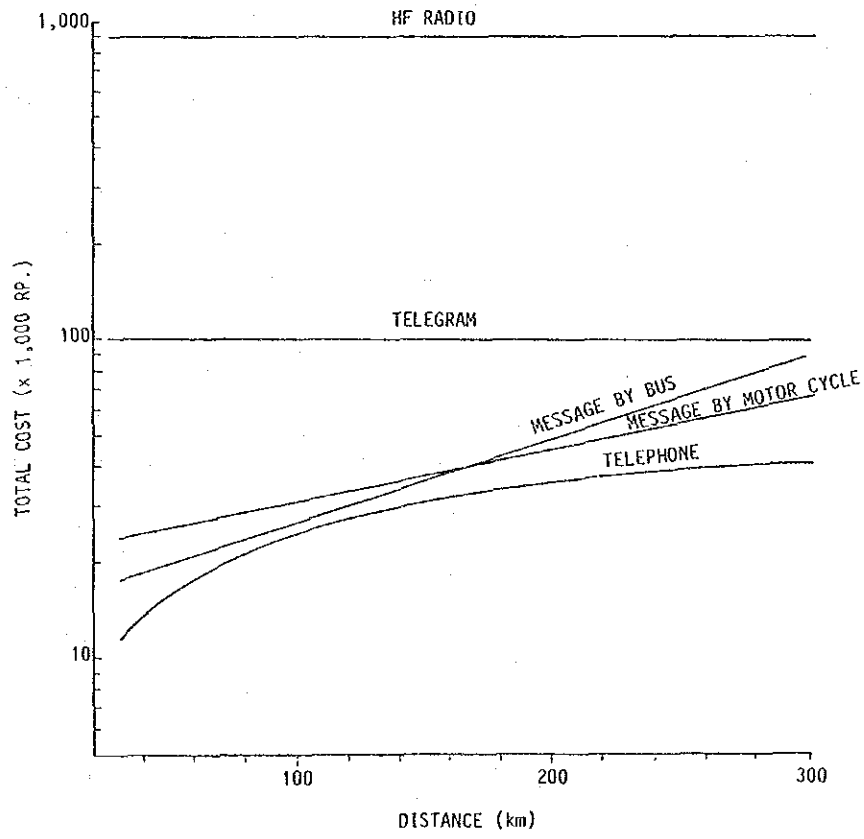


Figure 18 Cost Comparison for Communication Media

3-2 Estimate of Subscriber Demand

(1) Estimate Method

The estimate of subscriber demand was made by dividing telephone subscribers into the following 4 categories and then predicting their respective numbers in 69 Kecamatan in 10 sample Kabupaten.

1) **Public subscribers (A):** military, police and administrative agencies (including public phones)

2) **Public subscribers (B):** public and social facilities (medical facilities, schools, post offices, etc.)

3) **Industrial subscribers:** corporations and individuals belonging to 1st, 2nd and 3rd industrial sectors (medium and large factories and commercial shops)

4) **Residential subscribers:** individuals having economnic means to pay telephone charges.

The estimated numbers of subscribers for each Kecamatan are shown in Figure 19.

Based on these estimates, the total subscriber demand was then calculated for the 10 sample Kabupaten.

Regressive analysis according to the method of least squares was then performed between the number of subscribers in the sample Kabupaten and their socio-economic indexes, in order to derive a formula for estimating the potential subscribers in each category.

The estimation formulas relate to population, population density and real income, as shown in Figure 19.

KECAMATAN-LEVEL SUBSCRIBER DEMAND IN SAMPLE AREAS AS OF 1984

SUBSCRIBER DEMAND CATEGORIES	RANGE OF DEMAND PER KECAMATAN
PUBLIC DEMAND (A)	13 - 82
PUBLIC DEMAND (B)	3 - 38
INDUSTRIAL DEMAND	0 - 301
RESIDENTIAL DEMAND	0 - 125

AGGREGATION OF DEMAND FROM KECAMATAN-LEVEL TO KABUPATEN-LEVEL IN 10 SAMPLE KABUPATEN

REGRESSION ANALYSIS TO OBTAIN DEMAND ESTIMATE FUNCTION BY SUBSCRIBER DEMAND CATEGORY

PUBLIC DEMAND (A) = f(POPULATION DENSITY) · POPULATION

PUBLIC DEMAND (B) = f(POPULATION DENSITY) · POPULATION

INDUSTRIAL DEMAND = f(INCOME) · POPULATION

RESIDENTIAL DEMAND = f(INCOME/POPULATION) · POPULATION

DEMAND ESTIMATE FOR ALL KABUPATEN IN INDONESIA

Figure 19 Flow Chart of Demand Estimate

(2) Results of Demand Estimate

As seen in Figure 20, when the number of Kabupaten are divided by island according to scale of demand, the largest scale of demand is on Jawa, followed by Sumatera.

Figure 21 shows the changes in demand by subscriber category and their respective percentages between 1984 and 2000. Reflecting the growth in population and income, the percentage of public demand decreases while the percentages of industrial and residential demand increase.

According to Figure 22, because of the large population and high population density on Jawa, subscriber demand and demand density are both high. In Maluku and Irian Jaya, on the other hand, due to the smaller population the subscriber demand is less; nevertheless, per capita income is high, so demand density is high.

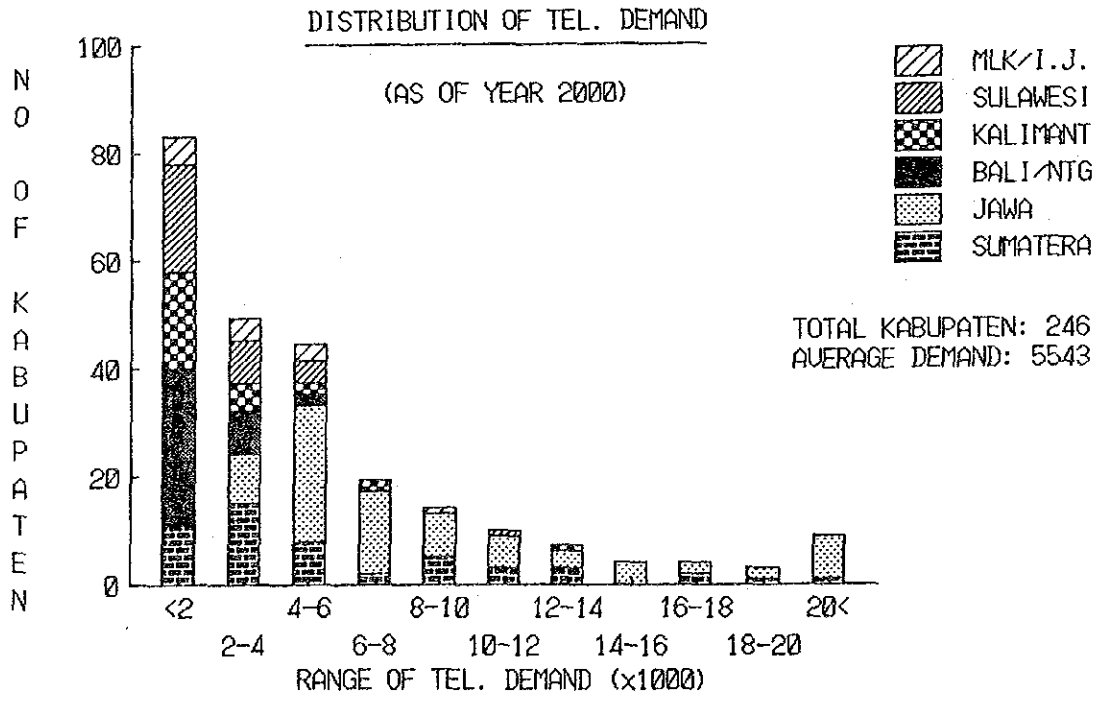


Figure 20 Telephone Demand Scale Distribution

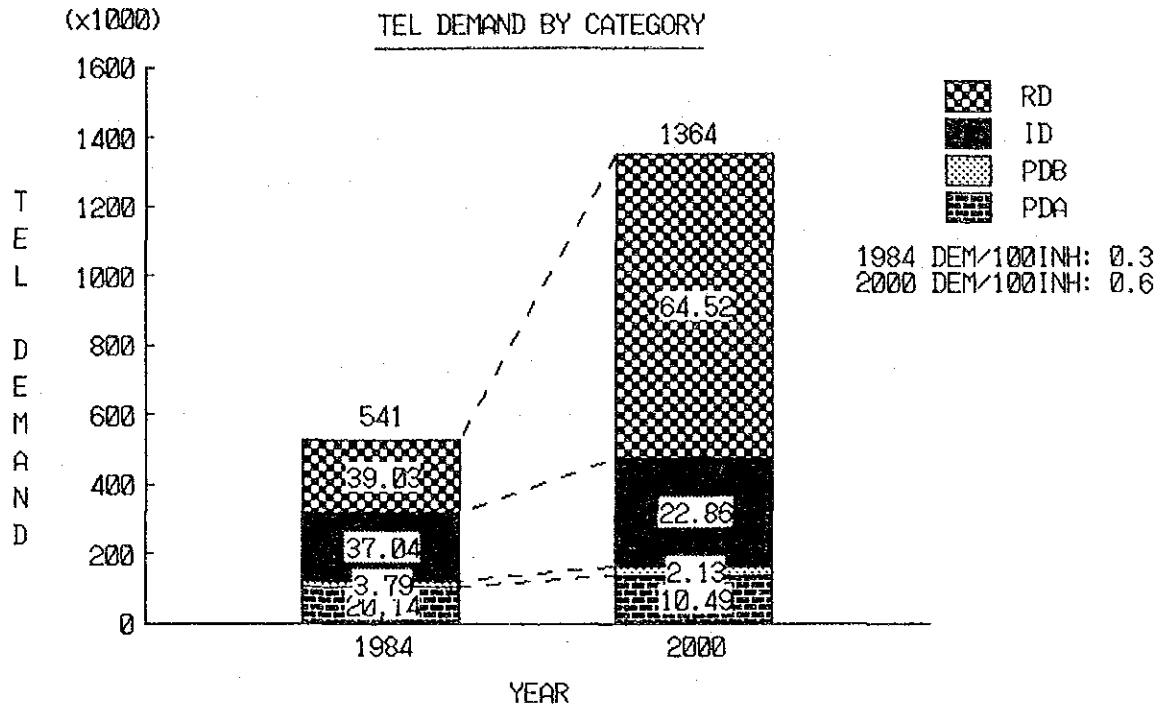


Figure 21 Telephone Demand by Subscriber Category

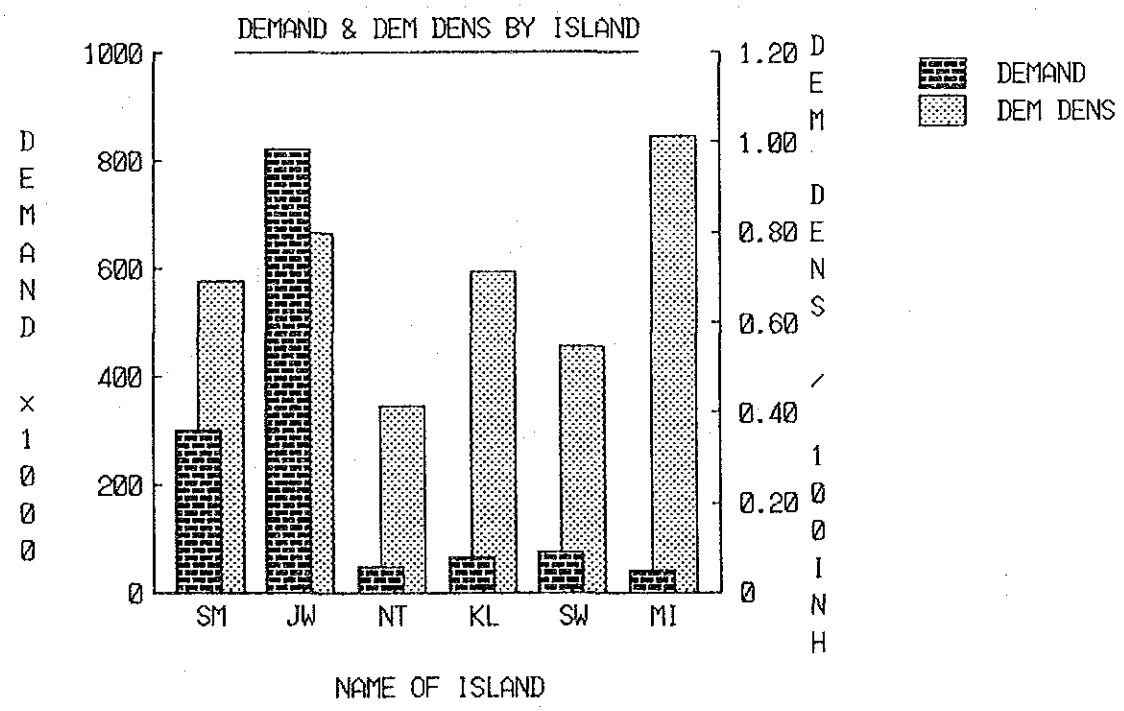


Figure 22 Demand and Demand Density by Island

3-3 Call Demand and Call Revenue

(1) Current Status of Call Demand

An analysis of current call demand in each region (by distance) reveals the nationwide averages shown in Figure 23.

Some 84% of total call demand lies within primary areas, thus indicating that it is most appropriate from the standpoint of call demand to consider the Kabupaten as the unit of the network.

(2) Forecast of Call Revenue

A forecast of call revenue through the year 2000, based on actual current call revenue in areas having automatic telephone service, is shown in Figure 24.

In Jawa, because the distance of "long-distance" calls is shorter than in other regions, call revenue is also less. In contrast, in Maluku, Irian Jaya and Kalimantan, call revenue is higher due to the high frequency of long-distance calls being made to Jakarta and other major cities.

The national average call revenue per subscriber is expected to be as follows:

Year	Call Revenue/Year
1992	Rp.884,000
1994	Rp.925,000
1996	Rp.947,000
1998	Rp.967,000
2000	Rp.989,000

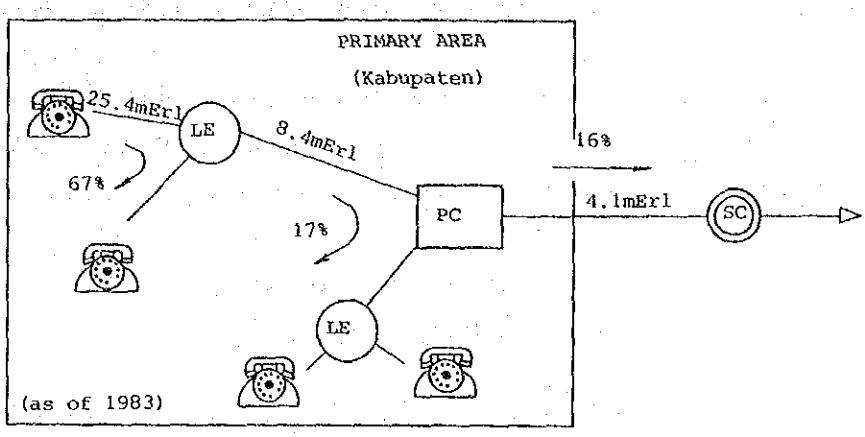


Figure 23 Typical Call Demand in Primary Area

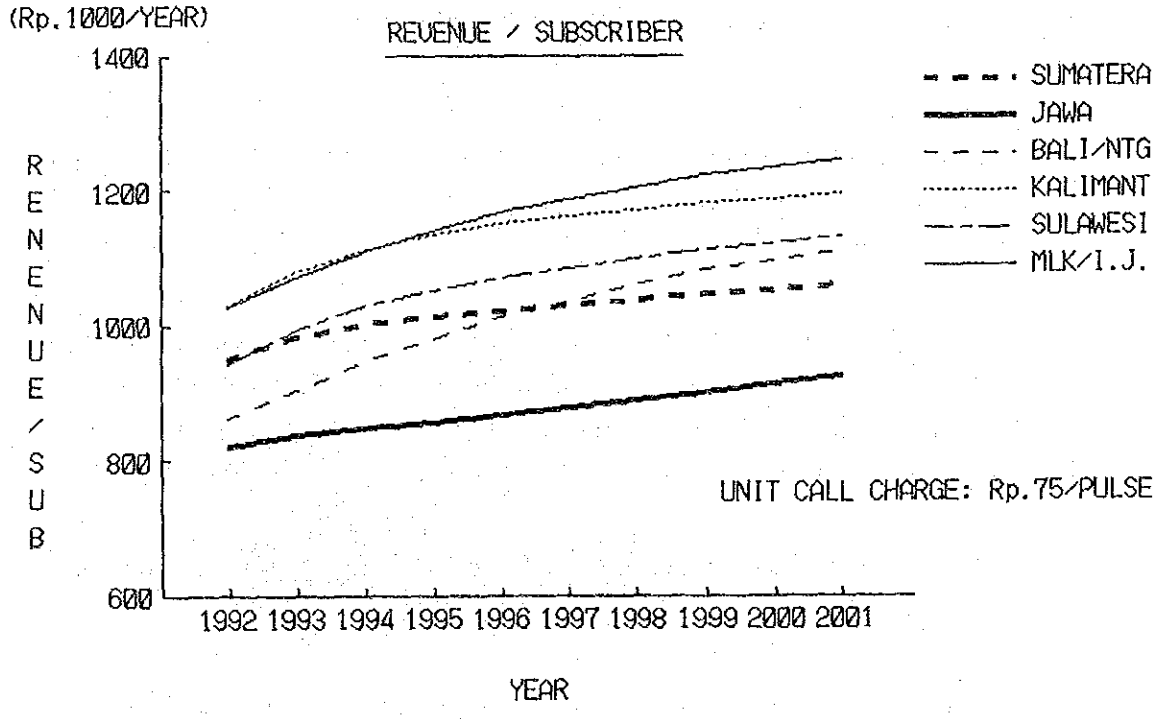


Figure 24 Forecasted Call Revenue by Island

4. TECHNICAL ANALYSIS OF OPTIMUM NETWORK

4-1 Indonesian Geography and Telecommunications Network

The average land areas of Indonesia's Kabupaten and Kecamatan on each island are shown in Figure 25. From this figure, the following conclusions can be drawn:

(1) The area size of Kecamatan is in direct proportion to that of Kabupaten.

(2) The network area length based on Kabupaten units varies from 44km in Jawa and Nusa Tenggara to the fourfold figure of 188km in Maluku and Irian Jaya.

(3) The network area length based on Kecamatan units varies from 9km in Jawa to 54km in Maluku and Irian Jaya.

The project's initial cost based on subsystem are shown in Figure 26 and in the following breakdown:

Local distribution link (cable)	18%	
Local distribution link (radio, TDMA-RCS) ..	45%	81%
Transfer link (cable and radio)	18%	
Switching system	19%	

Based on the above, when considering the optimum network according to least cost, emphasis should be placed on transfer systems (local distribution links and transfer links) and in particular on the following two points:

- Standards for selecting the type of local distribution link for distances up to approx. 25km

- Standards for selecting the type of transfer link for distances between 10 and 100km

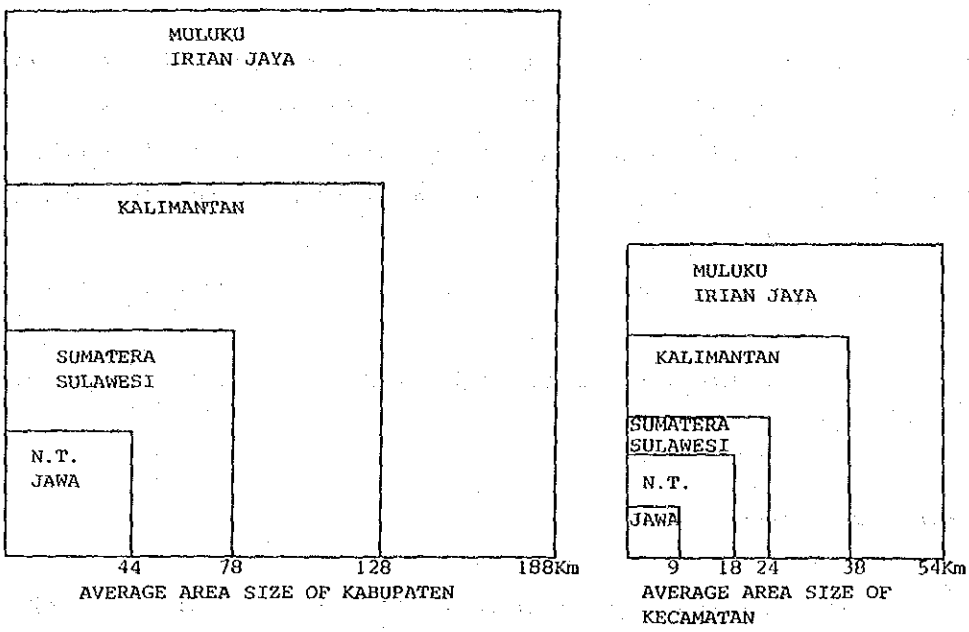


Figure 25 Average Land Area of Kabupaten and Kecamatan

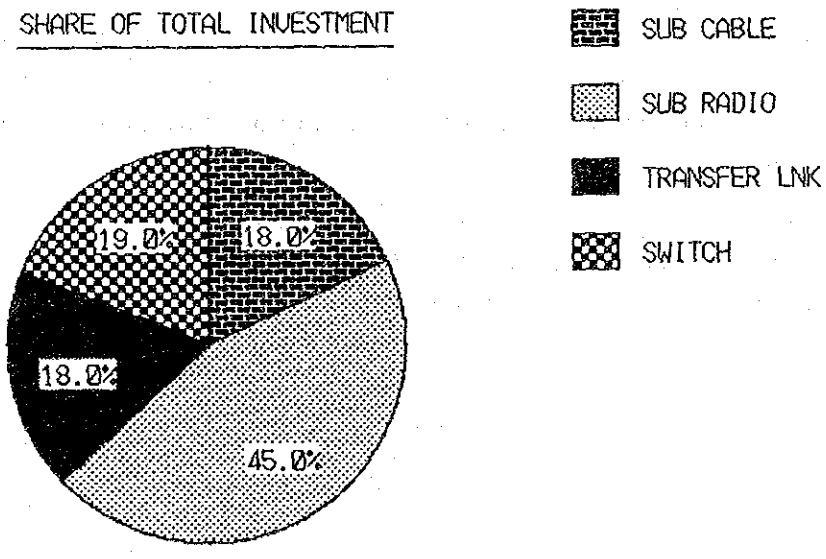


Figure 26 Share of Total Investment

4-2 Transfer System Cost Comparison

(1) Local Distribution Links

Figure 27 shows an initial cost comparison between pair cable and TDMA-RCS (TDMA-Radio Concentrator System), which are the two most important media for local distribution links in the Rural Telecommunications Network Project.

- TDMA-RCS is cheaper when distance exceeds 12km.

- TDMA-RCS is cheaper when subscriber demand per group falls below 10.

(2) Transfer Links

In consideration of call demand in each Kabupaten, the capacity of the transfer links to be used in the Rural Telecommunications Network Project should fall within the range of 10 to 400 lines per direction.

Figure 28 shows an initial cost comnparison between cable PCM link and digital radio link for use in such terrestrial transmission systems of small and medium capacity.

- Cable PCM links is cheaper when distance is less than 10km.

- Digital radio link is cheaper when the distance exceeds 20km.

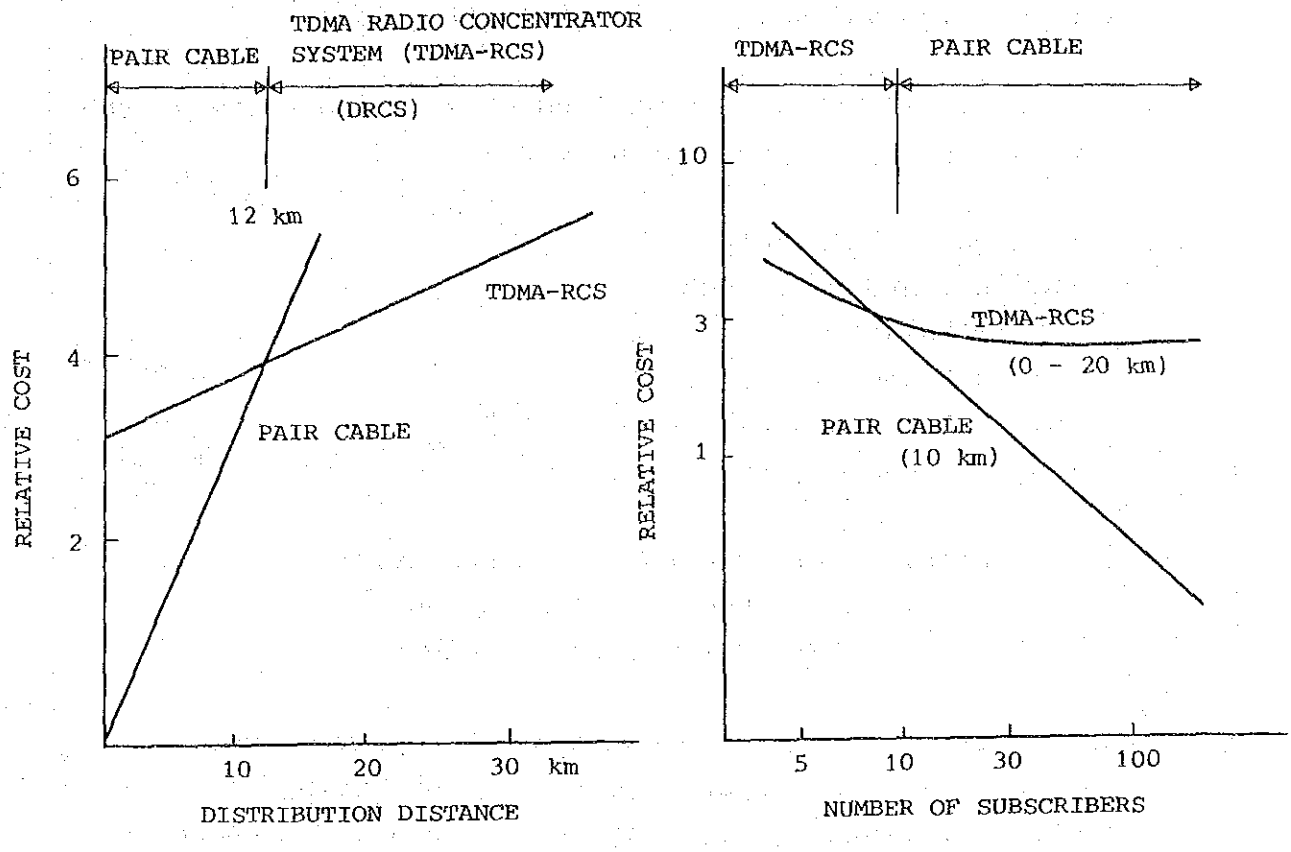


Figure 27 Cost Comparison for Local Distribution Link

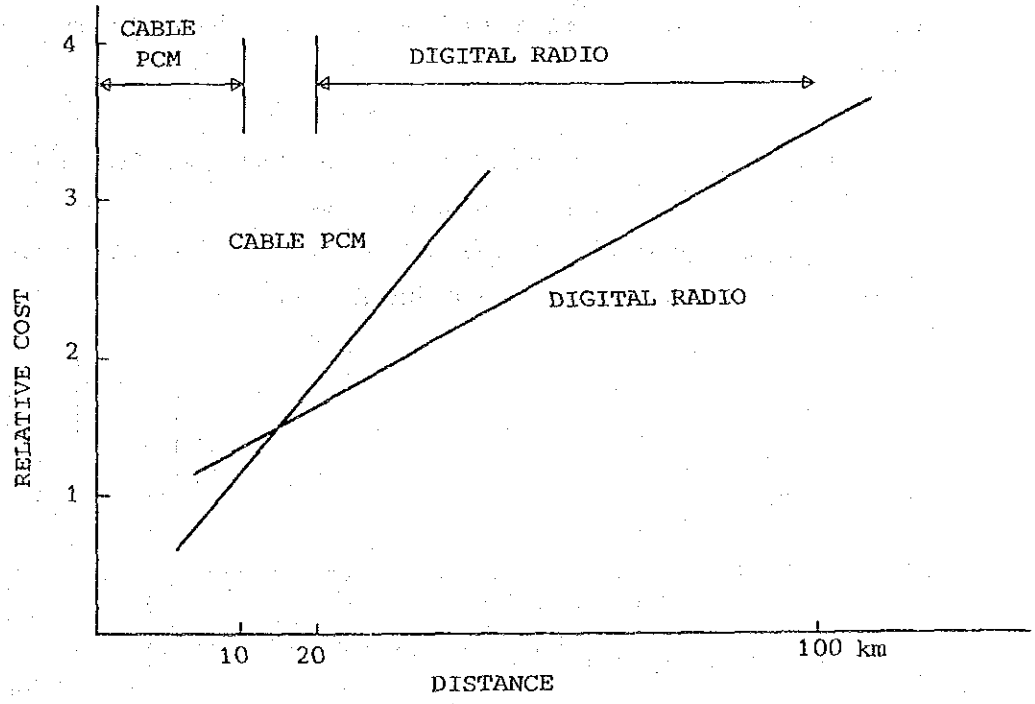


Figure 28 Cost Comparison for Transfer Link

4-3 Network Configuration and Range of Application

If the rural network were comprised of existing systems, the following 6 pattern types would be possible:

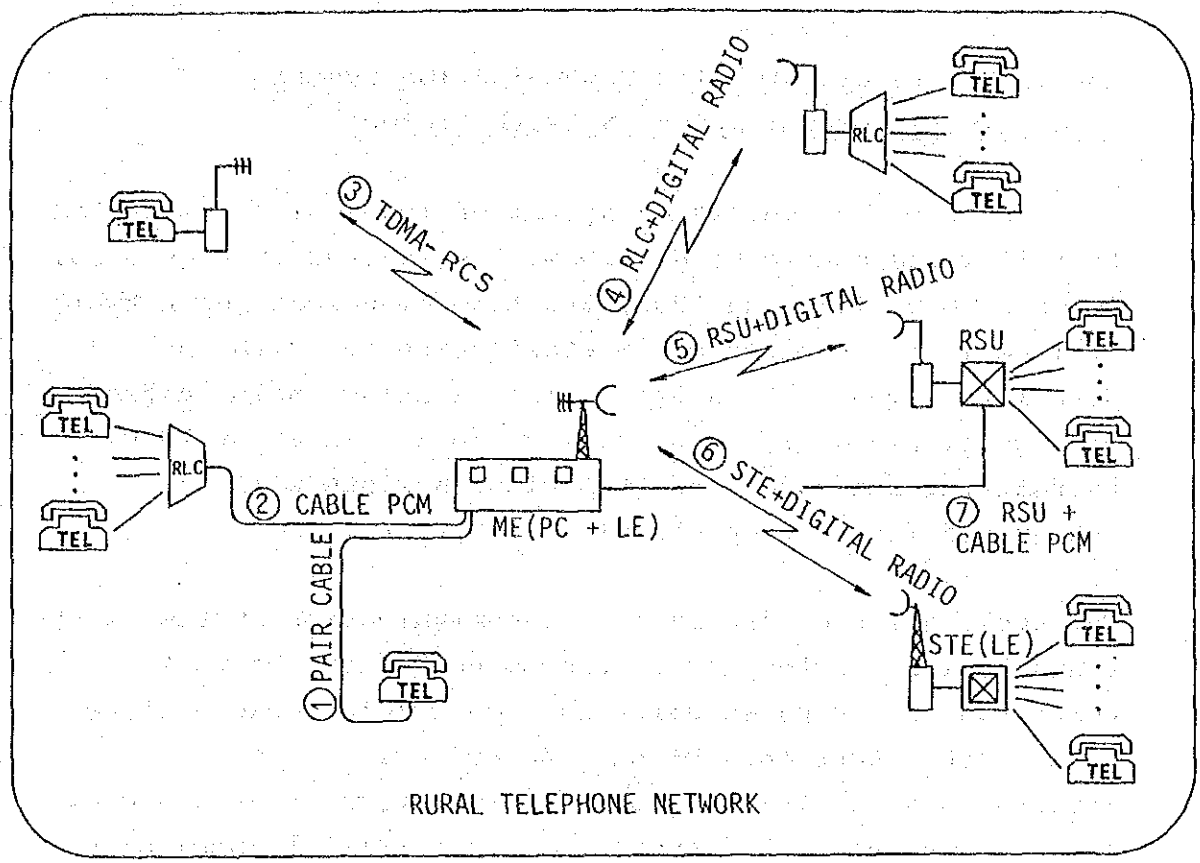
(1) Pair cable only
(2) RLC and cable PCM
(3) TDMA-RCS
(4) RLC and digital radio
(5) RSU and digital radio
(6) STE and digital radio

Note: RLC: Remote line concentrator
RSU: Remote switching unit
STE: Small terminal exchange

Figure 29 shows a selection chart of the optimum system (based on least cost) among the 6 patterns, using the parameters of distance from the main exchange and number of subscribers in a group.

This figure describes the standard system selection range and, although it may vary in detail depending on regional conditions, it can serve as a guideline for formulating a master plan.

(Note: In the figure, the number of subscribers for TDMA-RCS represents the values of the total number of subscribers in the coverage area divided in four directions from the main exchange.)



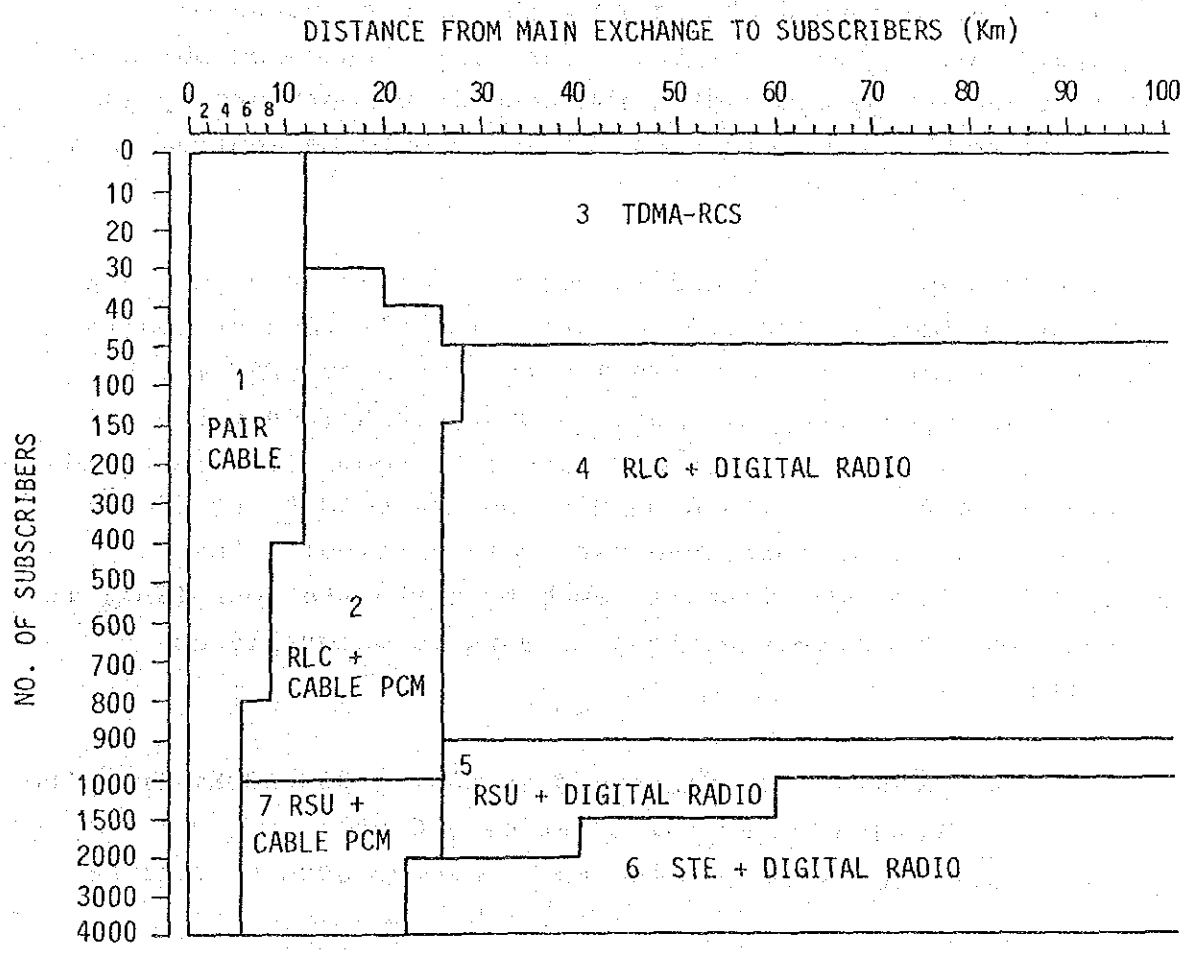


Figure 29 Selection Chart of Optimum System

4-4 Applicability of Satellite Communication Systems to Rural Telecommunications Network Project

The satellite communication system of Indonesia is expected to follow the course of development described in Figure 30. Between about 1990 and 1995, the telecommunications network will be in the process of digitalization and with the satellite communication system the existing analog network will be overlaid with a digital network. In about 2000, terrestrial and satellite transmission links will be integrated into a complete digital network.

The application of the satellite communication system as the transfer link in the Rural Telecommunications Network comprised on Kabupaten units is undesirable because it can cause **Double Hops Connection.** Accordingly, in the Indonesian Rural Telecommunications Network there are many areas which cannot be covered by terrestrial transmission links due to long distance from the main exchange or separation by sea. For this reason, in these regions area codes should be affixed as independent primary areas, and the satellite communication systems should be applied as a trunk link with other areas.

Because subscriber demand in outlying areas is expected to be approximately 100-300 per area, installation of small-capacity earth stations (SBK) with 5-10ch by SCPC may be seen to be sufficient. While a cost comparison between terrestrial transmission and satellite communication yields widely varying results depending on the conditions of selection and is therefore extremely difficult, the application range of small-capacity earth stations (SBK) in the Rural Telecommunications Network is generally as follows:

1) Kecamatan at distances exceeding 200-300km from the Kabupaten capital or Primary Center
2) Kecamatan separated more than 40-60km by sea

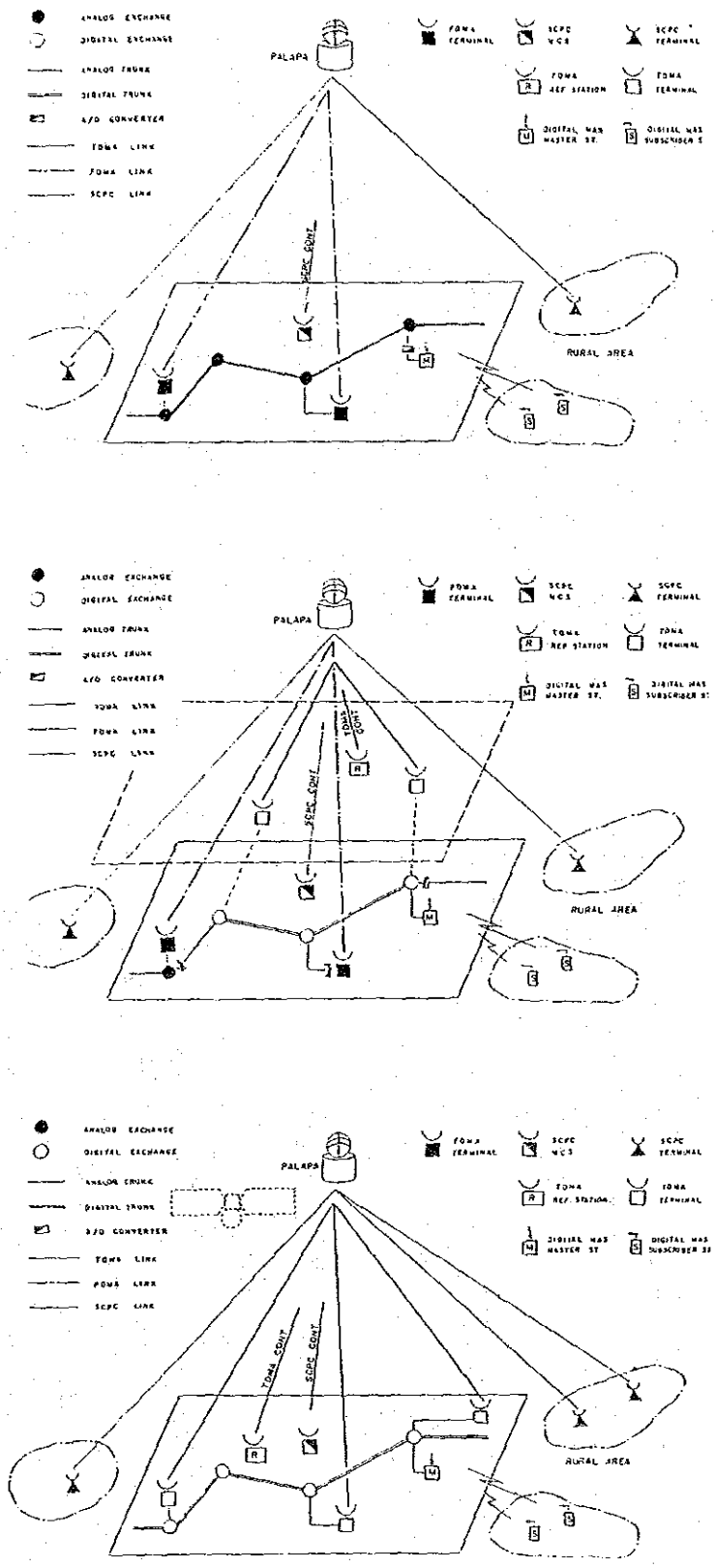


Figure 30 Development of Satellite Communication Network

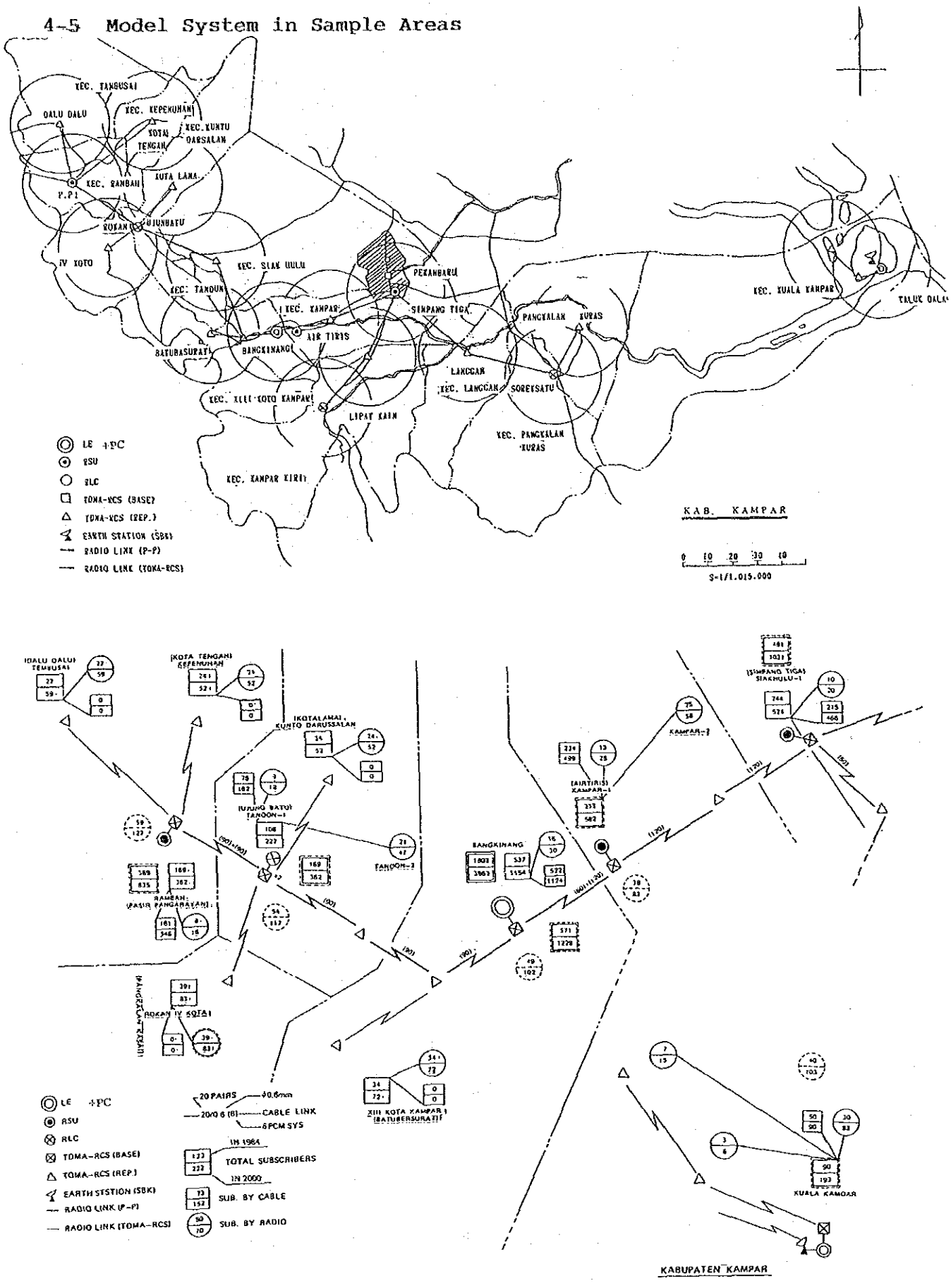


Figure 31 Model System for Kab. Kampar in Prop. Riau

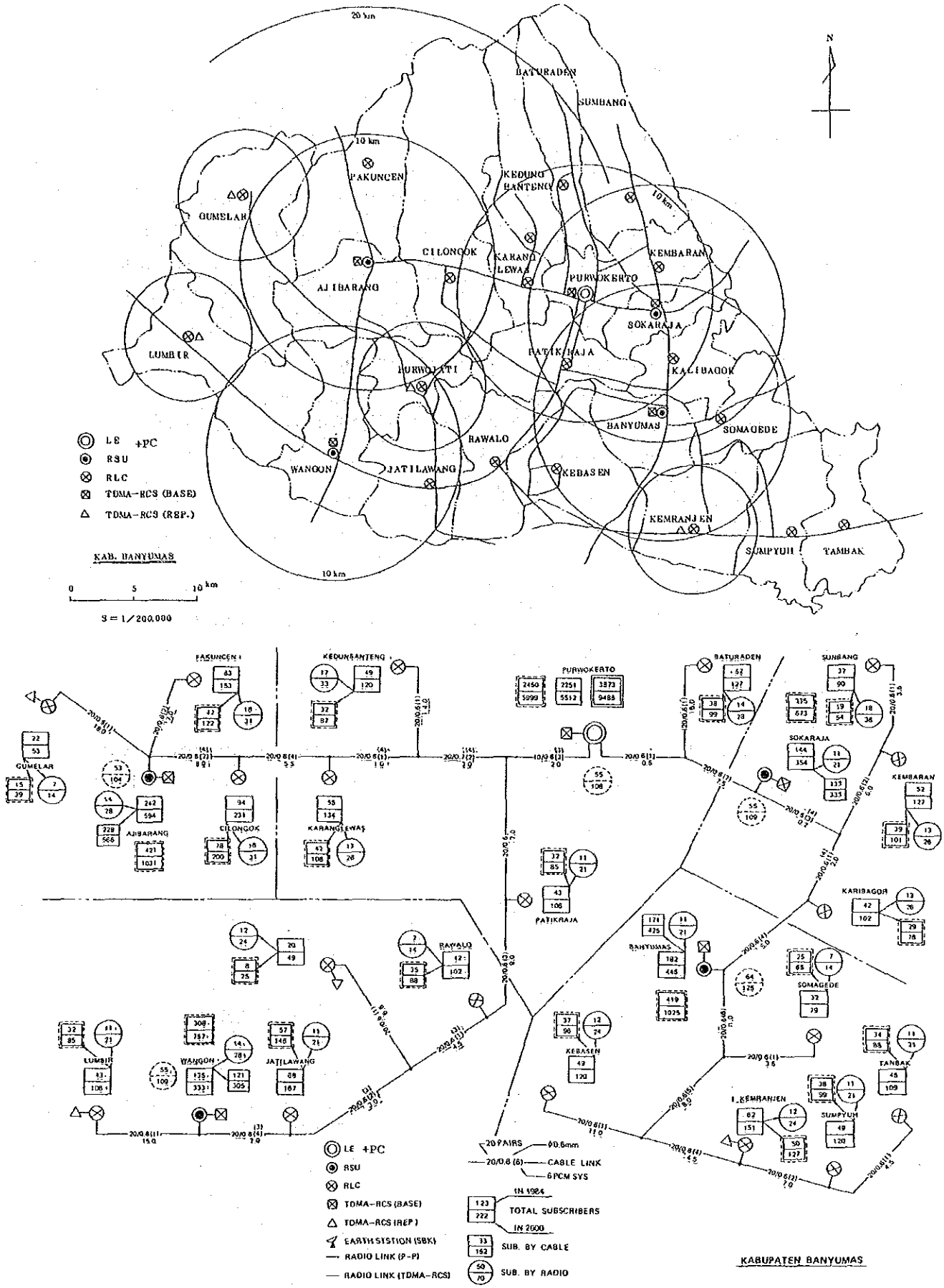


Figure 32 Model System for Kab. Banyumas in Prop. Jawa Tengah

4-6 Initial Cost Estimate

(1) Initial Cost Per Subscriber

Figure 33 shows a comparison of the Project's initial cost per subscriber for each island, based on the initial cost estimated for each Kabupaten. The cost is lowest in Jawa and highest in Maluku and Irian Jaya. The primary reason for this cost variance is, as described later, the difference in subscriber density per unit area.

The estimated initial cost of the Project on a nationwide basis is approximately Rp.4,400,000 per subscriber.

(2) Total Initial Costs by Region

Figure 34 shows the total initial cost of the Rural Telecommunications Network Project for each island. Jawa and Sumatera together account for 72% of the nationwide total.

The percentage of initial cost to be borne by subscribers in Desa is low in Jawa (30%) but over 50% on all other islands.

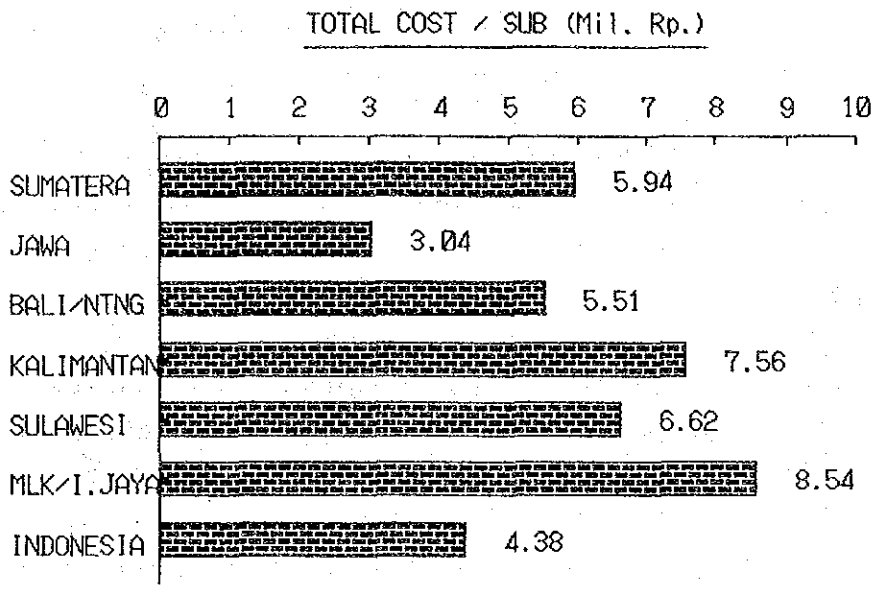


Figure 33 Initial Cost/Subscriber by Island

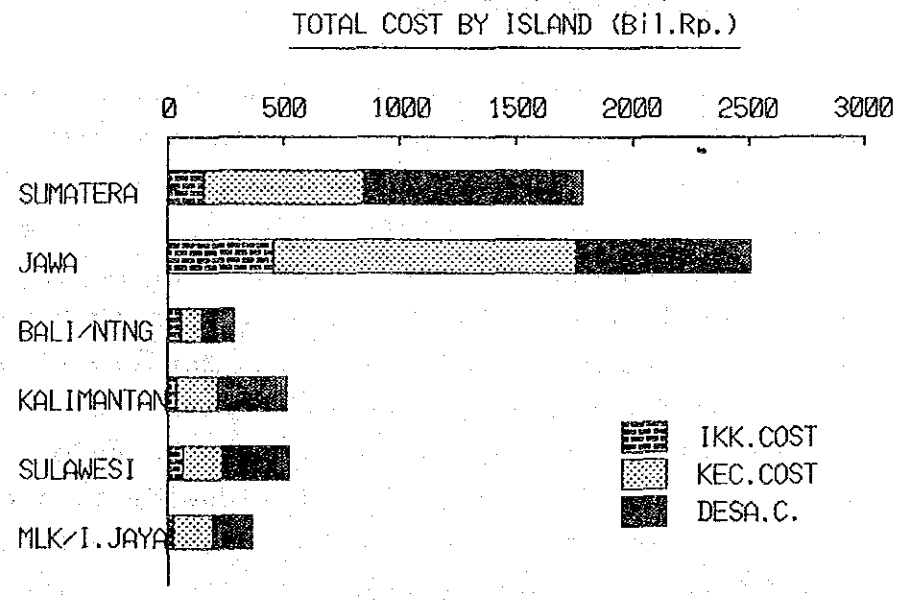


Figure 34 Total Initial Cost by Island

(3) Subscriber Density and Initial Cost

As described in Section 4-1 above, in Indonesia the regional trend seen in average land areas in the Kabupaten is the same as that in the Kecamatan.

Meanwhile, 81% of the initial cost of the Rural Telecommunications Network Project relates to local distribution links and transfer links, with costs increasing in direct proportion to the distance from the main exchange.

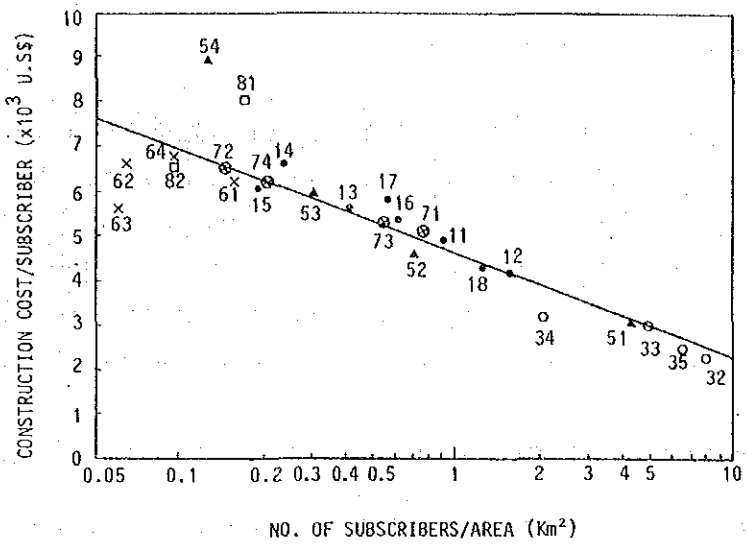
From these facts it is judged acceptable to consider that the initial cost per subscriber varies in relation to the average subscriber density within the network.

(Note: average subscriber density = total number of subscribers in network / network coverage area)

Figure 35 represents a graphic description of this relationship based on the calculation of initial costs for the 246 Kabupaten in the nation.

(4) Initial Cost Scale by Kabupaten

The distribution of the scale of initial cost for each Kabupaten is described in Figure 36. The majority of Kabupaten (54%) have initial costs lying in the 4-20 billion Rp. range. 41 Kabupaten, or 17% of the total, have initial costs exceeding 40 billion Rp. If construction is implemented collectively in the Kabupaten which have high initial costs, the major portion of the construction investment sum for the given fiscal year will be used for a small number of Kabupaten, and this would be undesirable from the standpoint of achieving a nationwide balance. For this reason, it would be best to distribute construction in Kabupaten with large-scale initial costs over a longer time span.



NOTE

SUMATERA
- 11 D.I. ACHE
- 12 SUMATERA UTARA
- 13 SUMATERA BARAT
- 14 RIAU
- 15 JAMBI
- 16 SUMATERA SELATAN
- 17 BENGKULU
- 18 LAMPUNG

JAWA
- 32 JAWA BARAT
- 33 JAWA TENGAH
- 34 D.I. YOGYAKARTA
- 35 JAWA TIMUR

NUSA TENGGARA
- 51 BALI
- 52 NUSA TENGGARA BARAT
- 53 NUSA TENGGARA TIMUR
- 54 TIMOR TIMUR

KALIMANTAN
- 61 KALIMANTAN BARAT
- 62 KALIMANTAN TENGAH
- 63 KALIMANTAN SELATAN
- 64 KALIMANTAN TIMUR

SULAWESI
- 71 SULAWESI UTARA
- 72 SULAWESI TENGAH
- 73 SULAWESI SELATAN
- 74 SULAWESI TENGGARA

MALUKU & IRIAN JAYA
- 81 MALUKU
- 82 IRIAN JAYA

Figure 35 Subscriber Density and Initial Cost

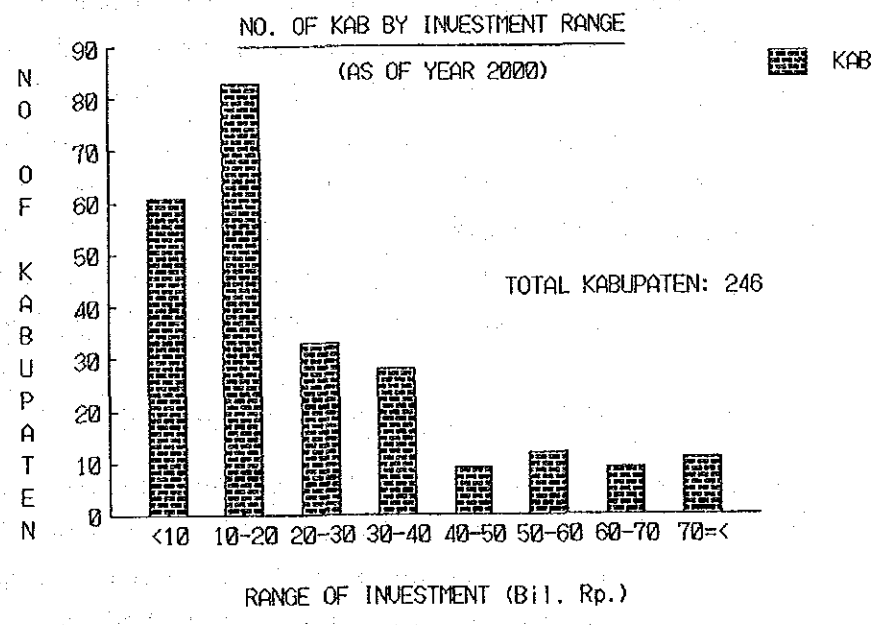


Figure 36 Initial Cost Scale Distribution

4-7 Reduction of Initial Cost

As described in Section 4-1, local distribution links and transfer links together account for 81% of the initial cost of this Project. Accordingly, a reduction in the cost of such links would contribute greatly to a reduction in overall Project costs. Several examples are outlined below describing how such a cost reduction might be achieved.

(1) Common Use of Power Distribution Poles for Telephone Cables

In a rural telecommunications network, aerial cables are used with great frequency. In this Project, construction of such cables represents 30% of the initial cost. It is estimated that half of the supporting poles for these aerial cables could be derived through common use with power line poles. By sharing these poles, it is expected that intial costs for the aerial cable system could be reduced by about 10%, thereby realizing a reduction of 3% in overall Project cost. (Figure 37)

(2) Use of Commercial Power

For the purposes of this Study, initial costs were estimated based on the use of solar batteries as the power source for TDMA-RCS subscriber units. If, however, commercial power can be obtained for all subscribers, then it is expected that initial costs of the TDMA-RCS could be reduced by about 10%. PLN is now proceeding with development aimed at supplying commercial power to all Desa by the year 2000. Therefore, if construction of the TDMA-RCS is carried out first in those Desa receiving commercial power supply, the Project costs can be reduced by 4% overall (Figure 38).

(3) Large-Volume Simultaneous Orders of One Model of Equipment

When ordering manufacture of telecommunications equipment, by ordering the same model in large quantities at one time it is possible to reduce the (unit) cost of equipment manufacture. Figure 39 shows the estimated rate of cost reduction which would be possible if this procedure were applied for the TDMA-RCS.

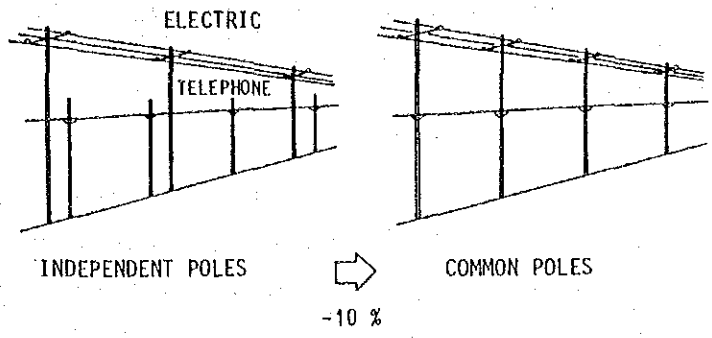


Figure 37 Common Use of Electric Power Poles

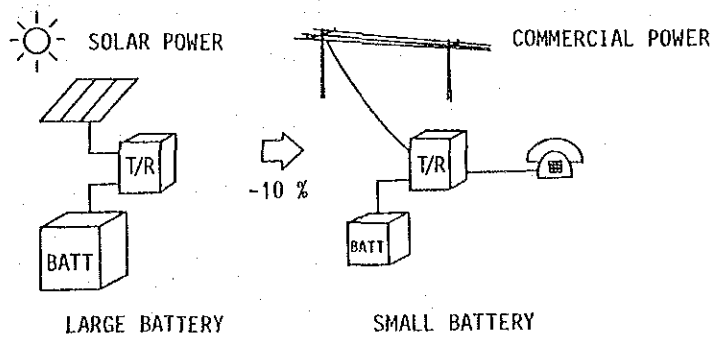


Figure 38 Use of Commercial Power

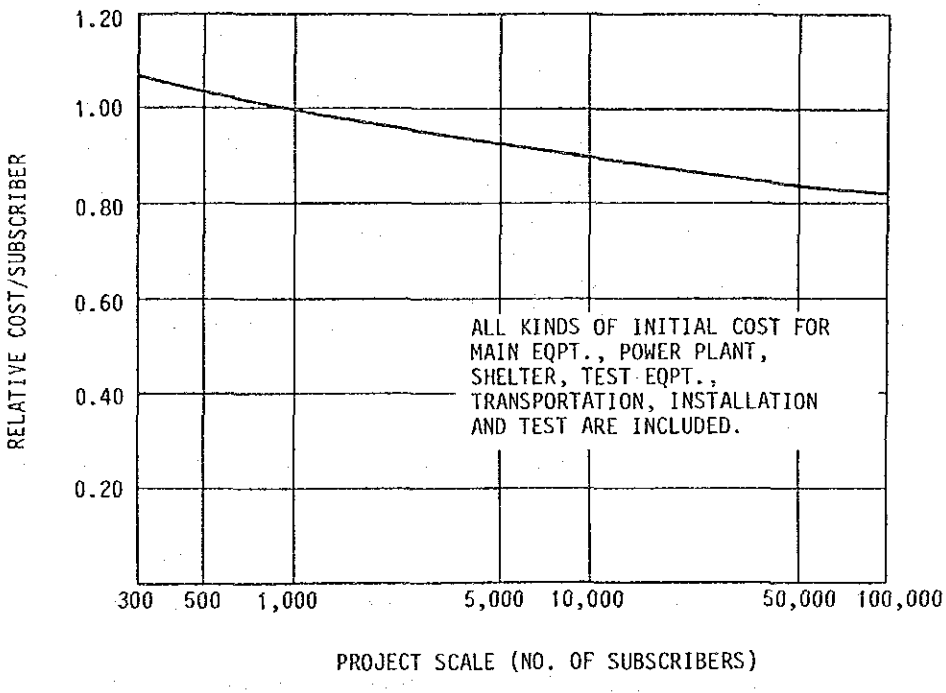


Figure 39 Cost Reduction by Mass Production

CONCLUSION AND RECOMMENDATIONS

1. Conclusion

1) The total number of line units in whole Indonesia as of 1983, in terms of telephone exchange capacity, is approx. 666,000, with the telephone density of 0.4 per 100 inhabitants, the lowest in all ASEAN countries.

2) The automatic telephone service is supplied to almost all Kecamatan in Kotamadya. However, there are no telephone facilities in 84% kecamatan in Kabupaten.

3) The objective area of this study covers all Kabupaten in Indonesia, more precisely 246 Kabupaten, and the development objective is set to install at least 1 telephone in each Desa by the year 2000.

4) The telephone demand in the year 2000 is estimated to be 1,364,000 L.U. in Kabupaten, and 3,534,000 L.U. in Kotamadya.

5) The initial cost to be required after PELITA-IV and up to the year 2000 to meet the demand of the objective area only is estimated to be 5.6 trillion Rp., and a total of 12 trillion Rp. (3 trillion yen) will be necessary to cover all the cost to meet the total demand in whole Indonesia, also including the cost of toll transmission facilities.

6) The FIRR when the network is extended to cover the Desa is:

   6.8% in case Kabupaten (objective area) only are included.
   15% in case Kotamadya, too, are included.

It can therefore be judged that the implementation of the Rural Telecommunications Network Project is feasible if Kotamadya are included.

2. Recommendations

1) The objective total number of line units in the year 2000, in terms of telephone exchange capacity, should be set at 1,364,000 L.U., with the telephone density of 0.68 per 100 inhabitants, 5.2 times as much as the density in 1983.

2) Under PELITA-IV (1984-1988), improvement and expansion should be carried out as Phase-I for only IKK of 50 Kabupaten which are given the highest priority. At the same time, a pilot project should be implemented for some networks in certain Kabupaten covering both Kecamatan and Desa. (See Fig. 40.)

3) Under REPELITA-V (1989-1983), the network improvement and expansion should be carried out as Phase II for about 140 Kabupaten covering IKK and Kecamatan.

4) Under REPELITA-VI and VII (1994-2000), Phase-III Project should be implemented to complete the network improvement in IKK and Kecamatan in the remaining Kabupaten, and also to cover the network improvement for the Desa in all 246 Kabupaten.

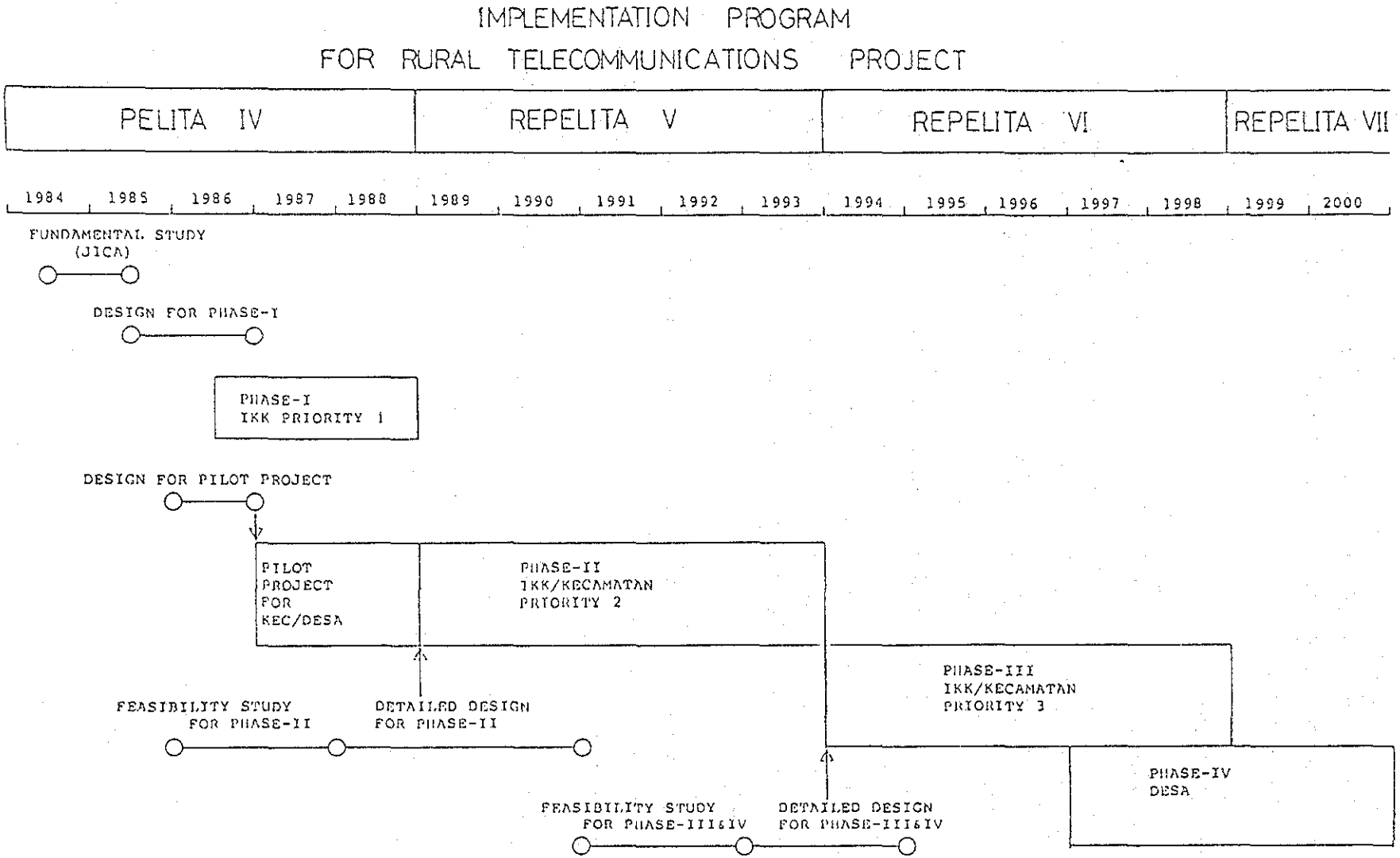


Figure 40 Implementation Program

CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

1-1 Study Background

As an integral part of National Development Five-Year Plan series of the Government of Indonesia, telecommunication system improvement and expansion plans are being carried out by PERUMTEL, the competent authority. Already completed are the first five-year plan (PELITA I: 1969/70 - 1973/74), the second five-year plan (PELITA II: 1974/75 - 1978/79) and the third five-year plan (PELITA III: 1979/80 - 1983/84). Now in progress is the fourth five-year plan (PELITA IV: 1984/85 - 1988/89).

By these five-year plans, the telecommunication network of Indonesia has been greatly improved, featuring automatic telephone service in urban areas, establishment of nationwide main transmission routes, and realization of satellite communication system. Nevertheless, the telephone service diffusion in the country still remains less than desired. Especially serious is the delay of rural telecommunication network improvement. For the Government of Indonesia, this constitutes one of important problems of requiring early solution.

Under such circumstances, the Government of Indonesia has taken up nationwide rural telecommunication network improvement as one of keynote planks of PELITA IV and succeeding series. Thus, for the formulation of master plan for that purpose, the Government of Indonesia requested the Government of Japan to make necessary study. In reply, the Government of Japan dispatched the preliminary study team to Indonesia in February - March 1984. As a consequence, the scope of work of the main study to follow was determined.

Based on that arrangement, the study, this time, was carried out concerning the status quo of rural telecommunication network of Indonesia, as well as the means to improve it.

The study was made by establishing sample areas and investigating social, economic and technical requirements to be considered when rural telecommunication system for each sample area is designed. Study results were to be used for the formulation of master plan for nationwide rural telecommunication network improvement and expansion.

1-2 Study Objective and Outline

1-2-1 Study Objective

This study is to formulate the master plan for improvement and expansion of rural telecommunication network of Indonesia to be accomplished in the year 2000. The master plan provides the guideline for feasibility study to be carried out for rural telecommunication network improvement and expansion in each rural area.

1-2-2 Study Outline

(1) Coverage Area

This study covers all Kabupatens. Kotamadyas are not used as coverage units.

Each Kabupaten has its capital city. The capital city constitutes the economic, cultural and administrative center of the Kabupaten concerned and its environs.

Toll Center (TC) is to be established in each Kabupaten, in principle. TC is to serve as pivotal point of each rural telecommunication network. This fact reflects the network formation philosophy that each rural telecommunication network be composed on Kabupaten basis.

(2) Study Proceedings

The study was made in two phases, i.e., initial study and final study.

Initial study, which included field surveys, was made during June through September 1984. With a view to thorough probe into socio-economic and technical requirements concerning rural telecommunication services, initial study concentrated on collection of information on nationwide level, as well as establishment of system improvement guideline and selection of new system to be adopted. At the same time, sample areas wherein to study applicability of selected new system were picked up.

Final study was carried out during September 1984 through September 1985 following the completion of initial study. Field survey in each sample area took place in October through December 1984.

Final study mainly consisted of schematic design through application of system examined in initial study to sample areas, and financial/economic analysis based on service improvement guideline. In careful consideration of study results, the fundamental improvement plan for nationwide rural telecommunication service was formulated.

Sample areas were selected from among representative areas in Jawa Tengah and Riau Provinces. They are:

- Jawa Tengah Province
  - Kabupaten Cilacap
  - Kabupaten Banyumas
  - Kabupaten Purbalingga

- Riau Province
  - Kabupaten Indragiri Hulu
  - Kabupaten Kampar

Furthermore, five other Kabupatens were selected as reference areas for Outer Jawa. Field survey findings in these five Kabupatens were taken into consideration in the nationwide master plan formulation. Additional five Kabupatens selected are:

- Kalimantan Selatan Province
  - Kabupaten Hulu Sei Selatan
  - Kabupaten Hulu Sei Tengah

- Sulawesi Selatan Province
  - Kabupaten Pangkep
  - Kabupaten Sinjai

- Maluku Province
  - Kabupaten Maluku Tengah

Ten Kabupatens named above comprise 69 Kecamatans. For those Kecamatans, demand study, social and economic activities study and telecommunication equipment study were carried out. Studies were also made for both outline and in-depth details of the on-going fourth five-year plan for telecommunication development and for electrification plan of PLN during the five-year plan period.

1-3 Study Team Organization and Duty Lineup of Members

1-3-1 Study Team Organization

The study team organization, member's name and their duty lineup are as follows:

Name	In charge of	Affiliated to
Masami Kato	Chairman JICA ADVISORY COMMITTEE	International Cooperation Ministry of Posts & Telecommunications
Yoichi Mishima	Member JICA ADVISORY COMMITTEE	International Affairs Office Nippon Telegraph and Telephone Corporation (NTT)
Yasuo Suzuki	Member JICA ADVISORY COMMITTEE	International Affairs Bureau Nippon Telegraph and Telephone Public Corporation
Tadao Yamagishi	Member JICA ADVISORY COMMITTEE	Assistant Professor School of Political Science and Economics TOKAI University

Name	In charge of	Affiliated to
Minoru Tatematsu	Member JICA ADVISORY COMMITTEE	NTT
Ryutaro Totsuka	Member JICA ADVISORY COMMITTEE	Social Development Cooperation Department Japan International Cooperation Agency (JICA)
Osamu Makino	Member JICA ADVISORY COMMITTEE	JICA

Name	In charge of	Affiliated to
Tatsumi Oku	Leader of Study Team	The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Tetsuya Sakamoto	Outside Cable System Engineering	NTC
Junichi Kurobe	Radio System Engineering	NTC
Takahiko Adachi	Switching System Engineering	NTC
Kazuyuki Tsuzuki	Satellite Communication System Engineering	NTC
Toshio Isobe	Transmission System Engineering	NTT
Yoshio Moritomo	Transmission System Engineering	NTC
Tatsumi Amano	Traffic Engineering	NTC
Mikio Danno	Financial and Economic Analysis	NTC
Akira Konakayama	Financial and Economic Analysis	NTC

1-3-2 Study Itinerary

The study comprised two stages, Stage-I and Stage-II, and was carried out in accordance with the "Scope of Work" which was agreed upon between Directorate General of Posts and Telecommunications of Indonesia (DITJEN POSTEL), Department of Tourism, Posts and Telecommunications and Japan International Cooperation Agency (JICA) on March 9, 1984.

(1) Stage-I

The field survey and study were carried out from June 11 until September 25, 1984.

1) Main items of the survey are as follows:

a) Explanation of Inception Report and consultation for Survey Schedule

b) Collection of data/information to be mainly required for PELITA-IV Telecommunication Project

c) Field survey of several areas in Jawa Tengah and Riau Provinces

d) Collection of data/information to be mainly required for Rural Telecommunication System Engineering and the socio-economic analysis

e) Hearing for Rural Telecommunication Project

f) Arrangement, study and analysis of the collected data/information

g) Selection of the sample areas for the case study in the above two provinces

h) Submission of Progress Report

2) Main items of the study in Japan are as follows:

a) Arrangement and analysis of the collected data/information

b) Study of the demand forecasting method and the applicable telecommunication system for the rural area

c) Socio-economic analysis

d) Study of the area priority ordering and the evaluation criteria

e) Preparation of Progress Report

(2) Stage-II

Stage-II comprised four phases, Phase 1: Field Survey, Phase 2: Study in Japan, Phase 3: Explanation of Draft Final Report and Phase 4: Submission of Final Report

1) Field Survey

The field survey of the following sample areas and reference areas was carried out from September 26 until December 25, 1984.

- Sample Area

Jawa Tengah Province:	KAB. Cilacap
	KAB. Banyumas
	KAB. Purbalingga
Riau Province:	KAB. Kampar
	KAB. Indragiri Hulu

- Reference Area

Kalimantan Selatan Province:

KAB. Hulu Sei Selatan
KAB. Hulu Sei Tengah

Sulawesi Selatan Province:

KAB. Sinjai
KAB. Pangkep

Maluku Province: KAB. Maluku Tengah

Main items of the field survey are as follows:

a) Submission and explanation of the progress report

b) Telephone demand survey, Socio-economic survey and the investigation of the existing telecommunication facilities

c) Study of the demand forecast, network configuration, telecommunication system and system design for the sample area

d) Estimation of the telephone demand

e) Collection and analysis for the traffic data

f) Study of the existing satellite communications system

g) Collection and analysis for the socio-economic data

2) Main items of the study in Japan are as follows:

a) Estimation of the construction cost and the basic design for sample areas

b) Study of the technical criteria

c) Study of the applicable system criteria

d) Study for the maintenance, operation and training of the rural telecommunication system

e) Study of the socio-economic evaluation etc

The explanation of the interim report was carried out from March 21 until March 28, 1985.

3) Preparation of the draft final report

After the discussion on the interim report, the draft final report including the comments for the interim report was prepared and its explanation was carried out from August 2 until August 16, 1985.

4) Final Report

The final report has been prepared including the comments of Indonesia Government, and submitted on October 1985.

1-4 Competent Indonesian Authorities and Personal

Competent Indonesian authorities for the implementation of this study are DITJEN POSTEL and PERUMTEL.
DITJEN POSTEL belongs to the Department of Communications and Tourism of the Government of Indonesia.
Personnel of these organizations and Japanese authorities in Indonesia, who participated in this study, are as follows:

(1) DITJEN POSTEL

Ir. Sukarno Abdulrachman	Director General
Ir. Rollin	Deputy Director General
Mr. R.I. Soemardi BC. T.T.	Director Planning Division
Ir. Agus Darman	Director Engineer Division
Ir. Koesmarihati Sugondo	Chief of Planning & Programming Section
Mr. Soedarpo BC.T.T.	Chief of Telecommunication Planning Section
Mr. Sukarso BC.T.T.	Technique Telephone
Mr. R. Soeroto BC.T.T.	Operation Telephone
Mr. Soeharsono BC.T.T.	Operation Telephone
Mr. Sutarto	Staff
Drs. Daruis	"
Mr. Agus Yekti Edh	"

(2) PERUMTEL

Ir. Willy Moenandir Mangoendiprodis	First Director
Ir. Djoko Sulistiyo Hadi BC.T.T.	Director of Development
Ir. Saleh Gunawan	Junior Director of Development Program
Ir. Saleh Effendi	Chief of Binprotratel
Ir. Rodyat	Chief of Binprosentel
Ir. Taufik Akbar	Chief of Binprosattel
Ir. Hartadi Asturi	
Mr. Roesmijanto	Assistant Chief of Binprotratel
Ir. Gumilar	Binprotratel
Ir. Imam Soebekti	"
Mr. Mulia Tanbunan	"
Mr. Yayat Supriatna	"
Mr. Tjahjono	"
Mr. Effendi	"
Mr. Sukowiyono	Binprosattel
Ir. Guntur Siregar	Chief of Binprojartel
Ir. Sadhono Hadi	Binprosentel
Mr. Dawis Fadillah	"
Mr. Taman Mulyadi	"
Mr. Suyanto	"
Drs. Setyanto	Kamatel
Mr. Eddy Sudarma	"

(3) BAPPENAS

Mr. Simatupang	Engineer Communication
Mr. T.A. Satem	Department of Home Affairs

(4) Personnel concerned on Japan side are:

Mr. Noboru Yoshida	Secretary, Japanese Embassy, Jakarta
Mr. Hisamitsu Nishio	Jakarta Office, Japan International Cooperation Agency
Mr. Tatsuich Hidaka	Residen Representative, Jakarta Office, NTTPC
Mr. Yasufusa Honda	General Manager, Jakarta Representative Office, NTT

CHAPTER 2 GENERAL VIEW

CHAPTER 2. GENERAL VIEW

2-1 National Development and Telecommunications

Development of a nation means to improve the nation's welfare level by transforming various factors which are complexly related in the social, economical, cultural and political fields. The transformations occur in terms of improvement of qualities, expansion of quantities and changes of interdependency among the factors. How fast these transformations spread around the nation and how smoothly these transformations are absorbed into production and consumption activities of people may determine how effective development policies can be. For variables such as labor, capital, land (including natural resources), technology and institutional factors to be used effectively in a system, the nation needs factors which integrate these in a system. Communication is one of them. Communication itself does not produce and consume tangible goods but plays a role of a catalyst which promotes production and consumption activities. For development of the nation, how well communication infrastructure is developed can determine whether or not development policies can work effectively in all sectors.

Telecommunications play a major role in all communication media in these days. It is, therefore, important to develop telecommunicaton infrastructure as a strategic means of national development. However, the effects of investment on telecommunication infrastructure are difficult to measure because they are indirect rather than direct and also they are qualitative rather than quantitative. Hence, telecommunications projects tend to receive under-estimated evaluations. They quite often are ranked very low among development projects.

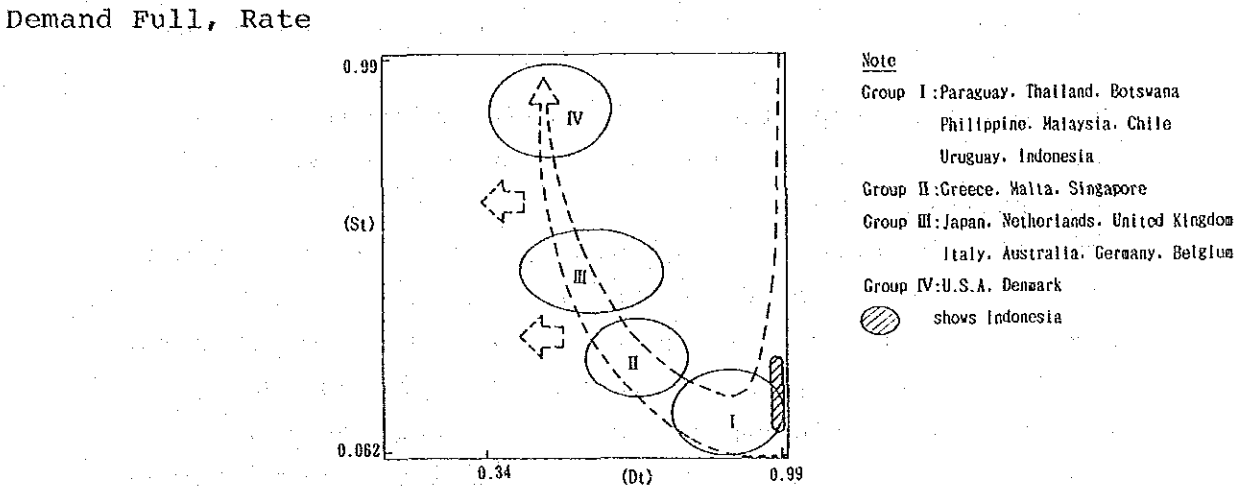
This problem is also quite prominent in Indonesia. Table 2-1-1 shows how some consumption goods are penetrated into Indonesian people. The telephone penetration rate is very low in comparison with expensive items such as T.V. sets and automobiles. This fact implies that there exists effective demand for telephone services but that the past supply rate has been far smaller than it should have been. Figure 2-1-1 shows the relationship between telephone penetration rates and demand fulfillment rates of 20 countries in the world between 1970 and 1980. The supply rate in Indonesia was shown very low (Refer to Section 4-2-5 for more detail description).

Table 2-1-1 Penetration Rates of Several Consumer Goods

a.	Motorized Bikes	24.3/1000 people
b.	T.V. Sets	19.0/1000 people
c.	Automobiles	10.2/1000 people
d.	Main Telephones	3.3/1000 people

Source : 1982 Statistical Year Book of Indonesia

Figure 2-1-1 The Relationship between Telephone Penetration Rates and Demand Fullfilment Rates of 20 Countries in the World



Source: 1984 CCITT Statistical Year Book

Development of Communications intrastructures, especially telecommunication intrastructures, is an urgent matter in Indonesia to implement balanced development policies in the vast areas of Indonesia which aim at creating an integrated society. Underdevelopment of telecommunications intrastructures could become a bottle neck of further development. Telecommunications have to function as a network system. This inevitably increases scales of projects. It is, therefore, important to investigate feasibilities of projects and to design the best telecommunications network systems. In so doing, it is necessary to examin various problems of Indonesia carefully.

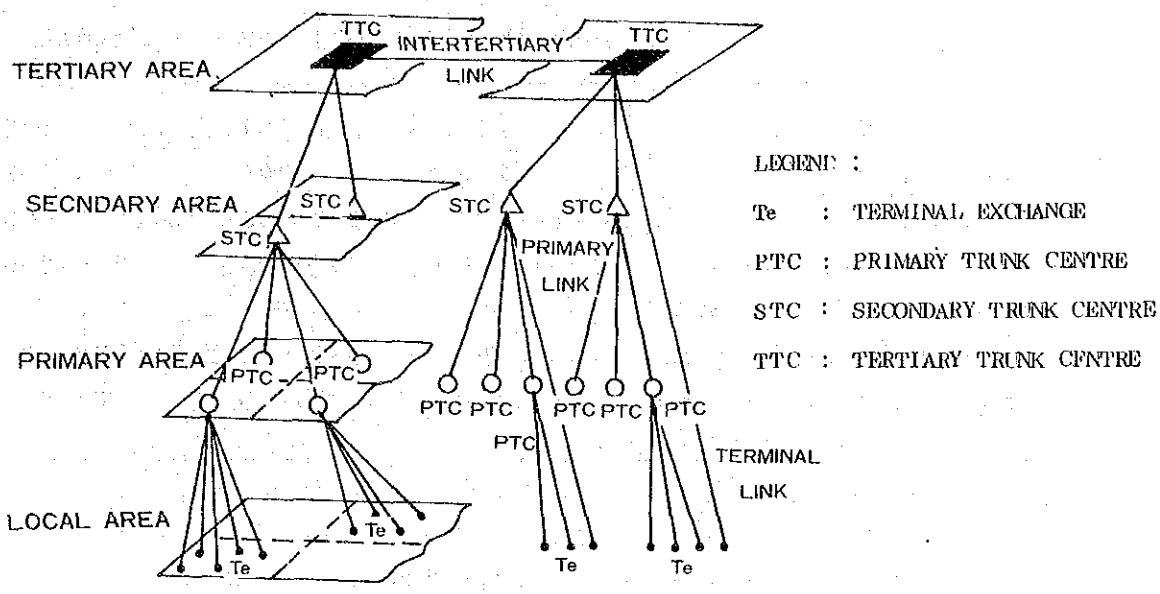
Chpater 2 and Chpater 3 aim at the following two matters. One is to analyze problems associated with communications and the other is to provide necessary information and data for the latter chapters.

2-2 Telecommunication Objectives in Rural Areas

This section consists of two parts. The first part discusses a fundamental idea this project stands on. The second part discusses why development of rural telecommunications sytems is important for Indonesia.

The most important element in telecommunications is a formation of network systems. A network system consists of four factors. The first is the size of the area it covers. The second is the size of the users and their categories such as administration, business and residential users. The third is the number of exchanges and the technology. The fourth is the method of transmission. A network system has in general a hierachial structure shown in Figure 2-2-1. It consists of many classes of exchange stations. This class structure of exchange stations enables pople in all areas to talk to each other.

Figure 2-2-1 Domestic Telephone Service Network



In Indonesia, a Kabupaten or a Kotamadya is a suitable administrative area as a unit of network configurations in which a tertiary trunk center can be located. Table 2-2-1 shows how telephone services penetrate into Kabupaten and Kotamadya. Kubupaten have low penetration rates in comparison with those of Kotamadya.

Table 2-2-1 Telephone Penetration Rates in Kabupaten and Kotamadya (1983)

	Kabupaten	Kotamadya	Total
No. of Kod & Kab	246	54	300
No. of Kecamatan	3,212	208	3,400
Population	145,000,000	12,800,000	157,800,000
No. of Subscribers	131,000	385,000	516,000
Telephones/100 people	0.09	3.01	0.33
Line Units of Auto.Ex.	91,000	486,000	577,000
Line Units of Man. Ex.	87,000	2,000	89,000

ANNEX 2-2-1, 2-2-2 and 2-2-3 show how the number of Kabupaten distributes in each Province according to their population rates of Kecamatan which have automatic telephone services, manual telephone services and no telephone services, respectively. Though each Province or each main island has a bit different situation, telephone penetration rate is generally low.

In regional development projects, especially rural area development projects, how to classify areas into rural or urban areas is always a big problem. Unfortunately, there is no universal definition. Different definitions have been employed for different projects. This project studies rural telephone network systems. Since analytical stress of the project is placed on network systems, rural areas are defined in such a way that a set of network configuration is completely designed within the areas.

Rural areas may be defined by three different classifications.

1) Rural-Urban Classification by Desa
(Classification used by Biro Pusat Statistik and Ministry of Home Affairs)

2) Rural-Urban Classification by the number of potential telephone subscribers

3) Rural-Urban Classification by network configurations.
The first classification can work effectively when each rural Desa can be treated independently. The second classification is one of suitable definitions of rural areas for telecommunications projects. However, additional information on how potential subscribers are located in an area is needed to effectively use this classification.

In this project, Kabupaten is proposed to be a unit of network configurations because Kabupaten in Indonesia has, in general, a large enough area size and demand size to design a rural telephone network system by itself. Classifying Kabupaten which have either no telephone service or only manual telephone services as rural areas has many advantages over other classifications, because (1) it gives the first priority to network configurations, (2) it takes account of demand size, (3) it covers underdeveloped areas for telephone services, and (4) it coincides, in general, with an area of local economic activities.

Figure 2-2-2 shows how telephone services will be developed in rural areas. Desa are considered as end points of network configurations. This goal can satisfy 3 Km criterion of the Kuala Lumpure Statements adopted at the 1983 ITU Seminar. The statement says "telephone services should be available within 3 Km of walking distance from any place by the year 2000." Table 2-2-2 shows how far each Desa is located from other Desa except those in Jawa. Hence, considering Desa as end points of network configurations can not only satisfy 3 Km criterion but also produce great impacts to people living rural desa.

The fundamental position of the project is to design a fundamental plan on rural telecommunications network systems, not a piece-meal and ad-hoc development plan of local telephone systems. In so doing, the project employed its own definition of the rural areas and made an effort to study the rural areas from more general points of view.

Next, how the fundamental position of the project is related to the needs of rural telecommunications network systems will be discussed. Telecommunications enable people to make long distance communications instantaneously. Instant transmission of information will generate the following effects:

(1) In administrative and social services, increase of efficiency in defense, police, law enforcement and administration
Speeding up and widening out of social services

(2) Increase of efficiency and transactions in business.
Enlargement of transaction areas

(3) Increase of efficiency of individual activities
Enlargement of communication areas
Speeding up of making requests for emergency aids

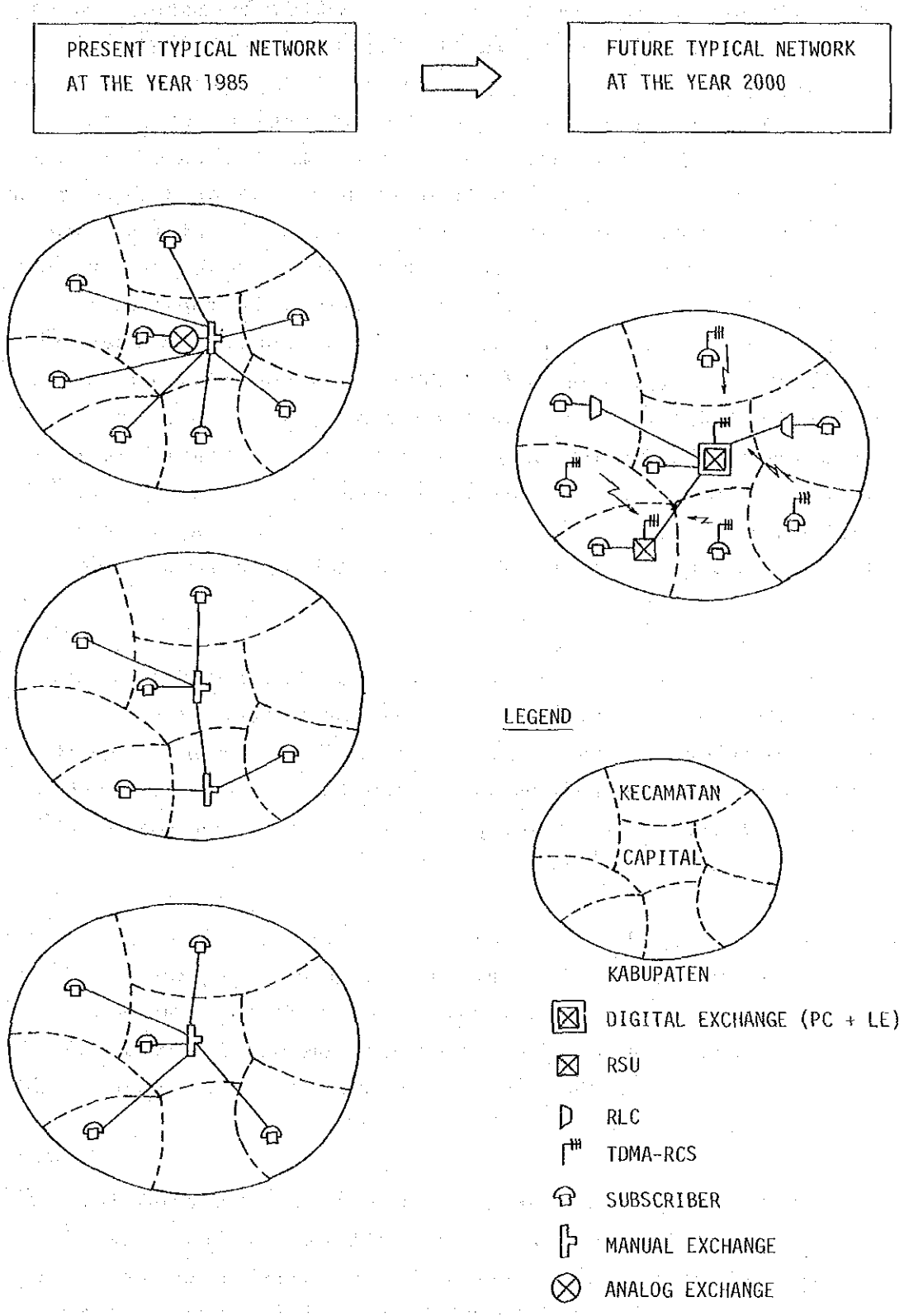


Figure 2-2-2 DEVELOPMENT OF Rural Telecommunications Network

Development of communications is promoted by expansion of social structures and of interdependency of industrial sectors due to advanced inter-regional division of labor. Simultaneously, development of communications creates changes of social structures. People in the rural areas are usually not accustomed to intensive use of information and, hence, have low demand for telecommunications. One of the obstacles for people in the rural areas to move out of a traditional self-sufficient economy is their mental hesitency to move out of it. It is necessary to change their mental attitude and to develop a social structure in which information plays an important role. Then, a traditional self-sufficient economy can be transformed into an inter-regional market economy. Development and diffusion of mass communications media such as radio and T.V. played a big role in making such transformation easier.

To accelerate further social changes, the society needs more than one way flow of information which mass communications media supply. It is inevitable to create bilateral and multi-lateral information flows associated with production and consumption activities people in the rural areas are involved.

Development of the rural areas through changing information utilization patterns promotes regional advancement of socio-economic structures and reduces regional differences. Furthermore, smooth information exchanges prevent chaotic migrations into the urban areas from the rural areas.

Now, why the project takes the position, the need for establishing telecommunications network systems, is clear. It is urgently needed to establish network systems in which bilateral and multi-lateral information flows among rural areas are created.

Table 2-2-2 The Distribution of the Number of Kabupaten According to the Number of Desa covered by one hour of walking (1980)

Province	less than 1	1	2	5	10	15	20	25	30(Desa No.s)
D.I. Aceh			3	2		2	1		
S. Utara			6	1	4				
S. Barat			3	3		1	1		
Riau	3	2		1	1				
Jambi	1	2	2						
S. Selatan	3	2	2	1					
Bengkulu		1		2	1				
Lampung		1	1	1					
Dki Jakarta									
J. Barat			3	11	3	1	2		
J. Tengah				3	4	8	3	9	2
D.I. Yogyakarta		1			3				
J. Timur				4	10	8	4	2	1
Bali			1	4	3				
N. Teng Barat		2	3	1					
N.T. Timur	1	3	7	1					
Timor Timur	13								
K. Barat	1	1	4						
K. Selatan		2	5		1	1			
K. Timur	4								
Sul Utara		2		2					
Sul Tengah		3	1						
Sul Selatan	6	7	8						
Sul Tengara	1	1	2						
Maluku	1	1	2						
Irian Jaya	5	1	2	1					

2-3 Present Situations of Indonesia

This section summarizes various aspects of the present Indonesian socio-economic structures.

1 1) Indonesia is the largest nation among nations which consist of many islands. It consists of about 13,700 islands within the north-south range of 1800 Km and the east-west range of 500 Km. About 150 million people live in the area.

2) Regional distribution of people is very uneven. Jawa, which takes only 6.9% of all Indonesia areas, has 62% of the whole Indonesian population.

3) The average population density of Indonesia is 77 people per 1 Km^2 but Jawa has 693 people per 1 Km^2, Kalimantan 13 people per 1 Km^2 and Irian Jaya 3 people per 1 Km^2. Table 2-3-1 Summarizes demographic data of Indonesia.

4) There are about 13000 islands which have less than 1000 inhabitants.

5) Most people are Malayian but there are many different tribes who speak different languages and live in different customs. The national language is Indonesian but about 25 other languages are also currently used in various areas.

6) Since Indonesia consists of many islands, there exist many value systems and cultures in various areas.

7) Urban population rate of Indonesia is on the average is 22.4% (1980) but Jawa's figure is 70%. Table 2-3-2 shows urban population rates of main islands.

Table 2-3-1 Average Area (km^2) per Desa, KEO, KAB and Average Population per Desa, KEO, KAB

CODE	PROVINCE	NO.OF DESA	NO.OF KECAMATAN	NO.OF KABUPATEN	NO.OF KOTAMADYA	AREA (Km2)	AVERAGE AREA OF DESA	AVERAGE AREA OF KEC.	AVERAGE AREA OF KAB.KOT	POPULATION 1980	AVERAGE POP. DESA	AVERAGE POP. KEC.	AVERAGE POP. KAB.	POPULATION DENSITY (PER Km2)
11	D.I ACEH	5.543	131	8	2	55.392	10	423	5.539	2.621.100	473	20.008	262.110	47
12	SUMATERA UTARA	5.606	185	11	6	70.787	13	383	4.164	8.392.300	1.497	45.364	493.665	119
13	SUMATERA BARAT	3.596	92	8	6	49.778	14	541	3.556	3.418.400	951	37.157	244.171	69
14	RIAU	1.025	69	5	1	94.562	92	1.370	15.760	2.177.100	2.124	31.552	362.850	23
15	JAMBI	1.378	38	5	1	44.924	33	1.182	7.487	1.451.600	1.053	38.200	241.933	32
16	SUMATERA SELATAN	2.398	85	8	2	103.688	43	1.220	10.369	4.646.900	1.938	54.669	464.690	45
17	BENGKULU	1.119	23	3	1	21.168	19	920	5.292	771.000	689	33.522	192.750	36
18	LAMPUNG	1.506	71	3	1	33.307	22	469	8.327	4.642.400	3.083	65.386	1.160.600	139
10	SUMATERA TOTAL	22.171	694	51	20	473.606	21	682	6.671	28.120.800	1.268	40.520	396.068	59
31	D.K.I JAKARTA	236	30	0	5	590	3	20	118	6.528.000	27.661	217.600	1.305.600	11.064
32	JAWA BARAT	4.721	409	20	4	46.300	10	113	1.929	27.555.600	5.837	67.373	1.148.150	595
33	JAWA TENGAH	8.456	490	29	6	34.206	4	70	977	25.467.000	3.012	51.973	727.629	745
34	D.I YOGYAKARTA	563	73	4	1	3.169	6	43	634	2.761.100	4.904	37.823	552.220	871
35	JAWA TIMUR	8.168	546	29	8	47.922	6	88	1.295	29.297.200	3.587	53.658	791.816	611
30	JAWA TOTAL	22.144	1.548	82	24	132.187	6	85	1.247	91.608.900	4.137	59.179	864.235	693
51	BALI	564	51	8	0	5.561	10	109	695	2.479.400	4.396	48.616	309.925	446
52	NUSA TENGGARA BARAT	599	56	6	0	20.177	34	360	3.363	2.735.000	4.566	48.839	455.833	136
53	NUSA TENGGARA TIMUR	1.847	110	12	0	47.876	26	435	3.990	2.747.300	1.487	24.975	228.942	57
54	TIMOR TIMUR	1.717	64	13	0	14.874	9	232	1.144	557.300	325	8.708	42.869	37
50	NUSA TENGGARA TOTAL	4.727	281	39	0	88.488	19	315	2.269	8.519.000	1.802	30.317	216.436	96
61	KALIMANTAN BARAT	4.682	106	6	1	146.760	31	1.385	20.966	2.495.300	533	23.541	356.471	17
62	KALIMANTAN TENGAH	1.145	92	9	1	152.600	133	1.659	15.260	957.800	837	10.411	95.780	6
63	KALIMANTAN SELATAN	1.614	100	9	1	37.660	23	377	3.766	2.072.700	1.284	20.727	207.270	55
64	KALIMANTAN TIMUR	1.070	70	4	2	202.440	189	2.892	33.740	1.222.600	1.143	17.466	203.767	6
60	KALIMANTAN TOTAL	8.511	368	28	5	539.460	63	1.466	16.347	6.748.400	793	18.338	204.497	13
71	SULAWESI UTRA	1.269	83	4	2	19.023	15	229	3.171	2.123.600	1.673	25.586	353.933	112
72	SULAWESI TENGAH	1.302	62	4	0	69.726	54	1.125	17.432	1.294.600	994	20.881	323.650	19
73	SULAWESI SELATAN	1.165	170	21	2	72.781	62	428	3.164	6.084.600	5.223	35.792	264.548	84
74	SULAWESI TENGGARA	677	43	4	0	27.686	41	644	6.922	946.200	1.398	22.005	236.550	34
70	SULAWESI TOTAL	4.413	358	33	4	189.216	43	529	5.114	10.449.000	2.368	29.187	282.405	55
81	MALUKU	1.821	55	4	1	74.505	41	1.355	14.901	1.416.400	778	25.753	283.280	19
82	IRIAN JAYA	893	116	9	0	421.981	473	3.638	46.887	1.178.800	1.320	10.162	130.978	3
80	MALUKU & I.J TOTAL	2.714	171	13	1	496.486	183	2.903	35.463	2.595.200	956	15.177	185.371	5
	INDONESIA	64.680	3.420	246	54	1.919.443	30	561	6.398	148.041.300	2.289	43.287	493.471	77

Table 2-3-2 Urban-Rural Population in Indonesia (1980)

Area	Urban ($\times 10^3$)	Rural ($\times 10^3$)	Urban Pop Rate (%)
Jawa	22,626	70,951	24.2
Sumatera	5,653	20,096	22.0
Kalimantan	1,288	5,003	20.5
Sulawesi	1,832	8,637	17.5
Others	10,220	42,980	19.2
Indonesia	32,846	113,931	22.4

Source: Statistical Year Book of Indonesia

8) The growth rates of urban population and rural population are 5.4% and 1.7% (1980), respectively. These figures reflect a recent trend of urban migrations, especially in Jawa. Table 2-3-3 shows urban migration figures.

Table 2-3-3 Urban Migration Figures (1980)

Area	Urban		Rural	
	Inflows	Rate (per pop)%	Inflows	Rate (per pop)%
Jawa	991,614	4.3	225,527	3.3
Sumatera	474,836	8.7	1,695,820	12.0
Kalimantan	224,513	15.6	327,089	6.2
Sulawesi	81,616	4.9	210,243	2.4
Others	159,747	11.9	160,373	1.8
Indonesia	1,932,326	5.9	3,619,052	3.2

Source: Statistical Year Book of Indonesia

The Indonesian government has been implementing the transmigration policy which promote relocation of people from Jawa to Sumatera and Kalimantan.

9) Regional and industrial income differences are prominent in Indonesia.

10) Since the government supported social insurance system is not well developed, there exist many traditional mutual insurance forms among people.

11) Primary school education has been recently becoming very popular. Illiteracy rate among young people has been rapidly decreasing. Higher education, on the other hand, is still not popular. Table 2-3-4 shows the present educational situation of Indonesia.

Table 2-3-4 Schools, Teachers and Students

School	No. of Schools	No. of Teachers ($\times 10^3$)	No. of Students ($\times 10^3$)
S.D.	105,516	665	22,487
SMP	10,516	192	3,329
SMA	2,703	70	1,036
STP	305	8	72
STM	674	22	234
SMEA	710	16	229
Others	949	122	268
University	41	36	196

Source: Statistical Year Book of Indonesia

(12) The Administrative System of Indonesia consists of 27 Province, as the primary districts, 246 Kabupaten and 54 Kadamadya as the secondary districts, 3,420 Kecamatan as the tertiary districts and 64,680 Desa a the smallest administrative districts.

(13) The numbers of Kabupaten and Kotamadya in Jawa and in other areas are 106 and 194 respectively. The numbers of Kecamatan in Jawa and in other areas are 1,548 and 1,872, respectively. The numbers of desa in Jawa and in other areas are 22,144 and 42,536, respectively

2-4 The Present Socio-Economic States

(1) The most noticiable feature of Indonesia is that it has been trying to change its industrial structure from agriculture dominant structure to manufacturing dominant structure through large government projects financed by oil revenues.

(2) The growth rate of real GDP between 1972 and 1982 was 7.3% per annum. The nominal GDP per capita reached US$560 in 1981. It now belongs to the medium income nations group according to the world bank classifications.

(3) The industrial structure of Indonesia consists of agriculture (24.5% in the 1981 nominal GDP share), mining (24.2%), manufacturing (11.7%) and services (15%). The share of agriculture has been diminishing. The share of mining is quite large due to oil production. The mining sector had only 12.3% share in 1973 but went up to 24.2% in 1981. The share of manufacturing has been rapidly increasing. The manufacturing sector together with the services, sector is predicted to be the leading sector in the Indonesian ecomony.

(4) There are two problems which the Indonesian manufacturing sector has to solve in order to make a further advancement. They are (a) expansion of capital goods production and (b) growth of domestic manufacturing firms.

(5) The balance of payments has been recently going to the side of excess imports. To improve this situation, Indonesia has to export more manufactured goods or to depend on forign aids if oil revenues keep going down. Debt service ratio has been also at unhealthy figures.

(6) Socio-Economic Characteristics of Indonesian Province (An analysis by the Principal Component Analysis Method)

This section aims to analyze what kind of characteristics each propinsi posseses by examing four indexes. 21 variables were examined for each propinsi and classified into the following four groups by the principal component analysis.

- Index of manpower quality
- Index of living conditions
- Index of economic activities
- Index of communications

ANNEX 2-4-1 shows the figures of the original 21 variables.

1) Index of manpower quality

This index was created by the following three variables through the principal component analysis.

1: The number of high school, vocational academy and university graduates per 100 people.

2: The number of professional and managerial workers per 100 working population.

3: The number of workers in the tertiary sector per 100 working population.

Table 2-4-1 shows the first and second principal component values and their contributions.

Table 2-4-1 Principal Component Values and their Contributions

Vav. No.	Comp. No.1	Comp. No.2
1	0.9583	-0.0825
2	0.0459	-0.2581
3	0.9348	0.3458
Cont.	0.8956	0.0643
Acc. Cont	0.8956	0.9595

Table 8-2-7 shows the scores of propinsi.

Examination of the results

The component No. 1 takes positive values for all three variables. This component shows the size of manpower quality. The component No. 2 takes negative value for the variable No. 3. Province whose scores based on the comp. No. 2 have areas of large government projects. Hence, this component shows the degree of the government officials in manpower quality. Figure 2-4-1 shows the relationship between the comps No. 1 and No. 2.

2) Index of Living Conditions

This index was created by the following 5 variables trough the principal component analysis.

4. The number of hospitals per 10,000 people

5. The number of radios possessed per 100 people

6. The number of T.V. sets possessed per 100 people

7. The number of motorized vehicles possessed per 100 people

8. The number of cinema houses per 10,000 people

Table 2-4-2 shows the first and second principal component values and their contributions.

Table 2-4-2 Principal Component Values and their Contributions.

Variable No.	Comp. No. 1	Comp. No. 2
4	0.8277	-0.2519
5	0.3545	0.8655
6	0.9280	0.0403
7	0.9276	0.2020
8	0.6613	-0.4886
Cont.	0.5939	0.2187
Acc. Cont.	0.5939	0.8127

Table 8-2-7 shows the scores of Province

Examination of the Results

The component No. 1 takes positive vaules for all five variables. Hence, this component shows the size of living conditions index. The component No. 2 takes negative values for the variables No. 4 and No. 8. This can be explained as the degree of penetration rates of durable consumer goods. Figure 2-4-2 shows the relationship between the comps No. 1 and No. 2.

3) Index of Economic Activities

This index was created by the following five variables through the principal component analysis.

9 The amount of development expenditures per 10,000 people

Code	Province
11	D.I. Aceh
12	Sumatra Utara
13	Sumatra Barat
14	Riau
15	Jambi
16	Sumatra Selatan
17	Bengkulu
18	Lampung
31	Dki Jakarta
32	Jawa Barat
33	Jawa Tengah
34	D.I. Yogyakarta
35	Jawa Timur
51	Bali
52	Nusa Tenggara Barat
53	Nusa Tenggara Timur
54	Timor Timur
61	Kalimantan Barat
62	Kalimantan Tengah
63	Kalimantan Selatan
64	Kalimantan Timur
71	Sulawesi Utra
72	Sulawesi Tengah
73	Sulawesi Selatan
74	Sulawesi Tenggara
81	Maluku
82	Irian Jaya

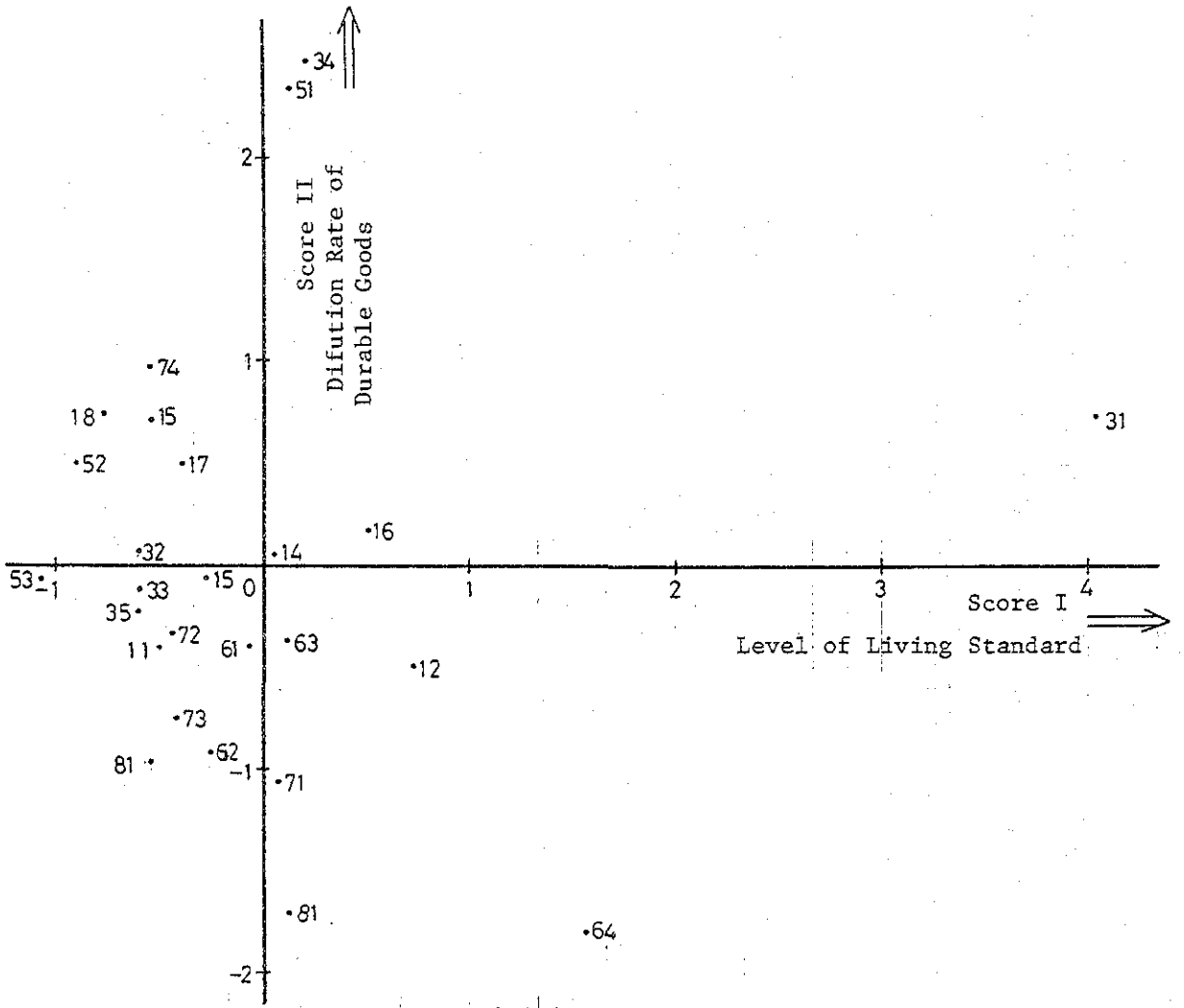


Figure 2-4-2

Graph of Principal Component of Living Standard Index

11 The ratio of asphalted road length to the total road length (%)

12 The share of urban population (%)

13 The total amount of bank credits (Rp. 10,000 per person)

15 The share of the tertiary sector in GRDP (%)

Table 2-4-3 shows the first and second principal component values and their contribution.

Table 2-4-3: Principal Component Values and their Contributions

Variable No.	Comp. No. 1	Comp. No.2
9	0.5853	0.7357
11	0.8708	-0.4579
12	0.9734	-0.0722
13	0.9503	-0.2245
15	0.7657	0.3289
Cont.	0.7075	0.1830
Acc. Cont	0.7075	0.8905

Table 8-2-7 shows the scores of propinsi.

Examination of the results
The component No. 1 takes positive values for all five variables. Hence, this component shows the size of economic activity index. The component No. 2 takes negative values for the variables No. 11, 12 and 13. This shows the degree of urbanization.

Figure 2-4-3 shows the relationship between the components No. 1 and No.2.

4) Index of communications
This index was created by the following five variables through the principal component analysis.

16 Telephone density per 100 people

17 The number of post offices per 10,000 people

18 The number of letters sent per person

19 The number of metered telephone pulses (10 pulses per person)

20 The number of telegraphs per 100 people

Table 2-4-4 shows the first and second principal component values and their contributions.

Code	Province
11	D.I. Aceh
12	Sumatra Utara
13	Sumatra Barat
14	Riau
15	Jambi
16	Sumatra Selatan
17	Bengkulu
18	Lampung
31	Dki Jakarta
32	Jawa Barat
33	Jawa Tengah
34	D.I. Yogyakarta
35	Jawa Timur
51	Bali
52	Nusa Tenggara Barat
53	Nusa Tenggara Timur
54	Timor Timur
61	Kalimantan Barat
62	Kalimantan Tengah
63	Kalimantan Selatan
64	Kalimantan Timur
71	Sulawesi Utra
72	Sulawesi Tengah
73	Sulawesi Selatan
74	Sulawesi Tenggara
81	Maluku
82	Irian Jaya

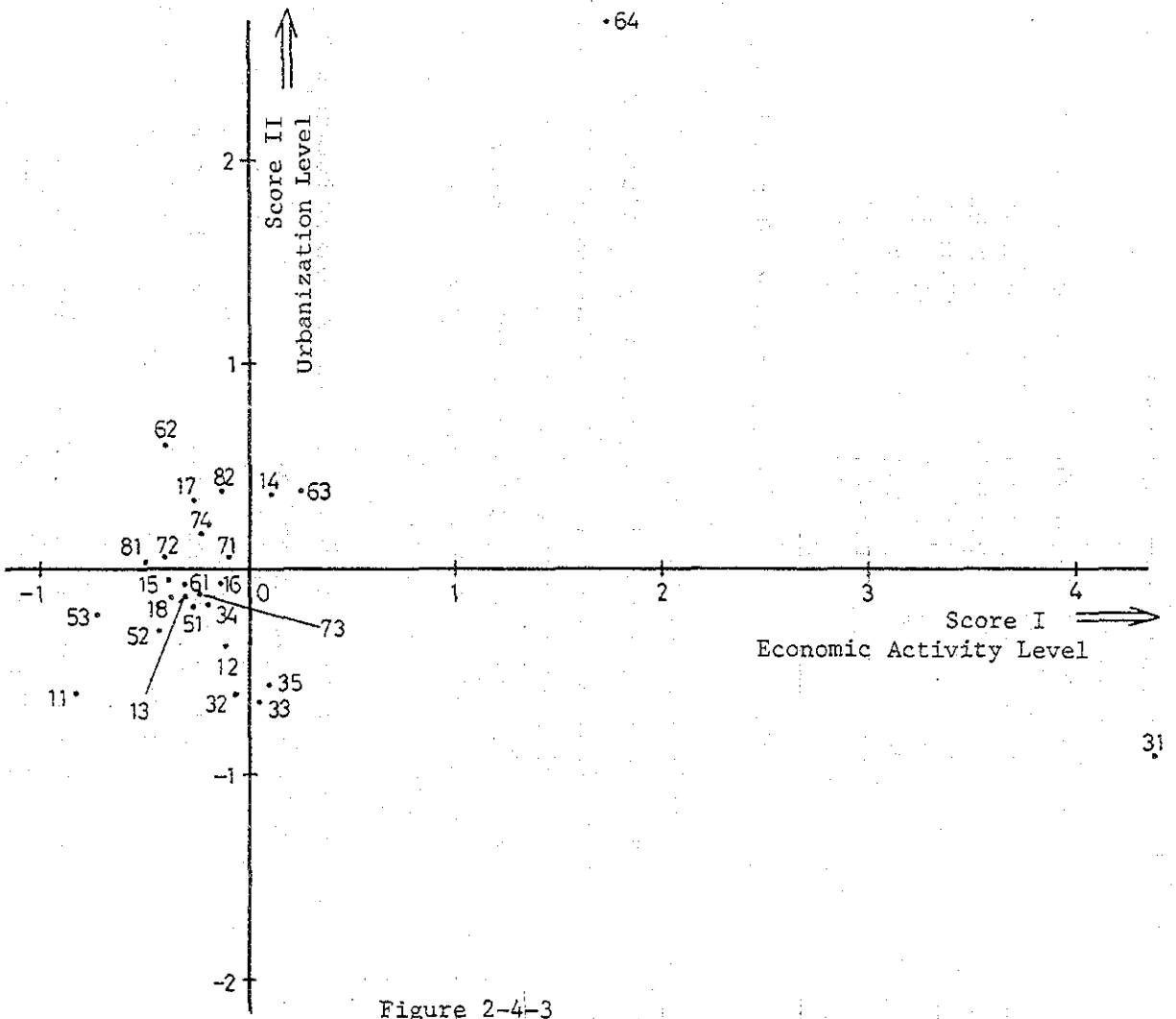


Figure 2-4-3
Graph of Principal Component Score of Economic Activity Index

Table 2-4-4: Principal Component Values and their Contributions.

Variable No.	Comp. No. 1	Comp. No. 2
16	0.9799	-0.1655
17	0.4998	0.6393
18	0.9737	-0.1906
19	0.9594	-0.2614
20	0.3560	0.7841
Cont	0.6410	0.2311
Acc Cont.	0.6410	0.8721

Table 8-2-7 shows the scores of province.

Examination of the results
The component No. 1 takes positive values for all five variables. Hence, this component shows the size of communications index. The component No. 2 takes negative values for the variables 16, 18 and 19. This shows the degree of dependency of telegraphs.

Figure 2-4-4 shows the relationship between the components No. 1 and No. 2.

The findings of the estimation results are summarized as follows;

a) D.K.I. Jakarta has the largest first principal scores in all indexes. The analysis shows how unique this area is.

b) Kalimantan Timur has also unique characteristics.

c) D.K.I. Jakarta, D.I. Yogyarta, Sulawesi Utara, Bali, Kalimantan Timur and Maluku have highly well educated and trained individuals. (Refer to Figure 2-4-1)

Code	Province
11	D.I. Aceh
12	Sumatra Utara
13	Sumatra Barat
14	Riau
15	Jambi
16	Sumatra Selatan
17	Bengkulu
18	Lampung
31	Dki Jakarta
32	Jawa Barat
33	Jawa Tengah
34	D.I. Yogyakarta
35	Jawa Timur
51	Bali
52	Nusa Tenggara Barat
53	Nusa Tenggara Timur
54	Timor Timur
61	Kalimantan Barat
62	Kalimantan Tengah
63	Kalimantan Selatan
64	Kalimantan Timur
71	Sulawesi Utra
72	Sulawesi Tengah
73	Sulawesi Selatan
74	Sulawesi Tenggara
81	Maluku
82	Irian Jaya

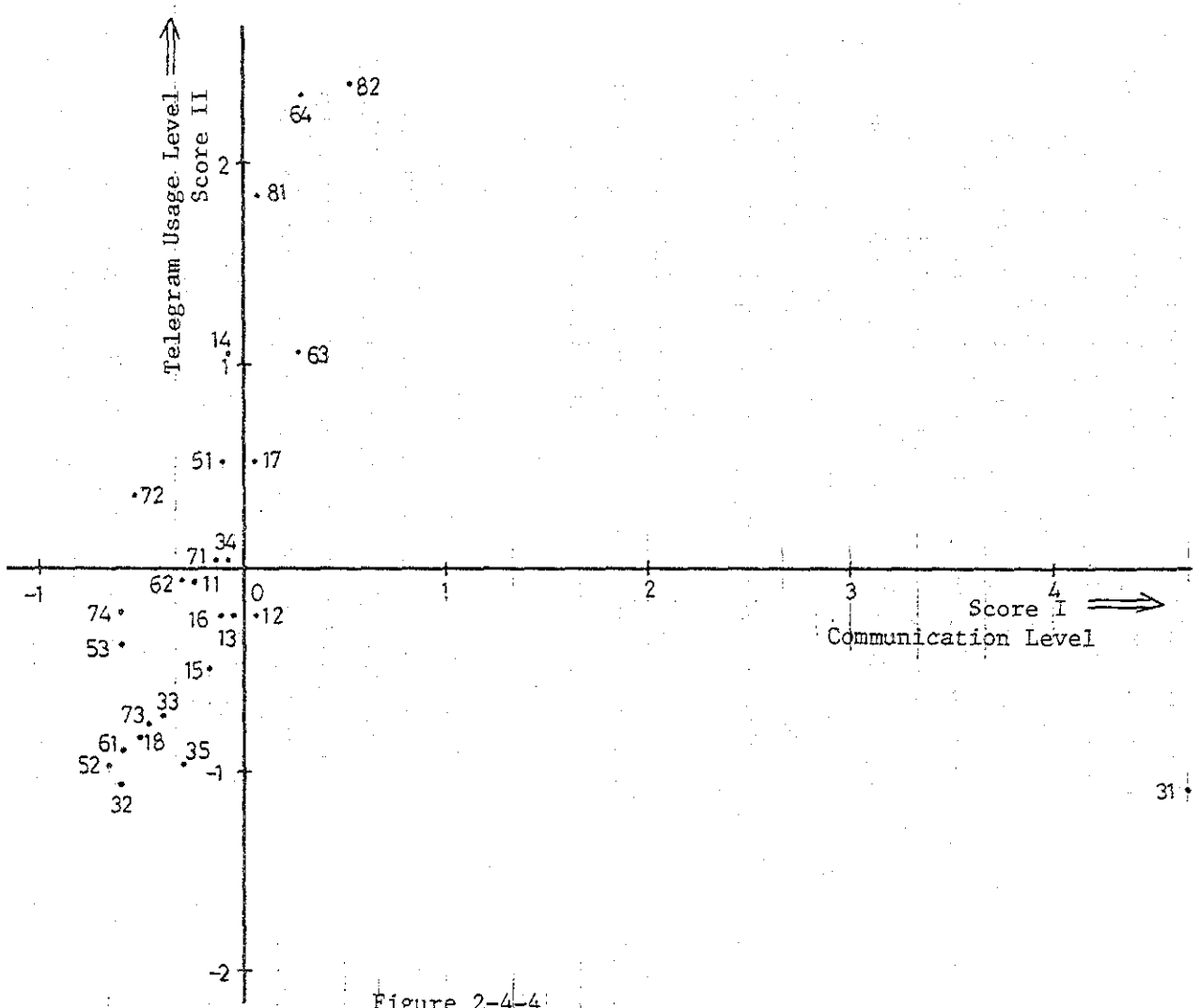


Figure 2-4-4

Graph of Principal Compoment Score of Communication Index

d) D.I. Yogyakarta and Bali have high penetration rates of durable consumer goods though the size factor of living conditions is not large. The reason why these two propinsi have high scores of the second principal component is that hospitals, cinemas and other public facilities are not well supplied. On the other hand Kalimantan Timur has a high score in the first principal component because of well supplied public facilities. (Refer to Figure 2-4-2)

e) Except D.K.I. Jakarta and Kalimantan Timur, there is no distinct pattern among propinsi in urbanization and economic activities. (Refer to Figure 2-4-3)

f) Except D.K.I. Jakarta, the level of communications is in general low. However, since Irian Jaya, Kalimantan Timur, Maluku, and Kalimantan Seletan depend on telegraph heavily, telephone services will provide great impacts in these propinsi. (Refer to Figure 2-4-4)

g) Though Nusa Tenggara Barat, Jawa Barat, kalimantan Barat, Lumpung, Jawa Timur and Jawa Tengah seem to use telephone and letters relatively more than other communication methods, the over-all communications level is low. (Refer to Figure 2-4-4)

2-5 Telecommunication Status Quo

2-5-1 Roles of Telecommunication Service in Indonesia

In Indonesia, a country with vast national territories and a large population estimated at 160 million as of 1984, telecommunication as an important infrastructure performes a significant role in the attainment of national development plans. Exchange of information by telecommunication media is indispensable for social life. For exploitation of natural deposits, such as petroleum, natural gas, tin and nickel, for agricultural development utilizing fertile lands, for development of rich forestry and fishery resources, for fulfillment of national transmigration policy from overpopulated to underpopulated areas, and from the viewpoint of national defense also, telecommunication assumes utmost importance.

2-5-2 Status Quo of Telecommunication Service

(1) Telephone Equipment Condition

As of the end of March 1984, telephone equipment installed in Indonesia consists of about 670,000 line units. This breaks down to about 580,000 line units at 170 automatic exchanges and about 89,000 line units at 509 manual exchanges.

Out of existing telephone equipment, upwards of 85% are concentrated in urban areas, whereas the urban population accounts for not more than 20% of the total.

In other words, city dwellers who occupy only 20% of total population use 85% of all telephone equipment installed in the country. The 80% majority population consists of rural inhabitants and they can use only 15% of all telephone equipment installed.

Table 2-5-1 and Figure 2-5-1 present national trends in the number of telephone equipment and main telephone during the period from 1969 to 1983. Table 2-5-2 shows Province by Province telephone diffusion rate and STD service rate as of 1983. That is to say, telephone diffusion rate as of 1983 is 0.33/100 inhabitants and automatization rate is 86.6%.

Shown in Figure 2-5-2 and Figure 2-5-3 are tertiary center area and main exchange locations, as well as exchange hierachy, in Indonesia. Figure 2-5-4 shows the main transmission route of the existing microwave system.

Table 2-5-1 Transition of Telephone Facilities

TRANSITION OF TELEPHONE FACILITIES IN INDONESIA

PELITA & YEAR		EXCHANGE				CAPACITY				MAIN TELEPHONE				TRAFFIC	
		AUTO.	MANUAL	Total	A.RATE (%)	AUTO. (lu)	MANUAL (lu)	Total (lu)	A.RATE (%)	AUTO. (line)	MANUAL (line)	Total (line)	A.RATE (%)	AUTO. (puls)	MANUAL (minute)
	1969	26	506	532	4.9	84.660	122.718	207.378	40.8	65.691	73.515	139.206	47.2	231.698.089	30.532.485
	1970	28	504	532	5.3	90.660	102.167	192.827	47.0	72.864	72.097	144.961	50.3	-	-
I	1971	33	496	529	6.2	95.300	96.142	191.442	49.8	72.832	68.328	141.160	51.6	-	-
	1972	33	506	539	6.1	110.860	101.782	212.642	52.1	91.016	71.376	162.392	56.0	-	-
	1973	34	504	538	6.3	115.500	101.920	217.420	53.1	102.197	74.832	177.029	57.7	631.209.339	50.917.299
	1974	37	507	544	6.8	125.500	104.092	229.592	54.7	113.107	80.321	193.428	58.5	758.760.178	51.430.883
	1975	39	507	546	7.1	144.100	99.562	243.662	59.1	129.791	76.163	205.954	63.0	875.006.934	47.775.213
II	1976	45	507	552	8.2	160.600	104.846	265.446	60.5	137.525	80.801	218.326	63.0	1.137.971.712	57.790.174
	1977	54	506	560	9.6	218.320	107.293	325.613	67.0	156.358	82.899	239.257	65.4	1.548.183.738	72.083.054
	1978	69	493	562	12.3	367.200	108.253	475.453	77.2	192.857	82.268	275.125	70.1	2.164.647.936	75.753.301
	1979	101	468	569	17.8	460.100	88.172	548.272	83.9	253.696	63.419	317.115	80.0	2.504.542.206	70.316.160
	1980	117	457	574	20.4	524.860	73.262	598.122	87.8	319.843	50.540	370.383	86.4	3.353.441.972	64.157.757
III	1981	150	469	619	24.2	545.500	74.130	619.630	88.0	362.800	53.893	416.693	87.1	4.297.046.600	64.729.028
	1982	164	500	664	24.7	557.963	86.579	644.542	86.6	416.078	56.202	472.280	88.1	4.949.036.036	67.621.456
	1983	170	509	679	25.0	576.797	89.336	666.133	86.6	455.957	60.501	516.458	88.3	5.384.293.609	53.521.978

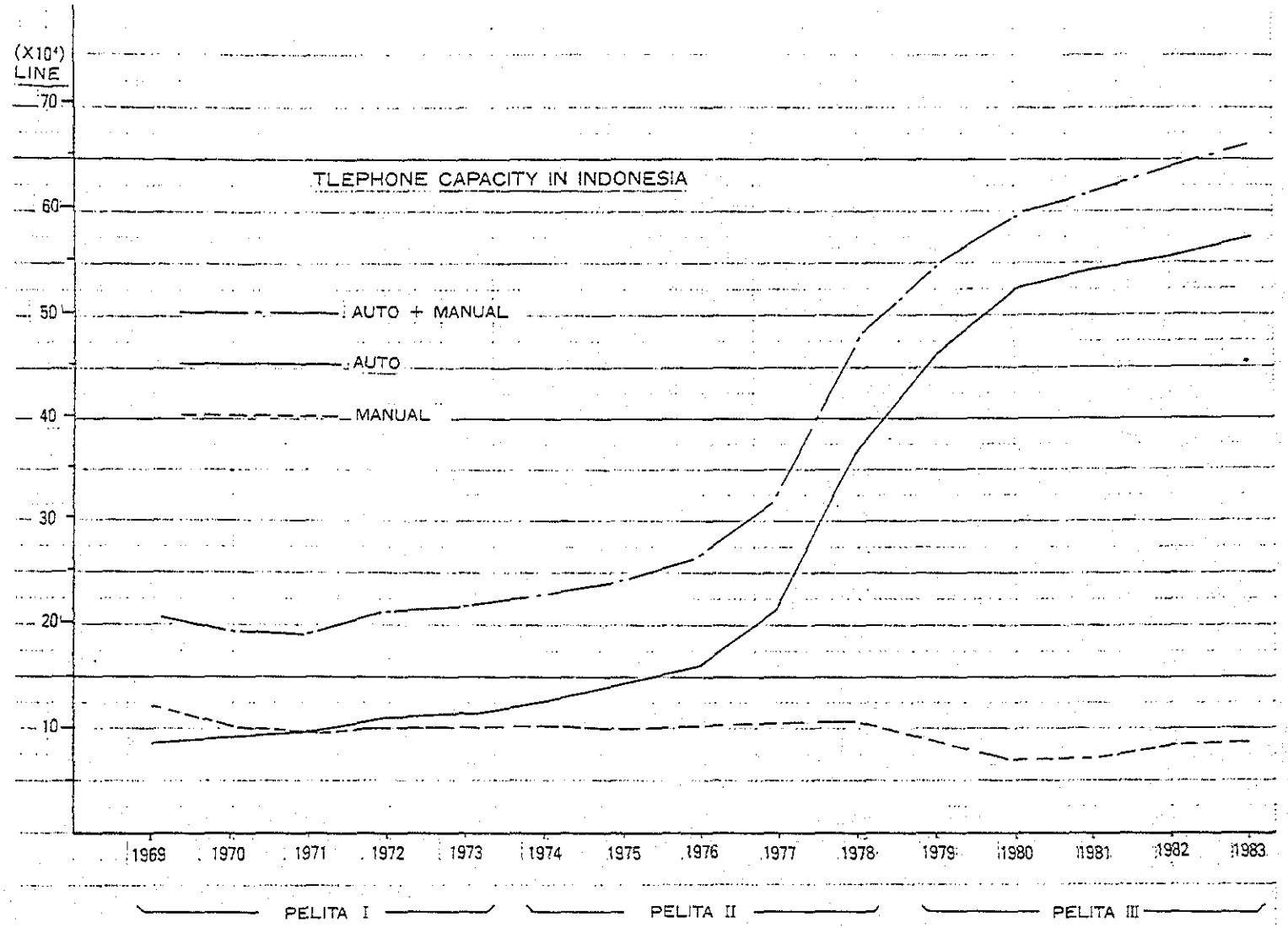


Figure 2-5-1 Transition of Telephone Capacity in Indonesia

Table 2-5-2 Telephone Density and Auto Rate for Sub.

Code	Province	Telephone Density	Auto Rate (%)
11	D.I. Aceh	0.31	72.3
12	Sumatra Utara	0.48	90.1
13	Sumatra Barat	0.24	70.6
14	Riau	0.26	68.0
15	Jambi	0.21	67.4
16	Sumatra Selatan	0.20	74.8
17	Bengkulu	0.09	80.6
18	Lampung	0.17	48.5
31	Dki Jakarta	2.6	100.0
32	Jawa Barat	0.17	81.9
33	Jawa Tengah	0.16	75.3
34	D.I. Yogyakarta	0.22	87.4
35	Jawa Timur	0.25	86.5
51	Bali	0.36	74.7
52	Nusa Tenggara Barat	0.17	62.0
53	Nusa Tenggara Timur	0.09	39.2
54	Timor Timur	—	100.0
61	Kalimantan Barat	0.11	48.1
62	Kalimantan Tengah	0.20	33.3
63	Kalimantan Selatan	0.24	66.1
64	Kalimantan Timur	0.36	89.6
71	Sulawesi Utra	0.25	60.4
72	Sulawesi Tengah	0.17	29.5
73	Sulawesi Selatan	0.21	73.4
74	Sulawesi Tenggara	0.12	62.5
81	Maluku	0.29	80.7
82	Irian Jaya	0.48	75.5
	Indonesia	0.33	86.6

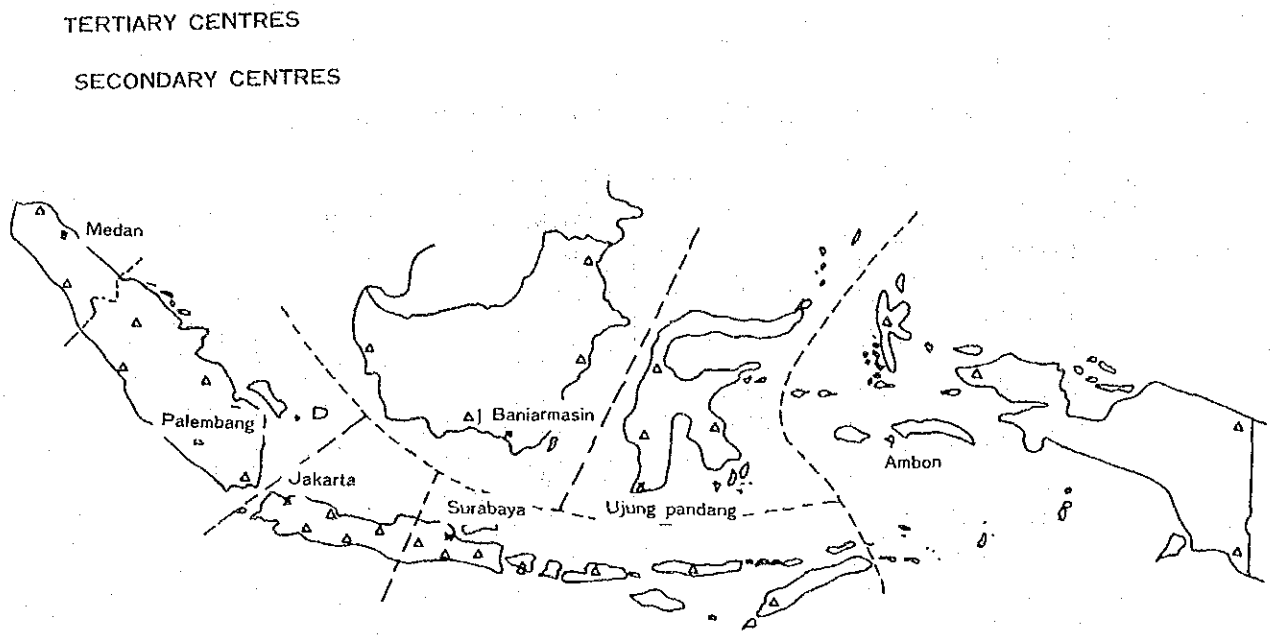
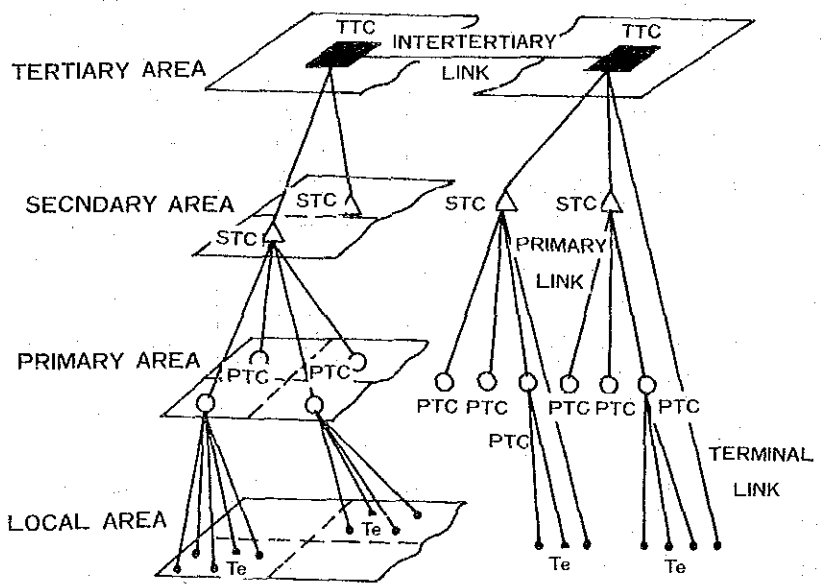


Figure 2-5-2 Main Trunk Switching Areas in Indonesia



LEGEND :

Te : TERMINAL EXCHANGE

PTC : PRIMARY TRUNK CENTRE

STC : SECONDARY TRUNK CENTRE

TTC : TERTIARY TRUNK CENTRE

Figure 2-5-3 Hierachy of Trunk Centers

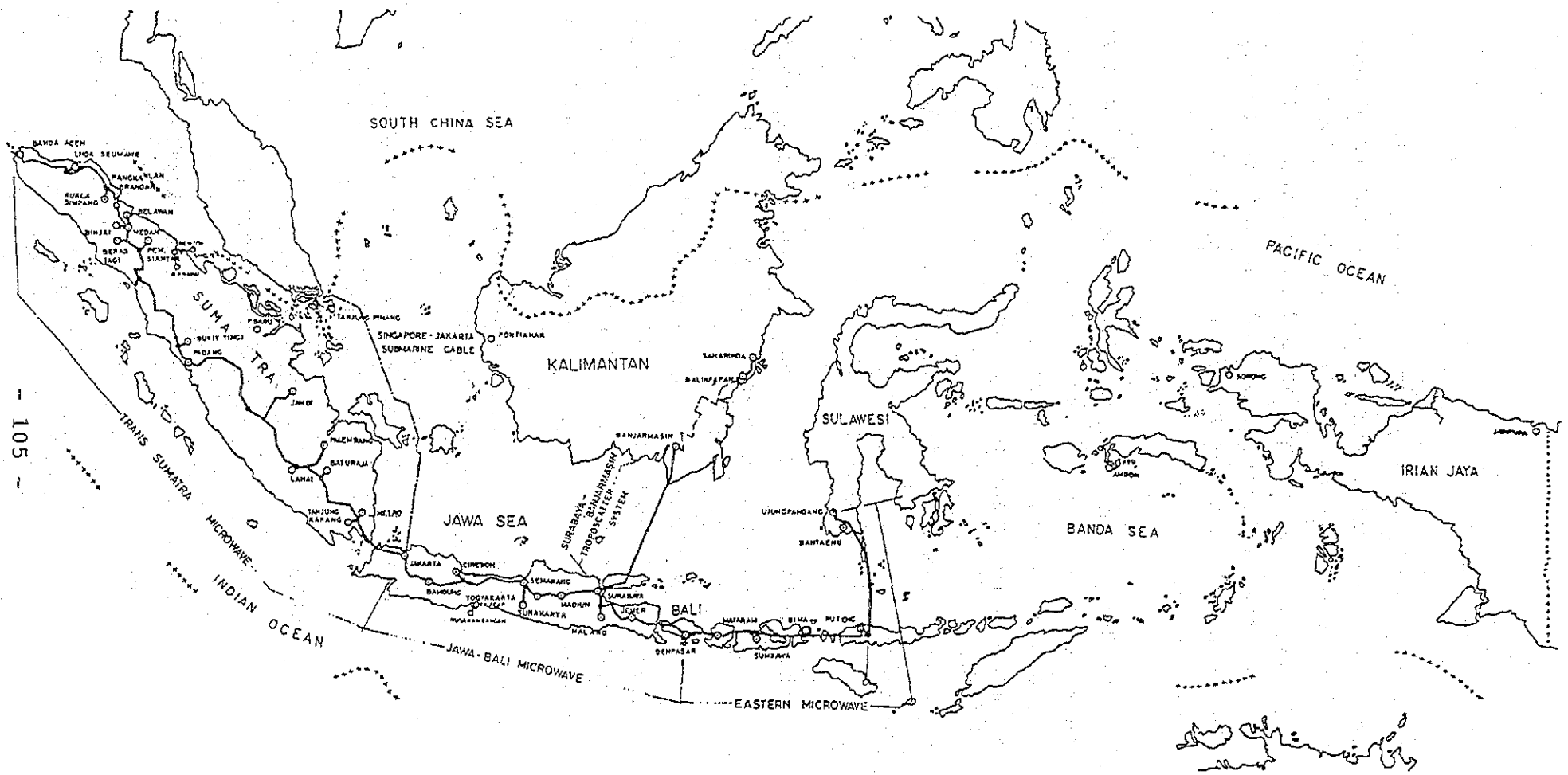


Figure 2-5-4 Existing Microwave Systems in Indonesia

(2) SKSD Condition

Satellite now used for SKSD, i.e., domestic satellite communication system, are PALAPA A2 and B1. Transponders available total 34, or, more precisely, 10 at PALAPA A2 and 24 at PALAPA B1. When PALAPA B2 is launched and replace PALAPA A2, the combined total of B1 and B2 transponders increases to 48.

Figure 2-5-5 present approximate locations of SKSD earth stations now in use. Figure 2-5-6, 2-5-7 shows how the transponders are used at present, as well as radio frequencies used.

Satellite communication systems are threefold. They are:

1. FDMA (Frequency Division Multiple Access) system
2. TDMA (Time Division Multiple Access) system
3. SCPC (Single Channel per Carrier) system

Out of these three systems, FDMA and TDMA are the systems applicable to satellite communication main circuits. As of the end of PELITA III, FDMA and TDMA systems are installed as shown in Table 2-5-3.

Table 2-5-3 Number of Satellite Communication Circuits as of end of PELITA III

System	End of PELITA III (1983/84)
FDMA	* 2,112 circuits
TDMA	-
Total	* 2,112 circuits

* Note: On transponder, one circuit equals 2 CH.

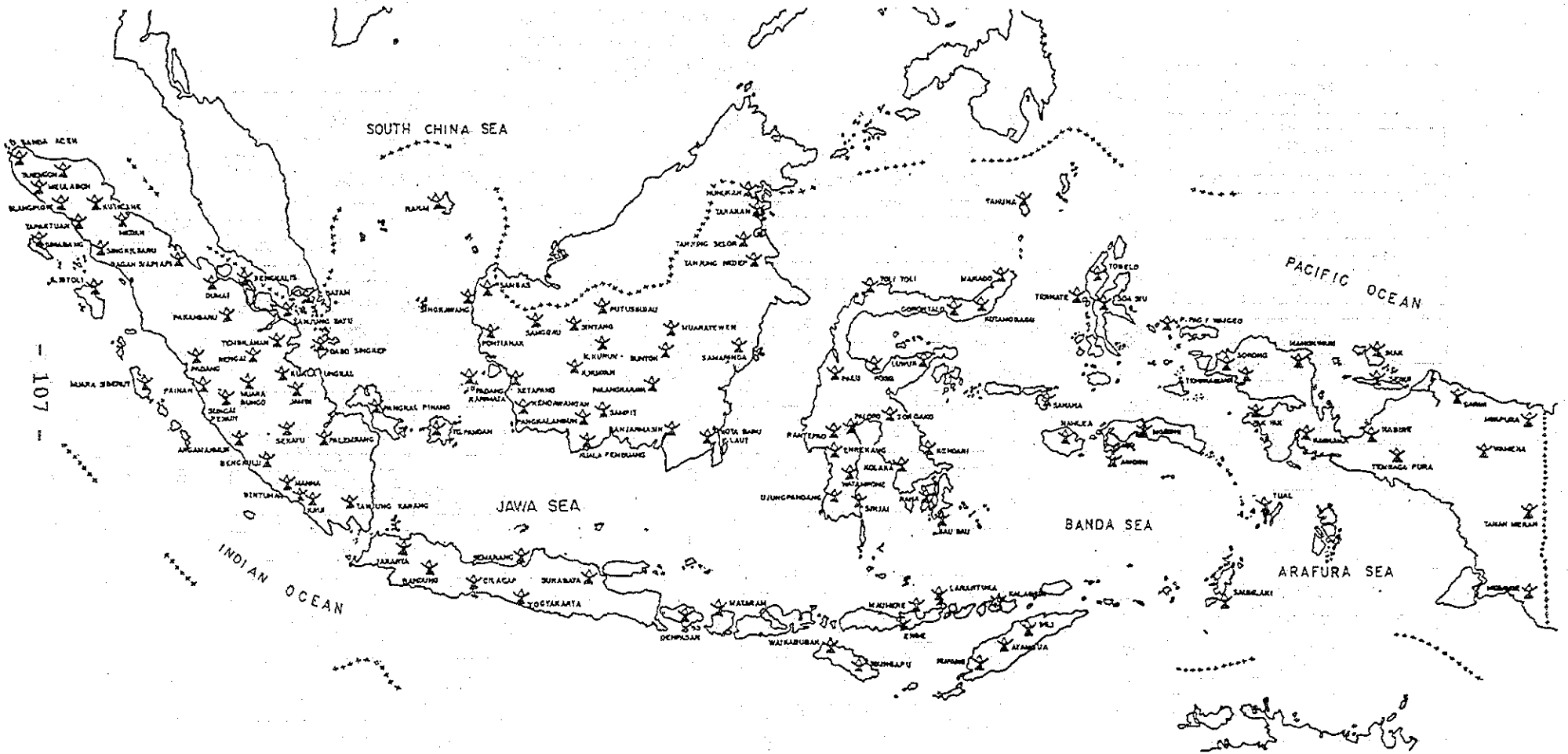
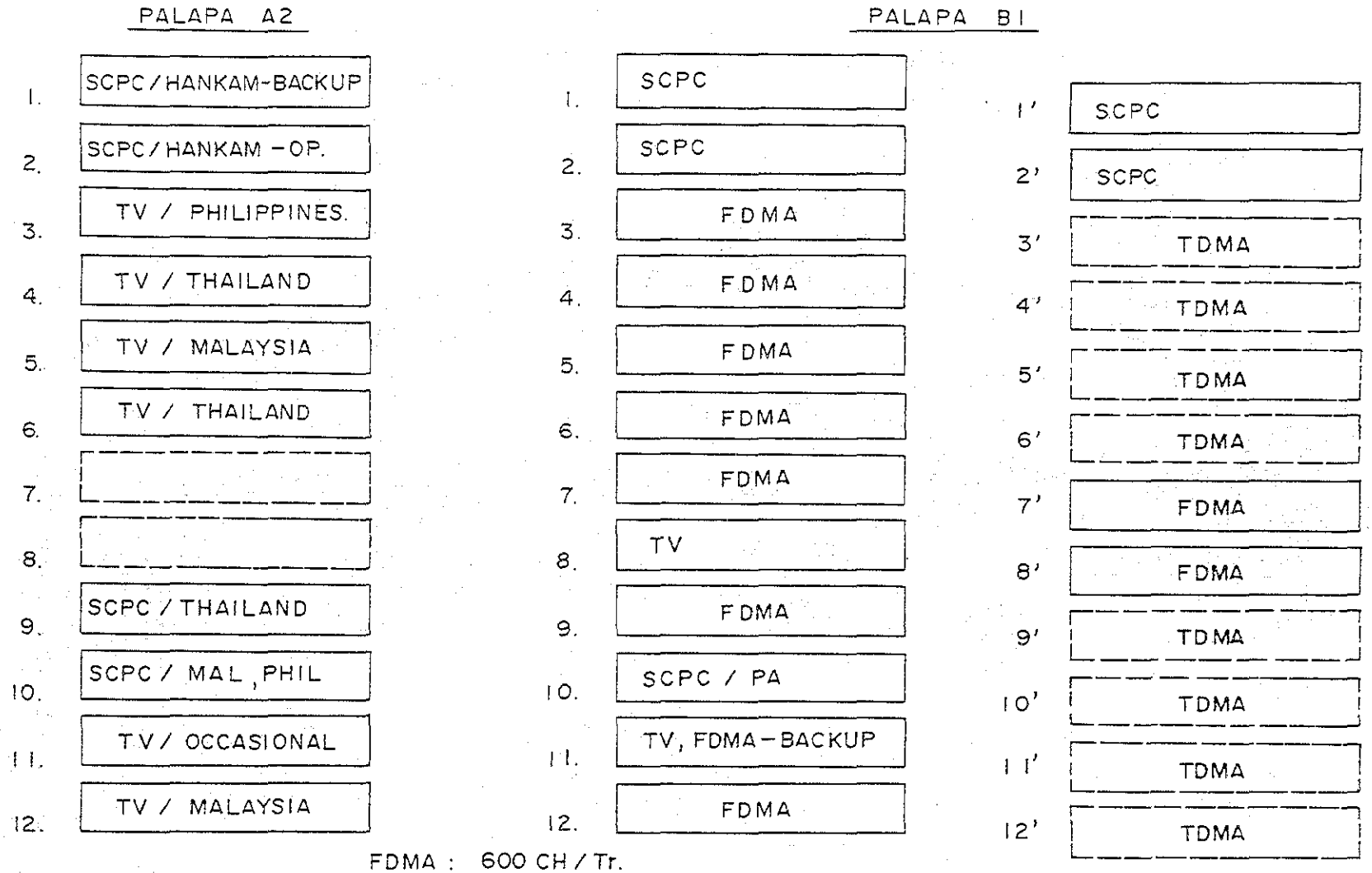
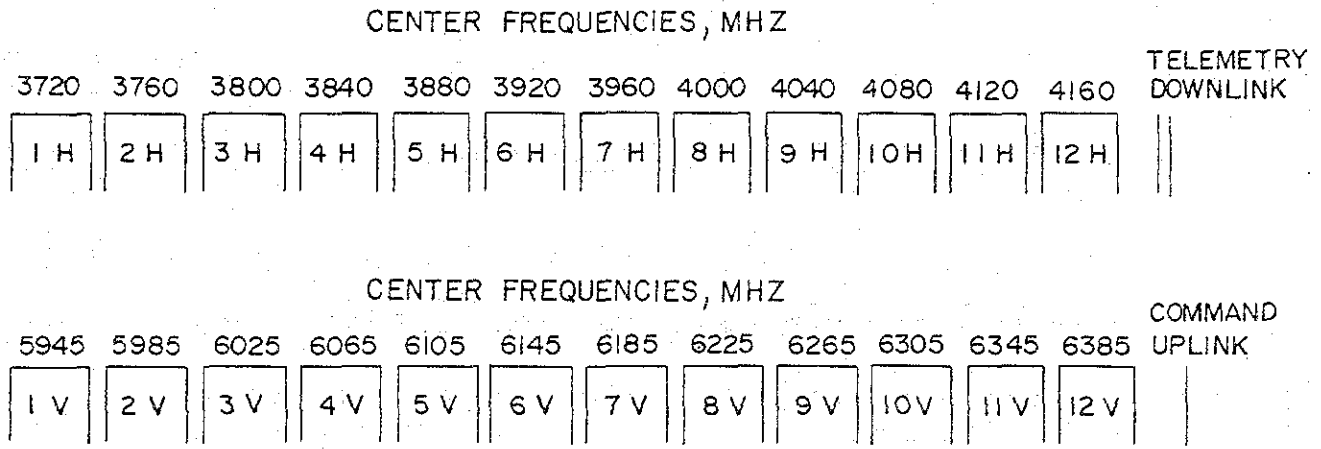


Figure 2-5-5 Location of Earth Stations for Domestic Satellite Communication System



FDMA : 600 CH / Tr.
TDMA : 900 CH / Tr.
SCPC : 1000 CH / Tr. (VOX)

Figure 2-5-6 Use of Transponders



H = Horizontal Polarization
V = Vertical Polarization

Figure 2-5-7 (1/2) Palapa-A Frequency and Polarization

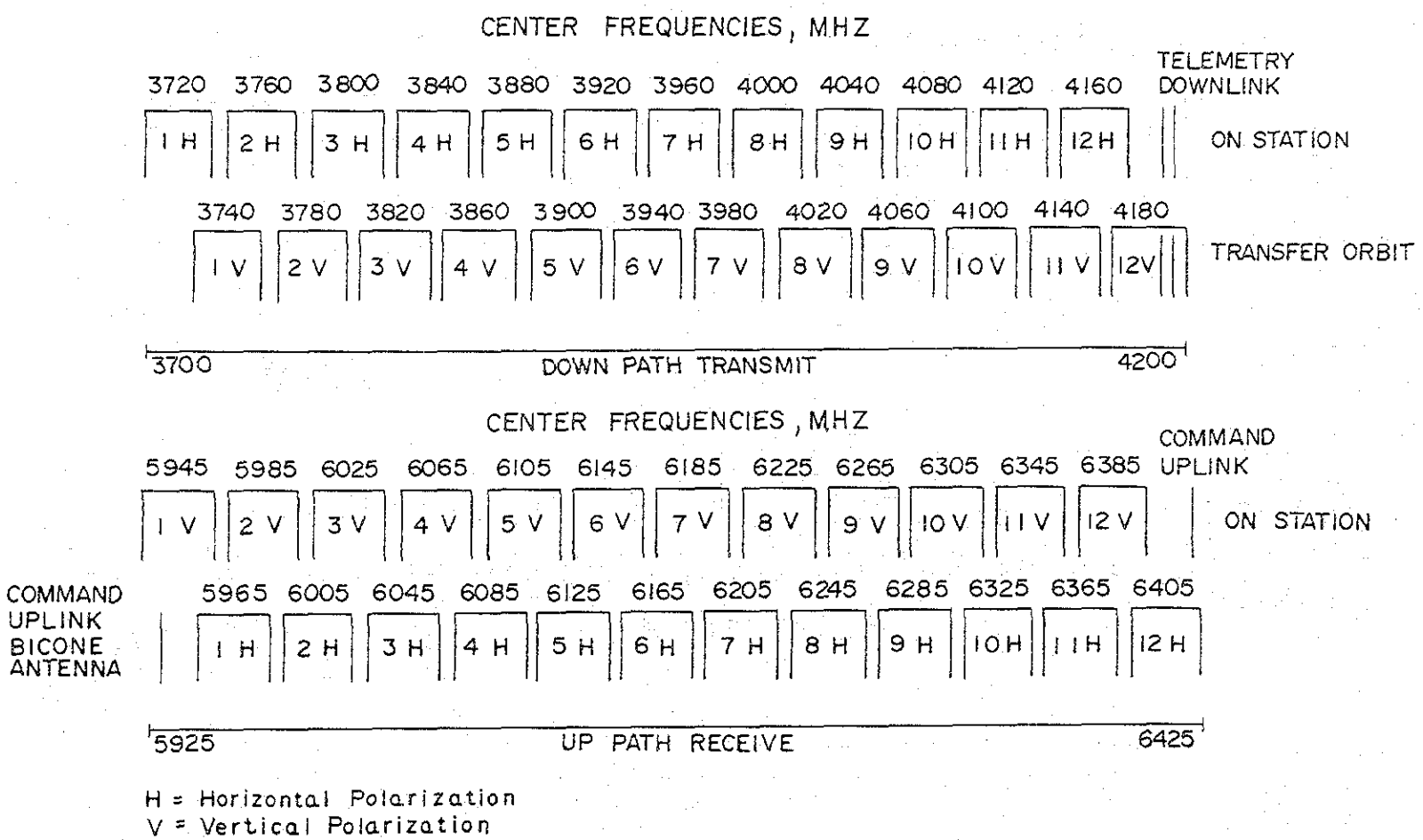


Figure 2-5-7 (2/2) Palapa-B Frequency and Polarization

At present, TDMA system is not adopted. Additional installation of main satellite communication circuits during PELITA IV is by TDMA system.

SCPC system is applicable to geographically alienated area where traffic volume is extremely small (several Erlangs). Existing SCPC system installations appear in Table 2-5-4.

Table 2-5-4 Existing SCPC System Installations (at end of 1983/84)

Area	No. of Stations	No. of Modems	Modem Ratio (%)
Sumatera	37	574	28.0
Jawa	10	506	24.7
Nusa Tenggara	11	108	5.3
Kalimantan	25	314	15.3
Sulawesi	19	253	12.4
Irian Jaya & Muluku	23	293	14.3
Whole Indonesia	124	2,048	100.0

Modem ratio indicates relative size of communication traffic in underpopulated area as arranged area by area in consideration of existing SCPC traffic condition.

SKSD system earth stations comprise three types: SBB, SBS and SBK. SBK is domestically produced in Indonesia and is even exported abroad. Standard SBK can accommodate 12 SCPC circuits per earth station.

Main system parameters for SBB, SBS and SBK, and system parameters of satellite itself are given in ANNEX 2-5-1.

SCPC/DA is a system which can be aptly used for isolated rural area and for community where total traffic volume is relatively small.

SCPC/DA system in Indonesia is featured as under.

a) Centralized control system is adopted so that equipment of earth station established in rural area is simplified.

   When satellite communications system is used for rural communication, the availability of the whole system is determined almost exclusively by maintenability of small type earth station to be established in rural area. However, in rural area, skilled maintenance staff is difficult to obtain so that earth station equipment must be as simple as possible.

b) Modulation system for voice channel is CFM (companded FM). Considering that main system in satellite communications system is being digitalized (PCM/PSK/TDMA) in almost all cases, SCPC system also ought to be digitalized. In this case, to be noted is that voice signal connection is channel by channel connection; therefore, SCPC system digitalization cannot dispense with control station hardware and software remodelling, and this nullifies digitalization merit. Furthermore, equipment required at small type earth station necessarily becomes complicated. This is not advisable from the viewpoints of cost and maintenance.

Note: At present, modification of software is in progress for control software to improve control capacity from up to 120 stations/3,000 modems up to 2,500 stations/14,000 modems.

Other SCPC system features other than the foregoing are:

c) Flexibility in transmission system establishment. In other words, with SCPC, transmission system can be established practically independent of existing network.

d) Small type earth station (antenna diameter: 4.5 m) neither takes much time nor requires much labor to construct. It can be established at almost all places regardless of geographical conditions.

e) Cost is fixed. Initial cost is almost completely free from influence of distance from access point to national network. Sole cost variation factor is transport cost.

f) System expandability makes it possible to meet with unforeseen traffic variation on a channel basis.

For standard type SBK, capacity expansion up to 12 CH is easy to realize.

g) Re-use potential is high. When main communications network becomes improved to the extent the rural communications network, which at present cannot be constructed at reasonable cost by other means than satellite communications system, can be composed of terrestrial system, earth stations which are no longer needed can be moved to other places and re-used.

(3) Non-Voice Communication System Condition

1) Telex System

At the present stage, telex subscribers are accommodated in local gentex exchanges. Telex exchanges in all parts of Indonesia belong to either of four, i.e., Medan, Jakarta, Surabaya and Ujung Pandang, tandem exchanges. Local gentex exchange is not equipped with through circuits to other exchanges so that all outgoing/incoming traffic is carried to/from subscribers concerned via tandem exchange to which the gentex exchange belongs. Gentex tandem exchanges in Indonesia, as well as their area numbers and service areas, appear in Table 2-5-5 below. Existing gentex network is shown in Figure 2-5-8.

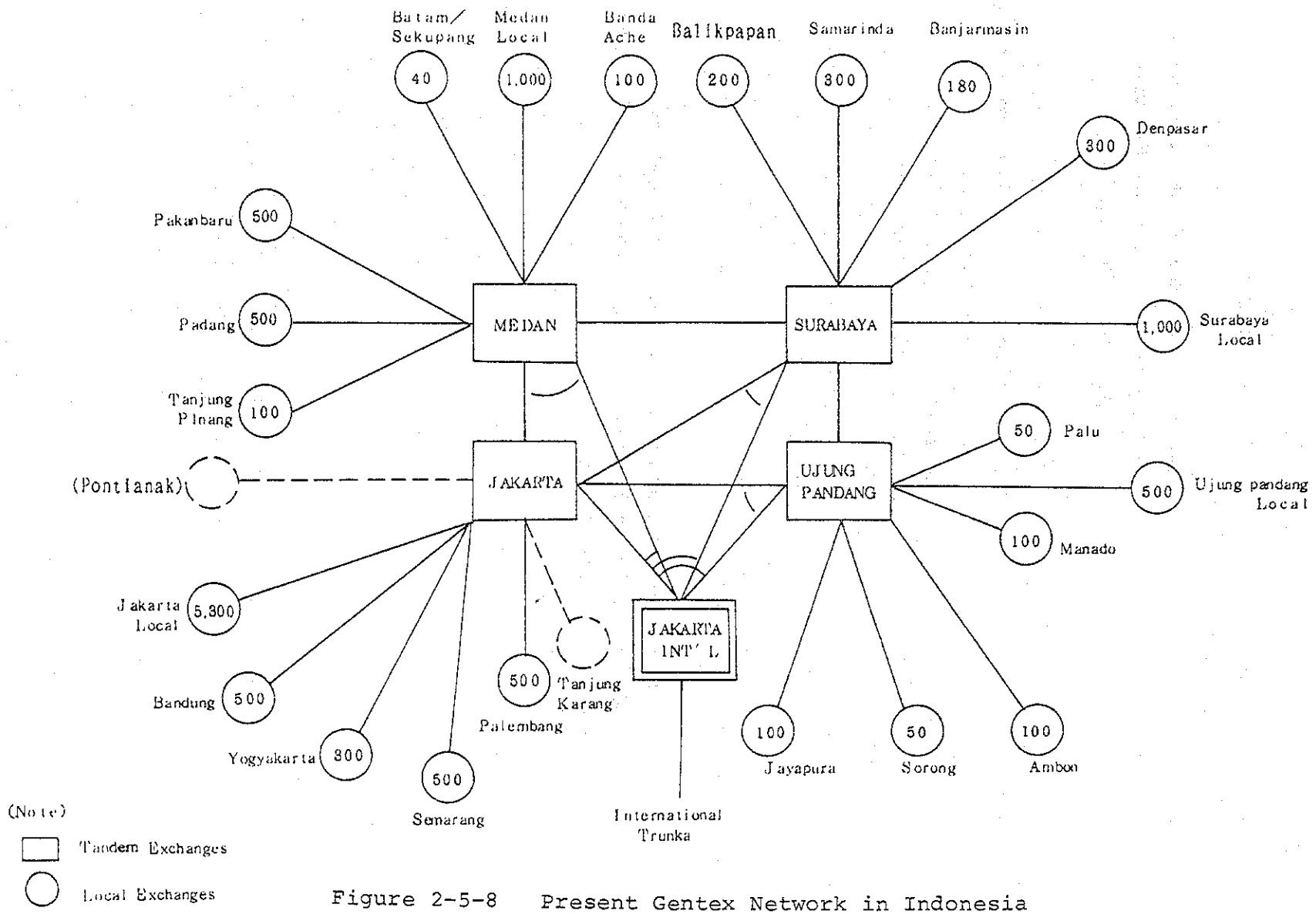


Figure 2-5-8 Present Gentex Network in Indonesia

Table 2-5-5 Gentex Tandem Exchanges, Area Numbers and Service Areas

Tandem Exchange	Area Number	Service Area
Jakarta	2 & 4	Jakarta, Jawa Barat, Jawa Tengah, D.I. Yogyakarta, Jamba, Sumatera Selatan, Bengkulu, Lampung
Surabaya	3	Jawa Timur, Bali, Nusa Tenggara Barat, Timor, Timur, Nusa Tenggara, Timur, Kalimantan Barat, Kalimantan Tengah, Kalimantan Selatan, Kalimantan Timur
Medan	5	D.I. Aceh, Sumatera Utala, Sumatera Barat, Riau
Ujung Pandang	7	Sulawesi, Makuku, Irian Jaya

The number and line unit capacity of gentex exchange in each Propinsi as of the end of 1983/84 are as Table 2-5-6.

Table 2-5-6 Province by Province Gentex Exchange Breakdown

Province	No. of Exchange	Line Unit Capacity
D.I. Aceh	1	100
Sumatera Utala	1	1,000
Sumatera Barat	1	500
Riau	3	640
Jambi	-	-
Bengkulu	-	-
Sumatera Selatan	1	500
Lampung	-	-
D.K.I. Jakarta	6	5,300
Jawa Barat	1	500
Jawa Tengah	1	500
D.I. Yogyakarta	1	300
Jawa Timur	1	1,000
Bali	1	300
Nusa Tenggara Barat	-	-
Nusa Tenggara Timur	-	-
Timor Timur	-	-
Kalimantan Barat	-	-
Kalimantan Tengah	-	-
Kalimantan Selatan	1	180
Kalimantan Timur	2	500
Sulawesi Utala	1	100
Sulawesi Tengan	1	50
Sulawesi Selatan	1	500
Sulawesi Tenggara	-	-
Maluku	1	100
Irian Jaya	2	150
Total	27	12,220

Source: POSTEL Annual Report 1983

Telex terminals and their growth rate and density during 1971 through 1983 are as under.

Table 2-5-7 Annual Trend of Telex Installations (1971 - 1983)

Year	No. of Terminals	Growth rate (%)	Density (per 1,000 people)	Remark
1970	679		0.0058	
		7.9		
71	746		0.0062	
		19.8		
72	894		0.0073	
		9.5		
73	979		0.0078	
		14.8		
74	1,124		0.0087	
		39.8		
75	1,571		0.0116	
		23.6		
76	1,942		0.0140	
		23.4		
77	2,397		-	
		33.8		
78	3,208		-	
		21.9		
79	3,909		-	
		35.3		
80	5,289		0.0357	
		26.3		
81	6,679		0.0441	
		11.8		
82	7,466		0.0483	
		17.2		
83	8,748		0.0553	
	.			
	.	(26.4)		
	.			
(88)	(28,198)		(0.160)	PELITA IV schedule

Source: PERUMTEL Annual Report

Since 1970, the number of telex terminals continues to increase at annual rate of about 21.7%. The number of telex terminals as of 1983 is about 13 times the number as of 1970. At the time of PELITA IV termination, the number of telex terminals is scheduled to reach about 28,200.

Up to 43% of all telex terminal equipment are installed in Jakarta City and 52% in Kotamadya and other cities.

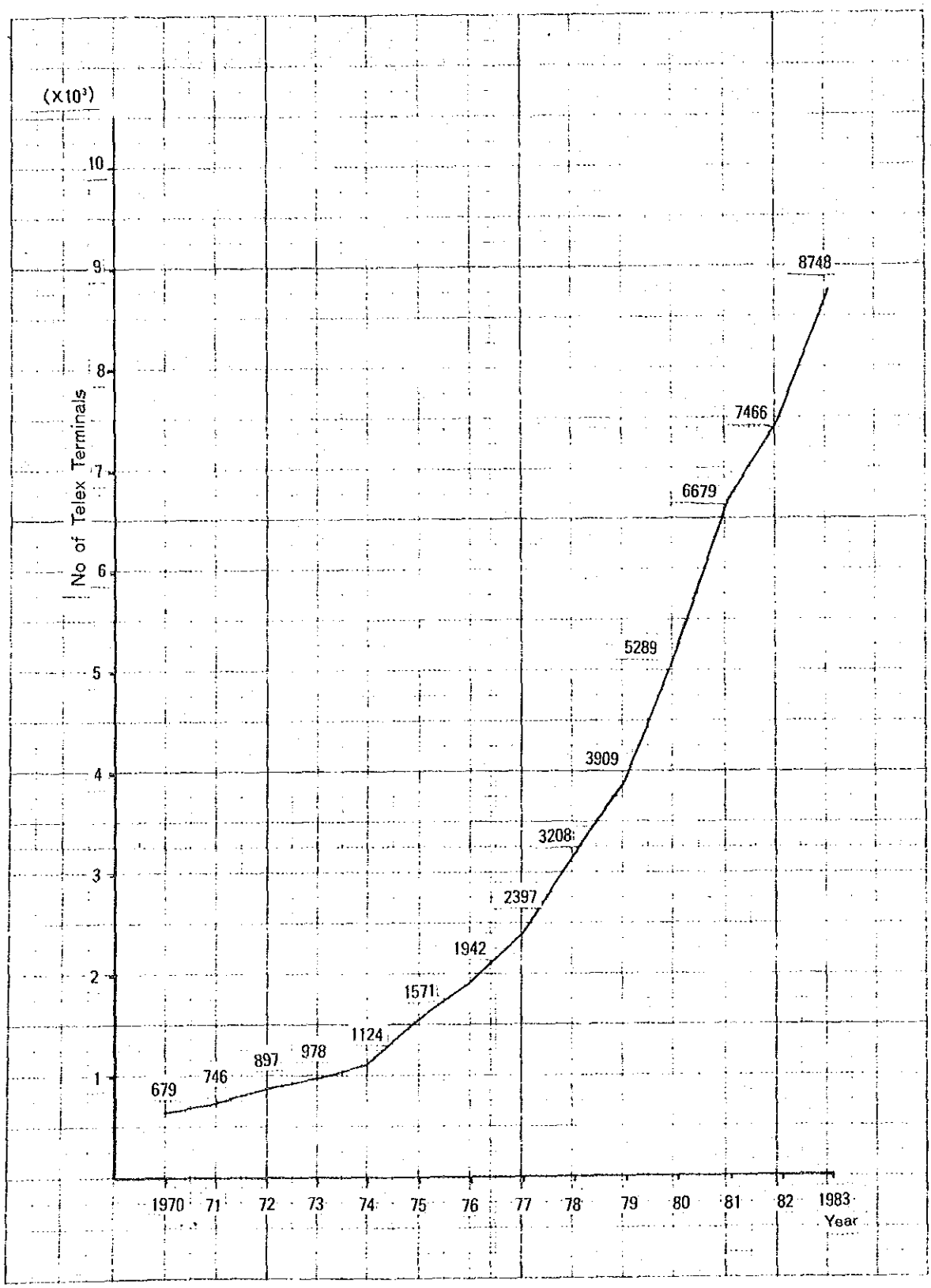


Figure 2-5-9 Transition of Telex Terminals

National and international telex traffic trends are compiled in Table 2-5-8 and Table 2-5-9, respectively. These telex traffic trends are graphically presented in Figure 2-5-10.

Table 2-5-8 National Telex Traffic Trends, 1973 - 1981

	National Traffic		Per Subscriber	
	No. of Pulse ($\times 10^3$)	Growth Rate (%)	No. of Call ($\times 10^3$)	Growth Rate (%)
1973	9,935.30		10.14	
		27.6		11.3
74	12,664.70		11.27	
		34.9		-3.4
75	17,090.90		10.89	
		33.8		8.1
76	22,862.10		11.77	
		22.6		-0.7
77	28,026.30		11.69	
		28.1		-3.5
78	35,894.30		11.19	
		20.6		-1.1
79	43,279.10		11.07	
		31.5		-2.8
80	56,903.70		10.76	
		44.9		14.8
81	82,278.52		12.32	
Average	-	30.3	-	2.5

Source: Statistical Yearbook of Common Carrier Telecommunications, ITU

Table 2-5-9 International Telex Traffic Trends, 1973 - 1983

	International Traffic		Per Subscriber	
	No. of Call ($\times 10^3$)	Growth rate (%)	No. of Call ($\times 10^3$)	Growth Rate (%)
1973	276.40		0.282	
		33.4		16.3
74	368.80		0.328	
		46.5		4.9
75	540.20		0.344	
		22.2		-1.2
76	660.10		0.340	
		50.3		21.8
77	992.20		0.414	
		29.4		-3.4
78	1,284.10		0.400	
		30.3		7.0
79	1,673.10		0.428	
		30.9		-3.3
80	2,190.50		0.414	
		29.2		2.4
81	2,830.87		0.424	
		18.9		6.4
82	3,366.19		0.451	
		8.6		-7.3
83	3,655.95		0.418	
Average	-	29.5	-	4.0

Source: Statistical Yearbook of Common Carrier Telecommunications, ITU

National telex traffic growth rate is about 30% in annual average. Per subscriber growth rate is estimated at 2.5% in annual average.

International telex traffic registers 30% growth in annual average. Per subscriber growth rate can be safely assumed to be 4%.

2) Telegraph System

Telegraph terminals of telegraph stations in main cities of Indonesia are accommodated in local gentex exchanges so that sending and receiving of messages between telegraph stations can be done by automatic connection through gentex network.

Telegraphic communication to/from telegraph stations without access to terrestrial transmission route and satellite communication system is by Morse code, using high frequency circuits.

Year by year trends in the number of national and international telegraphic messages are shown in Table 2-5-10 and Figure 2-5-11.

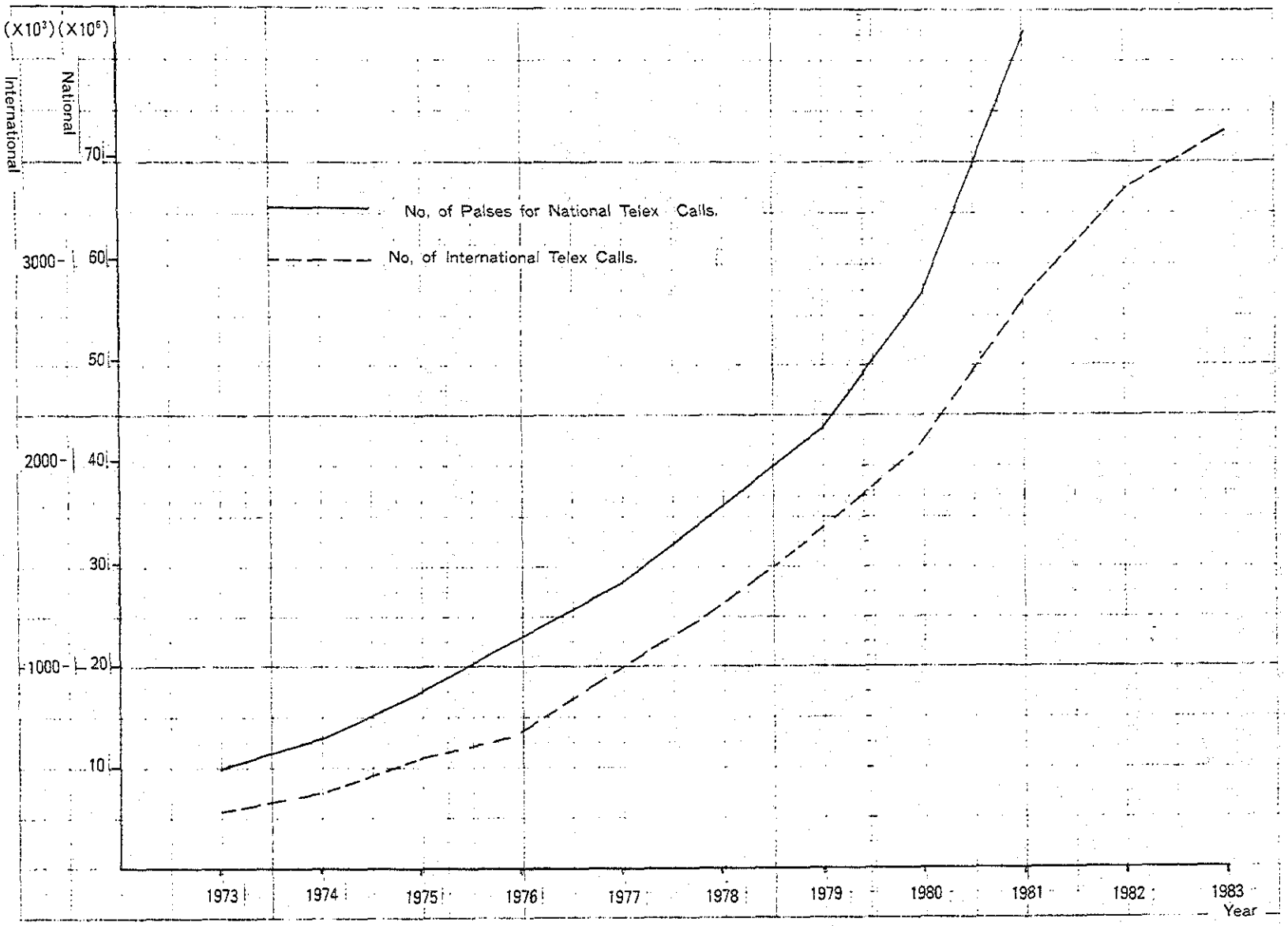


Figure 2-5-10 No. of Pulses for National Telex Calls and International Telex Calls

Table 2-5-10 Annual Total of National and International Telegraphic Messages, 1973 - 1983

($\times 10^3$)

	National	International	Total
1973	3,590.10	468.880	4,058.980
74	3,776.10	468.820	4,244.920
75	3,574.10	440.400	4,014.500
76	4,070.40	381.550	4,451.750
77	4,403.60	336.340	4,739.940
78	4,905.40	287.940	5,193.340
79	5,503.50	251.190	5,754.690
80	6,452.50	231.620	6,684.120
81	6,923.71	180.730	7,104.440
82	7,141.83	139.329	7,281.159
83	7,861.11	105.007	7,966.117

Source: Statistical Yearbook of Common Carrier Telecommunications, ITU

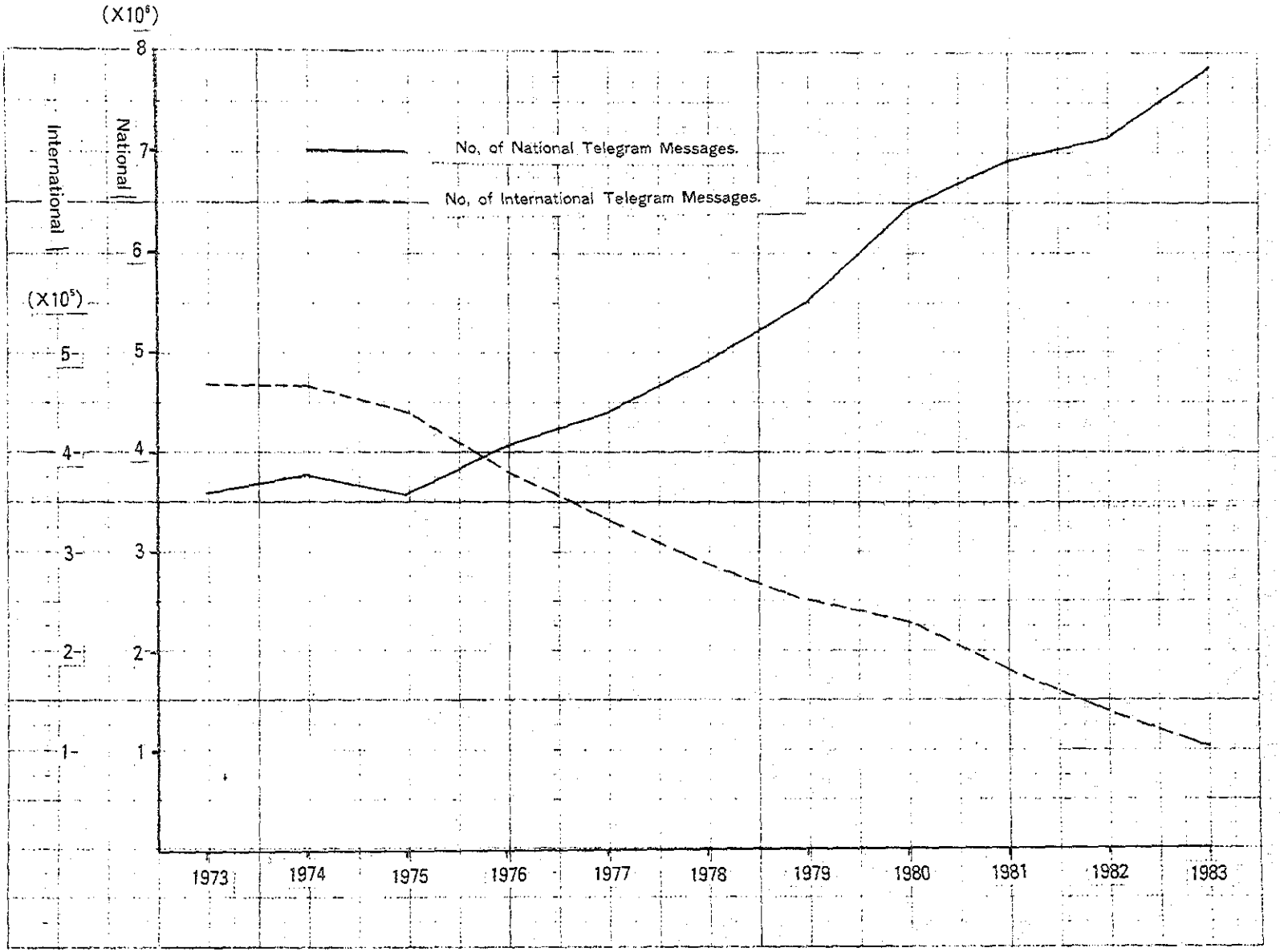


Figure 2-5-11 No. of National and International Telegram Messages

For national telegraphic messages, average annual growth rate during the period from 1973 to 1983 is estimated at 8%. International telegraphic messages continue to decrease year by year, the number handled in 1983 being not more than 22% compared with 1973.

3) Other Service

Lease of communication circuits to large users is also in practice. Service trend appears in Table 2-5-11.

Table 2-5-11 Leased Circuit Service Trend, 1973 - 1982

	No. of Circuits ($\times 10^3$)
1973	0.063
74	0.076
75	0.105
76	0.124
77	0.150
78	0.172
79	0.202
80	0.385
81	0.444
82	0.126

Source: Statistical Yearbook of Common Carrier Telecommunications, ITU

Up to 43% of all telex terminal equipment are installed in Jakarta City and 52% in Kotamadya and other cities.

(4) Automatic Telephone Service and Revenue per Subscriber Trends

Data for 1969 through 1983 concerning the number of automatic and manual exchanges, exchange capacities, number of subscribers, automatic telephone ratio and annual service revenue for the whole of Indonesia are in Table 2-5-12.

Figure 2-5-12 presents relationship between automatic subscriber telephone ratio and average annual revenue per subscriber and between automatic subscriber telephone ratio and traffic (annual average number of pulses). The illustration shows that as automatic subscriber telephone ratio increases, so does service revenue per subscriber also. This is why automatic subscriber telephone service should be promoted positively.

Annual service revenue from automatic exchange operation occupies 92.5% majority out of total telephone service revenue.

(5) Telephone Tariff System

Telephone tariff revenue mainly consists of telephone installation charge revenue, monthly rental revenue and call charge revenue.

1) Telephone Installation Charge Revenue (Refer to Table 2-5-13.)

Telephone installation charge is collected from subscriber having his telephone newly installed. This charge includes installation work charge.
Telephone installation charge is divided into seven grades according to geographical conditions.

2) Monthly Rental Revenue (Refer to Table 2-5-13.)

Monthly rental is collected from each subscriber regardless of the number of calls. This periodical fee includes telephone set rent.

3) Call Charge Revenue

Call charge is levied on subscribers according to call volume.

For toll calls, tariff is by PPM (Periodic Pulse Metering) method. (See Table 2-5-14.) At present (1985), charge per pulse metering is Rp 75.

For local calls except in JAKARTA, charge is by uniform rate at automatic exchanges. In JAKARTA, three minutes per pulse metering system is adopted.

Table 2-5-12 Transition of Telephone Revenue

TRANSITION OF TELEPHONE FACILITIES IN INDONESIA

PELITA & YEAR		SUBSCRIBER				TRAFFIC				REVENUE per SUB		
		AUTO. (line)	MANUAL (line)	TOTAL (line)	A.RATE (%)	AUTO. (puls)	MANUAL (minute)	AUTO. (p/sub.)	MANUAL (m/sub.)	AUTO. (Rp)	* MANUAL (Rp)	TOTAL (Rp)
	1969	65.691	73.515	139.206	47.2	231.698.089	30.532.485	3.527	415	35.271	25.831	30.286
	1970	72.864	72.097	144.961	50.3	-	-	-	-	-	-	-
I	1971	72.832	68.328	141.160	51.6	-	-	-	-	-	-	-
	1972	91.016	71.376	162.392	56.0	-	-	-	-	-	-	-
	1973	102.197	74.832	177.029	57.7	631.209.339	50.917.299	6.176	680	61.764	39.271	52.256
	1974	113.107	80.321	193.428	58.5	758.760.178	51.430.883	6.708	640	95.140	58.011	79.723
	1975	129.791	76.163	205.954	63.0	875.006.934	47.775.213	6.742	627	134.833	68.479	110.295
II	1976	137.525	80.801	218.326	63.0	1.137.971.712	57.790.174	8.275	715	165.493	86.697	136.331
	1977	156.358	82.899	239.257	65.4	1.543.183.738	72.083.054	9.870	870	188.828	111.757	162.124
	1978	192.857	82.268	275.125	70.1	2.164.647.936	75.753.301	11.224	921	214.246	131.852	189.609
	1979	253.696	63.419	317.115	80.0	2.504.542.206	70.316.160	9.872	1.109	335.560	265.960	321.641
	1980	319.843	50.540	370.383	86.4	3.353.441.972	64.157.757	10.485	1.269	318.453	360.111	324.137
III	1981	362.800	53.893	416.693	87.1	4.297.046.600	64.729.028	11.844	1.201	468.227	321.392	449.236
	1982	416.078	56.202	472.280	88.1	4.949.036.036	67.621.456	11.894	1.203	568.219	386.813	546.631
	1983	455.957	60.501	516.458	88.3	5.384.293.609	53.521.978	11.809	885	657.014	399.511	626.848

* Include the revenue of Interlocal traffic for Auto Subscribers

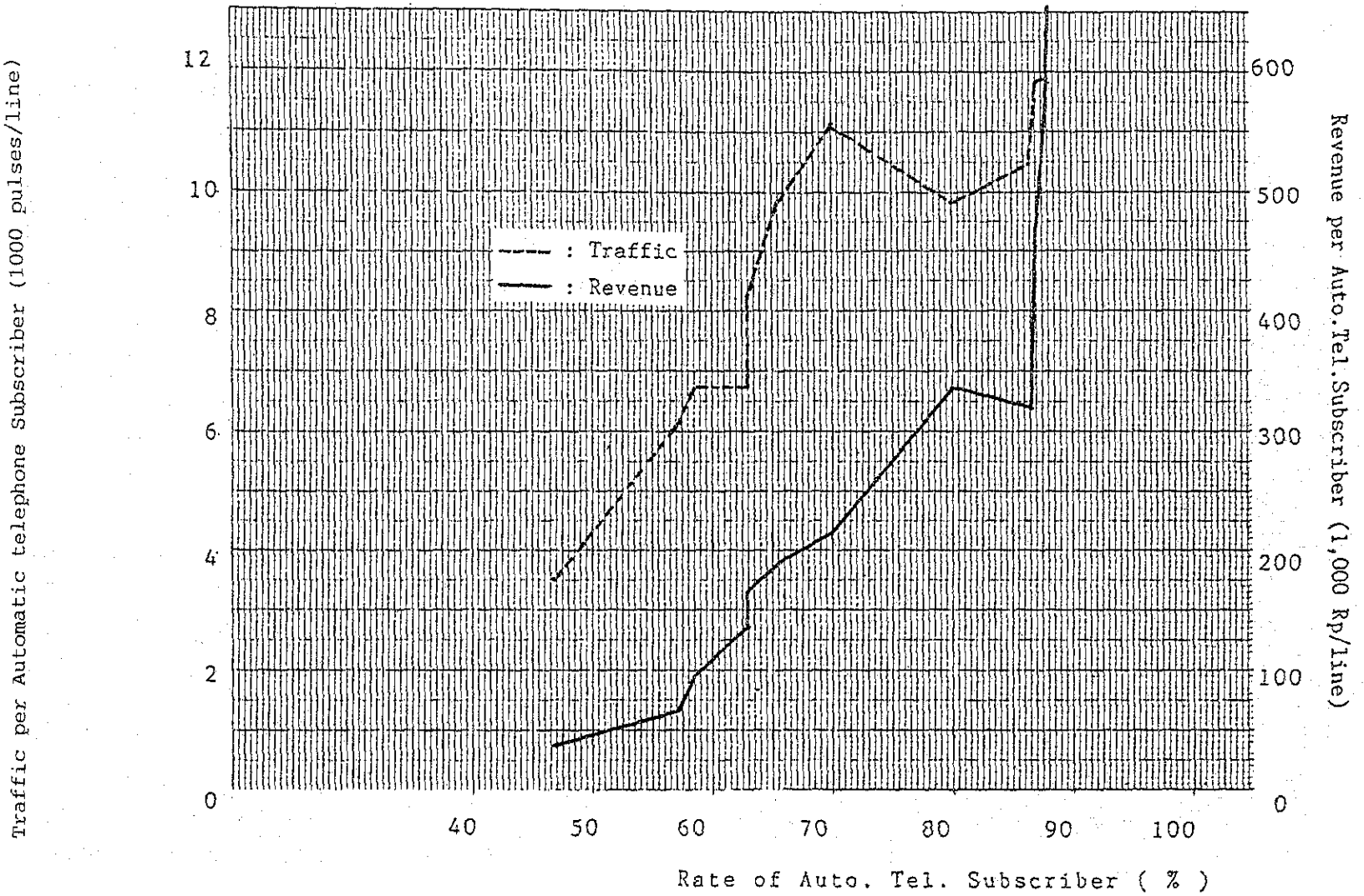


Figure 2-5-12 Traffic and Revenue per Subscriber (Automatic Exchange)

Table 2-5-13 Telephone Tariff in Indonesia

Apr. 1985

Installation Fee		Extra Additional Fee		Brunch Tel. Inst. Fee	Rental Fee / Month RP.			3 minutes Fee RP.	SLDD & INTERLOCAL
Claasification 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 JADARTA 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 2-5-14 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

2-6 Telecommunication Development Plan

Before PELITA-I (1969)

In 1969, telephone density was 0.16 per population of 100. This telephone density was one of the lowest in the world. Telephone demand was far from being satisfied.

The Government placed major emphasis on food production so that is spent development fund mainly to finance transportation, electricity and irrigation projects, i.e., to strengthen basic infrastructure.

Telecommunications facilities at that time were:

a) Telephone facilities: About 175,000 line units, where of 57% were manual switches.

b) Transmission facilities: Almost exclusively bare wire system or high frequency radio system.

c) Telegraph facilities: Generally superannuated, mostly operating by Morse code system.

2-6-1 PELITA-I (1969/70 - 1973/74)

PELITA-I (First National Development Five-Year Plan) got underway in 1969. Telephone facilities development objective was to realize 233,000 line units by 1974, based on average annual capacity improvement by 6%. Telecommunications facilities at the time of PELITA-I termination (1973/74) were:

a) Telephone facilities: About 225,000 line units, whereof about 43% were manual switches.

b) JAWA - BALI microwave link came into operation.

c) SLDD (Subscriber long distance dialling) service began.

d) Telephone density: About 0.18 per population of 100.

e) Spur transmission route improvement was carried out.

f) High quality telex service became possible.

g) International telecommunications service facilities were improved.

2-6-2 PELITA-II (1974/75 - 1978/79)

In succession to PELITA-I, PELITA-II began to be implemented in 1974. Telecommunications facilities as of PELITA-II termination in 1978/79 were:

a) Telephone facilities: About 475,000 line units.

b) Telex facilities: 9,200 terminals.

c) Total number of circuits in SLDD network: About 26,000 circuits.

d) About 1,317,000 ch.km microwave network was completed.

e) 40 earth stations of domestic satellite communication system were completed.

By the above telecommunications facilities expansion, telephone density was improved to 0.29 per population of 100.

2-6-3 PELITA-III (1979/80 - 1983/84)

PELITA-III implementation began in 1979. Telecommunications facilities as of PELITA-III termination in 1983/84 were:

a) Telephone facilities: About 670,000 line units. Telephone density was improved to 0.42 per population of 100.

b) SLDD facilities were installed at 89 exchanges at end of 1981. As of end of 1983/84, the number of such exchanges increased to 106.

c) In terristrial transmission network, about 26,900 circuits were additionally installed including 15,070 circuits in PELITA-II carryover.

d) 75 earth stations of domestic satellite communication system were completed, bringing the number of earth stations (SBK) to 122 at end of 1983/84.

e) With 1,854 STJJ (long distance subscribers) circuits newly installed, STJJ systems operating in all parts of the country reached a total of 85.

2-6-4 PELITA-IV (1984/85 - 1988/89)

a) Telephone facilities (Refer to Table 2-6-1): 947,500 line units to be additionally installed. (Breakdown: PELITA-III carryover - 194,500 line units; PELITA-IV schedule - 750,000 line units.) This will bring total installations to about 1,620,000 line units and telephone density to about 0.92 per population of 100.

b) Telex facilities (Refer to Table 2-6-1):
19,450 terminals; to be additionally installed.
(Breakdown: PELITA-III carryover - 3,400 terminals; PELITA-IV schedule - 16,050 terminals.)
This will bring total telex terminals to 31,670 and telex density to about 0.018 per population of 100.

For domestic satellite communication system, expansion plan as shown in Table 2-6-2 is scheduled during PELITA-IV period.

Table 2-6-1 Program for Telecommunication Development

($X10^3$ L.U)

PROGRAM	84/85	85/86	86/87	87/88	88/89	Total
1. CARRY OVER PELITA III						
A. TELEPON	31	84.5	62	20	-	197.5
B. TELEX.	-	2.2	1.2	-	-	3.4
	(1.0)	(0.35)	-	0	-	(1.35)
2. REPELITA IV						
A. TELEPON	38.6	156.0	286.7	228.7	237.5	947.5
B. TELEX.	-	2.0	1.2	11.7	1.35	19.45
	(1.0)	(0.35)	-	-	-	(1.35)

( ) = HASIL REALOKASI.

Table 2-6-2 No. of FDMA, TDMA Circuits

	At End of PELITA III (1983/84)	At End of PELITA IV (1988/89)
FDMA	2,112	2,556
TDMA	-	9,000
Total	*2,112	*11,556

*Note: 1 circuit on transponder equals 2 CH.

Figure 2-6-2 presents FDMA and TDMA satellite communication system pre-assignment as of the end of PELITA IV (1988/89). For details of domestic satellite communication system development, refer to the relevant description in ANNEX 2-6-1.

Abbreviation

ABM	Ambon
BAC	Banda Aceh
BIK	Biak
BJM	Banjarmasin
BND	Bandung
BTM	Pulau Batam
DIL	Dilli
DPS	Denpasar
GTL	Gorontalo
JKT	Jakarta
JYP	Jayapura
KDR	Kendari
KPG	Kupang
MDN	Medan
MND	Manado
MRK	Merauke
PAL	Palu
PDN	Padang
PKB	Pekanbaru
PLM	Palembang
PNT	Pangkalpinang
PTN	Pontianak
SMD	Somarinda
SMP	Sampit
SMR	Semarang
SRB	Surabaya
TNT	Ternate
UJP	Ujung Pandung
YOG	Yogyakarta

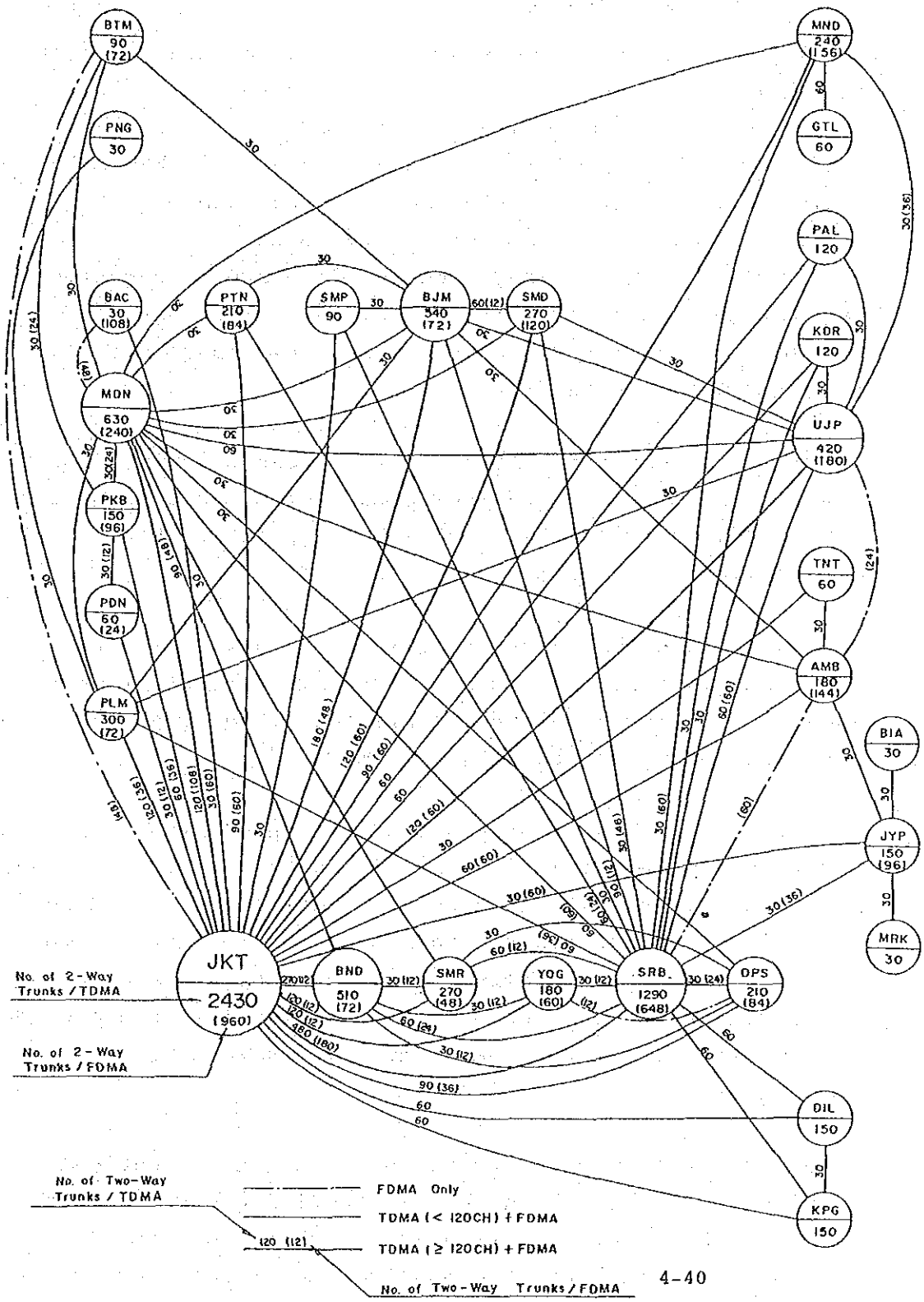


Figure 2-6-1 Satellite Communications System T.D.M.A. (FDMA) 1989

2-7 The Need for the Project

Development of telecommunications has been mainly promoted in the urban areas because of its short-term profitability. The telephone penetration rate of 1984 is 1.66 (per 100 people) in Kotamadya and 0.09 in Kabupaten. There is also a great difference between them from the point of view of easy accessibility to telephone services. The urban areas (Kotamadya) have 1 subscriber per 0.03 km^2 but the rural areas (Kabupaten) have 1 subscriber per 17.4 km^2. The rural areas have very low geographical accessibility.

It has been asserted that the rural areas have very low demand for telecommunications because they have low income and depend on self-sufficient economies in which not much communications to other areas are needed.

People in Indonesia have recognized the need for faster rural development to make a further advancement of social progress. Telecommunications are perceived as an effective means for rural development.

Indonesia consists of many islands in which high mountains and thick forests make construction of roads, railways and ports difficult. It is, however, inevitable to develop communications and transportation infrastructures to move out of a traditional self-sufficient economy to an inter-regional market economy. Telecommunications provide an important and effective means for development strategies under these circumstances.

Though short-term benefits of rural telecommunications development may not be great, it should be given a much higher priority among government projects for social development when long-term and indirect impacts are taken into consideration.