社会開発協力部報告書

No. 7

# THE REPUBLIC OF INDONESIA

# STUDY REPORT

# ON

# LONG TERM PLANNING

# FOR

# DEVELOPMENT OF TELECOMMUNICATIONS SYSTEM

## (EXECUTIVE SUMMARY)

FEBRUARY 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

# THE REPUBLIC OF INDONESIA

# STUDY REPORT

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# PREFACE

In response to the request of the Government of Indonesia, the Japanese Government has decided to conduct a study on the Long Term Planning for Development of Telecommunications System and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team headed by Mr. Junichi KUROBE, the Nippon Telecommunications Consulting Co., Ltd. from February 3 to March 29, 1986 and from June 15 to September 27, 1986.

The team had discussions with the officials concerned of the Government of Indonesia and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

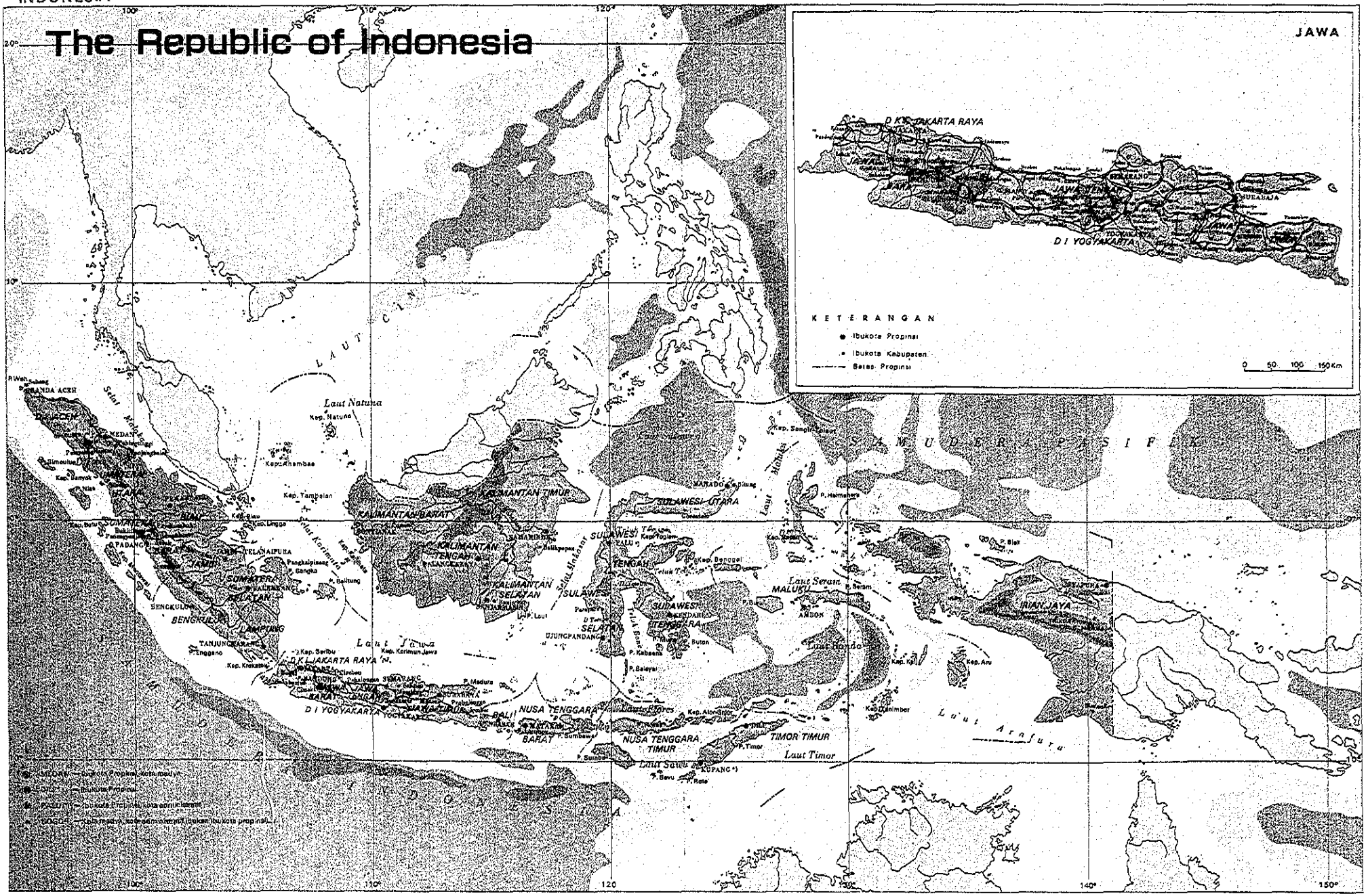
I wish to express my deep appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the team.

February, 1987

Keisuke Arita

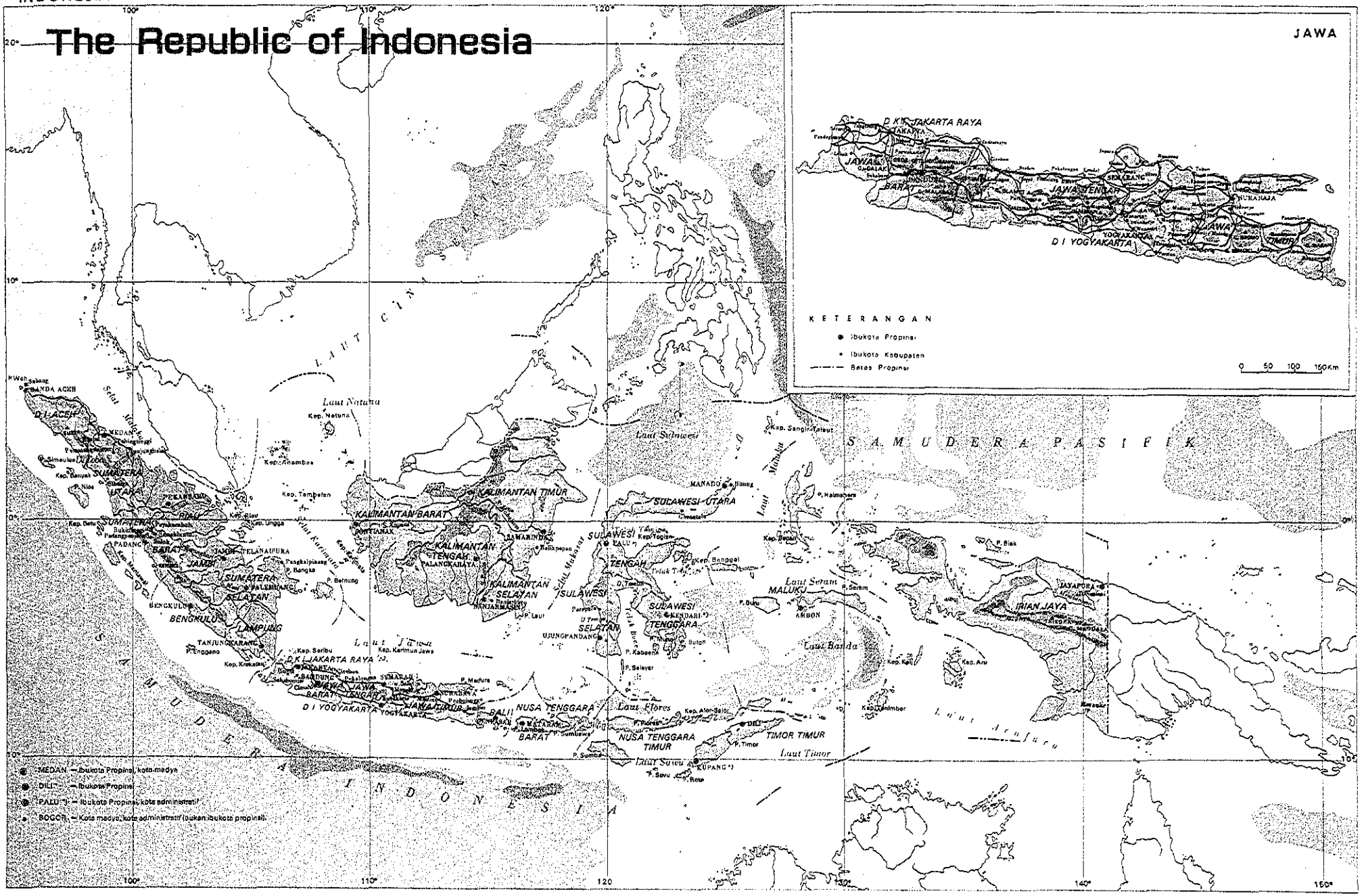
Keisuke Arita
President
Japan International Cooperation Agency

# The Republic of Indonesia



INDONESIA

# The Republic of Indonesia



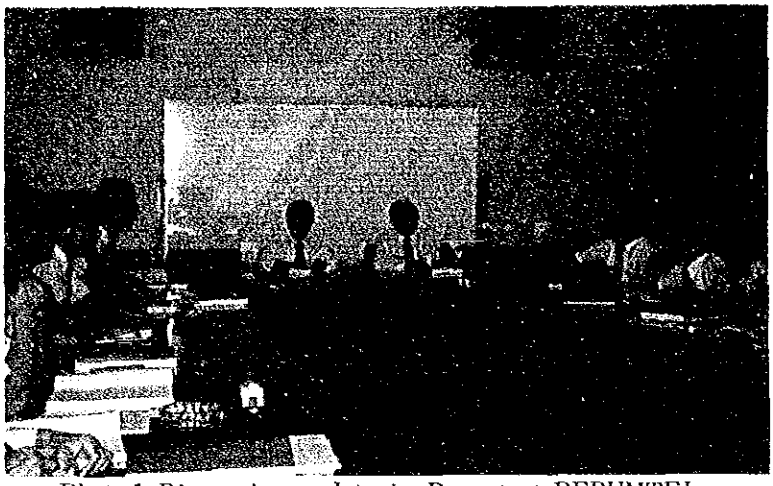


Photo.1 Discussion on Interim Report at PERUMTEL

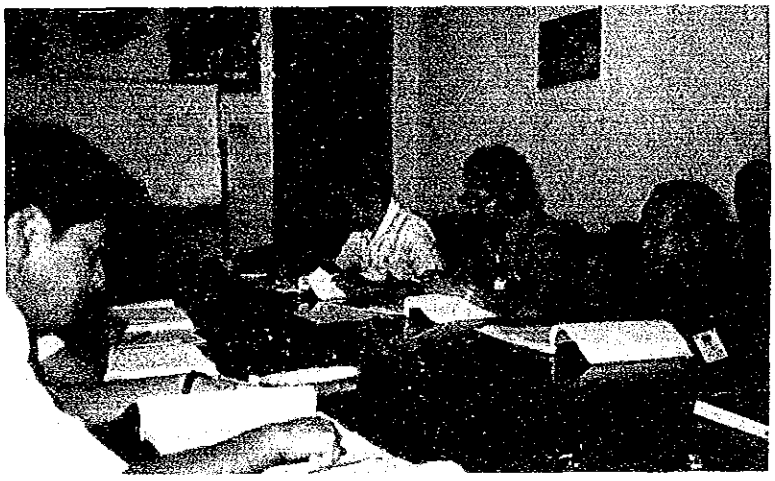


Photo.2 Discussion on Interim Report at DITJEN

Photo.3 Discussion on Final Draft Report at DITJEN POSTEL

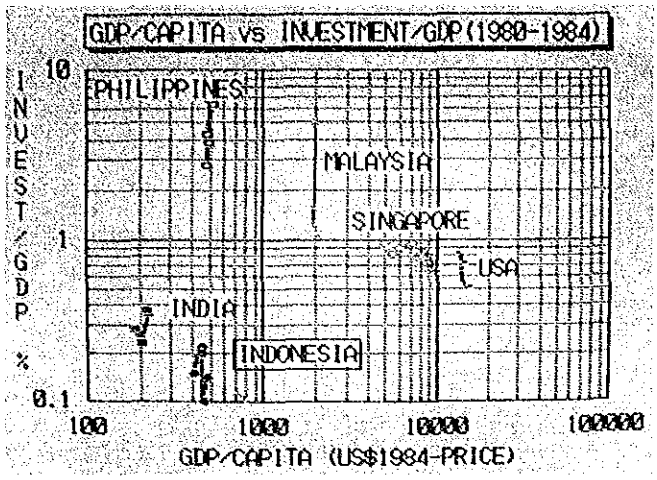



Photo.4 GDP/Capita vs. Telecommunication Investment/GDP

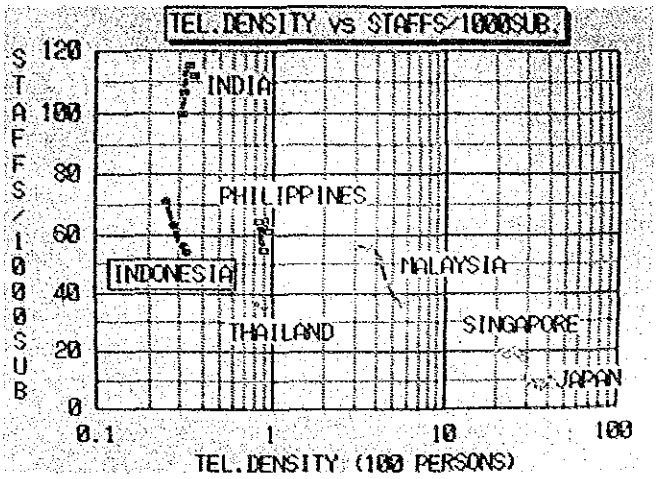



Photo.5 Telephone Density vs. Staffs/1000 Subscribers

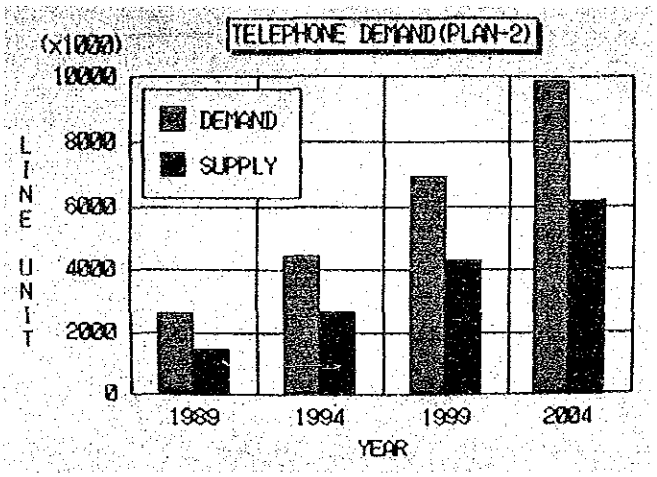



Photo.6 Telephone Demand in Indonesia (Supply Plan2)

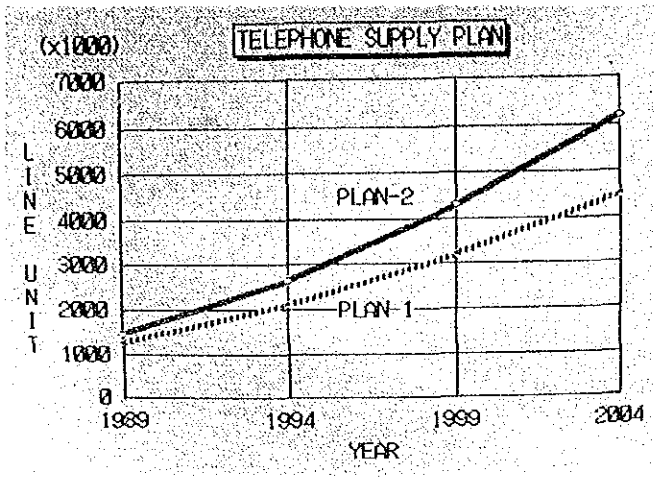



Photo.7 Telephone Service Supply Plans

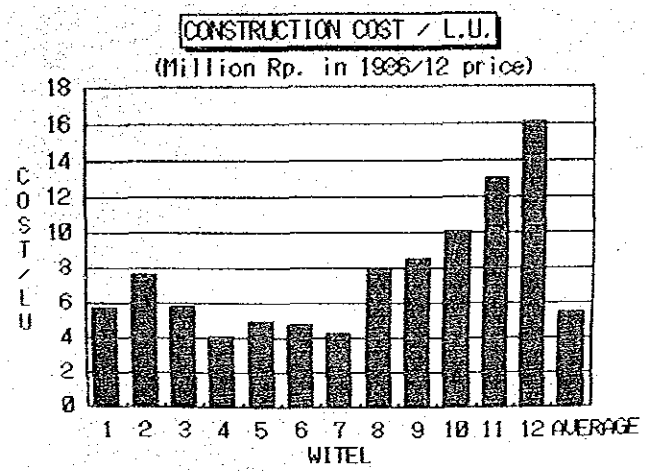



Photo.8 Construction Cost per Line Unit by WITEL

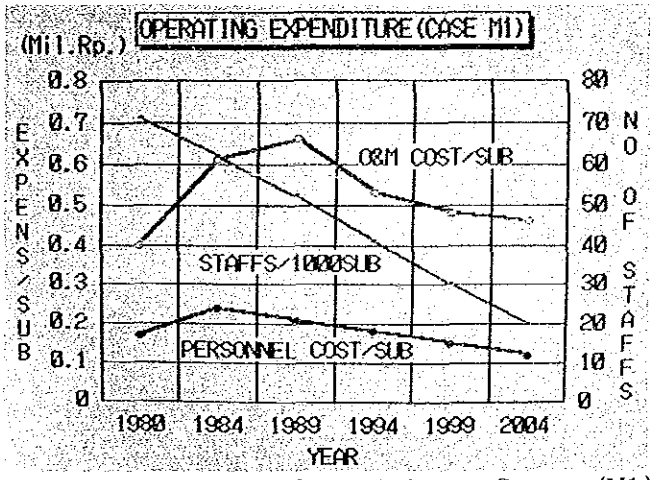



Photo.9 Operating Expenditure Reduction Strategy (M1)

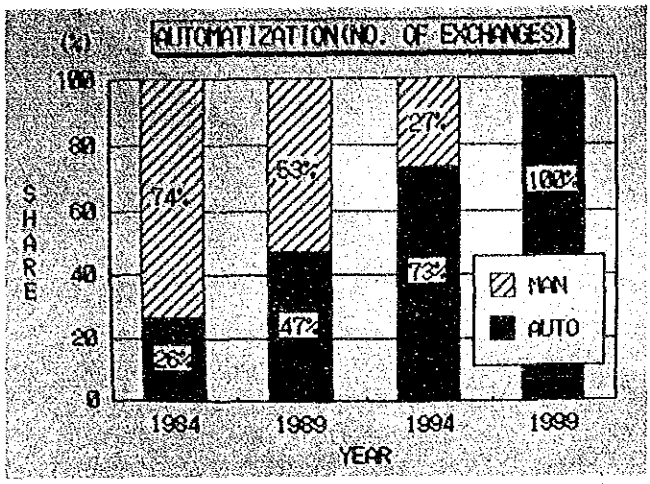



Photo.10 Automatization Plan (No. of Exchanges)

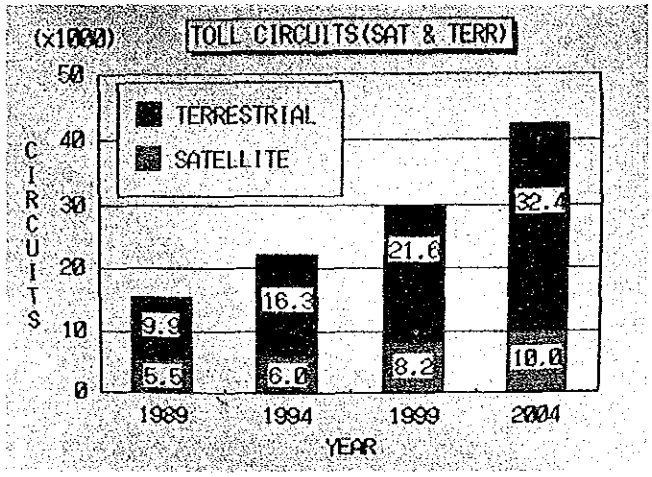



Photo.11 Toll Circuits Expansion Plan

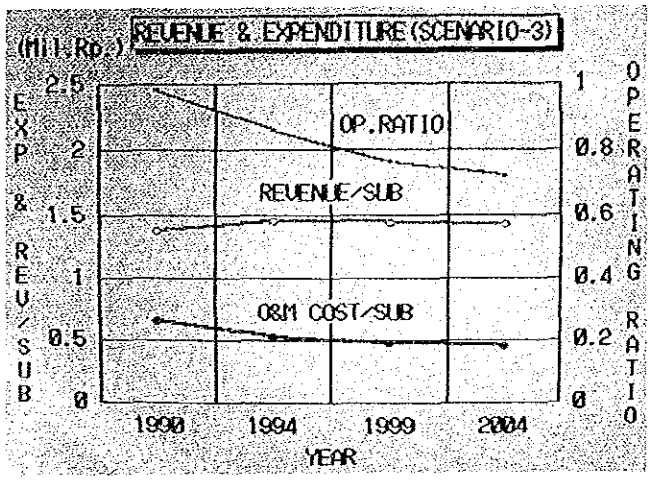



Photo.12 Revenue and Expenditure of Scenario-3

# SUMMARY AND PROPOSALS

# SUMMARY AND PROPOSALS

## 1. Background of the Study

This study was made by the Japan International Cooperation Agency (JICA) in 1986, aiming at establishing "the Long-Term Development Plan up to the Year 2004" for the domestic public telecommunications systems operated by Perusahaam Umum Telekomunikasi (PERUMTEL), the Government of Indonesia. The three key themes discussed in the study are:

1) Establishment of development objectives up to the year 2004 and study of proper strategies for them.

2) Formation of basic plans for network and facilities expansion.

3) Financial and economic evaluation of the plans and project formation.

For the above study, the following three new methods were introduced:

1) Multiple regression models to make more systematic demand forecasting.

2) Development of an econometric simulation model in evaluating financial performances of investment plans.

3) A use of the Input-Output Table in analyzing economic impacts of telecommunications development.

## 2. Development Objectives and Strategies

### (1) Objectives

Main objectives of telecommunications development in Indonesia are considered to be as follows, judging from the significance of telecommunications development and other circumferential conditions:

1) Provision of the telecommunications services which support national development (development of infrastructure).

2) Improvement of the services in quantity and quality (reduction of waiting applicants and unsuccessful calls through automatization of the services).

3) Improvement of financial conditions of PERUMTEL (promotion of self-financing capability).

Based on the above objectives and in due consideration of comparable conditions in other ASEAN nations, the individual targets to be realized in the year 2004 were determined.

Service Categories : The main body of the nationwide services consists of telephone, telegraph and telex. In the urban areas, various kinds of non-telephone services will be introduced through the realization of ISDN.

User Categories : The first priority of the service provision goes to business and official-use customers. In the urban areas, some of residential demands will also be satisfied.

Network Coverage : The networks will be developed mainly in the urban areas (Kotamadya and Kabupaten capitals), and that for telephone service will

also be expanded to each rural area (Kecamatan and Desa centers). This realizes the rural development target in the ITU Kuala Lumpur Declaration, i.e., "Telephone service shall be available within any 3 km radius for all people".

| | | |
|---|---|---|
| Telephone Density | : | 5 - 10/100 persons in the urban areas (1-3/100 persons in 1985).<br>1.8 - 2.5/100 persons in the whole nation (0.3/100 persons in 1985). |
| Waiting Periods for Subscription | : | Minimum 2 weeks, maximum 3 years in the urban areas.<br>Maximum 5 years in the rural areas. |
| Service Standard | : | The telephone service will be provided by the automatic dialing. The telegrams will be delivered in one or two days. |
| Operating Standard of PERUMTEL | : | The operating ratio after tax will be less than 0.9. The IRR of investment will be more than 18%. |

**(2) Strategies**

To achieve the development targets discussed in the previous section, the following items are studied as strategic variables.

**Investment Strategies**

- Service categories
- User categories ..... Service offering plan
- Network coverage

- Impact of economic power
- Supply speed ..... Annual supply plan

- Regional priority ..... Regional distribution plan

**Management Strategies**

- Construction costs
  Manpower development ..... Expenditure management
- Operating expenditure

- Operating revenue ..... Revenue management

- Fund source ..... Fund plan

**Technical Development Strategies**

- Network configuration ..... Network development plan

- Automatization
- Digitalization ..... Facility modernization plan

- Backbone transmission system ..... Backbone transmission system development plan

The investment strategies are studied from the national development viewpoint. The technical and management strategies are studied from the PERUMTEL management viewpoint.

An optimal combination of the supply plan, regional capacity distribution plan, expenditure management, revenue management and fund plan is determined by evaluating the financial results of the strategies simulation, of which flow is shown in Figure 1.

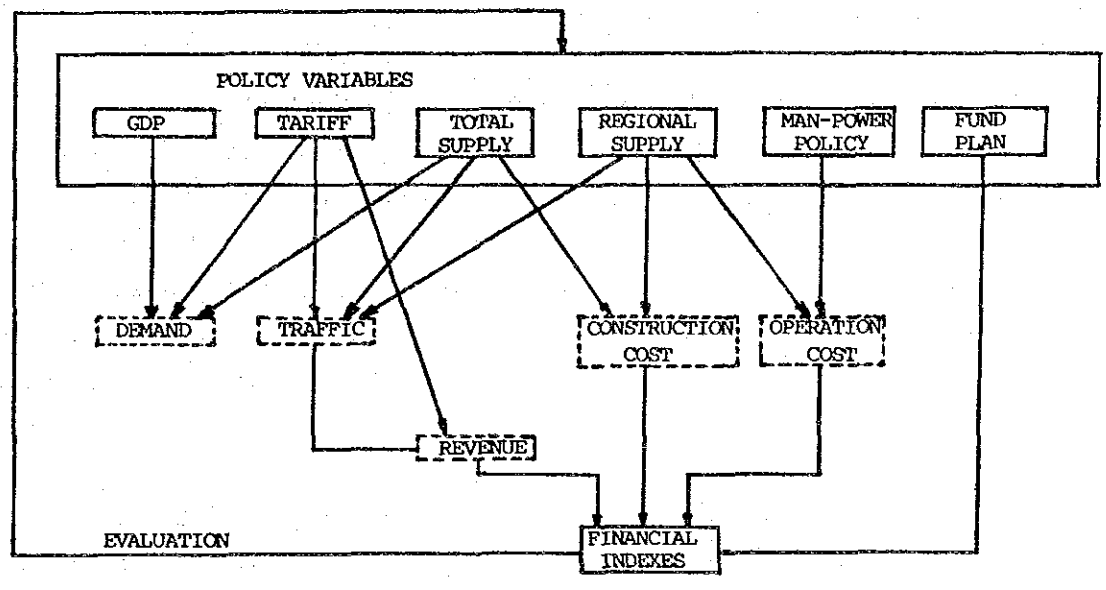



Figure 1 Strategy Simulation Flow

## 3. The Current State of Telecommunications Services

### (1) The Current State of Services

An analysis was made to examine the current state of the telecommunications services in Indonesia in comparison with other countries. The study result shows that the telephone, telegraph and telex services in Indonesia are below the average level of the services in other ASEAN countries. Even in comparison with India whose GDP per capita is one half of that of Indonesia, the telephone density of Indonesia (0.3/100 persons) is lower than that of India (0.4/100 persons).

On the other hand, some of new services such as data communication service and land mobile telephone service have already been introduced in large cities and therefore Indonesia ranks high in this field among the ASEAN countries.

Another analysis was made to examine development efforts during the past fifteen years and PELITA-IV. Under PELITA-IV, the service level is planned to be twice higher than the level at the end of PELITA-III, with a view to dramatically upgrading the service of which development level has been very low during the past fifteen years.

### (2) The Current State of PERUMTEL Management

A comparison was made with respect to economic indexes and management indexes among nine countries. It has been found that there exist many problems in service management in Indonesia. The balanced development of service management can be targeted at the current stage of Malaysia as a reasonable next development stage. (Refer to Figures 2, 3 and 4.) It has also been found that the monthly rental fee in Indonesia is about one third (1/3) of the average level of six countries as shown in Table 1.

Table 1 Telephone Service Fees (US$ in 1984)

| Country | Installation Fee | Monthly Rental Fee | GDP per Capita |
|---|---|---|---|
| Japan | 480 | 10 | 9,780 |
| Singapore | 110 | 9 | 7,260 |
| Malaysia | 130 | 10 | 2,060 |
| Thailand | 280 | 17 | 830 |
| Philippines | 100 | 14 | 410 |
| Indonesia | 180 | 3 | 480 |

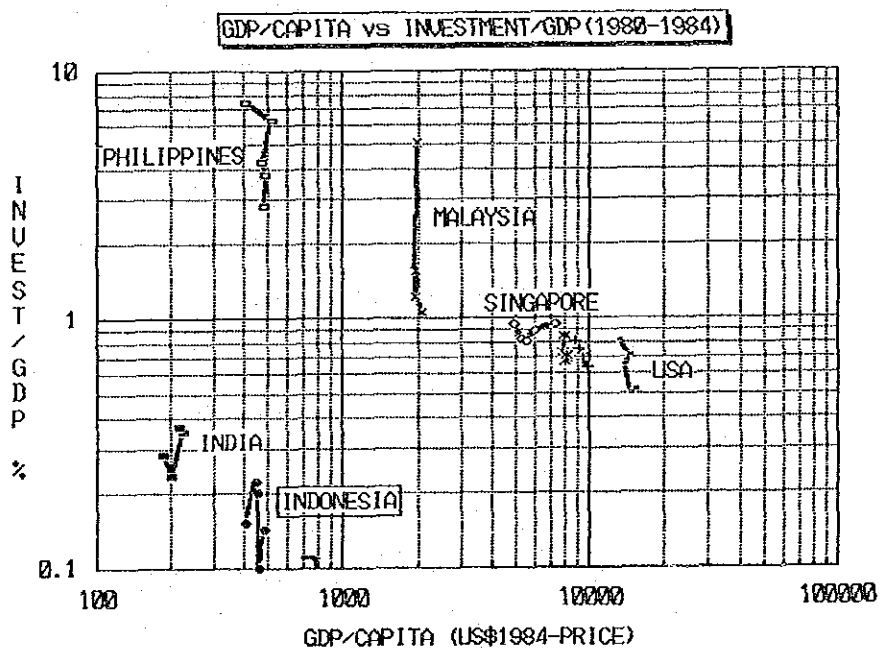



Figure 2 GDP/Capita vs. Telecommunications Investment/GDP

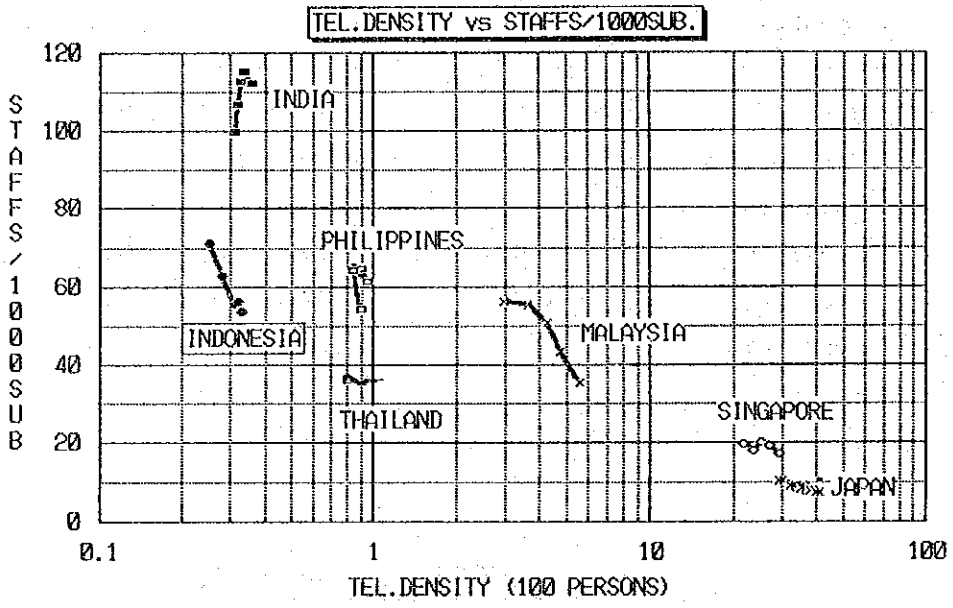



Figure 3 Telephone Density vs. Staffs/1000 Subscribers

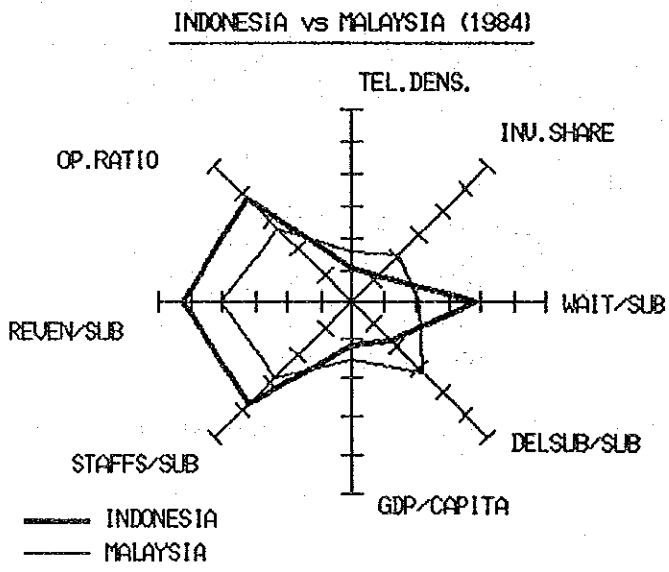



Figure 4 Comparison between Indonesia and Malaysia

## 4. Telecommunications Services Subscribers Demand Forecasts

### (1) Telephone Services Subscriber Demands

A forecasting model was developed, based on the data of the twenty countries during the past ten years to predict the number of potential subscribers of the telephone service. The telephone service subscriber demand tends to increase when the supply volume (the number of actual subscribers) increases due to the new demand creating effect. Hence, forecasting was made for the three cases having different supply volumes. Also taken into consideration was the fact that the telephone demand relates to tariff and GDP growth rate.

Table 2 shows the telephone demand forecasts made for three cases, i.e., Plan 1, Plan 2 and Plan 3, on an assumption that the tariff system is the same as the present one and the GDP growth rate is 5%.

Table 2 Telephone Service Demands in Indonesia

(Unit: 1000 L.U.)

| Supply Plan | Item | Year 1989 | 1994 | 1999 | 2004 |
|---|---|---|---|---|---|
| Plan 1 | Telephone Demand | 2,330 | 3,709 | 5,496 | 7,633 |
| | Supply Volume | 1,250 | 2,100 | 3,200 | 4,500 |
| Plan 2 | Telephone Demand | 2,584 | 4,431 | 6,930 | 9,872 |
| | Supply Volume | 1,450 | 2,650 | 4,300 | 6,200 |
| Plan 3 | Telephone Demand | 2,833 | 5,074 | 8,300 | 12,345 |
| | Supply Volume | 1,650 | 3,150 | 5,400 | 8,200 |

Even in Plan-3, the telephone demand still greatly exceeds the supply volume (the number of actual subscribers).

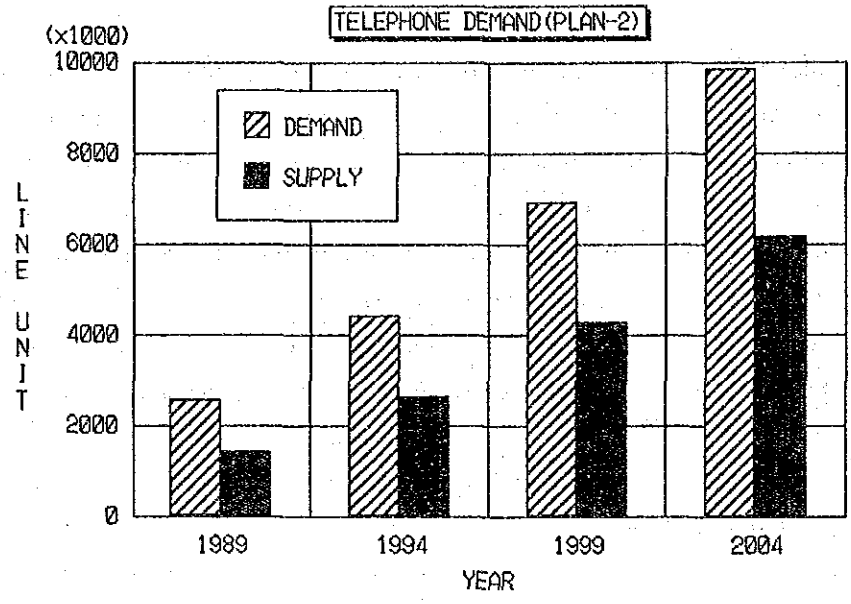



Figure 5 Telephone Service Demand in Indonesia

The sensitivity of demand variation due to variations of GDP growth rate and tariff system is not so high as follows:

1) GDP growth rate = 5% to 3%: Demand Change = about 6% down.
2) Installation fee = 20% up : Demand Change = about 3% down.

**(2) Non-Telephone Services Subscriber Demands**

The forecasted potential number of subscribers for each non-telephone service category is as shown in Table 3, when capacity expansion of the telephone service is carried out according to the Supply Plan 2 with the 5% GDP growth rate.

Table 3 Non-Telephone Services Demand in Indonesia

(Unit: L.U.)

| Service Category | 1989 | 1994 | 1999 | 2004 |
|---|---|---|---|---|
| Telex | 25,000 | 39,000 | 60,000 | 84,000 |
| Data Communication | 750 | 2,100 | 4,400 | 7,800 |
| Facsimile | 7,000 | 27,000 | 65,000 | 124,000 |
| Radio Paging | 55,000 | 101,000 | 163,000 | 236,000 |
| Land-Mobile Telephone | 7,000 | 10,000 | 12,000 | 15,000 |

It is assumed that the telex service subscribers will be partially switched to the data communications service subscribers and the facsimile service subscribers.

## 5. Telecommunications Traffic Forecasts

### (1) Telephone Service Traffic

The total volume of the nationwide toll telephone service traffic flow in the case of Supply Plan 1 and Supply Plan 2 was estimated as follows:

Table 4 Toll Telephone Service Traffic in Indonesia

| Supply Plan | Item | 1989 | 1994 | 1999 | 2004 |
|---|---|---|---|---|---|
| Plan 1 | Subscribers (x1000) | 990 | 2,100 | 3,200 | 4,500 |
| | Total Traffic (Erl) | 10,100 | 18,200 | 29,200 | 42,900 |
| | Traffic/Subs (mErl) | 8.1 | 8.7 | 9.1 | 9.5 |
| Plan 2 | Subscribers (x1000) | 1,130 | 2,650 | 4,300 | 6,200 |
| | Total Traffic (Erl) | 12,000 | 23,600 | 40,800 | 61,600 |
| | Traffic/Subs (mErl) | 8.3 | 8.9 | 9.5 | 9.9 |

Most of the current telephone service customers are business customers in Indonesia. This trend seems to continue for a while. This indicates that traffic per subscriber still tends to increase as the number of subscribers increases.

### (2) Telegraph Service Traffic

Telegraph service traffic in Indonesia is still increasing. Traffic in 1994 was estimated to be 6.5 telegrams/100 persons and that in 2004, 8 telegrams/100 persons.

### (3) Telex Service Traffic

The nationwide telex service traffic is forecasted to increase by 7% per year. The traffic per subscribers, however, is forecasted to decrease to 39,800 pulses/year in 1994 from 57,910 pulses/year in 1984.

## 6. Investment Strategies

### (1) Telephone Service Supply Plan

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

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

In view of the above reason, two supply plans according to the possible GDP growth rates in the year 2004 are proposed in Table 5 (Proposal #1).

Table 5 Telephone Supply Targets in 2004

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

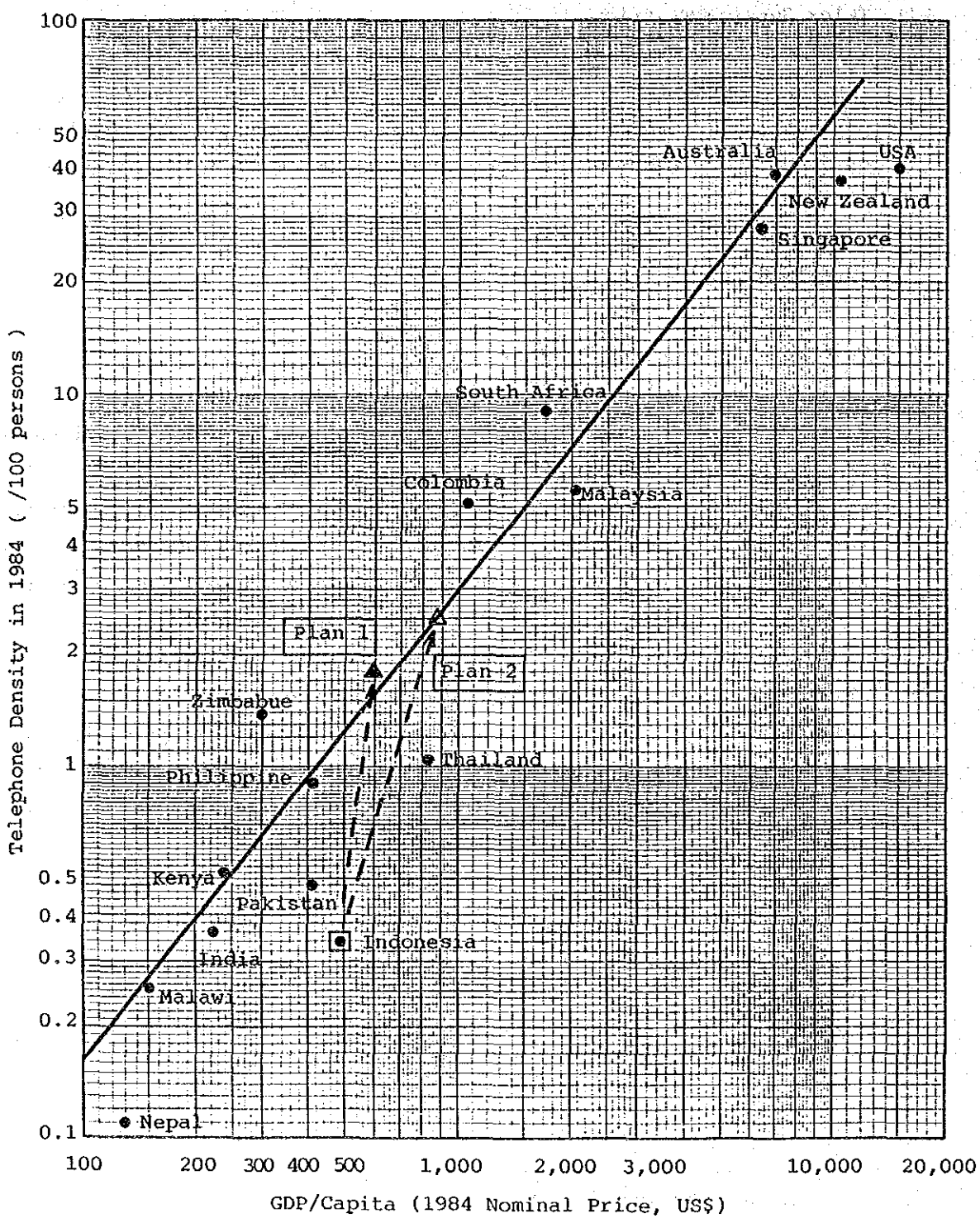



Figure 6 Telephone Density and GDP/Capita of the Countries in the World

Supply plans for every five years which are designed to realize the above targets are proposed in Table 6 and Figure 7.

Table 6 Telephone Service Supply Plans (Nationwide)

(Unit: 1000 L.U.)

| Plan | Item | PELITA-IV (1989) | REPELITA-V (1994) | REPELITA-VI (1999) | REPELITA-VII (2004) |
|---|---|---|---|---|---|
| 1 | Telephone Demand | 2,330 | 3,709 | 5,496 | 7,633 |
| | Additional Capacity | 550 | 850* | 1,100 | 1,300 |
| | Total Capacity | 1,250 | 2,100 | 3,200 | 4,500 |
| | Line Unit/100 persons | 0.70 | 1.06 | 1.46 | 1.84 |
| | Capacity/Demand | 0.54 | 0.57 | 0.58 | 0.59 |
| 2 | Telephone Demand | 2,584 | 4,431 | 6,930 | 9,872 |
| | Additional Capacity | 750 | 1,200* | 1,650 | 1,900 |
| | Total Capacity | 1,450 | 2,650 | 4,300 | 6,200 |
| | Line Unit/100 persons | 0.73 | 1.33 | 1.96 | 2.54 |
| | Capacity/Demand | 0.56 | 0.60 | 0.62 | 0.63 |
| | Population | 179,000 | 199,000 | 219,000 | 244,000 |

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

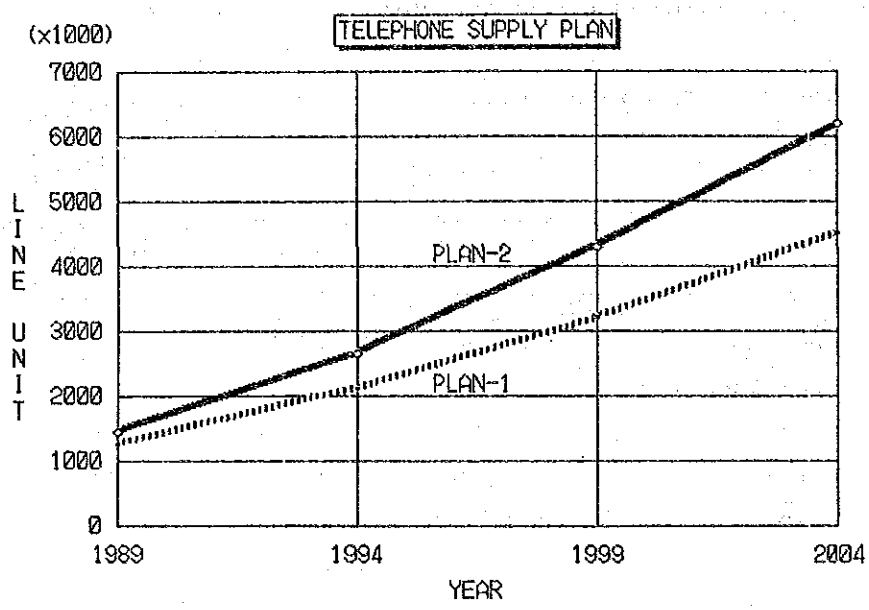



Figure 7 Telephone Service Supply Plans

**(2) Non-Telephone Services Supply Plan**

The non-telephone services will be provided to satisfy the demands in the urban areas. The supply plan in the case of 5% GDP growth rate is proposed as shown in Table 7 (Proposal #2).

Table 7 Non-Telephone Service Supply Plan (Nationwide)

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

For the case of 3% GDP growth, expansion should be scaled down by 20 - 30% of the above proposal.

### (3) Regional Capacity Distribution

In addition to the Strategy A2 in which regional capacity distribution is carried out in such a way as to maintain, even in the future, the WITELs capacity share realized at the end of PELITA-IV (shown in Figure 8), the following two strategies were considered:

1) To improve financial performances through increasing the capacity expansion in the 6 highest profitable regions (WITELs which include Medan, Palembang, Jakarta, Bandung, Semarang, Surabaya) by 20%, and decreasing the capacity expansion in other regions by 20%. (Strategy A1)

2) To realize balanced national development through decreasing the capacity expansion in the Jakarta area by 20% and making the telephone density in other regions uniform. (Strategy A3)

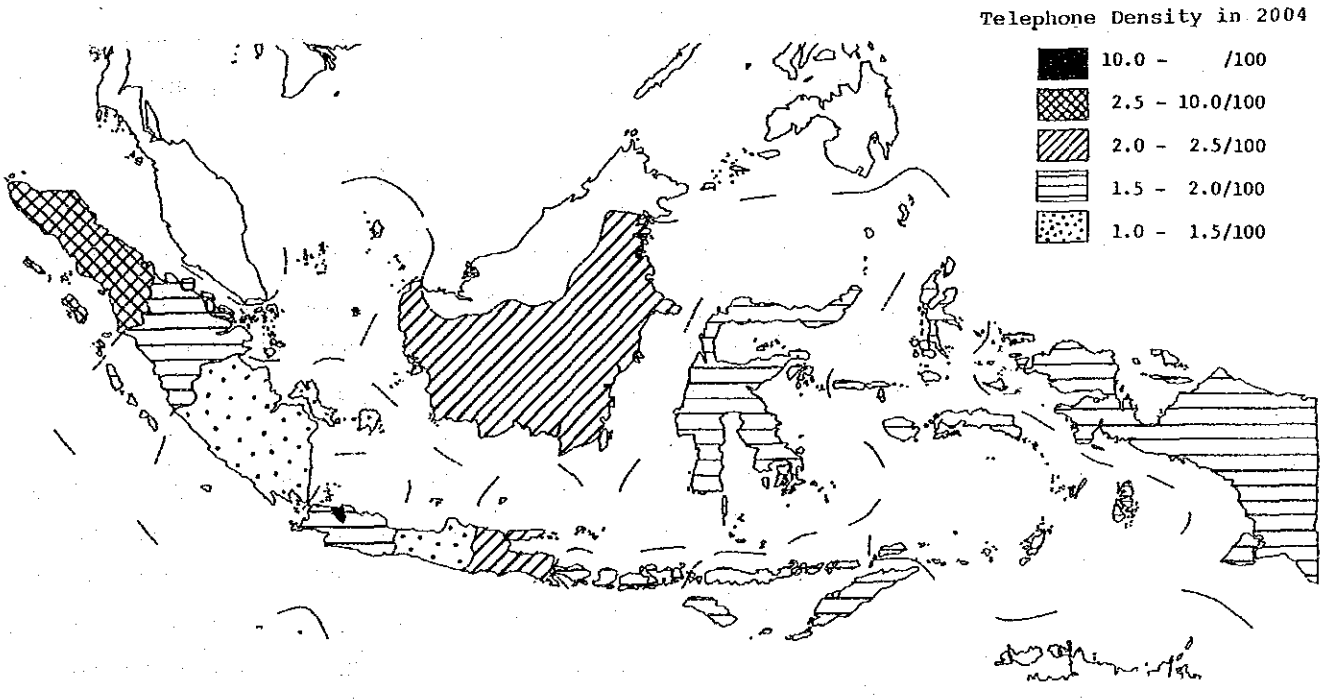



Figure 8 Telephone Supply by WITEL (Strategy A2)

## 7. Management Strategies

### (1) Expenditure Management

As a result of analyzing the asset data of the past ten years, the future construction costs were estimated to be Rp. 4 Million per L.U. in Jakarta, the least expensive area, and Rp. 16 Million per L.U. in Irian Jaya, the most expensive area as shown in Figure 9. The estimated total construction costs for each REPELITA are as follows:

Table 8 Investment Costs of REPELITA-V, VI and VII
(December 1986 price)

| Plan | Item | REPELITA-V | REPELITA-VI | REPELITA-VII |
|---|---|---|---|---|
| Plan 1 and A2 | Telephone Expansion Capacity (1000 L.U.) | 850 | 1,100 | 1,300 |
| | Total Cost (Billion Rp.) | 5,267 | 6,816 | 8,055 |
| Plan 2 and A2 | Telephone Expansion Capacity (1000 L.U.) | 1,200 | 1,650 | 1,900 |
| | Total Cost (Billion Rp.) | 7,430 | 10,217 | 11,765 |

As a result of analyzing the operation expenditure data of the past five years, it has been found that the O&M costs per subscriber have been increasing, although the number of staffs per subscriber has been decreasing. If this trend continues in the future, the O&M costs per subscriber will be Rp. 1.0 Million in 1994 and Rp. 1.5 Million in 2004. These figures exceed the revenue per subscriber, which will be discussed later. The increasing O&M costs must be controlled by technology development and management efforts by PERUMTEL. One of such efforts was quantified as the Strategy M1 in which the number of staffs per 1,000 L.U. is reduced to 20 and the O&M cost per subscri-ber is reduced to Rp. 0.4 Million, as shown in Figure 10.

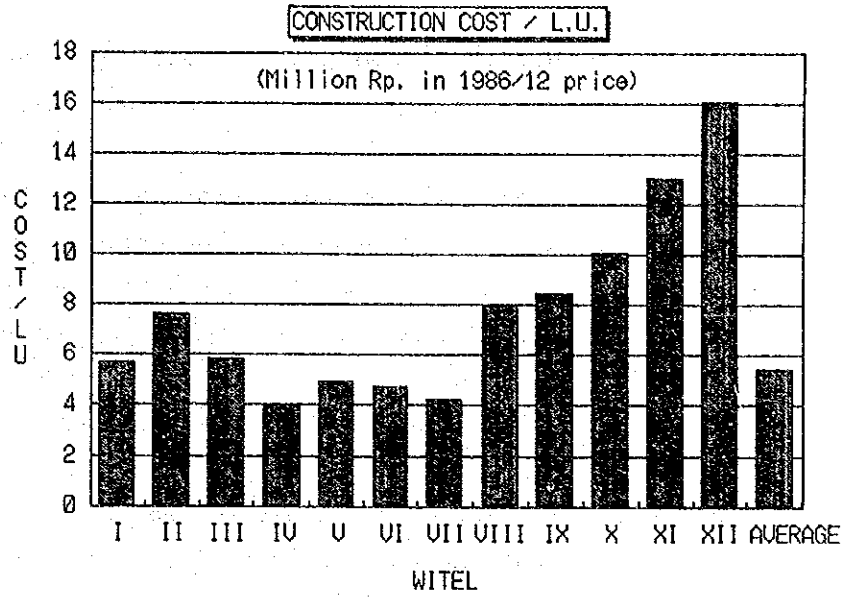



Figure 9 Construction Costs in the WITELs (December 1986 price)

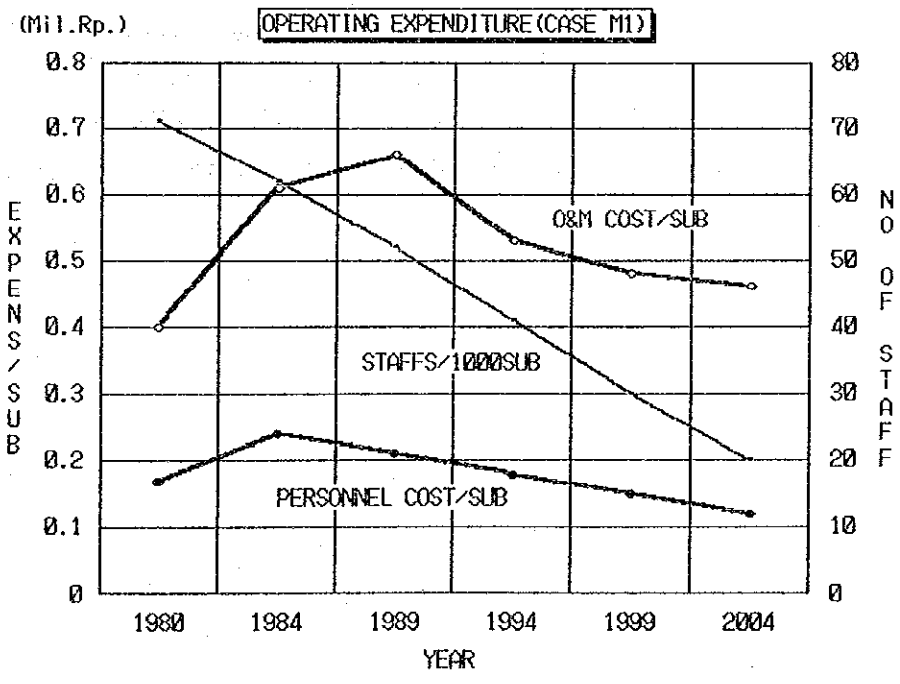



Figure 10 Operating Expenditure Reduction Strategy (M1)

(2) Revenue Management

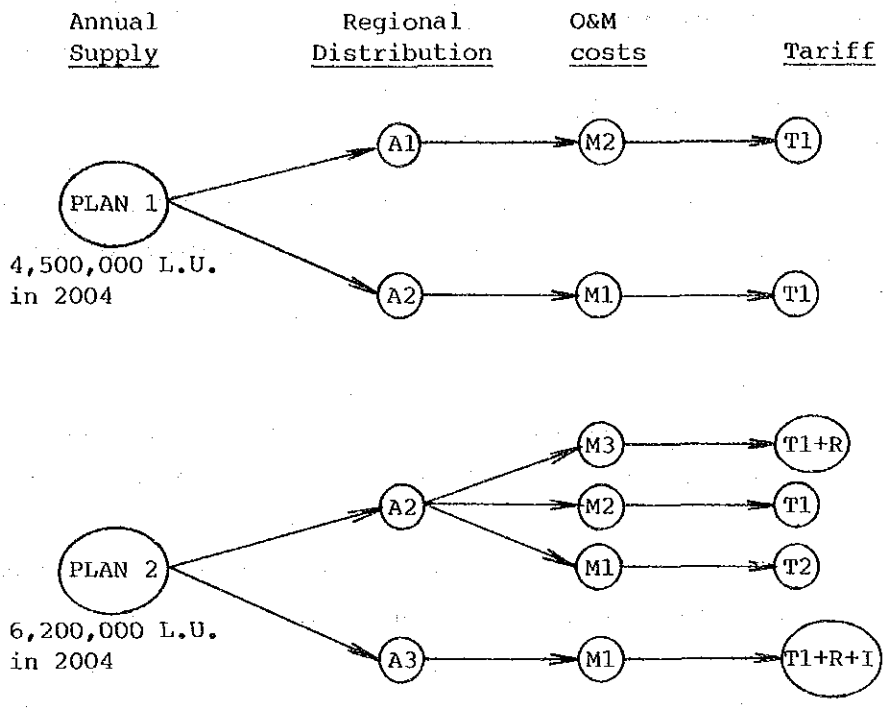
The 90% of total revenue of PERUMTEL is currently generated by the telephone service. This trend is expected to continue in the future.

When the telephone density is low and, therefore, the share of the business customers is large, the revenue per subscriber increases as the number of the telephone subscriber increases because traffic per subscriber also increases. The revenue from one telephone subscriber in 1994 is estimated to be Rp. 1.3 Million and that in 2004, Rp. 1.4 Million, in case the current tariff system is maintained.

Since it was found to be quite difficult to improve the PERUMTEL's financial condition without changing the tariff system, some strategies on tariff changes were also considered. For example, the call fee increase from Rp. 75/pulse to Rp. 85/pulse (Strategy T1) will increase revenue by 13%.

(3) The Results of Strategies Simulation

Several simulation studies were conducted by making several combinations of investment and management strategies. The results were evaluated by financial indexes. As a result, the combinations of the strategies shown in Figure 11 were found feasible.




Note

| | | |
|---|---|---|
| A1 | : | Capacity expansion in the six major cities |
| A2 | : | Capacity expansion in line with PELITA-IV capacity expansion plan |
| A3 | : | Equal capacity distribution in all the WITELs except Jakarta |
| M1 | : | 20 staffs/1000 L.U. |
| M2 | : | 30 staffs/1000 L.U. |
| M3 | : | 40 staffs/1000 L.U. |
| T1+R+I | : | Increase of the call, monthly rental, installation fees |
| T1+R | : | Increase of the call and monthly rental fees |
| T1 | : | Increase of the call fee (Rp. 85/pulse) |
| T2 | : | Increase of the call fee during REPELITA-V only (Rp. 85/pulse during REPELITA-V) (Rp. 75/pulse after REPELITA-V) |

Figure 11 Feasible Combinations of Strategies

## 8. Technical Development Strategies

### (1) Network Integration Plan

Figure 12 shows the network integration plan up to the year 2004. This plan was formed on the basis of the following policies (Proposal #3):

1) To provide full scale ISDN in 2000.
2) Expansion of the existing analog system will be stopped in PELITA-IV. Only digital system will be constructed in and after REPELITA-V.
3) Circuit switched data communication service is to be provided by ISDN in large cities, and no dedicated network will be constructed.
4) Video communication service is to be provided by leased lines for the time being and switched type service will be provided after the year 2000.

### (2) Facility Modernization Plan

The facilities must be modernized to improve the quality of the services and to establish ISDN. The facility modernization shall be promoted by automatization and digitalization of the system.

The automatization plan is shown in Figure 13. The digitalization plan for switching systems up to the year 2004 is proposed as follows:

| Type of Switch | 1989 | 1994 | 1999 | 2004 |
|---|---|---|---|---|
| Analog Switch | 46% | 28% | 7% | 0% |
| Digital Switch | 54% | 72% | 93% | 100% |

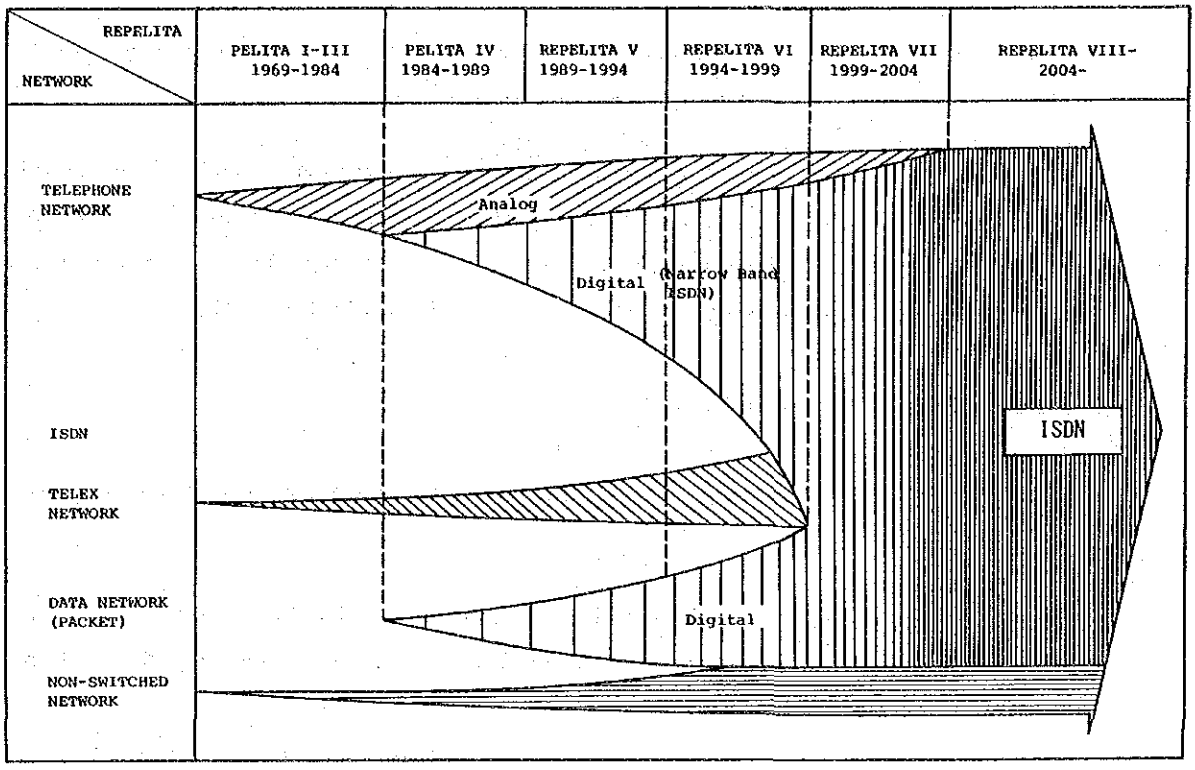



Figure 12 Network Integration Plan

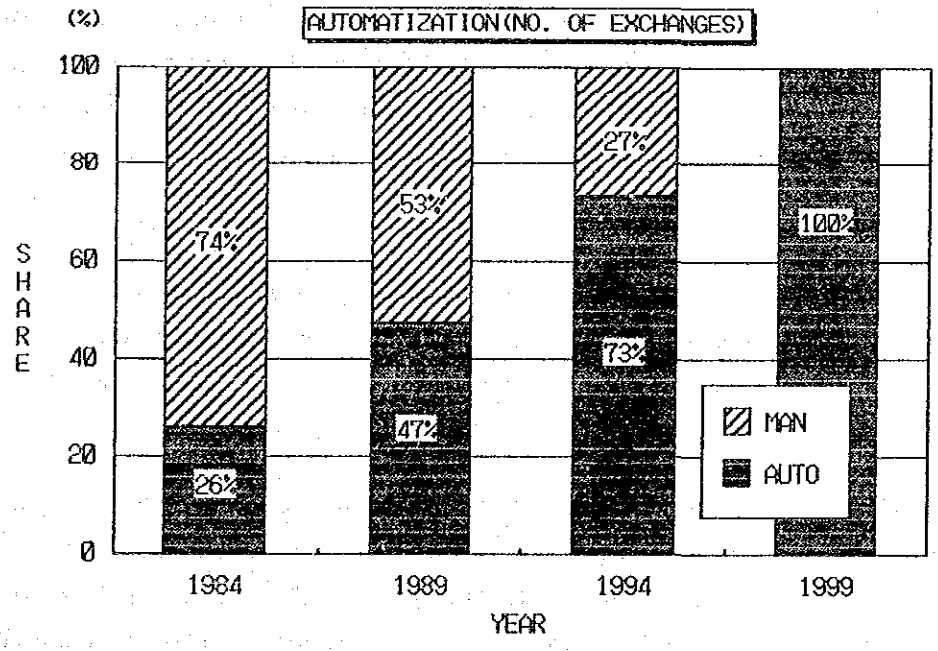



Figure 13 Automatization Plan

Digitalization of transmission systems also has to be promoted together with digitalization of switching systems.

For the urban areas with automatized analog system, digital network will be overlaied to expand the network (Overlay Method). For the rural areas with only manual system, automatization for each unit area will be promoted by digital system (Islands Method).

**(3) Backbone Transmission System**

The basic principles for backbone transmission system expansion are as follows:

1) To increase the reliability of the network, two-route system by terrestrial and satellite transmission shall be employed to link the Secondary Centers.
2) TV program transmission through terrestrial system to all the Province capitals shall be available at the earliest possible time.
3) Two terrestrial transmission routes shall be provided for links having high traffic flow.
4) Ring-belt structure by terrestrial routes (terrestrial transmission route which resembles a belt made by connected loops) for links having high traffic flow that connects islands, and cities within island shall be employed to make detouring possible in case of emergency.

It is proposed by costs analysis that the toll circuits shall be mainly distributed to satellite systems for long distance (more than 1500 - 2750 km) transmission and to terrestrial systems for short distance (less than 1500 - 2750 km) transmission.

Figure 14 shows the toll circuits distribution between satellite and terrestrial systems within the capacity limit of satellite systems. As can be seen from Figure 14, the share of terrestrial systems in handling traffic needs to be gradually expanded after PELITA-IV.

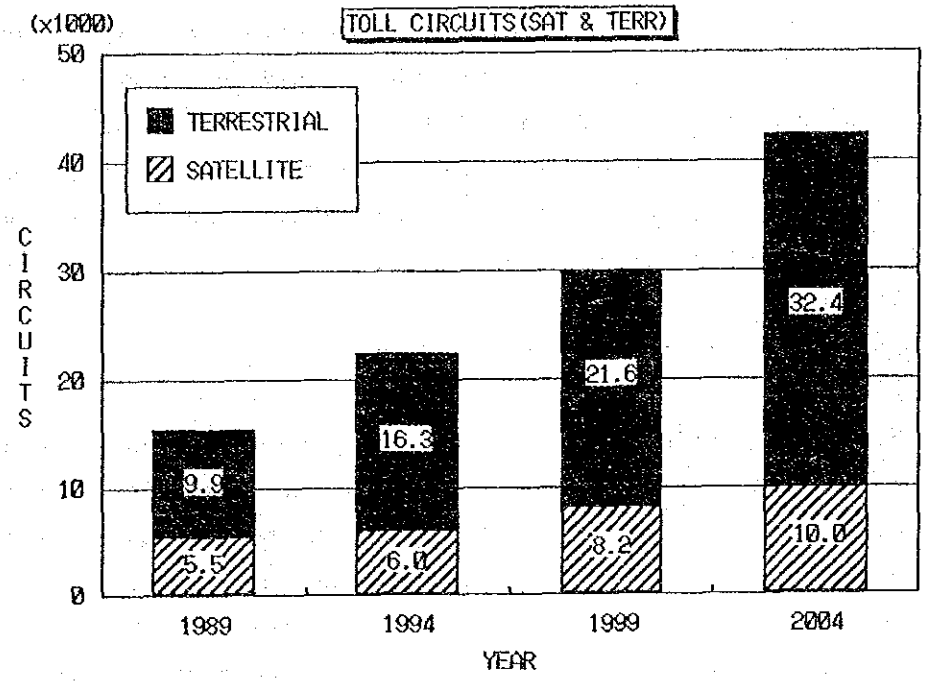



Figure 14 Distribution Plan of Toll Circuits between Terrestrial and Satellite Systems

## 9. Development Scenarios

### 9-1 Optimum Development Scenarios

The four optimum development scenarios based on the simulation results and the technical development strategies discussed in Section 8 are proposed as follows (Proposal #4):

**(1) Scenario 1 (Optimum Scenario on Plan 1)**

This is the optimum scenario when the GDP growth rate is 3% per year. The capacity will be expanded in such a way as to maintain the regional capacity distribution pattern realized at the end of PELITA-IV. The number of staff personnel must be reduced to 20 staffs/1000 L.U. by the year 2004, which will enable to decrease the O&M costs remarkably. The call fee will be increased to Rp. 85/pulse to increase the revenue.

(2) Scenario 2 (Alternative Scenario on Plan 1)

This is the second best alternative scenario for 3% GDP annual growth rate. The capacity will be expanded mainly in six major cities. In so doing, the number of staff personnel will be reduced to 30 staffs/1000 L.U. by the year 2004. Such profitability improvement efforts by PERUMTEL will be assisted by a revenue increase through the call fee increase to Rp. 85/pulse.

(3) Scenario 3 (Optimum Scenario on Plan 2)

This is the optimum scenario when if the GDP growth rate is 5% per year. The capacity will be expanded by the same distribution pattern realized at the end of PELITA-IV. The number of staff personnel will be reduced to 20 staffs/1000 L.U. by the year 2004 in order to reduce the O&M costs. The call fee will be increased to Rp. 85/pulse only during the period of REPELITA-V but can be decreased to the present level of Rp. 75/pulse by the year 2004.

(4) Scenario 4 (Alternative Scenario on Plan 2)

This is the second best alternative scenario for 5% GDP annual growth rate, to be applied when the number of staff personnel is reduced to only 30 staffs/1000 L.U. by the year 2004. The call fee must be increased to Rp. 85/pulse and will be kept at that level until the year 2004.

Table 9 shows the details of Scenario-1 and Table 10, Scenario-3. Figure 15 and Figure 16 show respective annual variations of revenues and expenditures.

Table 9 Development Scenario-1 (Optimum Scenario on Plan-1)

| Strategy Item | | REPELITA-V (1989-1994) | REPELITA-VI (1994-1999) | REPELITA-VII (1999-2004) |
|---|---|---|---|---|
| Investment Strategy | Service categories | Mainly telephone/telegraph | (Same as REPELITA-V) | Introduction of ISDN |
| | User categories | Social/Business | Social/Business | Social/Business/Residence |
| | Network coverage | To all Kabupaten capitals | To major Kecamatan capitals | To all Desa centers |
| | Supply volume | 850,000/2,100,000 L.U. | 1,100,000/3,200,000 L.U. | 1,300,000/4,500,000 L.U. |
| | Regional distribution | Share of PELITA-IV | (Same as REPELITA-V) | (Same as REPELITA-V) |
| Management Strategy | O&M costs/subscriber | Million Rp. 0.52 | Million Rp. 0.44 | Million Rp. 0.40 |
| | Staffs/1000 L.U. | 41 staffs | 30 staffs | 20 staffs |
| | Tariff System: | | | |
| | Installation fee | No change | No change | No change |
| | Monthly rental fee | No change | No change | No change |
| | Call fee | Rp. 85/pulse | Rp. 85/pulse | Rp. 85/pulse |
| | Government equity | 10% of required fund | 10% of required fund | Not required |
| | External fund | 50% of required fund | 15% of required fund | 15% of required fund |
| Technical Development Strategy | Network integration | Independent | Integrate Telex to Telephone | Full integration |
| | Automization & Digitalization | Up to middle cities | Up to small cities | Full automatization & digitalization |
| | Terrestrial share | 73% | 72% | 76% |
| | Satellite share | 27% | 28% | 24% |

Note: The supply volume shows Additional telephone capacity/Total telephone capacity. The December 1986 base price is used for costs and fees.

Table 10 Development Scenario-3 (Optimum Scenario on Plan-2)

| Strategy Item | | REPELITA-V (1989-1994) | REPELITA-VI (1994-1999) | REPELITA-VII (1999-2004) |
|---|---|---|---|---|
| Investment Strategy | Service categories | Mainly telephone/telegraph | (Same as REPELITA-V) | Introduction of ISDN |
| | User categories | Social/Business | Social/Business | Social/Business/Residence |
| | Network coverage | To all Kabupaten capitals | To major Kecamatan capitals | To all Desa centers |
| | Supply volume | 1,200,000/2,650,000 L.U. | 1,650,000/4,300,000 L.U. | 1,900,000/6,200,000 L.U. |
| | Regional distribution | Share of PELITA-IV | (Same as REPELITA-V) | (Same as REPELITA-V) |
| Management Strategy | O&M costs/subscriber | Million Rp. 0.53 | Million Rp. 0.48 | Million Rp. 0.46 |
| | Staffs/1000 L.U. | 41 staffs | 30 staffs | 20 staffs |
| | Tariff System: | | | |
| | Installation fee | No change | No change | No change |
| | Monthly rental fee | No change | No change | No change |
| | Call fee | Rp. 85/pulse | Rp. 80/pulse | Rp. 75/pulse |
| | Government equity | 10% of required fund | 10% of required fund | Not required |
| | External fund | 60% of required fund | 45% of required fund | 30% of required fund |
| Technical Development Strategy | Network integration | Independent | Integrate Telex to Telephone | Full integration |
| | Automization & Digitalization | Up to middle cities | Full automatization & digitalization | (Same as REPELITA-VI) |
| | Terrestrial share | 73% | 72% | 76% |
| | Satellite share | 27% | 28% | 24% |

Note: The supply volume shows Additional telephone capacity/Total telephone capacity. The December 1986 base price is used for costs and fees.

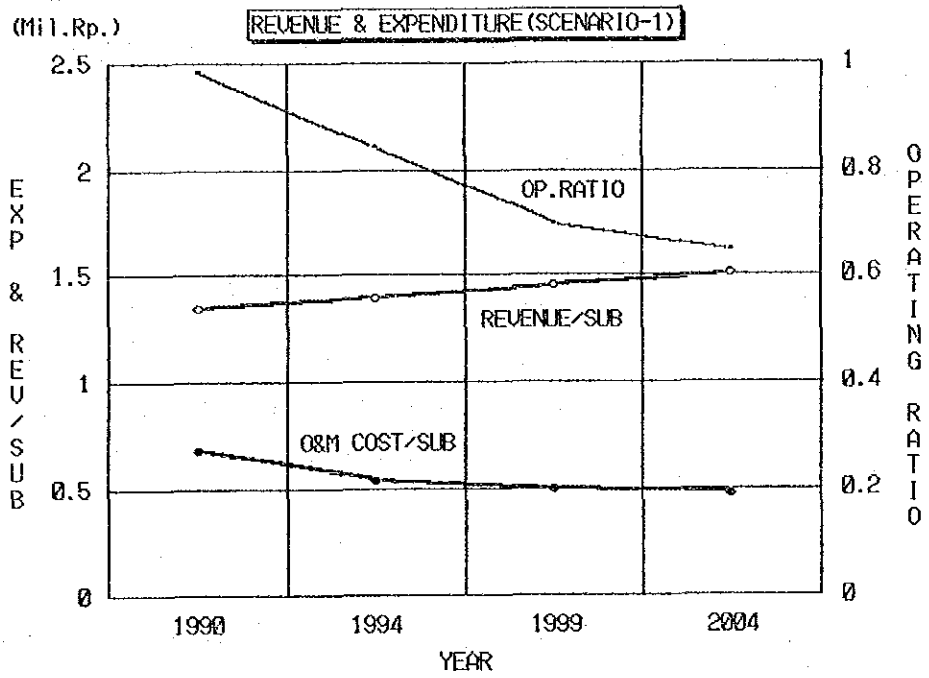



Figure 15 Revenue/Expenditure Forecast of Scenario-1

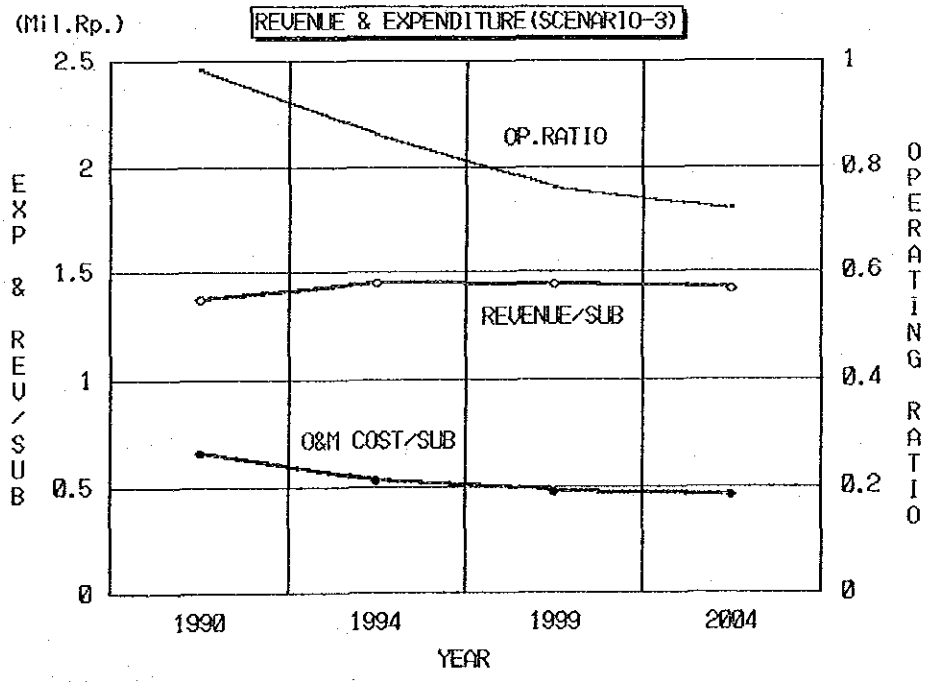



Figure 16 Revenue/Expenditure Forecast of Scenario-3

## 10. Facility Expansion Plan

The following is a facility expansion plan in the case of the 5% GDP growth rate:

### (1) Network Plan

1) Telephone Network

TCs and SCs can be integrated into one hierarchy in 2004 to achieve efficient utilization of the long distance transmission network in order to meet the toll traffic increase.

2) Telex Network

The network will be integrated into the digital telephone network during REPELITA-VI.

3) Packet Switched Data Communication Network

The SKDP packet switched data communication network will be expanded to accommodate the increased demand. The existing PACKSATNET system will be integrated into the packet switched data communication network.

### (2) Telephone Service Facility

1) Capacity

The capacity will be expanded to 2,650,000 in 1994, 4,300,000 in 1999, and 6,200,000 in 2004.

2) Telephone Exchanges

The number of telephone exchanges will be expanded to 836 in 1994, 969 in 1999 and 1,132 in 2004.

### (3) Non-Telephone Service Facilities

1) Telegraph Service Facility

Quick delivery service will be available in all the Kecamatan capitals by 1994 and in all Desa by 2004. The required number of telegraph offices will be 1,000 in 1994, 2,000 in 1999 and 3,500 in 2004.

2) Other Non-Telephone Service Facilities

| Category | REPELITA-V | REPELITA-VI | REPELITA-VII |
|---|---|---|---|
| Telex | 32,000 L.U. | Integrated into the telephone network | Integrated into the telephone network |
| Packet Data | 2,100 L.U. | 4,400 L.U. | 7,800 L.U. |
| Radio Paging | 44,000 L.U.<br>Jakarta<br>Surabaya<br>Bandung<br>Medang<br>Semarang | 80,000 L.U.<br>Ujung Pandang<br>Palembang<br>Malang<br>(new introduction) | 126,000 L.U.<br>Yogyakarta<br>Banjar Masin<br>Denpasar<br>Cirebon<br>(new introduction) |
| Land-Mobile Telephone | 14,500 L.U.<br>Jakarta<br>Surabaya<br>Bandung<br>Semarang | 15,500 L.U.<br>the same cities as those of REPELITA-V. | 16,000 L.U.<br>the same cities as those of REPELITA-V. plus Medan (new introduction) |
| ISDN | Narrow Band<br>Jakarta<br>Surabaya<br>Bandung<br>Medan | Narrow Band<br>the same cities as those of REPELITA-V. | Wide Band<br>Jakarta<br>Surabaya<br>Bandung<br>Medan |

Note: For telex and land-mobile telephone services, the capacity is not same as Table 7 considering the existing capacity.

### (4) Long Distance Transmission Facility

1) Terrestrial Transmission System

Figure 17 shows a proposed long-term backbone terrestrial transmission system plan (Proposal #5). Section 10-3-1 of this report discusses three expansion plans of backbone terrestrial transmission systems for every five years up to the year 2004.

2) Satellite Transmission System

As a result of examining satellites launching plans and earth stations construction plans, about 250 earth stations are proposed to be needed in 2004 as shown in Figure 18 (Proposal #6).

### (5) Manpower Training and Maintenance Center Facility

1) Manpower Training Facility

When the telephone service capacity is expanded to 6,200,000 L.U. by 2004, and the staffing rate is reduced to 20 staffs per 1000 subscribers, one third (1/3) of the current rate, 84,000 new staffs must be employed in fifteen years.

That is,

$$\underset{\text{(new)}}{84{,}000 \text{ staffs}} = \left(6{,}200{,}000 \text{ L.U.} \times \frac{20 \text{ staffs}}{1000}\right) - \underset{\text{(present)}}{40{,}000 \text{ staffs}}$$

This figure implies that 5,000 - 6,000 new staffs must be trained every year. Therefore, the education and training facilities of PERUMTEL must be expanded.

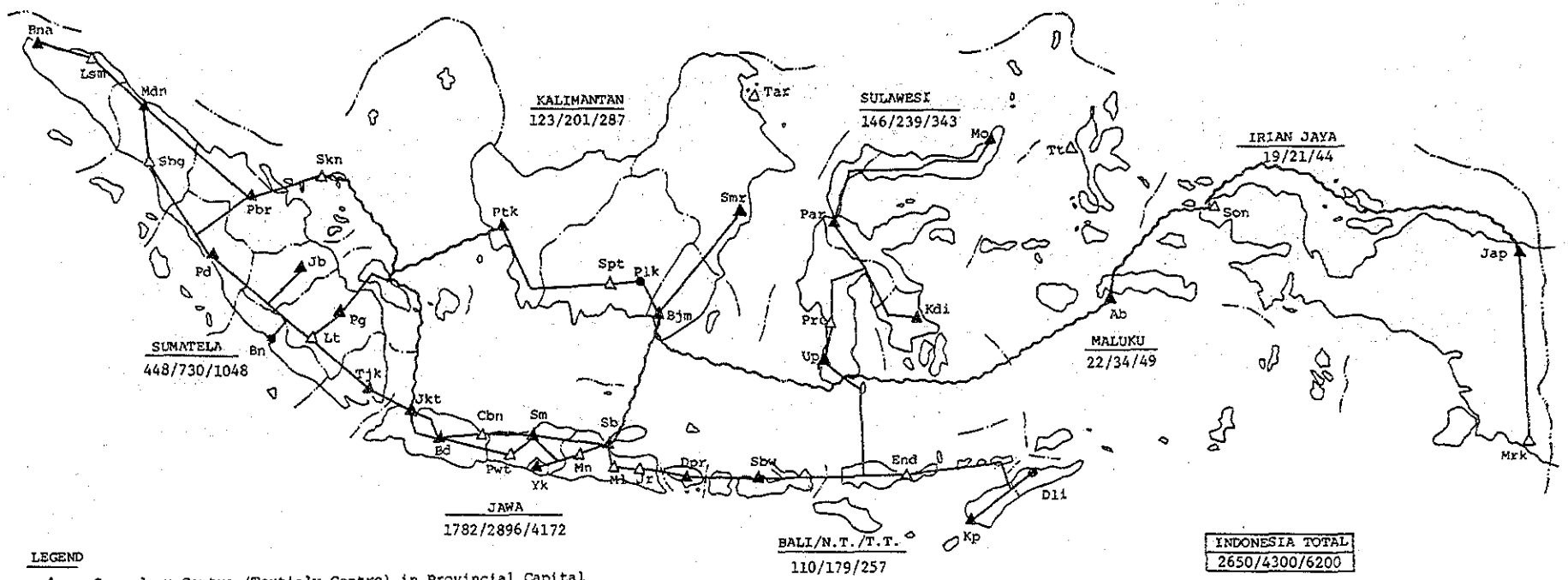



Figure 17 Backbone Terrestrial Transmission Link in The Year 2004

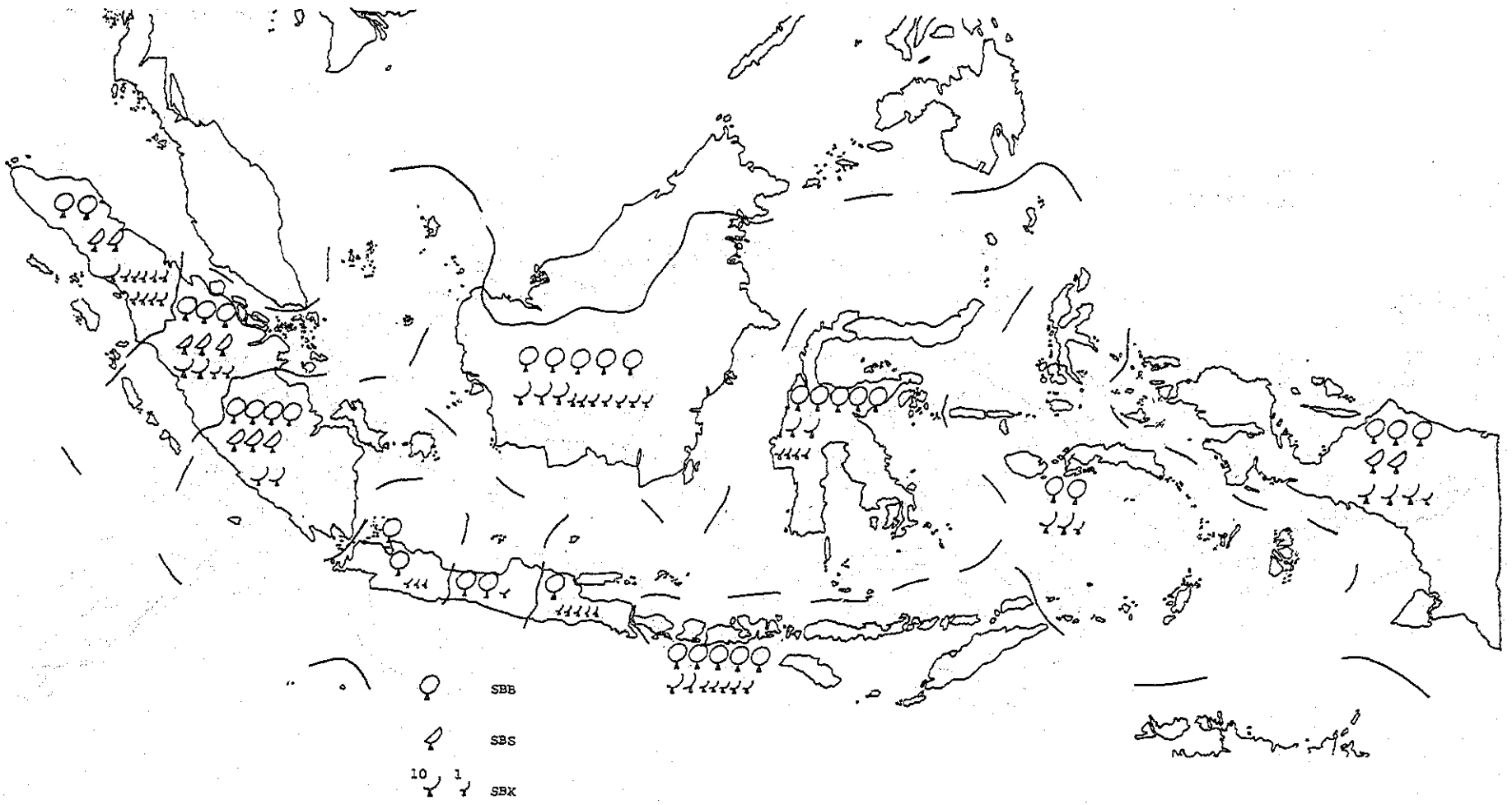



Figure 18 The Number of Earth Stations in The Year 2004

2) Maintenance Center Facility

Five outside plant maintenance centers are planned to be constructed in Jakarta.

3) Network Management System

The local cable network management centers and the toll network management centers will be established for all WITELs in REPELITA-V and REPELITA-VI, respectively.

**(6) Project Implementation Program**

The projects for realizing REPELITA-V and REPELITA-VI were formulated according to the following policies:

1) The package project system by area will be adopted for the local telephone networks in regions outside Jakarta, by integrating switching system, local cable network and junction network projects, instead of currently adopted separate project system by technical fields. By applying this package project system, well balanced total telephone network can be realized.

2) The separate project system by technical fields will be adopted for the toll switching system, long distance transmission system and radio subscriber system projects, because each system employs different technologies and, besides, each system requires well coordinated interface condition which should not be dealt with separately by area.

3) Non-telephone service facilities will be provided by independent projects on a service category basis because the project size is small and the different technologies are to be used.

The main projects for REPELITA-V and REPELITA-VI are listed in Table 11 through Table 14.

Table 11 Main Project in REPELITA-V (1/2)

| Code | Project Title | Project Size | Work Period | Priority |
|---|---|---|---|---|
| **Greater Jakarta Local Network** | | | | |
| V- 1 | Local Switching System Project (Phase 1) | 150,000 L.U. | 3 years | 1 |
| V- 2 | Local Switching System Project (Phase 2) | 175,000 L.U. | " | 2 |
| V- 3 | Local Cable Network Project (Phase 1) | 150,000 L.U. | " | 1 |
| V- 4 | Local Cable Network Project (Phase 2) | 175,000 L.U. | " | 2 |
| V- 5 | Junction Network Project | | " | 1 |
| **Local Telephone Network outside Jakarta** | | | | |
| V- 6 | Sumatera Kotamadya Project I (WITEL I) | 71,000 L.U. | 5 years | 1 |
| V- 7 | Sumatera Kotamadya Project II (WITEL II,III) | 55,000 L.U. | " | 2 |
| V- 8 | Sumatera Kabupaten Project (WITEL I - III) | 43,000 L.U. | " | 3 |
| V- 9 | Jawa Kotamadya Project I (WITEL V) | 77,000 L.U. | " | 1 |
| V-10 | Jawa Kotamadya Project II (WITEL VI) | 63,000 L.U. | " | 2 |
| V-11 | Jawa Kotamadya Project III (WITEL VII) | 122,000 L.U. | " | 1 |
| V-12 | Jawa Kabupaten Project (WITEL V - VII) | 87,000 L.U. | " | 2 |
| V-13 | Bali/Nusa Tenggara/Timor Timur Project (WITEL VIII) | 41,000 L.U. | " | 3 |
| V-14 | Kalimantan/Sulawesi Kotamadya Project (WITEL IX, X) | 71,000 L.U. | " | 2 |
| V-15 | Kalimantan/Sulawesi Kabupaten Project (WITEL IX, X) | 30,000 L.U. | " | 3 |
| V-16 | Maluku/Irian Jaya Project (WITEL XI, XII) | 15,000 L.U. | " | 3 |
| **Toll Switching System** | | | | |
| V-17 | Expansion of Digital Toll Switching System | 30,000 CCT | 5 years | 1 |
| **Terrestrial Transmission** | | | | |
| V-18 | Trans Sulawesi Digital M/W System | 2,300 km | 5 years | 1 |
| V-19 | Bjm-UP Optical Fiber Submarine Cable | 700 km (+M/W150 km) | 3 years | 1 |
| V-20 | Trans Kalimantan Digital M/W System | 1,050 km | 4 years | 2 |
| V-21 | East Indonesia Digital M/W System | 1,900 km | " | 2 |
| V-22 | Mdn-Bna Digital M/W System | 550 km | 3 years | 2 |
| V-23 | Bpp-Smr Digital M/W System | 200 km | 2 years | 3 |
| V-24 | Up-Ab Optical Fiber Submarine Cable | 1,100 km (+M/W200 km) | 3 years | 3 |
| V-25 | Jawa Digital Spur M/W System | 750 km | 4 years | 1 |
| V-26 | Sumatera Digital Spur M/W System | 350 km | " | 2 |
| V-27 | Subscriber Radio System (Phase 1) | 5,000 L.U. | " | 2 |
| V-28 | Subscriber Radio System (Phase 2) | 5,000 L.U. | " | 3 |

Table 12 Main Project in REPELITA-V (2/2)

| Code | Project Title | Project Size | Work Period | Priority |
|---|---|---|---|---|
| Satellite Transmission System | | | | |
| V-29 | PALAPA C1 Launching | 1 Sat. | 5 years | 1 |
| V-30 | TDMA Satellite Link Expansion | up to 4,800 ch | " | 2 |
| V-31 | 50 Small Earth Stations (SBK) | 50 SBK | " | 3 |
| V-32 | Relocation of 31 Smaller Earth Stations | 31 SBK | " | 3 |
| Others | | | | |
| V-33 | Expansion of Packet Data Communication System | up to 2,100 terminals | 3 years | 1 |
| V-34 | Expansion of Radio Paging System | up to 45,000 L.U. | 5 years | 2 |
| V-35 | Expansion of Land-Mobile Telephone System | up to 14,500 L.U. | 3 years | 3 |
| V-36 | ISDN Pilot Project | 1 system | " | 2 |
| V-37 | Provision of Coin Telephone Sets | 47,000 sets | " | 1 |
| V-38 | Local Cable Maintenance Center Project | 5 centers | 4 years | 1 |
| V-39 | Network Management Center Project (Cable) | 12 centers | " | 1 |
| V-40 | Education & Training Center Project | expansion | 3 years | 1 |

Table 13 Main Project in REPELITA-VI (1/2)

| Code | Project Title | Project Size | Work Period | Priority |
|---|---|---|---|---|
| | **Greater Jakarta Local Network** | | | |
| VI- 1 | Local Switching System Project (Phase 1) | 250,000 L.U. | 3 years | 1 |
| VI- 2 | Local Switching System Project (Phase 2) | 287,000 L.U. | " | 2 |
| VI- 3 | Local Cable Network Project (Phase 1) | 250,000 L.U. | " | 1 |
| VI- 4 | Local Cable Network Project (Phase 2) | 287,000 L.U. | " | 2 |
| VI- 5 | Junction Network Project | | " | 1 |
| | **Local Telephone Network outside Jakarta** | | | |
| VI- 6 | Sumatera Kotamadya Project I (WITEL I) | 117,000 L.U. | 5 years | 1 |
| VI- 7 | Sumatera Kotamadya Project II (WITEL II,III) | 91,000 L.U. | " | 2 |
| VI- 8 | Sumatera Kabupaten Project (WITEL I - III) | 71,000 L.U. | " | 3 |
| VI- 9 | Jawa Kotamadya Project I (WITEL V) | 127,000 L.U. | " | 1 |
| VI-10 | Jawa Kotamadya Project II (WITEL VI) | 104,000 L.U. | " | 2 |
| VI-11 | Jawa Kotamadya Project III (WITEL VII) | 201,000 L.U. | " | 1 |
| VI-12 | Jawa Kabupaten Project (WITEL V - VII) | 143,000 L.U. | " | 2 |
| VI-13 | Bali/Nusa Tenggara/Timor Timur Project (WITEL VIII) | 68,000 L.U. | " | 3 |
| VI-14 | Kalimantan/Sulawesi Kotamadya Project (WITEL IX, X) | 117,000 L.U. | " | 2 |
| VI-15 | Kalimantan/Sulawesi Kabupaten Project (WITEL IX, X) | 49,000 L.U. | " | 3 |
| VI-16 | Maluku/Irian Jaya Project (WITEL XI, XII) | 25,000 L.U. | " | 3 |
| | **Toll Switching System** | | | |
| VI-17 | Expansion of Digital Toll Switching System | 40,000 CCT | " | 1 |
| | **Terrestrial Transmission** | | | |
| VI-18 | Jakarta-Surabaya Digital M/W System | 750 km | 4 years | 1 |
| VI-19 | Jakarta-Pangkalpinang Optical Fiber Submarine Cable System | 550 km | 3 years | 2 |
| VI-20 | Pangkalpinang-Sekupang Optical Fiber Submarine Cable System | 800 km | 4 years | 2 |
| VI-21 | Palembang-Pangkalpinang Digital M/W System | 200 km | 3 years | 2 |
| VI-22 | Pekanbaru-Medan Digital M/W System | 500 km | " | 1 |
| VI-23 | East Indonesia Digital M/W System (Ruteng-Ujung Pandang) | 400 km | 4 years | 3 |
| VI-24 | Ambon-Jayapura Optical Fiber Submarine Cable System | 1,950 km | 5 years | 3 |
| VI-25 | Subscriber Radio System (Phase 1) | 9,000 L.U. | 4 years | 2 |
| VI-26 | Subscriber Radio System (Phase 2) | 10,000 L.U. | " | 3 |

Table 14 Main Project in REPELITA-VI (2/2)

| Code | Project Title | Project Size | Work Period | Priority |
|---|---|---|---|---|
| Satellite Transmission System | | | | |
| VI-27 | PALAPA C2 Launching | 1 Sat. | 5 years | 1 |
| VI-28 | TDMA Satellite Link Expansion | up to 11,340 ch | " | 2 |
| VI-29 | 33 Small Earth Stations (SBK) | 33 SBK | " | 3 |
| VI-30 | Replacement of SBB and SBS | 19SBB/20SBS | " | 3 |
| Others | | | | |
| VI-31 | Expansion of Packet Data Communication System | up to 4,400 terminals | 3 years | 1 |
| VI-32 | Expansion of Radio Paging System | up to 80,000 L.U. | " | 2 |
| VI-33 | Expansion of Land-Mobile Telephone System | up to 15,500 L.U. | " | 3 |
| VI-34 | ISDN Expansion Project | | 3 years | 2 |
| VI-35 | Provision of Coin Telephone Sets | 33,000 sets | " | 1 |
| VI-36 | Network Management Center Project (Switching) | 12 centers | 4 years | 1 |

## 11. Economic Evaluation

### (1) Consumer Surplus Analysis

The consumer surplus to be produced from telephone service subscription is highest in Jakarta: it is estimated to be approximately 3.6 times the installation fee and approximately 2.6 times the national average in 1994. (Refer to Figure 19.) The Plan 2 produces twice larger amount of consumer surplus than the Plan 1.

The amount of consumer surplus will tend to increase as development advances through REPELITA-V, REPELITA-VI and REPELITA-VII.

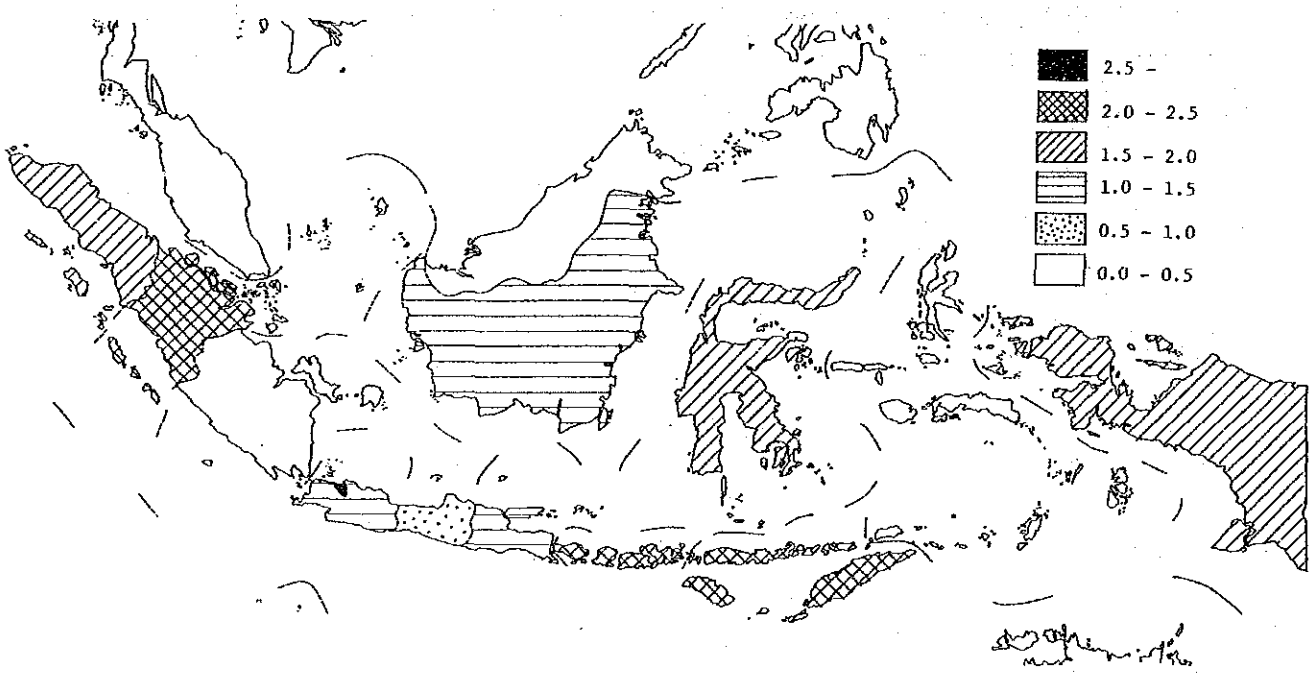



*Figure 19 Consumer Surplus from Telephone Subscription*

### (2) Input-Output Table Analysis

The input-output relationship between the communications sector and other sectors was analized by using the Input-Output Table (1980) and analysis results are summarized as follows:

1) Outputs of the communication sector are mainly demanded by the following sectors for their production.

- Water Transport
- Air Transport
- Other Industry
- Construction
- Financing/Real Estate
- Public Administration Service

2) The communications sector demands mainly outputs of the following sectors for its own production.

- Service Allied to Transport
- Communication (own output)
- Financing/Real Estate
- Trade/Restaurant
- Air Transport
- Public Administration Service

## 12. Proposals

The following recommendations are proposed as the basic guidelines for the Long-Term Telecommunications System Development Plan up to the Year 2004:

1) The telephone service capacity expansion plan shall be made according to how GDP grows. The target figures in 2004 are 4,500 L.U. if the GDP growth rate is 3% per year and 6,200 L.U. if the GDP growth rate is 5% per year (See Table 6).

2) The non-telephone services capacity expansion plan shall be made according to how the demands grow. The plan shall be carried out according to the schedule shown in Table 7.

3) Integration of the Telecommunications networks shall be promoted toward establishment of ISDN by 2004. Then, new services shall be offered by ISDN (See Figure 12).

4) The actual development plan shall be carried out according to the most suitable development scenario chosen out of the four previously discussed development scenarios by examining the national economic conditions and the management conditions of PERUMTEL.

5) The backbone terrestrial transmission routes shall be developed according to the long-term development plan shown in Figure 17.

6) The satellite earth stations shall be constructed according to the long-term development plan shown in Figure 18.

7) The telephone service capacity expansion project shall be a packaged project which integrates switching system, local cable network and junction network projects. Table 11 through Table 14 show lists of main projects which shall be carried out during REPELITA-V and REPELITA-VI.

## 13. Advice

Many projects must be carried out in the future in order to achieve what is discussed and recommended in the Long-Term Telecommunications System Development Plan.

The on-going PELITA-IV is not following the schedule very well. One of the reasons for the delay seems to arise from some institutional problems which may work as obstacles for telecommunications projects in Indonesia. The following advice points out how these problems shall be solved to achieve more smooth executions of the future projects:

1) The budgetary limit for a small project be raised to allow PERUMTEL to implement such project at his own discretion in well balanced timing considering total network development.

2) In order to promote import of materials necessary for production of telecommunications equipment in Indonesia, foreign exchange rationing be increased for telecommunications equipment manufacturers, such as PT. INTI, etc.

   Also for PERUMTEL, foreign exchange rationing be increased at least for several years to come because a number of telecommunications projects must be implemented with foreign loans.

3) Some taxation policies to improve the financial condition of PERUMTEL be taken for promoting investment projects.

4) On the facility expansion planning, the attention be paid keeping well balanced networks among different technical fields.