

## 8-2 Network Development Plan

### (1) Network Integration

In Indonesia, the following four public networks are currently in service;

- 1) Telephone Network
- 2) Telex Network
- 3) Data Network (Packet Switched Type)
- 4) Non-Switched Network (Leased Line)

When the favorable impacts of the technological innovations and introduction of ISDN are taken into consideration, public networks in Indonesia should be integrated into ISDN in the future. In Figure 8-2-1, an appropriate network integration plan is proposed. This plan is based on the present situation of the telecommunications facilities, various demand forecasts, and trend of technological innovations in the foreseeable future.

The basic concepts of the plan are;

- 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.

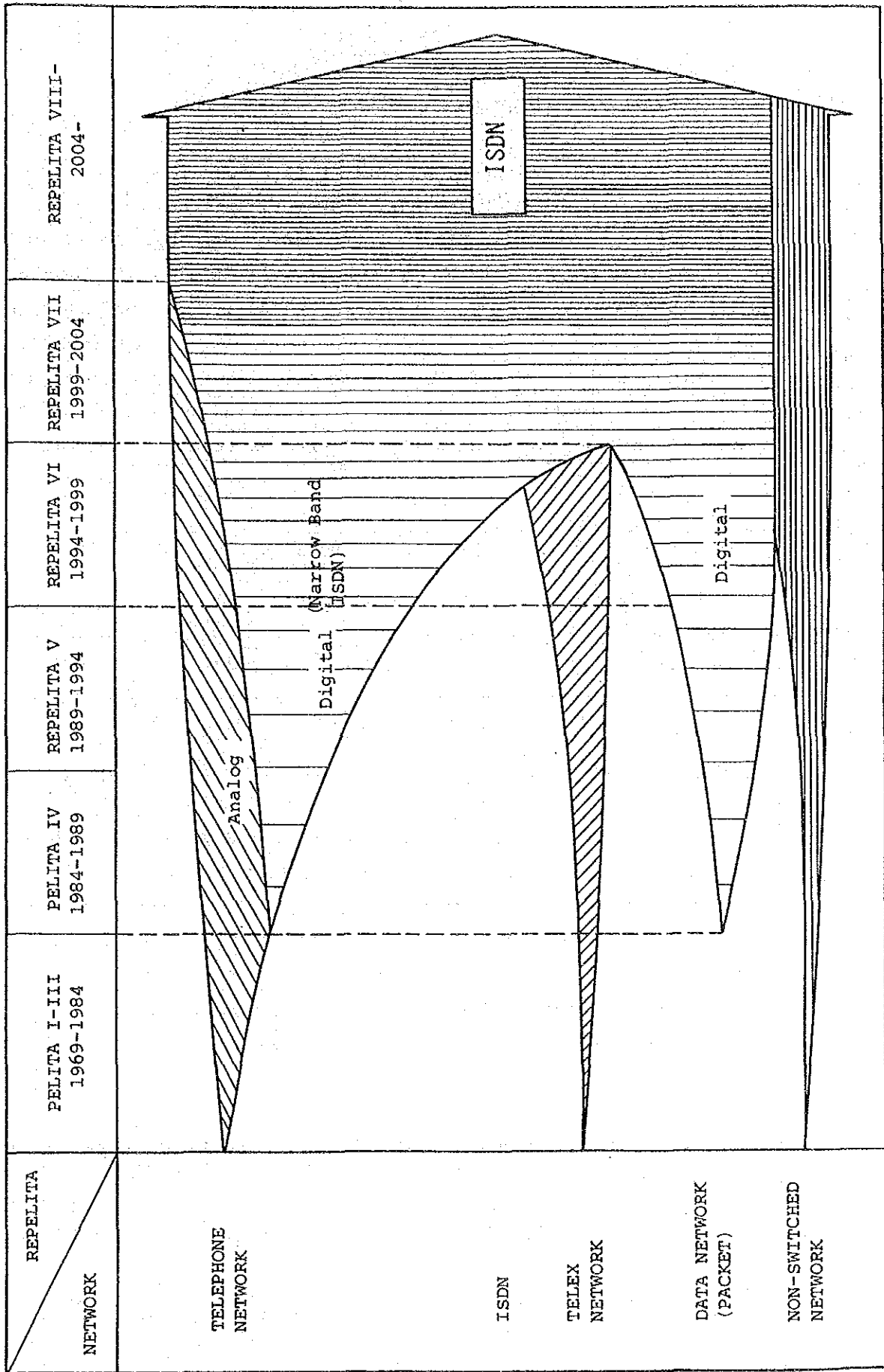


Figure 8-2-1 Network Integration Plan

(2) Telephone Network Development

It is proposed that telephone network is to be developed in accordance with the Fundamental Plan 1985. However, as a result of traffic increase due to the increase of the number of subscribers, more high usage links between SC-SC and SC-TC will be needed. Consequently in the future, it will become economic to establish high usage links between almost all SCs. At this stage, hierarchical distinction between TC and SC tends to diminish as shown in Figure 8-2-2. It is estimated that the number of switching centers categorized by exchange hierarchy will be increased as shown in Table 8-2-1.

Table 8-2-1 Number of Switching Centers up to 2004

Switching Centers	PELITA-IV 1989	REPELITA-V 1994	REPELITA-VI 1999	REPELITA-VII 2004
ISC	2	2	2	2
TC	7	7	7	] 40
SC	33	33	33	
PC	192	238	266	266
LE	482	556	761	824
Total	726	836	969	1,132

Note: Remote Switching Units (RSU) are included in LE.

(3) Telex Network Development

The number of switching centers involved in the telex network is indicated in Table 8-2-2.

Table 8-2-2 Existing Telex Switching Centers

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International Switching Center (ISC)	2
Local Transit Exchange (LT)	5
Local Exchange (LE)	33

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The number of telex terminals in 1994 is expected to be the range of 32,300 and 39,200 and will be less than the exchange capacity of 32,300 at the end of PELITA-IV (1989). The some portion of telex subscribers will switch to the facsimile service.

Therefore, it is proposed that the existing telex network will be fully utilized up to 1994 by expanding in only local exchanges. At the beginning of REPELITA-VI when service life of the exchanges will come to the end, the telex network will be integrated into the digital telephone network as the narrow band ISDN. (See Figure 8-2-3.)

(4) Packet Switched Data Communication Network Development

The current SKDP packet switched data communication network has only one Network Control Center (NCC) in Jakarta. The maximum capacity of the NCC allows 1008 simultaneous connections. To accommodate traffic increase in the future, extension of NCC becomes necessary.

Future expansion of NCC and ANP (Advanced Network Processor) based on the DT (Data Terminal) demand forecast, is proposed as indicated in Table 8-2-3.

Table 8-2-3 Proposed Extension of NCC and ANP

Item	PELITA-IV 1989	REPELITA-V 1994	REPELITA-VI 1999	REPELITA-VII 2004
NCC	1	1	2	2
ANP	3	9	18	30
DT	700	2,100	4,400	7,800

When the service life of the existing PACKSATNET comes to the end, it will be integrated into SKDP as shown in Figure 8-2-4.

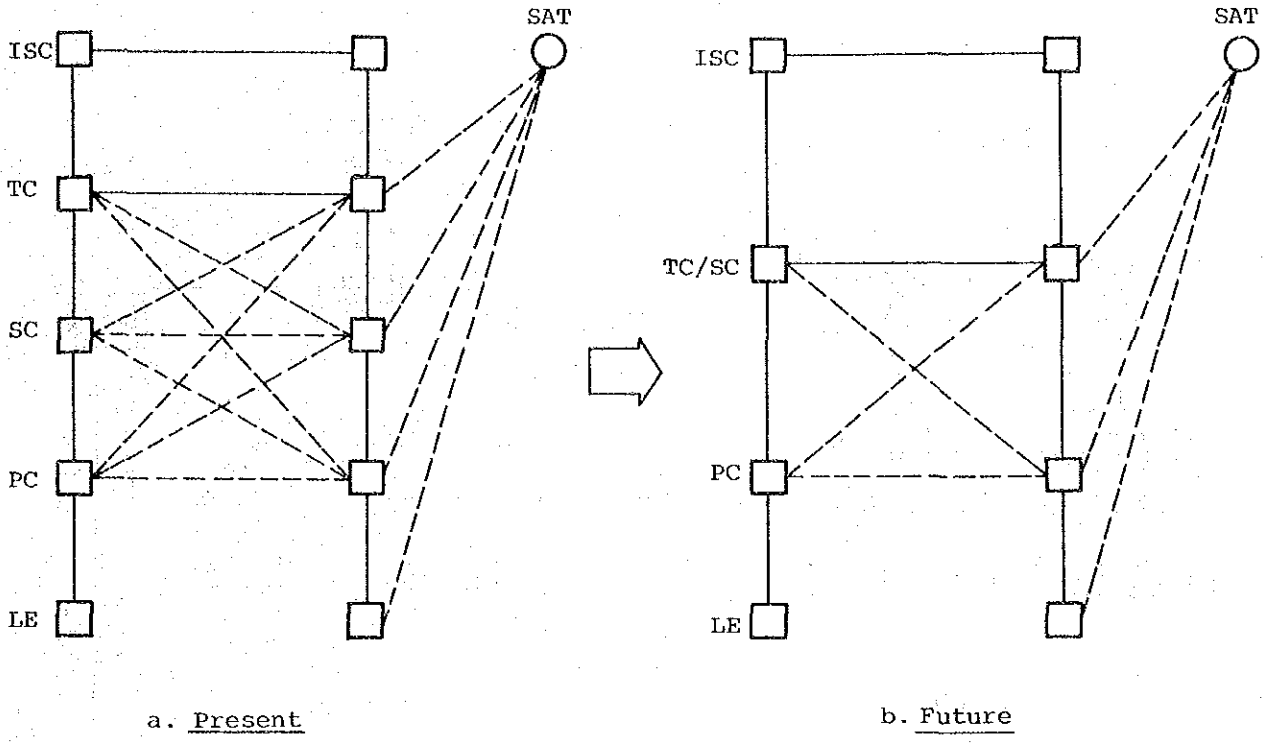


Figure 8-2-2 Telephone Network Development Plan

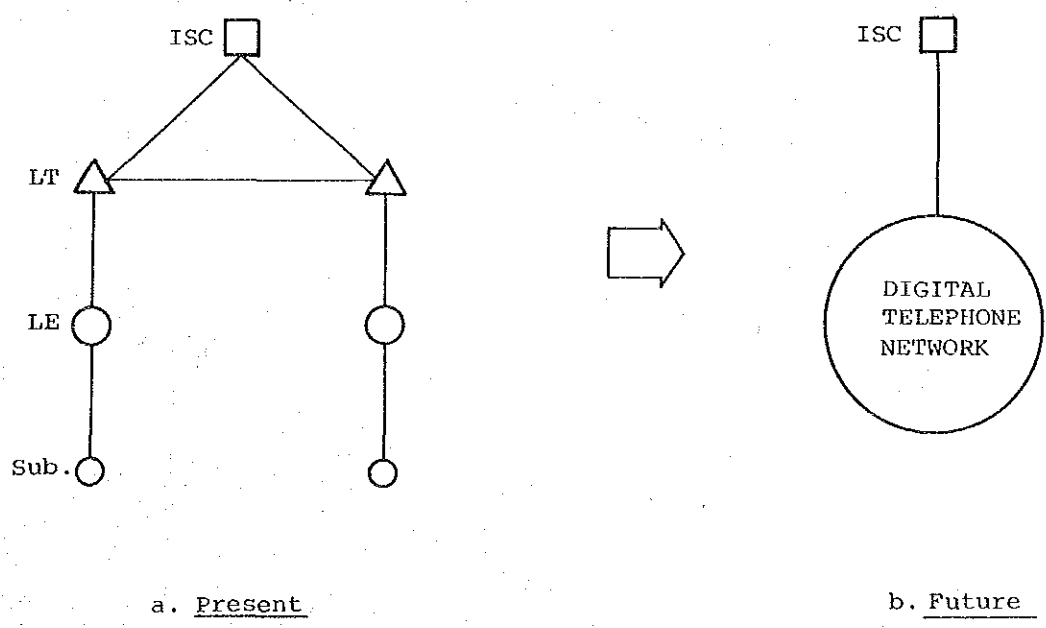
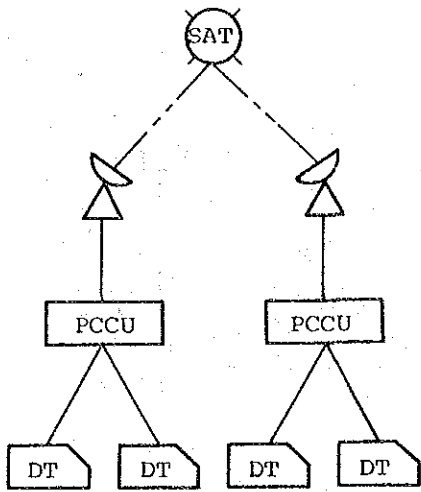
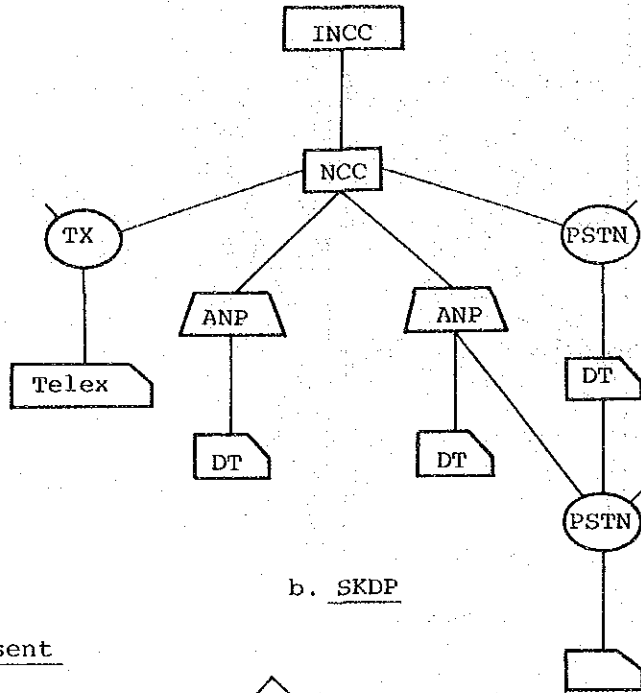


Figure 8-2-3 Telex Network Development Plan

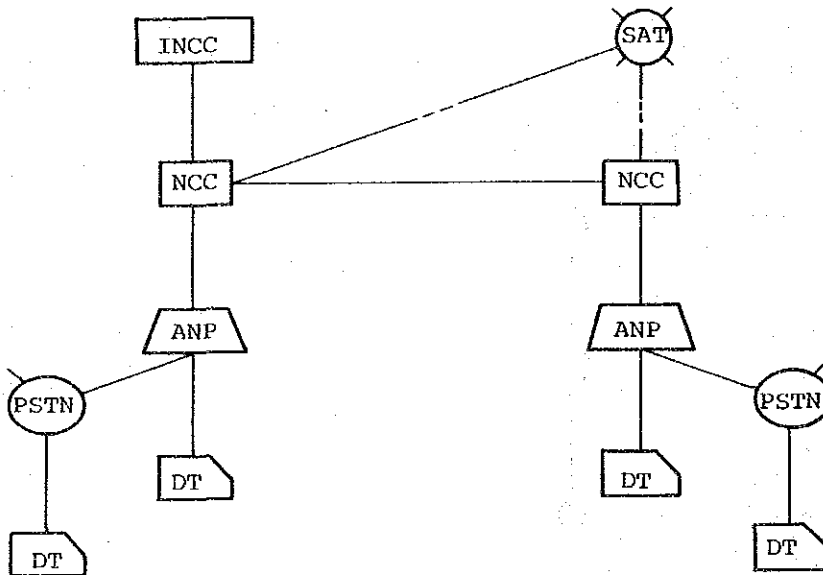


a. PACKSATNET



b. SKDP

Present



c. SKDP

Future

Figure 8-2-4 Packet Data Communication Network Development Plan

### 8-3 Facility Modernization Plan

#### (1) Automatization of Switching System

At the end of PELITA-III, the share of automatic exchanges was only 26%. In PELITA-IV, the automatization of switching system is greatly promoted to improve service quality.

In the case of Supply Plan-2, the degree of switching system automatization at the end of each REPELITA is proposed as shown in Table 8-3-1. By keeping this speed, the automatization can be completed in REPELITA-VI. In the case of Supply Plan-1, the automatization will be completed in REPELITA-VII.

Table 8-3-1 Switching System Automatization Plan (Plan-2)

Item	PELITA-III 1984	PELITA-IV 1989	REPELITA-V 1994	REPELITA-VI 1999
<b>Capacity:</b>				
Automatic (1000 LU)	601	1,380	2,605	4,300
Manual (1000 LU)	96	70	45	0
Automatic share	86%	95%	98%	100%
<b>No. of Exchanges:</b>				
Automatic	175	327	610	969
Manual	508	399	226	0
Automatic share	26%	47%	73%	100%

#### (2) Digitalization of Network

The telephone network of Indonesia, until the end of PELITA-III (1984), mostly consisted of analog switching and transmission systems. Since the beginning of PELITA-IV, digital switching systems was introduced and have been rapidly growing in installations. As a



result, digitalization of transmission systems has been following the same step. Digitalization in Indonesia seems as rapid as the world trend of technological advancement.

The degree of switching system digitalization expected at the end of PELITA-IV and REPELITA-V is shown in Table 8-3-2. Digitalization speed in WITEL-IV (Jakarta), WITEL-XI and WITEL-XII is rather low due to the existence of substantial amount of analog facilities, while, in other WITELs, the rate of digitalization is high and expected to reach 70 - 80%.

Table 8-3-2 Digitalization of Exchange by WITEL

(1000 L.U.)

WITEL	End of PELITA-IV				End of REPELITA-V			
	Analog	Digital	Total	Dig (%)	Analog	Digital	Total	Dig (%)
I	60	84	144	58	60	174	234	74
II	21	25	46	54	21	54	75	72
III	29	50	79	63	29	100	129	78
IV	312	231	543	43	312	556	868	64
V	64	103	167	62	64	213	277	77
VI	69	68	137	50	69	157	226	69
VII	109	129	238	54	109	279	388	72
VIII	19	46	65	71	19	87	106	82
IX	16	54	70	77	16	100	116	86
X	23	60	83	72	23	115	138	83
XI	7	6	13	46	7	14	21	67
XII	6	4	10	40	6	11	17	65
TOTAL	735	860	1,595	54	735	1,860	2,595	72

Note: Above figures do not include line units for manual exchange.

In order to keep the number of waiting telephone applicants to a minimum level possible, the existing analog switching systems that have more than 25 years of service life shall be replaced by the schedule as shown in Table 8-3-3 and Figure 8-3-1.

Table 8-3-3 Retirement Plan of the Existing Analog Switching System

Type of Switch	REPELITA-V	REPELITA-VI	REPELITA-VII
EMD (L.U.)	44,000	41,000	113,000
PRX (L.U.)	-	-	185,000
Others (L.U.)	15,000	28,000	122,000
Total (L.U.)	59,000	69,000	430,000

When the service life of the existing analog switching system is taken into account, digitalization plan of switching system up to the year 2004 is proposed as shown in Table 8-3-4.

Table 8-3-4 Switching System Digitalization Plan (Plan-2)

Type of Switch	PELITA-IV 1989	REPELITA-V 1994	REPELITA-VI 1999	REPELITA-VII 2004
Analog Switch	46%	28%	7%	0%
Digital Switch	54%	72%	93%	100%
Total L.U.	1,450,000	2,650,000	4,300,000	6,200,000

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

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

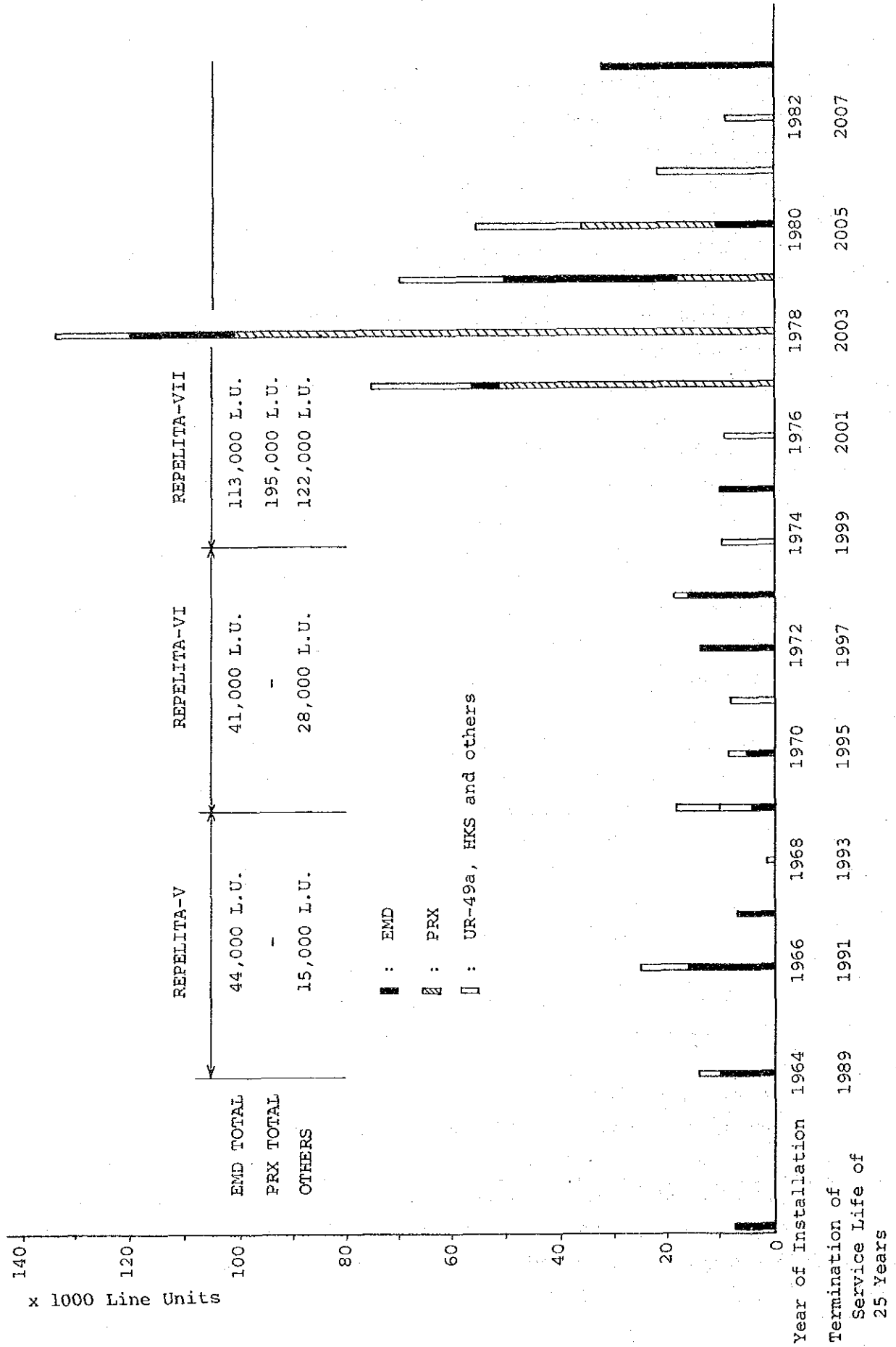


Figure 8-3-1 Switching Systems to be Replaced due to Termination of Service Life

## 8-4 Backbone Transmission System Development

### (1) The Number of Required Circuits

The number of required circuits to be accommodated in backbone transmission systems between the TCs and the SCs is calculated from the Inter-Province telephone service traffic flow and the result is shown in Table 8-4-1. Detailed results are shown in ANNEX 7.

Table 8-4-1 No. of Required Circuits in Backbone Routes (Plan-2)

Circuit	PELITA-IV 1989	REPELITA-V 1994	REPELITA-VI 1999	REPELITA-VII 2004
Telephone:	14,000	20,300	27,100	38,600
Non-Telephone: (10% of telephone)	1,400	2,000	2,700	3,800
Total	15,400	22,300	29,800	42,400

### (2) Principles of Transmission Plan

It is considered appropriate that the most desirable backbone transmission plan is to be made based on the following principles in Indonesia where the land is geographically very extensive;

- 1) Two-route system among the SCs by terrestrial and satellite systems shall be employed to improve reliability.
- 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 having disconnected links.

In Indonesia, two backbone systems, i.e., terrestrial and satellite systems are available. A study was made to find a proper principle traffic distribution between terrestrial and satellite systems.

The results of the economic evaluation based on the annual costs of the system are illustrated in Figure 8-4-1. It can be seen from the figure that satellite system becomes economical when terrestrial link exceeds more than 500 km.

On the other hand, satellite system has the following disadvantages;

- 1) Long transmission time delay
- 2) Limited circuit capacity
- 3) Link availability of satellite system is constant, while that of terrestrial system varies by distance, but better up to 2500 km.

In view of the above, the reasonable circuit distribution plan is proposed in Figure 8-4-2. 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. The results of distribution of long line circuits between terrestrial and satellite systems are shown in Table 8-4-2.

Table 8-4-2 Distribution of Long Distance Circuits between Terrestrial and Satellite Systems

(Unit: Line Units)

	PELITA-IV 1989	REPELITA-V 1994	REPELITA-VI 1999	REPELITA-VII 2004
Terrestrial Link	9,900	16,300	21,600	32,400
Satellite Link	5,500	6,000	8,200	10,000
Total	15,400	22,300	29,800	42,400
Terrestrial Share	64%	73%	72%	76%
Satellite Share	36%	27%	28%	24%

Rapid increase of the satellite circuit share cannot be expected due to satellite weight limitation. Since the number of total circuits is growing rapidly, the increase of the terrestrial circuit share becomes necessary.

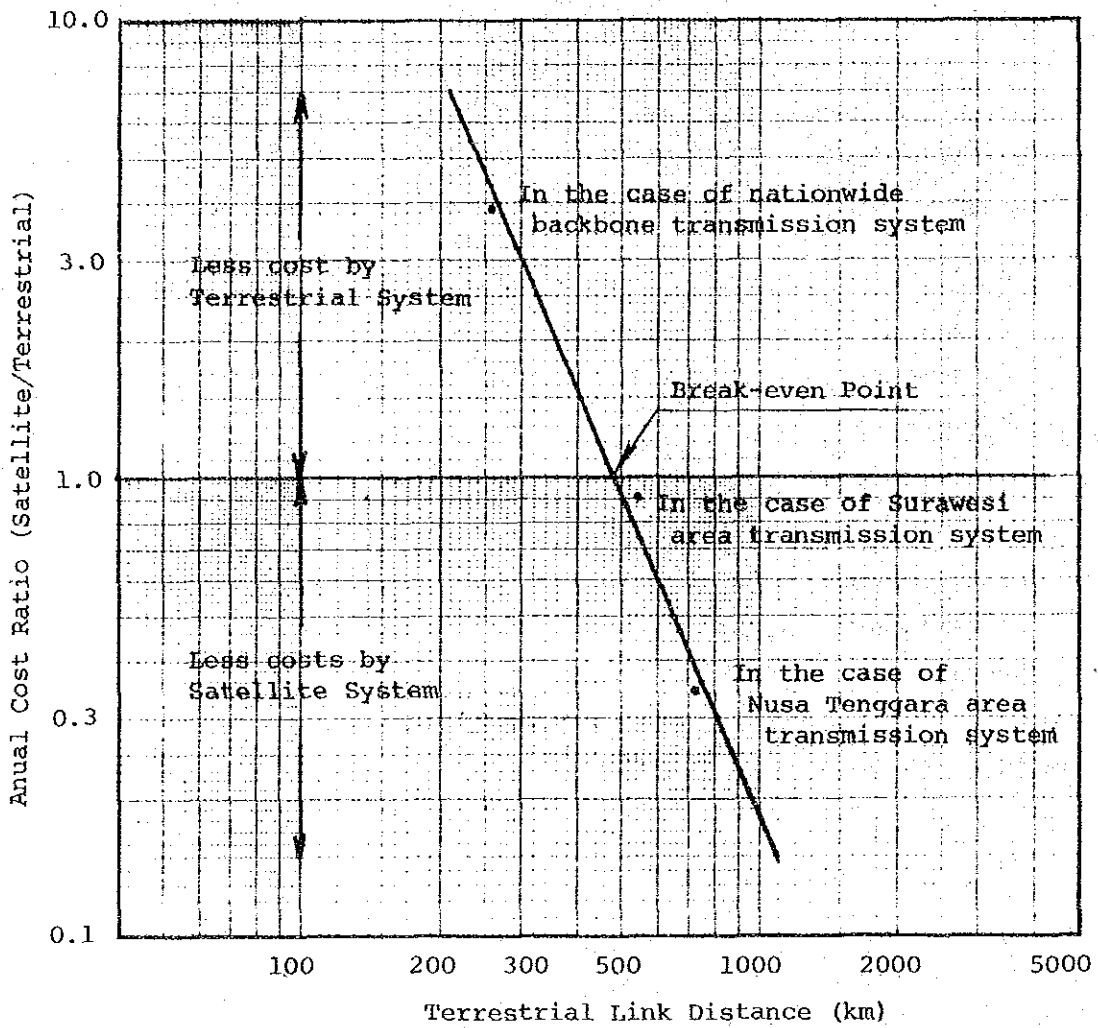


Figure 8-4-1 Cost Comparison between Terrestrial and Satellite Systems

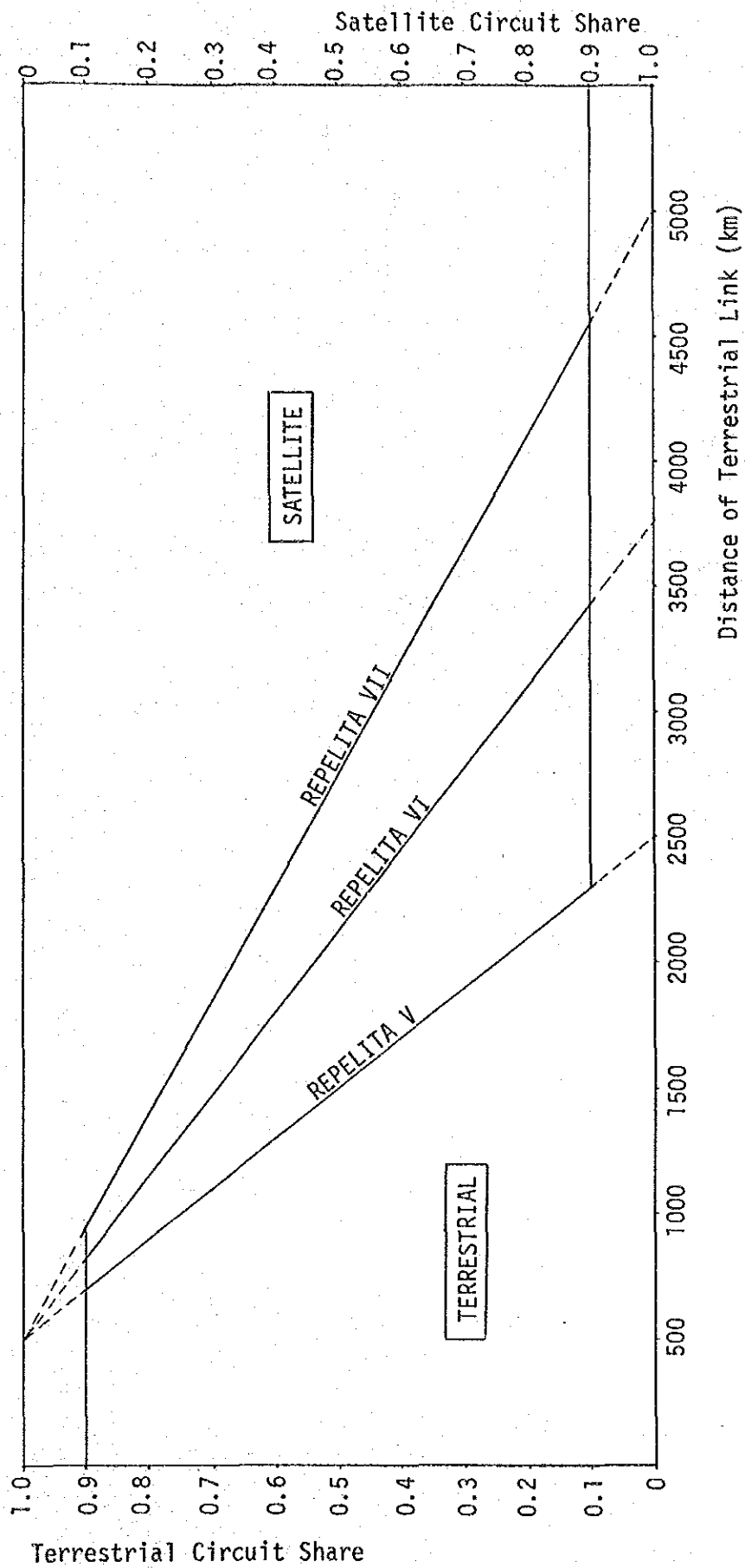


Figure 8-4-2 Circuit Share of Terrestrial and Satellite





**CHAPTER 9**  
**DEVELOPMENT SCENARIOS**



## CHAPTER 9 DEVELOPMENT SCENARIOS

### 9-1 Optimum Development Scenarios

The optimum development scenarios based on the simulation results and the technical development strategies discussed in Chapter 8 are proposed in Table 9-1-1 through Table 9-1-4.

#### (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 O&M costs reduction efforts by PERUMPEL will be assisted by a revenue increase policy of the call fee increase to Rp. 85/pulse.

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

This is the optimum scenario when 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 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 year the 2004.

The revenue, expenditure and operating ratio for Scenario 1 and Scenario 3 are shown in Figure 9-1-1 and Figure 9-1-2.

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

Strategy Item	REPELITA-V (1989-1994)	REPELITA-VI (1994-1999)	REPELITA-VII (1999-2004)
Investment Strategy	<p>Service categories: Mainly telephone/telegraph Social/Business</p> <p>User categories: To all Kabupaten capitals</p> <p>Network coverage: 850,000/2,100,000 L.U.</p> <p>Supply volume: Share of PELITA-IV</p> <p>Regional distribution: (Same as REPELITA-V)</p>	<p>(Same as REPELITA-V)</p> <p>Social/Business: To major Kecamatan capitals</p> <p>To all Desa centers: 1,100,000/3,200,000 L.U.</p> <p>(Same as REPELITA-V)</p>	<p>Introduction of ISDN</p> <p>Social/Business/Residence: To all Desa centers</p> <p>1,300,000/4,500,000 L.U.</p> <p>(Same as REPELITA-V)</p>
Management Strategy	<p>O&amp;M costs/subscriber: Million Rp. 0.52</p> <p>Staffs/1000 L.U.: 41 staffs</p> <p>Tariff System:</p> <ul style="list-style-type: none"> <li>Installation fee: No change</li> <li>Monthly rental fee: No change</li> <li>Call fee: Rp. 85/pulse</li> <li>Government equity: 10% of required fund</li> <li>External fund: 50% of required fund</li> </ul>	<p>Million Rp. 0.44</p> <p>30 staffs</p> <ul style="list-style-type: none"> <li>No change</li> <li>No change</li> <li>Rp. 85/pulse</li> <li>10% of required fund</li> <li>15% of required fund</li> </ul>	<p>Million Rp. 0.40</p> <p>20 staffs</p> <ul style="list-style-type: none"> <li>No change</li> <li>No change</li> <li>Rp. 85/pulse</li> <li>Not required</li> <li>15% of required fund</li> </ul>
Technical Development Strategy	<p>Network integration: Independent</p> <p>Automatization &amp; Digitalization: Up to middle cities</p> <p>Terrestrial share: 73%</p> <p>Satellite share: 27%</p>	<p>Integrate Telex to Telephone: Up to small cities</p> <p>72%</p> <p>28%</p>	<p>Full integration</p> <p>Full automatization &amp; digitalization: 76%</p> <p>24%</p>

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

Table 9-1-2 Development Scenario-2 (Alternative Scenario on Plan-1)

Strategy Item	REPELITA-V (1989-1994)	REPELITA-VI (1994-1999)	REPELITA-VII (1999-2004)
Investment Strategy	<p>Service categories: Mainly telephone/telegraph Social/Business</p> <p>User categories: Social/Business</p> <p>Network coverage: To all Kabupaten capitals</p> <p>Supply volume: 850,000/2,100,000 L.U.</p> <p>Regional distribution: Share increase of 6 WITELs</p>	<p>(Same as REPELITA-V)</p> <p>Social/Business</p> <p>To major Kecamatan capitals</p> <p>1,100,000/3,200,000 L.U.</p> <p>(Same as REPELITA-V)</p>	<p>Introduction of ISDN</p> <p>Social/Business/Residence</p> <p>To all Desa centers</p> <p>1,300,000/4,500,000 L.U.</p> <p>(Same as REPELITA-V)</p>
Management Strategy	<p>O&amp;M costs/subscriber Staffs/1000 L.U.: Million Rp. 0.54 46 staffs</p> <p>Tariff System:</p> <p>Installation fee: No change</p> <p>Monthly rental fee: No change</p> <p>Call fee: Rp. 85/pulse</p> <p>Government equity: 10% of required fund</p> <p>External fund: 50% of required fund</p>	<p>Million Rp. 0.50</p> <p>38 staffs</p> <p>No change</p> <p>No change</p> <p>Rp. 85/pulse</p> <p>10% of required fund</p> <p>20% of required fund</p>	<p>Million Rp. 0.48</p> <p>30 staffs</p> <p>No change</p> <p>No change</p> <p>Rp. 85/pulse</p> <p>Not required</p> <p>15% of required fund</p>
Technical Development Strategy	<p>Network integration: Independent</p> <p>Automization &amp; Digitalization: Up to middle cities</p> <p>Terrestrial share: 73%</p> <p>Satellite share: 27%</p>	<p>Integrate Telex to Telephone</p> <p>Up to small cities</p> <p>72%</p> <p>28%</p>	<p>Full integration</p> <p>Full automization &amp; digitalization</p> <p>76%</p> <p>24%</p>

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

Table 9-1-3 Development Scenario-3 (Optimum Scenario on Plan-2)

Strategy Item	REPELITA-V (1989-1994)	REPELITA-VI (1994-1999)	REPELITA-VII (1999-2004)
Investment Strategy	Mainly telephone/telegraph Social/Business To all Kabupaten capitals 1,200,000/2,650,000 L.U. Share of PELITA-IV	(Same as REPELITA-V) Social/Business To major Kecamatan capitals 1,650,000/4,300,000 L.U. (Same as REPELITA-V)	Introduction of ISDN Social/Business/Residence To all Desa centers 1,900,000/6,200,000 L.U. (Same as REPELITA-V)
O&M costs/subscriber Staffs/1000 L.U.	Million Rp. 0.53 41 staffs	Million Rp. 0.48 30 staffs	Million Rp. 0.46 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 Automization & Digitalization Terrestrial share 73% Satellite share 27%	Integrate Telex to Telephone Full automatization & digitalization 72% 28%	Full integration (Same as REPELITA-VI) 76% 24%

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



Table 9-1-4 Development Scenario-4 (Alternative Scenario on Plan-2)

Strategy Item	REPELITA-V (1989-1994)	REPELITA-VI (1994-1999)	REPELITA-VII (1999-2004)
Investment Strategy	Mainly telephone/telegraph Social/Business To all Kabupaten capitals 1,200,000/2,650,000 L.U. Share of PELITA-IV	(Same as REPELITA-V) Social/Business To major Kecamatan capitals 1,650,000/4,300,000 L.U. (Same as REPELITA-V)	Introduction of ISDN Social/Business/Residence To all Desa centers 1,900,000/6,200,000 L.U. (Same as REPELITA-V)
Management Strategy	O&M costs/subscriber Staffs/1000 L.U. Tariff System: Installation fee Monthly rental fee Call fee Government equity External fund	Million Rp. 0.54 38 staffs No change No change Rp. 85/pulse 10% of required fund 50% of required fund	Million Rp. 0.57 30 staffs No change No change Rp. 85/pulse Not required 30% of required fund
Technical Development Strategy	Network integration Automization & Digitalization Terrestrial share Satellite share	Integrate Telex to Telephone Full automatization & digitalization 72% 28%	Full integration (Same as REPELITA-VI) 76% 24%

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

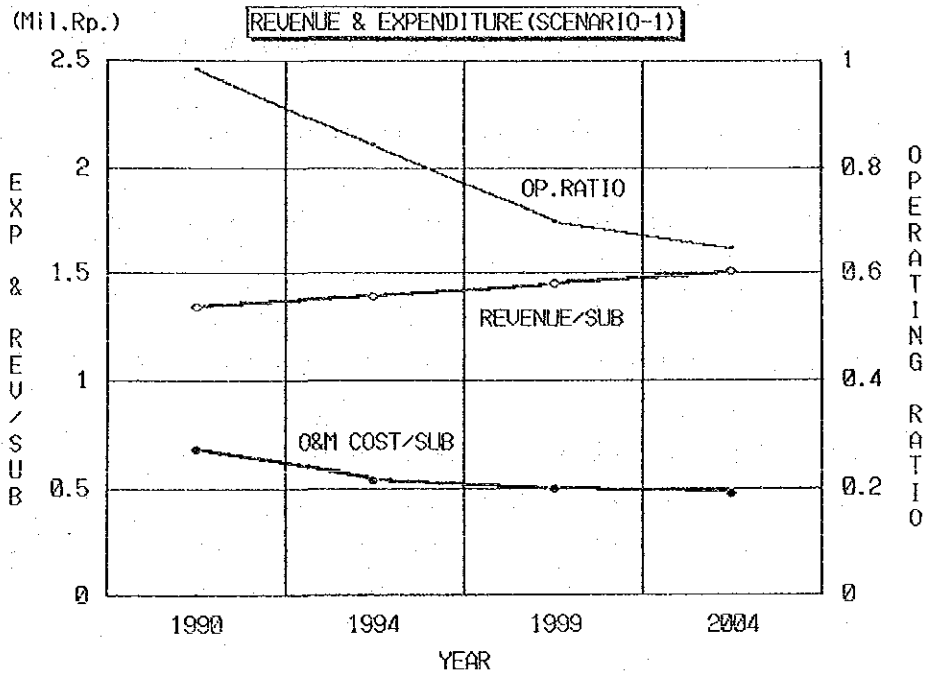


Figure 9-1-1 Revenue and Expenditure of Scenario-1

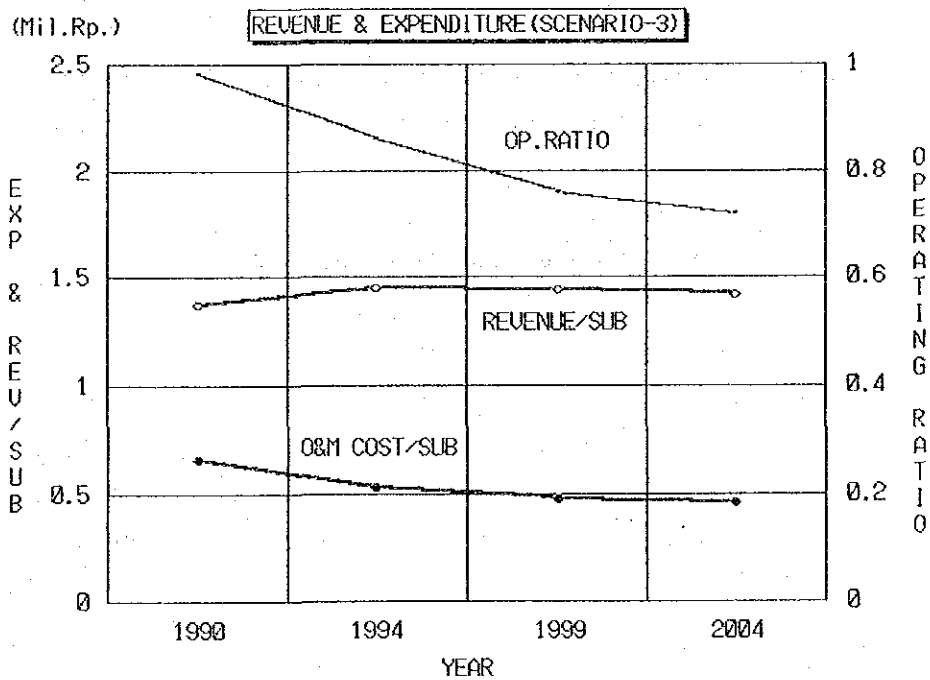


Figure 9-1-2 Revenue and Expenditure of Scenario-3

9-2 Development Policies of Next Three Five-Year Plans

The following development policies are proposed for each scenario:

(1) Development Policies for Plan 1 (Scenarios 1 and/or 2)

1) REPELITA-V (1989-1994): "Reinforcement of Foundation"

- i) Expansion of SLDD network for cities
- ii) Expansion of telephone network to all the Kabupaten capitals
- iii) Expansion of data communication network
- iv) Re-assessment of the tariff system
- v) Reduction of waiting period for telephone connection
- vi) Improvement of telephone successful call rate

2) REPELITA-VI (1994-1999): "Take-off"

- i) Expansion of SLDD network for all the Kabupaten capitals
- ii) Expansion of telephone network to the major Kecamatan capitals
- iii) Integration of telex network into telephone network
- iv) Establishment for the foundation of self-supporting financial capability

3) REPELITA-VII (1999-2004): "Introduction of ISDN"

- i) Realization of full automatization
- ii) Completion of Integrated Digital Network (IDN)
- iii) Initiation of wide band ISDN in the large cities
- iv) Expansion of telephone network to all the Desa centers
- v) Achievement of self-supporting financial capability

(2) Development Policies for Plan 2 (Scenario 3 and/or 4)

1) REPELITA-V (1989-1994): "Reinforcement of Foundation"

- i) Expansion of SLDD network for the cities
- ii) Expansion of telephone network to all the Kabupaten capitals
- iii) Expansion of data communication network
- iv) Re-assesment of the tariff system
- v) Reduction of waiting period for telephone connection
- vi) Improvement of telephone successful call rate

2) REPELITA-VI (1994-1999): "Take-off"

- i) Realization of full automatization
- ii) Expansion of telephone network to all the Kecamatan capitals
- iii) Integration of telex network into telephone network
- iv) Establishment for the foundation of self-supporting financial capability

3) REPELITA-VII (1999-2004): "Introduction of ISDN"

- i) Completion of Integrated Digital Network (IDN)
- ii) Initiation of wide band ISDN in the large cities
- iii) Expansion of telephone network to all the Desa centers
- iv) Achievement of self-supporting financial capability



**CHAPTER 10**  
**FACILITY EXPANSION PLAN**



## CHAPTER 10 FACILITY EXPANSION PLAN

Along with the optimum development scenarios, the facility expansion plans until the year 2004 are proposed in this chapter. The facility expansion plans are discussed only for the Supply Plan 2. If the Supply Plan 1 is selected due to the low GDP growth rate of 3% per year or insufficient fund availability, the facility expansion plans must be scaled down by 20 - 30% of the Plan 2.

### 10-1 Telephone Service Facility

#### (1) Capacity

The capacity expansion plans of the telephone service facility are shown in Table 10-1-1.

Table 10-1-1 Capacity Expansion Plan for Telephone Facility

Item	PELITA-IV 1989	REPELITA-V 1994	REPELITA-VI 1999	REPELITA-VII 2004
Expansion Volume (L.U.)	750,000	1,200,000	1,650,000	1,900,000
Total Capacity (L.U.)	1,450,000	2,650,000	4,300,000	6,200,000
Population (x1000)	179,000	199,000	219,000	244,000
Line Unit/100 persons	0.81	1.33	1.96	2.54

#### (2) Telephone Exchanges

In the Kotamadya areas, one new telephone exchange will be installed for about 20,000 subscribers, while in the Kabupaten area the ap-



appropriate number and capacity of telephone exchanges will be installed according to the administrative boundary and geographical situations of Kabupaten.

Guidelines in determining the proposed exchange installation are shown in Figure 10-1-1. The results of the regression analysis on the data from the experimental designs made for the 10 sampled Kabupatens based on the above guidelines, are shown in Figure 10-1-2.

From the regression results, the proposed number of exchanges to be installed up to 2004 is shown in Table 10-1-2.

Table 10-1-2. Proposed Telephone Exchanges to be Installed up to 2004

Item		1989	1994	1999	2004
Kotamadya	L.U. Capacity	320,000	590,000	1,120,000	1,860,000
	No. of Exchange	158	174	192	210
Kabupaten	L.U. Capacity	1,130,000	2,060,000	3,180,000	4,340,000
	No. of Exchange	568	662	777	922
Total	L.U. Capacity	1,450,000	2,650,000	4,300,000	6,200,000
	No. of Exchange	726	836	969	1,132

Note: The RSUs are counted as exchanges.

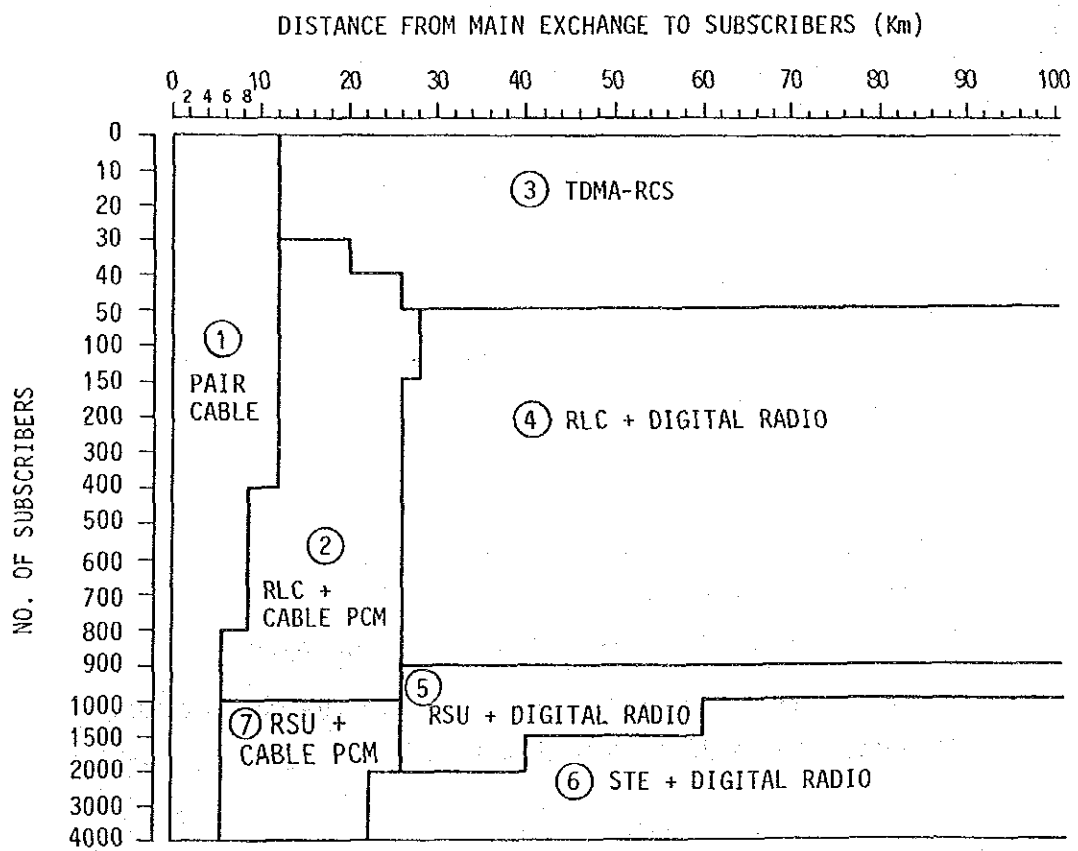
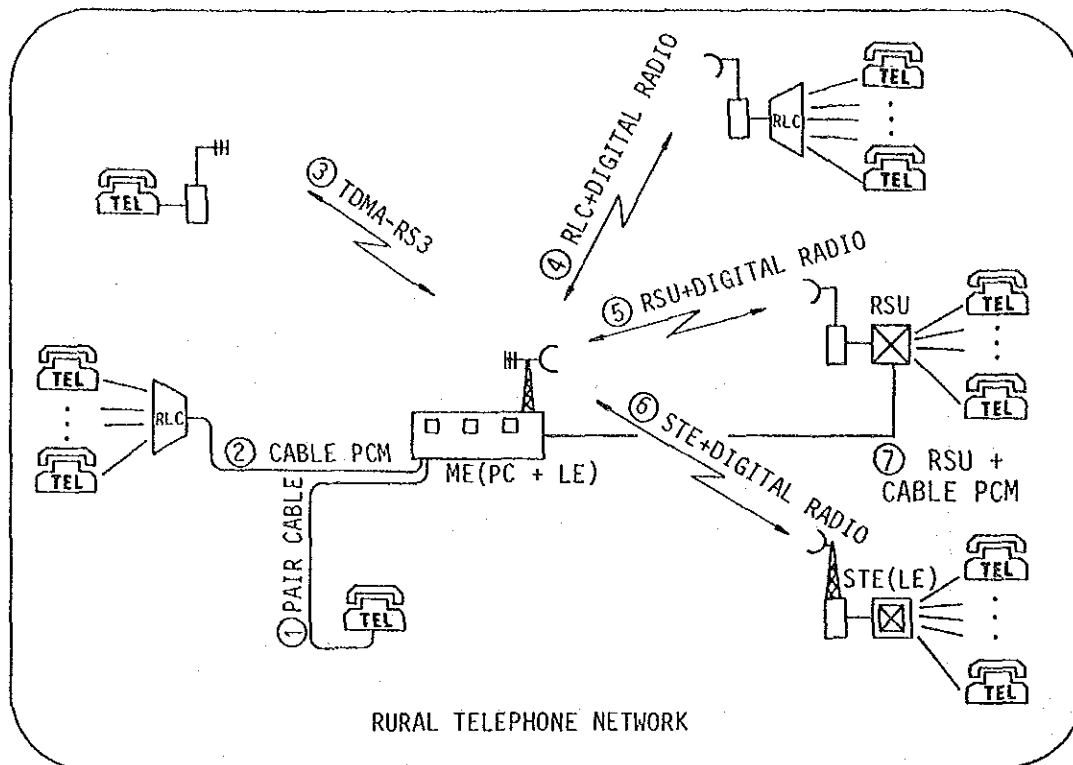
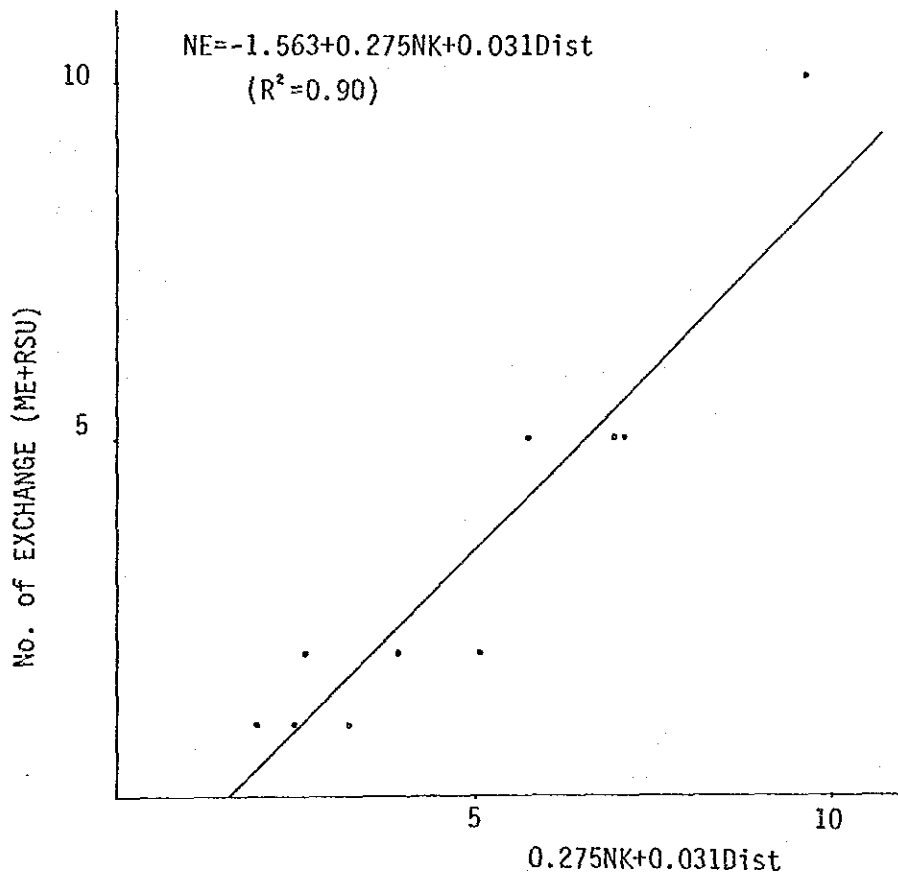


Figure 10-1-1 Selection Chart of Optimum System



NOTE

NE: Number of Exchanges (ME+RSU)

NK: Number of Kecamatan

Dist: Average Distance(km) from IKK to Kecamatan

The regression formula can be used where the total capacity of Kabupaten is less than 10,000 L.U.

Figure 10-1-2 Number of Exchanges in Kabupaten

(3) Subscriber Lines

Subscriber lines are categorized in the following;

- 1) Local Cable
- 2) Radio Subscriber Link

In the urban areas, in general, local cable pairs are used, while in the rural areas local cable pairs and radio subscriber links are used together. At present, not many radio links are in use, but due to the expansion of the network to Kecamatan and then to Desa, the use is expected to increase.

Suppose at least one telephone line is to be installed in all the Desa, the number of radio subscribers will become about 68,000.

In view of the above, a subscriber line expansion plan is proposed in Table 10-1-3.

Table 10-1-3 Subscriber Line Expansion Plan up to 2004

	1989	1994	1999	2004
Local primary cable pairs	2,175,000	3,960,000	6,405,000	9,198,000
Radio subscriber links	1,000	10,000	30,000	68,000

10-2 Non-Telephone Service Facility

(1) Telegraph Service Facility

The average distances between 246 Kabupaten and their Kecamatan capitals are shown in Table 10-2-1. Based on the distances, the required number of telegraph offices to provide quick delivery service to all Kabupaten was estimated and is also shown in Table 10-2-1.

Table 10-2-1 Average Distance and Required No. of Telegraph Office in Kabupaten

Average Distance between Kab. and Kec.	No. of Kabupaten	Required No. of Telg Office/Kab.	Required No. of Telg. Office
less than 20 km	83	1	83
20 - 40 km	89	2	178
40 - 60 km	28	4	112
more than 60 km	46	8	368
Total	246	-	741

Since at least one telegraph office is needed in a Kotamadya area, the necessary number of telegraph offices is 795, i.e., 54+741. Quick delivery service can be provided to almost all the Kecamatan capitals.

To expand a quick delivery area as far as to Desa, telegraph office have to be placed in all the Kecamatan capitals.

A new telegraph office plan is proposed in Table 10-2-2.

Table 10-2-2 Telegraph Office Installation Plan up to 2004

Item	1989	1994	1999	2004
No. of telegraph offices	670	1,000	2,000	3,500
No. of telegrams per year (x1000)	10,191	13,096	16,185	20,104

(2) Other Non-Telephone Service Facilities

The expansion plan for other non-telephone service facilities than telegraph service is shown in Table 10-2-3.

Table 10-2-3. Expansion Plan for Non-Telephone Service Facilities

Category	(Line Unit)		
	REPELITA-V	REPELITA-VI	REPELITA-VII
Telex	0/32,000	10,000/42,000 (Note 1)	8,000/50,000 (Note 1)
Facsimile	No dedicated network is planned.		
Packet Data	1,400/2,100	2,300/4,400	3,400/7,800
Radio Paging	45,000/45,000	36,000/80,000	46,000/126,000
	Jakarta Surabaya Bandung Medang Semarang	Ujung Pandang Palembang Malang  (new intro- duction)	Yogyakarta Banjar Masin Denpasar Cirebon (new intro- duction)
Land-Mobile Telephone (Note 2)	4,500/14,500	1,000/15,500	500/16,000
	Jakarta Surabaya Bandung Semarang	same cities as REPELITA-V.	Medan (new intro- duction)
ISDN	Narrow Band	Narrow Band	Wide Band
	Jakarta Surabaya Bandung Medan	same cities as REPELITA-V.	Jakarta Surabaya Bandung Medan

Note 1. The existing telex network will be integrated to the digital telephone network.

Note 2. For land-mobile telephone service, the capacity is not same as Table 6-2-3 considering the existing capacity in Jakarta.

### 10-3 Long Distance Transmission Facility

#### 10-3-1 Terrestrial Transmission System

##### (1) Backbone Terrestrial Transmission System Basic Plan

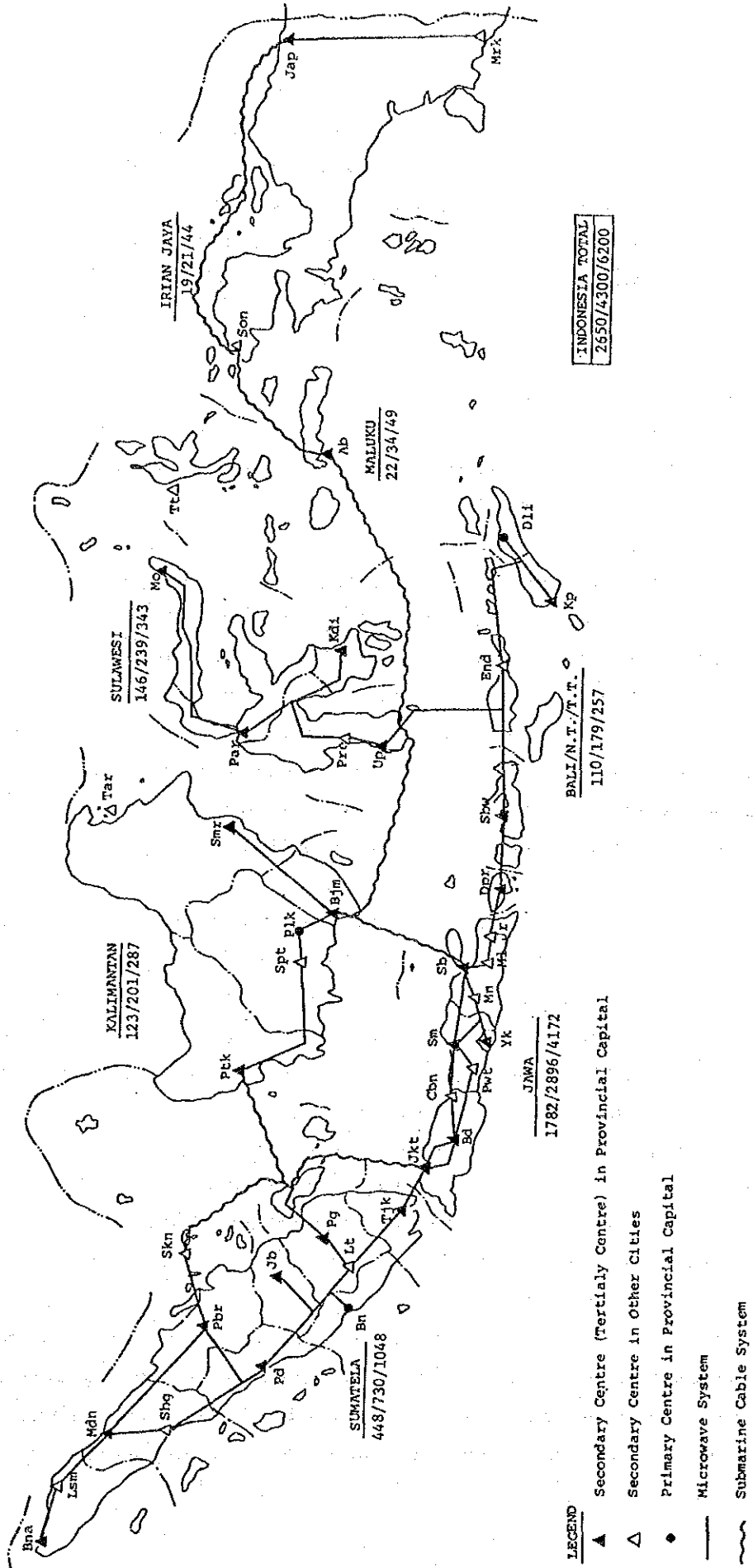
A proposed backbone terrestrial transmission systems plan in 2004 is shown in Figure 10-3-1. This plan was formed on the basis of the strategies discussed in Chapter 8 and the following principles;

- 1) To link all the province capitals by terrestrial systems
- 2) To link all TC/SC by terrestrial systems
- 3) To link by terrestrial systems, all TC, TC and principal SC in a two-route loop structure configuration.

The principle 1) is to reflect the national policy of providing back up systems for television programs transmission by terrestrial systems. At present, television programs transmission is done by mainly satellite systems; however, in case of satellite systems failures, terrestrial back up systems at least up to any province capital become necessary.

Keeping transmission links ready all the time exclusively for emergency television programs transmission is proved to be uneconomical to PERUMTEL. Stand-by systems for telephone transmission should be used for the back up purpose.

As to the principle 2), there are two exceptions, i.e., SCs of Tarakan and Ternate whose population sizes are small and subscriber demand in 2004 is still expected to remain only about 10,000. For these two regions the distance to adjacent SC is too long to establish a terrestrial system at reasonable costs. Therefore, these two SCs will be linked only by a satellite system.



- LEGEND**
- ▲ Secondary Centre (Tertiary Centre) in Provincial Capital
  - △ Secondary Centre in Other Cities
  - ◆ Primary Centre in Provincial Capital
  - Microwave System
  - ~ Submarine Cable System

87/143/205 No. of Subscribers in 1994/1999/2004 (x1000)

Figure 10-3-1 Backbone Terrestrial Transmission Link in The Year of 2004



As to the principle 3), even though Ambon has a TC, only one terrestrial link is proposed. The expected number of subscribers within the Ambon TA (Tertiary area) is 93,000 which is only 1.5% of the national total. Therefore, the expected traffic volume may not justify the provision of terrestrial systems in a two-route configuration.

(2) Expansion Time Schedule

The time schedule of the backbone terrestrial system is to be determined by taking into account the following factors:

- 1) Service life of the existing system
- 2) Increase in the required number of circuits
- 3) Construction period required for the implementation

As to the factor 1), all existing backbone terrestrial systems are microwave systems whose mean service life is expected to be 20 years, as reported in the ITU GAS 3, Handbook, "General Network Planning" and Strategies Plan 85 of PERUMTEL.

In Indonesia, the Jawa-Bali microwave system (Jakarta-Surabaya) constructed in 1966 was replaced in 1983 due to wear and deterioration. The service life was in fact only 17 years. In view of an accelerated rate of technology obsolescence of the existing system caused by recent technological innovations, real technical service life may reasonably be expected to be about 15 years. However, in this report, with a good use of the existing system, service life was proposed to be 20 years. Based on this assumption, the expected terminal years of service life of the existing systems are estimated and shown in Figure 10-3-2.

As to the factor 2), where there are existing systems or there are existing systems nearby, extension of circuits or system extension of the existing systems should be planned. Suppose the service life of the existing systems remains only about 5 years, in the near

future there will be a need for replacement of basic equipments by old design. Upon making the replacement, manufactures will face problems in obtaining necessary out dated components under the circumstances of rapid technological innovations. It will be almost impossible to get the replacement. Therefore, it will be appropriate to plan the replacement of the whole system or to establish a new route in other place.

As to the factor 3), construction of long route transmission systems or construction in geographically rough regions inevitably needs a longer period for the implementation. In case of the above situations, projects should be planned sufficiently in advance to meet the required completion date.

Considering above factors, the expansion time schedule of terrestrial transmission systems was determined. For the link to Pontianak, two terrestrial transmission routes will be constructed in the future. Pontianak-Banjarmasin route shall be constructed earlier than the other route by the comparison result as shown in Table 10-3-1.

### (3) Alternative Plan

On the other hand, several alternate routes were also studied. Highly possible routes were examined in comparison with the planned routes proposed in this report.

The following are the alternative routes;

- 1) Samarinda - Palu route
- 2) Ujungpandan - Kendari - Ambon route
- 3) Manado - Tornate - Ambon route

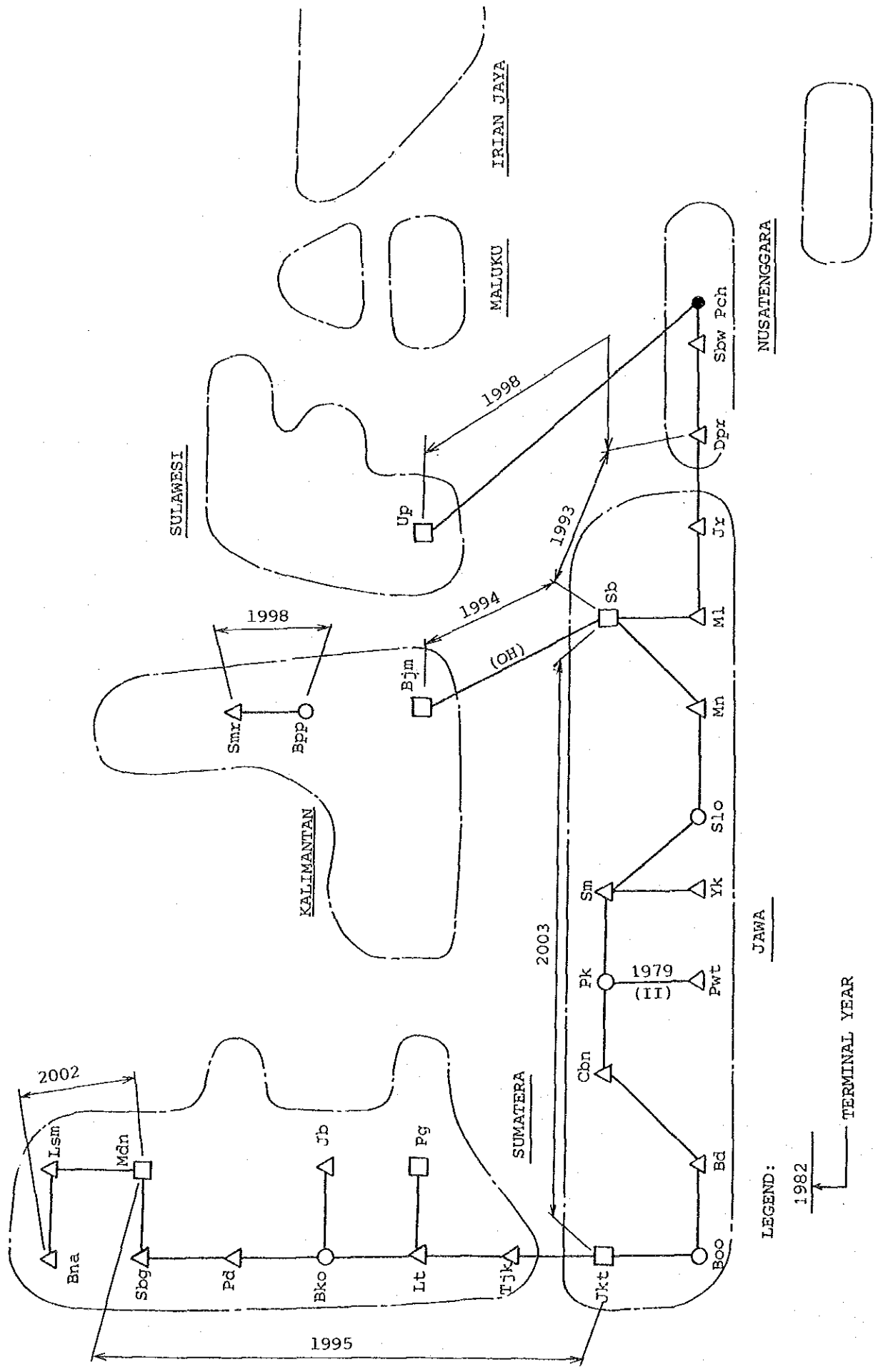


Figure 10-3-2 Service Life of Existing Backbone Terrestrial Transmission Links

Table 10-3-1 Comparison for Alternative Transmission Routes

Section	Route	Implementation Plan	No. of Circuits	Annuity Cost	Implementation Period	Connected SC's&PC's	Remarks	Evaluation
Kalimantan	Bjm - Up	Fiber: 720km	1300 ch	10.7 M\$ (4)	3 Years (2)	1 (1)	(1)	(8)
		Radio: 5hops						
Sulawesi	Bjm - Bpp - Pal - Up	Fiber: 350km	1300 ch	12.1 M\$ (3)	4 Years (1)	9 (2)	3 Projects (0)	(2)
		Radio: 31hops						
Sulawesi	Up - Ab	Fiber: 1060km	200 ch	14.2 M\$ (4)	3 Years (2)	1 (0)	(1)	(7)
		Radio: 3hops						
Maluku	Up - Wtp - Kka - Kdi - Ab	Fiber: 820km	200 ch	13.9 M\$ (4)	4 Years (1)	3 (1)	2 Projects (0)	(2)
		Radio: 10hops						
Pontianak	Up - Mo - Tt - Ab	Fiber: 880km	200 ch	19.0 M\$ (2)	5 Years (0)	7 (2)	2 Projects (0)	(3)
		Radio: 37hops						
Pontianak	Pg - Pgp - Ptk	Fiber: 440km	200 ch	8.9 M\$ (4)	3 Years (2)	2 (1)	Not directly connected to Bjm (TC) (0)	(2)
		Radio: 7hops						
Weighting for Evaluation	Bjm - Plk - Spt - Ptk	Radio: 25hops	200 ch	9.1 M\$ (4)	4 Years (1)	6 (2)	(1)	(8)
				4	2	2	1	

Note: The figure in ( ) shows the evaluated point considering weighting factor in each item.

According to Table 10-3-1, the route proposed by this report is better than any alternative routes.

The proposed backbone transmission construction plan up to 2004 is presented in Figures from 10-3-3 to 10-3-6.

(3) Spur and Terminal Transmission systems

Terrestrial transmission systems to be used for the links below SC are defined as follows:

- 1) Spur system : Terrestrial transmission systems to link SC-PC
- 2) Terminal system: Terrestrial transmission systems to link PC-LE

Planning of spur and terminal transmission systems are made in accordance with the following principles;

- 1) In principle, a single route is established to link higher switching centers,
- 2) The shortest possible route via a nearby exchange is to be selected.

The use of Satellite systems for spur or terminal systems is explained in Section 10-3-2.

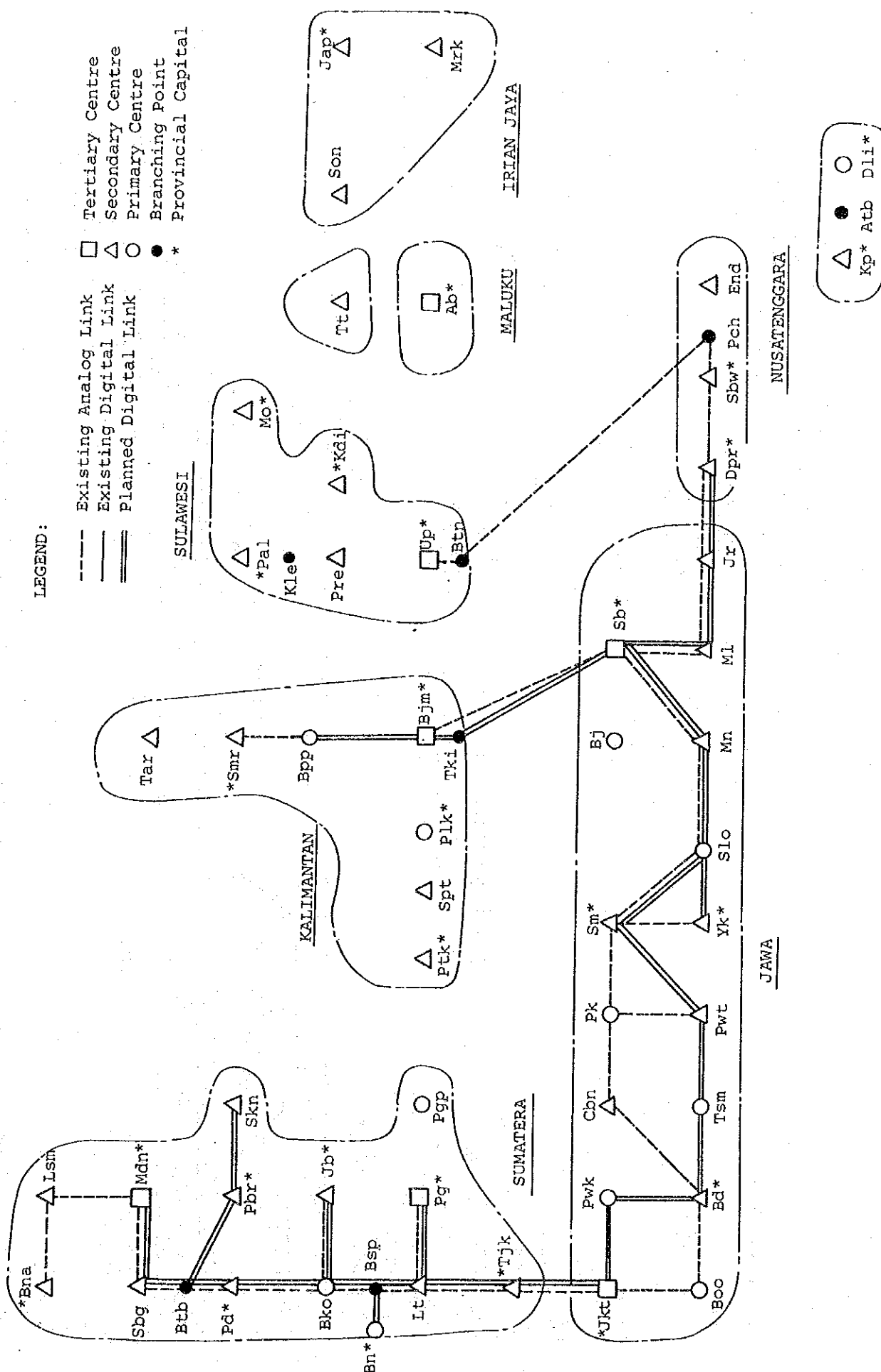


Figure 10-3-3 Backbone Terrestrial Transmission Link Plan in PELITA-IV(1984-1989)

LEGEND:

- Existing Analog Link
- Existing Digital Link
- === Planned Digital Link
- Plotted Digital Link
- Figures show channel requirement.
- \* Provincial Capital
- Tertiary Centre
- △ Secondary Centre
- Primary Centre
- Branching Point

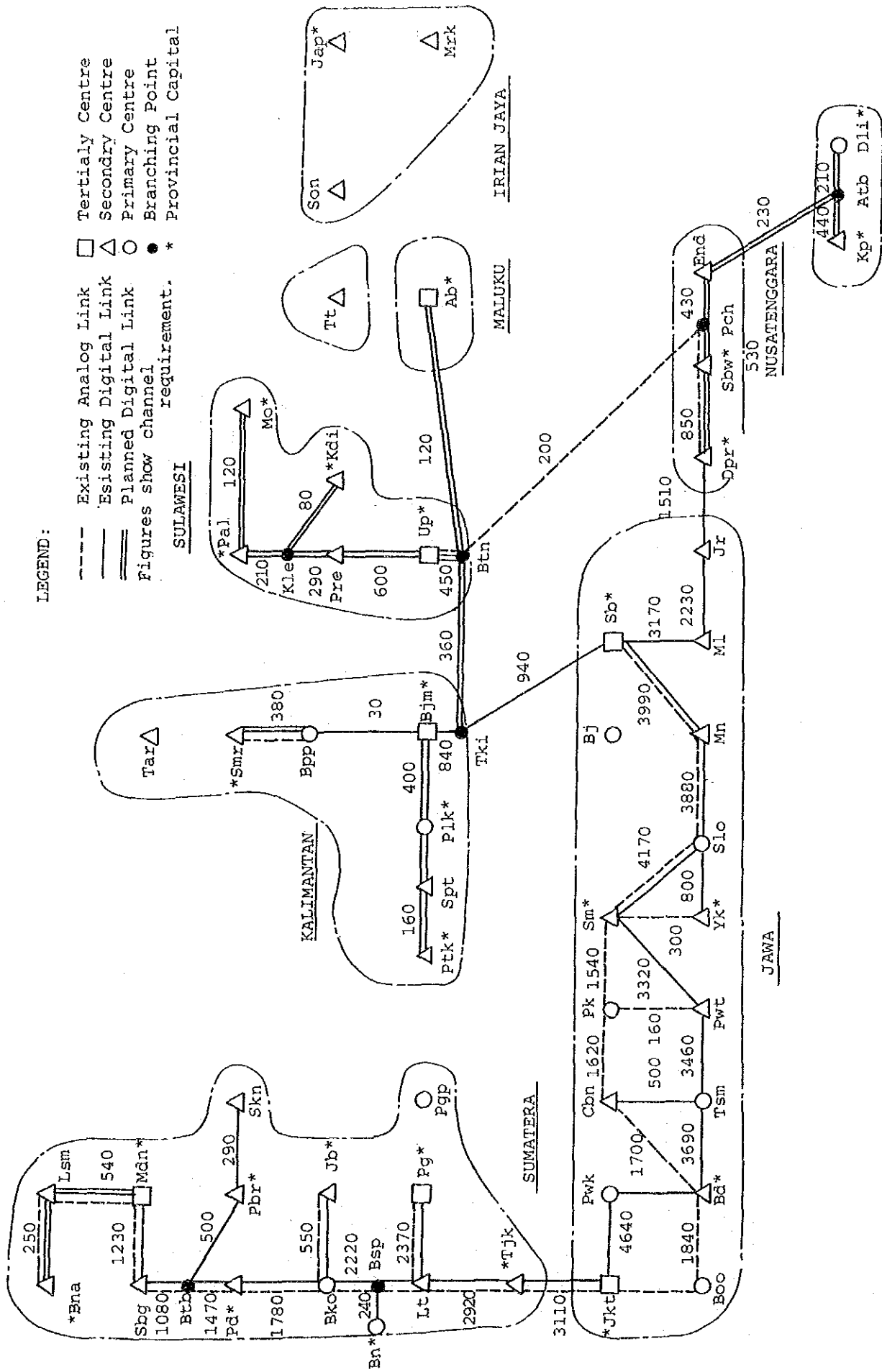


Figure 10-3-4 Backbone Terrestrial Transmission Link Plan in REPELITA-V(1989-1994)

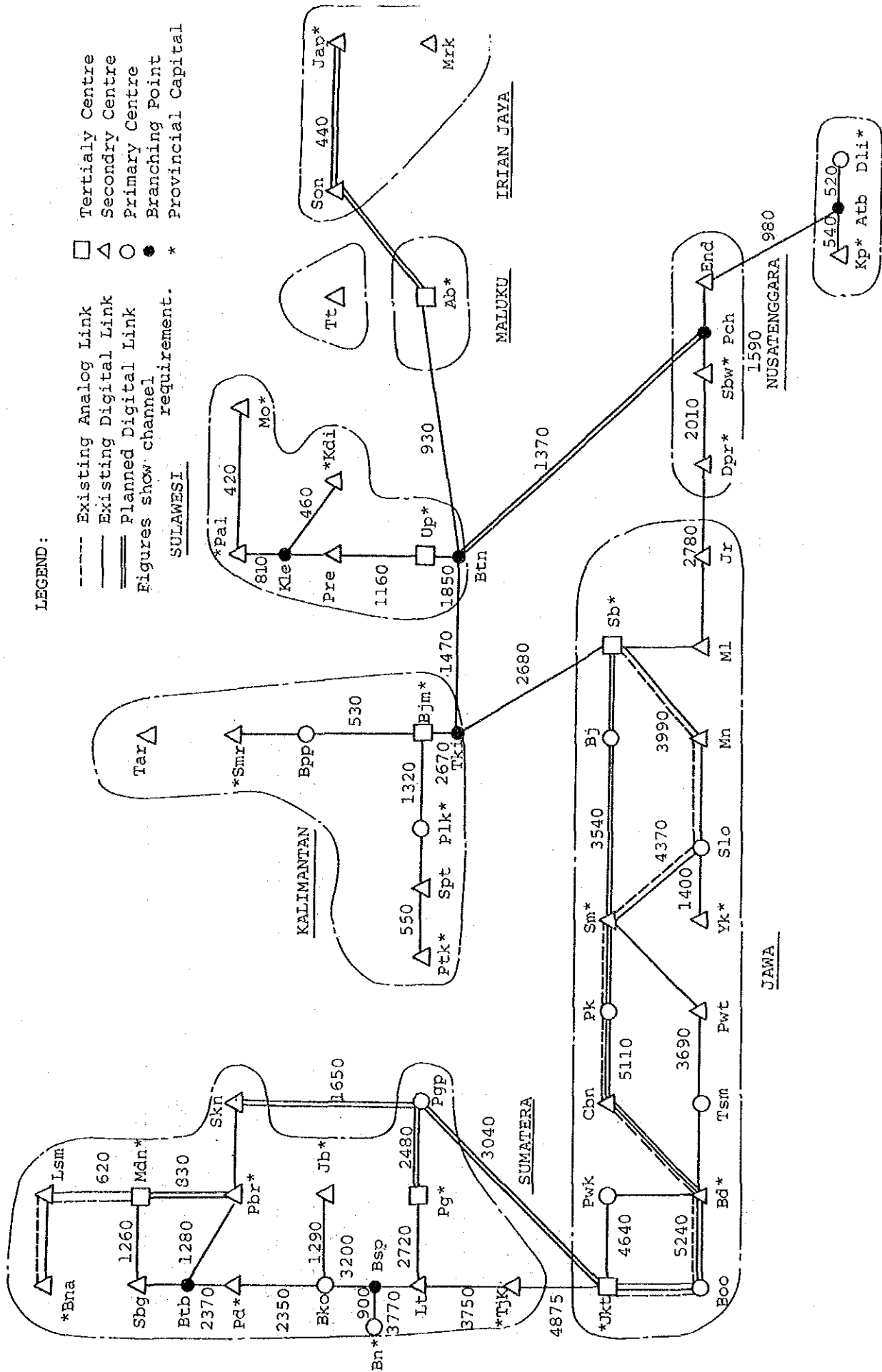


Figure 10-3-5 Backbone Terrestrial Transmission Link Plan in REPELITA-VI (1994-1999)



**LEGEND:**

- Existing Analog Link
- Existing Digital Link
- == Planned Digital Link
- △ Figures show channel
- requirement.
- SULAWESI
- Tertiary Centre
- △ Secondary Centre
- Primary Centre
- Branching Point
- \* Provincial Capital

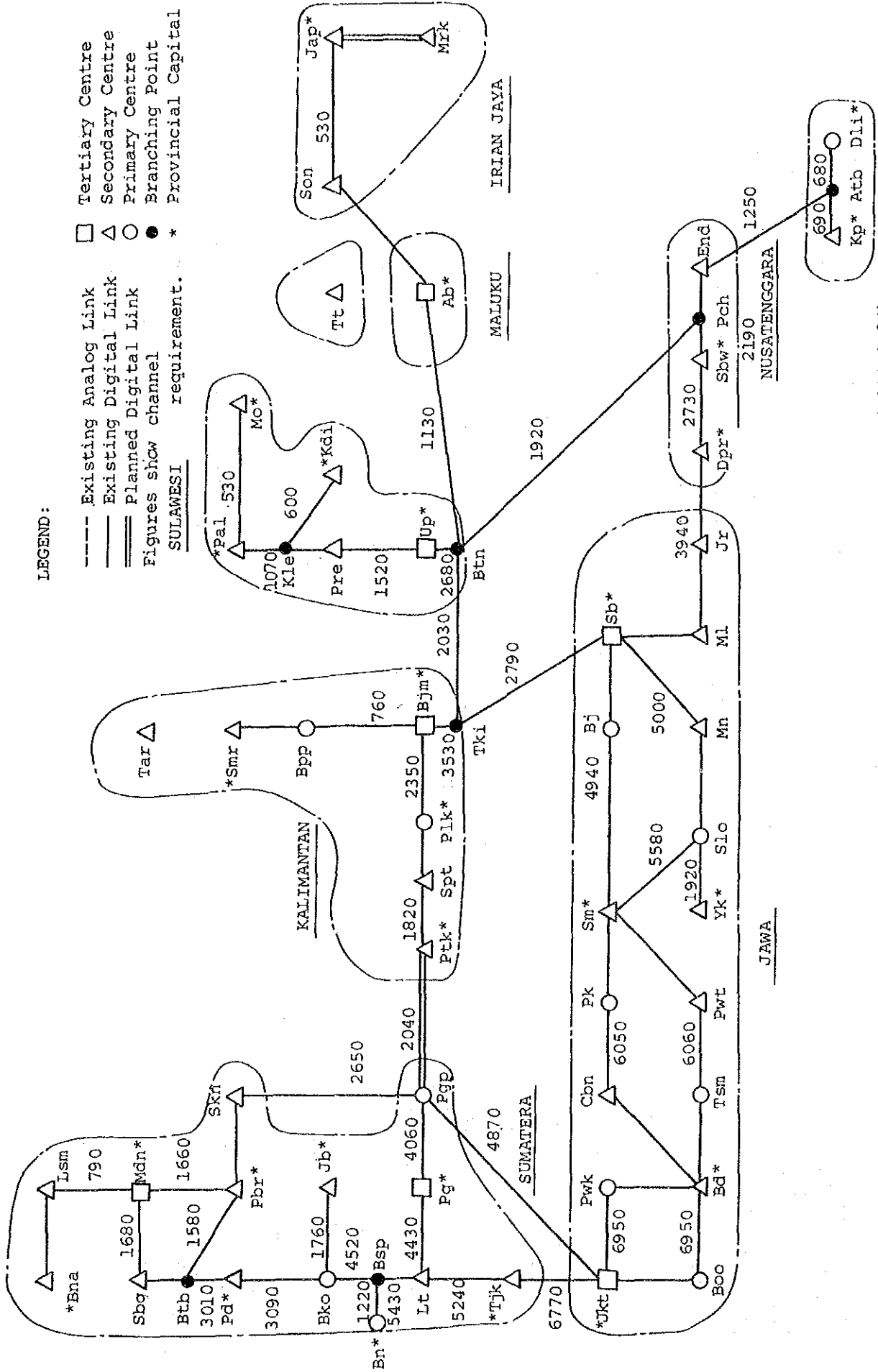


Figure 10-3-6 Backbone Terrestrial Transmission Link Plan in REPELITA-VIII (1999-2004)

## 10-3-2 Satellite Transmission Systems

### (1) Launching Plan

Because of the recent technology improvements, longer satellite service life has been achieved. Domestic satellites in Indonesia are expected have the following service life;

PALAPA B : 8 years

PALAPA C : 10 years

The proposed launching plan of the PALAPA satellites and use of transponders up to 2004 are indicated in Table 10-3-2.

### (2) Capacity of Satellite Circuits

The approximate number of available circuits per one transponder by the PALAPA satellites is calculated as follows:

FDM : 600 ch (Max.) x 0.8 (channel accommodation loss)

TDMA: 900 ch (Max.) x 0.7 (channel accommodation loss)

SCPC: 500 ch (Max.) x 1.0 (channel accommodation loss)

The available number of circuits by the transponder use plan indicated in Table 10-3-2 is shown in Table 10-3-3.

Table 10-3-2 Launching Schedule of PALAPA Satellite

Planning Period		PELITA IV	REPELITA V	REPELITA VI	REPELITA VII
YEAR		1989	1994	1999	
PALAPA	A2	(12)			
	B1	(24)	1991		
	B2P	1987	(24)	1995	
	C1		1991	(24)	2001
	C2			1995	(24)
	D1				2001 (36)
	D2				
			( ): No. of Transponders		
Frequency	C band	48	48	48	48
	Ku band	-	-	-	12
Use of Transponder	FDM	7	7	-	-
	SCPC	5	5	6	6
	TDMA	4	6	13	17
	TV	1	1	2	2
	SPARE	1	1	1	1
	OTHERS	6	4	2	10
	LEASE	24	24	24	24

Table 10-3-3 Available Circuits by PALAPA Satellite

System	1989	1994	1999	2004
FDM	3,360	3,360	-	-
TDMA	2,700	4,050	8,775	11,475
SCPC (PA)	500	500	1,000	1,000
Pre-assign Total	6,560	7,910	9,775	12,475
SCPC (DA)	2,000	2,000	2,000	2,000
Grand Total	8,560	9,910	11,775	14,475

(3) Earth Station Facilities

Earth stations for the PALAPA satellites transmission systems are classified into three according to the capacity and purposes of the use.

High Traffic Earth Station (SBB) : FDM, TDMA, SCPC, TV

Medium Traffic Earth Station (SBS) : TV, SCPC

Low Traffic Earth Station (SBK) : SCPC (Max. 12ch)

SBK is planned when the following two costs and capacity conditions are satisfied;

- 1) The number of subscribers is less than 650-1000.
- 2) The number of through repeater stations to the adjacent telephone exchanges or existing terrestrial radio stations exceeds two when the terrestrial transmission system is used.

The number of earth stations in each REPELITA is shown in Table 10-3-4. Figure 10-3-7 shows the number of earth stations at the end of REPELITA-VII.

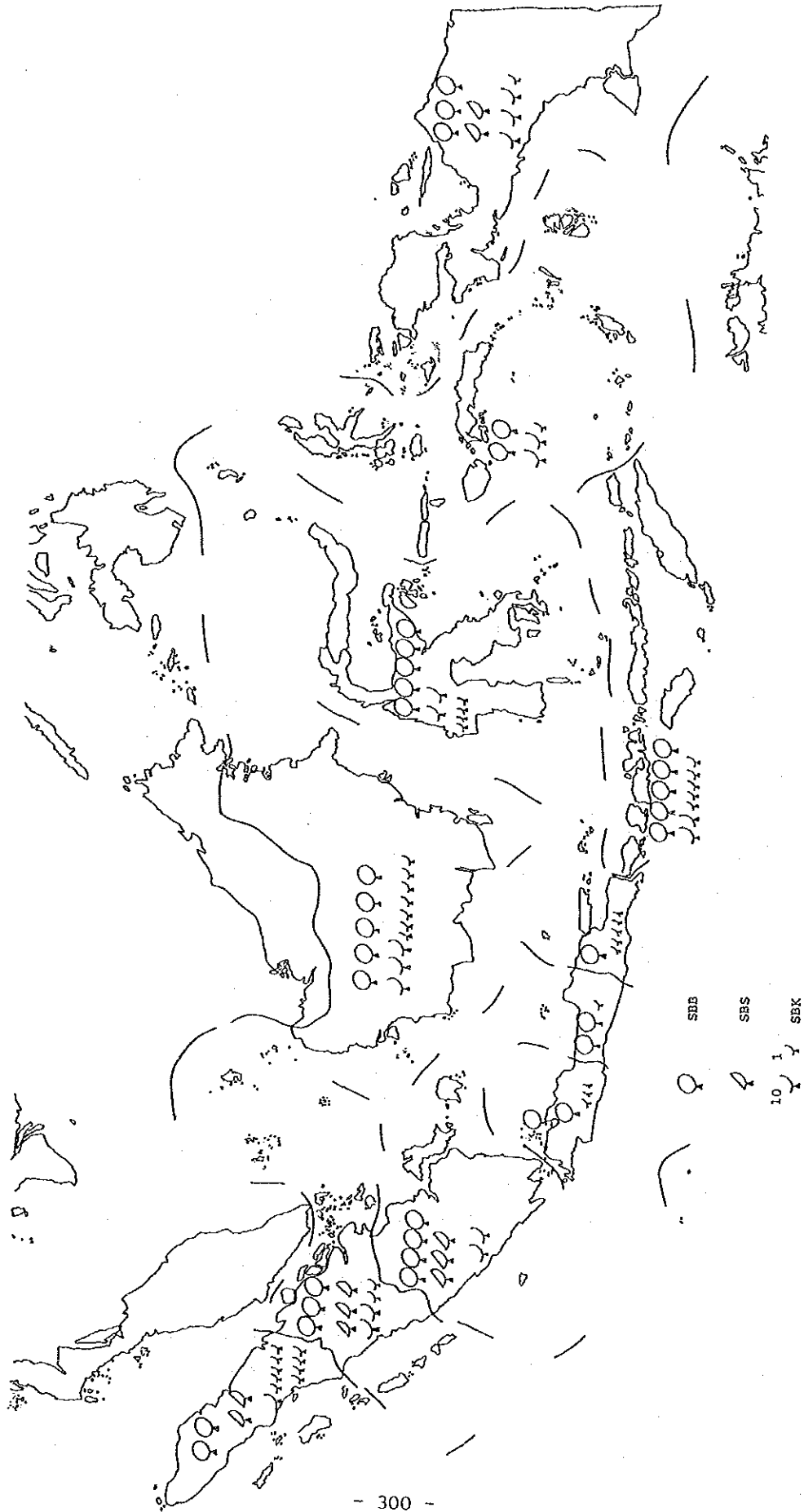


Figure 10-3-7 The Number of Earth Stations in 2004

Table 10-3-4 The Number of Earth Stations up to 2004

WITEL	PELITA-IV			REPELITA-V			REPELITA-VI			REPELITA-VII		
	SBB	SBS	SBK	SBB	SBS	SBK	SBB	SBS	SBK	SBB	SBS	SBK
I	2		20	2		25	2	1	26	2	2	19
II	2	1	25	2	1	27	3		31	3	3	22
III	2	3	26	2	3	29	4		30	4	3	20
IV	1			1			1			1		
V	1		3	1		3	1		3	1		3
VI	2	1	1	2	1	1	2		1	2		1
VII	1		3	1		5	1		5	1		5
VIII	1	3	27	1	3	28	5		30	5		25
IX	3	2	26	3	2	40	5		43	5		37
X	2	3	21	2	3	30	4		28	5		24
XI	1	1	13	1	1	18	2		22	2		21
XII	1	6	10	1	6	19	3	2	27	3	2	31
TOTAL	19	20	175	19	20	225	33	3	246	34	10	208

#### 10-4 Network Management System

The purpose of network management is to provide the best possible services to subscribers by maintaining the existing telecommunications facilities. Facilities for the management are mainly in the following two categories;

- 1) Local cable network facilities important for service order quality
- 2) Long line network facilities important for call setup quality

Among the above two, the most important but difficult management usually seems to be local cable network management. Therefore, it is essential to establish this management system by the end of

REPELITA-V period. To achieve this, a local cable network management center shall be installed at all WITELs' center cities (12 cities). The second category should be realized within the establishment of toll switching system; therefore, it is proposed to be realized in REPELITA-VI in which the capacity size to handle toll traffic shall be increased.

(1) Local Cable Network Management

Local cable network management in Indonesia is not systematically handled at present. For example, there are many unusable and faulty cables, but why and where they went unusable or faulty are often not clear. This problem was created by the insufficient past budget appropriations for cable maintenance because a large amount of the budget went to new constructions. To improve this problem and to utilize the existing facilities in a more efficient manner, a local cable network management center shall be installed at all WITELs' center cities.

The proposed major works of the local cable network management center are as follows;

- 1) Existing facility data management for each exchange
- 2) Planning and execution of failure cable repair
- 3) Storing of spare cables and materials
- 4) PERUMTELS construction for small cable network
- 5) Guidance of facility maintenance to each exchange

The details of works takes into account of experiences that will be obtained through operation of the outside plant maintenance model center constructed in Bandung.

(2) Network Management for Long Lines Operation and Traffic Control

In a manual network system, an operator provides a high degree of supervision and control over traffic flow and is able to respond to

difficulties in operating the network on the spot. Therefore, subscribers are always assured of the best possible services. However, with the introduction of the automatic services, this supervision and control will not be provided in details.

In view of the above, the total network management becomes very important, especially when the scale of automatic network is large. Network management is a real time surveillance and control activity utilizing techniques to optimize the use of call carrying capacity in a network under difficulties caused by traffic overload or facility failures.

Some of the expected difficulties are:

- Failure of transmission or switching system
- Unexpected increase of traffic caused by natural or man-made disasters or events in which traffic concentrated into one particular point of the network
- With a wide application of alternative routing and common control with switching systems in a modern automatic network, traffic congestion can be easily spread to normally unaffected other routes of the network.

To overcome these difficulties, establishment of an organization to deal exclusively with network management, called network management center becomes necessary. The principal works to be done at the network management center are as follows;

1) Assessment of network difficulties

- Identification of sources of network difficulties
- Estimation of the effects to the network.



2) Controls of network

- Inhibiting of routing to certain destination codes
- Circuit busying
- Cancellation or alteration of alternative routing
- Introduction of special recorded announcements to subscribers

It is proposed that network management centers will be established in following six cities by the end of REPELITA-VI;

- Medan
- Palembang
- Jakarta
- Surabaya
- Banjarmasin
- Ujungpandan

10-5 Training and Maintenance Center Facility

(1) Education and Training Facility

The PERUMTEL's principal facilities for education and training are located in "Education & Training Centre" in Bandung. The regional training units are located in Jakarta, Semarang, Surabaya, Medan, Pandang, Palembang, Ujung Pandang, Denpasar and Bandung.

The Education means to educate recruited personnels or PERUMTEL's employees for telecommunication service career, while the Training is to give skills and knowledge required for specific jobs or tasks.

The present total capacity for education and training can accommodate about 1600 persons per year. With the proposed new additions of about 200,000 L.U. per year, PERUMTEL must recruit about 5000 persons every year during REPELITA-V and VI. Accordingly, the capacity of education and training facility has to be nearly tripled.

(2) Maintenance Center Facility

1) Switching System Maintenance Center

Since all the new switching equipments to be installed in the future are of digital electronic types, a centralized operation and maintenance system can be easily employed because of its intrinsic nature of small failure possibility and easiness in adopting remote control systems. By taking advantage of this feature for the purpose of reducing operation and maintenance expenditures, a centralized operation and maintenance system should be positively employed where efficiency improvement becomes substantial, for example, in cities having more than several digital exchanges. During REPELITA-V, at least one switching operation and maintenance center is to be installed at each WITEL.

2) Outside Plant Maintenance Center

For Jakarta, considering the huge capacity expansion of local cable network, the outside plant maintenance centers are to be planned at the following 5 locations;

- Kota Area
- Cempaka Putih Area
- Jatinegara
- Slipi Area
- Kebayoran Area

For other regions, the outside plant maintenance can be controlled by the Local Cable Network management Centers which proposed for all WITELs in Paragraph 10-4.

## 10-6 Equipment Supply and Construction

### (1) Materials and Equipment Supply

Local production of principal materials and equipments is in process. Production of digital switching equipments, transmission equipments and cables have been already started.

This Long Term Development Plan aims to include all product localization for principal equipments in figure. For some periods until about the beginning of REPELITA-VI, some portion of the required equipments may be procured from abroad if the proposed development plan must be completed in time as scheduled.

### (2) Manpower Needed for Construction

The number of additional new subscribers in a year during PELITA-III was 30 thousands on the average, but for the period of PELITA-IV, the number of proposed new subscribers is remarkably increased to 200 thousands followed by 200 - 300 thousands during the succeeding periods.

Therefore, the constant and sufficient number of personnels needed for the construction must be trained and maintained. Since construction is to be done by contractors through PERUMTEL's contracts, it becomes necessary for local contractors to obtain satisfactory implementation and work management capabilities to complete the increased number of additional subscribers proposed.

From the experiences in Japan, the number of employees of contractor contractors to complete implementation works to accommodate 200 thousands new subscribers per year, is estimated to be about 3000 man-year.

(3) Organizations for Construction

At present, the most emphasis shall be focussed in the promotion of work implementation capability both on the part of PERUMTEL and local contractors. In the near future, by PERUMTEL, the need for adequate management capabilities for software supply and maintenance, and integration of new digital exchanges and new services into the rapidly expanding current automatic service network will emerge.

Therefore, the following organizations and their functions for construction are considered appropriate;

<u>Organization</u>	<u>Works to be done</u>
PERUMTEL	: Implementation program making and its management, software supply and maintenance, and network service management
Contractor	: Implementation design, equipment supply and work implementation

10-7 Project Implementation Program

(1) Policy on Project Information

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 (between PC-LE and LE-LE) 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. However in Jakarta the technically separate

project system still will be adopted because of a large expansion needed in each technical field.

- 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 used.

(2) List of Projects

The main projects for REPELITA-V and REPELITA-VI are listed in Table 10-6-1 and Table 10-6-2.

In general, each project is executed according to the following steps:

- 1) Feasibility Study of Projects
- 2) Financing for Investment
- 3) Detailed Design and Preparation of Tender Documents
- 4) Tendering, Evaluation, Selection of Successful Tenderer and Contract
- 5) Equipment/Materials Production and Installation Work
- 6) Acceptance Test and Handing-over

The work period in the tables shows the approximate period to execute from the above item 3) through item 6), except for item 1) and item 2).

The priority in the tables has been given by considering the following.

- 1) The large industrialized cities are mainly developed to satisfy business demand.
- 2) The priority is classified into three levels by each technical field or by service category.
- 3) The implementation time schedule must be coordinated among technical fields to establish the balanced network.

Table 10-6-1(1/2) Main Project in REPELITA-V (1/2)

Code	Project Title	Project Size	Work Period	Pri- ority
<u>Greater Jakarta Local Network</u>				
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
<u>Local Telephone Network outside Jakarta</u>				
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
<u>Toll Switching System</u>				
V-17	Expansion of Digital Toll Switching System	30,000 CCT	5 years	1
<u>Terrestrial Transmission</u>				
V-18	Trans Sulawesi Digital M/W System	2,300 km	5 years	1
V-19	Bjm-UP Optical Fiber Submarine Cable (+M/W150 km)	700 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 (+M/W200 km)	1,100 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 10-6-1(2/2) Main Project in REPELITA-V (2/2)

Code	Project Title	Project Size	Work Period	Pri- ority
<u>Satellite Transmission System</u>				
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
<u>Others</u>				
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 10-6-2(1/2) Main Project in REPELITA-VI (1/2)

Code	Project Title	Project Size	Work Period	Pri- ority
<u>Greater Jakarta Local Network</u>				
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
<u>Local Telephone Network outside Jakarta</u>				
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
<u>Toll Switching System</u>				
VI-17	Expansion of Digital Toll Switching System	40,000 CCT	"	1
<u>Terrestrial Transmission</u>				
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 10-6-2(2/2) Main Project in REPELITA-VI (2/2)

Code	Project Title	Project Size	Work Period	Pri- ority
<u>Satellite Transmission System</u>				
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
<u>Others</u>				
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



**CHAPTER 11**  
**ECONOMIC EVALUATION**



## CHAPTER 11 ECONOMIC EVALUATION

Two methods are used to evaluate the economic impacts of the two investment strategies proposed in this study, i.e., Supply Plan 1 and 2. The first evaluation is made by analyzing the consumers surpluses of two investment strategies. This method calculates how much benefits consumers can enjoy for given levels of price and supply.

The second evaluation is made by analyzing the input-output structure of the Indonesian economy. This method can analyze how the telecommunications sector is intertwined with other sectors in using the outputs and in being used as the inputs. The input-output table of Indonesia is used for this purpose.

### 11-1 Consumers Surplus Analysis

The consumers surplus was calculated by using the subscriber demand function for the telephone service. The market condition to subscribe the telephone service is shown in Figure 11-1-1.

Subscription Fee

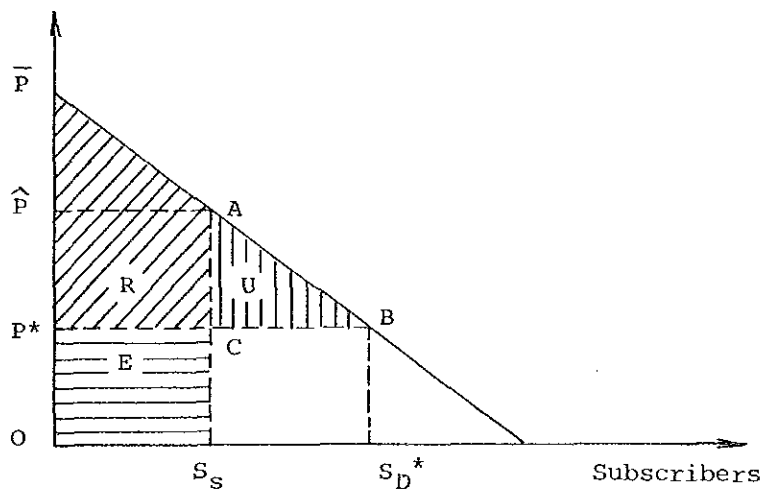


Figure 11-1-1 The Telephone Service Market

Suppose that the current subscription fee is  $P^*$  and that the supply level of the telephone service is  $S_s$ , then the realized consumers surplus is the area of  $\hat{P}P^*CA$  (the shaded area R), while the actual amount of the customer expenditure to subscribe the telephone service is the installation fee ( $P^*$ ) times the number of new subscribers ( $S_s$ ), i.e., the area  $OP^*CS_s$  (the shaded area E). If the telephone service is supplied enough to satisfy the demand level of  $S_D^*$ , then the consumers surplus is expanded to the area of  $\bar{P}P^*B$ . Hence, the difference, the area of  $ACB$  (the shaded area U), is the unrealized amount of the consumers surplus due to the limited supply of the telephone service.

The computational results of the consumers surplus for the Scenario 1 and the Scenario 3 are summarized in Table 11-1-1.

Table 11-1-1 Consumers Surplus

Year	Scenario 1		Scenario 3	
	Realized* surplus (the area R)	Realized surplus/ Total surplus [(The area R)/(The area R+The area U)]	Realized* surplus (the area R)	Realized surplus/ Total surplus [(The area R)/(The area R+The area U)]
1989	5,986	0.22	9,167	0.22
1994	23,966	0.27	42,427	0.28
1999	46,237	0.22	91,249	0.23
2004	70,890	0.18	139,946	0.18

\* Units: Million Rp. 1975 price

The Scenario 3 is better than the Scenario 1 in the following points;

- 1) The total amount of the realized consumers surplus by the Scenario 3 is almost twice larger than that of the Scenario 1 during the planning period.
- 2) The portion of the realized consumers surplus to the total surplus is slightly larger.
- 3) The realized consumers surplus increases faster during the planning period.
- 4) Jakarta produces the highest amount of consumers surplus in both scenarios.
- 5) The rates of the consumers expenses to the realized consumers surplus named the surplus rate, i.e.

$$\text{The surplus rate} = (\text{The area R}) / (\text{The area E})$$

are summarized for the two scenarios in 1994 and 2004 as follows;

Year	Area	Scenario 1 The surplus rate	Scenario 3 The surplus rate
1994	Jakarta	2.8	3.6
	Nationwide	2.0	2.6
2004	Jakarta	5.1	7.1
	Nationwide	3.9	5.5



- 6) The amounts of the consumers surplus per new subscriber for the national average named the reservation price, i.e.

The reservation price = (the area R) / [the number of new subscribers ( $S_s$ )]

are summarized for the two scenarios in 1994 and 2004 as follows;

Year	Scenario 1 The reservation price	Scenario 3 The reservation price
1994	0.68	0.85
2004	1.31	1.77

Units: Million Rp. 1986 price

In both Scenarios, the nationwide average consumers reservation prices are greater than the current highest installation fee of Million Rp. 0.5 of Jakarta. The average subscriber seems to be willing to pay more for the telephone service installation.

## 11-2 Input-Output Table Analysis

### (1) The Input-Output Structure of Indonesia

Input-output tables integrate all transactions of goods and services produced among industries, households and public sectors. They consist of industry sectors as endogeneous sectors and value added and final demands as exogeneous sectors. Figure 11-2-1 summarizes the input-output structure of Indonesia in 1980.

		Intermediate Demands	5880 Final Demands		
Intermediate Inputs		2798	Consumption Demand 3074	Investment Demand 1189	Export 1616
	4833 Gross Value Added	Wage Income 1167	(Billion RP.)		
Business Surplus 3442					
Others 224					
Import 104					

Figure 11-2-1 The Input-Output Structure of Indonesia in 1980

The rows of the table show how the goods and services are demanded in all the sectors. During 1980, the total market value of the goods and services demanded was 8677 billion Rp. of which 2798 billion Rp. worth of the goods and services was demanded by intermediate users and the rest went to the final demands.

The columns of the table show what and how much goods and services are needed to produce one unit of the goods and services. They are also called the input coefficients vectors. During 1980, the total market value of the goods and services produced was 7631 billion Rp. The difference between the demand and the production was covered by imports of 1046 billion Rp.

The mining and quarrying sector has the largest demand share of 18%. The next largest sectors are the trade sector of 11% and the construction sector of 10%. The communication sector including the postal services takes up the share of 0.3%, 26.4 billion Rp.

The amount of the intermediate inputs needed to produce all the goods and services in Indonesia was 37% of the total production. The rest, 63%, was attributed to the value added. The value added consists of the wage income, business surplus, depreciation and others. The largest value added occurred in the form of business surplus, 71% as its share. The next is wage income, 24% as its share.

Figure 11-2-2 summarizes how each sector is placed in the structure of the intermediate demand and the intermediate inputs relationship.

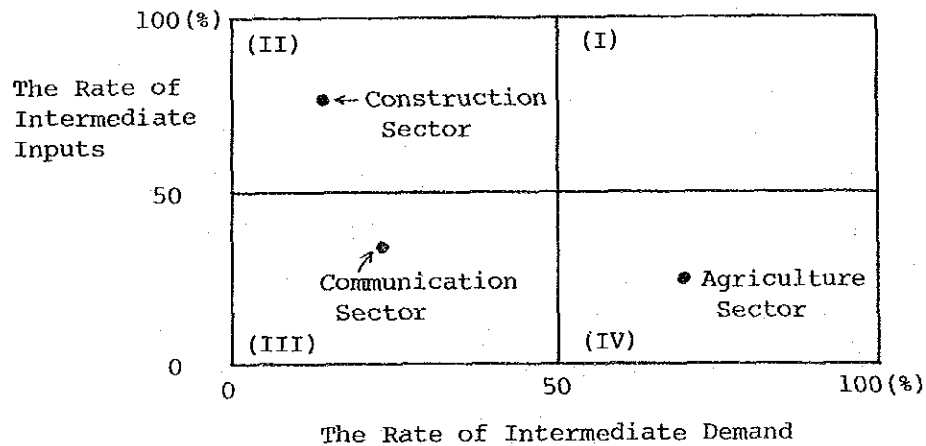


Figure 11-2-2 The Sector Classification

- I The group of sectors which demands the large amount of the intermediate inputs and, at the same time, whose products are demanded as the intermediate inputs in the large quantity.
- II The group of sectors which demands the large amount of the intermediate inputs, but whose products are mainly demanded for the final demands.

III The group of sectors which demands the small amount of the intermediate inputs, and whose products are mainly demanded for the final demands.

IV The group of sectors which demands the small amount of the intermediate inputs, but whose products are demanded as the intermediate inputs in the large quantity.

Table 11-2-1 shows the input coefficients of the communication sector.

Table 11-2-1 The Input Output Coefficients of the Communication Sector

Sector	Column vector (Other sect. - Comm sect.)	Row vector (Comm sect. - Other sect.)
1. Paddy	0.00	0.00
2. Other Food Crops	0.00	0.00
3. Other Agriculture	0.00	0.0002
4. Live Stock	0.00	0.00
5. Forestry	0.00	0.0002
6. Fishery	0.00	0.00
7. Mining and Quarrying	0.00	0.0004
8. Food, Beverage and Tobacco	0.00	0.0004
9. Other Industry	0.11	0.0005
10. Oil Refinery	0.04	0.002
11. Utilities	0.01	0.0014
12. Construction	0.07	0.001
13. Trade/Restaurant	0.01	0.0055
14. Railway Transport	0.00	0.0004
15. Road Transport	0.01	0.002
16. Water Transport	0.24	0.002
17. Air Transport	0.23	0.0039
18. Service Allied to Transport	0.01	0.0187
19. Communication	0.01	0.0113
20. Financing/Real Estate	0.06	0.0076
21. Public Administration Service	0.06	0.0020

(2) The Production Inducement Structure

1) From Table 11-2-1, outputs of the communications 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) From Table 11-2-1, 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

All the production activities are induced by the final demands. The amount of production which is induced by the increase in the final demands is called the induced production. The dependency coefficients tell how each category of the final demands induces the production.

When the final demands are classified into the consumption demand, the investment demand and the exports, sectors are called the consumption demand dependent sector, the investment demand dependent sector and the exports demand dependent sector if the dependency coefficients are larger than 50% in each category, respectively.

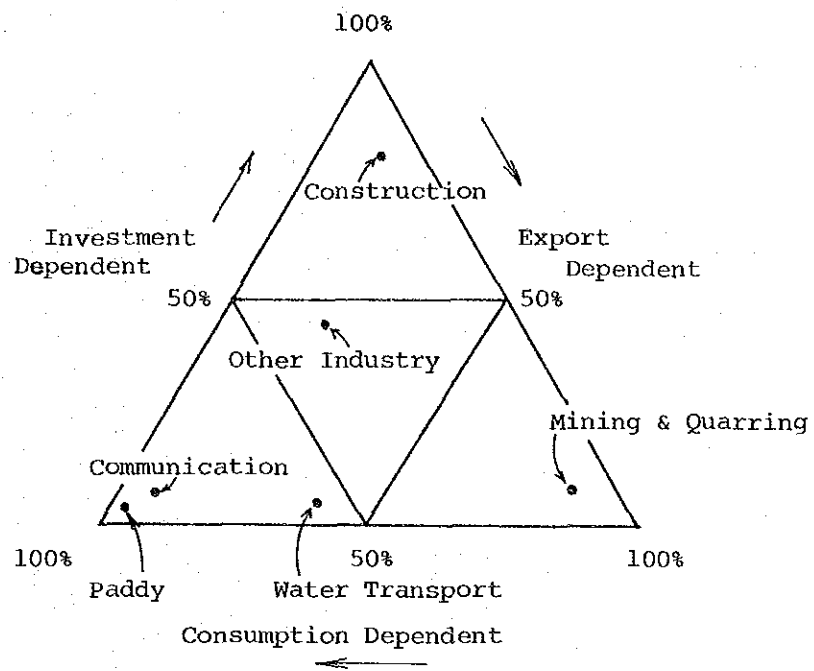


Figure 11-2-3 Sector Classification According to the Dependency Coefficients



**ANNEX 1**  
**STRATEGIES SIMULATION MODEL**





## ANNEX 1 STRATEGIES SIMULATION MODEL

### 1. INTRODUCTION

In recent years, the use of mathematical models in corporations has expanded rapidly. This expansion has paralleled the growth in formal quantitative analysis in most corporations and has led to management recognition that models can make exploration of the implications of strategic and environmental assumptions easy and fast. Models can deal with complex interactions involving large quantities of data and can show how various decisions in one part of an organization affect the rest, thus facilitating integration and coordination. They can also show the risk and timing implications of alternative actions. Better insights into corporation can arise from using models to understand its sensitivities to numerous internal and external variables.

Models usually have two groups of variables. The first group of the variables are called endogeneous variables. They are determined within models as model outputs. The second group of the variables are called exogeneous variables. They are given to models from outside as model inputs. Exogeneous variables are divided further into two groups. The first group of exogeneous variables are called environmental, or external, or non-policy variables. They characterize the environmental or external conditions which surround organizations and hence, cannot be controlled by decision makers. The second group of exogeneous variables are called policy or controllable variables. They are not determined by models but can be controlled and fixed by decision makers as the results of their policy decisions.

There are mainly two occasions to use models. The first is for forecasting. In this case, models are regarded as forecasting models. The second is for making management policies and decisions.

In this case, models are regarded as policy making or decision making models.

Forecasting models generally project the future levels of performance or activity indicators (e.g., production volume, costs, profits, etc.) as outputs for the given future levels of exogeneous variables. In forecasting models, the current policies will be assumed to prevail in the forecasting periods and only environmental conditions will be assumed to change. Decision makers can examine what will happen to their organizations if they continue to employ the current policies under many future prospects. A wide range of possible future environmental prospects are examined so that decision makers can make advanced preparations for future uncertainties.

Policy making models generally project the consequences of organizational policy changes. In policy making models, a wide range of policies are examined through changes in policy variables for a few possible environmental prospects. Decision makers can examine what will happen to their organizations if they employ certain policies under some future possible prospects.

In both occasions, models are used to make experiments. Experiments by models are called simulation. Models for simulation are required to accurately capture essential structural characteristics of organizations and be quantitatively operational.

## 2. THE SIMULATION MODEL

### 2-1 The Structure of the Simulation Model

An econometric model of the PERUMTEL system has been developed as a planning tool to assist decision makings on long term investment projects. The important and essential aspects to be modeled are; (a) the aspect of demand for the services and the revenue estimation, (b) the aspect of service provision and estimation of costs of operation, (c) the aspect of investment planning and estimation of fund size required and its sources, and (d) the aspect of profits. These aspects are incorporated into sales management, manpower management, production management, investment planning, fund management and profit management in actual management plannings. The model can analyze the effects of decisions of each management.

Figure A-7-1 shows the flow chart of the model. First, the amount of newly created capacity to the PERUMTEL system in period  $t$  ( $DCAP_t$ ) is given to the model as the first exogeneous variable. Then the amount of total available capacity of the PERUMTEL in period  $t$  ( $CAP_t$ ) is determined with the amount of total available capacity in period  $t-1$  ( $CAP_{t-1}$ ) and  $DCAP_t$ .

$CAP_t$  is then distributed among 12 WITELs. This decision is made by the model operator exogeneously. The amount of total available capacity of the  $i$ -th WITEL in period  $t$  is determined.

The number of telephone service ( $S_{it}$ ), telex service ( $SX_{it}$ ), and data communication service ( $SD_{it}$ ) subscribers are determined by the subscriber demand functions of the telex and data communication services. The volume of traffic of telephone service ( $XTX_{ijt}$ ), telegraph service ( $TLG_{it}$ ), and telex service ( $XTX_{it}$ ) are calculated by the traffic models of these services.

The revenue ( $R_{it}$  and  $R_t$ ) are then calculated by the fares ( $PI_{it}$ ,  $PM_{it}$ ,  $PC_{it}$ ), the subscribers and the traffic volume. At the same time, the personnel ( $PC_{it}$ ) and non-personnel operation ( $NPC_{it}$ ) expenses are derived from the personnel and non-personnel expenses functions, respectively, with telephone and telex service subscribers and the telegraph traffic. It is also possible to derive the number of staffs in the  $i$ -th WITEL from  $PC_{it}$  by the average wage.

The earnings before tax payment, depreciation expenses, and interest payment are calculated from the above revenue and O&M costs.

As an independent module of the above flow, the number of people who desire to start subscribing the telephone service ( $D_{it}$ ) is estimated by the telephone service subscriber demand function. The number of the waiting applicants at the end of period  $t-1$  ( $W_{t-1}$ ) plus the number of new applicants in period  $t$  as new demand in period  $t$  is determined by the size of population ( $N_{it}$ ), the level of income ( $Y_{it}$ ), the number of telephone services subscribers at the end of period  $t-1$  ( $S_{t-1}$ ) and the real subscription fee ( $PI_{it}$ ). At the end of period  $t$ , the number of waiting applicants ( $W_{it}$ ) will be derived from the difference between  $D_{it}$  ( $= W_{it} - 1 + NA_{it}$ ) and  $S_{it}$ . The number of the  $i$ -th WITEL for the next period.

As another independent module, the necessary amounts of various investment funds which are induced by the addition of new capacity are estimated. New investments for land and buildings, telephone installation, radio installation, telex and telegraph installation, cable networks, and other are calculated as exogeneous variables.

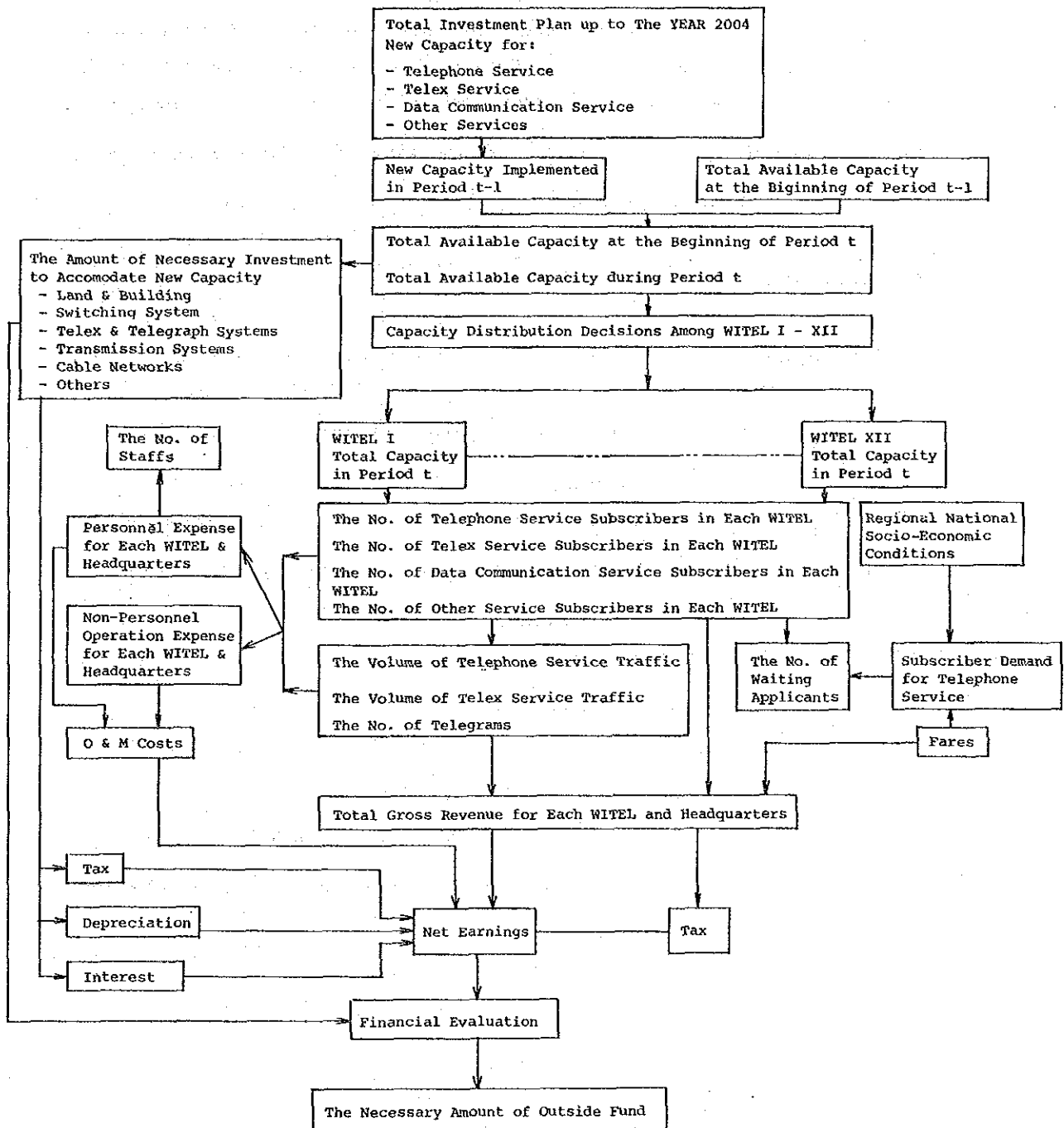


Figure A-1-1 Flow Chart of the Strategies Simulation Model

Finally, the amount of the net earnings minus tax payments, depreciation, and interest payment is figured out. This figure is compared with the necessary amount of the total investment to accommodate the newly added capacity and then how much amount of the external fund ( $OF_t$ ) is needed to carry out the investment project. The schedules of various  $OF_t$ s are presented for the entire project periods for different combinations of the policy variables.

## 2-2 The Variables of The Model

The following is the list of the exogeneous variables for the model;

- 1)  $DCAP_t$  : The amount of newly created total capacity to the PERUMTEL system in period t
- 2)  $STF_{it}$  : The number of staff in the i-th WITEL in period t
- 3)  $PI_{it}$  : Telecommunication services installation fee in the j-th WITEL in period t
- 4)  $PM_{it}$  : Telecommunication services monthly rental fee in the i-th WITEL in period t
- 5)  $PC_{it}$  : Telecommunication services call fee in the i-th WITEL in period t
- 6)  $Y_{it}$  : Real income in the region the i-th WITEL in period t
- 7)  $N_{it}$  : The number of inhabitants in the region of the i-th WITEL in period t
- 8)  $DP_t$  : Depreciation rate in period t
- 9)  $T_t$  : Depreciation rate in period t
- 10)  $Q_t$  : The real interest rate in period t
- 11)  $R_t$  : The inflation rate in period t
- 12)  $P_{ij}$  : The pulse/minute of telephone service from the i-th Province to the j-th Province
- 13)  $AREA_i$  : The area size of the region of the i-th WITEL

- 14) DI : Dummy for Indonesia
- 15) DBRS : Dummy for 8 Province of the 8 large cities
- 16) DHQ : Dummy for the Headquarters

The following is a list the endogenous variables which are determined in the model;

- 1)  $D_{it}$  : The number of people who desire to start subscribing telephone service in the i-th WITEL in period t
- 2)  $S_{it}$  : The number of telephone service subscribers in the i-th WITEL in period t
- 3)  $SX_{it}$  : The number of telex service subscribers in the i-th WITEL in period t
- 4)  $SD_{it}$  : The number of data communication service subscribers in the i-th WITEL in period t
- 5)  $W_{it}$  : The number of waiting applicants for telephone service from the i-th WITEL in period t
- 6)  $XTP_{ijt}$  : The volume of traffic of the telephone service from the i-th WITEL to the j-th WITEL in period t
- 7)  $XTX_{it}$  : The volume of traffic of the telex service in the i-th WITEL in period t
- 8)  $TLG_{it}$  : The number of telegrams sent from the i-th WITEL in period t
- 9)  $CAP_{it}$  : The amount of total capacity available to the i-th WITEL in period t
- 10)  $CAP_t$  : The amount of total capacity available to the PERUMTEL system in period t
- 11)  $PC_{it}$  : The real personnel expenses in the i-th WITEL in period t
- 12)  $NPC_{it}$  : The real non-personnel operation expenses in the i-th WITEL in period t
- 13)  $DPCT_t$  : The amount of real depreciation costs in period t



- 14)  $TCT_t$  : The amount of real tax payment in period t
- 15)  $ICT_t$  : The amount of real interest payment in period t
- 16)  $R_{it}$  : The amount of real revenue in the i-th WITEL in period t
- 17)  $R_t$  : The amount of real total revenue in period t
- 18)  $GE_t$  : The amount of real gross earnings in period t
- 19)  $OF_t$  : The amount of real outside fund to finance investment projects in period t
- 20)  $NE_t$  : The amount of real net earnings in period t

### 2-3 The System of The Equations of The Model

#### 1) TELEPHONE SERVICE SUBSCRIBER DEMAND (WITEL)

$$D_{it} = (0.1365 + 0.7773*(S/N)_{it-1} - 0.0108*PI_{it} + 0.00008*Y_{it}) * (N_{it} - S_{it} - 1)$$

#### 2) TELEX SERVICE SUBSCRIBER DEMAND (NATION WIDE)

$$\log(SX/S)_t = -1.7934 + 0.72074*\log(SX/S)_{t-1} - 0.03560*\log(SD/S)_{t-1}$$

#### 3) DATA COMMUNICATION SERVICE SUBSCRIBER DEMAND (NATION WIDE)

$$\log(SD)_t = -8.778 + (0.7707 + 1.1149*(S/N)_t)*\log(S_t) + 3.1724*DI$$

#### 4) TELEPHONE SERVICE TRAFFIC (INTER-PROVINCE)

$$\log(XTP_{ijt}) = -4.31559 + 0.61196*\log(S_{jt}) + 0.51539*\log(S_{it}) - (1.7117 - 0.1092*D8RS)*\log(P_{ijt})$$

5) TELEGRAPH SERVICE TRAFFIC (NATION WIDE)

$$\begin{aligned} \text{TLG}_{it} = & -137.636 + (12.236 + 5.2345*(S/N)_{it}) * N_{it} \\ & + (0.33045 - 1.4697*(S/N)_{it}) * Y_{it} \end{aligned}$$

6) TELEX SERVICE TRAFFIC (WITEL)

$$\log(\text{XTX}_{it}) = 6.2730 + (0.36966 + 0.06061*(Y/N)_{it}) + \log(\text{SX}_{it})$$

7) PERSONNEL EXPENSES (WITEL)

$$\begin{aligned} \log(\text{PC}_{it}) = & -7.8904 + 0.58137 + \log(S_{it}) + 0.46621 * \log(\text{TLG}_{it}) \\ & + 0.4933 \log(\text{XTX}_{it}) - 2.9141 \text{ DHQ} \end{aligned}$$

8) NON-PERSONNEL OPERATION EXPENSES (WITEL)

$$\begin{aligned} \log(\text{NPC}_{it}) = & -3.7916 + 0.5238 * \log(S_{it}) + 0.8044 * \log(\text{SX}_{it}) \\ & + 0.19046 \log(\text{PC}) - 1.1314 \text{ DHQ} \end{aligned}$$

9) TOTAL CAPACITY (NATION WIDE)

$$\text{CAP}_t = \sum_i \text{CAP}_{it}$$

10) WAITING APPLICANTS (WITEL)

$$W_{it} = D_{it} - (S_{it} - S_{it-1})$$

11) TOTAL REVENUE (WITEL)

$$\begin{aligned} R_{it} = & \text{PI}_{it} * (S_{it} - S_{it-1}) + \text{PM}_{it} * S_{it} + \sum_j \text{PC}_{ijt} * \text{XTP}_{ijt} \\ & + \text{PI}_{it} * (\text{SX}_{it} - \text{SX}_{it-1}) + \text{PM}_{it} * \text{SX}_{it} + \text{PC}_{it} * \text{XTX}_{it} \\ & + \text{PI}_{it} * (\text{SD}_{it} - \text{SD}_{it-1}) + \text{PM}_{it} * \text{SD}_{it} + \text{PC}_{it} * \text{TLG}_{it} \end{aligned}$$

12) TOTAL REVENUE (NATION WIDE)

$$R_t = \sum_i R_i$$

13) GROSS EARNINGS BEFORE TAX, DEPRECIATION AND INTEREST EXPENSES.  
(WITEL)

$$GE_{it} = R_{it} - PC_{it} - NPC_{it}$$

14) GROSS EARNINGS (NATION WIDE)

$$GE_t = \sum_i GE_{it}$$

15) NET EARNINGS (NATION WIDE)

$$NE_t = GE_t - DCT_t - ICT_t - TCT_t$$

16) DEPRECIATION COSTS

$$DCT_t = DP_t * CAP_t$$

17) TAX EXPENSES

$$TCT_t = T_t * (GE_t - DCT_t - ICT_t)$$

18) OUTSIDE FUND

$$OF = \text{TOTAL INVESTMENT FUND NEEDED} - \sum_t (NE_t + DCT_t)$$

19) INTEREST EXPENSES

$$ICT_t = Q_t * OF$$

### 3. SIMULATION RESULTS

The simulation results for Scenario-1 through Scenario-4 are shown in following tables;

Table A-1-1 Simulation Results on Scenario-1 (1/2)

Description	SIMULATION RESULTS (PROFIT/LOSS STATEMENT OF PERUMTEL) (Million Rp.)														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	GDP %:		1.05		TARIFF :		CHANGE		MAN-POWER:		CHANGE		KAB/KOTA:		SAME
1. Profit/Loss before Tax	998,583	1,166,392	1,372,603	1,607,878	1,866,596	2,051,899	2,302,704	2,587,098	2,907,700	3,267,457	3,477,595	3,810,061	4,176,384	4,578,722	5,022,364
2. Depreciation	643,859	727,321	810,782	894,244	977,705	1,061,167	1,169,176	1,277,184	1,385,193	1,493,202	1,601,211	1,728,858	1,856,505	1,984,152	2,111,799
3. Interest	279,555	330,852	374,995	406,253	437,856	469,176	500,620	532,174	563,821	595,568	627,315	659,062	690,809	722,556	754,303
4. Gross Profit	75,170	108,219	186,826	307,381	517,055	684,556	874,620	1,085,182	1,331,953	1,643,941	1,735,171	1,929,092	2,156,869	2,420,662	2,748,858
5. Corporate Tax (35 %)	26,310	37,877	65,369	107,583	180,969	239,595	306,117	379,814	466,184	575,379	607,310	675,182	754,904	847,232	962,100
6. Profit after Tax	48,861	70,342	121,457	199,797	336,086	444,962	568,503	705,369	865,769	1,068,562	1,127,861	1,253,910	1,401,965	1,573,430	1,786,758
7. OPS (55 %)	26,873	38,688	66,790	109,889	184,847	244,729	312,676	387,953	476,173	587,709	620,324	689,650	771,081	865,387	982,717
8. Social Pension (20 %)	9,172	14,068	24,287	39,959	67,217	88,992	113,701	141,074	173,154	213,712	225,572	250,782	280,393	314,686	357,352
9. General Reserve (25 %)	12,215	17,586	30,359	49,949	84,021	111,240	142,126	176,342	216,442	267,140	281,965	313,477	350,491	393,358	446,689
10. Operating Ratio	0.96	0.95	0.92	0.88	0.82	0.79	0.75	0.72	0.69	0.65	0.66	0.64	0.63	0.62	0.60

SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)

Source of Fund	SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	GDP %:		1.05		TARIFF :		CHANGE		MAN-POWER:		CHANGE		KAB/KOTA:		SAME
1. General Reserve	12,215	17,586	30,359	49,949	84,021	111,240	142,126	176,342	216,442	267,140	281,965	313,477	350,491	393,358	446,689
2. Depreciation	643,859	727,321	810,782	894,244	977,705	1,061,167	1,169,176	1,277,184	1,385,193	1,493,202	1,601,211	1,728,858	1,856,505	1,984,152	2,111,799
3. Installation	47,016	47,043	47,072	47,102	47,134	47,166	47,198	47,230	47,262	47,294	47,326	47,358	47,390	47,422	47,454
4. Procurement of Loan	503,483	503,483	503,483	503,483	503,483	503,483	503,483	503,483	503,483	503,483	503,483	503,483	503,483	503,483	503,483
5. Equity	100,697	100,697	100,697	100,697	100,697	100,697	100,697	100,697	100,697	100,697	100,697	100,697	100,697	100,697	100,697
Total	1,309,260	1,398,120	1,494,385	1,597,437	1,715,034	1,861,232	1,700,187	1,842,478	1,990,658	2,149,366	2,188,382	2,347,607	2,512,338	2,682,926	2,863,985
Application of Fund															
1. Repayment of Loan	186,036	219,250	232,024	198,002	201,704	103,840	0	0	0	0	0	0	0	0	0
PELLITA II, III&IV	0	0	0	0	419,569	419,569	419,569	419,569	419,569	419,569	419,569	419,569	419,569	419,569	419,569
REPELLITA V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REPELLITA VI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REPELLITA VII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Re-investment	34,483	38,241	42,410	47,032	52,159	56,749	61,743	67,176	73,088	79,519	85,165	91,212	97,688	104,624	112,052
3. Working Capital	37,069	41,109	45,590	50,560	56,071	61,005	66,373	72,214	78,569	85,483	91,533	98,053	105,015	112,471	120,456
4. Investment	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966
Total	1,264,554	1,305,567	1,326,990	1,302,560	1,736,468	1,944,295	1,850,818	1,862,092	1,874,358	2,050,596	1,879,675	1,892,222	1,905,660	1,920,052	2,127,974
Net Surplus	44,707	92,553	167,395	294,877	-21,434	-383,064	-150,631	-19,614	116,300	98,770	308,707	455,385	606,679	762,875	736,012
Accumulated Surplus	44,707	137,260	304,655	599,532	578,098	195,034	44,403	24,790	141,089	239,859	548,566	1,003,951	1,610,630	2,373,505	3,199,516
Debt service Ratio	3.78	3.61	3.63	5.01	1.78	2.36	3.27	3.61	3.96	3.13	12.00	12.98	13.99	15.04	7.40

Table A-1-2 Simulation Results on Scenario-1 (2/2)

GDP ? % : 1.03 KAB/KOTA: SAME  
 SUPPLY PLAN: 1 MAN-POWER : CHANGE  
 SUB/CAPA : 1 TARIFF : CHANGE

SIMULATION RESULTS (CASH FLOW STATEMENTS)

(UNIT: MILLION Rp.)

		F.I.R.R.	1990	1991	1992	1993	1994	1995	1996
REPELITA V	HEAD		-13,600	-36,757	-50,371	-66,698	-94,720	-81,120	-81,120
	WITEL I	12%	-112,942	-98,230	-81,215	-61,664	-39,307	76,751	76,751
	WITEL II	9%	-37,283	-33,256	-28,601	-23,267	-17,195	20,519	20,519
	WITEL III	11%	-64,743	-56,850	-47,539	-36,677	-24,109	42,140	42,140
	WITEL IV	47%	-202,660	-115,687	-16,088	97,473	226,532	457,528	457,528
	WITEL V	12%	-119,707	-104,030	-85,742	-64,577	-40,225	82,795	82,795
	WITEL VI	17%	-88,085	-73,251	-56,027	-36,165	-13,383	77,396	77,396
	WITEL VII	19%	-127,533	-103,451	-75,685	-43,848	-7,497	125,223	125,223
	WITEL VIII	6%	-44,416	-40,228	-35,412	-29,918	-23,690	21,150	21,150
	WITEL IX	15%	-52,273	-44,093	-34,828	-24,382	-12,648	40,570	40,570
	WITEL X	8%	-69,548	-61,860	-53,137	-43,293	-32,228	38,112	38,112
	WITEL XI	7%	-13,487	-12,232	-10,761	-9,058	-7,105	6,553	6,553
	WITEL XII	9%	-13,672	-12,189	-10,469	-8,494	-6,245	7,529	7,529
	TOTAL	19%	-959,950	-792,114	-585,874	-350,569	-91,819	915,147	915,147
		F.I.R.R.	1995	1996	1997	1998	1999	2000	2001
REPELITA VI	HEAD		-71,994	-96,109	-118,282	-138,667	-157,399	-139,799	-139,799
	WITEL I	18%	-127,178	-105,790	-81,895	-55,272	-25,676	124,517	124,517
	WITEL II	14%	-42,874	-37,135	-30,696	-23,503	-15,497	33,310	33,310
	WITEL III	17%	-73,939	-62,261	-49,065	-34,221	-17,588	68,146	68,146
	WITEL IV	87%	-155,966	-31,356	107,133	260,755	430,903	729,838	729,838
	WITEL V	18%	-135,154	-112,224	-86,486	-57,692	-25,567	133,636	133,636
	WITEL VI	26%	-94,163	-72,441	-48,122	-20,976	9,255	126,732	126,732
	WITEL VII	29%	-133,428	-98,477	-59,500	-16,137	32,014	203,769	203,769
	WITEL VIII	11%	-52,105	-46,197	-39,584	-32,212	-24,024	34,004	34,004
	WITEL IX	22%	-57,441	-45,993	-33,313	-19,301	-3,851	65,019	65,019
	WITEL X	13%	-80,682	-69,961	-58,067	-44,909	-30,386	60,642	60,642
	WITEL XI	11%	-15,963	-14,174	-12,147	-9,863	-7,305	10,371	10,371
	WITEL XII	13%	-15,895	-13,798	-11,435	-8,788	-5,835	11,991	11,991
	TOTAL	27%	-1,056,783	-805,918	-521,459	-200,788	159,044	1,462,177	1,462,177
		F.I.R.R.	2000	2001	2002	2003	2004	2005	2006
REPELITA VII	HEAD		-111,847	-139,383	-165,323	-189,767	-212,801	-192,001	-192,001
	WITEL I	20%	-148,486	-120,292	-89,547	-56,070	-19,668	157,832	157,832
	WITEL II	16%	-50,156	-42,360	-33,832	-24,526	-14,394	43,287	43,287
	WITEL III	19%	-86,704	-71,016	-53,783	-34,903	-14,263	87,059	87,059
	WITEL IV	96%	-178,385	-17,530	157,396	347,412	553,626	906,913	906,913
	WITEL V	20%	-158,083	-127,686	-94,442	-58,154	-18,602	169,546	169,546
	WITEL VI	29%	-108,862	-80,004	-48,503	-14,172	23,192	162,030	162,030
	WITEL VII	33%	-154,220	-108,236	-58,154	-3,684	55,495	258,478	258,478
	WITEL VIII	12%	-61,191	-53,201	-44,469	-34,951	-24,599	43,980	43,980
	WITEL IX	24%	-67,272	-52,333	-36,111	-18,522	524	81,916	81,916
	WITEL X	15%	-94,941	-80,891	-65,616	-49,039	-29,333	78,246	78,246
	WITEL XI	13%	-18,843	-16,381	-13,669	-10,692	-6,866	14,024	14,024
	WITEL XII	16%	-18,742	-15,887	-12,755	-9,328	-4,987	16,080	16,080
	TOTAL	29%	-1,257,733	-925,201	-558,808	-156,396	287,325	1,827,390	1,827,390

Table A-1-3 Simulation Results on Scenario-2 (1/2)

Description	SIMULATION RESULTS (PROFIT/LOSS STATEMENT OF PERUMTEL) (Million Rp.)										2000	2001	2002	2003	2004
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999					
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999					
1. Profit/Loss before Tax	969,758	1,130,496	1,329,341	1,556,687	1,806,581	1,938,394	2,171,495	2,437,201	2,738,137	3,077,334	3,208,132	3,511,503	3,847,790	4,219,195	4,631,419
2. Depreciation	643,859	727,321	810,782	894,244	977,705	1,061,167	1,169,176	1,277,184	1,385,193	1,493,202	1,601,211	1,728,858	1,856,505	1,984,152	2,111,799
3. Interest	279,553	330,852	374,995	406,253	371,836	317,905	282,365	259,916	257,466	179,181	180,306	181,432	182,557	183,682	161,707
4. Gross Profit	461,345	72,323	143,563	256,189	437,039	559,323	719,954	900,101	1,115,498	1,404,951	1,426,615	1,601,214	1,808,728	2,051,361	2,351,913
5. Corporate Tax (35 %)	16,221	25,313	50,247	89,666	139,964	195,763	251,984	315,035	390,424	491,733	499,315	560,425	633,055	717,976	825,270
6. Profit after Tax	30,124	47,010	93,316	166,523	297,076	363,560	467,970	585,066	725,074	913,218	927,299	1,040,789	1,175,673	1,333,384	1,532,643
7. DPS (55 %)	16,568	25,855	51,324	91,588	163,592	199,958	257,384	321,786	398,790	502,270	510,015	572,434	646,620	733,361	842,954
8. Social Pension (20 %)	6,025	9,402	18,663	33,305	59,415	72,712	93,594	117,013	145,015	182,644	185,460	208,158	235,135	266,677	306,529
9. General Reserve(25 %)	7,531	11,752	23,329	41,631	74,269	90,890	116,993	146,266	181,268	228,305	231,825	260,197	293,918	333,346	383,161
10. Operating Ratio	0.98	0.97	0.94	0.90	0.84	0.83	0.80	0.77	0.74	0.70	0.72	0.71	0.69	0.67	0.65

GDP %: 1.05 TARIFF : CHANGE  
 PLAN : 1 MAN-POWER: CHANGE  
 SUB/CAP: 1 KAB/KOTA: SAME

SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)

Source of Fund	SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)										2000	2001	2002	2003	2004
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999					
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999					
1. General Reserve	7,531	11,752	23,329	41,631	74,269	90,890	116,993	146,266	181,268	228,305	231,825	260,197	293,918	333,346	383,161
2. Depreciation	643,859	727,321	810,782	894,244	977,705	1,061,167	1,169,176	1,277,184	1,385,193	1,493,202	1,601,211	1,728,858	1,856,505	1,984,152	2,111,799
3. Instalation	47,016	47,043	47,072	47,072	47,134	61,046	61,107	61,172	61,241	61,241	72,195	72,261	72,330	72,404	72,483
4. Procurement of Loan	503,483	503,483	503,483	503,483	503,483	260,626	260,626	260,626	260,626	260,626	251,010	251,010	251,010	251,010	251,010
5. Equity	100,697	100,697	100,697	100,697	100,697	130,313	130,313	130,313	130,313	130,313	0	0	0	0	0
Total	1,304,576	1,392,287	1,487,355	1,589,119	1,705,281	1,606,038	1,740,211	1,877,559	2,020,641	2,175,687	2,138,241	2,294,327	2,455,765	2,622,915	2,800,456

Application of Fund	SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)										2000	2001	2002	2003	2004
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999					
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999					
1. Repayment of Loan	186,036	219,250	232,024	198,002	201,704	103,840	0	0	0	0	0	0	0	0	0
PELITA II, III&IV	0	0	0	0	419,369	419,569	419,569	419,569	419,569	419,569	217,189	217,189	217,189	217,189	217,189
REPELITA V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REPELITA VI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REPELITA VII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Re-investment	34,483	38,241	42,410	47,032	52,159	56,749	61,743	67,176	73,088	79,519	85,165	91,212	97,688	104,624	112,052
3. Working Capital	37,069	41,109	45,590	50,560	56,071	61,005	66,373	72,214	78,569	85,483	91,553	98,053	105,015	112,471	120,456
4. Investment	1,006,966	1,006,966	1,006,966	1,006,966	1,006,966	1,303,132	1,303,132	1,303,132	1,303,132	1,303,132	1,540,066	1,540,066	1,540,066	1,540,066	1,540,066
Total	1,264,554	1,305,567	1,326,990	1,302,560	1,736,468	1,944,295	1,850,818	1,882,092	1,874,358	2,104,893	1,933,972	1,946,519	1,959,957	1,974,349	2,182,271
Net Surplus	40,023	86,720	160,365	286,559	-31,187	-338,258	-110,607	15,467	146,282	70,794	204,269	347,808	495,808	648,566	818,186
Accumulated Surplus	40,023	126,743	287,108	573,667	542,480	204,222	93,615	109,082	255,364	326,158	530,427	878,234	1,374,043	2,022,609	2,640,795
Debt service Ratio	3.75	3.59	3.80	4.96	1.77	2.32	3.21	3.54	3.88	2.80	8.77	9.49	10.23	11.00	6.27

Table A-1-4 Simulation Results on Scenario-2 (2/2)

GDP ? % : 1.03 KAB/KOTA: SAME  
 SUPPLY PLAN: 1 MAN-POWER: CHANGE  
 SUB/CAPA : 1 TARIFF : CHANGE

SIMULATION RESULTS (CASH FLOW STATEMENTS)

(UNIT: MILLION Rp.)

		F.I.R.R.	1990	1991	1992	1993	1994	1995	1996
REPELITA V	HEAD		-13,600	-38,866	-54,522	-73,115	-103,972	-90,372	-90,372
	WITEL I	11%	-112,942	-98,647	-82,082	-63,011	-41,163	74,895	74,895
	WITEL II	8%	-37,283	-33,525	-29,158	-24,128	-18,378	19,337	19,337
	WITEL III	11%	-64,743	-57,177	-48,217	-37,730	-25,558	40,691	40,691
	WITEL IV	46%	-202,660	-116,990	-18,790	93,287	220,780	451,776	451,776
	WITEL V	12%	-119,707	-104,497	-86,712	-66,084	-42,301	80,718	80,718
	WITEL VI	16%	-88,085	-73,734	-57,032	-37,729	-15,539	75,239	75,239
	WITEL VII	19%	-127,533	-104,085	-77,002	-45,897	-10,322	122,397	122,397
	WITEL VIII	6%	-44,416	-40,497	-35,967	-30,776	-24,867	19,973	19,973
	WITEL IX	14%	-52,273	-44,383	-35,427	-25,308	-13,918	39,300	39,300
	WITEL X	8%	-69,548	-62,152	-53,740	-44,223	-33,502	36,838	36,838
	WITEL XI	6%	-13,487	-12,332	-10,966	-9,375	-7,540	6,119	6,119
	WITEL XII	8%	-13,672	-12,300	-10,697	-8,847	-6,728	7,047	7,047
	TOTAL	18%	-959,950	-799,185	-600,312	-372,936	-123,010	883,956	883,956
		F.I.R.R.	1995	1996	1997	1998	1999	2000	2001
REPELITA VI	HEAD		-89,052	-118,403	-146,034	-172,080	-196,662	-179,062	-179,062
	WITEL I	16%	-130,197	-109,869	-87,101	-61,671	-33,333	116,860	116,860
	WITEL II	10%	-44,826	-39,734	-33,980	-27,512	-20,269	28,538	28,538
	WITEL III	15%	-76,326	-65,481	-53,167	-39,259	-23,611	62,123	62,123
	WITEL IV	80%	-165,823	-44,568	90,366	240,239	406,445	705,380	705,380
	WITEL V	17%	-138,563	-116,828	-92,359	-64,909	-34,200	125,003	125,003
	WITEL VI	23%	-97,613	-77,114	-54,098	-28,331	442	117,919	117,919
	WITEL VII	27%	-137,978	-104,633	-67,365	-25,813	20,427	192,182	192,182
	WITEL VIII	8%	-54,067	-48,803	-42,871	-36,219	-28,788	29,240	29,240
	WITEL IX	19%	-59,576	-48,827	-36,886	-23,654	-9,024	59,846	59,846
	WITEL X	11%	-82,846	-72,828	-61,678	-49,304	-35,605	55,424	55,424
	WITEL XI	7%	-16,696	-15,147	-13,374	-11,359	-9,083	8,593	8,593
	WITEL XII	10%	-16,709	-14,877	-12,795	-10,443	-7,801	10,025	10,025
	TOTAL	23%	-1,110,272	-877,111	-611,340	-310,314	28,937	1,332,070	1,332,070
		F.I.R.R.	2000	2001	2002	2003	2004	2005	2006
REPELITA VII	HEAD		-140,657	-177,599	-213,238	-247,652	-280,913	-260,113	-260,113
	WITEL I	18%	-152,634	-126,109	-97,088	-65,390	-30,819	146,682	146,682
	WITEL II	12%	-52,625	-45,806	-38,286	-30,019	-20,956	36,725	36,725
	WITEL III	16%	-90,061	-75,696	-59,830	-42,360	-23,170	78,151	78,151
	WITEL IV	86%	-193,213	-37,867	131,371	315,527	515,717	869,004	869,004
	WITEL V	18%	-162,895	-134,401	-103,126	-68,866	-31,403	156,745	156,745
	WITEL VI	26%	-113,462	-86,505	-56,970	-24,667	10,608	149,446	149,446
	WITEL VII	29%	-160,356	-116,882	-69,395	-17,600	38,823	241,806	241,806
	WITEL VIII	9%	-63,697	-56,682	-48,956	-40,474	-31,187	37,392	37,392
	WITEL IX	20%	-70,057	-56,186	-41,065	-24,609	-6,729	74,663	74,663
	WITEL X	13%	-97,803	-84,834	-70,675	-55,245	-36,498	71,080	71,080
	WITEL XI	9%	-19,811	-17,718	-15,388	-12,804	-9,310	11,580	11,580
	WITEL XII	12%	-19,802	-17,352	-14,636	-11,639	-7,662	13,405	13,405
	TOTAL	24%	-1,337,073	-1,033,636	-697,280	-325,801	86,502	1,626,567	1,626,567



Table A-1-5 Simulation Results on Scenario-3 (1/2)

Description	SIMULATION RESULTS (PROFIT/LOSS STATEMENT OF PERUMTEL) (Million Rp.)										GDP %:		TARIFF : CHANGE		MAN-POWER: CHANGE		KAB/KOTA: SAME										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1.05	2	1.05	2	1	2	1	2				
	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	PLAN :	PLAN :	TARIFF :	TARIFF :	MAN-POWER:	MAN-POWER:	KAB/KOTA:	KAB/KOTA:				
1. Profit/Loss before Tax	1,200,490	1,424,387	1,707,931	2,042,133	2,422,148	2,641,853	2,947,320	3,298,805	3,700,123	4,155,594	4,327,227	4,673,936	5,057,509	5,480,126	5,949,472												
2. Depreciation	746,094	869,423	992,751	1,116,080	1,239,408	1,362,737	1,532,314	1,701,891	1,871,467	2,041,044	2,210,621	2,405,891	2,601,162	2,796,432	2,991,702												
3. Interest	410,722	515,164	611,427	694,629	659,258	647,831	663,156	697,522	731,887	638,544	623,776	609,008	594,240	579,472	494,117												
4. Gross Profit	43,674	39,800	103,753	231,424	523,482	631,285	751,850	899,393	1,096,769	1,476,007	1,492,831	1,659,037	1,862,107	2,104,222	2,463,653												
5. Corporate Tax (35 %)	15,286	13,930	36,314	80,999	183,219	220,950	263,147	314,788	383,869	516,602	522,491	580,663	651,737	736,478	862,279												
6. Profit after Tax	28,388	25,870	67,440	150,426	340,263	410,335	488,702	584,605	712,900	959,404	970,340	1,078,374	1,210,369	1,367,744	1,601,375												
7. DPS (55 %)	15,613	14,229	37,092	82,734	187,145	225,684	268,786	321,553	392,095	527,672	533,687	593,106	665,703	752,259	880,756												
8. Social Pension (20 %)	5,678	5,174	13,488	30,085	68,033	82,667	97,140	116,921	142,580	191,881	194,068	215,675	242,074	273,549	320,275												
9. General Reserve(25 %)	7,097	6,468	16,860	37,606	85,066	102,584	122,176	146,151	178,225	239,851	242,585	269,593	302,592	341,936	400,344												
10. Operating Ratio	0.98	0.98	0.96	0.93	0.86	0.85	0.84	0.82	0.81	0.76	0.78	0.77	0.76	0.74	0.72												

Source of Fund	SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)										GDP %:		TARIFF : CHANGE		MAN-POWER: CHANGE		KAB/KOTA: SAME										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1.05	2	1.05	2	1	2	1	2				
	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	SUB/CAP:	PLAN :	PLAN :	TARIFF :	TARIFF :	MAN-POWER:	MAN-POWER:	KAB/KOTA:	KAB/KOTA:				
1. Repayment of Loan	7,097	6,468	16,860	37,606	85,066	102,584	122,176	146,151	178,225	239,851	242,585	269,593	302,592	341,936	400,344												
2. Depreciation	746,094	869,423	992,751	1,116,080	1,239,408	1,362,737	1,532,314	1,701,891	1,871,467	2,041,044	2,210,621	2,405,891	2,601,162	2,796,432	2,991,702												
3. Installation	64,144	64,189	64,238	64,238	64,346	64,466	64,571	64,684	64,809	64,934	65,053	65,171	65,288	65,406	65,524												
4. Procurement of Loan	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639												
5. Equity	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606												
Total	1,859,570	1,982,315	2,116,086	2,260,162	2,431,039	2,679,619	2,868,892	3,062,560	3,264,336	3,495,540	3,263,396	3,485,834	3,714,278	3,949,082	4,202,968												
Application of Fund																											
1. REPAYMENT OF LOAN	233,066	286,350	307,916	274,462	281,696	151,040	0	0	0	0	0	0	0	0	0												
2. DEPRECIATION	746,094	869,423	992,751	1,116,080	1,239,408	1,362,737	1,532,314	1,701,891	1,871,467	2,041,044	2,210,621	2,405,891	2,601,162	2,796,432	2,991,702												
3. INSTALLATION	64,144	64,189	64,238	64,238	64,346	64,466	64,571	64,684	64,809	64,934	65,053	65,171	65,288	65,406	65,524												
4. PROCUREMENT OF LOAN	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639	891,639												
5. EQUITY	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606	148,606												
Total	1,859,570	1,982,315	2,116,086	2,260,162	2,431,039	2,679,619	2,868,892	3,062,560	3,264,336	3,495,540	3,263,396	3,485,834	3,714,278	3,949,082	4,202,968												
Net Surplus	57,439	171,715	388,213	768,722	554,614	148,741	68,078	164,437	444,229	168,760	77,985	191,790	514,823	1,051,983	1,232,548												
Accumulated Surplus	57,439	171,715	388,213	768,722	554,614	148,741	68,078	164,437	444,229	168,760	77,985	191,790	514,823	1,051,983	1,232,548												
Debt service Ratio	3.51	3.26	3.49	4.44	1.36	1.74	2.35	2.61	2.88	1.57	3.34	3.63	3.92	4.25	2.58												

Table A-1-6 Simulation Results on Scenario-3 (2/2)

GDP ? % : 1.05 KAB/KOTA: SAME  
 SUPPLY PLAN: 2 MAN-POWER : CHANGE  
 SUB/CAPA : 1 TARIFF : CHANGE

## SIMULATION RESULTS (CASH FLOW STATEMENTS)

(UNIT: MILLION Rp.)

		F.I.R.R.	1990	1991	1992	1993	1994	1995	1996
REPELITA V	HEAD		-19,200	-58,200	-85,386	-115,845	-161,539	-142,339	-142,339
	WITEL I	13%	-149,342	-129,275	-105,586	-77,814	-45,415	108,050	108,050
	WITEL II	5%	-72,628	-67,213	-60,487	-52,297	-42,465	30,999	30,999
	WITEL III	12%	-86,192	-75,719	-63,072	-47,991	-30,166	58,032	58,032
	WITEL IV	50%	-268,755	-148,154	-7,278	156,530	346,355	652,673	652,673
	WITEL V	13%	-158,505	-137,621	-112,751	-83,388	-48,940	113,961	113,961
	WITEL VI	18%	-116,405	-96,571	-73,069	-45,425	-13,090	106,876	106,876
	WITEL VII	21%	-168,614	-135,961	-97,550	-52,632	-332	175,146	175,146
	WITEL VIII	3%	-88,544	-82,760	-75,596	-66,896	-56,471	32,918	32,918
	WITEL IX	11%	-102,872	-90,659	-76,068	-58,804	-38,524	66,200	66,200
	WITEL X	6%	-138,454	-126,985	-113,197	-96,807	-77,485	62,542	62,542
	WITEL XI	3%	-25,388	-23,766	-21,690	-19,115	-15,980	9,729	9,729
	WITEL XII	4%	-27,023	-25,096	-22,656	-19,649	-16,009	11,216	11,216
	TOTAL	17%	-1,421,921	-1,197,979	-914,386	-580,132	-200,061	1,286,004	1,286,004
		F.I.R.R.	1995	1996	1997	1998	1999	2000	2001
REPELITA VI	HEAD		-111,883	-158,388	-202,490	-244,401	-284,300	-257,900	-257,900
	WITEL I	16%	-181,499	-154,603	-124,405	-90,599	-52,845	158,169	158,169
	WITEL II	6%	-93,182	-85,832	-77,312	-67,522	-56,347	44,665	44,665
	WITEL III	14%	-106,738	-92,686	-76,675	-58,534	-38,066	83,205	83,205
	WITEL IV	77%	-232,263	-71,212	108,510	308,663	531,203	952,390	952,390
	WITEL V	15%	-193,886	-165,891	-134,301	-98,787	-58,978	165,011	165,011
	WITEL VI	22%	-135,753	-109,139	-79,195	-45,612	-8,043	156,911	156,911
	WITEL VII	26%	-192,298	-148,559	-99,570	-44,838	16,189	257,472	257,472
	WITEL VIII	4%	-114,884	-107,060	-98,003	-87,607	-75,755	47,155	47,155
	WITEL IX	13%	-127,176	-110,790	-92,244	-71,342	-47,867	96,128	96,128
	WITEL X	7%	-177,374	-162,012	-144,553	-124,813	-102,581	89,957	89,957
	WITEL XI	4%	-33,192	-31,001	-28,411	-25,387	-21,893	13,457	13,457
	WITEL XII	5%	-35,039	-32,424	-29,348	-25,777	-21,665	15,769	15,769
	TOTAL	20%	-1,735,168	-1,429,597	-1,077,998	-676,555	-220,949	1,822,391	1,822,391
		F.I.R.R.	2000	2001	2002	2003	2004	2005	2006
REPELITA VII	HEAD		-179,890	-235,635	-289,828	-342,577	-393,975	-363,575	-363,575
	WITEL I	15%	-210,772	-179,912	-146,370	-109,974	-70,533	172,453	172,453
	WITEL II	5%	-108,078	-99,346	-89,650	-78,934	-67,135	49,183	49,183
	WITEL III	12%	-124,839	-108,626	-90,822	-71,331	-50,043	89,603	89,603
	WITEL IV	70%	-281,151	-98,604	99,016	312,710	543,564	1,028,568	1,028,568
	WITEL V	14%	-226,075	-194,080	-159,197	-121,243	-80,015	177,911	177,911
	WITEL VI	21%	-157,534	-126,940	-93,653	-57,498	-18,284	171,664	171,664
	WITEL VII	24%	-223,482	-173,431	-119,138	-60,321	3,322	281,163	281,163
	WITEL VIII	3%	-133,329	-124,054	-113,760	-102,387	-89,869	51,664	51,664
	WITEL IX	12%	-147,972	-129,093	-108,455	-85,949	-61,453	104,359	104,359
	WITEL X	6%	-206,151	-188,444	-169,033	-147,812	-121,479	100,231	100,231
	WITEL XI	4%	-38,801	-36,188	-33,244	-29,950	-25,275	15,432	15,432
	WITEL XII	5%	-40,921	-37,776	-34,246	-30,309	-24,847	18,260	18,260
	TOTAL	17%	-2,078,995	-1,732,127	-1,348,381	-925,574	-456,022	1,896,914	1,896,914

Table A-1-7 Simulation Results on Scenario-4 (1/2)

Description	SIMULATION RESULTS (PROFIT/LOSS STATEMENT OF PERUMTEL) (Million Rp.)														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1. Profit/Less before Tax	1,166,300	1,580,522	1,653,618	1,976,243	2,343,082	2,536,913	2,873,011	3,264,961	3,718,489	4,240,100	4,395,111	4,815,887	5,287,397	5,813,697	6,405,200
2. Depreciation	746,094	869,423	992,751	1,116,080	1,239,408	1,362,737	1,532,314	1,701,891	1,871,467	2,041,044	2,210,621	2,405,891	2,601,162	2,796,432	2,991,702
3. Interest	410,722	515,164	611,427	694,629	659,258	660,091	687,677	734,302	780,927	889,627	664,643	639,658	614,674	589,689	494,117
4. Gross Profit	94,884	0	49,440	165,535	444,415	514,084	653,021	828,769	1,066,094	1,509,429	1,519,848	1,770,338	2,071,562	2,427,576	2,919,381
5. Corporate Tax (35 %)	3,320	0	17,304	57,937	155,545	179,930	228,557	290,069	373,133	528,300	551,947	619,618	725,047	849,652	1,021,784
6. Profit after Tax	6,165	0	32,136	107,597	288,870	334,155	424,464	538,700	692,961	981,129	967,901	1,150,720	1,346,515	1,577,924	1,897,598
7. DPS (55 %)	3,391	0	17,675	59,179	158,879	183,785	233,455	296,285	381,129	539,621	543,345	632,896	740,584	867,858	1,043,679
8. Social Pension (20 %)	1,233	0	6,427	21,519	57,774	66,831	84,893	107,740	138,592	196,226	197,580	230,144	269,303	315,585	379,520
9. General Reserve (25 %)	1,541	0	8,034	26,899	72,218	83,539	106,116	134,675	173,240	245,282	246,975	287,680	336,629	394,481	474,399
10. Operating Ratio	1.00	1.00	0.98	0.95	0.88	0.88	0.86	0.84	0.82	0.77	0.79	0.77	0.75	0.73	0.71

GDP %: 1.05 TARIFF : CHANGE  
 PLAN : 2 MAN-POWER: CHANGE  
 SUB/CAP: 1 KAB/KOTA: SAME

SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)

Source of Fund	SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1. General Reserve	1,541	0	8,034	26,899	72,218	83,539	106,116	134,675	173,240	245,282	246,975	287,680	336,629	394,481	474,399
2. Depreciation	746,094	869,423	992,751	1,116,080	1,239,408	1,362,737	1,532,314	1,701,891	1,871,467	2,041,044	2,210,621	2,405,891	2,601,162	2,796,432	2,991,702
3. Installation	64,144	64,189	64,238	64,238	64,346	64,466	68,371	88,684	88,809	88,809	102,309	102,468	102,641	102,830	103,037
4. Procurement of Loan	891,639	891,639	891,639	891,639	891,639	1,021,670	1,021,670	1,021,670	1,021,670	1,021,670	705,881	705,881	705,881	705,881	705,881
5. Equity	148,606	148,606	148,606	148,606	148,606	204,334	204,334	204,334	204,334	204,334	0	0	0	0	0
Total	1,854,014	1,975,848	2,107,260	2,249,455	2,418,211	2,762,741	2,955,000	3,153,250	3,361,518	3,603,138	3,267,786	3,503,921	3,748,314	4,001,627	4,277,023

Application of Fund

Application of Fund	SIMULATION RESULTS (SOURCE AND APPLICATION STATEMENT, PERUMTEL) (Million Rp.)														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1. Repayment of Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PELLITA II, III & IV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REPELITA V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REPELITA VI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REPELITA VII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Re-Investment	40,000	45,120	50,895	57,410	64,758	71,364	78,643	86,664	95,504	105,246	113,244	121,851	131,112	141,076	151,798
3. Working Capital	43,000	48,504	54,713	61,716	69,615	76,716	84,541	93,164	102,667	113,139	121,738	130,990	140,945	151,657	163,183
4. Investment	1,486,065	1,486,065	1,486,065	1,486,065	1,486,065	2,043,339	2,043,339	2,043,339	2,043,339	2,043,339	2,352,936	2,352,936	2,352,936	2,352,936	2,352,936
Total	1,802,131	1,868,039	1,899,589	1,879,653	2,645,167	3,085,492	2,949,556	2,966,201	2,984,543	3,656,148	3,439,510	3,457,168	3,476,384	3,497,061	4,107,542
Net Surplus	51,883	107,809	207,671	369,882	226,956	-322,751	5,444	187,050	376,975	-233,010	-171,524	46,752	271,950	504,567	169,481
Accumulated Surplus	51,883	159,692	367,363	737,166	510,209	187,458	192,902	379,952	756,927	503,916	332,392	379,145	651,075	1,155,641	1,325,122
Debt service Ratio	3.48	3.24	3.46	4.40	1.34	1.72	2.32	2.59	2.87	1.49	3.01	3.28	3.57	3.87	2.48

Table A-1-8 Simulation Results on Scenario-4 (2/2)

GDP ? % : 1.05 KAB/KOTA: SAME  
 SUPPLY PLAN: 2 MAN-POWER : CHANGE  
 SUB/CAPA : 1 TARIFF : CHANGE

## SIMULATION RESULTS (CASH FLOW STATEMENTS)

(UNIT: MILLION Rp.)

		F.I.R.R.	1990	1991	1992	1993	1994	1995	1996
REPELITA V	HEAD		-19,200	-61,028	-91,058	-124,731	-174,477	-155,277	-155,277
	WITEL I	13%	-149,342	-129,829	-106,757	-79,664	-48,008	105,457	105,457
	WITEL II	4%	-72,628	-67,623	-61,353	-53,667	-44,386	29,078	29,078
	WITEL III	11%	-86,192	-76,153	-63,989	-49,438	-32,192	56,006	56,006
	WITEL IV	49%	-268,755	-149,878	-10,906	150,820	338,387	644,705	644,705
	WITEL V	12%	-158,505	-138,241	-114,061	-85,457	-51,837	111,064	111,064
	WITEL VI	17%	-116,405	-97,214	-74,428	-47,576	-16,108	103,858	103,858
	WITEL VII	20%	-168,614	-136,804	-99,332	-55,450	-4,283	171,195	171,195
	WITEL VIII	2%	-88,544	-83,172	-76,466	-68,270	-58,398	30,992	30,992
	WITEL IX	10%	-102,872	-91,102	-77,003	-60,281	-40,592	64,131	64,131
	WITEL X	5%	-138,454	-127,432	-114,140	-98,297	-79,571	60,456	60,456
	WITEL XI	2%	-25,388	-23,915	-22,005	-19,612	-16,677	9,033	9,033
	WITEL XII	3%	-27,023	-25,264	-23,012	-20,210	-16,795	10,430	10,430
	TOTAL	17%	-1,421,921	-1,207,655	-934,510	-611,833	-244,938	1,241,127	1,241,127
		F.I.R.R.	1995	1996	1997	1998	1999	2000	2001
REPELITA VI	HEAD		-135,080	-189,766	-242,606	-293,803	-343,533	-317,133	-317,133
	WITEL I	18%	-181,912	-152,156	-118,320	-79,952	-36,548	174,467	174,467
	WITEL II	6%	-94,910	-87,218	-78,150	-67,557	-55,273	45,739	45,739
	WITEL III	15%	-107,848	-92,479	-74,729	-54,344	-31,033	90,238	90,238
	WITEL IV	89%	-224,710	-43,419	161,354	392,201	652,030	1,073,217	1,073,217
	WITEL V	17%	-194,560	-163,581	-128,169	-87,837	-42,035	181,954	181,954
	WITEL VI	24%	-136,711	-107,430	-74,052	-36,123	6,870	171,824	171,824
	WITEL VII	29%	-192,569	-144,101	-89,120	-26,902	43,368	284,651	284,651
	WITEL VIII	4%	-116,579	-108,341	-98,647	-87,343	-74,253	48,657	48,657
	WITEL IX	15%	-128,069	-110,077	-89,443	-65,881	-39,067	104,928	104,928
	WITEL X	8%	-178,409	-161,562	-142,159	-119,927	-94,552	97,986	97,986
	WITEL XI	4%	-33,879	-31,613	-28,880	-25,632	-21,815	13,535	13,535
	WITEL XII	5%	-35,807	-33,098	-29,855	-26,021	-21,535	15,899	15,899
	TOTAL	22%	-1,761,042	-1,424,839	-1,032,775	-579,124	-57,376	1,985,963	1,985,963
		F.I.R.R.	2000	2001	2002	2003	2004	2005	2006
REPELITA VII	HEAD		-224,214	-296,430	-368,028	-439,120	-509,806	-479,406	-479,406
	WITEL I	19%	-208,908	-171,325	-129,950	-84,466	-34,527	208,459	208,459
	WITEL II	6%	-109,946	-100,095	-88,983	-76,506	-62,551	53,766	53,766
	WITEL III	16%	-125,276	-105,815	-84,160	-60,133	-33,536	106,110	106,110
	WITEL IV	96%	-255,821	-27,794	222,137	495,797	795,179	1,280,183	1,280,183
	WITEL V	18%	-224,567	-185,498	-142,346	-94,771	-42,402	215,525	215,525
	WITEL VI	26%	-156,368	-119,369	-78,580	-33,683	15,671	205,618	205,618
	WITEL VII	30%	-219,718	-158,595	-91,428	-17,709	63,117	340,958	340,958
	WITEL VIII	4%	-135,144	-124,599	-112,716	-99,384	-84,485	57,049	57,049
	WITEL IX	15%	-147,809	-125,044	-99,835	-71,978	-41,253	124,559	124,559
	WITEL X	9%	-206,339	-185,012	-161,325	-135,083	-102,491	119,219	119,219
	WITEL XI	4%	-39,652	-36,744	-33,410	-29,617	-24,187	16,520	16,520
	WITEL XII	6%	-41,855	-38,362	-34,375	-29,856	-23,529	19,577	19,577
	TOTAL	21%	-2,095,617	-1,674,682	-1,202,998	-676,509	-84,799	2,268,137	2,268,137

