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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DIRECTORATE GENERAL OF POSTS AND TELECOMMUNICATIONS
DEPARTMENT OF TOURISM, POSTS AND TELECOMMUNICATIONS

THE REPUBLIC OF INDONESIA

THE STUDY

ON

TELECOMMUNICATIONS NETWORK DEVELOPMENT PLAN

FOR

REPELITA–VI

FINAL REPORT

(SUMMARY)

FEBRUARY 1993

NIPPON TELECOMMUNICATIONS CONSULTING CO., LTD.
TOKYO, JAPAN

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a pre-feasibility study on the Telecommunications Network Development Plan for REPELITA-VI and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team headed by Mr. Hideji Kajikawa, Nippon Telecommunications Consulting Co., Ltd., from March 1992 to February 1993.

The team held discussions with the officials concerned of the Government of Indonesia, and conducted a field survey at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

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

February 1993

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

February 1993

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency

Letter of Transmittal

It is our great pleasure to submit to you the Study Report on Telecommunications Network Development Plan for REPELITA-VI in the Republic of Indonesia.

This report has been prepared by Nippon Telecommunications Consulting Co., Ltd., based on a contract with JICA. The study team consisting of 13 members and headed by Mr. Hideji Kajikawa conducted the works from March 1992 to February 1993.

The study aims to formulate the 6th Five-Year Telecommunications Development Plan (1994 to 1998) under the 6th Five-Year National Development Plan in the Republic of Indonesia.

Study objective areas covered the whole country. Through field surveys and analysis of survey results, the five-year plan has been drawn up, including formation of development targets, network and system plans, operation/maintenance plans and implementation plans, as well as cost estimates and project evaluation.

We wish to take this opportunity to express our deep gratitude to the officials concerned of the Japan International Cooperation Agency and other authorities concerned of the Government of Japan. We also wish to offer our sincere appreciation to the officials concerned of DEPARPOSTEL/POSTEL, PT. TELKOM and other related agencies of the Government of Indonesia for their unlimited cooperation and assistance extended to the study team in connection with the execution of their duties.

Before closing, we earnestly hope that this report will be effectively used for further development of telecommunications in the Republic of Indonesia.

Very truly yours,

T. Makiyama

Takeichi Makiyama
President
Nippon Telecommunications Consulting Co., Ltd.

C O N T E N T S

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ACRONYMS AND INITIALS

DEPARPOSTEL:	Department of Tourism, Posts and Telecommunications
POSTEL:	Directorate General of Posts and Telecommunications
PERUMTEL:	Purusahaan Umum Telekomunikasi(present TELKOM) (Public Telecommunications Corporation)
PT. TELKOM:	PT. Telekomunikasi Indonesia(previous PERUMTEL) (State-Owned Limited Liability Company)
WITEL:	Wilayah Usaha Telekomunikasi (Regional Bureau of PT. TELKOM)
WARTEL:	Public Telecommunication Office
REPELITA:	Five-Year Development Plan
Propinsi:	Province
IKP:	Ibu Kota Propinsi (Province Capital)
Kotamadya:	Municipality
Kabupaten:	Regency
IKK:	Ibu Kota Kabupaten (Regency Capital)
Kecamatan:	Sub-District
IKC:	Ibu Kota Kecamatan (Sub-District Capital)
Desa:	Village
PBH:	Revenue Sharing
BOT:	Build, Operation and Transfer
ISDN:	Integrated Services Digital Network
N-ISDN:	Narrowband ISDN
B-ISDN:	Broadband ISDN
IDN:	Integrated Digital Network
IN:	Intelligent Network
PCN:	Personal Communication Network
SKDP:	Packet Switched Public Data Network
PALAPA:	Domestic Satellite System in Indonesia
GENTEX:	Telegram by Telex Network
STKB:	Mobile Telephone System in Indonesia
MTS:	Mobile Telephone System
RSS:	Radio Subscriber System
RSU:	Remote Switching System
DLU:	Digital Line Unit
MHS:	Message Handling Service
PBX:	Private Branch Exchange
STDI:	Digital Switching System in Indonesia
SKKL:	Submarine Cable System
SDH:	Synchronous Digital Hierarchy
ISD:	International Subscriber Dialling
SLDD:	Subscriber Long Distance Dialling
VSAT:	Very Small Aperture Terminal
CCS:	Common Channel Signalling System
SCR:	Successful Call Ratio

ISC:	International Switching Center
TC:	Tertiary Center
TA:	Tertiary Area
SC:	Secondary Center
SA:	Secondary Area
PC:	Primary Center
PA:	Primary Area
LE:	Local Exchange
MEA:	Multi-Exchange Area
GDP:	Gross Domestic Product
GRDP:	Gross Regional Domestic Product
IRR:	Internal Rate of Return
FIRR:	Financial IRR
EIRR:	Economic IRR

SUMMARY

SUMMARY

1. OVERVIEW

1.1 Background

Domestic and international telecommunications services in Indonesia had been operated monopolistically by respective government owned organizations, PERUMTEL and PT. INDOSAT, until just before the commencement of this study.

The telecommunications laws of Indonesia were revised in 1990 and, in consequence, private participation in telecommunications became possible. In the following year, 1991, the P.P. No. 25/1991 was enforced under the revised laws, and PERUMTEL was corporatized into a state-owned limited liability company named PT. TELKOM.

PT. TELKOM now provides domestic services, such as telephone, telegram, telex and leased line services, monopolistically in the same way as PERUMTEL did.

Recently, however, a PBH system (Revenue Sharing) began to be introduced in some districts under the revised telecommunications laws. This PBH system allows private companies to provide telecommunications services in cooperation with PT. TELKOM. The revised laws also permit private companies to provide non-basic services, through resale of lines leased from PT. TELKOM.

Thus the telecommunications sector itself is going to change drastically through the corporatization of PERUMTEL and the approval of input of private funds in the telecommunications sector, etc.

For development of telecommunications, "Long-Term Telecommunications System Development Plan" was prepared by JICA in 1987. This plan proposed the long- and medium-term development plans up to 2004, including the Telecommunications Development Plan for REPELITA-VI. Presently the development program for PELITA-V is being implemented, according to the 1987 JICA Plan and others.

Recently, however, the national economy has achieved a remarkable progress, as can be seen in the development of infrastructure such as power, gas and water supply, etc. In addition, recent change in industrial structure, i.e., transition from oil-dependent economy to industry-dependent economy, has greatly contributed to the enhancement of social and economic activities. As a result, demand for telecommunications has sharply increased beyond all expectations, and the pace of supply of telecommunications facilities is considerably behind

the demand growth.

On the other hand, the Government of Indonesia intends to let its national economy take off during the REPELITA-VI period, which is the first REPELITA in the Second Long-Term National Economic Development Phase.

In promoting the development plans, the Government puts priority to the development of telecommunications since the current inadequate telecommunications are regarded as an obstacle to the national development. That is, the Government intends to implement a telecommunications development program in a larger scale than the current long- and medium-term plans so as to fulfill the demand.

Under the above circumstances, the Government of Indonesia decided to prepare a telecommunications network development plan for REPELITA-VI (April 1994 to March 1999) urgently, and requested the assistance of the Government of Japan.

In response to this request, the Government of Japan decided to conduct a Study on Telecommunications Network Development Plan for REPELITA-VI. In consequence, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a preliminary study team to Indonesia in December 1991, and a study team in March through August, 1992.

1.2 Study Objective and Objective Areas

The objective of the Study is to formulate a Telecommunications Network Development Plan for REPELITA-VI according to the telecommunications long-term development policy. The objective areas of the Plan are the whole territory of the Republic of Indonesia.

1.3 Scope of the Study

Telecommunications network development plans, operation and maintenance plans, and implementation plans for REPELITA-VI have been formulated, based on the results of field surveys and thorough discussions with the staff concerned of PT. TELKOM and DEPARPOSTEL and other competent authorities of the Government of Indonesia.

Studies were made as follows:

(1) Collection and Analysis of Data

The existing data, documents and information on the following were collected and analyzed:

a) Existing Plans/Reports on Telecommunications

The following plans and reports which are considered to present basic policy for telecommunications development planning were thoroughly studied in establishing telecommunications development targets for REPELITA-VI.

- Fundamental Technical Plan
- Strategic Development Plan
- Long-Term Telecommunications Systems Development Plan
- PT. TELKOM's Corporate Plan
- Plans on telecommunications development for the Second Long-Term Development Phase prepared by PT. TELKOM and DEPARPOSTEL, respectively.
- Others

b) Social and Economic Activities and Statistical Data

Current social and economic activities and industrial structures in Indonesia were investigated. On the basis of the investigation findings, the basic policy and strategy for telecommunications development were formulated. From the statistical data obtained, the growth rates of national economy and population were forecast. These data also served as the basic data for demand forecast.

c) National Development Plans

The priority given to the telecommunications sector in the National Development Plans and the role of telecommunications for promotion of economic and social activities were investigated. The study results were used as the basic data in establishing the policy and targets of telecommunications network development plans.

d) Telecommunications Development Plans and On-going Projects

To estimate the quantity of facilities at the end of the PELITA-V (March 1994) on the assumption of which development plans for the REPELITA-VI are to be formulated, telecommunications systems improvement plans prepared by Directorate of Development and WITEL of PT. TELKOM, as well as the progress of the on-going projects, were

investigated.

In this work, attention was paid to the progress of projects which are to be implemented in the REPELITA-VI period continuously. Projects yet to be implemented but already signed or now ready for tender were regarded as "on-going" projects, and taken into account in estimating the quantity of facilities at the end of PELITA-V. On the other hand, facilities planned under PELITA-V but scheduled to be installed after April 1994 were included in the facilities to be realized under REPELITA-VI.

e) Status Quo of Telecommunications Services and Facilities

Status quo of telecommunications networks and facilities in Indonesia was investigated to obtain basic data for facility development planning. As for the current telecommunications services, their types and quality were investigated. Investigation results were used as the basic data in determining the targets on service quality, etc.

(2) Establishment of Development Target

REPELITA-VI is the first stage of the Second Long-Term Development Phase. Therefore, the long-term development policy, strategy and targets to be achieved by the year 2020 were studied, and the development target (basic component) for REPELITA-VI was set at "achieving the telephone density which is commensurate with the economic level of Indonesia at the end of REPELITA-VI."

In addition, to stimulate the national economy through telecommunications development, an additional investment target (additional component) was formulated.

The overall target (basic plus additional) was set at expansion of telephone facilities with new installation of 5,000,000 line units.

(3) Demand Forecast

The future telephone demand was forecast, through the review of the microscopic demand forecast made by PT. TELKOM, and the macroscopic forecast prepared by the study team. With respect to the microscopic demand forecast, the adopted forecast method was reviewed and forecast results were confirmed, with adjustment wherever necessary. The macroscopic forecast was

made, by applying the CCITT model which represents the correlation among the GDP per capita, demand and supply density. With respect to the demand for non-telephone and mobile telephone services now available in Indonesia, future demands were estimated from the data in various countries in the world.

(4) Formulation of Telecommunications Network Development Plan for REPELITA-VI.

Targets of telecommunications services including new services were established and, based on the demand forecast results, supply plans for respective services were drawn up. The Telecommunication Network Development Plan for REPELITA-VI was formulated, based on the supply plans by services thus prepared and the traffic forecast results. Further, installation plans and operation/maintenance plans were drawn up, based on the Network Development Plan.

(5) Formulation of Implementation Plan and Project Evaluation

Annual facilities-based and WITEL-wise implementation plans during the REPELITA-VI were prepared.

Implementation plans present quantity of proposed expansion by facilities, i.e., switching, transmission, subscriber cables, buildings, etc. for each WITEL. According to these plans, individual projects were formulated and implementation plans for these projects were drawn up.

In Indonesia, projects were usually framed for individual facilities independently. That is, there were switching projects, transmission projects, subscriber cable projects, etc. Therefore, a network can hardly function as required until all the relevant projects have been completed, often resulting in delay in inauguration of a network due to the delay in one of the projects involved.

To cope with the above situation, attention was focused on formation of a project which permits by itself the establishment of a regional network.

For each project, financial analysis and economic evaluation were made, based on the estimation of investment costs and revenues. Economic benefits were also studied both qualitatively and quantitatively.

On the other hand, private participation in the telecommunications sector which has already been permitted since 1990 is expected to increase in coming

years. In addition, complete privatization and/or break-up of the executive entity are also under study now.

To implement by far the larger scale investment plans than the previous ones by utilizing private funds, some measures must be taken by the executive entity and/or the Government so as to permit the entity to keep suitable profits.

In view of the above, corporate financial evaluation was also made in the study, to identify impacts of the investments on the executive entity's entire operations.

Since the complete privatization and restructuring in the sector are still under study as mentioned above, the corporate financial evaluation was made on condition that a single telecommunications agency undertakes a domestic telecommunications business monopolistically.

1.4 Composition of Study Report

On the basis of the study results mentioned above, Telecommunications Network Development Plan for REPELITA-VI have been prepared in the form of a Study Report.

The Report is composed of the following:

(1) Summary — Summary of the study results.

(2) Main Reports

a) Volume I — Consisting of:

Development targets, demand forecast, Telecommunications Network Development Plan, and Conclusion and Recommendation.

b) Volume II — Implementation Plans consisting of:

Annual installation plans by exchange.

c) Volume III — Project List and Digest consisting of:

Project areas, investment costs and financial and economic evaluation.

(3) Data Book

Other data and information obtained through the study work, mainly consisting of:

a) Regional demand forecast.

b) Status quo of the existing facilities.

c) Basic data for network and facility planning

- Regional supply plans
- Traffic forecast
- Required number of circuits
- Required quantity of transmission facilities

d) Construction cost estimates

2. CURRENT STATUS OF TELECOMMUNICATIONS

2.1 Reform of Telecommunications Sector

PT. TELKOM was newly born as a state-owned limited liability company on 24 September 1991 according to an enforcement of P.P. No. 25/1991, changing its corporate status from the previous PERUMTEL. Under the slogan of 4 "D", namely, Delegation, Decentralization, De-bureaucratization and Deregulation, PT. TELKOM has been strengthening its foundation as a private company since its inauguration.

2.2 Services

National telecommunications services in Indonesia are categorized as follows:

a) Telephone services;
b) Non-telephone services (telex, telegram, data communications and ISDN);
c) Mobile communication services (mobile telephone and radio paging); and
d) Leased circuits services.

(1) Telephone Services

Table 2.1 shows the development of telephone services in Indonesia PELITA-wise. As for the PELITA-V, the status as of December 1991 is given.

Table 2.1 Telephone Services in Indonesia

PELITA	I	II	III	IV	V
Year	1973	1978	1983	1988	1991
Main Lines (x1,000)	198	275	503	803	1,247
- Automatic	107	193	444	708	1,210
- Manual	91	82	59	95	37
Public Telephones			2,363	5,736	25,363
- Coin			2,363	5,724	21,679
- Card				12	2,884
- WARTEL					800
Population(mill.)	128.6	140.7	158.1	175.6	182.3
Main Tel/100	0.15	0.20	0.32	0.46	0.68

Note: Figures of PELITA-V are as of 1991.

(2) Non-telephone Services

a) Telex and Tel gram Services

Facilities and service productivity for telex and telegram services are shown in Table 2.2.

Table 2.2 Telex and Telegram Services in Indonesia

PELITA	I	II	III	IV	V
Year	1973	1978	1983	1988	1991
<Telex Service>					
Total Pulses (x1,000)	9,925	35,894	336,400	522,484	561,110
No.of Telex Terminals	1,194	2,871	8,570	15,441	19,529
Telex Capacity (LU)	1,210	9,230	12,220	17,300	27,879
<Telegram Service>					
No. of Messages (x1,000)	3,776	5,213	7,858	11,668	13,583
No. of GENTEX Terminals	-	199	544	819	1,111
Leased Circuits	96	172	560	1,611	2,266

b) Data Communications Services

Data transmission services have been operated by an SKDP network since 1985, and the number of connected subscribers reached approx. 1,000, as of the end of 1991. The breakdown of the data transmission services in 1988 through 1991 is shown in the following Table 2.3:

Table 2.3 Data Transmission Services in Indonesia

Year	1988	1989	1990	1991
Dial-up Services (SKDP)	223	330	452	519
Leased Circuits	23	37	62	67

c) ISDN Services

PT. TELKOM plans an introduction of ISDN services by the end of PELITA-V. The following services will be introduced among Jakarta, Bandung and Surabaya:

- Data transmission services;
- Teletex service;
- Video conference service by still pictures; and
- G4 facsimile service.

(3) Mobile Communication Services

a) Mobile Telephone Services

Land mobile telephone services were started in Jakarta in 1977. As of March 1992, the mobile telephone services are available in Jakarta, Surabaya, Batam, Jakarta-Bandung and Surabaya-Malang.

The system capacity and the number of subscribers are shown in Table 3.4 below. The growth rate during last 5 years from 1987 to 1991 was 36.4 percent per annum.

Table 2.4 Mobile Telephone Service in Indonesia

PELITA	I	II	III	IV	V
Year	1973	1978	1983	1988	1991
No. of Areas	-	1	1	5	6
System Capacity	-	-	-	13,024	47,300
No.of Subscribers	-	-	1,750	9,008	23,307

b) Radio Paging Service

After the first operation in 1986 in Jakarta area, the radio paging service is spreading throughout the country. The growth rate of the last 5 years from 1987 to 1991 was 45.5 percent per annum. Statistical data relating to the paging service are shown in the following Table 2.5:

Table 2.5 Radio Paging Service in Indonesia

PELITA	I	II	III	IV	V
Year	1973	1978	1983	1988	1991
No. of Areas	-	-	-	12	24
No.of Sub.s	-	-	-	22,478	78,235

2.3 Facilities - Status at the End of PELITA-V

At present, PT. TELKOM is implementing, and is going to implement, a number of projects. Judging from the progress of these projects, the volume of telecommunications facilities at the end of PELITA-V is estimated as shown in Table 2.6.

Table 2.6 Telecommunications Facilities at the end of PELITA-V

Category	Volume (x1,000)
Switching Capacity	3,000 L.U.
Outside Plant	4,283 pairs
Subscriber Connections	2,391
Public Telephones	50 sets
Telephone Density / 100Pop	1.3

2.4 Financial and Investment Conditions

(1) Financial Condition

PERUMTEL's business operations during the 1986 through 1991 period were profitable. Particularly in 1991, PERUMTEL's financial performance was remarkably improved owing to the raise in rates enforced in October 1990. That is, the rate of return on book valued net fixed assets in operation increased to 21%, as compared with 12% of 1990, the debt equity ratio remained below 60:40, and the debt service coverage kept above a 2.0 level.

(2) Investments

Investments in plant are increasing rapidly since 1990. Funds for these plant investments, however, are largely reliant on foreign loans. In 1991, as much as 83% of the funds were covered by foreign loans. PBH system began to be introduced in 1991 to cover a part of plant investments. According to the accounting data, PT TELKOM will afford approx. 10% of the required investments with its own internal funds.

3. DEVELOPMENT TARGETS

REPELITA-VI is the first five-year plan in the Second Long-Term Development Phase (1994 - 2019). The Government of Indonesia aims at launching its national economy in the period of REPELITA-VI. Therefore, the targets of the telecommunications development plan for REPELITA-VI are required to meet with the long-term development policy established by DEPARPOSTEL and PT.TELKOM.

3.1 Long-term Development Stages and Targets (up to the year 2019)

The long-term telecommunications development policy mentioned above is presented in three (3) stages, each stage covering a decade. On the basis of this policy, long-term development targets were set up as follows:

(1) First Stage : Acceleration Decade (1990-1999)

The target at this stage is to improve the telephone density up to the level which can be commensurate with the economic level of Indonesia internationally, and to make telecommunications a driving force to accelerate the national economic development.

(2) Second Stage : Enhancement Decade (2000-2009)

The target at this stage is to consolidate and enhance the foundation of the telecommunications sector to ensure a self-reliance in the next stage.

(3) Third Stage : Autonomy Decade (2010-2019)

The target at this stage is to realize the information network for universal personal communications.

3.2 Long-term Development Targets (at the year 2019)

Through the above development stages, the following will be achieved at the end of the Second Long-Term Phase:

(1) Services

a) Service Volume (Telephone Density)

To realize "immediate telephone installation upon application" (telephone density is 10 or more per 100 inhabitants).

b) Service Penetration

To provide telephone services all over the country including rural areas.

c) Service Quality

To achieve SCR (Successful Call Ratio) of 70% or more.

d) Service Diversification

To provide various services for UPT (Universal Personal Telecommunications) under B-ISDN.

(2) Facilities

To complete a B-ISDN by introduction of ATM (Asynchronous Transfer Mode) aiming at the realization of an IN (Intelligent Network) in the next Long-Term Phase.

(3) Human resources

To develop human resources to cope with rapid technical evolution and diversified demands for telecommunications services.

(4) Finance

To secure profitability and realize self-reliance.

3.3 Development Targets for REPELITA-VI Program

Aiming to realize the adequate telephone density commensurate with the economic level of Indonesia and to accelerate the national economic growth, the following targets are to be achieved during REPELITA-VI:

(1) Installation of 5,000,000 line units

The telephone service development target is composed of two components:

a) Basic Component .. Installation of 3,500,000 line units to achieve the telephone density commensurate with the economic level of Indonesia at the end of REPELITA-VI.

b) Additional Component .. Installation of 1,500,000 line units to accelerate the national economic development.

Table 3.1 Development Targets for Telephone Service

3.0 MLU : at the end of PELITA-V
3.5 MLU : basic component during REPELITA-VI 1.5 MLU : additional component during REPELITA-VI
8.0 MLU : at the end of REPELITA-VI (accumulation)

Note: MLU ... Million Line Units

Figure 3.1 shows the correlations between demand and supply densities and GDP per Capita.

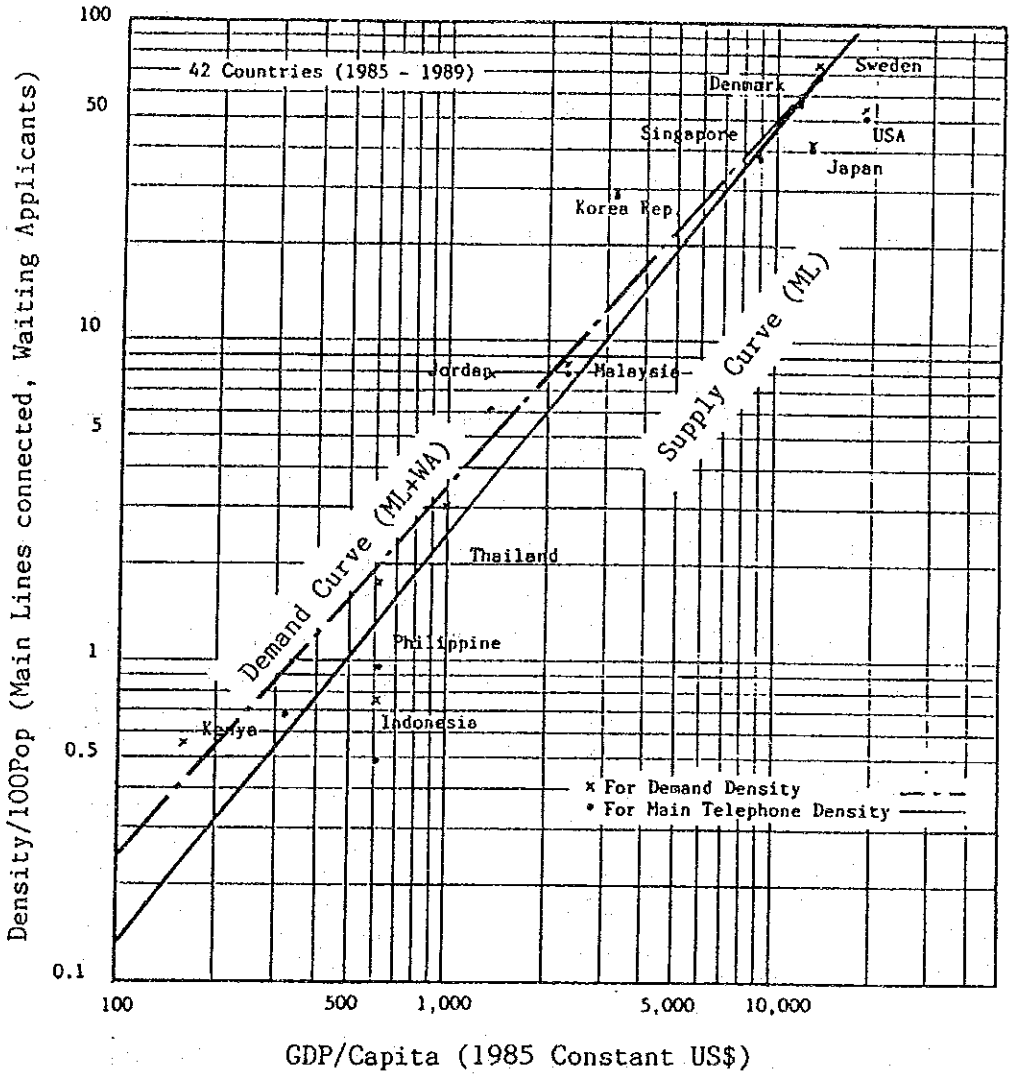


Figure 1-6-1 The Regression Curve expressing correlations between demand and supply densities and GDP per Capita

3.5 MLU as a basic component is distributed to regions (WITEL area), districts (Kotamadya and Kabupaten) and sub districts (Kecamatan) as follows:

a) Distribution to regions (WITEL area).

Distribution ratios were determined through the evaluation of the following:

- microscopic demand data by PT. TELKOM;
- the number of existing telephone lines;
- population; and
- regional GDP (GRDP).

The distribution of basic component to regions is summarized in Table 3.2 below.

Table 3.2 Supply Distribution to WITEL

WITEL	Additional Line Units	Existing Line Units	Total by WITEL
I	242	209	451
II	121	133	254
III	213	134	347
IV	1,093	1,333	2,426
V	540	286	826
VI	307	191	498
VII	486	347	833
VIII	142	103	245
IX	173	98	271
X	148	147	295
XI	35	16	51
XII	45	19	64
Total	3,545	3,016	6,561

Unit: thousand

b) Distribution from a region to districts and sub-districts

Distribution ratio was established, based on the results of microscopic demand forecast made by PT. TELKOM

Installation of 1.5 MLU as an additional component will be realized mainly by private participation. Areas suitable for additional component were decided as shown in Table 3.3, in due consideration of economic activities, population and demands.

Table 3.3 Provision for Profitable Areas

Area		Provision
Jakarta	:	0.7 MLU
Surabaya	:	0.4 MLU
Bandung	:	0.4 MLU
Total	:	1.5 MLU

MLU: million line units

(2) To provide automatic telephone service up to all the Kecamatan Capitals and major villages;

(3) To establish IDN (integrated Digital Network) between major cities including the provincial capitals;

(4) To improve telephone service quality, i.e., SCR (Successful Call Ratio) up to the range of 45% - 50%;

(5) To improve the network security by diversification and duplication of transmission routes; and

(6) To provide N-ISDN services to major big cities, such as Jakarta, Surabaya, Bandung and Medan.

4. DEMAND FORECAST

4.1 Telephone Service

(1) Telephone service demand was forecasted in both macroscopic and microscopic approaches. Macroscopic demand forecast was conducted by the regression model in correlation between the expressed demand density and GDP per capita, while microscopic demand forecast was conducted by PT. TELKOM in association with 17 national universities. The result of macroscopic demand forecast is shown in the following Table 4.1:

Table 4.1 Result of Macroscopic Demand Forecast on 3.5 MLU Supply Basis

Year	1994	1995	1996	1997	1998
Demand Density	1.8	2.2	2.6	3.0	3.5
Demand	3,386	4,179	5,074	6,030	7,060

Unit: density: per 100 inhabitants
demand : thousand

(2) Macroscopic Demand Forecast for 5.0 MLU base at the end of REPELITA-VI is estimated by the same regression model as above. The result of estimate is shown in the following Table 4.2:

Table 4.2 Result of Macroscopic Demand Forecast on 5.0 MLU Supply Basis

Accumulated capacity	: 8.0 million line units
Main lines to be connected	: 6.4 million lines units
Main line density	: 3.2/100 inhabitants
Demand density	: 4.2/100 inhabitants
Estimated Demand to 8.0MLU	: 8.53 million

The past experience indicates that the number of main lines to be connected remains to be 80% of the total capacity of installed facilities. Hence, only 6.4 MLU are to be connected even with the 5.0 MLU increase. This amount falls short of 7.06 MLU, the estimated demand in the case of 3.5 MLU supply.

4.2 Mobile Communication Services

For macroscopic demand forecast of mobile telephone service and radio paging service, forecast models were developed by regression analysis. The analysis was made

in correlation between densities of main telephone lines and mobile terminals, using statistical data in other 29 to 31 countries over the world. The result of demand forecast by the regression analysis is shown in the following Tables 4.3 and 4.4.

Meanwhile, there is a large potential demand for mobile telephone services. As a result of comparison on service penetration in the neighbor countries, the potential demand for the mobile telephone service in Indonesia is estimated to be 10% - 15% of the main telephone lines on condition of proper tariff structure and others.

Table 4.3 Demand Forecast for Mobile Telephone Service

REPELITA Year	VI 1998	VII 2003	VIII 2008
No. of Terminals	272,500	478,900	1,009,000

Table 4.4 Demand Forecast for Radio Paging Service

REPELITA Year	VI 1998	VII 2003	VIII 2008
No. of Terminals	414,500	666,300	1,242,100

4.3 Telex and Telegram Services

Future demand growth for telex and telegram services is pessimistic because the recent service trend seen in the developed countries is that the telex service demand is being transferred to other services, i.e., facsimile, etc., and the telegram service demand is absorbed in telephone service as the introduction of a rural telephone system is promoted in rural areas.

Taking the above trend into account, the number of telex and gentex terminals is forecasted as follows:

Table 4.5 Demand Forecast for Telex Service

REPELITA Year	V 1993	VI 1998	VII 2003
No. of terminals	21,500	23,500	25,000
Growth rate per annum	4 %	2 %	1 %

4.4 Data Communications Services

The following two (2) types of data communications services are at present provided.

- leased circuits; and
- packet data communications services.

For macroscopic estimation of demand, the forecast model was also developed by regression analysis in correlation between the number of circuits (or data terminals) and the number of main telephone lines, using the statistical data of other 23 countries over the world. The result of forecasts is shown in the following Tables 4.6 and 4.7:

Table 4.6 Demand Forecast for Leased Circuits

REPELITA Year	VI 1998	VII 2003	VIII 2008
No. of Circuits	36,000	56,500	102,100

Table 4.7 Demand Forecast for Data Communications Service

REPELITA Year	VI 1998	VII 2003	VIII 2008
No. of Circuits	73,700	104,600	163,700

5. TELECOMMUNICATIONS NETWORK DEVELOPMENT PLAN

5.1 Network Development Plan

5.1.1 Planning Principles

Principles for network planning and facility planning are based on the latest Fundamental Technical Plan (FTP) and Strategic Development Plan (SDP).

5.1.2 Network Development Policy

(1) Telephone Network Development

a) The development target of REPELITA-VI is established on condition that the total line unit capacity at the end of PELITA-V is approximately 3.0 MLU.

b) The network and installation planning for the development target of REPELITA-VI (5.0 MLU) is made on the following basis:

1) 3.5 MLU on exchange by exchange basis;
2) 1.5 MLU on profitable area by area basis; and
3) Backbone transmission links covering 5.0 MLU traffic requirements.

c) The telephone network development is made on the following policy:

1) to expand the network coverage to all the Kecamatan;
2) to automatize all the existing manual boards; and
3) to digitalize the existing network toward ISDN and IN.

d) A network development for the land mobile telephone service is as follows :

1) to expand the cellular mobile telephone system (900 Mhz Band) to major provincial capitals covering highways connecting these capitals; and
2) to introduce a digital system in new service areas, in principle.

(2) Transmission Network Development

a) Backbone Link

Major backbone terrestrial transmission links are to be diversified with the adoption of back-up links of satellite system aiming at improvement of network security. The system applicable to SDH (Synchronous Digital Hierarchy) is employed for new routes of major backbone terrestrial links.

b) Spur Link

Digital spur transmission links are extended up to major IKK to prepare for completion of IDN in the next Development Decade.

c) Subscriber Link

Installation of the subscriber radio transmission system is encouraged to cover all IKC with telephone services.

(3) Local Network Development

Primary cables of approximately 5.0 million pairs for 3.5 MLU and approximately 2.0 million pairs for additional 1.5 MLU are to be provided for new subscriber connections, as well as for rehabilitation of outside plant, while introduction of optical fiber subscriber cables can be considered for a large cluster of users.

(4) ISDN

To introduce the ISDN service, ISDN switching equipment with CCS No.7 is to be provided in Jakarta, Surabaya, Bandung and Medan.

5.2 Basic Conditions For Establishing the Project Implementation Program

The Project Implementation Program will be prepared based on the following:

(1) Projects to be proposed are classified into the following two categories:

a) Area project packages covering specific areas; and
b) Backbone transmission project packages

(2) An area project package is to be composed of all the network components for a specific area to regard the following as important:

a) to build up well-balanced networks on area by area basis; and
b) to simplify project formation and program management.

As stated above, projects are formed on area by area basis except backbone transmission projects. However, conventional project formation by network component is available by rearrangement of the tables, as installation plan for an exchange is indicated by network component.

(3) Finance sources are not specified for each project formed. However, each project will be classified by profitability on internal rate of return (IRR).

5.3 Project Formation

Area project packages to be proposed are formed by assembling several minimum project units.

(1) Minimum Project Unit

An area project package covering a primary area is a minimum project unit. The area project package consists of all the network components, i.e., switch, transmission, outside plant, etc. A primary area as a telecommunications administrative area is equivalent to a Kabupaten area as an administrative area.

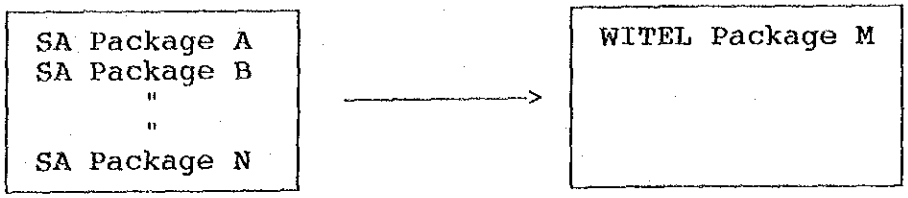
(2) Project Packages to be proposed

Project packages are basically proposed in consideration of a suitable project size. Actual projects, however, would be rearranged combining 2 or 3 proposed packages based on available amount of loans or funds. A typical project formation is defined as follows:

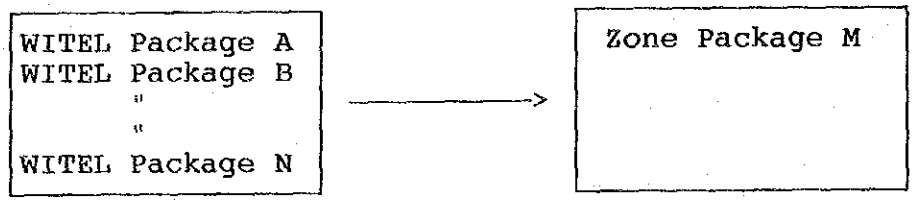
a) Primary Area Packages to Secondary Area Packages

Note: PA: Primary Area
SA: Secondary Area

b) Secondary Area Packages to WITEL Packages



c) WITEL Packages to Zone Packages



d) Backbone Transmission Project Packages

Backbone Transmission Project Packages

(consisting of Sub-Transmission Project Packages)

e) Other Project Packages

- Mobile Telephone Packages
- Radio Paging Packages
- Operation and Maintenance Packages
- Others

5.4 Summary of Projects to be Proposed

As a result of the project formation study, projects are proposed as summarized in Table 5.1.

Table 5.1 Summary of Projects to be Proposed

Category of Project Packages	No. of Packages
Area Project Packages (including 2 Junction Projects)	53
Backbone Transmission Projects	19
Mobile Telephone Project Packages	4
Radio Paging Project Packages	4
1.5 MLU Area Project Packages (JKT, SBY, BDN)	3
O&M Project Packages	2
Coin Telephone Project Package	1
Project Management/Engineering	1
Total Project Packages	87

5.5 Project List & Digest

A project digest covers an outline of each project package shown in the project list. Items mentioned in the project list and digest are as follows:

(1) Project List

a) Project name;
b) Objective area;
c) Total project cost;
d) Financial IRR (internal rate of return);
e) Implementation unit No.;
f) Supply volume by implementation unit No.; and
g) Cost by implementation unit No.

(2) Project Digest

a) Project title;
b) Project name (code name);
c) Location;
d) Executive agency;
e) Objectives;
f) Project description;
   - Implementation
   - Technical component and scope of work
g) Implementation time schedule;
h) Project cost;
i) Amount proposed for commitment;
j) Related to technical assistance;
k) Stage of project preparation; and
l) Additional information
   - Objective exchange
   - Related projects

5.6 Project Cost Estimate

(1) Unit Cost

The project cost estimate is made based on the unit cost by sub-system. The unit cost is established considering a cost trend during PELITA-V and cost reduction to be expected. Overall unit cost for the whole system and unit costs by sub-system are shown in the following Table 5.2:

Table 5.2 Unit Cost for Cost Estimate

Cost Items	Unit Cost(us$)	Share(%)
Land	22.66	1.50
Telephone Exchange	300.36	20.00
Telex exchange	12.36	0.80
Outside Plant	500.00	33.20
Terrestrial Transmission	368.74	24.50
Satellite Transmission	212.18	14.20
Supporting Facility	57.68	3.80
Consultant	28.84	2.00
Total	1,502.00	100.00

(2) Cost Summary of REPELITA-VI

The outline of project formation and project costs by WITEL are shown in Table 5.3.

Table 5.3 Cost Estimate by Project Package

Package Category	No. of Packages	Project Cost (MUS$)
<Area Project Packages for 3.5 MLU>		
I	4	264.15
II	2	160.53
III	3	260.56
IV	15	882.82
V	9	593.79
VI	4	422.68
VII	7	543.79
VIII	2	204.14
IX	2	250.93
X	3	227.30
XI	1	56.66
XII	1	89.17
Coin Telephone (note)	1	170.00
<Backbone Project Packages for 5.0 MLU>		
Backbone Transmission	19	1,248.73
<Profitable Area Project Packages for 1.5 MLU>		
Jakarta	1	507.82
Surabaya	1	292.81
Bandung	1	292.87
TOTAL	76	6,468.75
<Other Project Packages>		
Mobile Telephone	4	625.27
Paging	4	180.30
Operation & Maintenance	2	10.09
Project Manage/Engineering	1	326.90
GRAND TOTAL	87	7,611.31

Note : The cost for coin telephone project package is included in the area project packages.

5.7 Operation and Maintenance Plan

5.7.1 Enhancement of Operation and Maintenance Management

Key items to enhance the operation and maintenance management are:

(1) Improvement of technicians' ability;
(2) Expansion of O&M Built-In-Training;
(3) Promotion in rehabilitation of telecommunications network;
(4) Provision of sufficient amount of spares and measuring equipment;

(5) Keeping enough amount (multi-year) of spares;
(6) Development of repair centers;
(7) Consolidation of System Operation Procedures (SOP) /System Maintenance Procedures (SMP);
(8) Development of Integrated Network Management System (IMS); and
(9) Effective utilization of reports and data works.

5.7.2 Improvement of SCR

(1) General Countermeasures

General countermeasures to improve successful call ratio (SCR) are summarized as follows:

Table 5.4 Countermeasures for Improvement of SCR

<Incomplete & Wrong Dialling> * Public Campaign "How to handle Telephone Sets" * Timely Updating of Directory "New & Changeover"
<Called Subscriber Busy> * Increase of Telephone density * Line Hunting facilities * Call Waiting Services
<No Answer> * Answering phone * Call Forwarding * Campaign "No Immediate Call Repeat, when busy"

(2) Short-term solution to be focused on Jakarta

The short-term solution to improve SCR in Jakarta area is proposed as follows:

a) To identify key customers by exchange location;
b) To Prepare an overlay network to transfer about 50,000 key subscribers from their respective PRX exchanges by providing facilities as appropriate;
c) To introduce unified seven (7) digit numbering scheme; and
d) To serve high-rise buildings with fiber-optic cable.

(3) Medium-term Solution

The medium-term solution to improve SCR in Jakarta area is proposed as follows:

a) Implementation of a pilot project in one local exchange area in Jakarta. Measures to be taken include:

- provision of appropriate number of circuit groups; and
- provision of a line-hunting system for "busy subscribers", etc.

b) Implementation of a trial project

The target is to extend to a specific tandem area that includes the local exchange area in a pilot project.

c) Implementation of Rehabilitation Project

Rehabilitation projects are to be implemented for all the local exchange areas belonging to the other five (5) tandem areas. The scope of services is to be provided under the rehabilitation of subscribers network in Jakarta.

5.7.3 Human Resources Development

(1) Efficiency of PT.TELKOM Staff

The efficiency target expressed in number of staff per 1,000 DEL at the end of REPELITA-VI is set 10 for whole Indonesia.

(2) Number of New Employees

The total number of staff to be newly employed during REPELITA-IV is estimated as follows:

Table 5.5 The Number of New Employees Estimated

Category	Number of New Employees <3.5 MLU basis>	<5.0 MLU basis>
<Specified Field>		
Technical	11,740 (2,348)	17,060 (3,412)
Non-technical	4,280 (856)	8,640 (1,728)
<Qualification>		
University	7,590 (1,518)	9,530 (1,906)
Academy	5,080 (1,016)	8,070 (1,614)
High/Jun.High Sch.	3,350 (670)	8,100 (1,620)
Total	16,020 (3,204)	25,700 (5,140)

Note: Figures in ( ) show the number of staff per annum.

5.7.4 Introduction of Network Management System

IMS (Integrated Network Management System) is to be provided to ensure continuous monitoring of overall status of the network and to ease difficulties in operating and maintaining the telecommunications facilities in the network. IMS will support:

a) Digital SPC exchanges at RNCC (Regional Network Control Center) MFOS (Multifunction Operations System);

b) Digital transmission supervisory systems at NNCC (National Network Control Center) MFOS TNS (Total Network Surveillance);

c) Analogue SPC exchanges at RNCC MFOS;

d) Satellite transmission supervisory systems at NNCC; and

e) Analogue transmission supervisory system at NNCC.

5.7.5 Establishment of Network Centers (NC)

Establishment of network centers aiming at network planning, network management and information management would become necessary. However, an anticipated large scale alteration in corporate organization based on the decentralization policy will call for making some adjustment in functions of the network centers as follows:

(1) Network Planning

Network planning function of an NC is to be provided to strengthen and unify the planning activities in various fields, such as switching, transmission and subscribers cable networks.

(2) Network Management

Network management function of an NC is to be provided to manage the performances, faults (on maintenance), configuration, accounting and security on both long-distance backbone networks and regional networks.

(3) Information Management

Information management function of an NC is to be provided for processing the information relating to the administration of departments, personnel, accounting and financial management.

(4) Organizational Structure

The National Network Center (NNC) is to be located at Jakarta and the Regional Network Centers (RNC), at Jakarta, Surabaya, Medan, Ujung Pandang and Balikpapan.

5.7.6 Information Resource Management Policy

(1) Database as information resources pertaining to employee, inventory control, accounting, customer billing, financial and any other information relating to corporate management is to be provided.

(2) MIS (Management Information System) is to be established to furnish the corporate top management with useful and comprehensive information processed from various data and database.

5.8 Financial and Economic Evaluation

5.8.1 Concept and Framework of Program Evaluations

Viability of the investment program for REPELITA-VI is assessed from the project financial and economic viewpoints. In addition to the above, evaluation from the corporate financial point of view is also made, on condition that a single executive body implements the investment program.

The project financial and economic evaluation is to identify conceptual viability of a program or a project while the evaluation from the corporate financial viewpoint is to reflect realistic conditions of operations. Also objectives of assessments are different. The objective of the former is the evaluation of an isolated program or project and that of the latter is assessment of impacts of the investment on the executive body's entire operations.

The great importance and hazardless nature of telecommunications tend to find a solution of the development of telecommunications networks by making a lower cost approach with technical considerations. This assessment is based on this approach.

Since the results of the financial and economic evaluations are favorable as a development program, the corporate financial point of view is stressed herein. In addition, to compensate difficulty of quantifying of economic benefit of the program, economic impact display and its utilization idea are incorporated.

5.8.2 Project Financial Evaluations

Area Project packages' profitabilities vary widely while Backbone Project packages' profitabilities vary narrowly.

Reference for fund procurement is established by profitability index derived from per line unit cost, pulse productivity, and construction period in association with project FIRR. Projects are classified into four profitability categories i.e. highly profitable, profitable, moderately profitable, and marginally profitable. This classification is recommended to be used as a reference to compile appropriate packages for particular loans, PT. TELKOM's own funding, private investment or other purposes.

In actual fund procurement situation, however, direct application of these classifications to individual projects is not recommended. Since the listed projects are minimum implementation units, actual implementation units shall consist of 2 or 3 projects in most cases. Profitability should be estimated particularly for the latter packages.

Appropriate compilation of the projects for funding is a key to successful financial procurement.

5.8.3 Program Financial Evaluation

FIRR is 19.31 percent, cost to benefit ratio 1.25 and benefit minus cost is 2.0 billion U.S. dollars in terms of net present value discounted by 13 percent interest rate. This indicates rather higher profitability as a development program. In real situation, however, detailed examination is required to identify actual profitability.

Results of sensitivity analyses by development cost differentiation are:

(1) FIRR of 15.93 percent in case that development cost is 20 percent higher than the original calculation; and

(2) FIRR of 23.86 percent in case that development cost is 20 percent lower than the original calculation.

5.8.4 Program Economic Evaluation

Since socio-economic impact of the telecommunications network development involves so many kinds of benefits which are practically impossible to quantify, qualitative analysis of the network development in general is important.

Characteristics of telecommunications network development impacts are summarized as follows:

Efficient operations and increases of business chances are realized in industrial and business entities through enhancement of availability of market information for sales and procurement. The impact includes favorable effects on the global environment through energy saving.

EIRR is 26.08 percent, cost to benefit ratio 1.6 and benefit minus cost is 4.6 billion U.S. dollars in terms of net present value discounted by 13 percent interest rate. Higher EIRR than this result shall be deduced from the calculation incorporating the consumer surplus or other benefits which are difficult to be quantified in monetary value.

5.8.5 Basic Corporate Finance Forecast

Profit of PT. TELKOM becomes negative in FY 1997 despite 20 percent tariff raising is applied in FY 1995 in addition to PT. TELKOM's streamlining efforts, sharing ratio improvement regarding international call charges, and other arrangements. Negative profitabilities are kept afterwards. The main cause of the negative profitability is development loan's interest payment.

Revenue, interest payment burden, depreciation ratio, and operating cost are four possible manipulatable factors for the improvement of profitability. Among them interest payment burden and revenue are discussed as appropriate counter measures. For, reasonable operating cost decrease is already incorporated in the original projection and depreciation ratio is not a fundamental measure to alleviate negative development impact.

5.8.6 Sensitivity Analysis

Simple sensitivity analyses are conducted for following ways and purposes:

a) Adopt tariff increases by 30 percent instead of 20 percent for each 5 years from FY 1995 -- to identify the tariff raising sensitivity;

b) Adopt tariff increases for maintaining profitability (avoiding continuous increase) -- to identify the necessary tariff raising level to have profitability;

c) Marketable capacity set for 85 percent instead of 80 percent -- to identify effect of marketable capacity increase;

d) Apply no declining of pulse productivity per main line

unit instead of 1.5 percent annual declining -- to identify effect of maintaining productivity per main line unit;

e) Apply both marketable capacity of 85 percent and no declining productivity -- to identify combining effect of them;

f) Assume additional equity for local fund requirement -- to identify effect of no cost financing; and

g) Assume all foreign official loans' interest rate of 8 percent -- to identify effect of massive low cost financing.

Each case has certain improvement effects but is not able to cover severe development impacts during FY 1997 to 1999.

5.8.7 Possible Scenarios for Implementation

Implication obtained from the above analyses is that both revenue increase measures and low cost financing are indispensable to carry out this huge investment program for the REPELITA-VI. Study to find out optimal combination(s) of these factors requires detailed data, investigation and analyses, and political and managerial considerations. However, brief study for the implementation is conducted as following.

The case of combination of efforts for raising marketable capacity, maintaining pulse productivity, special consideration of interest rate of 8 percent for the foreign official loans in the period from FY 1993 to 1997, and additional capital amounting to 1.4 billion U.S. dollars with 20 percent tariff increases in every 5 years are displayed as an example. In this case, profitability is rather easily maintained.

This is just an example. There are many applicable options which can contribute to corporate financial improvement. Many feasible alternatives are able to be planned by combining these options. Decision of adopting the plan is subject to the political and managerial considerations.

For the establishment of corporate financial policy, immediate implementation of detailed studies for the productivity improvement, the tariff adjustment, and the low cost fund raising methods are recommended.

6. CONCLUSION AND RECOMMENDATIONS

The development target of 5 MLU capacity increase during the REPELITA-VI period is reasonable for the Indonesian Government to forge the telecommunications sector as a driving force of the Indonesian economy. The program established by the study team to achieve the target is feasible and implementable. There are, however, financial and technical conditions to be satisfied for the successful achievement of the program.

6.1 Financial Conditions

Although the result of the financial evaluation indicates rather high profitability of the investment program (FIRR: 19.31 percent), development cost impact is expected to be very much burdensome for the executive entity. Especially in the early period after the completion of development, deficits of entity's accounts are imperative without special measurements.

Avoiding such deficits is indispensable for the entity to maintain credibility and financial health. It is important to procure necessary fund including private equity investment and future commercial loans. These measurements to avoid negative profitability of the executive entity in any accounting period other than streamlining efforts are considered as the special conditions for the successful achievement of the target. Following are the conditions:

(1) Tariff adjustment for 20 to 30 percent raise from the current level is to be made in 1995. Periodical adjustments might be necessary afterwards.

(2) Productivity improvement measures are to be applied to increase revenue. The measures are the following.

   a) Improvement of marketing survey accuracy and sales promotion; and

   b) Improvement of SCR (Successful Call Ratio).

   These measures aim to decrease idle capacity ratio, and to maintain or to increase per line unit pulse productivity.

(3) Sharing ratio adjustment of international calls by gradual rasing from current 35 percent of PT. TELKOM's portion to 60 percent level by the year 1996.

(4) Special financial arrangements are to be taken.

Special considerations for the fund procurement helping alleviation of development funding cost burden are essential for the successful target realization.

There shall be many combinations which satisfy development fund requirement and limited fund cost affording capability. Following are example cases which meet conditions derived from sensitivity analyses, but not the funds actually procured.

Table 6.1 Financial Procurement Examples

Fund Category	Case A	Case B	Case C
Equity Investment	1.5	2.5	3.5
Moderate Cost Fund	3.0	3.0	2.0
Commercial Loan	1.0	0.0	*
Internal Cash	2.0	2.0	2.0
Total	7.5	7.5	7.5

Unit: billion U.S$
* : See explanation c) below.

Equity Investment represents no cost financing which includes equity investment to increase capital and no interest telephone subscriber's bond. Moderate Cost Fund means moderate interest loans or bonds of which interest rate is ranging from 8 percent to 13 percent including intra-governmental loan, low interest subscriber's bond, and a government guaranteed bond. Commercial Loan means loans or bonds with 20 percent to 25 percent interest rate. Internal Cash is available fund generated by the executive agency itself. Following are conditions assumed for each case.

a) In the case A, interest rate of the Moderate Cost Fund is assumed 8 percent;

b) In the case B, interest rate of the Moderate Cost Fund is assumed 13 percent; and

c) In the case C, interest rate of the Moderate Cost Fund can be a few points higher than 13 percent. This means part of the Moderate Cost Fund can be Commercial Loan.

(5) Measures to support telecommunications network development and telephone service penetration/diffusion in rural areas

a) Supporting program to promote telephone subscriptions and effective utilization.

b) Establishment of a rural area development fund to support rural area telecommunications network development. (In case private equity investments are made, a new executive entity or entities will be established.)

Source of the fund shall be a special tax collected from profitable domestic telecommunications companies.

Item a) is to help the executive entity whey they extend the telecommunication network toward rural areas, so that the entity can secure a certain level of capacity utilization and revenue from subscribers in the rural areas.

Item b) is to support rural area telecommunications network development by supplying necessary funds with no or very low interest rate.

6.2 Recommendations for Financial Conditions Fulfillment

There will be many feasible combinations of applicable measures. An establishment of the program to fulfill the above mentioned conditions is an urgent need. It involves policy, legal and institutional, and managemental issues which are closely inter-relating to each other. Also study on each issue requires detailed data, survey and analysis.

One aspect of urgent actions required for the establishment of the program is immediate implementation of detailed studies for the productivity improvement, the tariff adjustment and the low cost fund raising, and the rural area telecommunications network development. These studies should aim to facilitate decision maker's judgement for the program establishment.

Another category of the urgent actions are necessary negotiations and coordinations for the tariff adjustment, the sharing ratio adjustment for international call, the fund procurement, and the rural area telecommunications network development assistance programs. Result of these actions shall be fed back to the above mentioned studies and, at the same time, the study results shall be the input for the negotiating and coordinating actions.

Collaborative activities between studies and political/ coordinating actions are indispensable.

6.3 Recommendations for Technical Aspects

The proposed area project packages, which are composed of all the sub-systems such as switch, transmission, local cable and related supporting facilities, are to be executed for realization of a network system resulting to provide telecommunications services immediately. Therefore, it is generally recommended to carry out the proposed project packages considering measures under mentioned.

For smooth implementation of the program, it is necessary to "follow up" the implementation program proposed in this report according to the following procedures:

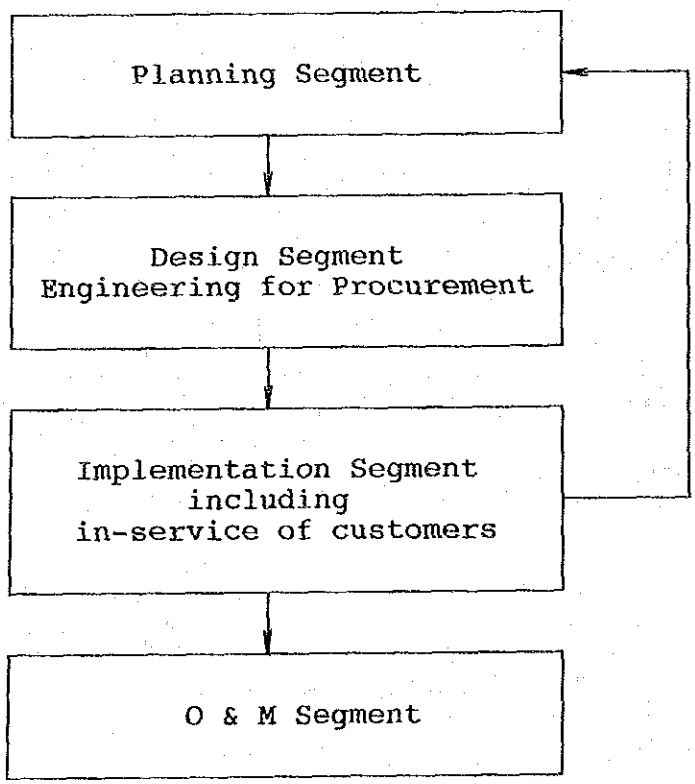


Figure 6.1 Follow-Up of Implementation Program

The following paragraphs describe in detail the measures to be taken for implementation of the program.

6.3.1 Management

(1) Coordination among Related Segments

Close coordination is to be established and

strengthened among the segments for planning, designing, implementing, tendering and contract, procurement, etc. aiming at realization of practical scheduling and synchronization among the implementation bodies.

(2) Enhancement of Information Management System

To well-organize the implementation bodies, the information management system is to be enhanced. The necessary information for administrative sections and departments is to be clarified and up-dated, while management of such information is to be integrated and unified. In this connection, facility records are also required to be arranged and up-dated. For example, the following information are to be recorded after investigation:

a) space availability of site and building;
b) availability of antenna supporting tower;
c) type and capacity of system;
d) type and number of equipment;
e) number of subscribers; and
f) number of waiting applicants.

(3) Management for immediate Customer's Service

The following procedures are to be systematically managed through computerization:

a) receipt of customer's application in sales section;
b) ordering of application to operation section;
c) check and confirmation of facility availability;
d) execution of necessary installation for the customer; and
e) registration of the related facilities.

(4) Promotion of Standardization

Standardization of the following items is to be promoted including preparation of related manuals:

a) planning method;
b) basic design for procurement; and
c) installation method of each sub-system.

(5) Fostering of Local Telecommunications Trade

It is necessary to foster the local telecommunications trade such as engineering company, manufacturer, construction company for securing the scheduled ordering and procurement based on the medium- and long-term plan.

6.3.2 Planning Segment

Aiming at the effective investment, the planning segment is to be well-organized. The planning segment deals yearly implementation planning together with medium-term and long-term planning. In addition, the planning segment is requested to up-date the plans by feeding-back of the contents of the latest contract.

6.3.3 Design Segment

Designing is to be carried out in advance of the project implementation for purposes of procurement and tendering.

6.3.4 Implementation Segment

For strengthening of implementation management, the following measures are to be taken:

a) To inform the suitable commencement schedule of land acquisition and building construction to the related organization;

b) To request for the related organization to proceed the necessary action for obtaining of governmental approval such as road excavation and radio application;

c) To manage the whole program continuously including the respective project management. It is also requested to dispatch own supervisors periodically to sites concerned; and

d) For in-service of customers, to store suitable volume of installation materials and to maintain sufficient number of installation vehicles.

6.3.5 Operation and Maintenance Segment

Operation and maintenance segment is to be strengthened through the following measures:

a) unification of the supervisory and control items;
b) establishment of routine inspection items for preventive maintenance; and
c) unification of logistic system to secure spare items and repair materials, etc.

6.3.6 Technical Alternatives

Taking the future expendability and viability of network system into consideration, appropriate advanced technology is to be reflected to the proposed plan timely. For

example, the following subscriber system could be applied in large cities as an alternative to cater for the difficulty in expanding cable networks.

a) large capacity subscriber radio system using quasi-millimeter wavelength system;
b) optic cable subscriber system; and
c) portable telephone system.

As for the backbone transmission system, in addition, installation of fiber optic transmission systems are to be accelerated instead of the proposed microwave systems in cases that fiber optic system has advantage systematically and has no difficulty in installation of fiber cable.

6.3.7 Use of Consultants

Use of both foreign and local consultants is encouraged for assistance of the following works:

a) Program Management;
b) Planning;
c) Standardization; and
d) Project management.