JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

SRI LANKA TELECOM (SLT)

THE STUDY ON TELECOMMUNICATIONS NETWORKS IN THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

FINAL REPORT

VOLUME-I

SUMMARY

MAY 1996

NIPPON TELECOMMUNICATIONS CONSULTING CO., LTD. (NTC)

JAPAN TELECOMMUNICATIONS ENGINEERING AND CONSULTING SERVICE (JTEC)

TOKYO, JAPAN

CURRENCY AND EQUIVALENT UNITS

As of May 1995

Currency Unit	=	Sri Lanka Rupees(SRs)
US$ 1.00	=	SRs 50.0
SRs 1.00	=	US$ 0.02

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PREFACE

In response to a request from the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct a study on Telecommunications Networks in the Democratic Socialist Republic of Sri Lanka and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team headed by Mr. Tatsumi AMANO, Nippon Telecommunications Consulting Co., Ltd., three times between March 1995 and May 1996.

The team held discussions with the officials concerned of the Government of Sri Lanka, and conducted field surveys 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 Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the team.

May 1996

Kimio Fujita
President
Japan International Cooperation Agency

May 1996

Mr. Kimio Fujita
President
Japan International Cooperation Agency

Dear Mr. Fujita:

Letter of Transmittal

It is our great pleasure to submit to you the Study Report on Telecommunications Networks in the Democratic Socialist Republic of Sri Lanka.

This report has been prepared by Nippon Telecommunications Consulting Co., Ltd. (NTC) and Japan Telecommunications Engineering and Consulting Service (JTEC), based on a contract with JICA. The study team conducted the works from March 1995 to May 1996.

The study aims at formulating the master plan for telecommunications networks development up to the year 2015 and feasibility study for priority projects which will be implemented by the year 2000, in the Democratic Socialist Republic of Sri Lanka.

Objective areas of the study covered the whole country for the master plan and several target areas for the feasibility study. Through field surveys and analyses of data / information collected, the master plan has been drawn up covering mainly development targets and strategies, network development plan, facilities plan, implementation plan, operation / maintenance / human resource plans as well as cost estimate and project evaluation. The feasibility study has been made for three priority projects identified as a result of the master plan study.

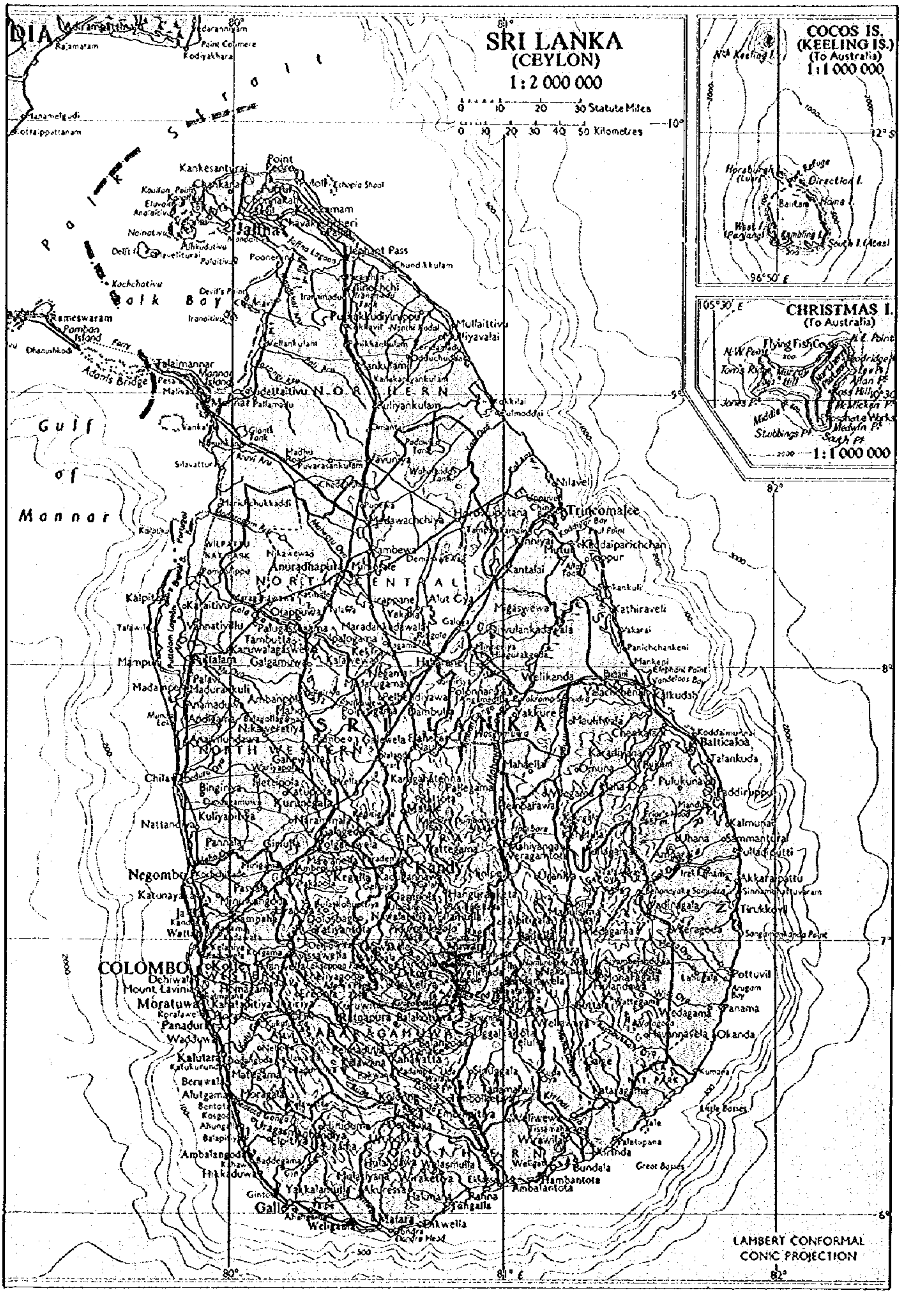
We wish to take this opportunity to express our deep gratitude to the officials concerned of the Japan International Cooperation Agency and other authorities concerned of the Government of Japan. We wish to offer our sincere appreciation to the officials concerned of Ministry of Posts and Telecommunications, Sri Lanka Telecom and other authorities concerned of the Government of Sri Lanka for their unlimited cooperation and assistance extended to the study team in connection with the execution of their duties.

Finally, we earnestly hope that this report will contirbute to future telecommunications development in the Democratic Socialist Republic of Sri Lanka.

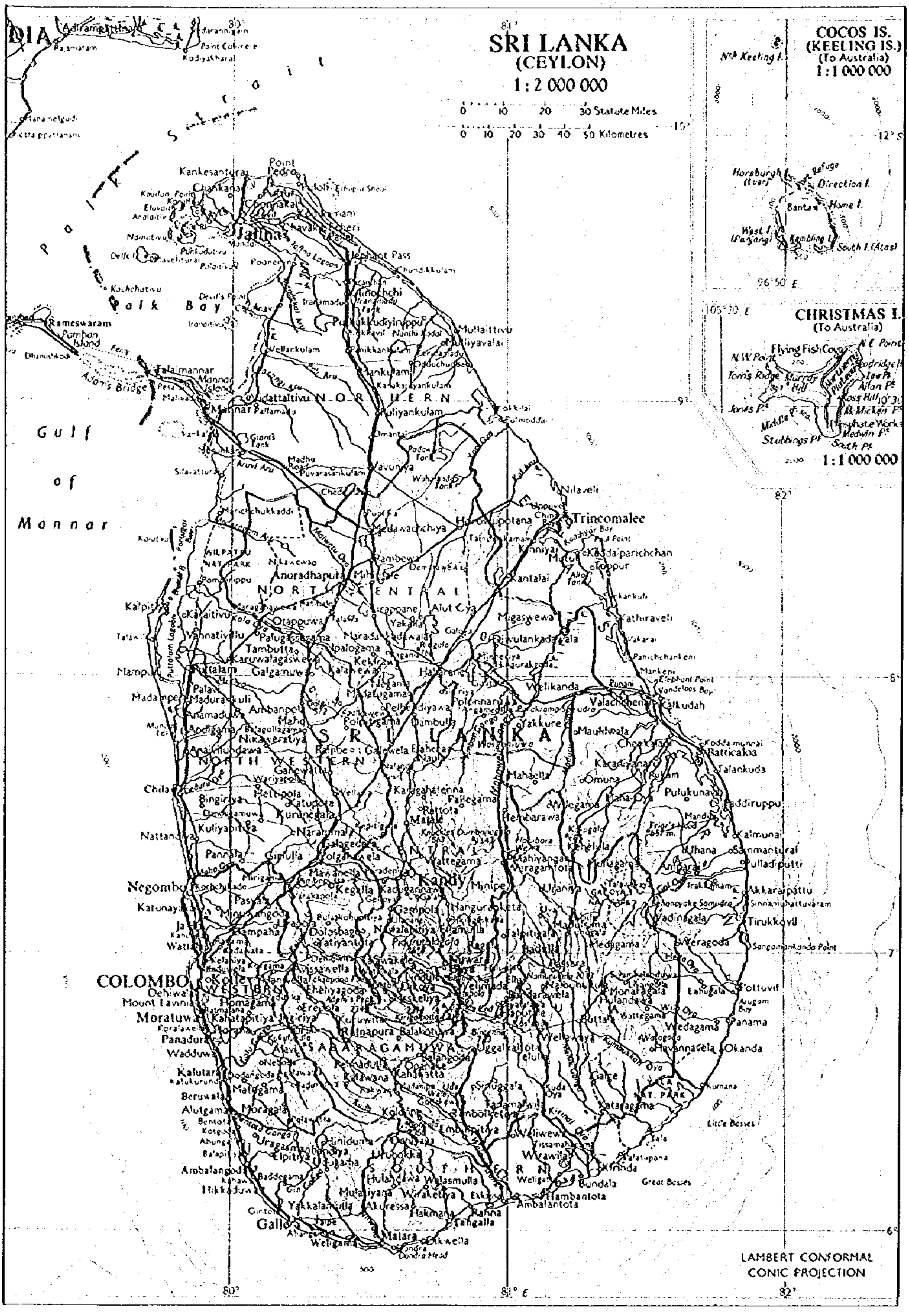
Very truly yours,

Tatsumi Amano
Team Leader
Study on Telecommunications Networks
in the Democratic Socialist Republic
of Sri Lanka

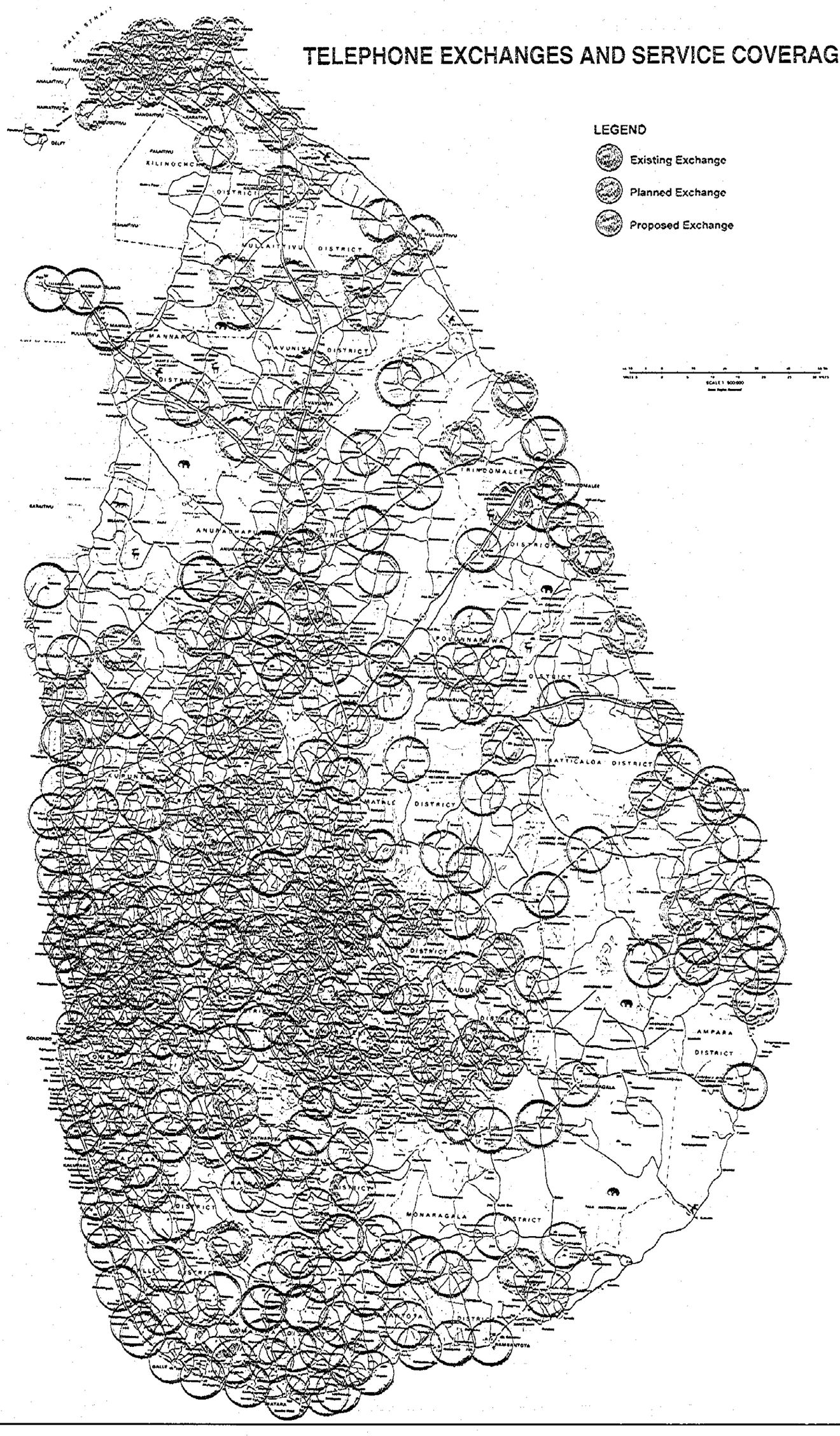
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA



THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA



TELEPHONE EXCHANGES AND SERVICE COVERAGE



CONTENTS

VOLUME-I SUMMARY

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AMPS	Advanced Mobile Phone Services
ATM	Asynchronous Transfer Mode
B-ISDN	Broadband ISDN
BOO	Build, Own and Operate
BOT	Build, Operation and Transfer
BTT	Turnover Tax
CC	Country Code
CCB	Coin and Collection Box Telephone
CCS	Common Channel Signalling System
CLR	Circuit Loudness Rating
CSPDN	Circuit Switched Public Data Network
DANIDA	Danish International Development Agency
DEL	Direct Exchange Line
DF/R	Draft Final Report
DGT	Director General of Telecommunications
DN	Destination Network
DNC	Destination Network Code
DP	Distribution Point
DRMASS	Digital Radio Multiple Access Subscriber System
DUP	Data User Part
EDCF	Economic Development Co-operation Fund, Korea
EIRR	Economic Internal Rate of Return
ERC	Economic Restructure Credit
ERC II	Economic Restructure Credit II
F/R	Final Report
F/S	Feasibility Study
FDM	Frequency Division Modulation
FIRR	Financial Internal Rate of Return
FIRROE	Financial Internal Rate of Return on Equity
FIRROI	Financial Internal Rate of Return on Investment
FISU	Fill-in Signal Unit
FM	Frequency Modulation
FOTS	Fibre Optic Transmission System
GCTNIP	Greater Colombo Telecommunications Network Improvement Project
GDP	Gross Domestic Product
GMDSS	Global Maritime Distress and Safety System
GOSL	Government of Sri Lanka
GRDP	Gross Regional Domestic Product
GSM	Global System for Mobile Communication
HF	High Frequency
IC/R	Inception Report
IDA	International Development Bank
IDD	International Direct Dialling
IDN	Integrated Digital Network

IN	Intelligent Network
INMARSAT	International Maritime Satellite Organisation
INTELSAT	International Satellite Organisation
ISC	International Switching Centre
ISDN	Integrated Services Digital Network
ISPC	International Signalling Point Code
ISUP	ISDN User Part
IT/R	Interim Report
ITU	International Telecommunications Union
JICA	Japan International Co-operation Agency
LAN	Local Area Network
LE	Local Exchange
LR	Loudness Rating
LSSU	Link Status Signal Unit
M/P	Master Plan
MF	Medium Frequency
MIS	Management Information System
MSU	Message Signal Unit
MTP	Message Transfer Part
N-ISDN	Narrowband ISDN
NPV	Net Present Value
NSB	National Saving Bank
NSC	National Switching Centre
NSN	National Significant Number
O&M	Operation and Maintenance
ODA	Official Development Assistance
OECF	Overseas Economic Cooperation Fund, Japan
OLR	Overall Loudness Rating
PAD	Packet Assembly / Disassembly
PCM	Pulse Code Modulation
PDCA	Plan, Do, Check and Action
PDH	Presiochronous Digital Hierarchy
PIP	Public Investment Programme
POTS	Plain Ordinary Telephone Service
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
QC	Quality Control
RLR	Receiving Loudness Rating
RSU	Remote Switching Unit
RTE	Regional Telecommunications Engineer
SCCP	Signalling Connection Control Part
SCP	Signal Control Point
SCPC	Single Channel Per Carrier
SDH	Synchronous Digital Hierarchy
SEA-ME-WE3	International Submarine Cable (via South East Asia - Middle East - Western Europe)
SLR	Sending Loudness Rating

SLT	Sri Lanka Telecom
SLTA	Sri Lanka Telecommunications Authority
SLTD	Sri Lanka Telecommunications Department
SN	Subscriber Number
SRS	Subscriber Radio System
SSC	Secondary Switching Centre
STD	Subscriber Trunk Dialling
TACS	Total Access Communications System
TC	Trunk Code
TCAP	Transaction Control Application Protocol
TDM	Tandem Switch
TMN	Telecommunications Management Network
TQC	Total Quality Control
TSC	Tertiary Switching Centre
TUP	Telephone User Part
UHF	Ultra High Frequency
UPT	Universal Personal Communications
VHF	Very High Frequency
WB	World Bank

8'

VOLUME-I

SUMMARY

1. INTRODUCTION

1.1 General

This Report covers a telecommunications master plan up to the year 2015 and a feasibility study for priority projects which will be implemented by the year 2000, for the Study on Telecommunications Networks in the Democratic Socialist Republic of Sri Lanka.

The report consists of :

- ❑ **Volume-I** **Summary**
- ❑ **Volume-II** **Master Plan**
- ❑ **Volume-III** **Feasibility Study for the Priority Projects**
- ❑ **Volume-IV** **Supporting for Master Plan**
- ❑ **Volume-V** **Data Book**

The study has been carried out in accordance with the work plan and schedule of the study which were discussed and agreed upon between Sri Lanka Telecom, hereinafter referred to as SLT and Japan International Co-operation Agency, hereinafter referred to as JICA. The study work has been done both in Sri Lanka and in Japan.

1.2 Background of the Study

To realise higher economic growth and equitable distribution of social benefits, the Government of Sri Lanka has been strongly emphasising the needs for adequate, efficient and reliable infrastructures in the national development policy. Telecommunications development is placed as a highest priority in the development policy for industrial development, higher productivity of agriculture and enhancing efficiency in the service sector.

In 1988, the Government of Sri Lanka set up the short-term telecommunications development target aiming at the total provision of 500,000 telephone lines including the

existing lines by the end of year 1995 based on the master plan formed under the support of Asian Development Bank.

In line with the master plan, SLT has been proceeding various projects for improvement to increase a telephone penetration ratio as a major telecommunications development index and to extend a network coverage to villages. Up to the present, the Government of Japan has been supporting telecommunications development in Sri Lanka in the form of the development study support for whole country and fund aids for the Greater Colombo Telecommunications Network Improvement Project for Phase I and II.

However, due to unstable social condition, shortage of the budget and delay in design work, some difficulties will be expected on achievement of the development targets. At present, approximately 180,000 telephone lines in whole country are supplied. In spite of an development effort, 187,000 of applicants are still on the waiting lists. In order to clear this situation, a master plan with a long-term view and adequate development strategies is required, while the present master plan is of short-term and already outdated.

Considering the above condition, the Government of Sri Lanka requested the Government of Japan to revise and update the master plan to incorporate the latest changes in policy and environment and to extend a development target year to the year 2015.

In response to the request, the Government of Japan dispatched JICA Preparatory Study Team to discuss regarding this study programme and the Scope of Work of the Study was agreed upon between SLT and JICA on 20th December 1994.

1.3 Objectives of the Study

The objectives of this study are as follows :

a) Phase-I Study
To formulate a long-term plan for the development of telecommunications networks in the Democratic Socialist Republic of Sri Lanka up to the year 2015.

b) Phase-II Study
To conduct a feasibility study for the priority project(s) identified in consequence of the Phase-I Study.

1.4 Overall Time Schedule of the Study

The study period is from the end of March 1995 up to the middle of May 1996. The time schedule of this Study by study stage is shown in the following Figure 1-1 :

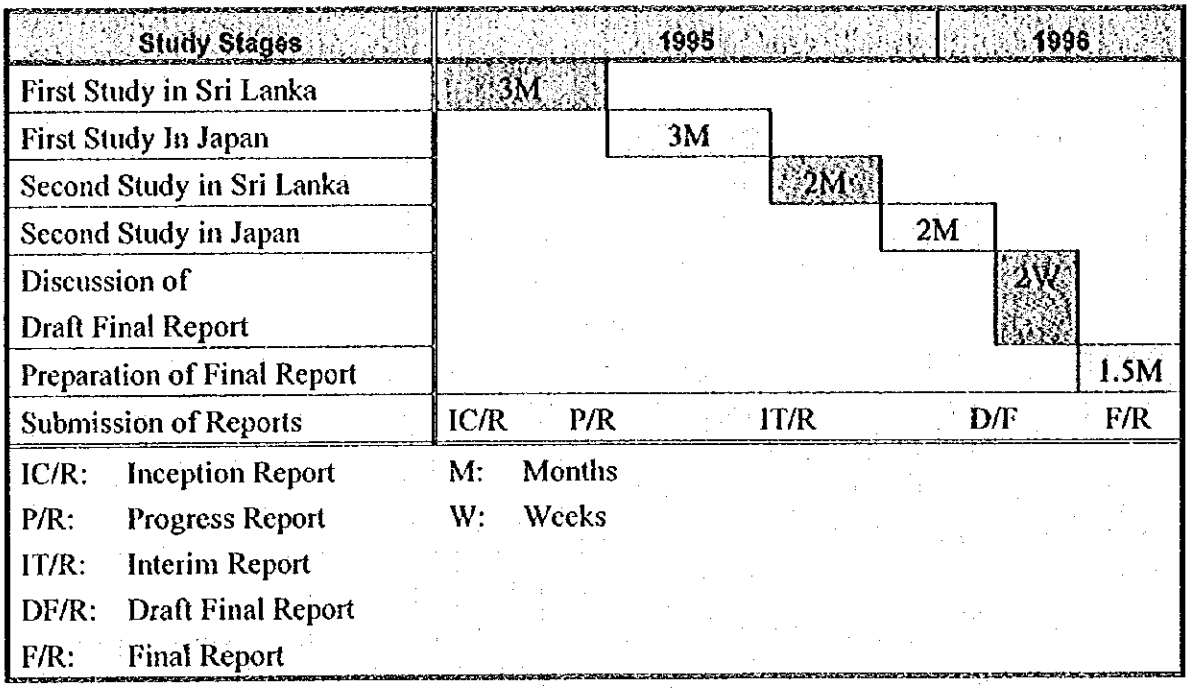


Figure 1-1 Work Schedule of the Study

1.5 Progress in the First Study in Sri Lanka

During the first study in Sri Lanka from 27th March to 24th June 1995, the study team carried out the following work together with counterparts :

a) Discussion of Inception Report submitted from the team;
b) Collection of data / information (socio-economy, national development policy, telecommunications);
c) Analyses of data / information collected;
d) Field survey (socio-economy, demand distribution and facilities);
e) Macroscopic demand forecast;
f) Study of long-term development framework and strategies;
g) Preparation of Progress Report,

h) Technology transfer through field survey, data collection and preparation of a development frame work.

1.6 Progress in the First Study in Japan

During the first study in Japan from 26th June to 26th September 1995, the study team prepared a draft master plan based on the results of the first study in Sri Lanka. The draft master plan consists mainly of the following :

a) Socio-economic analyses;
b) Demand forecasts;
c) Telecommunications development plan;
d) Operation and management plan;
e) Project formation and selection of priority project(s);
f) Evaluation of master plan,
g) Technology transfer through training in Japan for a SLT counterpart for one month from 19th September to 15th October 1995.

1.7 Progress in the Second Study in Sri Lanka

During the second study in Sri Lanka from 18th October to 14th December 1995, the study team carried out the following work together with counterparts :

a) Explanation and discussion of Interim Report submitted from the study team;
b) Selection of priority projects for feasibility study;
c) Presentation and discussion on Work-shop;
d) Collection of data and information for feasibility study;
e) Field survey for priority projects selected for the feasibility study;
f) Explanation and discussion of basic conditions of feasibility study and outlines of project scope,
g) Technology transfer through field survey and project basic design for the feasibility study.

1.8 Progress in the Second Study in Japan

During the second study in Japan from 15th December 1995 to 13th February 1996, the study team prepared a draft final report consisting of a master plan and feasibility study for three (3) priority projects. The study team carried out the following work :

a) Modification of the master plan submitted as Interim Report;
b) Basic design and cost estimate for the priority projects selected for feasibility study;
c) Evaluation of objective priority projects for feasibility study;
d) Preparation of a draft final report consisting of a master plan study and feasibility study.

1.9 Progress in the Third Study in Sri Lanka

During the third study in Sri Lanka from 14th to 26th February 1996, the study team carried out explanation and discussion of a draft final report with SLT key personnel, counterparts and other officials from organisations concerned. Contents of the draft final report has been basically accepted.

1.10 Progress in the Third Study in Japan

During the third study in Japan from 15th April 1996 to 29th April 1996, the study team prepared a final report consisting of a master plan and feasibility study for three (3) priority projects based on the results of explanation and discussion on the draft final report.

2. SOCIO-ECONOMY OF SRI LANKA

2.1 Geographical Conditions

Sri Lanka lies off the southern tip of India between latitudes 6° and 10° north and longitude 80° and 82° east. Sri Lanka has a maximum length of 432 km and a maximum width of 224 km. The land area of the island is 65,610 km^2.

2.2 Demographic Trend

According to the results of 1981 population census, population stood at 14,988,000 and an average household size of 4.9. It was officially estimated at 17.7 million in 1994 with a growth rate of 1.39% per annum between 1981 and 1994. The following Table 2-1 shows Population in 1994 and Land Area by Province :

Table 2-1 Population in 1994 and Land Area by Province

Province	Population (x1,000)	Land Area (km^2)
Western	4,640.7	9,781
Central	2,310.6	9,158
Southern	2,226.2	8,316
North-Western	1,469.1	8,292
Sabaragamuwa	1,351.2	7,431
Northern	1,974.5	5,490
Eastern	1,005.3	5,398
Uva	1,112.6	4,869
North-Central	1,675.1	3,603
Sri Lanka Total	17,765.0	62,337

Source: Statistics of the Government of Sri Lanka

2.3 General Socio-Economic Trend

Sri Lanka shall be divided into four major commercial zones i.e. Colombo and its outskirts, northern area, eastern area and southern area. Jaffna is the centre of the northern area, and Trincomalee in the east and Galle in the south are central cities, respectively. A tangible trends of the development is that the economic zone of Colombo and its outskirts,

which has been the centre and the core of the Sri Lanka's economic zone, is extending to the directions shown in the Figure 2-1.

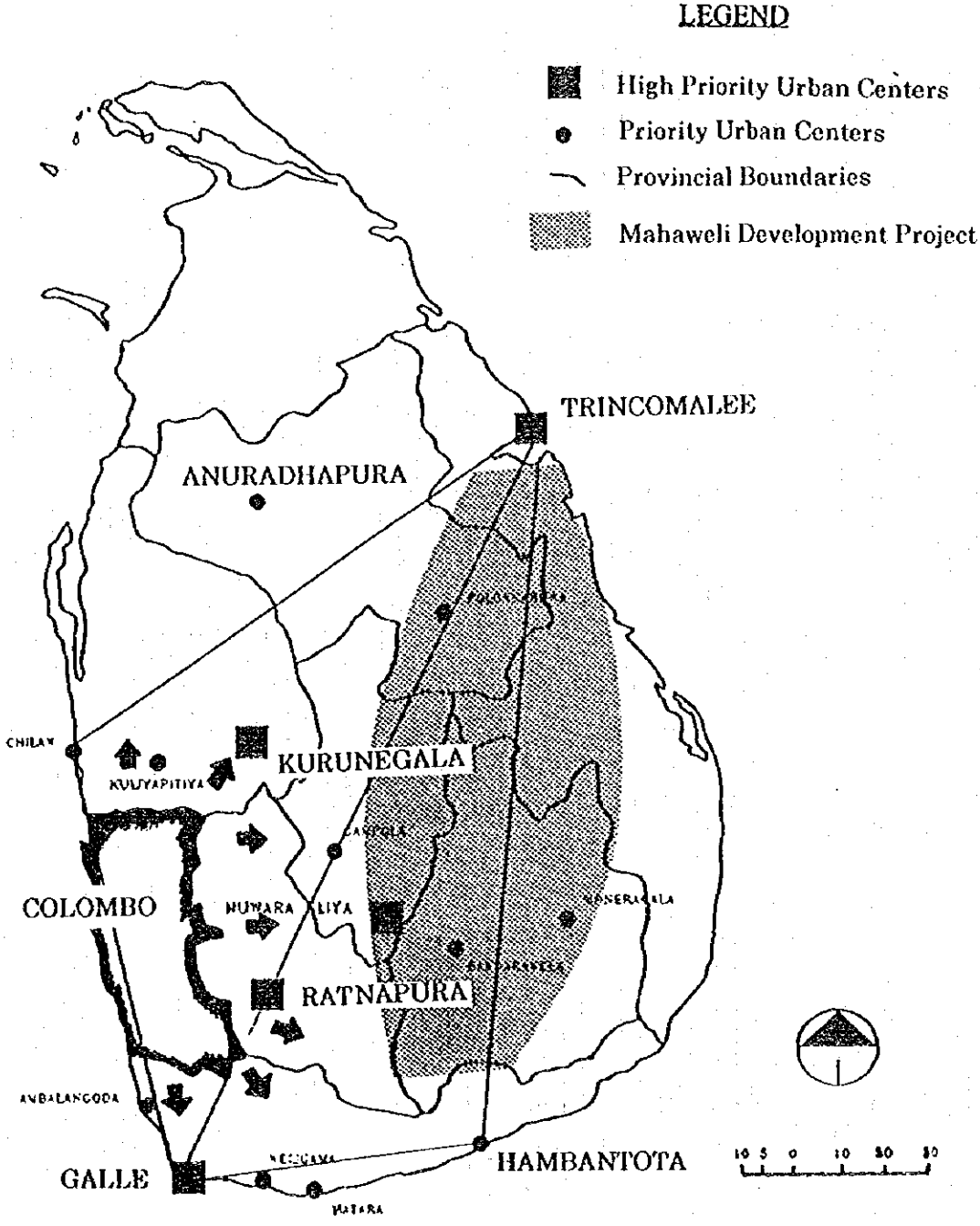


Figure 2-1 Economic Trend of Sri Lanka

2.4 Economic Activities

2.4.1 Gross Domestic Product (GDP)

GDP real growth rate has averaged 4.47% since 1987. The major economy is still largely agricultural with approx. 25% of GDP generated by this sector and approx. 39% of the employed population is belonging this. However, Sri Lanka economy had 4.3% real growth in 1992, despite a severe drought which caused a small fall in agricultural output. Recent figures on GDP are shown below :

Table 2-2 Gross Domestic Product (GDP) in Sri Lanka

Item	Amount
GDP (million)	US$9,246.7
GDP growth rate	4.47% during 1987-1993
GDP/Capita	US$526

Note: US$1.00=SRs49.0 (1993), Pop=17,595,000 (1993)

2.4.2 Gross Regional Domestic Product (GRDP)

The GRDP by province has been announced by Department of National Planning. Those figures are summarised in Table 2-3.

Table 2-3 GRDP per Capita by Province

Unit: Srs.

Province	GRDP/Capita by Province	Province	GRDP/Capita by Province
Western	38,143	Uva	15,491
Southern	14,753	North West	25,457
Central	17,049	North Central	9,198
Northern	7,601	Eastern	25,373
Sabaragamuwa	20,176	All Province	21,784

Note: at 1992 factor cost

2.5 New Economic Policy

In New Economic Policy released on September 1994, the new Sri Lanka administration announced that it would firmly pursue the policies of economic liberalisation and structural adjustment initiated by the previous administration. On the other hand, however, the new administration reportedly indicated its intention to make adjustments in some of the policies proposed by the previous Government, including its plans to consolidate protection of labourers, increase wages for workers at export-processing areas, and privatise national enterprises. Basically, the new administration emphasises social welfare and relief for the poverty. The new economic policies are referred to below :

- **Increase real economic growth up to 8% by the year 2000;**
- **Decrease the budget deficit to 3%-4% of GDP;**
- **Control the inflation rate.**

2.6 Future Socio-Economic Trend

2.6.1 Future Population Growth

Looking at past population growth rates, Sri Lanka indicated growth of 1.4% in its population between 1981-1991. By 1994, the total population had reached approx. 17.7 million. The population projection announced by Sri Lanka Government is shown in Table 2-4.

Table 2-4 Future Population

Year	Population (x1,000)	Year	Population (x1,000)
1994	17,765	1999	18,648
1995	17,937	2000	18,830
1996	18,111	2005	19,780
1997	18,288	2010	20,690
1998	18,467	2015	21,524

Source: the Government of Sri Lanka

2.6.2 Future Economic Growth

Future economic growth rate up to 2015 has never been published by the Sri Lanka Government. Therefore, an economic projection is made by the study team through discussion with staff of Department of National Planning, and industries could be achieved given that adequate foreign investment continue and privatisation in industries would be made steadily in line with the Government Policies. The future economic growth are shown in Table 2-5.

Table 2-5 Future Economic Growth

Year	Growth Rate	Million US$	Year	Growth Rate	Million US$
1994	5.50%	9,494	1999	7.70%	13,277
1995	6.00%	10,063	2000	8.00%	14,339
1996	6.50%	10,717	2005	7.00%	20,882
1997	7.00%	11,469	2010	5.00%	28,212
1998	7.50%	12,331	2015	5.99%	36,014

Source: Assumption by JICA study team through the discussion with staff of National Planning

3. NATIONAL DEVELOPMENT AND TELECOMMUNICATIONS

3.1 National Development

Over the past five years, under a new industrialisation policy established in 1989, the Government of Sri Lanka (GOSL) has focused its economic activities on the development of export-oriented industries capable of obtaining foreign currency. The policy has the following three pillars :

- **To cultivate the private sector into the driving force of economic growth;**
- **To reduce the role of public sector while making it work more effectively;**
- **To distribute wealth fairly among the people.**

3.2 Telecommunications Development Plan and On-Going Projects

Aiming at nation-wide telecommunications services, improvement of service quality, demand fulfilment and improvement of operational efficiency, the Telecommunications Department launched the five year development programme which was included in the public investment programme 1990 - 1994 of Ministry of Policy Planning and Implementation.

The programme which shall be finished by the end of 1994 is expected to be completed by the year 1997 due to some disturbances. By the completion of the on-going projects as shown in Tables 3-1 and 3-2, the number of Direct Exchange Lines (DEL) will reach to approximately 500,000. According to the demand forecast in this study, the expressed demands are estimated as 680,000 in 2000, 980,000 in 2005 and 1,670,000 in 2015. To cope with the large number of waiters and expressed demand estimated, Third Telecommunications Development is to be promptly finalised and implemented.

Table 3-1 List of On-Going Projects by Foreign and Private Funds

No.	Name of Projects	Finance
1	International Telecommunications Network Facilities Project	ADB
2	Second Telecommunications Project (Trunk Transmission Network)	ADB
3	Technical Assistance for Trunk Transmission	ADB
4	Technical Assistance for International Network Facilities	ADB
5	Revenue & Operation Support System (ROSS)	ADB
6	Matara Telecommunication Development Project	Finland
7	Consultancy for Matara Project	Finland
8	Second Telecommunication Project (Exchanges)	IDA/WB
9	Exchange Rehabilitation	IDA/WB
10	Technical Assistance for Second Telecommunication Project (Exchanges)	IDA/WB
11	Greater Colombo Telecommunication Network Improvement Project II Package I (Greater Colombo Area)	OECF
12	Greater Colombo Telecommunication Network Improvement Project II Package II (Gampaha & Katunayaka Area)	OECF
13	OECF III Regional Telecommunication Development Project	OECF
14	150K Suppliers Credit Project	Private
15	Improvement of Telecommunication Facilities in Ingiriya Area	EDCF
16	Improvement of Telecommunication Facilities in Horana Area	EDCF

Source: Sri Lanka Telecom

Note: ADB: Asian Development Bank
IDA: International Development Association
WB: World Bank
OECF: Overseas Economic Cooperation Fund, Japan
EDCF: Economic Development Cooperation Fund, Korea

Table 3-2 List of On-Going Projects by SLT's Own Fund

No.	Name of Projects
1	Local Transmission Links (spur link) for WB Exchange Project
2	Outside Plant Development in 9 Regional Stations
3	Subscriber Line Connections in Regions
4	Multi-Access Radio Systems
5	Single Channel Radio Systems
6	Crash Programme for Cable Augmentation and Subscriber Line Connection
7	Colombo - Katunayake Radio Transmission Link Expansion
8	Investment in TAT (Transatlantic) No. 12/13 Cable
9	Investment in Colombus II Cables
10	Investment in MT (Malaysia - Thailand) Cable
11	Intelsat Satellite Capacity Expansion
12	Colombo PCM Expansion 2
13	Colombo PCM Expansion 3
14	5ESS Gateway Expansion No.2

Source: Sri Lanka Telecom

3.3 Problems in Telecommunications Development and Future Development Trends

There are several factors involved in the failure to fulfil current demand :

- Inability to raise sufficient amount of funds;
- Deficiency in drawing up an appropriate project;
- Inability to implement the project.

The first or largest factors is this: the current SLT system acts as an obstacle to the necessary amount of funds being available at a stipulated timing and on an appropriate scale. To put it differently, telecommunications funding requirements can no longer be met through public sources, and the delay in upgrading the telecommunications infrastructure has become more prominent in comparison with economic growth. In order to fill the gap between telecommunications infrastructure supply and demand, another factor liable to become a bottleneck of the economic growth, infrastructure development projects scheme in association with private sector participation have now emerged as worthy of a close examination.

4. PRESENT TELECOMMUNICATIONS SERVICES

4.1 Present Status of Telecommunications Administration

In accordance with the Telecommunications Act No. 25 of 1991, Sri Lanka Telecom Corporation (SLT) was licensed for the operations of basic telecommunications services and took over the operations of both domestic and international telecommunications services from the SLTD, on 1st September 1991.

The act also provided Sri Lanka Telecommunications Authority (SLTA) as the Regulatory Authority under a Director General of Telecommunications (DGT) within the Ministry of Posts and Telecommunications. SLTA mainly controls tariff system and inter-connection charge, licensing of operators, radio frequency allocation, national numbering, consumer protection, enforcement of relevant laws and licensing conditions, in accordance with the 1991 Act.

At present, SLT is a fully government owned but otherwise autonomous enterprise headed by a Chairman and a board of directors appointed by the Government and is licensed for the operations of not only basic services consisting of plain ordinary telephone service (POTS), telex and telegram services but also other non-basic services including public payphone service.

In addition, various private companies are licensed for providing various telecommunications services i.e. mainly mobile telephone, paging, data communication and public payphones which are defined as the value added services.

The present organisation of telecommunications sector among Governmental organisations and private companies is shown in the Figure 4-1.

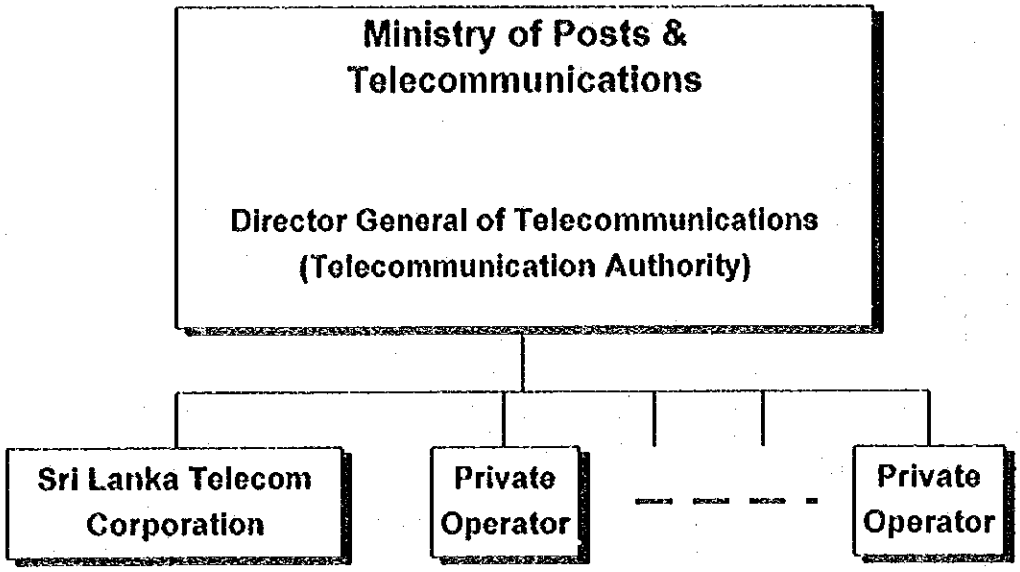


Figure 4-1 Present Organisation of Telecommunications Sector in Sri Lanka

4.2 Present Status of Telecommunications Services and Operators

By the enforcement of Telecommunications Act No. 25 of 1991, operations of telecommunications services were opened to the private sector excluding for basic services consisting of local, long distance and international POTS, and telex and telegram services. Under the Act, participation of private investors to non-basic services, especially to mobile telephone service has been promoted to meet the rapidly increasing demand. In consequence, the number of private companies licensed has grown dramatically and it has reached to 18 private companies in total as of May 1995.

4.2.1 Telecommunications Services Operated by SLT

Sri Lanka Telecom (SLT) has been monopolistically providing nation-wide basic telecommunications services and the other services including value added services since 1991 consisting of :

a) Plain ordinary telephone service (domestic and international);
b) Telex service (domestic and international);
c) Telegram service (domestic and international);

d) Leased circuits;
e) Public payphone service;
f) Cellular mobile service (BOT basis);
g) Packet switched service (joint venture between SLT and Indian Saga);
h) Radio maritime services including INMARSAT services.

Note: a) to c): basic telecommunications services;
c) to g): value added services.
BOT: Build, Operation and Transfer

4.2.2 Telecommunications Services Operate by Private Companies

In Sri Lanka, the number of private companies to provide various telecommunications services are rapidly increasing, especially under the Telecommunications Act 1991. As of May 1995, 18 private companies are providing their services. The number of private companies by the service category is shown in the Table 4-1.

Table 4-1 The Number of Private Companies by Service Category

Service Categories	No. of Private Companies
Cellular mobile telephone	4
Paging service	5
Stored & forward fax service	2
Data transmission	3
Mobile radio trunking	1
Payphone	3

Source: Sri Lanka Telecommunications Authority (as of June 1995)

5. PROBLEMS BEING ENCOUNTERED IN SECTOR

5.1 Service Provision

On the review of activities in telecommunications sector, a most important item is available services and their volume to be supplied. In Sri Lanka, basic telecommunications services, such as fixed telephone, telex, telegram and leased circuit services are operated by SLT as monopoly at present. On the other hand, the value added services, such as cellular mobile telephone, public payphone, electric mail, data communication and paging services are operated by several private companies. However, enhanced value added services like voice mail, video conference, ISDN (Integrated Services Digital Network) and IN (Intelligent Network) services are not provided yet. Most remarkable problems in telecommunications services provision is how the telephone service supply catches up the telephone demand as soon as possible. Aiming at quicker telecommunications development, major problems to be solved are summarised below :

- **Rapidly increasing telephone demand and waiters;**
- **Insufficient network capacity to cover the demand;**
- **Low teledensity in rural areas.**

5.2 Service Quality

The service quality is also one of important issues for telecommunications services. The current service quality of telephone service provided by SLT is indicated as follows :

- **Low call completion rate;**
- **High fault occurrence rate;**
- **Low fault clearance rate.**

According to the existing data, the current service quality indicated by the above factors are gradually improved, but they are still low compared with those in other Asian countries.

5.3 Operational Management

The public telecommunication services must be provided with low service charge and high service quality as well as possible. For these objectives, the management of telecommunications operators must pay attention to adequate staff allocation, facilities capacity and investment plan. In this regard, it seems that SLT at present is not executing efficient operation caused by characteristics of public corporation. In consequence, the operation and management of SLT are to be improved from a view of the following :

- **Staff productivity (the number of staff per 1000DEL);**
- **Composition of staff for each field;**
- **Training of staff;**
- **Revenue and expenditure;**
- **Billing system;**
- **Accounting system.**

6. DEMAND FORECAST

The demand forecasts has been made for telephone, telex, telegram and value-added services, which provides a basis for the economic and technical study of the master plan for development of the telecommunications network in Sri Lanka up to the year 2015. The forecasting base year is set at 1995, and successive forecasts are made at 2000, 2005 and 2015.

Demand for national telephone service was estimated by the macroscopic forecast method, based on two models: ITU (International Telecommunication Union) model for national level forecasting and Sri Lanka model for district level forecasting.

Also Demand for telex and telegram services were estimated by adoption of the decreasing ratio based on latest trend in Sri Lanka. Demands for value-added services, i.e., cellular mobile telephone service, radio paging service, leased circuit services and ISDN were estimated in this study based on mainly other countries data. The estimation of demand for new services at an initial stage usually needs detailed market surveys including direct interviews for collection of fairly reliable data. Results of the demand forecasts for respective services are referred to below.

6.1 Telephone Demand Forecast by ITU Model

For the macroscopic demand forecast by the ITU regression model, a forecast model was developed by the regression analysis. The analysis was made by studying a correlation between the expressed demand density and GDP per capita using the statistical data as of 1992 of 50 (Fifty) countries over the world. A result of the demand forecast is shown in Table 6-1. Table 6-2 shows demand distribution among Colombo and other districts.

Table 6-1 Results of Demand Forecast by ITU Model

Items	1995	2000	2005	2015
Population (x1,000)	17,937.3	18,830.9	19,780.6	21,524.0
Suppressed : 0%	480,679	678,127	978,536	1,663,173
Demand Density	2.68	3.60	4.95	7.73
Suppressed : 20%	576,815	813,753	1,174,244	1,995,808
Demand Density	3.22	4.32	5.94	9.27

Table 6-2 Demand in Colombo District and Others

Area	Items	1995	2000	2005	2015
Sri Lanka	Pop. ('000)	17,937.3	18,830.9	19,780.6	21,524.0
	Demand	480,679	678,127	978,536	1,663,173
Colombo	Pop. ('000)	2,024.9	2,112.8	2,204.3	2,361.3
	Demand	232,180	333,652	489,919	842,887
	(Share)	48.30%	49.20%	50.10%	50.70%
Other district	Pop. ('000)	15,912.4	16,718.1	17,576.3	19,162.7
	Demand	248,499	344,475	488,617	820,286
	(Share)	51.70%	50.80%	49.90%	49.30%

6.2 Telex Demand Forecast

Demand for telex service will decrease rapidly in coming years following the trend in a lot of countries where telex service demand is being transferred to other service media, i.e., facsimile, data communication, etc. In Sri Lanka also, it was observed that the decreasing ratio of telex subscribers is approx. 20% from the end of 1994 to May 1995. The ratio will continue to increase until the end of 1995. The study team assumed that the ratio will reach approx. 30% at the end of 1995. Considering the condition, telex demand was forecasted as shown in Table 6-3.

Table 6-3 Telex Demand

Year	1995	2000	2005	2015
No. of Telex Subscribers	1,380	230	90	0

6.3 Cellular Mobile Telephone Demand Forecast

Annual growth rate of cellular mobile telephone in Sri Lanka is large and not steady because that the service is still at introductive stage. Analyses have been made from various view points and approaches i.e. regression analysis and case study regarding other country. In consequence of the analyses, it is finally assumed that the recent growth in the number of cellular telephone subscribers in Sri Lanka will be 20% in consideration of the recent growth rate. A result of the demand forecast is shown in Table 6-4.

Table 6-4 A Result of Mobile Telephone Demand

Year	1995	2000	2005	2015
Mobile Telephones	47,400	133,400	195,800	332,600

7. DEVELOPMENT FRAMEWORK AND STRATEGIES

7.1 Basic Concept of the Master Plan

Telecommunications policy is outlined in keeping with the Economic Policy Statement of the Government of Sri Lanka which was announced on September 1994. The Economic Policy states that public investment would be needed to build the infrastructure which is required as a necessary complement to rapid private sector growth and socio-economic activities. In line with the above policy, the Telecommunications Policy has the objectives mentioned in the following Figure 7-1. However, the defence, security and environmental interests of the country will be protected while meeting the above objectives.

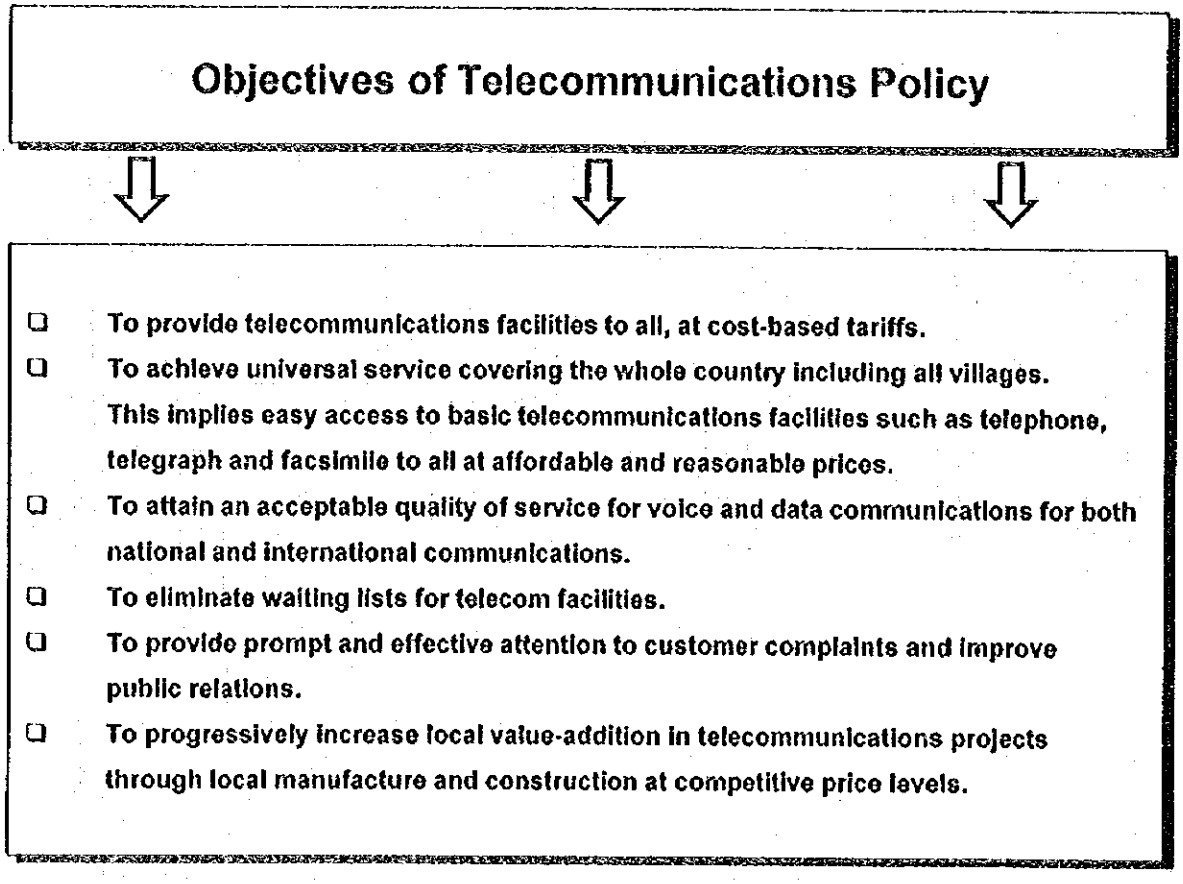


Figure 7-1 Objectives of Telecommunications Policy

7.2 Planning Period and Target Years of the Master Plan

This master plan covers long-term development for the telecommunications networks up to 2015 in whole Sri Lanka. The planning period up to 2015 is divided into several milestones as target years i.e. a short-term plan on exchange basis up to 2000, a medium-term plan on exchange basis up to 2005 and a long-term plan on SSC (Secondary Switch Centre) area basis up to 2015. The figure 7-2 shows a concept of planning period and target years in this master plan.

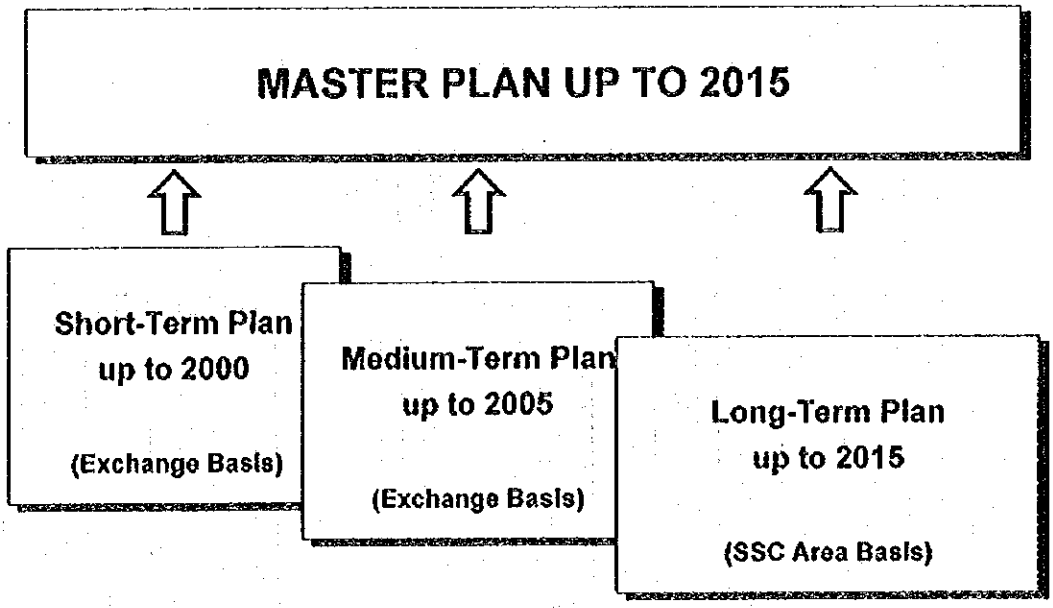


Figure 7-2 Planning Period and Target Years in the Master Plan

7.3 Overview of the Master Plan

This master plan has been prepared based on the telecommunications policy 1994 which is outlined in keeping with the Economic Policy Statement of the Government of Sri Lanka. The master plan covers long-term development for the telecommunications networks up to 2015 in whole Sri Lanka. Key indexes of the master plan are shown in the following Table 7-3 :

Table 7-1 Overview of Master Plan (1/2)

Indexes	Sub-Indexes	Present Status as of 1994	Development Targets		
			Short-Term Targets By FY 2000	Medium-Term Targets by FY 2005	Long-Term Targets by FY 2015
Socio-Economy	Population	17,765,000	18,331,000	19,781,000	21,524,000
	GDP/Capita (US$ Price in 1992)	534	761	1,056	1,673
Plain Ordinary Telephone Service (POTS)	Expressed Demand +20% Hidden Demand (DELs)	-	820,000	1,180,000	2,000,000
	Expressed Demand (DELs)	367,000	680,000	980,000	1,670,000
	Supply Volume (DELs)	181,000	667,000	980,000	1,670,000
	Switching Capacity (Line Units)	237,000	800,000	1,200,000	2,000,000
	DELs / 100 inhabitants	1.0	3.5	5.0	7.8
	Network Coverage	to Major Villages	to All Villagers by 1998	-	-
Telex Service	Telex Subscriber Demand	Decreasing	Decreasing	Decreasing	-
	Supply Volume (DELs)	1,560	No Expansion	No Expansion	to Other Services
Telegram Service	Gentex Service	88 Terminals for 44 Post Office	Same as the present	Same as the present	to Other Services
Leased Circuit	Voice Circuits, Data Circuits	Between Major Cities	Between Major Cities	Between All Districts	Nation-wide Service
Maritime Communication Services	Ordinary Services by MF, HF, VHF / INMARSAT services	Ordinary Services / INMARSAT services	Ordinary Services / Enhancing INMARSAT services	Ordinary Services / Enhancing INMARSAT services	Ordinary Services / Enhancing INMARSAT services
Value Added Services	Cellular Mobile Telephone	Operated (32,500DEL)	Major Cities	All District Capitals	All Districts
	Public Payphones	Operated	All Villages	Increase the Number	Increase the Number
	Electronic Mail	Operate in 1995	Major Cities	Major Districts	All District Capitals
	Data Communications	Operated	Major Cities	Major Districts	All District Capitals
	Voice Mail	Not Operated	Colombo	Major Cities	Major Districts
	Video Text	Not Operated	Colombo	Major Cities	Major Districts
	Audio Conference	Not Operated	Colombo	Major Cities	Major Districts
	Video Conference	Not Operated	Colombo	Major Cities	Major Districts
	Radio Paging	Operated	Major Cities	All District Capitals	Nation-wide Service
	Trunked Mobile Radio Services	Operated	Major Cities	Major Districts	All Districts
	Narrowband ISDN Services	Not Operated	Colombo	Major Cities	All District Capitals
	Broadband ISDN Services	Not Operated	-	-	Major Cities
	IN Services	Not Operated	Colombo	Major Cities	All Districts

Table 7-1 Overview of Master Plan (2/2)

Indexes	Sub-Indexes	Present Status as of 1994	Development Targets		
			Short-Term Targets By FY 2000	Medium-Term Targets by FY 2005	Long-Term Targets by FY 2015
Service Quality (for basic services)	Call Completion Rate	28%	45%	55%	70%
	No. of Faults (/ month / 100 DEL)	26	15	10	5
	Fault Clear Rate within 24hours	55%	85%	90%	95%
Operational Efficiency (for basic services)	Number of Staff	7,500	9,200	10,000	10,900
	Staff / 1,000 DEL	42	14	10	7
Network Facilities	Switching System	Manual / Analog / Digital	100% Digital	100% Digital	100% Digital / Introduction of ATM
	Transmission System	Microwave & FOTS / Analogue & PDH	FOTS & Microwave / 100% Digital / Backbone by FOTS/ Introduction of SDH	FOTS & Microwave / 100% Digital / Expansion of Backbone by FOTS / Expansion of SDH	FOTS & Microwave / 100% Digital / Expansion of Backbone by FOTS / Expansion of SDH
	Subscriber Network	Metallic Cable & Radio	Metallic Cable & Radio / Introduction of Optical Fibre Cable	Metallic, Optical Fibre and Radio system / Expansion of Optical Fibre	Metallic, Optical Fibre and Radio system / Expansion of Optical Fibre
	Maritime Communication	Conventional System	Introduction of GMDSS	-	-
Revenue	Revenue / DEL (US$)	838	620	551	505
	Total Revenue (US$1,000)	142,765	365,915	484,939	792,790
Expenditure	O&M Cost (US$1,000)	55,402	101,117	131,547	196,298
	Other Cost (US$1,000)	25,548	238,333	224,191	214,636
Profit	Profit before tax (US$1,000)	61,814	26,465	129,201	381,856

dev-indx.xls

Abbreviations:
DEL: Direct Exchange Line
PDH: Presiochronous Digital Hierarchy
SDH: Synchronous Digital Hierarchy
ATM: Asynchronous Transfer Mode
FOTS: Fibre Optic Transmission System
GMDSS: Global Maritime Distress and Safety System

8. OPERATION AND MAINTENANCE PLAN

8.1 Present Status on Operation and Maintenance

Korea Telecom and SOFRECOM reported some findings on SLT's operation and maintenance work as a result of the survey. The findings are basic problems to be improved on operation and maintenance during 1992-1994. In 1995, JICA study team surveyed and found some improvement which were made based on the recommendations by Korea Telecom and SOFRECOM. In consequence of the improvement, productivity were improved as shown in Table 8-1.

Table 8-1 Improvement of Productivity

Year	1986	1988	1990	1992	1994
No.of staff/1000DEL	94	87	77	56	42

8.2 Urgent Operation and Maintenance Improvement

As a result of the study, the following items to be improved and strengthened are mainly recommended :

- **Strengthening of new connections organisation and development of Customer Service system;**
- **Improvement of productivity, call completion rate, faults clearance speed, training, staff work efficiency, and set-up Quality Level of Service at each Region;**
- **Preventive maintenance programme for external plant and to decrease occurrence of external plant' faults;**
- **Financing and installation of Network Management Centre for switching and transmission;**
- **Improvement of Materials Management system;**
- **Improvement of Plant Record system.**

8.3 Future Operation and Maintenance Improvement

Based on the urgent operation and maintenance improvement and further improvement, a target quality of service are established as shown in Table 8-2 and Figure 8-1.

Table 8-2 Target Quality of Service

Item/Year	1994	2000	2005	2010	2015
Call completion rate	28%	45%	55%	63%	70%
Faults/month/100DELs	26	15	10	7.5	5
Faults clearance rate next day (24 hours)	55%	85%	90%	93%	95%

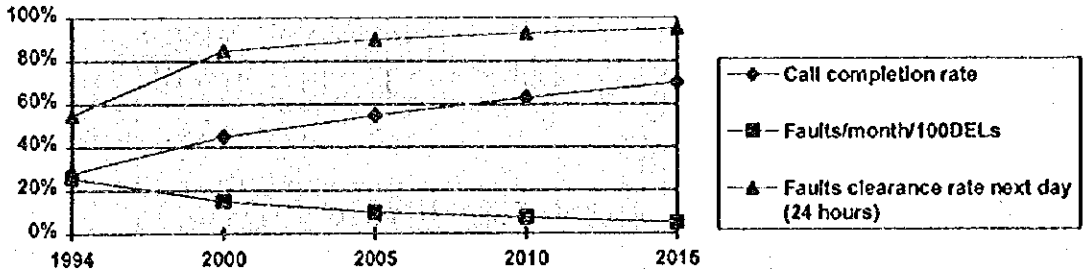


Figure 8-1 Target Quality of Service

9. HUMAN RESOURCE DEVELOPMENT PLAN

9.1 Present Status on Human Resource Development

Korea Telecom and SOFRECOM also reported some findings on SLT's human resource management and development as a result of the survey. The findings are basic problems to be improved on the human resource management and development during 1992-1994. In 1995, JICA study team surveyed and found some improvement which were made based on the recommendations by Korea Telecom and SOFRECOM. According to the SLT Manpower Plan Report issued in 1994, the number of SLT staff per 1000 DELs is 42. Past situation on staff per 1000DEL is shown in Table 9-1.

Table 9-1 The Number of SLT Staff per 1000 DELs

Item/Year	1991	1992	1993	1994
No. of DELs	125,834	135,504	157,774	180,724
No. of Staff	7,141	7,572	7,466	7,516
No. of Staff/1000 DEL	57	56	47	42

9.2 Urgent Human Resource Development

As a result of the study, the following items to be improved and strengthened are mainly recommended :

- Improvement of Telecommunications Training Facilities;
- Necessity to review human resource development policy;
- Improvement of staff allocation system;
- Call for foreign instructors and training in foreign countries;

9.3 Future Human Resource Development

Based on the urgent human resource development improvement and aiming at technical evolution and decrease of fault rate, improvement targets on human resource development are established as shown in Tables 9-2 and 9-3.

Table 9-2 The Target Number of Faults

Year	1994	2000	2005	2010	2015
No.of Faults/month/100 DELs	26	15	10	7.5	5
Ratio of No.of Faults/year (%)	100	203	215	206	188

Table 9-3 No. of SLT Staff per 1000 DELs

Year	1994	2000	2005	2010	2015
No.of DELs (x1000)	181	667	979	1,311	1,663
No.of staff	7,516	9,200	10,000	10,500	10,900
No.of Staff/1000 DEL	42	14	10	8	7

10. INSTITUTION, ORGANISATION AND MANAGEMENT PLAN

One of the recent subjects of the institutional reform in the world telecommunications sector has been the establishment of regulatory organisation and operational one independent from each other. The Telecommunications Act 1991 gave birth to SLTA responsible for the telecommunications regulatory activities in Sri Lanka, and SLT as monopolistic operator of the basic telecommunications services. This is quite reasonable and is in full conformity with this world-wide tendency in the telecommunications sector. The government of Sri Lanka set the following main objectives in the field of telecommunications :

- **To provide the telecommunications services throughout the country;**
- **To improve the quality of the telecommunications services;**
- **To satisfy the demand for the telecommunications services and to improve the efficiency of the telecommunications operations.**

The JICA study is made to SLT organisation based on this overall institutional framework of the telecommunications sector in Sri Lanka according to the following basic concepts :

- **Organisation structure has to be reviewed according to the new environment;**
- **Organisation structure has to follow up the company's strategic business policy;**
- **Strategic business policy of Sri Lanka Telecom is promptly expressed in the Corporate Plan of SLT.**

10.1 Present Status on Organisation and Management

Present status on organisation and management in telecommunication sector in Sri Lanka is referred to in Figures 10-1 and 10-2.

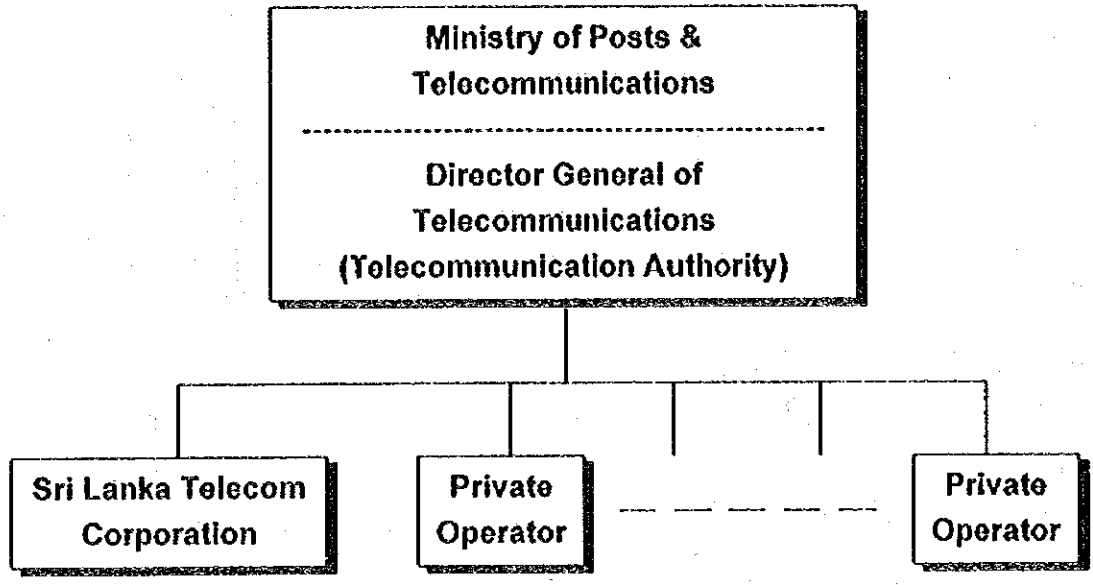


Figure 10-1 Present Organisation of Telecommunications Sector in Sri Lanka

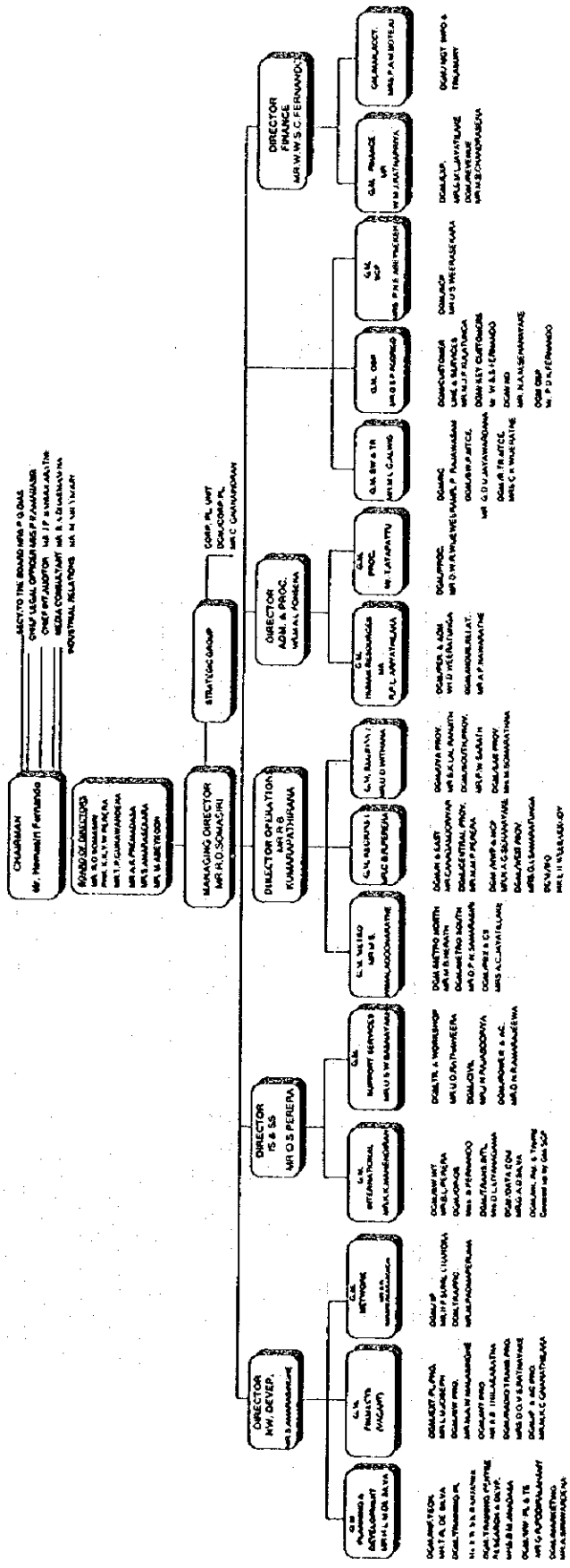


Figure 10-2 Organisation Chart of Sri Lanka Telecom

10.2 Urgent Organisation and Management Improvement for SLT

Forthcoming two decades will be the era of huge telecommunications expansions and the severe competitions era among telecommunications service providers. Therefore, requests for strengthening of SLT organisations are the important issues as mentioned below :

- **Strengthening of Customer Services Division;**
- **Preparation of Job Transaction Procedures:**
- **Completion of Job Description;**
- **Expansion of MIS throughout the SLT Organisation.**

10.3 Future Organisation and Management Improvement for SLT

Based on the urgent organisation and management improvement, improvement targets on organisation and management for SLT are mentioned below.

- **Strengthening of organisation of the headquarters of SLT, especially for finance, accounting, corporate planning and marketing / public relations;**
- **Decentralisation of organisation to cope with future huge network expansion;**
- **Establishment of regional organisations for appropriate managerial areas for future network;**
- **Establishment of job assignment in each organisational level to manage the future network and service operation.**

10.4 Institutional Issues

SLT has been playing the dominant role and will continue to keep the key position in the telecommunications sector of Sri Lanka. Accordingly, the central subject of Institutional Issues is how to reform, rationalise and activate the organisation of SLT. JICA Study Team recommends the following four options for the institutional reform of the telecommunications sector :

Option 1:
SLT will keep the status of public corporation and will provide the basic telecommunications services exclusively but will make continuous efforts to reform, rationalise and activate its organisations and operations.

Option 2:
SLT will continue to be a public corporation but private companies will be allowed to enter the field of the basic telecommunications services.

Option 3:
SLT will be privatised and will keep the position of the exclusive provider of the basic telecommunications services.

Option 4:
SLT will be privatised and the participation of private companies in the basic telecommunications services will be allowed.

The privatisation is one of effective ways to enlarge, activate and enhance the telecommunications services in Sri Lanka, however, it is necessary to note that privatisation is not almighty and has certain demerits and shortages too.

. It is thus important to study and describe the following necessary conditions to make the privatisation of SLT successful :

- Selection of the best partner;
- Enough consideration to the regions which are poor in the telecommunications infrastructure;
- Reform of organisation and management.

11. FINANCE AND INVESTMENT

To conduct a financial analysis of the entire telecommunications sector, it is essential to secure Profit and Loss Statements, Fund Flow Statements, and Balance Sheets with regard to SLT and other telecommunications operators. However, with the balance sheets of private telecommunications operators unavailable for this report, only SLT is financially analysed as described below. The following Table 11-1 summarises significant financial indicators.

Table 11-1 Significant Financial Indicators for the Master Plan Base Scenario

Items	1991	1992	1993	1994
STABILITY RATIO				
Debt/Equity(%)	55%	42%	41%	47%
Interest Coverage Ratio	5.13	7.07	7.36	8.64
Current Ratio	601.84%	754.68%	566.39%	525.25%
Profit Margin	50.11%	58.06%	38.07%	50.98%
Sustainable Growth Ratio	0.104	0.535	0.862	1.205
SOLVENCY RATIO	64.55%	70.38%	70.82%	67.90%
SELF FINANCING RATE	1072.28%	228.44%	101.15%	66.83%
L-T DEBT TO TTL CAPITALISATION	33.10%	27.71%	26.52%	28.06%
EQUITY TO TTL CAPITALISATION	60.27%	66.02%	64.73%	59.78%
RETURN ON NET FIXED ASSET	9.46%	34.73%	20.94%	13.38%
RETURN ON CAPITAL EMPLOYED	6.09%	19.73%	12.33%	9.35%
FIXED ASSET TURNOVER RATIO	0.18	0.56	0.50	0.37
ACCOUNT RECEIVABLE (DAYS)	304.54	284.37	250.92	289.60

Fixed asset turnover ratio, indicative of capital investment efficiency, stood at 0.56 in 1992; however, it has recently fallen to 0.37 due to a delay in realising revenues from capital investments made in 1994. The figure is expected to recover as these revenues are realised. **Return on employed capital,** representing the total investment effects, has been gradually decreasing to 9.35 percent with constant capital investment. The great decline from 1992 through 1993 is attributable to synergistic factors of changes in the tariff system and increase of capital investment. However, 9.35 percent is, in itself, an excellent figure. In addition, profit margin and solvency ratio are 50.98 percent and 67.90 percent respectively. **The interest coverage ratio** of 8.64 percent also indicates that it will be possible to introduce additional loans. In other words, Study team can conclude that the SLT financial management is sufficiently stable. The growth potential also represents a progressively increase (1.205 times in 1994). A comprehensive look at these figures reveals that SLT continues to maintain a sound financial condition, ready to be commercialisation.

Enhanced sustainable growth is also exemplified by a retained profit of 8.9 billion rupees from initial funds of 7.4 billion rupees. This is evaluated as indicating sufficiently equipped grounds for sound operations.

Table 11-2 Summary of Telecom Sector Investments

Unit : US$ million

Investor	1992	1993	1994
SLT	38	69	143
Other operator	5	20	23
Telecom. Inv/GDP	0.51%	0.97%	1.59%
GDP *)	8,413	9,135	10,470

Note: *) GDP is mentioned for comparison.

Telecom sector investment for last 3 years is summarised as Table 11-2. The GDP ratio has been increasing from year to year, which indicates SLT's active involvement in eliminating stagnation of demand fulfilment. Despite repeated requests by the Government of Sri Lanka (GOSL), SLT did not succeed in reducing stagnation of demand fulfilment due to a problem with raising funds, although it has done its utmost to respond to such requests. However, thanks to the realisation of such on-going projects as represented by the 150K Project and the OECF Project, it has been on the right track to eliminate stagnation of demand fulfilment since 1994.

12. RADIO FREQUENCY MANAGEMENT

12.1 Present Status of Frequency Management

Based on the Sri Lanka Telecommunications Act, No. 25 of 1991, the Sri Lanka Telecommunications Authority (SLTA) is taking the radio frequency management. The Act specifies about the powers and duties of SLTA as follows:

- **to ensure the conservation and proper utilisation of the radio frequency spectrum by operators and other organisations and individuals who need to use radio frequencies;**
- **to make and enforce compliance with rules to minimise electro-magnetic disturbance produced by electrical apparatus and all unauthorised radio frequency emissions.**

12.2 Frequency Management Improvement

(1) SLTA's Improvement Plan for Frequency Management

SLTA prepared an improvement plan for frequency management consisting of expansion of monitoring network by installation of new monitoring stations at Galle and Anurdhapura, and improvement of radio frequency management by an automated management system.

(2) Recommendations to Further Improvement

a) Issue of Radio Regulations in Sri Lanka
To utilise the radio frequency effectively, the radio regulations must be issued in near future. For this work, the special task force team is to be established under the technical assistance of ITU-R or other administrations.

b) Increase of Staff
In near future, the work volume of radio frequency management will increase in reflecting to the increase of radio stations. The present staff (only 13) will not sufficient for that increase. The number of staff must be increased.

c) Improvement of Radio Frequency Monitoring System

To speed up the radio frequency monitoring work in SLTA, the following facilities improvement is required :

- Addition of fixed monitoring stations;
- Addition of mobile monitoring stations;
- Introduction of directional finding receivers.

13. PROJECT IMPLEMENTATION PLAN

13.1 Project Formation

The project implementation plan consists of short-term plan by the year 2000, medium- term plan by the year 2005 and long -term plan by the year 2015. The projects specified are categorised as follows :

- **SSC area project packages covering total network in each SSC area consisting of switching system, transmission system and subscriber network;**
- **Single project packages which are independently formulated i.e. backbone transmission system, maritime communication system, training facilities, etc.**

The projects formulated from a view of SSC area package and single package are referred to in Table 13-1.

Table 13-1 List of Priority Projects to be Implemented by the Year 2000 (1/2)
(projects related mainly for the basic telecommunications services)

No.	Project Name	Cost (MUS$)	Priority
1-1	Reconstruction of telecommunications network in north region	114	A
1-2	SSC area network expansion project in Anuradhapura TSC area	11	A
1-3	SSC area network expansion project in Kandy TSC area	33	B
1-4	SSC area network expansion project in Galle TSC area	35	B
1-5	SSC area network expansion project in outskirts of Colombo	95	A
1-6	Local network expansion project in middle-east area of Colombo	61	A
1-7	Local network expansion project in north area of Colombo	41	B
1-8	Local network expansion project in south area of Colombo	132	B
1-9	Colombo Metro optical fibre ring transmission network project	23	A
1-10	Rural telecommunication network project (northern part)	50	C
1-11	Rural telecommunication network project (southern part)	50	C
1-12	Microwave backbone transmission network expansion project	6	B
1-13	Optical fibre backbone transmission network project (Central Ring)	20	A
1-14	Nigombo international telecommunication project (New ISC, TSC and earth station in Nigombo)	25	A
1-15	SEA-ME-WE 3 international submarine cable project	20	B

Table 13-1 List of Priority Projects to be Implemented by the Year 2000 (2/2)
(other projects)

No.	Project Name	Cost (MUS$)	Priority
2-1	GMDSS project (global maritime distress and safety system)	3	A
2-2	Radio frequency monitoring system project	15	A
2-3	Improvement of telecommunications training centre in Colombo	N.A.	A
2-4	Improvement of outside plant maintenance centre	N.A.	A
2-5	ISDN / IN service development project	N.A.	B
2-6	Cellular mobile telephone network expansion project	N.A.	B

Note: ISDN: Integrated Services Digital Network
IN: Intelligent Network

The priority for project implementation was proposed on the following classification considering the importance from viewpoints of national development and telecom sector activities :

Class A: **High priority considering political and economic situation;**
Class B: **Medium priority for supporting social and economic activities;**
Class C: **Low priority to expand services for rural communities.**

13.2 Selection of Priority Projects for Feasibility Study

Priority projects to be implemented by the year 2000 mentioned in Tables 13-1 aim to meet rapidly growing demand and to realise no waiter status after the year 2001. In order to conduct a feasibility study for priority projects, the following three projects were selected from the priority projects to be implemented by the year 2000 which are mentioned the above Table 13-1, from a view of national development policy, telecommunications policy and socio-economic priority :

- **Local network expansion project in Colombo Metro Area;**
- **Central ring fibre optic backbone transmission network project;**
- **New ISC, TSC and earth station project.**

Note: ISC: International Switching Centre
TSC: Tertiary Switching Centre

14. EVALUATION OF MASTER PLAN

14.1 Master Plan

An overall evaluation of new investment plan (Base case) presents a favourable picture as indicated below.

- Financial Internal Rate of Return on Equity : 13.31%
- Economic Internal Rate of Return : 19.33%
- Payout period : 8 years
- Sales Revenue : US$ 3,006,123,000
- Cash flow during operation : US$ 855,000,000

The payout period for the total required investment of US$ 2,240 million is eight years. All of the additional funds needed for facility expansion can be paid out. A cash flow of US$ 4,420 million is yielded throughout the evaluation period, **with FIRROE (Financial Internal Rate of Return on Equity) at 13.31%.** ***These FIRR values indicate a profitable ratio, showing a sound financial status for a public investment.*** It represents a sufficient margin of profit given that the investment plan includes low return projects, which has proposed targets mainly General subscribers. This aspect of the Master Plan represents part of its effects on social infrastructure, and will provide wide spread service for the general public.

14.2 Financial Soundness as Total Business Entity

When a Master Plan to achieve increased number of DELs(1,600,000) or telephone density (7.8/100 inhabitants) is realised, it will lead to rapid growth by Sri Lanka Telecom. Sector, enabling a firm management foundation to be constructed. Table 14-1 shows a summary of the cash inflow for Master Plan (base scenario).

The M/P's projected profitability would be inferior to that of the existing network. To implement the M/P, the existing operational entities have to provide cross subsidies, particularly during its first four years. Without these, targeted demand can never be fulfilled completely.

Table 14-1 Significant Financial Indicators for the M/P Base Scenario

Items	1997	1998	1999	2000	2005	2015
STABILITY RATIO						
Interest Coverage Ratio(times) ((Profit before interest payable and tax)/Interest payable	4.56	4.10	4.02	4.34	7.56	22.12
LIQUIDITY RATIO Current Ratio(%) (Current Assets / Current Liabilities)	140.8	147.3	159.3	190.0	409.9	1904.9
PROFITABILITY RATIO Profit margin(%) (Profit before tax / Sales)	18.4	16.1	10.5	9.7	29.5	50.8
GROWTH RATIO Sustainable Growth Ratio (Retained profit / Shareholder equity)	2.09	2.03	2.18	2.33	4.62	17.27
SOLVENCY RATIO(%) Equity / Total Assets	46.0	43.5	42.7	45.3	63.0	89.7
SELF FINANCING RATE(%) Annual Depreciation plus Surplus / Years Investments	54.9	52.1	107.1	1512.3	--------	--------
FIXED ASSETS TURN OVER RATIO	0.20	0.20	0.21	0.23	0.30	0.40
Account receivable (days)	145.2	129.4	123.5	119.1	104.5	87.2
Net profit / Total asset(%)	3.5	3.1	2.1	2.1	6.9	8.6

This M/P is for an action programme positioned as the final stage of the basic minimum access structure, and functions as a low-return project thus far carried forward. Although continued investment is required at this stage, SLT-owned equity alone cannot accommodate it; outside funds must be introduced. ***In implementing an investment programme which require any cross subsidies, it is important to prevent the profit ratio from suffering and to focus on fulfilling demand. GOSL then has to be back up financially and to prepare a GOSL guarantee for foreign loans, as represented by GOSL additional investment.***

15. IMPACTS BY PARTICIPATION OF PRIVATE WLL OPERATORS

Item No. 6 to 14 in this summary describe demand forecasts and telecommunications development plan based on the expressed demand (the existing telephone subscribers + waiters). On the other hand, this item 15 covers impacts to be expected on condition that the suppressed demand which is estimated as 20% of the expressed demand will be expressed by participation of private WLL (Wireless Local Loop) operators. Details are described below.

15.1 Overview of Impacts to be Expected

A telecommunications policy in Sri Lanka has been established by the department of national planning keeping with the economic policy statement of Government of Sri Lanka which was announced on September 1994. The economic policy states that public investment would be needed to build the infrastructure which is required as a necessary complement to rapid private sector growth and socio-economic activities.

In the telecommunications policy, it is most important policy to eliminate waiting lists for telecommunications facilities. To cope with this situation, telephone service which is major service of basic telecommunication services is going to be opened to private WLL operators. By participation of private WLL operators, the following various influences will be expected :

- **Quicker network expansion by both SLT and private operators will bring higher telephone DEL supply speed.**
- **The higher supply speed will bring more expressed demand by activating suppressed demand.**
- **By sound competition among SLT and private operators including mobile telephone operators, various qualities of service will be much improved.**
- **Corporate efficiency of SLT will be much improved by the competition.**
- **A burden for the Government in the telecommunications sector will be reduced.**

15.2 Impacts on Socio-Economy

The current challenge for Sri Lanka's telecommunication sector is how to meet the demand for over new 200,000 lines. The Government of Sri Lanka(GOSL) had been counting on Sri Lanka Telecom(SLT) to supply them, but SLT is a parastatal entity, and the

project remains incomplete several years after being commissioned. Meanwhile demand has continued to grow, creating an even more unwieldy situation.

SLT has been doing as best it can under these circumstances, but pending demand topped about 340,000 lines in 1995. Seeking a drastic resolution to the problem, GOSL decided to allow private Wireless Local Loop(WLL) operators to enter the business as a step toward restructuring the country's communications sector. These private operators can enter only the local telecommunication services market. Two private WLL companies have chosen to do so, and now must install a total of 200,000 lines(100,000 each) by the year 2000.

Current SLT WLL prices result from the restricted nature of the market instead of yielding benefits through economies of scale, the current market structure actually reduces the benefits available to SLT, thereby pushing up the subscription fee per line. The proposed project, which is targeted at 200,000 prospective subscribers, nearly as many as are currently registered, is expected to lower costs by taking advantage of economies of scale as well as improving existing service problems, which are caused by shortages of antennas and other equipment.

Once WLL operations get underway, users will be surprised at the ease of installation of WLL telephones. All they will have to do is pick up a WLL telephone unit at a store, receive a phone number, take the unit home, and plug it into an outlet by following the instructions in a simple manual. These will be no need to deal with the long waiting list maintained by SLT. This factor, among others, shows that this project will serve effectively meet current demand for additional lines.

15.3 Impacts on Telecommunications Network Plan

Sri Lanka plans to introduce two private fixed line networks in 1997 overlaying to the existing one provided by SLT. The new networks will be of wireless local loop (WLL) technology for providing fixed telephone lines. As a result, Sri Lanka will have three fixed line networks and four mobile networks for telecommunications service. The WLL network introduction will bring about impacts also to the numbering scheme, signalling plan, network synchronisation, engineering standards, and facilities plan.

The new numbering plan is expected to deal with the change to ISDN era as well as the change to be required for introduction of WLL networks in 1997. The existing numbering plan gives the private networks the trunk codes as if they were trunk call areas. SLTA is reforming this numbering plan systematically as various kind of services are expected in a

competitive circumstance. It will include a) Reduction of trunk call areas in number; b) Adoption of a closed number scheme; c) Introduction of new DNC (Destination Network Code); etc.

All the networks in Sri Lanka, including WLL networks, should be synchronised with a certain slip rate to guarantee a permissible quality of service. It is very much desirable that all the networks in the country is synchronised under one standard clock, i.e., the clock of SLT.

Sri Lanka will have two kinds of fixed line subscriber networks. While the SLT's existing network is consisted of such five (5) exchange ranks in hierarchy as ISC, NSC, TSC, SSC, and LE (Local Exchange), the WLL networks may be consisted of fewer stages of exchange. The new WLL networks may be made up of two or three stages of exchange rank making use of the advantage of recent digital switching system technology and radio system for subscriber network.

Private WLL network introduction will bring about a substantial change in the traffic flow of the SLT network, that is, about 25 to 30% of the traffic of SLT subscribers will be destined to WLL subscribers. The traffic will be routed to TSC which will the interconnection point between SLT network and WLL networks. As a result, the TSC capacity must be increased remarkably while local tandem switch capacity declines.

15.4 Impacts on Financial and Investment Plan

As stipulated in its original Master Plan, SLT is solely responsible for meeting the demand for new telephone installations. Accordingly, the capital investment during the initial three years represents a heavy burden, one affecting SLT's cash flow over ten years.

In 1995, GOSL declined to allow private capital into the market for basic telecommunication services, extending permission to two private WLL operators to offer such services provided that they install 200,000 telephone lines by the year 2000 described in Table 15-1.

Accordingly, the number of direct exchange lines (DELs) operated by SLT will record a 30% decrease from 1997 to 2000 due to the presence of these WLL operators. The total required funds will concurrently decline 40%. Since the original investment plan (Master Plan) calls for massive investment during the initial three years, long-term loans of US$643 million and GOSL additional investment of US$287 million were required. In the

revised invest plan, however the presence of the WLL operators eliminates the need for any investments other than amounts of US$230 million in long-term loan and US$41 million in private capital during initial three years. The concept figures are described in Table 15-2 and Figure 15-1.

Table 15-1 The Expected DEL Supply by SLT and Private WLL Operators

Year	Private WLL's DEL	SLT's DEL	Total DELs	Total Demand	Fill Ratio
1997	60,000	337,000	397,000	655,043	60%
1998	100,000	387,000	487,000	703,337	69%
1999	160,000	417,000	577,000	755,520	76%
2000	200,000	467,000	667,000	813,752	80%
2005	300,000	811,617	1,111,617	1,174,243	95%
2015	500,000	1,495,808	1,995,808	1,995,808	100%

Table 15-2 Impact of Financial Performance

Unit : US$ 1000

	No. of subs. for M/P		Investment		Profit/Loss		Accum.Cash Flow	
Year	Original	Revised	Original	Revised	Original	Revised	Original	Revised
1997	0	0	207,427	112,781	-11,481	-3,609	-120,380	-26,165
1998	95,292	53,333	276,091	89,836	-31,650	-7,848	-295,552	-45,566
1999	190,823	86,666	159,785	87,345	-26,199	1,115	-402,932	-55,108
2000	285,624	139,999	33,162	33,439	-6,993	5,256	-423,605	-52,906
2001	351,835	206,764	41,316	49,895	18,682	16,327	-422,692	-48,146
2002	409,505	276,409	124,857	153,757	35,506	27,367	-448,664	-55,275
2003	472,660	348,025	161,083	153,424	41,985	33,923	-471,700	-51,213
2004	539,613	416,557	85,934	90,808	50,046	41,828	-463,850	-26,925
2005	604,019	484,616	51,687	53,381	68,608	53,651	-443,604	-22,676
2010	943,629	827,602	61,432	62,862	177,654	120,192	-127,429	-11,851
2015	1,303,757	1,168,807	0	0	271,803	185,280	855,681	497,517
TOTAL	1,303,757	1,168,807	2,294,117	1,850,242	----	----	----	----

Source : Study team

With this lower investment during the initial three years, additional needed funds could be procured, with the feasibility of the Master plan further improved. Funding shortages had been seen as an obstacle to SLT's meeting the telephone demand. Now that these shortages are to be resolved by the private operators' installation of 200,000 lines by

the year 2000, however, the presence of the WLL operators will have a positive impact on Sri Lanka's telecom sector.

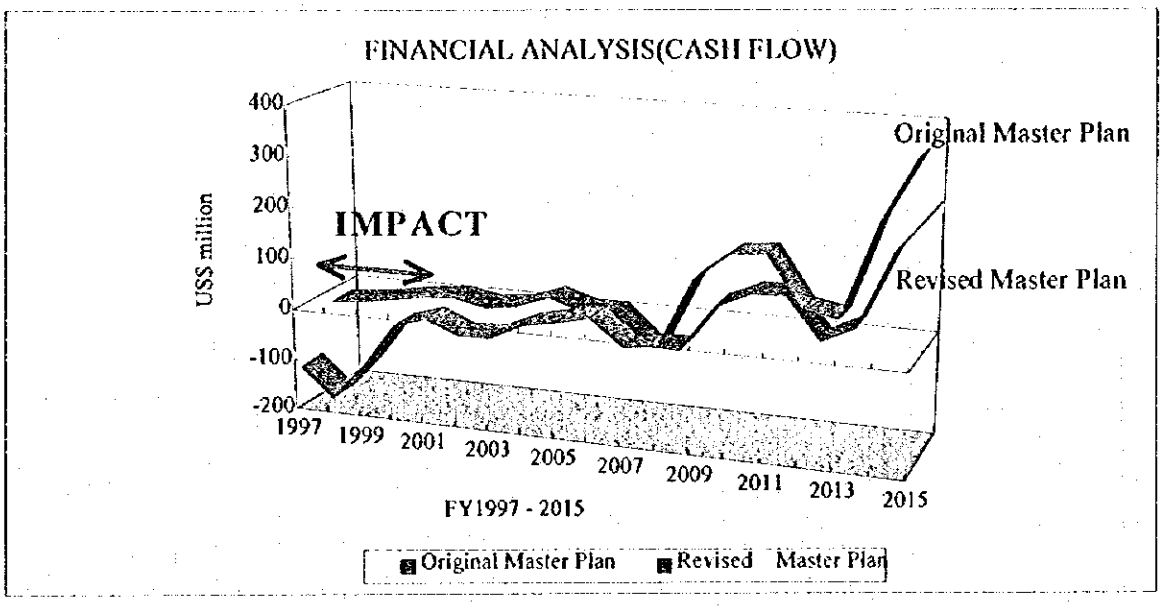


Figure 15-1 Financial Analysis on Private WLL Operator Participation (Cash Flow Statement)

16. FEASIBILITY STUDY FOR PRIORITY PROJECTS

16.1 Scope of the Projects

16.1.1 Selection of the Priority Projects

In the Phase-I Study for preparing a Master Plan, a project implementation plan up to the year 2015 was prepared. The project implementation plan consists of short-term, medium-term and long-term plans. The priority projects for the feasibility study were selected from the short-term plan as a urgent programme consisting of twenty one (21) projects which aims to meet rapidly growing telephone demand and to catch up 100% fulfilment to the waiting demand by the year 2001.

16.1.2 Priority Projects for the Feasibility Study

Through the discussion between SLT and JICA Study Team, three priority projects were agreed to conduct feasibility study as shown in Figure 16-1. The target areas of priority projects are shown in Figure 16-2.

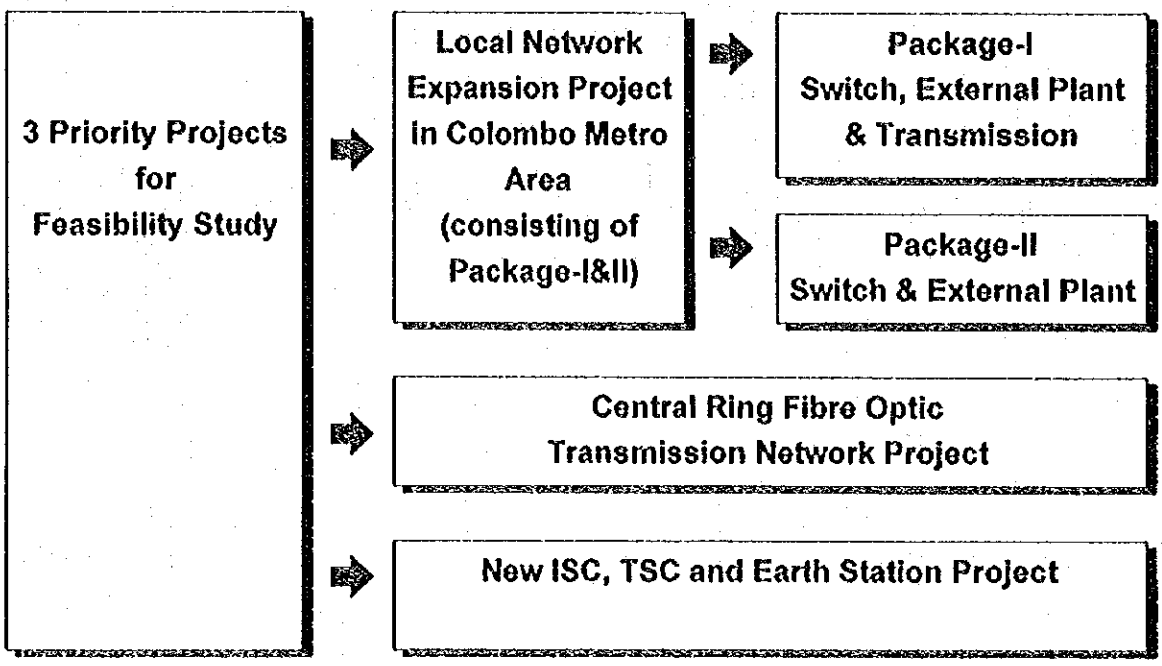


Figure 16-1 Three Priority Projects for Feasibility Study

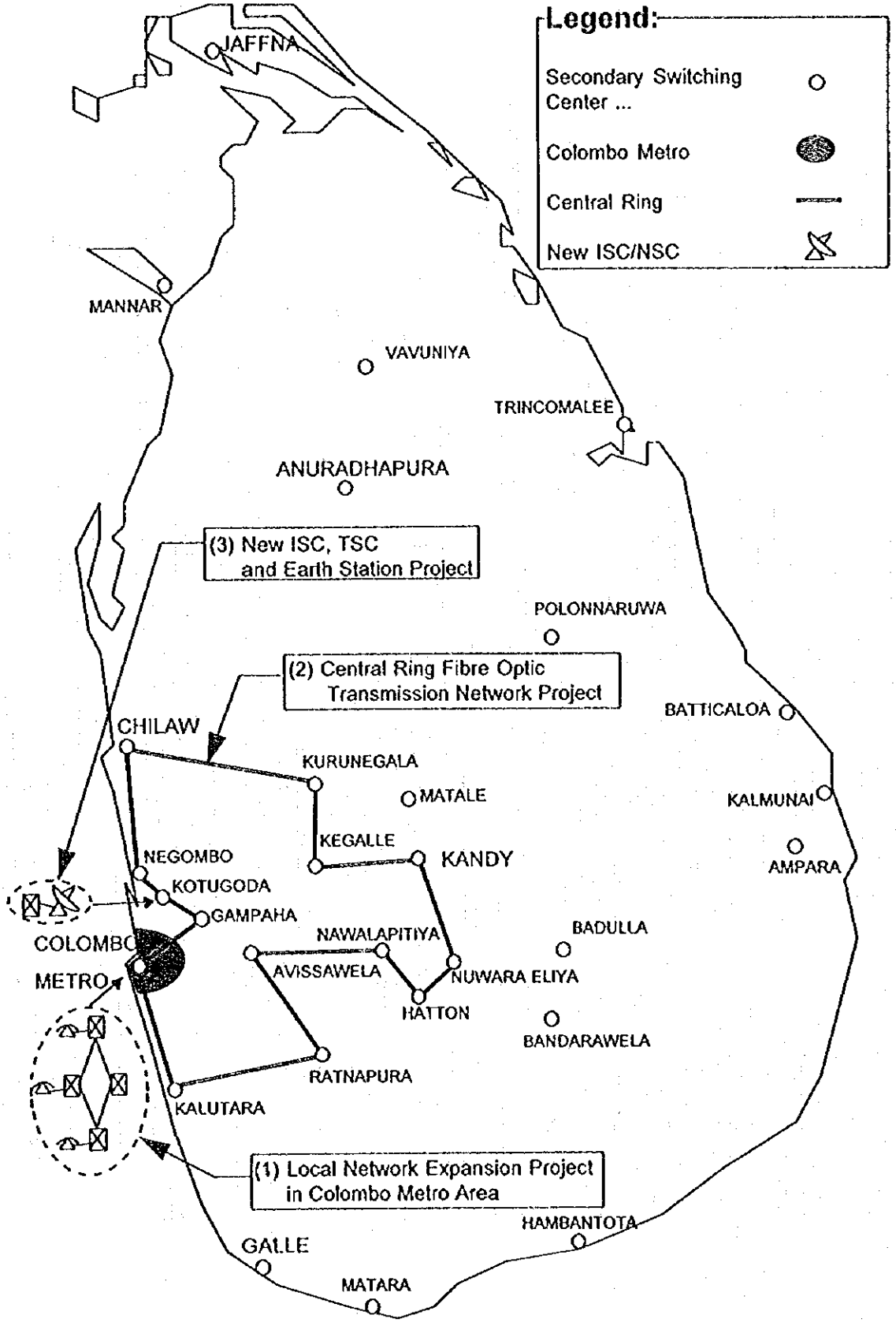


Figure 16-2 Target Areas of Priority Projects

❑ Local Network Expansion Project in Colombo Metro Area

Local network expansion project in Colombo metro area is implemented on a network basis consisting of switching system, external plant and transmission system. The team recommends that Colombo Metro Area Project is to be implemented as a network expansion project at the same time. However, the project might be split into several packages, i.e. Package-I and II as shown below from a view of technical aspects due to uncertainty of future fund raising.

Package-I

Package-I consists of three sub-packages i.e. switching system, external plant and transmission system. The entire transmission system sub-package is included into the Package-I without being split from a view of effective investment, transmission capacity balance and ease of facility management. The scope of project is summarised as follows:

- Switching system: 97,270 line units for 12 exchanges
- External plant: 75,600 primary pairs for 9 exchange areas
- Transmission system: 220 km by SDH system

Package-II

Package-II consists of two sub-packages i.e. switching system and external plant. The scope of project is summarised as follows:

- Switching system: 47,130 line units for 10 exchanges
- External plant: 62,200 primary pairs for 8 exchange areas

❑ Central Ring Fibre Optic Backbone Transmission Network Project

The project covers SDH fibre optic backbone transmission system connecting 13 SSC in the Central Region and new ISC, TSC and Earth Station Site. The total transmission route length will be approximately 650 km.

❑ New ISC, TSC and Earth Station Project

One unit of switching system for ISC, one unit of switching system for NSC (National Switching Centre) and one unit of switching system for TSC including such peripheral equipment as operator positions, power equipment, etc. And one unit of earth station for satellite communication.

16.1.3 Precondition of Feasibility Study

Up to the present, private participation in value-added telecommunications services has been promoted in Sri Lanka. In addition, POTS (Plain Ordinary Telephone Service) which is major service of basic telecommunication services is also going to be opened to private WLL operators under the telecommunications policy in Sri Lanka. In this circumstances, there will be difficulty to make detail planning and design in the feasibility study without any precondition. Because network configuration and supply volume, etc. will be unforeseeable depending on business strategies of respective private operators. Accordingly, this feasibility study is carried out in consideration of the following :

- ❑ **Impacts by Participation of Private Wireless Local Loop (WLL) Operators**
- ❑ **Modified Telephone DEL Supply Plan for Feasibility Study**
- ❑ **Future Progress of Telephone Network Expansion by SLT**

16.2 Cost Estimate

The summary of investment costs for the three Priority projects is shown in the following Tables.

16.2.1 Local Network Expansion Project in Colombo Metro Area

The scope of the project is a comprehensive project consisting of subsystems of digital switching, transmission and external plant for Colombo Metro area.

Table 16-1 Total Investment Cost for External Plants

Unit : US$1000

Items	Dsprociation	Total	Foreign	Local
External Plant	25.0 yrs	42,780	38,731	4,049
Other Equipment	12.5 yrs	11,651	640	11,011
Vehicle	5.0 yrs	280	280	0
Installation	-	29,971	17,827	12,144
Training	-	180	180	0
Tax	10%,35%	27,436	0	27,436
Engineering Service	-	4,036	4,036	0
Contingencies	10% of TTL	5,766	5,766	0
Total	-	122,100	67,460	54,640

Table 16-2 Total Investment Cost for Switching System

Unit : US$1000

Items	Depreciation	Total	Foreign	Local
Digital Exchange	12.5 yrs	29,164	29,164	0
Other Equipment	12.5 yrs	3,494	3,494	0
Building	50.0 yrs	1,800	0	1,800
Installation	-	1,747	1,747	0
Training	-	240	240	0
Tax	10%,35%	10,810	0	10,810
Engineering Service	-	2,551	2,551	0
Contingencies	10% of TTL	3,644	3,644	0
Total	-	53,450	40,840	12,610

Table 16-3 Total Investment Cost for Transmission System

Unit : US$1000

Items	Depreciation	Total	Foreign	Local
Transmission	12.5 yrs	9,065	9,065	0
External Plant	12.5 yrs	4,298	3,796	502
Vehicle	5.0 yrs	40	40	0
Installation	-	1,857	1,721	136
Training	-	300	300	0
Tax	10%,35%	5,386	0	5,386
Engineering Service	-	1,089	1,089	0
Contingencies	10% of TTL	1,556	1,556	0
Total	-	23,591	17,567	6,024

Grand Total	-	199,141	125,867	73,274

16.2.2 Central Ring Fibre Optic Backbone Transmission Network Project

The scope of project is a comprehensive project consisting of the new fibre optic backbone transmission system in the Central Region.

Table 16-4 Total Required Capital Cost

Unit : US$1000

Items	Depreciation	Total	Foreign	Local
Transmission	12.5 yrs	6,726	6,726	0
Fibre Optic cable	25.0 yrs	11,345	10,214	1,131
Vehicles	5.0 yrs	60	60	60
Installation	-	3,151	1,266	1,885
Training	-	220	220	0
Tax	10%,35%	8,759	0	8,759
Engineering Service	7% of TTL	1,505	1,505	0
Contingencies	10% of TTL	2,150	2,150	0
Total	-	33,916	22,141	11,775

16.2.3 New ISC,TSC and Earth Station Project

Estimate of the gross required capital funding for the New ISC/TSC and Earth Station Project is shown below.

The total required capital cost can be summarised in Table 16-5 and 16-6.

(1) Digital Exchange

Table 16-5 Total Investment Cost

Unit : US$1000

Items	Depreciation	Total	Foreign	Local
Digital Exchange	12.5 yrs	6,625	6,625	0
Other Equipment	12.5 yrs	794	794	0
Building	50.0 yrs	2,000	0	2,000
Installation	-	397	397	0
Training	-	360	360	0
Tax	10%,35%	2,774	0	2,774
Engineering Service	-	712	712	0
Contingencies	10% of TTL	1,018	1,018	0
Total	-	14,680	9,906	4,774

(2) Earth Station

Table 16-6 Total Investment Cost

Unit : US$1000

Items	Depreciation	Total	Foreign	Local
Antenna	12.5 yrs	530	530	0
Other Equipment	12.5 yrs	5,560	5,560	0
Building	50.0 yrs	1,820	400	1,420
Installation	-	780	640	140
Training	-	1,050	1,050	0
Tax	10%,35%	3,808	0	3,808
Engineering Service		682	682	0
Contingencies	10% of TTL	974	974	0
Total	-	15,204	9,836	5,368
Grand Total	-	**29,884**	**19,742**	**10,142**

16.3 Evaluation of the Projects

At the SLT's present stage of development, where the cross subsidy system is a necessary evil, SLT must adhere to the following strategic goals:

- To enrol as many subscribers as possible in the Colombo Metropolitan area;
- To recruit International subscribers;
- To satisfy the ever-increasing traffic volumes associated with success in the above two areas.

At present, SLT has three priority projects, as shown in following Table 16-7.

Table 16-7 Result of Financial Analysis
(1997 - 2015)

	Colombo Metro		Central Ring	Earth Station
	Case A	Case B		
FIRROI	18.37%	12.58%	16.41%	31.17%
FIRROE	10.12%	3.31%	8.49%	26.90%
EIRR	23.49%	17.50%	20.98%	38.36%
(Unit : US$1000)				
Capital Investment	199,141	122,100	33,916	29,884
Total Revenue	775,742	341,794	132,441	253,031
Accum. Cash Flow	163,310	30,412	25,311	92,709

Note :

Colombo Metro : Local network expansion project in Colombo Metro area

Case A : The project consisting of subsystems of **Digital Switching, transmission and External Plant** in Colombo Metro area.

Case B : The project consisting of **External Plant** in Colombo Metro area.

Central Ring : Central Ring Fibre Optic Backbone Transmission Project

Earth Station : New ISC,TSC and Earth Station Project

16.3.1 Local Network Expansion Project in Colombo Metro Area

According to the results of financial analyses, the Local network expansion project in Colombo Metro area (Case B) itself offers very low profitability. The project, however, is an important touchstone in SLT's future management strategy. With the participation in 1997 of private WLL operators, the telecom sector in Sri Lanka will see fierce competition for market share in the Colombo Metropolitan Area, where demand for telephones is enormous. Insofar as the private WLL operators offer superior speed of installation of telephone terminals, SLT has to establish a local network in advance and satisfy subscriber's needs, to effectively cope with the private WLL operators. ***SLT has accordingly drawn up its external plant project as a countermeasure.***

To implement the project, priority must be laid on securing financing through low-interest soft loans, thereby allowing SLT to acquire a larger market share in the Colombo Metropolitan area, its core operation base. Otherwise, the SLT's financial performance could be hard hit, given that 70% of the international calls on which it relies originate in this area.

As shown in the results above, the profitability of External Plant project of the Local Network Expansion project package (Case B) is rather low: an IRROI (Internal Rate of Return on Investment) of **12.58%**, and IRROE (Internal Rate of Return on Equity) of **3.31%**. ***Bridge financing of US$1.6 million would thus be required for the initial 2-year operation period.*** In other words, with its low profitability, the Project cannot stand on its own without being supported by cross subsidies from the corporate SLT.

At present IRROI, which is an index of project returns from the total investment, is 12.58%. This value is calculated only for the Local Network Expansion project. What would the value be when this project is consolidated into a smallest network project ? To find out, Study team should perform an evaluation on the smallest network project (Case A), including switch and transmission facilities. ***It is clear from the evaluation results that the smallest network would be profitable enough if it generates project returns of IRROI of 18.37% and IRROE of 10.12%.***

16.3.2 Consideration for the Project Scale of Local Network Expansion Project in Colombo Metro Area

Study team have proposed in this report that the Local Network Expansion Project in Colombo Metro area should be implemented as a network project in which Switch, Transmission, and Cable facilities are simultaneously consolidated. This is because the network project ensures tariff revenues upon completion. Under the assumption that the Local Network Expansion project in Colombo Metro area could possibly be implemented in multiple stages, Packages I and II have been prepared so that the Project could function at least as a Network. These two proposals are evaluated here.

Study team report here the results of a financial evaluation on Package I and II, using the same conditions used for the overall evaluation.

❑ Project Name	:	**Package-I**	**Package-II**
❑ FIRROI	:	20.79%	13.79%
❑ FIRROE	:	12.87%	4.95%
❑ Capital Investment	:	US$ 126,550,000	US$ 72,590,000
❑ Total Revenue	:	US$ 553,597,000	US$ 222,145,000
❑ Accum. Cash Flow	:	US$ 134,705,000	US$ 27,668,000

As is clear from the results, Package I remedies the lower profitability of Package II. This is because the Transmission project is included in Package I. In other words, Package I is different from Package II in terms of the characteristics and scale of the project concerned.

Since the priority is on construction of a well-balanced Telecom Network, Package I is drawn up to include the Cable Project, which serves a core, high-demand urban centre. Accordingly, a tightly organised Transmission Network must be fully implemented as part of the first-stage communications infrastructure, if the telecommunications traffic derived from an ever-increasing subscriber base is to be handled smoothly. If the Network is implemented in a flawed manner, communications will be inadequate and profitability non-existent. For the Cable Project to achieve profitability, the Transmission facilities and Switching facilities must be combined into a single package. With the resulting increase in Services, such as call completion rate, etc., SLT's overall corporate revenues will rise as well.

In terms of the cash flow of Package I, financing should remain positive throughout the project. Consequently, no funding problems are expected. Although initial investment (equity portion) of US$58,056,000 is required, the recovery period is set to be 7.52 years. In addition, the available cash flow will be US$134,705,000 throughout the operation period, yielding an 20.79% FIRROI against the total investment, and a 12.87% FIRROE against internal funds. Either ratio is indicative of a sound financial position.

On the other hand, Package II offers poorer profitability: IRROI is 13.79% and IRROE, 4.95%. Bridge financing of US$2.34 million will be required during the initial 3 year period. In other words, with its low profitability, Package II requires cross subsidies from SLT, indicating that the Project cannot be pursued on a stand-alone basis. Since Package II is a project involving the Colombo Metropolis, one of the few profitable zones in the country, a plan should be drawn up outlining a single, self-supporting project requiring no cross subsidies from SLT.

Considering from overall evaluation results, independent operation of Package II would require the following measures:

(1) Introduction of foreign grants
(2) Introduction of government subsidies
(3) Combined execution of Packages I and II.

Given that the privatisation of SLT has been seriously reviewed, (1) and (2) above can hardly be considered feasible, with (3) becoming an option of last resort. This leads to a conclusion that, except for unavoidable cases, Packages I and II should be carried out simultaneously as much as possible, rather than separately.

16.3.3 Central Ring Fibre Optic Project

The Central Ring Fibre Optic Project also offers a fine FIRR, at 15% or more. The Master Plan foresees a rapid increase in the number of subscribers over the four-year period until the year 2000. If this forecast proves true, transmission networks must be strengthened to handle the resulting increase in telephone traffic. Any failure in this regard would permanently impair the project's profitability.

There will be a fund surplus throughout the life of the project. There is thus no need for a bridging finance, which is necessary during periods where there is a fund shortage. ***No cash flow problems will arise.*** The payout period for the capital of ***US$18,369,160*** required in the initial investment (Equity portion) is ***9.92 years***. A cash flow of ***US$25,311,000*** is yielded throughout the operating period, with ***FIRROI at 16.41% and FIRROE at 8.49%***. These IRR values suggest that the project will stand financially feasible coupled with the high returns assumed that the project can be operated without financial difficulty. This FIRROE is attained because the equity accounts for 47.1% of total Investment Costs and anticipated sales revenues are sufficient to maintain the stable operation.

16.3.4 New ISC,TSC and Earth Station Project

The Earth Station Project offers the highest Financial Internal Rate of Return (FIRR). Unless this project produces profits, SLT will be hard hit and could receive only soft loans. As a sensitivity analysis clearly shows, a shift from 8% to 13% interest rates creates more than a 5.59% drop in FIRROE. SLT must solidify itself by contracting for low-interest soft loans to help finance this project.

There is thus no need for a bridging finance, which is necessary during periods where there is a fund shortage. ***No cash flow problems will arise.*** The payout period for the capital of ***US$16,880,000*** required in the initial investment (Equity portion) is ***3.58 years.*** A cash flow of ***US$92,709,000*** is yielded throughout the operating period, with ***FIRROI at 31.17% and FIRROE at 26.90%***. These IRR values suggest that the project will stand financially feasible coupled with the high returns assumed that the project can be operated without financial difficulty.

These above mentioned findings indicate that the project has sufficient investment potential and that the conditions on the loans recently applied for are appropriate for the type of the project, strongly benefiting its investment potential.

17. CONCLUSION AND RECOMMENDATIONS

17.1 Service Provision

(1) Demand Fulfilment

As of the end of 1994, approximately 181,000 DEL (Direct Exchange Line) are provided as a result of development up to the present. However, approximately 186,000 people are registered and waiting for telephone lines. According to the telecommunications policy 1994, the Government of Sri Lanka intends to achieve 100% fulfilment to the telephone demand by 1998. However, it is not seemed that on-going project will catch up increasing expressed demand due to delay of the on-going projects. Considering the situation, this master plan has been prepared that 100% fulfilment is to be attained by 2001. In order to catch up the expressed demand, it is recommended that the following is to be well managed :

- an adequate supply plan catching up the demand up to five years ahead;
- proper management on project implementation;
- efficient new subscriber connection.

(2) Programme Management

In order to achieve various development targets through smooth implementation of projects keeping the respective target completion time, total programme management on technical and financial aspects and co-ordination among projects is essentially recommended.

17.2 Telecommunications Service Quality

The service quality is still low level compared with those in developed countries. By taking appropriate actions with an introduction of adequate quality control system, the present service quality is to be improved as shown in the following Table 17-1.

Table 17-1 Improvement Targets of the Service Quality

Item	Target Year				Actions to be taken
	1994	2000	2005	2015	
Call Completion Rate	28%	45%	55%	70%	■ Increase DEL for high traffic subscribers ■ Promote pilot number and call waiting service ■ Campaign to reduce incorrect dialling ■ Expand trunk lines
Faults Rate	26	15	10	5	■ Replace unreliable overhead lines ■ Improve lightning protectors ■ Up-grade skill of maintenance staff
Clearance Rate within 24 hours	55%	85%	90%	95%	■ Modernise customer service management ■ Reinforce maintenance teams

17.3 Operational Management

(1) Organisation and Management

To cope with rapid institutional changes of the telecommunications sector, i.e. severer competition among operators and restructuring of the sector, strengthening, rationalising and modernising of the organisation and management of SLT are essential. Considering those circumstances, the following reform is recommended :

a) Strengthening of customer services division;
b) Introduction of MIS (Management Information System);
c) Strengthening of finance and accounting division;
d) Strengthening of corporate planning division;
e) Strengthening of marketing and public relations.

(2) Operational Efficiency

The number of staff per 1,000DEL as of the end of 1994 was 42. It means low efficiency compared with 16 of both Thai and Malaysia in 1991. This low efficiency will result large operation and maintenance cost. In order to improve the present low efficiency, it is recommended that the following measures are to be taken :

a) **Technology evolution consisting of :**
modernising network facilities, introducing computerised operation and maintenance system.

b) **Restructuring operation and management consisting of :**
staff allocation meeting technology evolution and competitive condition on restructuring of the telecommunications sector.

c) **Human resource development consisting of :**
improvement of telecommunication training facilities meeting various changes on technological, operational and managerial aspects,
and re-education of staff reallocated resulting strengthening and rationalising the organisation and management.

(3) Institutional Issues

JICA Study Team recommends four options 1 to 4 for the institutional reform of the telecommunications sector. The privatisation is a very useful method to enlarge, activate and enhance the telecommunications services in Sri Lanka, however, it is necessary to note that privatisation is not almighty and has certain demerits and shortages too. It is thus important to study and describe the following necessary conditions to make the privatisation of SLT successful :

- **Selection of the best partner;**
- **Enough consideration to the regions which are poor in the telecommunications infrastructure;**
- **Reform of organisation and management.**

17.4 Technical Aspects

In order to meet the telephone demand increasing rapidly in keeping with the aspirations of people and economic growth, and to satisfy the targets established following governmental policies, SLT is required to provide more capacity of telephone switching system, transmission network and external plant.

17.4.1 Capacity Expansion

SLT is required to have the capacity of telecommunications sufficient to provide telecommunications service within one year for every application after its registration. To satisfy that requirement, the exchanges should be given a switching capacity sufficient to cater the demand for five years after its completion. The external plant and the transmission system should also be expanded to correspond to the demand and traffic. To satisfy the demand in a due waiting time, SLT is required to have a capacity of exchange of 812,000 lines in 2000, 1,54,000 lines in 2005 and 1,837,000 in 2015. In Colombo SSC Area, a capacity of exchange of 460,000 lines should be provided by 2000 adding 144,000 lines to the existing capacity.

17.4.2 Telecommunications Facilities Project Management

A due management on the outside plant completion time and line connection work force is desired so that the exchange resources can be used effectively as much as possible. It is understood that the exchange resources could not be used at the most, in spite of a large number of waiters, because outside plant installation could not follow duly the rapid increase of exchange capacity. All the telecommunications facilities, that is, the switching system, outside plant and transmission system, should be provided in a good harmony so that they can used effectively.

It is very desirable to maintain the existing task force with General Manager of Projects, to make use of its know-how accumulated through projects for past years. The current capacity plan of telecommunications facilities should be reviewed and justified to provide it with an adequate quantity, after the WLL networks start their services substantially.

17.4.3 Network Facilities Decentralisation

The Sri Lankan telecommunications network will be developed very rapidly in coming years. In such circumstance, it is desirable to pay attention for the decentralisation of capital function in telecommunications network and enforcement in telecommunications facilities to guarantee a safer telecommunications network in the country. Study Team suggests SLT to introduce a new switching unit of ISC and three switching units of TSC to a new location near Colombo City. Kotugoda was discussed as a candidate location.

17.4.4 Reference Clock Distribution

Study Team recommends SLT to distribute its reference clock pluses to the other networks operated by private network providers. The synchronisation of all the digital exchanges will be a most important theme in very near future for SLT is replacing all the exchanges in SLT network and is expected to make interconnection with other networks in 1997. It is preferable all the digital exchanges in the country, including WLL network exchanges, are synchronised under only one reference clock for a higher grade of service.

17.4.5 Signalling System CCS No. 7

Study Team recommends SLT to use the specifications of CCS No. 7 recommended by ITU-T as its national standards. Such specifications are widely supported by leading manufacturers in the world. The time slot (TM) for the signalling link should also be TM No. 16. SLT will be advantageous for international tender with such specifications.

17.5 Financial Issues

(1) Requirements for ODA funds

SLT's current profitability structure clearly indicates the existence of cross subsidies between International Calls and Domestic Calls. In principle, cross-subsidy systems should be rectified. Given Sri Lanka's current socio-economic situation and structure of its telecommunications sector, however, immediate rectification is not possible. The income levels of general subscribers remain so low as to make it impossible to increase domestic tariffs, making it impossible to achieve a cost-based tariff system in the near term. At this stage of development in Sri Lanka's telecommunications sector, the essential task is to expand the existing network while ensuring a stable operational base for the relevant agencies.

Accordingly, the presence of cross subsidies must be accepted for the time being.

Under these circumstances, both the Sri Lankan government and supporting nations have been urged to effectively allocate private capital and governmental funds to meet the needs of the thriving Colombo Metropolitan Area as well as those of other, unprofitable areas. One potential move in this regard is the privatisation of SLT. To abide by the policy of the Sri Lanka government, supporting nations are required to take action based on the following standpoint:

To establish and maintain infrastructure, or the common assets closely associated with the nation's well-being and industrial base, in such a manner as to help developing nations achieve sound growth, regardless of whether such efforts are implemented by the private sector or are government-initiated.

To put it more precisely, the Sri Lanka government and ODA are expected to draw up a scenario that enables the Sri Lanka telecommunications sector to maintain tariff rates accessible to low-income people, even if the sector eventually shifts from a government-regulated to private-sector orientation, while also ensuring the continued success of any private going concerns.

(2) Sound Operation of Sri Lanka Telecommunication Sector

Assuming that prospective purchasers of WLL will have income demographics similar to current SLT subscribers, competition, between SLT and private WLL operators, will have to occur at around the current price level. Private WLL operators will be obliged to pay SLT a access charge, and under the current tariff system where cost structure is irrelevant, the level of this fee is expected to have a substantial influence on the financial performance of private WLL operators. ***SLT therefore should first analyse the circumstances carefully and then select an operator access charge allowing both SLT and the private parties to operate on a sound basis.***

The point of introducing competition is to minimise supply costs by inducing cost-cutting competition among operators, and thus to reduce tariffs for users down to the lowest possible level. However, the current national service tariff in Sri Lanka is low enough. This low tariff may well be the reason that demand for phone lines is expected to reach the 400,000 mark in 1996. To ensure sound, reliable operations by private WLL operators under these circumstances, a bulk discount on operator access charge rates should be offered and SLT's tariff system should be rebalanced. There should also be consideration given to a possible substantial increase in national call fees.

Eventually it will be necessary to introduce a gradual rebalancing of the tariff system with the goals of utilising the beneficiary payment principle more thoroughly and of improving the efficiency of resource allocation.

(3) Establishment of Fair Competitive Market Environment

Despite rapid changes in the sector itself, the final goal of acquiring 2,000,000 subscribers by the year 2015 remains unchanged. However, if this goal is to be achieved, there is no room for failure by either the private WLL operators or SLT. ***Indeed, unless both parties thrive, this goal will not be achieved.***

As noted below, it would be desirable if a fair competitive market environment could be established where both parties could freely compete.

- ❑ **To apply the BOI status to SLT after privatisation**
- ❑ **To establish proper inter-operator access charges**

Since private WLL operators are not allowed to participate in international services, they will not be in a position to earn profits. Once high inter-operator access charges are established, these WLL operators will face a very difficult situation without cross subsidies.

Since private WLL operators use wireless fixed telephones, they must compete mostly with SLT wired fixed telephone. As long as SLT maintains very low tariffs on domestic services, private WLL operators will in turn need to set tariffs even lower in order to be competitive. It is thus clear to everyone how important the establishment of appropriate access charges is to private WLL operators.

Given the above situation, GOSL must secure advice from consultants, take steps to ensure that telecommunication services are both reliable and available to all, and establish access charges at a level that will promote market competition.

(4) Cross Subsidies

Although the current cross subsidies violate the principle that a service's beneficiaries should bear the relevant costs, they can be permitted to continue because SLT contributes by expanding access to telephone services to general subscribers nation-wide, and because these subsidies serve to re-distribute income from the rich to the poor.

In principle, cross subsidies are permissible in that the tariffs on international services greatly exceed the cost of supplying such services, while those on domestic services are below the cost of supply. Despite the common argument that tariffs should be established on more of a cost basis, any increase is projected to affect mainly one category of subscribers:

general subscribers who spend less than US$200 annually, mostly on domestic calls. ***Since no dramatic change in general-subscriber income or tariff rates is expected under current socio-economic conditions, the government of Sri Lanka must realise that the telecom sector still remains at the development stage, and accept the presence of cross subsidies for the time being.***

It may be the case that these general subscribers, who account for more than 80% of the demand for telephone services, could enrol only at the current tariff level. There is a pressing need to examine the current living standards of general subscribers, restructure the tariff system, and maintain the price of telecommunication services at a level accessible to everyone. In addition, it is necessary to recognise that telephone services in Sri Lanka have traditionally been far satisfactory.

17.6 Impacts by Participation of Private WLL Operators

Once WLL (Wireless Local Loop) operations get underway, users will be surprised at the ease of installation of WLL phones. All they will have to do is pick up a WLL telephone unit at a store, receive a phone number, take the unit home, and plug it into an outlet by following the instructions in a simple manual. These will be no need to deal with the long waiting list maintained by SLT. This factor, among others, shows that this project will serve effectively meet current demand for additional lines.

Accordingly, the number of direct exchange lines (DELs) operated by SLT will record a 30% decrease from 1997 to 2000 due to the presence of these WLL operators. The total required funds will concurrently decline 40%. ***With this lower investment during the initial three years, additional needed funds could be procured, with the feasibility of the Master plan further improved. Funding shortages had been seen as an obstacle to SLT's meeting the telephone demand. Now that these shortages are to be resolved by the private operators' installation of 200,000 lines by the year 2000, however, the presence of the WLL operators will have a positive impact on Sri Lanka's telecom sector.***

17.7 Feasibility Study for Priority Projects

17.7.1 Technical Aspect

In order to meet the telephone demand increasing rapidly in keeping with the aspirations of people and economic growth, and to satisfy the targets established in harmony with governmental policies, SLT is required to provide more capacity of telephone switching system, transmission network and external plant.

According to the study of telecommunications development of Sri Lanka, conducted by Japan International Cooperation Agency (JICA), the demand on telephone lines will be about 1,174,000 lines in the whole country in the year 2005. In Colombo Metro Area, the demand in the year to be provided by SLT, provided that 26% of the national demand is catered by private networks other than SLT network, is forecast to be around 480,000 lines.

SLT is required to have the capacity of telecommunications facilities sufficient to provide telecommunications service within one year for every application after its registration. To satisfy that requirement, the exchanges should be given a switching capacity sufficient to cater the demand for five years after its completion. The external plant and the transmission system should also be expanded to correspond to the demand and traffic. It is very desirable for SLT to establish substantial projects to cope with such requirements.

Under such context, JICA Study Team analysed the present situation of existing telecommunications facilities to find appropriate projects for telecommunications facilities expansion to be implemented by the year 2000 referring to the demand in 2005. As a result 21 priority projects were listed. JICA Study Team picked up three out of them as most urgent projects to conduct feasibility study, that is,

a) Local network expansion project in Colombo Metro area;
b) Central ring fibre optic transmission network project; and
c) New ISC, TSC and earth station project.

Based on the feasibility study, JICA Study Team recommends to implement the aforementioned three projects by the year 2000. The Local network expansion project in Colombo Metro area is essential to settle unsatisfied telephone demand in the national capital, the Central ring fibre optic transmission network project is essential to provide communication links of due grade of service between the capital and major cities in the

country, and the New ISC, TSC and earth station project is essential to offer smooth traffic flow of international, trunk, and inter-network communication.

The first project should include the capacity expansion of approximately 144,000 subscriber lines of switching system, and corresponding transmission system, and external plant. The second project should include a fibre optic cable transmission system more than 600 Km affording the technology of STM-16 and STM-4 transmission system. The third project should include a unit of ISC and a unit of TSC besides an earth station.

(Note: STM: Synchronous Transfer Mode)

It should be noted that the facilities dimensioning be reviewed upon detail design as new telecommunications network operators are about take part in the year 1997. Attention should be paid to the trend of private network operators.

17.7.2 Financial Aspect

Study Team have currently proposed three projects: the New ISC, TSC and Earth Station Project, the Local Network Expansion Project in Colombo Metro Area, and the Central Ring Fibre Optic Backbone Transmission Network Project. Study team assume that the Earth Station Project alone would be profitable even if financed solely by the private sector. The two remaining projects may be profitable to some extent, but some form of public financing, such as ODA funds, seems advisable for these projects. Given the continued existence of cross subsidies, the profits to be derived from implementing a satellite earth-station project should be returned to the telecommunications sector as much as possible.

Please note, however, that the above evaluation is based on the presence of a cross-subsidy-based system. In this report study team have calculated FIRR as equivalent to 60% of the revenue from international telecommunications services, incorporating cross subsidies into the revenues for domestic telecommunications services. Without these cross subsidies, the FIRR for both the Local network expansion project in Colombo metro area and the Central Ring Fibre Optic Backbone Transmission Network Project becomes so low as to be essentially incalculable. Indeed, the two projects would hardly be feasible without the cross subsidies; tariff rates would necessarily be increased drastically. ***Study team hereby propose to introduce low-interest ODA funds for these two projects so as to allow eventual rectification of the existing cross-subsidy system.***

17.8 Review of the Master Plan

This master plan covering the period from 1998 to 2015 has been prepared mainly based on the past data, present conditions and future trends on socio-economy and telecommunications of Sri Lanka as of 1994 - 1995. It is hoped that this master plan will be useful and beneficial for Sri Lanka to the future. However, when remarkable changes on preconditions on preparation of this master plan were found in the future, it is recommended that this master plan is to be reviewed and revised based on the latest conditions.