

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

POSTS AND TELECOMMUNICATIONS CORPORATION LTD.
THE REPUBLIC OF ZAMBIA

THE STUDY
ON
LONG TERM PLAN FOR
DEVELOPMENT OF TELECOMMUNICATIONS NETWORK
IN
THE REPUBLIC OF ZAMBIA
FINAL MAIN REPORT

AUGUST 1993

NIPPON TELECOMMUNICATIONS CONSULTING CO., LTD.
TOKYO, JAPAN

THE REPUBLIC OF ZAMBIA

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FINAL MAIN REPORT

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Nominal basis in the first planning year is applied for this analysis. This means estimated prices and costs as of January 1, 1993, are used and they are assumed constant during the whole project period.
Exchange rate: US\$1 = Zambian Kwacha 360 (January 1, 1993)

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PREFACE

In response to a request from the Government of the Republic of Zambia, the Government of Japan decided to conduct a master plan study on Long Term Plan for Development of Telecommunications Network and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Zambia a study team headed by Mr. Fujio Aihara, Nippon Telecommunications Consulting Co., Ltd., twice between October 1992 to June 1993.

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

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

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

August 1993



Kensuke Yanagiya
President
Japan International Cooperation Agency

August 1993

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency

Dear Mr. Yanagiya:

Letter of Transmittal

It is our great pleasure to submit to you the Study Report on Long Term Plan for Development of Telecommunications Network in the Republic of Zambia.

This report has been prepared by Nippon Telecommunications Consulting Co., Ltd., based on a contract with JICA. The study team consisting of 9 members conducted the works from September 1992 to August 1993.

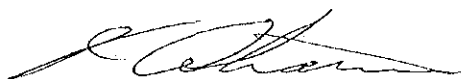
The study aims to formulate the Long Term Telecommunications Network Development Plan (1993 to 2012) in the Republic of Zambia.

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

We wish to take this opportunity to express our deep gratitude to the officials concerned of the Japan International Cooperation Agency and other authorities concerned of the Government of Japan. We wish to offer our sincere appreciation to the officials concerned of Planning and Development Cooperation, Office of The President, Ministry of Communications and Transport, Posts and Telecommunications Cooperation Ltd. and other authorities concerned of the Government of Zambia for their unlimited cooperation and assistance extended to the study team in connection with the execution of their duties.

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

Very truly yours,



Fujio Aihara
Team Leader

Long Term Plan for Development of
Telecommunications Network in the Republic of Zambia

CONTENTS

	Page
SECTION 1 INTRODUCTION	
1. Background	1 - 1
2. Study Objectives and Objective Areas	1 - 2
3. Scope of Study	1 - 2
3.1 Data Collection and Analysis	1 - 3
3.2 Demand Forecast	1 - 3
3.3 Development Targets	1 - 4
3.4 Network Expansion Plan and Project Implementation Plan	1 - 4
4. Work Schedule	1 - 5
5. Organization of Study Team	1 - 7
5.1 Japanese Side	1 - 7
5.2 Zambian Side	1 - 7
6. Composition of Study Report	1 - 8
SECTION 2 SOCIO-ECONOMY AND TELECOMMUNICATIONS	
1. Socio-Economic Environments	2 - 1
1.1 Economic Environment	2 - 1
1.2 Development Policy of Zambia	2 - 1
1.3 Social Needs of Telecommunications Networks in Zambia	2 - 2
2. Telecommunications Environments	2 - 3
2.1 World Trends of Telecommunications	2 - 3
2.2 Trends in Southern African Countries	2 - 4
2.3 Telecommunications Services in Zambia	2 - 5
SECTION 3 CURRENT STATUS OF TELECOMMUNICATIONS IN ZAMBIA	
1. Organization of PTC	3 - 1
1.1 Organization and Staff	3 - 1
1.2 Operation and Maintenance	3 - 6
2. Finance and Investment	3 - 12
2.1 Financial Status	3 - 12
2.2 Investment Status	3 - 17
3. Telecommunications Services	3 - 18
3.1 Telephone Service	3 - 18
3.2 Non-telephone Services	3 - 24
4. Telecommunications Network	3 - 28
4.1 Outline of Network	3 - 28
4.2 Switching System	3 - 28
4.3 Transmission System	3 - 34
4.4 External Plant System	3 - 40

	Page
4.5 Rural Telecommunications	3 - 41
4.6 Telex Network	3 - 45
5. On-going and Planned Project	3 - 48
5.1 On-Going Project	3 - 48
5.2 Planned Project	3 - 50
6. Current Problems of PTC	3 - 51
6.1 Operational Problems of PTC	3 - 51
6.2 Technical Problems	3 - 54

SECTION 4 DEMAND FORECASTS

1. Telephone Demand Forecast	4 - 1
1.1 Socio-Economic Growth	4 - 1
1.2 Historical Telephone Demand Growth	4 - 10
1.3 Process of Demand Forecast	4 - 11
1.4 Demand Forecast for Rural Area	4 - 19
1.5 Result of Demand Forecast	4 - 20
2. Non-telephone and New Services Demand Forecasts	4 - 24
2.1 Telex and Telegram Services	4 - 24
2.2 Mobile Telephone and Paging Services	4 - 27
2.3 Data Communication Services	4 - 28

SECTION 5 LONG-TERM DEVELOPMENT PLAN

1. Development Policy	5 - 1
1.1 First Stage: CREATION Decade (1993-2002)	5 - 1
1.2 Second Stage: GROWTH Decade (2003-2012)	5 - 1
2. Development Strategy	5 - 2
3. Long-Term Supply Plan	5 - 2
3.1 Basic Concept for Supply Plan	5 - 2
3.2 Case Study for Telephone Supply Volume	5 - 8
3.3 Financial Projection	5 - 12
3.4 Non-Telephone and New Services	5 - 25
4. Development Target	5 - 28
4.1 Service	5 - 29
4.2 Operation and Maintenance	5 - 29

SECTION 6 NETWORK EXPANSION PLAN

1. Fundamental Technical Plan	6 - 1
1.1 Network Hierarchy and Routing Plan	6 - 1
1.2 Numbering Plan	6 - 3
1.3 Signalling Plan	6 - 3

	Page
1.4 Network Synchronization Plan	6 - 4
1.5 Transmission Plan	6 - 6
2. Traffic Forecasts and Circuits Calculation	6 - 8
2.1 General	6 - 8
2.2 Trunk Traffic	6 - 10
2.3 Area Traffic	6 - 13
2.4 Local Traffic	6 - 13
2.5 International Traffic	6 - 15
2.6 Circuits Calculation	6 - 15
3. Urgent Program to be Carried out by PTC	6 - 20
3.1 Program 1 - External Plant Maintenance and New Subscriber Connection	6 - 20
3.2 Program 2 - Improvement of Billing System	6 - 21
3.3 Program 3 - Vehicle Survival Operation	6 - 21
4. Facility Expansion Plan	6 - 22
4.1 Expansion Plan of Switching System	6 - 22
4.2 Transmission System	6 - 26
4.3 External Plant System	6 - 31
4.4 Rural Telecommunications	6 - 32
5. Non-Telephone and New Services	6 - 37
5.1 Telex Network and Telegram Services	6 - 37
5.2 New Services	6 - 38

SECTION 7 OPERATION AND MAINTENANCE PLAN

1. General	7 - 1
2. Operation and Maintenance	7 - 1
2.1 Modernization of Routine Office Work by Computerization	7 - 1
2.2 Establishment of External Plant Maintenance Centers	7 - 1
3. Human Resources Development Plan	7 - 2
3.1 Staff Efficiency and Composition	7 - 2
3.2 Staff Training College	7 - 3
4. Introduction of Network Management System	7 - 4
4.1 Network Management Plan	7 - 4
4.2 Links to be used for Telecommunications Management Network	7 - 5
4.3 Provision of Network Management System	7 - 5
5. Improvement of Transport Means for O&M	7 - 6
6. Organization on Operation and Maintenance	7 - 6
6.1 Reinforcement of Technical Services	7 - 6
6.2 Separation of Non-essential Portion	7 - 6
7. Annual O&M Costs	7 - 6

SECTION 8 PROJECT IMPLEMENTATION AND COST ESTIMATION

1.	Project Formation	8 - 1
1.1	Basic Concept in Project Formation	8 - 1
1.2	Area Project Package	8 - 1
2.	Implementation of Projects and Priority Projects	8 - 3
2.1	Implementation of Projects	8 - 3
2.2	Priority Projects	8 - 6
2.3	Private Participation Project	8 - 7
3.	Project Cost Estimation	8 - 7
3.1	Unit Cost	8 - 7
3.2	Summary of Project Costs for the Long-Term Plan	8 - 7
4.	Project Digest	8 - 9

SECTION 9 FINANCIAL EVALUATION ON PRIORITY PROJECTS

1.	General	9 - 1
1.1	Method of Financial Analysis	9 - 1
1.2	Main Assumptions for Financial Analysis	9 - 1
2.	Sales Projection	9 - 4
2.1	Revenue Items	9 - 4
2.2	Present Tariff System	9 - 5
2.3	Sales Revenue Projection	9 - 5
3.	Investment Cost	9 - 8
3.1	Total Investment Cost	9 - 8
3.2	Expenditure Schedule of Total Investment Cost	9 - 8
4.	Operating and Maintenance Costs	9 - 10
5.	Financial Analysis	9 - 11
5.1	Summary of Financial Statements	9 - 11
5.2	Major Financial Indicators	9 - 11
5.3	Sensitivity Analysis	9 - 12
6.	Results of Financial Analysis	9 - 17
6.1	Project-Urban (Urgent Project + Urban Project)	9 - 18
6.2	Project-Rural	9 - 19
6.3	Sensitivity Analysis for Priority Projects	9 - 19
6.4	Financial Soundness as Total Business Entity	9 - 20

SECTION 10 ECONOMIC EVALUATION ON PRIORITY PROJECTS

1.	General	10 - 1
2.	Method of Economic Analysis	10 - 1
2.1	Economic Benefit of the Priority Projects	10 - 2
2.2	Economic Costs	10 - 2
2.3	Economic Parameters	10 - 3

	Page
3. Economic Analysis	10 - 4
3.1 Financial Structure Cases	10 - 4
3.2 Direct Benefit	10 - 4
3.3 Economic Cost Streams	10 - 8
4. Assessment of Result of Economic Analysis	10 - 10

SECTION 11 CONCLUSION AND RECOMMENDATIONS

1. Privatization and PTC's Problems and the Countermeasures	11 - 1
1.1 Corporate Financial Assessment and Privatization	11 - 1
1.2 PTC's Problems and the Countermeasures	11 - 2
2. Recommendations on Corporate Management	11 - 3
2.1 Organization	11 - 3
2.2 Liberalization of Customer Premises Equipment	11 - 4
3. Recommendations on Financial Aspects	11 - 5
3.1 Rural Project	11 - 5
3.2 Currency Exchange Losses	11 - 5
3.3 Tariffing Principles	11 - 5
3.4 Increase in Telephone Charges	11 - 6
4. Recommendation on Technical Aspects	11 - 11
4.1 Implementtion and Reviewing of Long-Term Development Plan	11 - 11
4.2 Introduction of New Technology	11 - 14
4.3 Successful Call Ratio	11 - 14
4.4 Employment of Consultant	11 - 14

ANNEXES

Annex 1 Minutes of Meeting	A1 - 1
Annex 2 List of Data Collected	A2 - 1
Annex 3 Financial Data	A3 - 1

LIST OF TABLES AND FIGURES

LIST OF TABLES

	Page
Section 3	
3-1-1 PTC's Telecommunications Division Staff Composition 1987 to 1992	3 - 3
3-1-2 Staff Efficiency	3 - 4
3-1-3 Statistics of Maintenance Work for External Plant	3 - 7
3-1-4 Statistics of Maintenance for Transmission, Earth Station Carrier System and Telex Exchange	3 - 8
3-2-1 PTC - Telecom Div Profit and Loss	3 - 14
3-2-2 PTC - Telecom Div Balance Sheet	3 - 15
3-2-3 PTC - Telecom Div Funds Statement	3 - 16
3-2-4 Investment Status	3 - 17
3-3-1 Telephone Service Development (Long-Term)	3 - 18
3-3-2 Telephone Service in Zambia (Short-Term)	3 - 18
3-3-3 The Number of PCO Lines	3 - 23
3-3-4 Telex Service in Zambia	3 - 24
3-3-5 Telegram Service in Zambia	3 - 25
3-3-6 Leased Circuit Services in Zambia	3 - 27
3-4-1 Summary of Local Telephone Switching Systems	3 - 29
3-4-2 Summary of Primary Centers	3 - 30
3-4-3 Telephone Exchange Equipment in Service	3 - 31
3-4-4 On-Going Projects for Switching Equipment	3 - 32
3-4-5 Ratio of Subscribers to Capacities	3 - 32
3-4-6 Exchanges Classified by Capacity	3 - 33
3-4-7 Distance Between PC and Local Office	3 - 34
3-4-8 Existing Microwave Links (1/2)	3 - 35
Existing UHF Links (2/2)	3 - 36
3-4-9 International Circuits (Indian Ocean Region)	3 - 38
3-4-10 International Circuits (Atlantic Ocean Region)	3 - 38
3-4-11 International Circuits (Terrestrial Route)	3 - 38
3-4-12 External Plant Facilities	3 - 40
3-4-13 Rural Telecommunications	3 - 41
3-4-14 Existing Plant Data (1/3)	3 - 42
Existing Plant Data (2/3)	3 - 43
Existing Plant Data (3/3)	3 - 44
3-4-15 Existing Telex Exchanges in Zambia	3 - 45
3-5-1 On-Going Projects	3 - 48
3-5-2 Support/Operational Projects	3 - 49
3-5-3 Ten Year Telecommunication Development Plan	3 - 50
3-6-1 Telephone Charges	3 - 51
3-6-2 Collection of Telephone Bill	3 - 51
3-6-3 Foreign Exchange Loss	3 - 52
3-6-4 Transition of Motor Vehicle Fleet	3 - 53

	Page
Section 4	
4-1-1	Population by Province, 1990 Census 4 - 1
4-1-2	Population Growth Rate, 1969 - 1990 4 - 2
4-1-3	Population Growth Rate for Next Two Decades 4 - 3
4-1-4	Population for Province ('000) 4 - 3
4-1-5	GDP per Capita and Growth Rate 4 - 3
4-1-6	GDP by Kind of Economic Activity 1989 - 1991 4 - 5
4-1-7	GDP Real Change of Factor Cost 4 - 5
4-1-8	Industrial Origin of GDP at Current Price 4 - 6
4-1-9	Employment by Sector 4 - 6
4-1-10	Economic Growth Rate 4 - 7
4-1-11	Gross Regional Domestic Product 4 - 8
4-1-12	Gross Domestic Product Growth 4 - 10
4-1-13	Subscribers and Applicants for 1985 - 1992 4 - 11
4-1-14	Telephone Demand by ITU Model 4 - 12
4-1-15	Telephone Demand by Logistic Model 4 - 15
4-1-16	Telephone Demand by Modified Model 4 - 16
4-1-17	Telephone Demand by All Models 4 - 16
4-1-18	Monthly Average Expenditures by Families in Rural and Urban Areas ... 4 - 19
4-1-19	Monthly Household Income by Province 4 - 20
4-1-20	Rural and Urban Area Demand 4 - 21
4-2-1	Telex Demand 4 - 24
4-2-2	Telegram Demand 4 - 25
4-2-3	Standard of Facsimile (by CCITT) 4 - 26
4-2-4	Facsimile Demand 4 - 27
4-2-5	Mobile Telephone Demand 4 - 27
4-2-6	Radio-Paging Demand 4 - 28
4-2-7	Leased Circuits Demand 4 - 29
4-2-8	Data Terminal Equipment Demand 4 - 30
Section 5	
5-2-1	Development Strategy in Telecommunications Sector 5 - 2
5-3-1	Supply Volume and Telephone Demand (Urban) 5 - 4
5-3-2	Groups Given The Priority in Rural Area 5 - 5
5-3-3	Cost Comparison between Urban and Rural 5 - 7
5-3-4	Supply volume and Telephone Demand (Rural) 5 - 7
5-3-5	Total Demand and Supply Volume 5 - 8
5-3-6	Scale of Case 1 and Case 2 5 - 9
5-3-7	Project Implementation Schedule Case 1 (1/2) 5 - 10
	Project Implementation Schedule Case 2 (2/2) 5 - 11
5-3-8	Total Investment Cost 5 - 13
5-3-9	Tariff System (1993) 5 - 15
5-3-10	Total Annual Revenues 5 - 16
5-3-11	Additional Operation and Maintenance Cost 5 - 17
5-3-12	Projected Financial Situation of Existing Network 5 - 20

	Page
5-3-13	Cash Flow Statement (Case 1) (1/4) 5 - 21
	Cash Flow Statement (Case 1) (2/4) 5 - 22
	Cash Flow Statement (Case 2) (3/4) 5 - 23
	Cash Flow Statement (Case 2) (4/4) 5 - 24
5-3-14	Supply Volume of Non-Telephone and New Services 5 - 25
5-4-1	Development Targets 5 - 28
5-4-2	Targets for Operation and Maintenance 5 - 30
 Section 6	
6-1-1	Transmission Loss Allocation 6 - 6
6-2-1	Trunk Traffic Matrix 6 - 12
6-2-2	Traffic Matrix (Lusaka Multi Exchange Area) 6 - 14
6-2-3	Trunk Circuit Matrix 6 - 17
6-2-4	Circuit Matrix in Lusaka for 2002 6 - 18
6-2-5	Circuit Matrix in Lusaka for 2012 6 - 19
6-3-1	Summary of Additional Subscriber 6 - 20
6-4-1	Replacement Year of Telephone Exchange 6 - 23
6-4-2	Classified Exchange Capacity 6 - 24
6-4-3	Higher Capacity Rank and Primary Center 6 - 24
6-4-4	Expansion Plan for First Decade 6 - 25
6-4-5	Expansion Plan for Second Decade 6 - 25
6-4-6	Summary for Transmission Expansion 6 - 26
6-4-7	Rural Telecommunication System 6 - 33
6-4-8	Summary of Expansion Volume for Provinces 6 - 37
6-5-1	Telex Expansion Schedule 6 - 37
6-5-2	Packet Network Plan (No. of Sub.) 6 - 40
 Section 7	
7-3-1	Staff Efficiency and Qualification 7 - 3
7-6-1	Operation and Maintenance Cost 7 - 7
 Section 8	
8-1-1	Summary of Project Package 8 - 2
8-1-2	Project Implementation Schedule (1/2) 8 - 4
	Project Implementation Schedule (2/2) 8 - 5
8-3-1	Unit Investment Cost 8 - 7
8-3-2	Summary of Project Cost 8 - 8
 Section 9	
9-2-1	Tariff System (1993) 9 - 5
9-2-2	Construction Cost Distribution Ratio 9 - 6
9-2-3	Total Annual Revenue for Priority Projects 9 - 7

	Page
9-3-1	Total Investment Cost 9 - 8
9-3-2	Investment Schedule for Project - Urban (1/2) 9 - 9
	Investment Schedule for Rural Project (2/2) 9 - 9
9-4-1	Operating and Maintenance Cost 9 - 10
9-5-1	Summary of Financial Analysis 9 - 13
9-5-2	Major Financial Indicators (1/3) 9 - 14
	Major Financial Indicators (2/3) 9 - 15
	Major Financial Indicators (3/3) 9 - 16
9-5-3	Summary of Sensitivity Analysis 9 - 17
9-6-1	Projected Financial Situation of Existing Network 9 - 21
9-6-2	Cash Flow Statement for Total Business Entity (Grant Case) 9 - 23
9-6-3	The Result of The Financial Analysis 9 - 24

Section 10

10-2-1	Standard Conversion Factor 10 - 3
10-3-1	Willingness To Pay 10 - 5
10-3-2	Trace of Telephone Charges 10 - 7
10-3-3	Economic Benefit Streams 10 - 8
10-3-4	Economic Cost Streams (1/2) 10 - 9
	Economic Cost Streams (2/2) 10 - 9
10-3-5	Economic Value of Operating & Maintenance Costs 10 - 10
10-4-1	Economic Cash Flow (Equity Case) 10 - 11
10-4-2	Economic Cash Flow (Grant Case) 10 - 12
10-4-3	Summary of Economic Analysis 10 - 13

Section 11

11-1-1	Investment and Profit and Cash Flow Statement 11 - 1
11-1-2	PTC's Problems and the Countermeasures 11 - 2
11-3-1	Tariff Level 11 - 8
11-3-2	Telephone Charge 11 - 8
11-3-3	Cash Flow Statement 11 - 8
11-3-4	Telephone Charge 11 - 9
11-3-5	Cash Flow Statement 11 - 10
11-4-1	Long-Term Plan and Short-Term Plan 11 - 11

LIST OF FIGURES

	Page
Section 1	
1-4-1 Work Schedule	1 - 6
Section 2	
2-2-1 Zambia and Surrounding Southern Africa Countries	2 - 7
Section 3	
3-1-1 Organization / PTC	3 - 2
3-1-2 Organization / Telecommunications	3 - 2
3-1-3 Staff Efficiency, Main Lines and Telecom Staff	3 - 4
3-1-4 PTC Country-Wide Networks	3 - 10
3-3-1 Telephone Service in Zambia	3 - 19
3-3-2 Total Demand and Waiting (As of September 30, 1992)	3 - 20
3-3-3 Total Demand Distribution (As of September 30, 1992)	3 - 20
3-3-4 Call Completion Ratio (% in 1992)	3 - 21
3-3-5 Telex Service in Zambia	3 - 24
3-3-6 Telegram Service in Zambia	3 - 26
3-4-1 Local Switching Capacity	3 - 29
3-4-2 Existing Network of PC and SC	3 - 30
3-4-3 Backbone Terrestrial Transmission	3 - 37
3-4-4 Satellite Network	3 - 39
3-4-5 External Plant Facilities	3 - 40
3-4-6 Existing National Telex Network	3 - 46
3-4-7 Gentex and Station	3 - 47
Section 4	
4-1-1 ITU Regression Line 42 Countries (1985-1989)	4 - 13
4-1-2 Total Demand	4 - 18
4-2-1 Facsimiles and Telephone Subscribers in Japan	4 - 26
Section 6	
6-1-1 Network Hierarchy	6 - 2
6-1-2 Multi-Exchange Area Network	6 - 2
6-1-3 Structure of CCS No. 7	6 - 4
6-1-4 Network Synchronization	6 - 5
6-2-1 Sequence of Traffic Forecasting	6 - 8
6-2-2 Calling Rate (Originating Traffic Per Sub.)	6 - 9
6-2-3 Originating Trunk Traffic	6 - 11
6-2-4 Mesh Network Configuration	6 - 13
6-2-5 International Traffic	6 - 15
6-4-1 Terrestrial Backbone Transmission System (2002)	6 - 29

	Page
6-4-2	Terrestrial Backbone Transmission System (2012) 6 - 30
6-4-3	Configuration of MARS Network 6 - 35
 Section 9	
9-6-1	Summary of Sensitivity Analysis for Grant Case IRROE % to Variation of Financial Parameter 9 - 25
 Section 10	
10-3-1	Consumer's Surplus 10 - 6
10-4-1	Result of Economic Analysis10 - 14 (Sensitivity of EIRR to Variation of Social Economic Benefit)
 Section 11	
11-2-1	Organization Chart 11 - 3
11-4-1	Long-Term Telecommunications Development Plan 11 - 13

ABBREVIATION

ADB	: African Development Bank
AD	: Assistant Directors
BHN	: Basic Human Needs
BRA	: Basic Rental Area
CAB	: Cabinet
CBT	: Computer Based Training
CCITT	: The International Telegraph and Telephone Consultative Committee
CCS NO.7	: Common Channel Signalling System No.7
CCT	: Circuit
CHN	: Channel
CMTS	: Cellular Mobile Telephone System
CPE	: Customer Premises Equipment
CSPDN	: Circuit Switched Public Data Network
DAMA	: Demand Assigned Multiple Access
DANIDA	: Danish International Development Agency
DDI	: Direct Dialling In
DEL	: Direct Exchange Line
DLC	: Digital Loop Carrier System
DP	: Data Port Module
DPS	: Distribution Points
DRSS	: Digital Radio Subscriber System
DTE	: Data Terminal Equipment
EIRR	: Economic Internal Rates of Return
EPMC	: External Plant Maintenance Center
EX	: Exchange
FAX	: Facsimile
FDM	: Frequency Division Multiplexing
FIRR	: Financial Internal Rates of Return
GDP	: Gross Domestic Product
GRDP	: Gross Regional Domestic Product
IBRD	: International Bank for Reconstruction and Development
IDD	: International Direct Dialling
IDN	: Integrated Digital Network
IDR	: Intermediate Data Rate
IMF	: International Monetary Fund
INF	: Interface
INTELSAT	: International Telecommunications Satellite Organization
IRR	: Internal Rate of Return
IRROE	: Internal Rates of Return on Equity
ISDN	: Integrated Services Digital Network
ITU	: International Telecommunication Union
JICA	: Japan International Cooperation Agency
LC	: Line Concentrator
LE	: Local Exchange
LLDC	: Least Developed Countries

LR	: Loudness Rating
MARS	: Multi Access Radio System
MDF	: Main Distribution Frame
MODEM	: Modulator and Demodulator
MSC	: Mobile Switching Center
MTBF	: Mean Time Between Failures
MTTR	: Mean Time To Repair
NE	: Network Element
NMC	: Network Management Center
NMCS	: Network Management and Control System
NMS	: Network Management System
OAM	: Operation, Administration and Maintenance
ODA	: Official Development Assistance
OECF	: The Overseas Economic Cooperation Fund
OS	: Operation System
PABX	: Private Automatic Branch Exchange
PAD	: Packet Assembly/Disassembly
PC	: Primary Center
PCM	: Pulse Code Modulation
PCO	: Public Call Office
POTS	: Plain Old Telephone Services
PSPDN	: Packet Switched Public Data Network
PSTN	: Public Switched Telephone Network
PTC	: Posts and Telecommunications Corporation
RASCOM	: Regional Africa Satellite Communication System
RCU	: Radio Concentrator Unit
RF	: Radio Frequency
RLC	: Remote Line Concentrator
RLR	: Receive Loudness Rating
RRS	: Rural Radio Subscriber System
RU	: Repeater Unit
SADC	: Southern African Development Community
SC	: Secondary Center
SCF	: Standard Conversion Factor
SCR	: Successful Call Ratio
SDH	: Synchronous Digital Hierarchy
SLC	: Subscriber Line Circuit
SLR	: Send Loudness Rating
SP	: Signalling Point
SPC	: Stored Program Control
STB	: Standby
STC	: Staff Training College
STD	: Subscriber Toll Dialling
STP	: Signalling Transfer Point
TAZARA	: Tanzania Zambia Railways
TDM	: Time Division Multiplex
TDMA	: Time Division Multiple Access
TLS	: Toll & Local Stage Telephone Exchange

TMN	: Telecommunications Management Network
TP	: Telephony
TR	: Transmitter-Receiver
TS	: Toll Stage Telephone Exchange
TV	: Television
VFT	: Voice Frequency Telegraphy
ZAMEFA	: Metal Fabricators of Zambia Limited
ZCCM	: Zambia Consolidated Copper Mines
ZCSO	: Zambia Central Statistical Office
ZESCO	: Zambia Electricity Supply Corporation
ZIMCO	: Zambia Industrial and Mining Corporation Limited
ZNBC	: Zambia National Broadcasting Corporation
ZR	: Zambia Railways

SECTION 1

INTRODUCTION

SECTION 1 INTRODUCTION

1. Background

Zambia is a landlocked country situated in the center of Southern Africa and bounded by Zaire, Angola, Namibia, Botswana, Zimbabwe, Mozambique, Malawi and Tanzania. The country has an area of 752,600 sq. Km and a population of 7,818,000 according to the census of August 1990.

Zambia's economy depends largely on copper, which in 1989 accounted for 87 percent of the total exports and contributed about 10 percent of GDP. However, the recent protracted sluggish market price of copper has resulted in a deficit in the balance of trade, declining of investments, and further a large accumulation of external debts.

Zambia has great potential for development of non-copper industries, particularly agriculture industry. However, the development is yet to be done.

Since 1989 Zambia has been implementing the Structural Adjustment Program with the assistance from the IMF and the World Bank. In spite of such effort, Zambia has been categorized as one of least developed countries (LLDC) since 1991. For some years to come, Zambia will have to continue to depend heavily on external assistance.

To cope with the above situation, the Government of Zambia started the New Economic Recovery Program in 1992. This Program aims to stabilize the financial and economic conditions, encourage foreign investments, and create attractive environments for private sector investments.

Under the Program, the Government plans to achieve positive real per capita growth as quickly as possible, slow down inflation to an acceptable level, and promote the steady growth of non-metal sectors during the second half of the decade. The Government expects that most parastatal will be privatized by 1997. In 1993, ZAMEFA, Metal Fabricators of Zambia Limited, is scheduled to be privatized.

In promoting the Program, the Government puts priority to the development of telecommunications as it is a basic social infrastructure indispensable for the economic recovery.

Domestic and international telecommunication services in Zambia are being provided by the Posts and Telecommunications Corporation Limited (PTC).

PTC's budgets, investments and operation are managed by Zambia Industrial and Mining Corporation Limited (ZIMCO), while its telecommunications policies are controlled by the Ministry of Communication and Transport.

For development of telecommunications, Ten Year Development Plan for Telecommunications (1992-2002) was prepared by PTC in April 1992. The total project cost for 10 years under this Plan is estimated to be US\$ 438.37 million which, however,

seems to be rather enormous. In accordance with the Capital Expenditure Budget 1992/1993, a few new projects and International Telephone Switching Center project amounting to 9.3 million US Dollars have been included in the budget.

Due to the recent economic depression, investments in telecommunications have been decreasing year by year and PTC's account is expected to turn to deficit in 1992 following 1991.

The Government of Zambia plans to split the telecommunications division from the PTC to form an independent telecommunications operating entity and the provision of subscribers' equipment will be liberalized in 1993.

The new entity thus formed will be required to adopt a more market-oriented management to cope with future privatization of the entity in competitive environment. Most important for the entity is to achieve self reliance.

In view of the above, the Government of Zambia considered that it would be is an urgent need for the nation to review the long-term telecommunications development plan in Zambia and to implement projects according to a preferential order so as to achieve most efficient improvement of telecommunications, to afford most effective realization of the Economic Recovery Program.

Under the above circumstances, the Government of the Republic of Zambia requested the assistance to the Government of Japan to draw up Long-Term Plan for Development of Telecommunications Network.

In response to the request, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the study team to carry out the study in accordance with the scope of works agreed upon by and between PTC and JICA.

2. Study Objectives and Objective Areas

The objective of the Study is to make a long-term plan for development of the telecommunications network in Zambia for the period of 20 years (1993-2012). The study covered the whole area of Zambia.

3. Scope of Study

A long-term plan for development of the telecommunications network in the Republic of Zambia has been prepared, based on the field survey results and discussions with staff concerned of PTC, the Ministry of Communications and Transport, and particularly, of the Planning and Development Bureau of the Presidential Office.

3.1 Data Collection and Analysis

Data and information necessary for the Study were collected and analyzed as follows:

(1) Social and Economic Conditions and National Development Plans

Data and information concerning the social and economic conditions, including national development plans, were collected and analyzed to acquire the current status of socio-economic activities, industrial structures and the national development programs. They were used as the basic data in establishing the policy and strategy for telecommunications development. Also, on the basis of these data, a role of telecommunications has been defined and the targets of telecommunications services have been established. Main data are:

- Country Profile Data
- National Account Statistics Bulletin
- New Economic Recovery Program 1992 - 1994
- World Bank draft Country Report

(2) Status Quo of Telecommunications

Field surveys were carried out for 11 local exchanges to know the status quo of telecommunications services and facilities.

The surveys results and the collected data as mentioned below were analyzed to prepare the telecommunications development plan including operation and maintenance plans, and a number of problems were elucidated.

- PTC Annual Report
- Ten Year Development Plan for Telecommunications (1992-2002)
- Budget 1992/1993
- Yearbook of Common Carrier Telecommunication Statistics

3.2 Demand Forecast

Demands for telephone, non-telephone and new services have been forecasted, based on the collected data and field survey findings, to provide the basic data for economic and technical studies of the long-term development plan.

For telephone services, demand has been forecasted by applying the ITU model which represents the correlation among the GDP per capita, demand and supply density, and a newly established special model in which the demand is estimated, taking into account the past trend of telephone demand growth.

For non-telephone and new services, demands have been forecasted based on the corresponding data in other countries.

3.3 Development Targets

The development policy of PTC and the development of scenario of the telecommunications sector as a whole have been established through discussions with the Ministry of Communications and Transport, based on the trends in socio-economic development and newly established New Economic Recovery Program 1992-1994.

Then, in accordance with the development policy, the development targets under the long-term plan have been established, based on the forecasted demand. In establishing the targets, priority has been given to the development of the profitable urban area, in view of the policy of achieving sound financial development through effective investments.

For the urban area, targets of supply volume have been established through case studies of two plans: (i) to satisfy 100% of the telephone demand and (ii) to satisfy 76% of the demand, which is the worldwide average level. On the basis of the study results, the latter, i.e., 76% demand fulfillment plan has been adopted as the target since it proved feasible and preferable both financially and technically.

For the rural area, the target has been set at fulfillment of 3% of the demand, with which the demand by public houses, farmlands, public call offices, etc. can be satisfied.

Other targets to be achieved under the long-term plan have also been established so that the total performances of the telecommunications division may reach the international levels in staff efficiency, maintenance efficiency, etc.

3.4 Network Expansion Plan and Project Implementation Plan

The network expansion plan and the project implementation plan to realize the established targets have been drawn up as follows:

Firstly, the fundamental technical plan suitable for Zambia has been prepared.

Then, on the basis of this plan, the telecommunications network expansion plan has been formulated for each category of facilities (i.e., switch, transmission and external plant) and for each exchange, including urgent projects.

Further the project implementation plan has been drawn up, with cost estimates, putting emphasis on efficient area by area function of a network which facilitates prompt connection of new subscribers.

Conventionally in Zambia, individual projects used to be formed for each category of facilities and, therefore, the facility completed by a project cannot function as a network until all the other related projects have been completed, keeping the long waiting applicants unconnected.

The implementation plan prepared by this study aims to remove such drawbacks.

For priority projects, financial analyses and assessments have been carried out, through the estimates of income and expenditure, and also economic benefits have been studied both qualitatively and quantitatively.

Corporate financial evaluation was also made in the study, to identify impacts of specific programs and projects on the executive entity's entire operation, as well as to study the viability of the entity after privatization.

4. Work Schedule

The schedule and milestone of the study is shown in Figure 1-4-1.

Month	1992					1993					August	
	September	October	November	December	January	February	March	April	May	June		July
Description												
Study in Zambia												
Study in Japan												
REPORT/PRESENTATION		A IC/R			A II/R		A DF/R Presentation		A DF/R Explanation		A F/R	

IC/R : Inception Report II/R : Interim Report

DF/R : Draft Final Report F/R : Final Report

Figure 1-4-1 Work Schedule

5. Organization of Study Team

5.1 Japanese Side

(1) Advisory Committee

Mr. Shigeaki TAKASHIMA	: Chairman / Ministry of Posts and Telecommunications
Mr. Hisato NAGASAKA	: Member / Ministry of Posts and Telecommunications
Mr. Yasuo SUZUKI	: Member / JICA

(2) Study Team

Mr. Fujio AIHARA	: Team Leader / Development Plan
Mr. Masayuki OIKAWA	: Demand Forecast / Outside Plant
Mr. Yoshiaki URESHI	: Traffic Forecast / Network Planning
Mr. Ryuji KATAYAMA	: Traffic Forecast / Switching System
Mr. Tadamasa SATO	: Circuit Planning / Transmission System
Mr. Naoto MATSUDA	: Non-telephone / New Services
Mr. Haruo ISHIZUKA	: Operation and Maintenance
Mr. Tomoyuki KURODA	: Financial and Economic Analysis
Mr. Yasushi KATO	: Administrative Support

5.2 Zambian Side

The persons who were closely concerned with the study are as shown below:

(1) Planning and Development Cooperation, Office of The President

Mr. M. C. SOKO Director of Economic and Technology Cooperation

(2) Ministry of Communications and Transport

Mr. E. A. KASHITA Minister of Communications and Transport
Mr. I. MPISHI Deputy Permanent Secretary Administration
Communications
Mr. E. A. HANAMWINCA Senior Telecommunications Engineer

(3) Central Statistical Office

Mr. D. DIANGAMO Director

(4) The World Bank

Mr. F.I.H. MOREITHI Senior Operations Officer

(5) Posts and Telecommunications Cooperation Ltd.

Mr. P. NG'OMA	Managing Director
Mr. A. KUMAR	Acting Director of Telecommunications
Mr. C. C. MUGALA	Acting Finance Director
Mr. R. K. SIAME	Acting Deputy Director - Planning and Development

(6) PTC Counterpart

Mr. K. SIACHINJI	Team Leader / Transmission Systems
Mr. H. TEMBO	Network & Circuit Planning
Mr. B. LUFUNDISHA	Network Planning / Telex
Mr. A. PIKITI	Switching Systems
Mr. P. KUNDA	Switching Systems
Mr. A. MWANDIRA	Outside Plant
Mr. S. MUNALULA	Outside Plant
Mr. F. KUMWENDA	Billing
Mr. G. MALENGA	Demand Forecast
Mr. M. NDUNA	Economic Analysis

6. Composition of Study Report

The results of the Study were compiled into the Report consisting of the following sections:

SECTION 2 presents a socio-economic environment surrounding Zambia and role and necessity of telecommunications in Zambian economic activities.

A world-wide trend of telecommunications and situation of telecommunications services in Zambia are also described.

SECTION 3 covers an actual situation of PTC's organization and staff, finance and investment, telecommunications services and facilities, on-going and planned project and facing present problems. Current major problems are (1) low (below 30%) of collection rate of telephone bill, (2) low utilization rate (55% in Sep. 1992) of vehicles due to lack of spare parts and (3) low maintenance efficiency of external plant. Urgent programs to cope with these problems are described in Section 6.

SECTION 4 presents, as an essential part of the plan, the results demand forecasts of telephone, non-telephone and new services.

SECTION 5 gives policy, strategy and targets of telecommunications services to be achieved decade by decade basing on the socio-economic situations and demand forecasts through discussion with PTC and Governmental agencies. Long term supply scenario of telecommunications are studied for two different cases.

SECTION 6 presents details of the well balanced telecommunications networks. Urgent programs to be undertaken by PTC have to be proceeded as a top priority, however, it is desirable to be assisted by expatriate consultants where, necessary. Introduction of new telecommunication services has also been mentioned.

SECTION 7 deals with operation and maintenance plan to enhance the efficiency of operation and maintenance to cope with future privatization of corporation through establishing External Plant Maintenance Center (EPMC), utilization of computers to routine works, introduction of Network Management system (NMS) to nationwide network.

SECTION 8 provides a list of projects to establish a well balanced telecommunication network and to accommodate as many new subscribers as possible. Costs by package are estimated. The project implementation schedule gives priority projects selected.

SECTION 9 gives the results of financial analysis for the priority projects. The method contrasts the total amount of cash outlay of the costs of construction, operation, etc., with the revenues obtained by the call charges, installation fees and rental fees and prepares the profit and loss statement, cash flow statement, etc. The validity of each priority project is thus assessed by investigation of those financial outputs predicted.

SECTION 10, the economic effect expected from the performance of these projects will be assessed dealing mainly with the calculation of Economic Internal Rates of Return (EIRR) when discounting sets of economic cost and benefit streams for the priority projects. Through elimination of the value of transfer items and application of appropriate shadow prices to the financial cost and benefit streams, the financial cash flows are transferred into economic cost and benefit streams to calculate the EIRR.

SECTION 11 presents the conclusion and recommendations on privatization and liberalization of CPE, reviews telecommunications development plan, and recommendations on financial conditions and also on technical aspects.

SECTION 2

SOCIO-ECONOMY AND TELECOMMUNICATIONS

SECTION 2 SOCIO-ECONOMY AND TELECOMMUNICATIONS

1. Socio-Economic Environments

1.1 Economic Environment

Since the independence from the United Kingdom in 1964, the economic growth in Zambia, as well as the income growth per capita, has been unstable, primarily due to instability in the price of copper and agricultural products. Copper accounts for 90% of Zambian exports and 10% of its Gross Domestic Product. The copper-dependent economy has been adversely affected by depressed copper prices since late 1970, a deterioration in the transport as a result of the civil wars being waged in neighboring countries, and a decline in copper production owing to increased mining costs. The result is evident: soaring inflation, accumulated debts and higher unemployment rate.

In 1983, the nation revised the socialist-controlled economy and accepted a structural adjustment program led by the IMF and the World Bank. As a result, the Kwacha was devalued, the interest rates were liberalized and the maize subsidy was eliminated.

For the sake of maintaining stability in its domestic political system, the country moved away from the structural adjustment program and prepared an independent economic restructuring program in 1987.

But this failed to improve country's economy. Therefore, in 1989, Zambia again consulted with the IMF and the World Bank and agreed to adopt a new structural adjustment program which is currently under implementation.

The program aims at the introduction of price policies, economic growth through boosting production, improving employment and incomes. It is also designed to liberalize the Zambia economy from excessive dependence on copper. Zambia has belonged to least developed countries (LLDC) since 1991.

In 1992, the Zambia Government devalued its currency by about 600%. In a similar devaluation implemented between 1985 and 1986, the Government devalued the Kwacha by 693%. Despite the devaluation, exports have not grown as much as expected. These factors contributed to a deterioration in the balance of payment, which gave Zambia the bitter experience of seeing its consumer prices again increase, this time by over 40%.

1.2 Development Policy of Zambia

(1) General

In the last decade, Zambia has experienced rapid deterioration of economic activities, consequent foreign exchange shortage, accelerated inflation and a spread of black market activities.

Under this situation, the Zambia Government has been launching various means and ways in order to vitalize its economy, such as follows:

- a) Stabilizing and restructuring the national economy
- b) Introducing price policies
- c) Designing to free the Zambia economy from excessive dependence on COPPER
- d) Embarking on a privatization program

(2) Telecommunication

Along the above national trends, the Zambia Government has prepared ways in order to accept a commercialization, such as follows:

- a) Splitting the corporation into Postal and Telecommunications
- b) Provision of subscriber's premises of Telecommunications in competitive environment

The commercialization will mean the restructuring of PTC through rationalization so that it makes a profit, yet still retaining the characteristics of a public corporation.

1.3 Social Needs of Telecommunications Networks in Zambia

The Zambian Government is planning to shift its economic focus from the declining copper industry to agriculture. Progress in agricultural development in areas such as the northern, north-western and central provinces, which receive higher annual rainfall than other regions, will mean the spread of Zambia's main industry over a vast area. Improvements in telecommunications is vital, in order to maintain communications throughout this area and increase economic efficiency. Furthermore, with the growing surplus of agricultural goods coming onto the market as agricultural development expands, trade in agricultural products, seedlings, fertilizers, fuels and services will be expanded. For this to happen efficiently, rapid, highly reliable long-distance communications will become necessary.

Furthermore, because telecommunications replaces some elements of transportation and enables transportation facilities to be used more effectively, it can reduce the energy required to maintain a certain level of communications. For this to become a reality, an early improvement in the telecommunications networks is desired.

Moreover, the development of the telecommunications network will have great impact on areas such as finance, transportation, medical services and education. This means that telecommunications will become a major factor in achieving structural change in Zambia.

2. Telecommunications Environments

2.1 World Trends of Telecommunications

(1) Telecommunications Sector

The increasing importance of telecommunications for economic development is recognized throughout the world. In addition, telecommunications technologies have brought a rapid change in both hardware and software, as well as service categories over the last fifteen years.

Under such circumstances, many developed and developing countries have taken major initiatives to restructure their telecommunications sectors over the last ten years aiming to enhance those productivity and competitiveness, and to be free from regulations.

The above-mentioned restructuring of the sector in many countries has involved the following:

- increased commercialization of the main service provider;
- increased competition; and
- various degrees of privatization coupled with regulations to promote competition, minimize monopoly abuses and to secure social objectives for service availability and performance.

(2) Competitive Provision on Telecommunications

Competitive provision in telecommunications services and terminals has been introduced in many countries aiming to reach high levels of responsiveness to customer needs, to charge minimum fee and to achieve maximum productivity.

As a result of introduction of competition in telecommunications, it is expected to provide a stable environment for investors and to protect users against possible abuses, as well to improve services and prices for customers.

a) Competition in Provision of Services

The following services have been provided by many operating companies under the competitive circumstance:

- value-added and information services;
- mobile telephone service;
- radio paging service;
- long-distance telephone service; and
- international telephone service.

b) Competition in Provision of Terminals

As a world-wide trend of the times, the following terminal equipments have been provided under the competitive conditions in order to promote diversity of supply:

- telephone sets including portable telephones;
- telex terminals;
- facsimile terminals; and
- PABX.

2.2 Trends in Southern African Countries

Zambia is located in the center of Southern Africa in geography and a junction point of terrestrial telecommunications. Thus the development of telecommunications in Zambia will contribute to its surrounding countries' telecommunications and socio-economic growth, also.

Areas, population, GDP per capita, number of telephone main lines, DELs per 100 inhabitants, of Zambia and neighboring countries in Southern Africa are compared and shown in Figure 2-2-1.

There are a few production units manufacturing cables or telephone sets in Zambia and neighboring countries.

Existing manufacturing facilities in SADC area are as follows:

Madagascar

- VIRIO : battery plant
- VY TOBAVY : distribution frames, antenna masts, cabinets, etc
- : PVC pipes

Malawi

- : wooden poles, manhole covers

Mozambique

- CELMOQUE : cables
- : racks, frames, shelves, cabinets
- : poles, overhead fitting materials

Zambia

- ZAMEFA : cables
- MANSA BATTERIES : batteries

Zimbabwe

- Telecom System (Pvt) Ltd : switching equipments
- PTC factory : reassembling of switching equipments, signalling convertor
- CHLORIDE ELECTRICAL LTD
- PLESSEY ZIMBABWE LTD
- ERICSSON ZIMBABWE
- CENTRAL AFRICA CABLES

Metal Fabricators of Zambia Limited (ZAMEFA) was incorporated in October 1968 as a private wire and cable company and the Zambia Government has a 51% of its shares through INDECO limited. ZAMEFA is a profitable company, and major customers of ZAMEFA are Zambia Consolidated Copper Mines (ZCCM), Posts and Telecommunications Corporation (PTC), Zambia Electricity Supply Corporation (ZESCO), Zambia Railways (ZR) and Construction Industry in Domestic, and Countries in the SADC and PTA region, Africa, Europe, Asia and the Far East in foreign. ZAMEFA will be privatized in 1993.

Two groups, telecommunications administrators and manufacturers of telecommunication equipment in the Southern Africa Development Community (SADC), convened in Lusaka to agree on more than 30 technical specifications of telephone cables and other materials. Telecommunications administrators in the region pledged to give priority to equipment manufactured within SADC member states for mutual benefits.

Regarding manufacturing prospects, RASCOM Feasibility Study Report (November 1990) by ITU presents that a country with a market for 300,000 telephone sets per year might be a break-even point for establishment of a local factory of telecommunications equipments for the profit threshold.

2.3 Telecommunications Services in Zambia

The public telecommunication services in Zambia are provided by the PTC under the Ministry of Communications and Transport. The PTC is also in charge of the postal services. It was established as a statutory body by the Posts and Telecommunications Act, 1975 and in April 1988, it was incorporated as a limited liability company by the Posts and Telecommunications Act 1987. It is a corporation wholly owned by Zambia Industrial and Mining Corporation Limited (ZIMCO). ZIMCO is a wholly government owned company established for development of industries and mining. Currently ZIMCO controls almost all government business enterprises. ZIMCO offers guidelines on the PTC budget, investment plans, management, etc.

According to a local news paper report, ZIMCO is being transformed into a slender investment holding company whose responsibility is to oversee other parastatal companies until they are privatized.

The PTC is controlled by the Board of Directors, of which one of the Executive Directors of ZIMCO is Chairman. It has two operative Divisions: Postal and Telecommunications, each being independent of the other.

In addition, there is a corporate department which provides such specialized common services to the operative divisions as financial services, audit services and data processing services. Telecommunications Division comprises of Planning and Development Department, Operations and Maintenance Department, Finance and Accounts Department and Human Resources Development Department.

The PTC continues to develop telecommunications infrastructure with the financial and technical assistance from the World Bank, African Development Bank and from industrialized countries including Japan.

The status quo of telecommunications in Zambia is described in the following section.

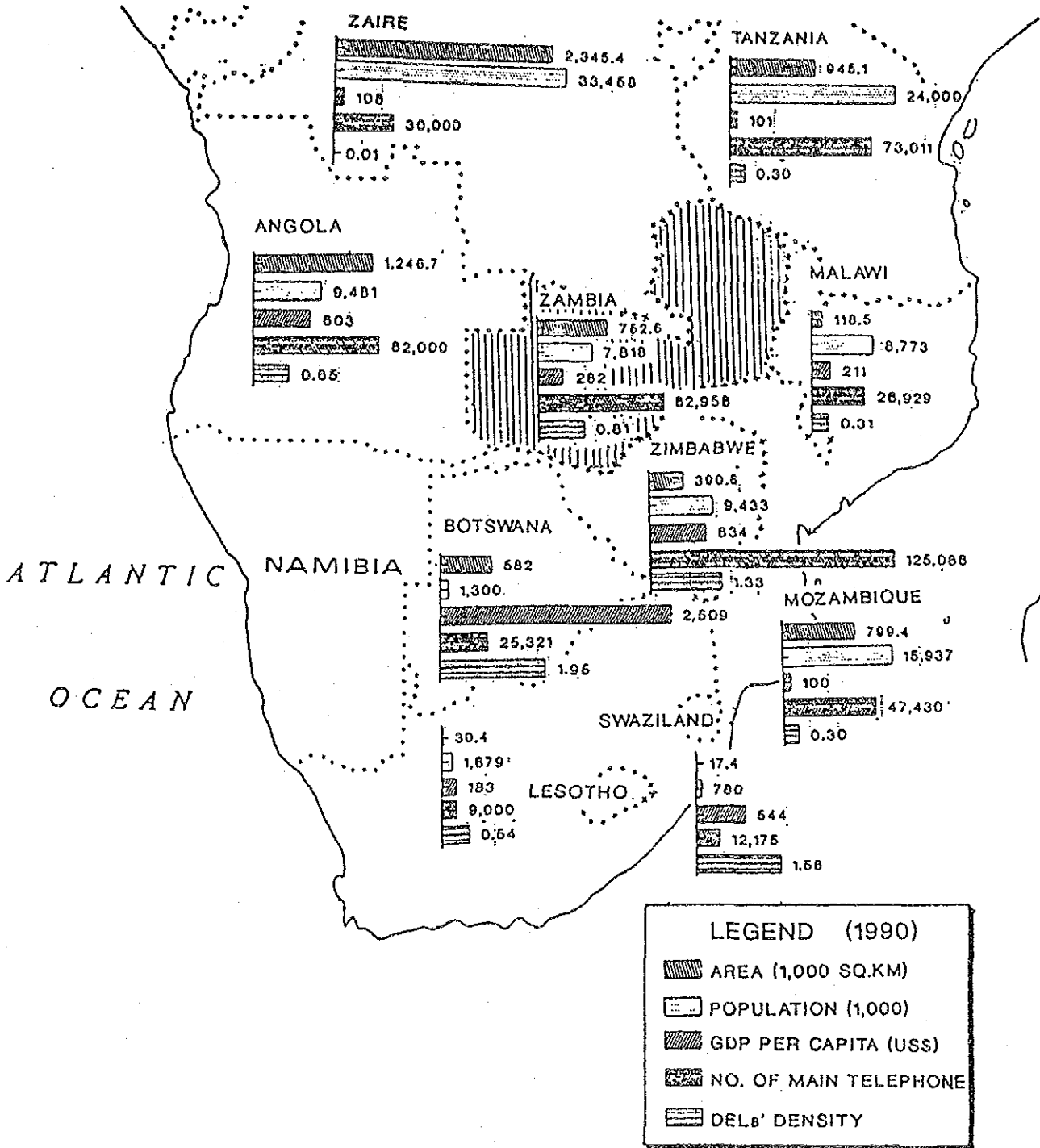


Figure 2-2-1 Zambia and Surrounding Southern African Countries

SECTION 3

**CURRENT STATUS OF TELECOMMUNICATIONS
IN ZAMBIA**

SECTION 3 CURRENT STATUS OF TELECOMMUNICATIONS IN ZAMBIA

1. Organization of PTC

1.1 Organization and Staff

1.1.1 Organization

The PTC is controlled by a Board of Directors, of which Chairman is one of the Executive Directors of ZIMCO. It has two operative Divisions: Postal and Telecommunications Divisions, each being independent of the other.

The PTC has a corporate department which provides specialized common services and data processing services to both divisions.

Telecommunications Division comprises of Planning and Development Department, Operations and Maintenance Department, Finance and Accounts Department and Human Resources Development Department.

The PTC's present organization is shown in Figures 3-1-1 and 3-1-2. Further details are given in DATA BOOK (DATA 2).

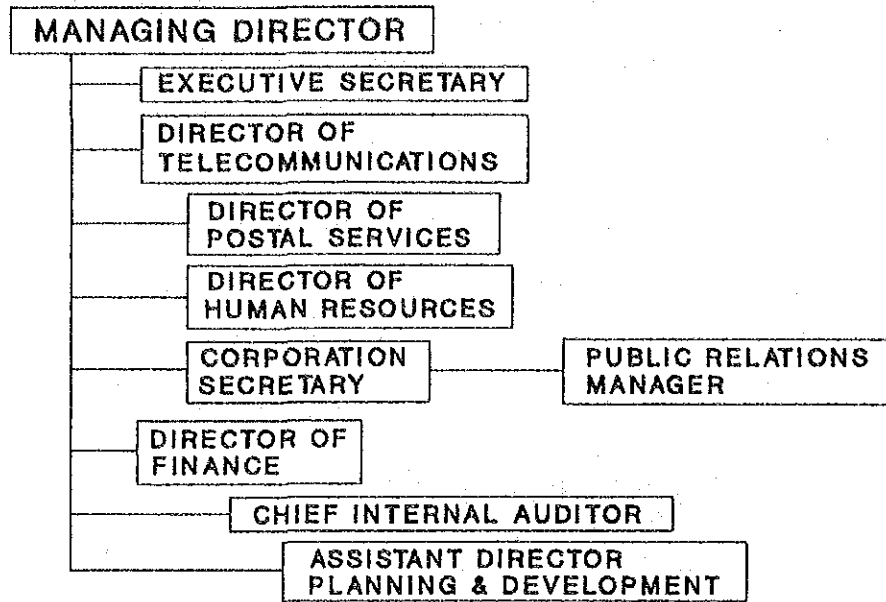


Figure 3-1-1 Organization / PTC

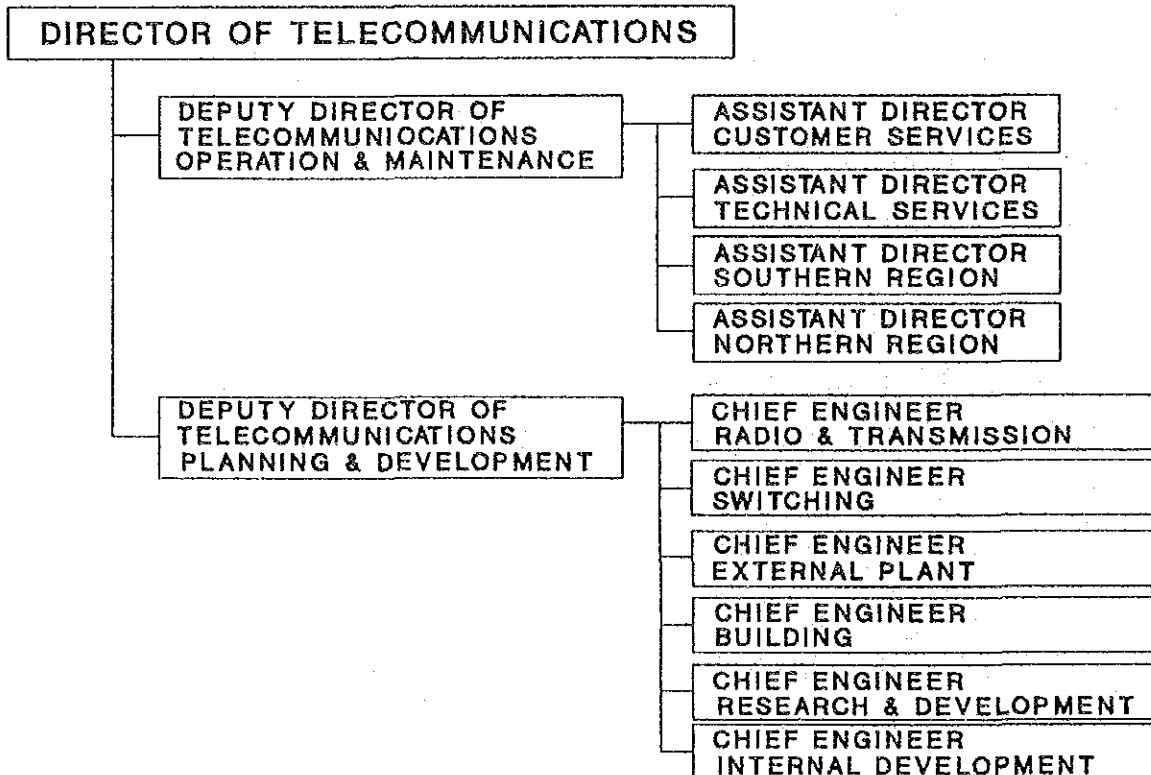


Figure 3-1-2 Organization / Telecommunications

1.1.2 Staff

The transition of the staff composition in Telecommunications Division of the PTC in terms of job categories, turnover, and educational qualification over the period from 1987 to 1992 is shown in Table 3-1-1.

Table 3-1-1 PTC's Telecommunications Division Staff Composition 1987 to 1992

	1987	1988	1989	1990	1991	1992
A. EMPLOYEES BY CATEGORY (by number)						
Management and administration	39	36	38	53	55	47
Engineers	149	158	189	168	205	191
Technicians	624	662	669	638	634	678
Operations	876	867	927	942	1005	1004
Others	948	1068	1604	1797	1838	1932
TOTAL	2627	2791	3427	3585	3737	3345
B. STAFF TURNOVER						
⊖ NUMBER OF TECHNICAL STAFF						
At start of the year	869	984	1023	972	1005	1133
Recruited during the year	39	115	74	85	23	21
Separated during the year	24	53	74	34	99	52
At end of the year	884	966	1023	1023	1081	1102
Staff turnover (%)	2.7	5.5	7.2	3.5	9.2	4.6
⊖ NUMBER OF NON TECHNICAL STAFF						
At start of the year	1738	1801	2343	2430	2736	2148
Recruited during the year	116	227	286	176	144	175
Separated during the year	105	183	225	95	148	80
At end of the year	1744	1845	2404	2511	2732	2243
Staff turnover (%)	6.0	10.2	9.6	3.5	5.4	3.7
C. QUALIFICATION OF STAFF						
University degree	30	32	35	42	48	52
Diploma/certificate	936	955	1051	1095	1168	1292
Secondary School	993	1017	1327	1053	1223	978
Others	668	787	1014	1395	1298	1023

NOTE: PTC staff categorization is Senior Management, Middle Management Supervisory and General.

From the above table, the following can be known:

- (1) The total number of the staff at the end of 1992 was 3,345, while the total number of DEL (Direct Exchange Line) was 70,756 (Sept. 1992) including manual exchange lines. From these figures the telecommunications staff per 1,000 DELs is assessed at 47.3. According to the ITU's Yearbook and other data collected, the staff efficiency in various countries is shown in Table 3-1-2.

Table 3-1-2 Staff Efficiency

Country	Main lines	Telecom.Staff	Staff.eff.	Year
Egypt	1,717,498	58,804 (40.0)	34.2	1990
S.Africa	3,254,246	93,856 (55.4)	28.8	1990
Tanzania	73,011	5,079 (44.8)	69.6	1990
Tunisia	303,318	5,500 (32.7)	18.1	1990
Zaire	29,186	6,569 (55.0)	225.1	1988
Zambia	70,756	3,345 (32.9)	47.3	1992
Indonesia	1,247,000	39,520 (45.1)	31.7	1991
Malaysia	1,247,687	28,168 (59.1)	22.6	1988
Thailand	1,324,522	18,885 (33.7)	16.3	1990
Philippine	610,126	19,053	33.4	1990
Panama	216,026	3,707 (59.5)	18.4	1990

Bracketed figures show the percentage of technical staff involved.

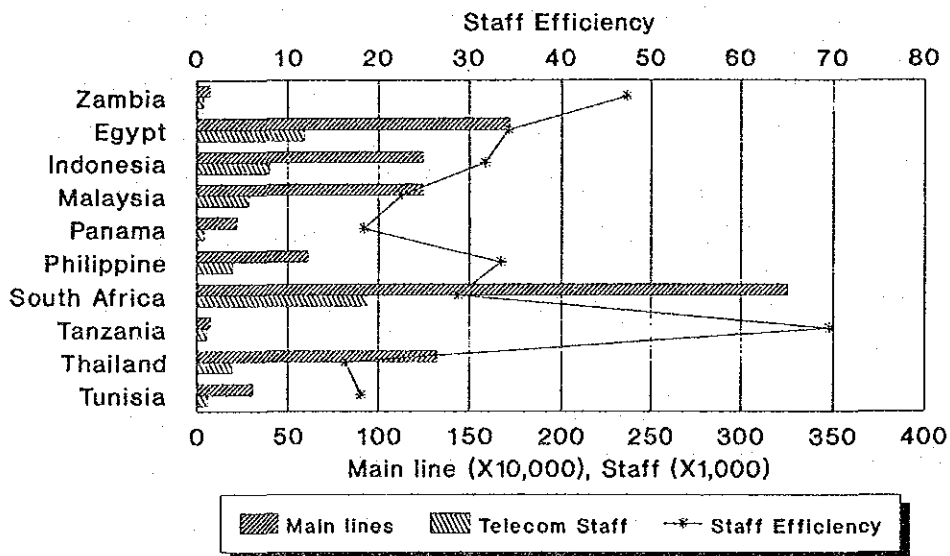


Figure 3-1-3 Staff Efficiency, Main Lines and Telecom Staff

It can be known from the table that Zambia belongs to the lower staff-efficiency group. However, it should be noted that the efficiency in Zambia has been improved from 59.0 to 47.3 in three years.

- (2) Proportion of the number of technical staff to the total number is 32.9% for 1992. The corresponding figures for other countries are shown in Table 3-1-2.

According to this table, Zambia falls under the lower proportion group. To cope with progressive introduction of digitalized equipment and computerized systems into telecommunication services, the proportion of technical staff should be raised gradually in line with the progress of digitalization.

- (3) As regards the educational qualification, the staff with university degree accounts for only 1.6 percent of the whole staff, the staff with diploma/certificate, 38.6 percent, and the staff graduated from secondary schools, 29.2 percent.

In the first and the second decades to come, the society will become more and more of information oriented, and the telecommunications operating entity will inevitably be required to provide more advanced, more sophisticated and more diversified telecommunications services. In this respect, qualitative enhancement of human resources is requisite, especially in the fields of planning and development, including R&D.

To fulfill such requirements, the staff structure should be gradually upgraded in terms of educational qualifications, i.e., of university degree and diploma/certificate.

1.1.3 Staff Training College

Staff Training College in Ndola was established in 1972 as a national vocational training center with the assistance of the United Nations Development Program, whose mandate ended in 1977. Since then it has been expanded considerably. Under the Principal, there are Telecommunications Engineering Branch, Telecommunications Operation Branch and Postal Branch and, in addition, Registrar, Course Development Unit and Library. Telecommunications Engineering Branch has courses for power, switching, radio transmission and external plant, while the telecommunications operation branch has courses for telegraph operation, telephone operation and traffic marketing and accountants.

The college accepts not only the PTC employees but also graduates from secondary schools for two year-course. In addition, the college accepts trainees from other enterprises in Zambia and also from other countries in Africa.

In the first year, trainees study basic subjects such as "introduction to telecommunications and electrical principles", "digital electronics and basic computers". In the second year, they study specialized subjects, i.e., power, switching, radio transmission and external plant.

The college has its own hostels in its compound to accommodate 160 students. In the near future, the capacity will be expanded to 400 students. Approximate 65% of the students are for engineering field, 15% for operation (telecom), 15% for operation (postal) and 5% for course development.

The college has computer based training facilities for digital switching system.

The PTC is scheduled to be split into the telecommunication division and the postal division next year. After the split, the college is supposed to become a college independent of both telecommunications and postal divisions.

The Staff Training College, even after independence, should retain a closer connection with the telecommunications division, because the both are in a complementary relation in a number of respects, e.g., course development, recruiting of lecturers, and installation, test and maintenance of laboratory equipment.

1.2 Operation and Maintenance

1.2.1 Functions of Operation and Maintenance (O&M)

Functions of O&M are explained according to the organization.

The O&M of PTC's telecommunication facilities is carried out under Deputy Director of Telecommunications for Operation and Maintenance as shown in Figure 3-1-4.

The Deputy Director has four Assistant Directors (ADs): two of them deal with the O&M in the northern and southern regions, respectively, the other two are in charge of customer services and for technical services, respectively. That is, the whole Zambia is divided into two regions for telecommunication services.

The whole region is covered by a number of area managers for major areas and a principal engineer who directs area managers for minor areas.

The Technical Service Department functions to:

- formulate and review the national maintenance plan;
- lay down O&M standard procedures;
- co-ordinate the logistics matters;
- carry out network performance surveillance and supervision;
- establish and maintain O&M data base;
- assist field units in settling various problems;
- co-ordinate with the planning department and
- liaise with the regional headquarters for overall network maintenance.

The technical services are provided by four principal engineers, each for switching, transmission, power and external plant, and two managers, one for Electronic Repair Center in Lusaka and the other for Engineering Workshop in Ndola.

The fundamental problems to solve in O&M by the PTC are summarized as follows:

- shortage of skilled technical staff;
- poor logistics; and
- poor management.

1.2.2 Status of Operation and Maintenance

(1) Telecommunication Facilities

Quarterly Maintenance Statistics are prepared and issued by the AD Technical Service. Summary of achievements in the maintenance work for the period from 1986 to 1991 is given in Table 3-1-3 and Table 3-1-4.

Table 3-1-3 Statistics of Maintenance Work for External Plant

Year	No. of working lines	Faults/line/year	Maintenance efficiency(%)
		Target: 1.50	Target: 95%
1986	47,164	2.38	76.23
1987	50,919	2.11	87.09
1988	58,492	1.80	82.77
1989	60,750	1.38	78.98
1990	65,057	0.89	80.36
1991	68,935	0.29	58.18

Source: A STATISTICAL PROGRESS REVIEW FOR THE PERIOD
1981/82-1990/91

Table 3-1-4 Statistics of Maintenance for Transmission, Earth Station Carrier System and Telex Exchange

Fisc. Year	Q'tr	Availability		Maintenance Efficiency (%) Carrier sys.	Availability (%) Telex Exchange
		Transmission Microwave	Earth Station		
86/87	1	97.43	99.99	---	99.88
	2	98.21	100.00	---	99.06
	3	97.90	100.00	88.90	97.09
	4	---	---	---	---
87/88	1	99.21	99.99	93.32	99.06
	2	99.83	99.90	93.32	99.06
	3	99.98	99.99	95.60	99.61
	4	99.48	99.98	80.47	99.59
88/89	1	99.92	99.99	96.57	99.48
	2	99.90	99.95	84.61	99.41
	3	99.80	97.45	85.70	99.79
	4	---	---	---	---
89/90	1	99.73	100.00	81.70	99.10
	2	99.90	100.00	78.60	99.10
	3	99.81	99.90	46.90	98.90
	4	99.70	99.90	85.80	99.63
90/91	1	97.70	99.90	---	---
	2	88.90	99.80	82.00	---
	3	98.22	99.90	85.70	99.98
	4	87.80	99.90	82.50	99.90
91/92	1	99.50	99.90	---	99.50
	2	94.30	99.60	---	99.70
	3	99.30	99.90	85.70	99.60
	4	97.20	99.90	66.30	99.90

Source: QUARTERLY MAINTENANCE STATISTICS BY HEADQUARTERS
PROGRESS REVIEW TECHNICAL SERVICES

As clearly seen in the above tables, maintenance of the external plant has been improving in Faults Per Line Per Year, i.e., 2.38 in 1986 to 0.29 in 1991, marking the better value than the target of 1.5, while Maintenance Efficiency remains between 58% and 87% and no steady improvement has been observed.

The target value, 1.5, for Faults Per Line Per Year was established by the PTC relaxing the ITU recommended value, 1.0, taking into account Zambian local conditions.

The Maintenance Efficiency is defined as a ratio of total cleared faults to total reported faults in percentage and the target was set at 95% where 70%, 90%, 97% and 100% of the reported faults should be cleared within 24 hours, 48 hours, 7 days and over 7 days, respectively.

For the transmission system and earth station facilities, the availability defined as

$$A = \text{MTBF}/(\text{MTBF} + \text{MTTR})$$

where, MTBF: Mean Time Between Failures
MTTR: Mean Time To Repair

has been used and the target is set at 99.99%.

Reviewing the past data on the transmission system and earth station facilities, the target value has been more or less satisfied.

For the carrier system, the achievement seems to be rather poor and there is no consistent improving tendency though no target figure has been established yet.

For the telex exchange, availability shows rather good figure, though so far no target figure has been set either.

According to the AD Technical Service, causes of poor maintenance of the external plant are summarized as follows:

- a) Shortage of Vehicles
- b) Shortage of Skilled Manpower
- c) Shortage of Spares
- d) Shortage of Proper Tools and Instruments
- e) No Adherence to Standard Procedures (Engineering Instructions)
- f) Poor Workmanship
- g) Poor Supervision
- h) Incomplete Plant Record (Not Up-Dated)

(2) *Billing Facilities, Billing and Collection*

- a) Billing Facilities

A country-wide network for billing systems is shown in Figure 3-1-4.

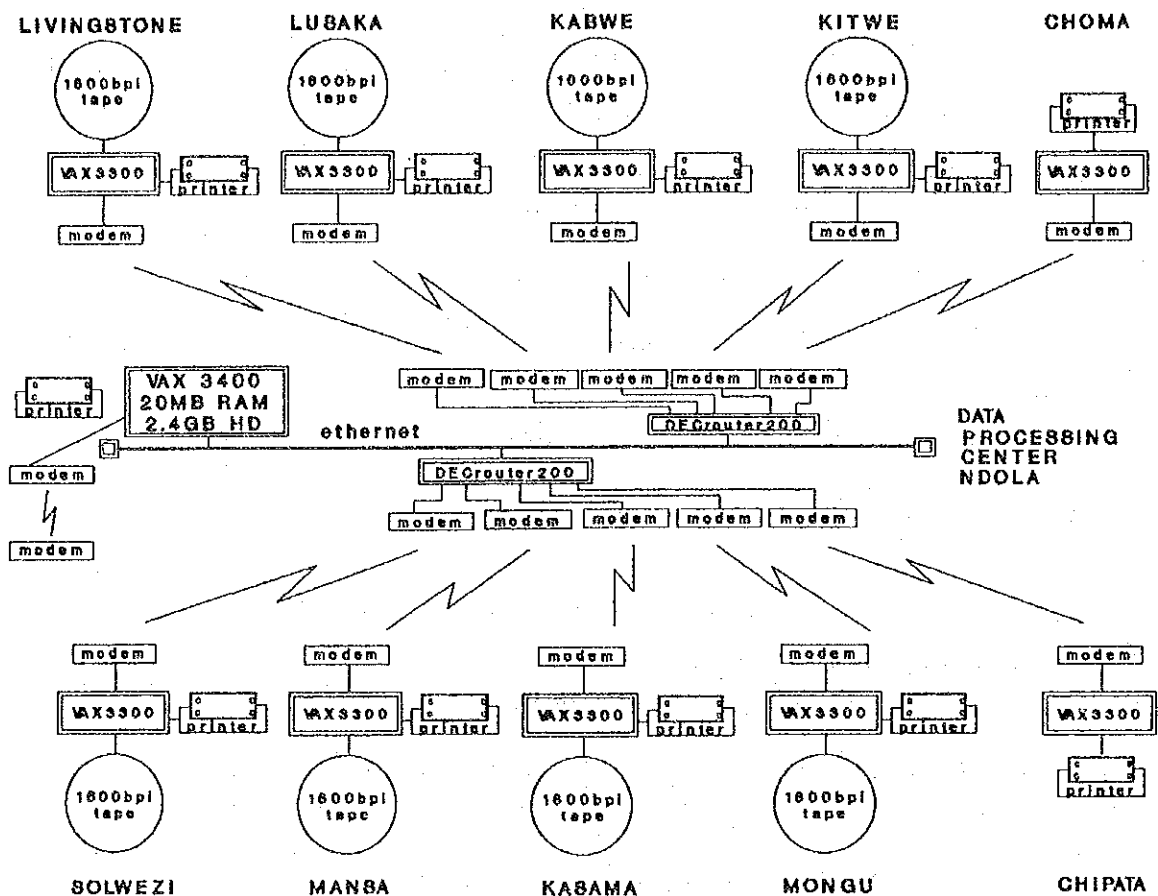


Figure 3-1-4 PTC Country-Wide Network

The billing facilities were purchased from DEC (Paris) through a local agent, Real Time Computer System, in December 1989, delivered in May 1990 and installed in October 1990.

The Data Processing Center is located in the compound of the Staff Training College in Ndola and, to this Center, data of billing for each exchange are sent through microwave links.

Present situation of each site is given below:

- | | |
|-------------------------|--|
| - Lusaka and Kitwe | In operation. |
| - Livingstone and Mongu | Not yet in but ready for operation. |
| - Solwezi and Mansa | To be modified to solve a minor problem due to lightning. |
| - Kasama and Kabwe | Software which is not compatible with exchange equipment is under modification and in the meantime the computers at Kasama and Kabwe have been transferred to Kitwe and Lusaka, respectively, for provisional use. |

- Choma and Chipata Software is under test and the operation will start by Feb. 1993.

It is noted that the installed facilities include old type computers, i.e., ICL ME29 in Ndola Data Processing Center.

According to Data Processing Manager, the existing computers installed at Lusaka and Ndola are insufficient in capacity for processing the data, and the provision of more powerful computers is necessary for billing and also for corporation's administration and management. However, it has not yet been realized due to lack of fund.

b) Billing

The PTC maintains four types of exchanges which can be categorized as digital, electronic, crossbar and manual.

The digital and electronic exchanges billing data are recorded on magnetic tapes which are mounted on exchanges at the beginning and the end of each billing period. After being dismantled, the magnetic tapes are forwarded to Ndola Data Processing Center for processing.

Not all electronic exchanges have their billing data recorded on magnetic tapes. Some electronic exchanges have billing data recorded on Mechanical meters e.g. MCR's.

For cross-bar and manual exchanges, billing data are obtained through meter reading, and the data obtained are entered into meter books. Thereafter, these are forwarded to Regional Data Processing Centers in Lusaka and Kitwe.

Billing data for manual exchanges is obtained by writing a paper ticket. There are no meters on the existing manual exchanges.

The information is keyed onto the diskettes which are later sent for processing in Ndola.

c) Collection

Collection of telephone charges from subscribers is of vital importance in managing and operating telecommunications services for the public.

It is a serious problem for the PTC that there is a considerable amount of accumulated telephone charges left uncollected. At present, such outstanding accounts amount to approx. 2.05 billion Kwacha as shown in DATA BOOK (Table 1-2-1) for SUMMARY OF BILLING VS. RECEIPTS FOR NATIONAL CALLS.

2. Finance and Investment

2.1 Financial Status

A review on the PTC's financial statements for the latest 7 years from the fiscal year ended March 31, 1992 (hereinafter respectively stated "85/86", "91/92", etc.) was made for the purpose of analyzing its financial status including profit and loss; assets, liabilities and equity; and source and application of funds. The results are indicated in Tables 3-2-1 to 3-2-4.

It is considered essential that in conducting the review the preconditions which the company has to follow as being a public utility service entity should be taken into account as follows:

- a) Capital intensiveness through the large scale investment in high technology equipment and facilities normally required for the telecommunications business as an infrastructure for the socio-economic activities.
- b) Zambia finances such investment mainly through ODA obtained from international institutions and/or bilateral government sources. In contrast with other infrastructure projects executed under grant aid(s) which is now usual practice for the country, this project is based upon long-term loans. Accordingly persisting high inflation and continuous sharp devaluation of the country's currency Kwacha resulting from its economic performance would decisively affect the operations of the company.
- c) Telephone charges from subscribers, which represent the essential part of revenues, are subject to the government control and have less elasticity even in need of upward adjustment because of the nature serving people's welfare for wide variety of communications activities of public, private and business sectors.

(1) Profit and Loss (See Table 3-2-1)

- a) The company once registered the profit (after tax and dividends) in 89/90 at the peak ratio of 14.5% to turnover on the foreign exchange loss deferring treatment basis as adopted under their accounting rule. However, the results of operations became sharply declined in 91/92 and showed red figures 547 million Kwacha or 8.4% loss to turnover due to high inflation and devaluation of Kwacha.
- b) Main causes of loss in 91/92 are as follows:
 - The gap between revenues and expenditures pertaining to overseas calls, where the company always suffers from the shortcomings of revenues against expenditures at a rate of 1 to 1.4 - 1.6 due to the fact that outgoing calls exceed incoming calls, increased to 7.8% of total revenues.
 - Provision for bad and doubtful debts increased to 9.7% of total revenues.

- Foreign exchange losses arising from the purchase of equipment and payment of creditors in addition to those on loans soared to the record high of 29.0% of total revenues.
- Interest expense increased to 10.4% of total revenues.
- Overhead expense items of staff costs and housing expenses, which had been showing decreasing tendency, reversely showed a big increase.

(2) Balance Sheet (See Table 3-2-2)

- a) Increase in assets employed and decrease in equity ratio due to the deferring treatment of foreign exchange loss

Capital structure as of March 31, 1992 showed equity ratio at 10.2% only as against long-term debt at 89.8% due to the simultaneous big increase in deferred foreign exchange losses as well as in long-term loans. This phenomenon is attributable to the company's accounting rule. It is necessary that such low equity ratio should be normalized to restore stability in the management of the company.

- b) Subscribers' slow payment of telephone bills and increase in provision for bad and doubtful debts

Turnover period of receivables from subscribers slowed down to 7.8 months of monthly revenues as of March 31, 1992 from less than 6 months obtaining in the previous fiscal years. As a result receivables soared to 4,264 million Kwacha, 2.7 times of the previous year. Provision for bad and doubtful debts as of March 31, 1992 was set at 18.1% of the above stated amount.

- c) Big increase in current liabilities

As a result of the above stated financial conditions, the company imperatively took the measure for its cash flow requirements in delaying payments which further resulted in the outstanding balance of current liabilities of 7,348 million Kwacha as of March 31, 1992, 3.3 times of the previous year.

(3) Funds Statement (See Table 3-2-3)

- a) Source and application of funds of the company for 4 years between 87/88 - 90/91 were moderately balanced, reflecting the improving profit and loss status and realization of loans under its financing plan.

- b) However, in 91/92 shortage in the source of funds for capital investment and loan repayment became serious, and on top of that a sharp increase in receivables occurred, as inflation and foreign exchange losses had become aggravated. The company was compelled to take unhealthy one time measure in delaying payments of its liabilities to alleviate cash flow problem on a large scale. Appropriate measures for complete solution should be studied and implemented as soon as possible.

Table 3-2-1 PTC-Telecom Div Profit and Loss

(in Kwacha Million)

Year	85/86	86/87	87/88	88/89	89/90	90/91	91/92
TURNOVER:							
Subscriber	120	231	403	NA	1312	2474	5430
Overseas Adm.	30	52	43	NA	201	411	1037
Others	11	12	30	NA	46	46	72
Total (A)	161	295	476	591	1559	2931	6539
EXPENDITURE:							
Foreign Adm.	59	67	67	NA	321	566	1548
Staff Costs/Hous.	28	42	57	NA	170	410	1042
Ratio to (A) %	17.4	14.2	12.0		10.9	14.0	15.9
Equipment Costs	7	15	21	NA	32	89	270
Depreciation	16	14	45	NA	85	120	172
Interest Expenses	2	25	43	NA	192	262	680
Finance Charges	16	10	3	NA	11	29	70
Other Exp. --Net (*)	24	38	52	NA	203	482	705
Prov. Bad Debts	2	13	28	NA	41	51	636
Misc. Items (*)	-10	-14	-6	NA	-80	-67	-27
Total (B)	144	210	310	NA	975	1942	5096
Ratio to (A) %	89.4	71.2	65.1		62.5	66.3	77.9
PRFT bfr FOREX LOSS	17	85	166	NA	584	989	1443
Ratio to (A) %	10.6	28.8	34.9		37.5	33.7	22.1
FOREX LOSSES:							
Loan; Short-t Portion	NA	NA	NA	NA	NA	NA	NA
Amortised	NA	NA	NA	NA	97	230	569
Asst/Liability rlted.	NA	NA	NA	NA	191	477	1110
Total (C)	29	39	25	NA	301	788	1895
Ratio to (A) %	18.0	13.2	5.3		19.3	26.9	29.0
TOTAL COSTS (B)+(C)	173	249	335	513	1276	2730	6991
Ratio to (A) %	107.5	84.4	70.4	86.8	81.8	93.1	106.9
PRFT bfr TAX	-12	46	141	78	283	201	-452
TAX	0	0	0	4	32	75	95
DIVIDEND	0	0	0	20	25	50	0
PROFIT FOR YEAR	-12	46	141	54	226	76	-547
Ratio to (A) %	-7.5	15.6	29.6	9.1	14.5	2.6	-8.4
Ratio to Asst Empld.	-3.1	6.8	13.6	3.7	8.6	1.6	-6.1

- (Note) 1. Prepared from PTC Financial Statements, Telecom. Div.
2. Numbers on the line of asterisked item have been adjusted so as to equalize them with the corresponding group total number of the Financial Statements.

Table 3-2-2 PTC-Telecom Div Balance Sheet

(in Kwacha Million)

Year	85/86	86/87	87/88	88/89	89/90	90/91	91/92
FIXED ASSETS	277	615	793	1004	1259	2054	3423
Ratio to (A) %	70.7	91.0	76.5	68.5	48.0	42.8	38.0
DEFERRED FIX LOSSES	121	149	197	267	1098	2819	7453
Ratio to (A) %	30.9	22.0	19.0	18.2	41.9	58.7	82.7
NET CURRENT ASSETS	-6	-88	46	195	265	-74	-1866
Ratio to (A) %	-1.5	-13.0	4.4	13.3	10.1	-1.5	-20.7
TTL ASSETS LESS CURRENT LIAB. (A)	392	676	1036	1466	2622	4799	9010
Less:							
LONG-T DEBTS	234	432	612	912	1804	3725	8089
Ratio to (A) %	59.7	63.9	59.1	62.2	68.8	77.6	89.8
NET ASSETS = SHRHLDRS' INTEREST	158	244	424	554	818	1074	921
Ratio to (A) %	40.3	36.1	40.9	37.8	31.2	22.4	10.2
A/C R'CVABLE FROM SUBSCRIBERS (B)	72	117	221	NA	751	1555	4264
Turnover Period: Mo.	5.4	4.8	5.6		5.8	6.4	7.8
PROV. BAD DEBTS	10	23	50	NA	86	137	772
Ratio to (B) %	13.9	19.7	22.6		11.5	8.8	18.1
CURRENT LIAB.	52	195	270	NA	987	2207	7348
Turnover Period: Mo.	3.9	7.9	6.8		7.6	9.0	13.5

LOAN BALANCE as of March 31, 1992

(in Kwacha Million)

IBRD	(Direct)	2141
ADB	(thru GRZ)	2466
OECF	(thru GRZ)	3541
DANISH	(thru GRZ)	402
FRENCH	(thru GRZ)	627
JAPAN	(thru GRZ)	133
Other	(Direct)	113
Total		<u>9423</u>
Short-Term Portion		<u>-1481</u>
Long-Term Portion		<u>7942</u>

Table 3-2-3 PTC-Telecom Div Funds Statement

(in Kwacha Million)

Year	85/86	86/87	87/88	88/89	89/90	90/91	91/92
SOURCE OF FUNDS:							
From Operations	35	82	211	NA	461	602	493
Loans	54	136	111	NA	84	272	204
Capital Grants	0	61	43	NA	28	0	63
Sale of Assets	0	1	1	NA	7	2	5
Capital Subscribed	83	32	42	NA	14	0	0
Total (A)	172	312	408	NA	594	876	765
APPLICATION OF FUNDS:							
Fixed Assets	174	340	218	NA	226	651	797
Loan Repayments	10	33	2	NA	157	156	402
To Posts Div.	0	8	10	NA	36	33	160
Dividends	0	0	0	NA	10	20	50
Interests	1	-3	1	NA	1	13	17
Others	12	0	0	NA	4	0	0
Total (B)	197	378	231	NA	434	873	1426
(DECREASE)/INCREASE IN WORKING CAPITAL (A) - (B)	-25	-66	177	NA	160	3	-661
(DECREASE)/INCREASE IN W. CAPITAL BY COMPONENTS:							
Stores	6	12	66	NA	68	20	220
Debtors	37	31	88	NA	360	900	2606
Current Liab.	-48	-141	-41	NA	-339	-905	-3852
Total (C)	-5	-98	113	NA	89	15	-1026
Cash/Overdraft (D)	-20	32	64	NA	71	-12	365
(C) + (D)	-25	-66	177	NA	160	3	-661

Increase in Current Liabilities during 91/92

(in Kwacha Million)

Other Crdtrs	2408
Interest Payable	890
Trade Crdtrs & Accruals	430
Misc.	124
Total	<u>3852</u>

2.2 Investment Status

- (1) A study was made on investment conducted for past 7 years between 85/86 - 91/92 with respect to the capital investment efficiency and whether such investment was made under the rule to maintain the required functions of the telecommunications facilities. Turnover rate of tangible fixed assets and estimated annual diminishing value of equipment/facilities were adopted as criteria for the assessment of capital investment efficiency and maintenance of functions respectively.

Since there is no readily available data from the financial statements, the following method was used.

In order to eliminate fluctuation of currency, all numbers were converted into U.S. Dollars. Capital investments and total revenues were converted into U.S. dollars by applying the average exchange rate for each year. Annual diminishing value was estimated by applying the following formula which is based on the actual records in Kwacha but excluding foreign exchange losses; i.e. (tangible fixed assets at beginning of year + capital investments) x 93% (weighted average) = tangible fixed assets at end of year. Thus, annual diminishing value is finally calculated.

- (2) As a whole until 90/91 capital investments appears to have been carried out more or less in accordance with the investment plan as originally set. Mainlines increased to 150% by 90/91, while revenues per mainline increased to 145% by 89/90 then declined to the level of 112 - 113% in 90/91 and 91/92. Finally, in 91/92 capital investments appeared to be less than estimated annual diminishing value due to the cash flow problem as described in Item 2.1. Accordingly it is observed that maintenance of the required functions of telecommunications facilities would be left for future solution.

Table 3-2-4 Investment Status

(in US\$ Million)

	86/86	86/87	87/88	88/89	89/90	90/91	91/92	Total
Investment \$ = K	64.1 2,741	39.2 7,305	24.3 8,889	29.8 8,224	17.5 12,903	22.5 28,989	12.9 61,728	210.3
Diminish To F. Asst (A)	9.1 114.0	11.2 142.0	11.3 155.0	12.8 172.0	13.5 176.0	13.5 185.0	13.9 184.0	85.3
Revenue (B) \$ = K	59.3 2,714	40.4 7,305	53.5 8,889	71.9 8,224	120.8 12,903	101.1 28,989	105.9 61,728	552.9
Turnover Rate (B)/(A);tm	0.52	0.28	0.35	0.42	0.69	0.55	0.58	
Fixed Asst / ML;\$	2,630	3,040	3,040	2,940	2,900	2,840	2,670	
RVNU/ML;\$	1,370	870	1,050	1,230	1,990	1,550	1,540	
Main Line	43,406	46,647	50,919	58,492	60,750	65,057	68,935	

3. Telecommunications Services

The national telecommunications services currently provided by the PTC are categorized as follows:

- a) Telephone Service
- b) Non-telephone Service (Telex, Telegram and etc.)

3.1 Telephone Service

3.1.1 Subscribers and Waiters

Table 3-3-1 shows the growth of the telephone connections in Zambia during 20 years since 1972. As seen in the Table, the telephone density as of September 30th 1992 is 0.88 per 100 inhabitants, while the number of public telephone coin boxes is still small, i.e., approx. 400. The automatic service rate in term of the number of main telephone lines has already reached 99.9% in 1992.

Table 3-3-1 Telephone Service Development (Long-Term)

Item	1972	1977	1982	1987	1992
Main Telephone	4,984	9,398	34,904	46,647	70,756
(Automatic)	4,915	9,330	34,734	46,359	70,663
(Manual)	69	68	172	288	93
Public Coin Box	47	102	193	301	425
Population (x1000)	4,800	5,900	6,930	7,031	7,818
Telephone Density	0.10	0.16	0.51	0.66	0.88

Note: Telephone Density indicates a number of Main Telephone Lines per 100 population.

Table 3-3-2 and Figure 3-3-1 indicate the telephone service development during the past 5 to 8 years, together with the number of waiting applicants. As shown in the Table, the subscriber accommodation ratio is only 52.8%, and the remaining 47.2% are kept waiting for telephone installation, although the exchange capacity is almost enough to accommodate all of them. This is mainly due to the unbalanced provision of external subscriber cables.

Table 3-3-2 Telephone Service in Zambia (Short-Term)

Item	1988	1989	1990	1991	1992
Subscriber	50,799	58,404	60,750	65,057	70,756
Waiter	28,807	29,090	36,491	52,526	61,868
Total Demand	79,606	87,494	97,241	117,583	132,624
Exchange Capacity	90,958	92,278	108,874	114,474	122,874

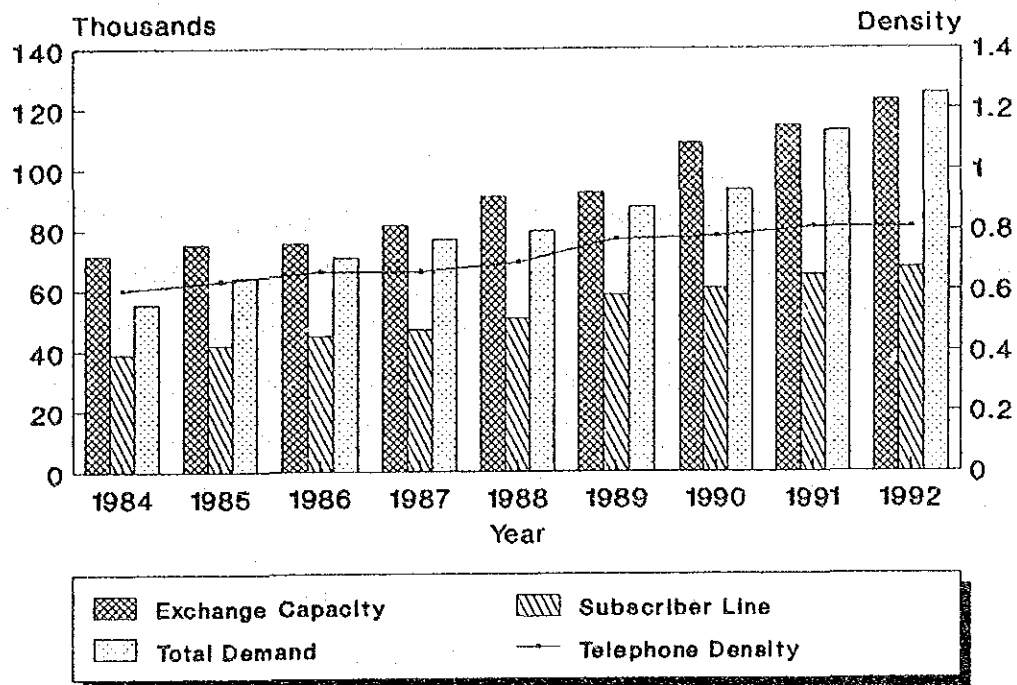


Figure 3-3-1 Telephone Service in Zambia

The total demand of 132,624, the ratios of working lines, waiters for marketing and waiters for practical installation are 53.4%, 43.2% and 3.5% respectively as shown in the Figure 3-3-2. The waiters for marketing can be further classified into the following as illustrated in Figure 3-3-2.

- a) No Switching Line Unit : Waiters who cannot be served due to the shortage of exchange lines.
- b) No Cables & DPs : Waiters who cannot be served due to the non availability of main cables or DPs.
- c) Out of Area : Waiters who are living outside the telephone exchange service area.
- d) Under Survey : Waiters who need further survey by PTC to clarify the reason for not being accommodated.

Figure 3-3-2 shows the distribution of total demand (132,624) into 11 cities and provincial areas, as of September 30, 1992.

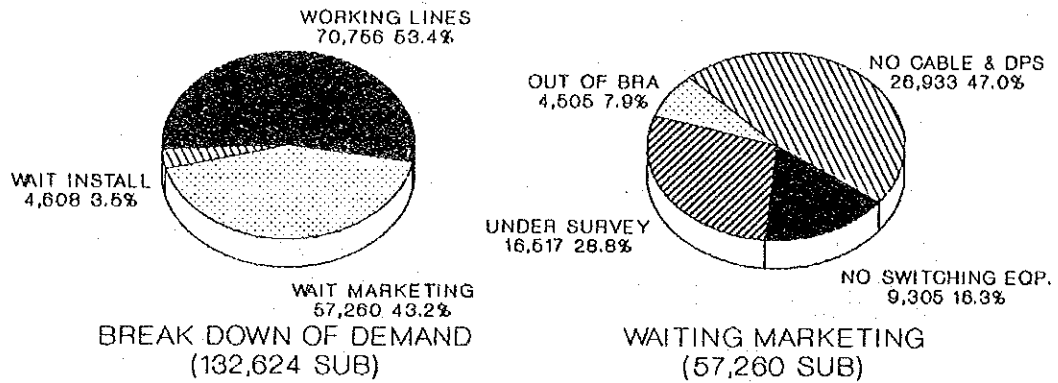


Figure 3-3-2 Total Demand and Waiting
(As of September 30, 1992)

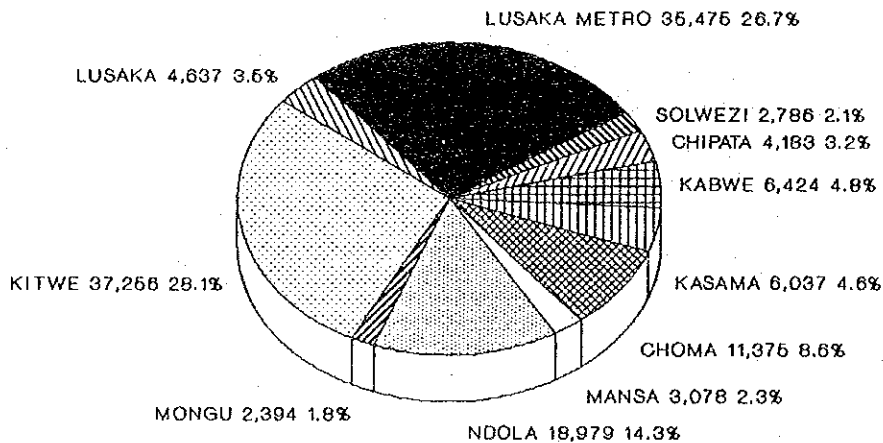


Figure 3-3-3 Total Demand Distribution
(As of September 30, 1992)

3.1.2 Service Quality

Figure 3-3-4 presents the call completion ratio in each area in terms of local, trunk and international calls. The average of call completion ratio is about 30 % which should be improved in order to get more revenue.

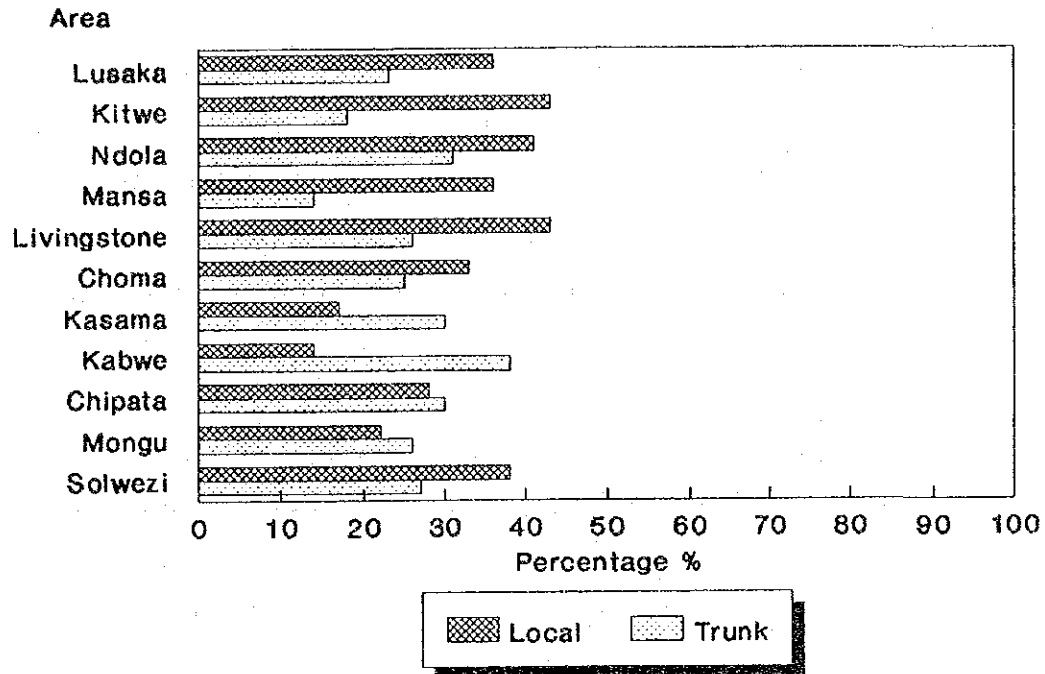


Figure 3-3-4 Call Completion Ratio (% in 1992)

3.1.3 Enhanced Telephone Services

The current telephone service provides POTS (Plain Ordinary Telephone Service) and the following enhanced services to the subscriber service areas where the digital SPC exchanges are operating.

- a) Do Not Disturb
- b) Automatic Transfer
- c) Automatic Alarm Call (Wake Me Up)
- d) Call Waiting
- e) Abbreviated Dialling
- f) Restricted Dialling
- g) Conference Call

3.1.4 International Telephone Service

The international direct dialling (IDD) service is available for all subscribers except for those who are served by the conventional type of exchanges in several areas.

a) Exchange Type with IDD Facility

- NEAX61E digital SPC exchange
- E10B digital SPC exchange
- ARF Cross-Bar Exchange
- NX1E Semi-SPC Exchange
- MCR Semi-SPC Exchange

b) Exchange Type without IDD Facility

- C23 Cross-Bar Exchange
- Manual Exchange

3.1.5 Public Call Office

Existing PCO (Public Call Office) policies, date back to the colonial era and followed those in practice in the British Post Office.

PCO facilities were purchased in the early 70's and the second consignment was an aid from Danish International Development Agency (DANIDA).

Presently, PTC has about 400 units for use by the public. According to the research conducted by PTC, the following main problems were reported concerning PCO terminals in the whole Zambia as of November 1991.

- a) The shortage of coins due to the non-availability of coins in the country.
- b) PCOs are often subjected to vandalism, making it difficult to maintain PCOs in satisfactory condition.
- c) The lack of staff, vehicles and spares renders low availability of PCOs.

The number of PCOs is shown in Table 3-3-3.

Table 3-3-3 The Number of PCO Lines

Region	1985	1986	1987	1988	1989	1990	1991
Northern	115	147	173	200	219	202	231
Southern	85	99	128	165	199	219	197
Total	200	246	301	365	418	421	428

Source: "PTC BI-ANNUAL TELEPHONE AND TELEX EXCHANGES UTILIZATION STATISTICS REPORT 1998-1991"

To solve the non-availability of coins, PTC decided to employ its own special coins for public pay-phones under a DANIDA's aid. Two types of special coins are available: one-unit (called local token) and five-unit (called distance token). PTC will change all the 400 public phones throughout the country to the special coin public phones. The special coins (tokens) will be in use by June or July, 1993, subject to approval by the Bank of Zambia. New public pay-phones to replace the existing ones will be installed before June, 1993. DANIDA offered to provide PTC with more public pay-phones if the use of special coins will be a success.

3.1.6 Border Communications

PTC has been providing the so-called "Border Communication" for neighboring subscribers who are located in Zaire beyond the border line and connected to Kitwe and Chingola exchanges in Zambia via UHF and microwave links as a special telephone service to a neighboring country. Ten (10) of the fourteen (14) voice channels terminate at Chingola Telephone exchange. Four (4) channels terminate on manual board at Kitwe. The outline of the "Border Communication" is described in the following:

- a) No. of Subscribers : Total of 7 subscriber lines (Zairian Manta Forest, Gecamines, etc.)
- b) Host Exchange : (i) Chingola ARF local exchange
(ii) Lubumbashi MT25 exchange in Zaire.
- c) Transmission Line :
 - Microwave Link Kitwe - Mufulira
 - Mufulira - Chingola
 - UHF Link Chingola - Lubumbashi in Zaire
- d) Manual Board Operator : 7 lines (3 connected to Chingola ARF exchange for International calls and 4 connected Lubumbashi MT25 exchange in Zaire).

Analog trunk switches (TS) of ARM type were supplied by Ericsson (SWEDEN).

The settlement of call charges seems to be a long outstanding issue between Zambian PTC and Zairian subscribers.

3.2 Non-Telephone Services

3.2.1 Telex Service

The telex service development in Zambia is shown in Table 3-3-4 and Figure 3-3-5.

Table 3-3-4 Telex Service in Zambia

ITEM	1984	1985	1986	1987	1988	1989	1990	1991
No. of Exchanges	1	1	1	1	1	2	2	2
Telex Exchange Capacity	2,048	2,048	2,048	2,048	2,048	4,504	4,504	4,504
Telex Subscriber Line	1,897	1,938	1,968	1,973	2,048	2,415	2,770	2,875
NATIONAL TRAFFICS (MINUTE) x 1000	3,999	4,201	3,340	3,489	3,451	3,202	2,548	1,951
INTERNATIONAL TRAFFICS (MINUTE) x 1000	2,032	2,192	1,860	1,668	1,585	1,509	1,309	593
TOTAL TRAFFICS (MINUTE) x 1000	6,031	6,393	5,200	5,157	5,036	4,711	3,857	2,544
Waiting List	156	262	273	339	637	872	742	1,094
No. of Main Telephones	38,924	41,929	45,075	47,037	50,799	58,442	60,750	65,057
Telex Sub./Telephone	0.155	0.152	0.115	0.110	0.099	0.081	0.063	0.039

Source: "A STATISTICAL PROGRESS REVIEW ON SERVICES, REVENUE AND EXPENDITURE FOR THE PERIOD 1983/84-1990/91" issued by PTC

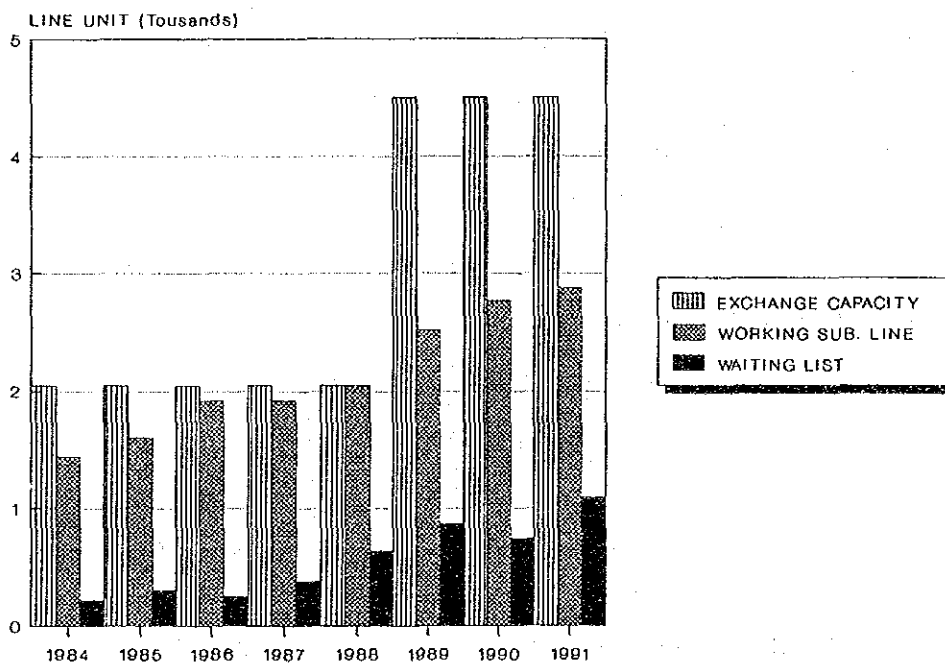


Figure 3-3-5 Telex Service in Zambia

- a) The number of subscriber lines increased by 51.6% during the period of 8 years from 1984 to 1991.
- b) The number of telex PCOs increased gradually in 8 years from 1984 to 1991, reaching 16 in total.
- c) The number of telex waiting applicants at 1991 reached more than seven times the figure at 1984.
- d) The ratio in the number of telex subscriber lines to the total number of main telephones decreased in the past 3 years from 1989 to 1991. The telex network expansion has not been carried out positively.
- e) The telex traffic has been rapidly decreasing since 1989, because telex users began to shift their communication means from telex to facsimile.

3.2.2 Telegram Service

The telegram service development in Zambia is shown in Table 3-3-5 and Figure 3-3-6

Table 3-3-5 Telegram Service in Zambia

ITEM	1984	1985	1986	1987	1988	1989	1990	1991
Domestic Messages (x 1000)	640	726	823	766	678	712	801	888
International Messages (x 1000)	72	63	43	26	23	23	16	12
Total Messages (x 1000)	712	789	866	792	701	735	817	900
No. of Telegram Offices with teleprinters	59	62	65	68	70	71	73	73
No. of teleprinters for GENTEX system	155	158	160	161	164	172	175	176
Telegram Leased CCTS	-	-	-	-	96	101	101	106
Population (x 1000)	6,445	6,656	6,873	7,098	7,330	7,570	7,818	8,074
Telegram/100 persons	11.05	11.85	12.60	11.16	9.56	9.71	10.45	11.15

Source: "A STATISTICAL PROGRESS REVIEW ON SERVICES, REVENUE AND EXPENDITURE FOR THE PERIOD 1983/84-1990/91" issued by PTC

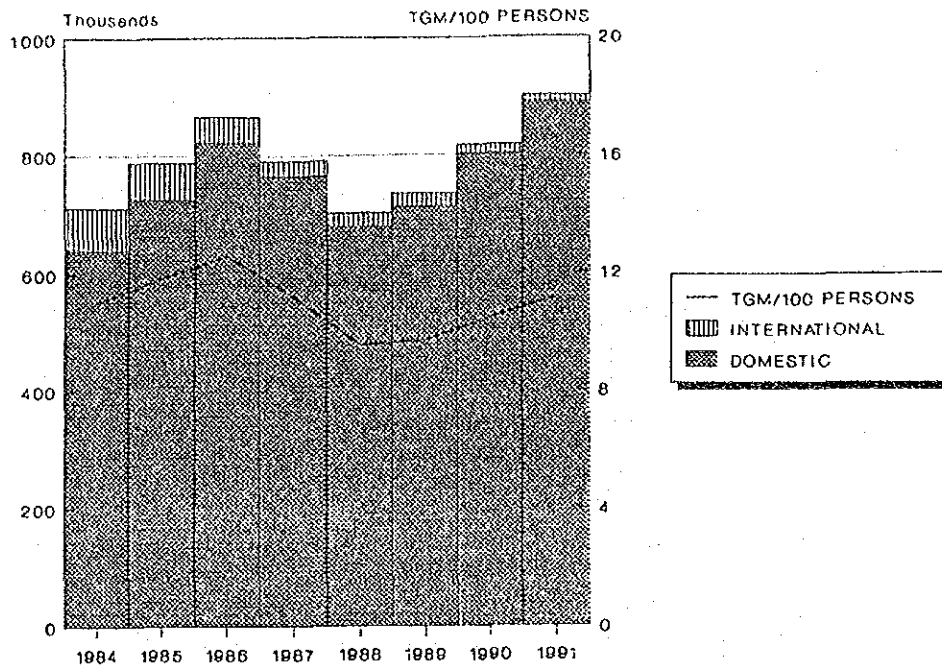


Figure 3-3-6 Telegram Service in Zambia

- a) The public telegram services for both international and domestic communications are available principally at 160 Post Offices and 84 Telegraph Offices as of 1991.

The delivery of telegram is by messengers within certain prescribed zones of telegraph offices. Beyond the prescribed delivery zones, post offices can offer delivery service. The majority of these offices work from 0800 to 1630 hours from Monday to Friday and from 0800 to 1300 hours on Saturday.

- b) Teleprinters of GENTEX system as automatic telegram send/receive system have been certainly expanded. 176 teleprinters of GENTEX system are in operation with telex network as of 1991.
- c) A "Phonogram" service is available by telephone subscribers on code 107.
- d) The number of domestic telegrams increased by 38.8% during the period of 8 years from 1984 to 1991.
- e) The number of international telegrams decreased rapidly by 30.9% annually during the period of 8 years from 1984 to 1991.
- f) The number of leased telegram (Inter-town, Local) circuits has been increasing gradually.

3.2.3 Facsimile Service

The facsimile service is provided by the telephone network in Zambia. The number of facsimile subscriber lines listed in the TELEPHONE DIRECTORY published by PTC has been increasing rapidly. This fact shows that the demand for data communication is growing. The number of terminals is now estimated to be more than 600.

3.2.4 Leased Circuits Service

The number of leased circuits is shown in Table 3-3-6

Table 3-3-6 Leased Circuit Services in Zambia

Item	1987	1988	1989	1990	1991	1992
INTER-TOWN	213	222	231	234	247	249
INTERNATIONAL	19	21	23	24	26	28
TOTAL	232	243	254	258	273	277

The leased circuit service is currently offered by utilizing the public telephone network. The number of leased circuits has been gradually increasing. In Zambia, Government offices, news agencies and banks are major users.

4. Telecommunications Network

4.1 Outline of Network

The current telecommunication facilities in Zambia are itemized as below:

a) Switching System

Most of the existing exchange systems are of automatic exchange, and a very few are manual exchanges which are used in rural areas. The digital SPC exchanges have been introduced into the national telephone network and international gateway exchanges. The digitalization ratio is relatively large, i.e., around 40% in terms of the number of lines.

b) Transmission System

Contrary to the switching system, a very few digital transmission facilities have been used in Zambia. As the existing transmission system, analog FDM microwave facilities are widely used linking all provinces. UHF and VHF facilities are also used to cover isolated areas. Earth stations for the international traffic are located in the suburban area of Lusaka.

c) External Plant System

The most serious issue of the existing network is how to upgrade the external subscriber line cables in terms of volume and quality to absorb the existing waiting subscriber demand which is rather too large, as compared with the quantity of the existing subscriber lines.

d) Rural Telecommunications

Existing rural telecommunication facility used in Zambia is MARS (Multi Access Radio System) or RRS (Rural Radio Subscriber system).

e) Telex System

The telex facility is in use for business subscribers.

4.2 Switching System

The current telephone switching facilities consist of automatic switching systems and manual boards. Switching systems are provided as follows:

4.2.1 Local Exchange

A total of 95 units of local telephone exchanges are installed in 92 exchange offices. 99.9% of them have been automatized in terms of exchange capacity, and 95% in terms of exchange unit, while 44% in terms of exchange capacity have been digitalized.

The existing telephone switching systems are summarized in Table 3-4-1.

Table 3-4-1 Summary of Local Telephone Switching Systems

Description	Provision	% of total
a) No. of Exchanges	91	(100%)
Automatic	86	95%
Manual	5	5%
b) Switching Units	95	(100%)
Digital (NEAX61E,E10B)	20	21%
Analog Electronics (NX1E,MCR)	47	50%
Cross Bar (ARF,ARK,C23)	23	24%
Manual (PLESSEY)	5	5%
c) Exchange Capacity	122,874	(100%)
Digital	54,000	44%
Analog Electronics	35,324	29%
Cross Bar	33,400	27%
Manual	150	0.1%

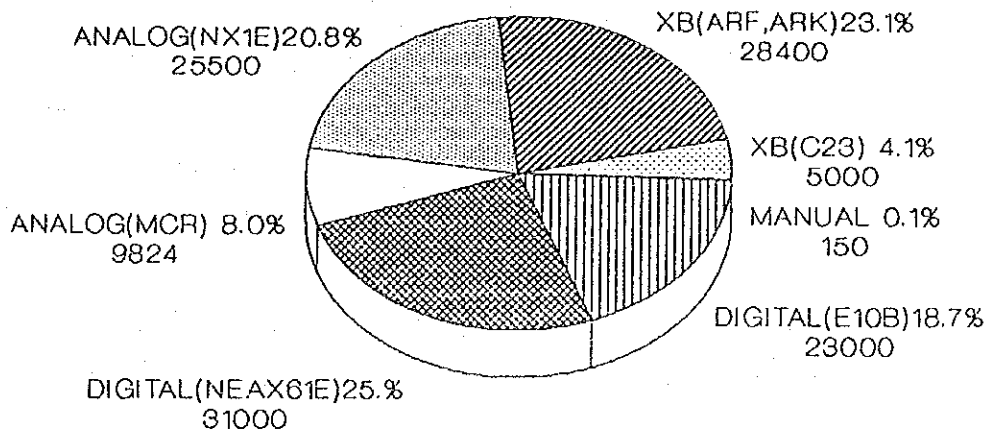


Figure 3-4-1 Local Switching Capacity

4.2.2 Toll Exchange

There are 11 Primary Centers (PC) in the capital of each province, Ndola and Choma.

Toll Stage (TS) telephone exchanges are provided in these Primary Centers as shown in Table 3-4-2.

Table 3-4-2 Summary of Primary Centers

Province	Primary Center	TLS (Combined)	TS (Separate)
Lusaka Copper Belt	Lusaka Kitwe Ndola	NEAX61E NEAX61E E10B	ARM
Luapula Southern	Mansa Livingstone Choma	NEAX61E E10B	ARM
Northern Central	Kasama Kabwe	NX-1E NX-1E	ARM
Eastern Western Northwestern	Chipata Mongu Solwezi	NEAX61E NEAX61E	ARM

Inter- and intra-province calls from local exchanges are connected through these TS exchanges.

In accordance with the existing switching and trunk network diagram, the Secondary Centers (SC) are located in Kitwe, Lusaka and Ndola.

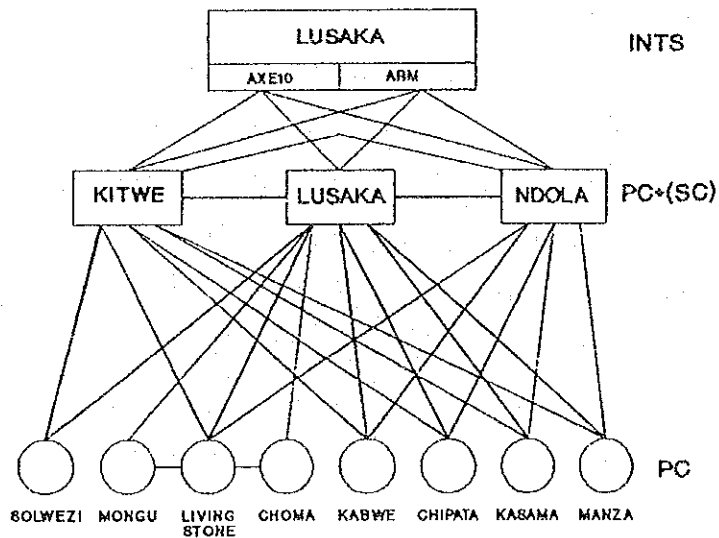


Figure 3-4-2 Existing Network of PC and SC

4.2.3 Tandem Exchange

There are 10 local exchanges in the urban area of Lusaka, and 2 in the urban area of Kitwe.

In Lusaka, each local tandem exchange is expected to carry overflow traffic on a direct route between each two local exchanges.

4.2.4 International Exchange

The international exchange is comprised of the digital and cross-bar exchanges.

4.2.5 Summary of Telephone Exchange

The telephone exchange equipment in service is summarized in Table 3-4-3.

Table 3-4-3 Telephone Exchange Equipment in Service

(As of Sept., 1992)

Stage	Type of Switch	Model	Supplier	Capacity	No. of Unit	Install Year
LS (TLS)	DIGITAL	E10B	ALCATEL (FRANCE)	23,000	(2) *	9 1987
		NEAX61E	NEC (JAPAN)	31,000	(5) *	11 1988-1991
	ANALOG	NX-1E	ITT NORTH (USA)	25,500	(1) *	5 1980-1984
		MCR		9,824	42	1980-1989
	CROSS BAR	ARF	ERICSSON (SWEDEN)	26,200	10	1967-1981
		ARK		2,200	8	1979-1981
		C23	HITACHI (JAPAN)	5,000	5	1980-1991
	MANUAL	PLESSY	PLESSEY (U.K)	150	5	
TOTAL			122,874	95		
TS	ANALOG	ARM		2,000	3	1978-1981
INTS	DIGITAL	AXE10	ERICSSON (SWEDEN)	560	1	1985
	CROSS BAR	ARM		800	1	1980
	TOTAL			1,360	2	

* : Units of TLS

On going projects as of September, 1992 are summarized in Table 3-4-4.

After completion of these on going projects, the digitalization ratio of telephone exchange facilities will increase up to 52 % of the total capacity.

Table 3-4-4 On-Going Projects for Switching Equipment

(As of Sept., 1992)

Stage	Type of Switch	Model	Remove Capacity	Type of New Sw.	New Model	New Capacity	Remark
LS	CROSS BAR	ARF	-5,000	DIGITAL	NEAX61E	5,000	Ridgeway
		C23	-2,000			5,000	2 units
		---	0			3,000	New unit
	TOTAL		-7,000 (3 units)			13,000 (4 units)	
INTS	CROSS BAR	ARM	-800 (1 unit)	DIGITAL	NEAX61E	2,000 (1 unit)	

4.2.6 Items to be Considered

(1) Facility Utilization Ratio in Capacity

The telephone exchange capacity in Zambia is 122,874 terminals, but working subscribers number only 70,756 (as of September, 1992). Approximate 60 percents of the total exchange capacity is being utilized.

On the other hands, the total number of telephone service waiters (Business and Residential) is amounts to 52,537.

Table 3-4-5 Ratio of Subscribers to Capacities

Description	Subscribers	% of Subs./Capas
Digital	36,115	67%
Analog Electronics	15,304	43%
Cross Bar	19,245	58%
Manual	92	61%
Total	70,756	58%

The biggest issue of the waiting list is the insufficient provision of the local cables. Excluding the number of waiters under investigation, the second biggest factor contributing to low utilization of exchange capacity is the lack of spare parts for the switching equipment.

It is not possible to newly procure spare parts for the NX1E and MCR exchanges as the manufacturers are no longer producing such parts. These models need to be replaced at an early stage before expiry of their economic life.

For the time being, parts and equipments of NX1E and MCR exchanges removed for replacement will be utilized for those still in use.

(2) C23 Cross Bar Exchanges

C23 cross bar exchange can receive and send only DP (dial pulse), and it cannot be upgraded because the container of a C23 cross bar exchange has no space to add the advanced functions, such as identification of originating subscribers, etc.

(3) MCR Analog Exchanges

MCR analog switching equipment consists of packages for 128 subscribers, trunks and control units, which are all accommodated in one locker. Since the number of trunks which can be accommodated in a locker is limited, the capacity of the trunks will be not enough to meet the traffic of 128 subscribers.

(4) Scale of Each Exchange

The distribution of capacity of telephone exchange units is shown in Table 3-4-6.

Table 3-4-6 Exchanges Classified by Capacity

Scale of units	Numbers of units	Remarks
10,000 - 20,000	2	Lusaka Main (1), (2)
7,500 - 10,000	2	Kitwe (1), (2)
5,000 - 7,500	5	
2,500 - 5,000	9	
1,000 - 2,500	19	
500 - 1,000	11	
250 - 500	16	
less than 250	35	

The number of units having less than 500 lines is 51. Only 2 units have a capacity of more than 10,000 lines.

(5) Distance from Primary Center to Local Exchanges

The maintenance center for each province is located in the telephone exchange office in the capital of province. The distance in a crow line between the capital of the province and each local office is shown in Table 3-4-7. The average distance in a crow line is 130 kilometers and the maximum distance is 380 kilometers.

Table 3-4-7 Distance Between PC and Local Office

Center	Average Distance (km)	Number of Local Offices	Maximum Distance (km)
Lusaka	75	10	220
Mansa	130	4	210
Choma	100	8	160
Kasama	160	8	200
Kabwe	120	4	230
Chipata	140	8	280
Mongu	110	4	180
Solwezi	230	5	380
Average	133	6	233

4.3 Transmission System

The transmission system maps showing the existing 23 microwave and 28 UHF/VHF links are given in Tables 3-4-8 (1/2, 2/2), 3-4-9 and Figure 3-4-3. The main route covers all provincial centers and other cities. All the links are analogue FDM except for four digital links inter-linking satellite exchanges to the Kitwe Main Exchange. International telecommunication service is provided via the terrestrial radio links and via the INTELSAT VI satellites. The number of international circuit lines is shown in Tables 3-4-9, 3-4-10 and 3-4-11.

The satellite network diagram and the network diagram for AOF (Atlantic Ocean Region) and IOR (Indian Ocean Region) are shown in Figure 3-4-4.

4.3.1 Terrestrial Backbone Radio System

The terrestrial backbone microwave radio and the associated spur UHF/VHF links provide national and international, telephone, telex, telegraph, television and sound programs.

4.3.2 Satellite System

There is no domestic satellite service in Zambia at present. The existing satellite service is served by the INTELSAT VI satellites operating at 60 degrees and 335.5 degrees in the AOR and IOR, respectively.

The two earth stations are located about 40 km away from Lusaka, the capital of the Republic of Zambia, and are of Standard A and Revised Standard A types for the IOR and AOR, respectively. The earth stations are called Mwembeshi I and II for the IOR and AOR, respectively.

Table 3-4-8 (1/2) Existing Microwave Links

	ROUTE	OPERATING FREQUENCY (GHz)	NUMBER OF RF CHANNELS			NO. OF EQUIVALENT TEL. CHANNEL	COMMISSION DATE	SUPPLIER
			TP	TV	STB			
1	Lusaka/Livingstone/ Zimbabwe	6	1	1	1	960	1974	NEC
2	Lusaka/Ilonda Tanzania	6	1	1	1	960	1978/82	NEC NEC
3	Lusaka/Copperbelt	6	1	1	1	1800	1987	NEC
4	Kitwe/Luanshya	6	1	-	1	960	1977	NEC
5	Lusaka/Chipata/Malawi	2	1	1	1	960	1980/84	NEC
6	Lusaka/Mongu	6	1	1	1	960	1978/81	NEC
7	Lusaka/Mass Media	8	-	2	1	960	1981	NEC
8	Chingola/Chililabombwe	6	1	-	1	960	1981	NEC
9	Kitwe/Chingola/Solwezi	7	1	1	1	960	1985	NERA
10	Solwezi/Mwigilunga	2	1	1	1	300	1985	NERA
11	Solwezi/Zambezi	2	1	1	1	300	1985	NERA
12	Solwezi/Kasempa	2	1	1	1	300	1985	NERA
13	Solwezi/Chizera	2	1	1	1	300	1985	NERA
14	Kasama/Mansa	2	1	1	1	960	1987	NEC
15	Kasama/Mporokoso	2	1	-	1	300	1987	NEC
16	Kasama/Nbala	2	1	-	1	300	1987	NEC
17	Kasama/Mpulungu	2	1	-	1	300	1987	NEC
18	Mansa/Samfya	2	1	-	1	300	1987	NEC
19	Mansa/Mwense	2	1	-	1	300	1987	NEC
20	Mansa/Mansa ZNBS	2	-	1	1	-	1987	NEC
21	Mansa/Kawambwa/Nchelenge	2	1	-	1	300	1987	NEC
22	Chipata/Lundezi/Chama	2	1	-	1	300	1987	NEC
23	Chipata/Mfuwe	2	1	-	1	300	1987	NEC
	TOTAL CHANNEL CAPACITY					14,040		

TP - Telephony RF - Radio Frequency
 TV - Television CHN - Channel STB - Standby

Table 3-4-8 (2/2) Existing UHF Links

	ROUTE	NUMBER OF EQUIVALENT TELEPHONE CHANNELS	FR (MHz)	COMMISSION DATE	SUPPLIER
1	Ilonda/Isoka	120	800	1978	NEC
2	Ilonda/Nakonde	120	800	1978	NEC
3	Monze/Gwembe	12	450	1980	GRANGER
4	Choma/Pemba	120	800	1989	GRANGER
5	Mkushi (Rep)/Mkushi (TE)	120	800	1978	NEC
6	Serenje (REP)/(TE)	120	800	1978	NEC
7	Kasama/Chinsali	120	800	1978	NEC
8	Kabwe/Kapiri Mposhi	120	800	1978	NEC
9	Mongu/Kalabo	120	800	1981	NEC
10	Mongu/Senange	120	800	1981	NEC
11	Mongu/Lukulu	120	800	1981	NEC
12	Choma/Itezhi Tezhi/ Namwala	120	800	1981	GRANGER
13	Mazabuka (Rep)/(TE)	120	800	1981	NEC/PYETMC
14	Kafue/Siavonga	120	800	1974	NEC/PYETMC
15	Lusaka/Luangwa	120	800	1984	NEC
16	Kabwe/Chibombo	24	900	1987	NEC
17	Chingola/Lubumbashi (Zaire)	14	900	1987	SAT
18	Lusaka/Chisamba	24	900	1987	NEC
19	Kabwe/Mukonchi	6	400	1991	TELECTRON
20	Lusaka/Kepochi	12	400	1990	HARIS/GRANGER
21	Namalundu (Rep) Namalundu Gorge	12	2000	1991	NORIA/GRANGER
22	Ndola/Masaiti	24	900	1989	TELECTRON
23	Lusaka/Nampundwe	120	900	1989	TELECTRON
24	Lusaka/Chelston/ Int. Airport	120	800	1989	TELECTRON
25	Kitwe/Ilimpi	480	2000	1991	NEC
26	Kitwe/Chambishi	480	2000	1991	NEC
27	Kitwe/Mindolo	360	2000	1991	NEC
28	Kitwe/Kalvulushi	480	2000	1991	NEC
	TOTAL CHANNEL CAPACITY	3,848			

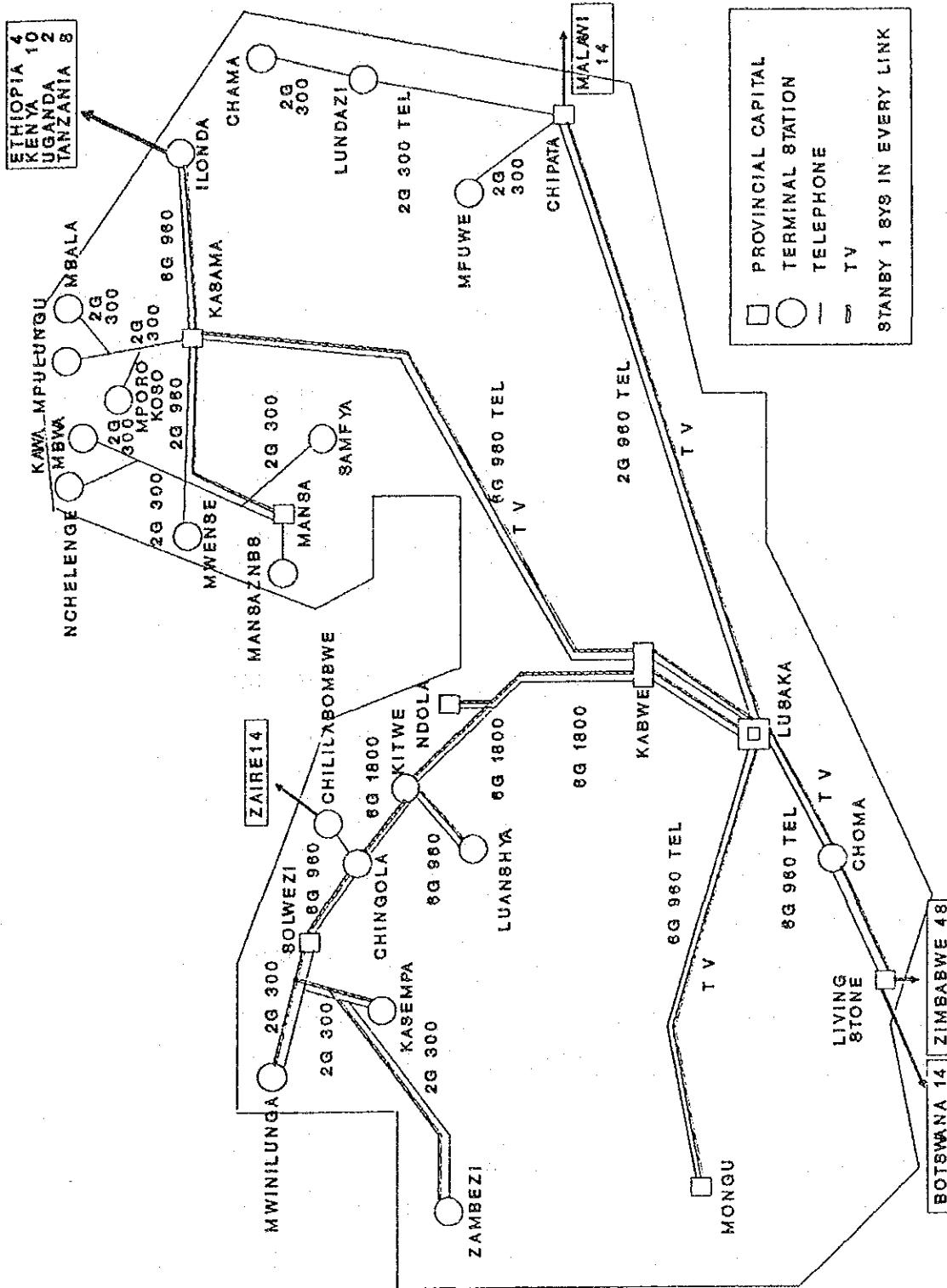


Figure 3-4-3 Backbone Terrestrial Transmission

Table 3-4-9 International Circuits (Indian Ocean Region)

Country	No. of CCTS	Type of CCT
Germany	15	FM/FDM
France	11	FM/FDM
Netherlands	3	FM/FDM
India	4	FM/FDM
Japan	3	FM/FDM
Italy	15	FM/FDM
Belgium	4	FM/FDM
Sweden	3	FM/FDM
Total	58	

Table 3-4-10 International Circuits (Atlantic Ocean Region)

Country	No. of CCTS	Type of CCT
UK	63	IDR
South Africa	41	FM/FDM
Canada	6	FM/FDM
USA	28	FM/FDM
Lesotho	2	SCPC
Angola	2	SCPC
Swaziland	2	SCPC
Total	144	

Table 3-4-11 International Circuits (Terrestrial Route)

Country	No. of CCTS	Type of CCT
Tanzania	8	FDM
Uganda	2	FDM
Kenya	10	FDM
Ethiopia	4	FDM
Zimbabwe	48	FDM
Malawi	14	FDM
Botswana	14	FDM
Zaire	14	FDM
Total	114	

Atlantic Ocean Region

Indian Ocean Region

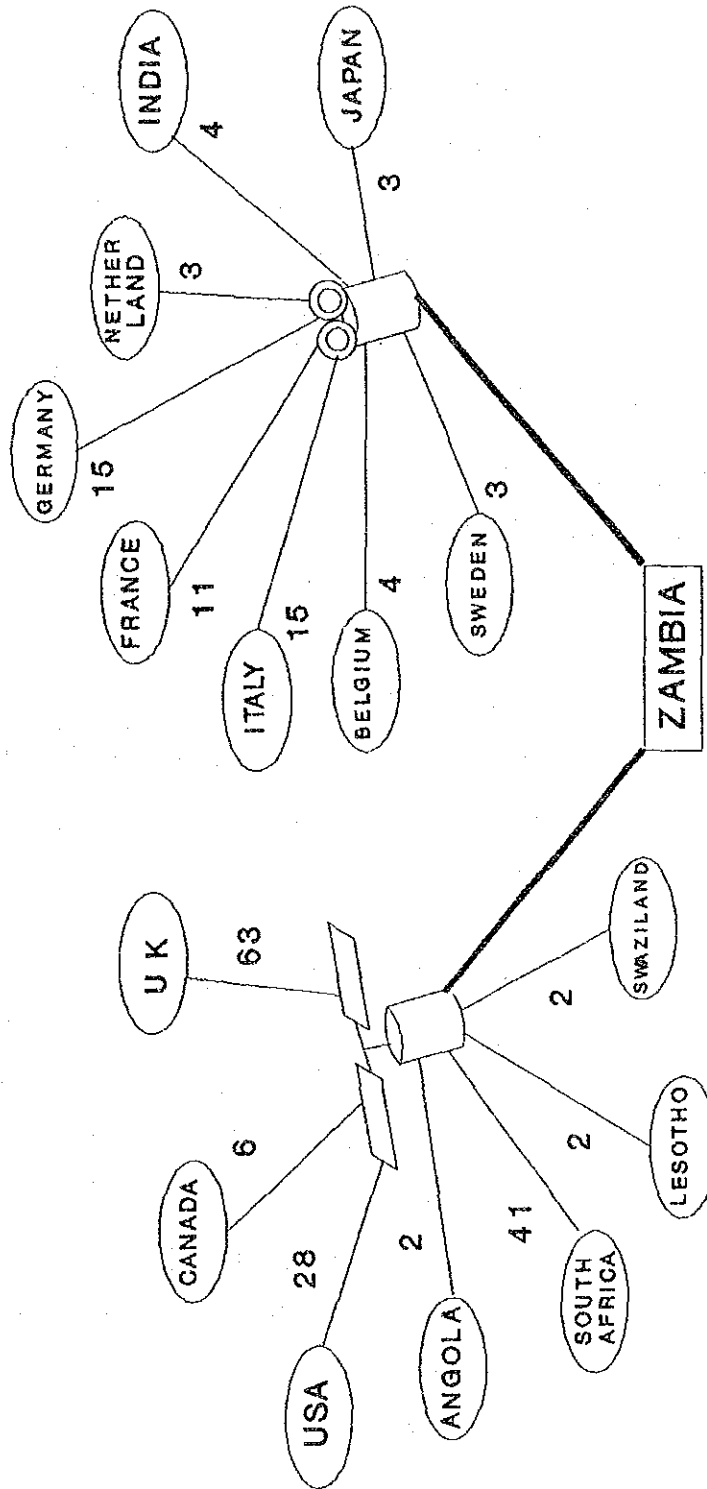


Figure 3-4-4 Satellite Network

4.4 External Plant System

(1) Current Status of Facilities

The current status (as of march, 1992) of external plant facilities is shown in Table 3-4-12 below, in terms of the number of pairs allotted to MDF, CAB, DP, etc., and illustrated in Figure 3-4-5.

Table 3-4-12 External Plant Facilities

Total pairs terminated on MDF	129,700 p
Total pairs terminated on CAB (E-side)	63,200 p
Total pairs terminated on CAB (D-side)	90,100 p
Total pairs terminated on DP	120,400 p
Total pairs stumped (at E-side)	10,100 p
Total pairs stumped (at D-side)	25,300 p
Total number of DP	9,830

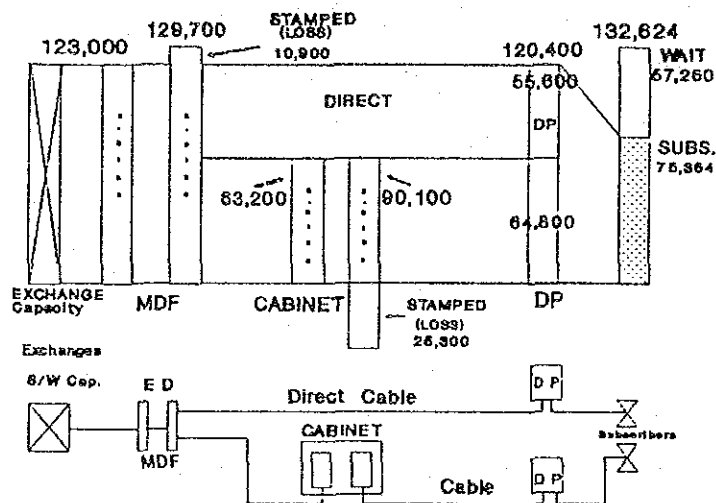


Figure 3-4-5 External Plant Facilities

(2) Facilities Constitution

a) Large Capacity Exchanges

The duct system is applied to accommodate large size of cables for the sections from an exchange to cabinets. From a cabinet to DP (distribution point) direct buried cable is used, and the cabinet system is employed as a distribution method.

b) Small Capacity Exchanges

Direct buried cables and aerial cables are used to connect an exchange to DP without using a cabinet. Open-wires are used for the direct connection of subscribers distant from an exchange.

4.5 Rural Telecommunications

MARS or RSS has been introduced to provide telephone services to vast and sparsely populated areas since 1984.

Table 3-4-13 given below shows the location, capacity and other information on RSS in Zambia.

Another system used for rural services is the open-wire system which is economical in construction cost, though easy to suffer damages due to vandalism, natural disaster, etc., and difficult to expand.

These systems provide telephone services to about 1,300 subscribers in the rural areas as of March, 1992.

Table 3-4-13 Rural Telecommunications

Route	TS	CAPACITY	EQUIPPED RF CHANNELS	FR (MHz)	WORKING LINES	COMMISSION DATE	SUPPLIER
Mufuwe (RSS)	VHF	40CH	10CH	150M	40	1988	NEC
Sunfya (RSS)	VHF	31CH	6CH	150M	20	1988	NEC
Lusaka (RSS)	VHF	367CH	40CH	150M	304	1984	NEC
Kabwe (RSS)	VHF	106CH	12CH	150M	74	1984	NEC
Ndola (RSS)	VHF	31CH	4CH	150M	29	1984	NEC
Mtushi (RSS)	VHF	75CH	8CH	150M	69	1985	NEC
Mongu (RSS)	VHF	31CH	4CH	150M	14	1984	NEC
Total		681CH	84CH		550		

Existing external plant data which have been collected by the questionnaires to be made during the observation trip are shown in Table 3-4-14 (1/3-3/3).

Table 3-4-14 Existing Plant Data (1/3)

CODE NO.	EXCHANGE NAME:	SWITCHING CAPACITY	PAIRS TERMINATED ON MDE	WORKING LINES	FAULTY PAIRS	SPARE PAIRS	PR KM AERIAL CABLE	PR KM E/SIDE	PR KM D/SIDE	PR KM OPEN W.	PR KM JUNCT CABLE	PR KM E/D	DUCT KM
0101	LUSAKA	25,000	19,371	11,087	622	8,284	766	13,837	13,959	448	1,665	6,710	65,000
0102	CHELSTONE	3,000	1,000	1,600	-	200	-	150	348	-	4,000	1,711	60,000
0103	CHINTIKA	1,500	1,300	1,750	244	82	5,630	20	82	-	1,046	-	60,000
0104	EMMADALE	4,000	2,500	1,624	-	876	-	38	175	90	800	1,517	38,000
0105	AIRPORT	512	527	473	35	-	-	-	-	6,000	275	-	-
0106	MAKENI	1,000	527	473	150	54	450	13,246	2,183	-	1,500	6,609	-
0107	RIDGEWAY	5,000	4,596	2,396	75	2,200	-	336	3,630	-	4,000	-	47,000
0108	ROMA	2,500	2,200	2,050	-	150	135	46	6,130	-	1,750	-	46,000
0109	WOODLANDS	5,000	4,042	3,645	120	1,403	275	4,050	2,701	629	1,000	-	124,000
	LUSAKA METRO TOTAL	48,312	36,092	23,902	1,246	13,249	7,256	31,723	29,276	7,167	15,840	15,547	440,000
0201	CHILANGA	760	500	405	15	35	25	5,150	1,300	-	3,600	1,854	23,300
0202	CBIRUNDU	44	200	44	-	156	-	-	-	-	-	54	11,000
0203	CHISAMBA	256	300	128	-	172	-	-	-	-	-	200	-
0204	CAONGWE	96	400	65	-	335	185	-	-	-	-	431	-
0205	RAFUE	2,000	3,000	640	54	2,368	135	3,530	4,302	112	-	-	26,000
0206	LUANGWA	96	160	98	-	70	79	-	-	-	-	38	-
0207	MUMBWA	200	310	135	-	175	-	-	-	-	-	252	-
0208	N. GORSE	96	450	77	-	373	383	-	-	-	-	183	-
0209	NAMPUNDWE	96	200	73	-	127	-	-	-	-	-	467	-
0210	SIAYONGA	512	295	210	-	85	143	-	-	-	-	1,343	-
	LUSAKA TOTAL	4,208	5,815	1,875	69	3,896	550	8,680	5,602	112	3,600	4,822	60,300
0301	KITWE	17,000	23,358	8,502	-	-	528	44,458	7,968	-	-	1,909	186,000
0302	CHAMBISHI	500	500	238	-	278	-	-	-	-	-	-	5,400
0303	C/OMBWE	1,000	1,000	917	-	83	787	-	-	-	-	-	-
0304	CHINGOLA	3,000	3,000	2,712	-	288	927	-	3,498	-	-	-	-
0305	ITIMPI	500	600	229	-	371	676	-	-	-	-	243	0,320
0306	KALULUSHI	1,000	1,800	841	-	959	-	-	-	-	-	1,425	14,000
0307	MUFULIRA	3,000	3,000	2,185	-	815	67	-	-	-	-	-	46,000
0308	MINDOLO	3,000	4,700	-	-	-	-	5,569	2,837	-	-	484	30,000
	COPEBELT TOTAL	29,000	37,958	15,624	0	2,794	2,985	50,127	15,734	0	0	4,542	284,720
0401	NDAOLA	6,000	8,643	8,250	74	-	132	9,652	5,509	33	-	420	198,000
0402	IND. NORTH	1,000	1,500	756	42	844	1,707	5,017	1,557	-	403	-	10,000
0403	IND. SOUTH	1,000	1,700	476	40	1,224	149	1,700	1,341	-	751	-	7,400
0404	KABUSHI	1,000	2,000	913	50	1,087	-	4,427	3,007	-	459	-	25,000
0405	NORTH RISE	1,000	1,300	719	8	531	-	848	1,060	128	241	-	20,600
0406	KANSENSHI	2,000	2,030	1,320	98	710	93	4,985	2,935	-	236	-	-
0407	PANODZI	1,000	1,000	424	23	574	571	1,027	0	-	-	770	12,000
0408	MASAITI	56	300	73	-	227	-	-	-	-	-	-	-
0409	LUANSIPA	3,000	2,023	1,944	25	199	6,587	4,376	6,732	168	-	2,576	184,000
	NDOLA TOTAL	16,000	20,666	14,875	360	5,336	9,339	32,532	22,941	329	2,090	3,766	377,600
0501	GANSA	1,000	-	736	-	4	215	-	721	604	-	721	-
0502	KAWAMBWA	256	400	149	-	251	245	-	-	1	-	314	-
0503	MWENSE	128	135	77	-	58	-	-	123	-	-	123	-
0504	NCELENCE	128	258	105	-	145	-	-	590	-	-	590	-
0505	SAPEYA	256	350	178	-	172	35	-	500	24	-	500	-
	LUAPULA TOTAL	1,768	1,143	1,245	0	630	495	0	2,248	629	0	2,248	0
	SUB TOTAL (1/3)	99,384	103,674	57,521	1,615	25,955	20,925	123,863	75,801	8,237	21,530	31,925	1,160

Table 3-4-14 Existing Plant Data (2/3)

CODE NO.	EXCHANGE NAME:	SWITCHING CAPACITY	PAIRS TERMINATED ON MDF	WORKING LINES	FAULTY PAIRS	SPARE PAIRS	PR KM AERIAL CABLE	PR KM E/SIDE	PR KM D/SIDE	PR KM OPEN W.	PR KM JUNCT CABLE	PR KM E/D	DUCT KM
0801	CROMA	1,800	1,151	1,151	198	649	1,433	2,318	2,822	4,994	-	-	5,850
0802	GWEMBE	200	200	85	1	115	45	-	-	284	-	149	-
0803	I. TEZHI	95	150	92	1	58	59	-	-	-	-	210	-
0804	KALONO	400	470	357	2	113	304	-	-	-	-	158	-
0805	MAAMBA	128	300	125	-	174	205	-	-	176	-	-	7,728
0806	MAZABUKA	300	1,520	783	7	737	102	838	1,449	-	-	-	-
0807	MONZE	500	500	592	3	148	600	268	822	15,918	-	-	-
0808	NAMWALA	122	200	114	-	86	-	-	-	1	-	314	-
0809	PEMBA	300	200	169	1	31	-	-	-	10,296	-	80	-
0810	L/STONE	5,000	4,300	2,964	20	1,336	503	4,146	1,922	822	1	1,265	34,000
0811	ZINBA	50	50	48	-	2	-	-	-	-	-	-	-
SOUTHERN TOTAL													
0701	KASAMA	9,502	5,281	6,473	232	3,448	3,251	7,570	7,015	32,491	1	2,475	48
0702	CHINSALI	1,500	1,575	1,162	255	135	785	912	2,317	469	-	632	14,800
0703	ISOKA	192	170	132	12	2	6	-	-	57	-	165	-
0704	LWINGU	256	200	192	55	-	19	-	-	8	-	680	-
0705	MBALA	640	487	464	33	-	388	-	-	4,758	-	1,621	-
0706	MPIKA	768	412	407	24	-	290	1,200	1,400	142	-	-	-
0707	MPOKOKOSO	256	142	139	7	3	78	-	-	6	-	565	-
0708	MPULUNGU	192	200	121	11	-	761	-	-	71	-	37	-
0709	MUNGWI	192	200	32	26	5	-	-	-	-	-	131	-
0710	NAKONDE	128	200	97	4	-	210	-	-	-	-	210	-
NORTHERN TOTAL													
0801	KABWE	4,300	3,786	2,880	444	146	2,531	2,112	3,717	5,574	8	4,102	14
0802	CHIBOMBO	4,000	2,305	2,305	1	4,475	2,320	5,053	2,970	25	100	620	47,000
0803	K/MPOSHI	384	700	271	5	145	155	-	-	19	-	402	-
0804	MKUSHI	384	375	255	5	357	380	-	-	35	-	908	-
0805	MUPEPETWE	1,000	300	22	5	270	112	-	-	238	-	388	-
0806	SERENJE	384	400	224	3	220	105	-	-	31	-	445	511,000
0807	CHALATA	20	-	10	-	10	-	-	-	-	-	-	-
0808	KANONA	10	-	7	-	-	-	-	-	-	-	-	-
CENTRAL TOTAL													
0901	CHIPATA	6,310	4,280	3,173	14	5,507	3,973	5,053	2,070	348	100	2,767	558
0902	CHADIZA	1,800	1,800	1,253	-	541	138	805	499	245	-	573	4,020
0903	CHAMA	200	1,150	1,103	-	47	-	-	-	-	-	148	-
0904	KATELE	128	500	84	-	416	-	-	-	-	-	517	-
0905	LONDALI	300	300	130	-	110	310	-	-	-	-	228	-
0906	MUWE	384	1,100	307	-	283	283	-	-	-	-	1,131	-
0907	NYIMBA	96	200	81	-	119	-	-	-	-	-	148	-
0908	PEFAUKE	200	200	75	-	125	-	-	-	-	-	147	-
0909	SINDA	400	350	285	-	64	-	-	-	-	-	290	-
0910	SINDA	200	150	47	-	103	66	-	-	-	-	76	-
EASTERN TOTAL													
0801	KASAMA	3,786	4,750	2,366	8	2,318	747	805	499	245	0	3,258	4,828
SUB TOTAL(2/3)													
		23,300	22,097	14,892	690	11,420	9,522	15,548	13,301	38,657	181	12,684	624

Table 3-4-14 Existing Plant Data (3/3)

CODE NO.	EXCHANGE NAME	SWITCHING CAPACITY	PAIRS TERMINATED ON MDE	WORKING LINES	FAULTY PAIRS	SPARE PAIRS	PR KM AERIAL CABLE	PR KM E/SIDE	PR KM D/SIDE	PR KM OPEN W.	PR KM JUNCT CABLE	PR KM E/D	DUCT KM
1001	MONGU	1,000	1,500	613	36	887	268	582	655	24	-	173	16,000
1002	KALABO	128	200	103	20	97	-	-	-	-	-	343	0,048
1003	KAOMA	255	2,000	134	20	65	-	-	-	-	-	291	0,048
1004	KUKULU	64	200	49	10	151	-	-	-	-	-	209	0,048
1005	SERANGA	256	300	141	15	159	39	-	-	4	-	126	0,048
1006	LINDUNGA	20	1	1	-	-	-	-	-	-	-	-	-
1007	SESHEKE	50	-	14	-	-	-	-	-	-	-	-	-
WESTERN TOTAL		1,774	4,231	1,055	101	1,360	307	582	655	28	0	1,142	16
1101	SOLWEZI	1,000	1,900	800	12	1,100	100	702	1,062	182	-	1,320	15,250
1102	KABOMPO	128	200	93	-	107	-	-	-	-	-	197	0,060
1103	KASEMFA	128	200	91	-	109	3	-	-	-	-	254	0,048
1104	MUEMBWE	96	400	68	-	332	-	-	-	-	-	345	0,048
1105	M/LUNGA	128	250	87	-	163	-	-	-	-	-	660	0,060
1106	ZANBEZI	128	300	84	-	216	-	-	-	-	-	257	0,060
NORTHWESTERN TOTAL		3,176	5,301	2,121	113	3,008	410	1,284	1,717	210	0	3,258	32
SUB TOTAL(3/3)		4,950	11,102	3,176	214	4,368	717	1,866	2,372	238	0	4,400	48
TOTAL		128,234	134,873	75,589	2,579	41,753	31,264	140,469	91,474	47,132	21,631	48,929	1,821

4.6 Telex Network

The combined national and international stored program control (SPC) telex exchange in Lusaka, type 4660/50 with 2,048-line capacity (obtained from Plessey), was commissioned in 1976. To meet the increased demand, a second telex exchange was commissioned in Kitwe in 1989. The total exchange capacity is 4,504, out of which 2,875 lines are working as of 1991.

Subscribers in big cities and towns are connected via Time Division Multiplex (TDM) equipment, while those in remote areas are connected via voice frequency telegraphy (VFT) circuits.

The Lusaka exchange has exceeded its economic life, and its performance has been deteriorated due to non-availability of spares. The existing telex exchanges in Zambia are shown in Table 3-4-15.

Table 3-4-15 Existing Telex Exchanges in Zambia

Name	Type of Switch	Supplier	Location	Service
Plessey	Electronic	Plessey U.K.	Lusaka	INT./DOM.
Eltex V	Digital Telex & Data	Sagen France	Kitwe	INT./DOM.

The configuration of the existing national telex network is illustrated Figure 3-4-6, and the configurations of the existing GENTEX and radio stations for telegram service, in Figure 3-4-7.

As of DEC. 1992

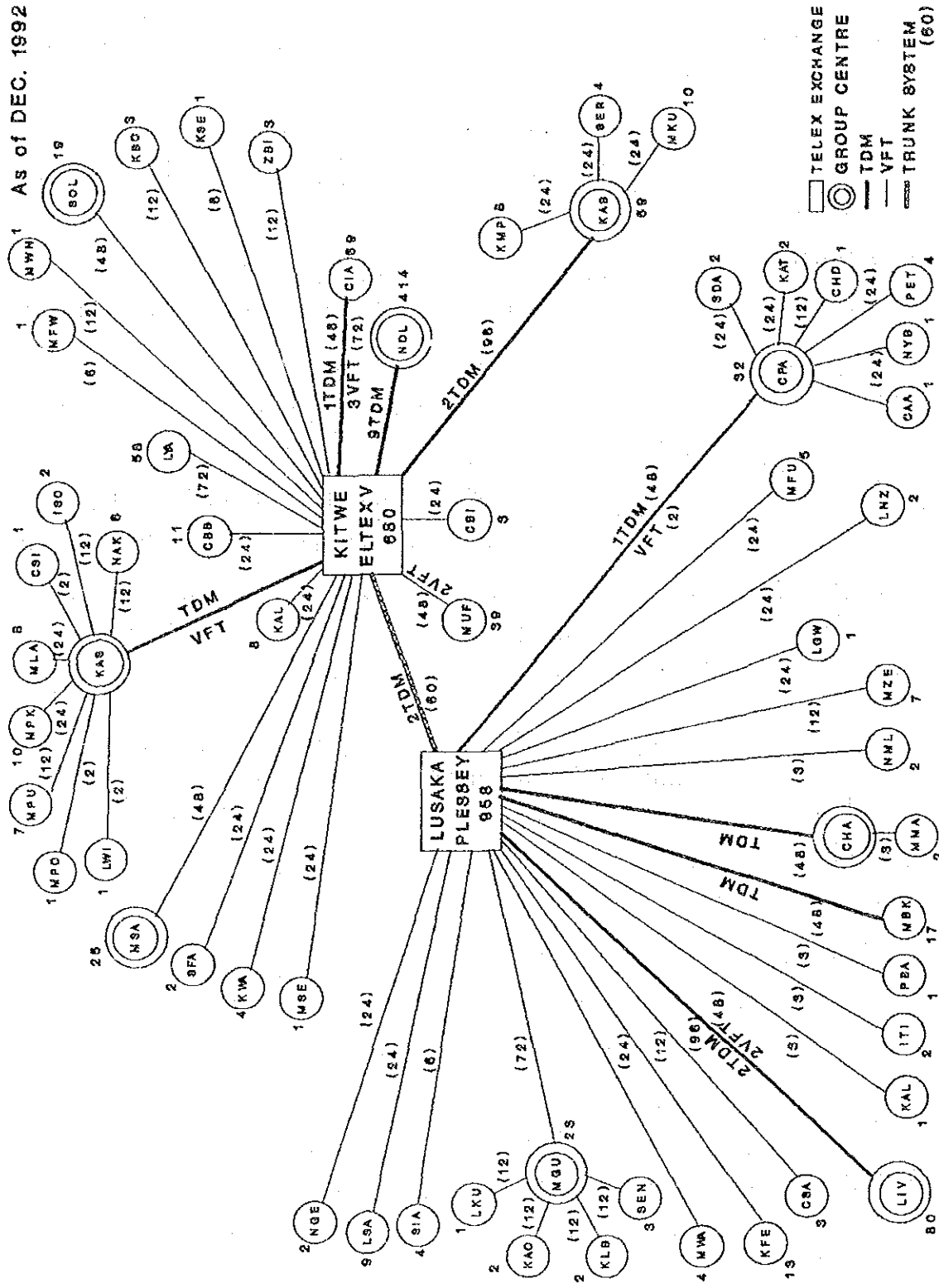


Figure 3-46 Existing National Telex Network

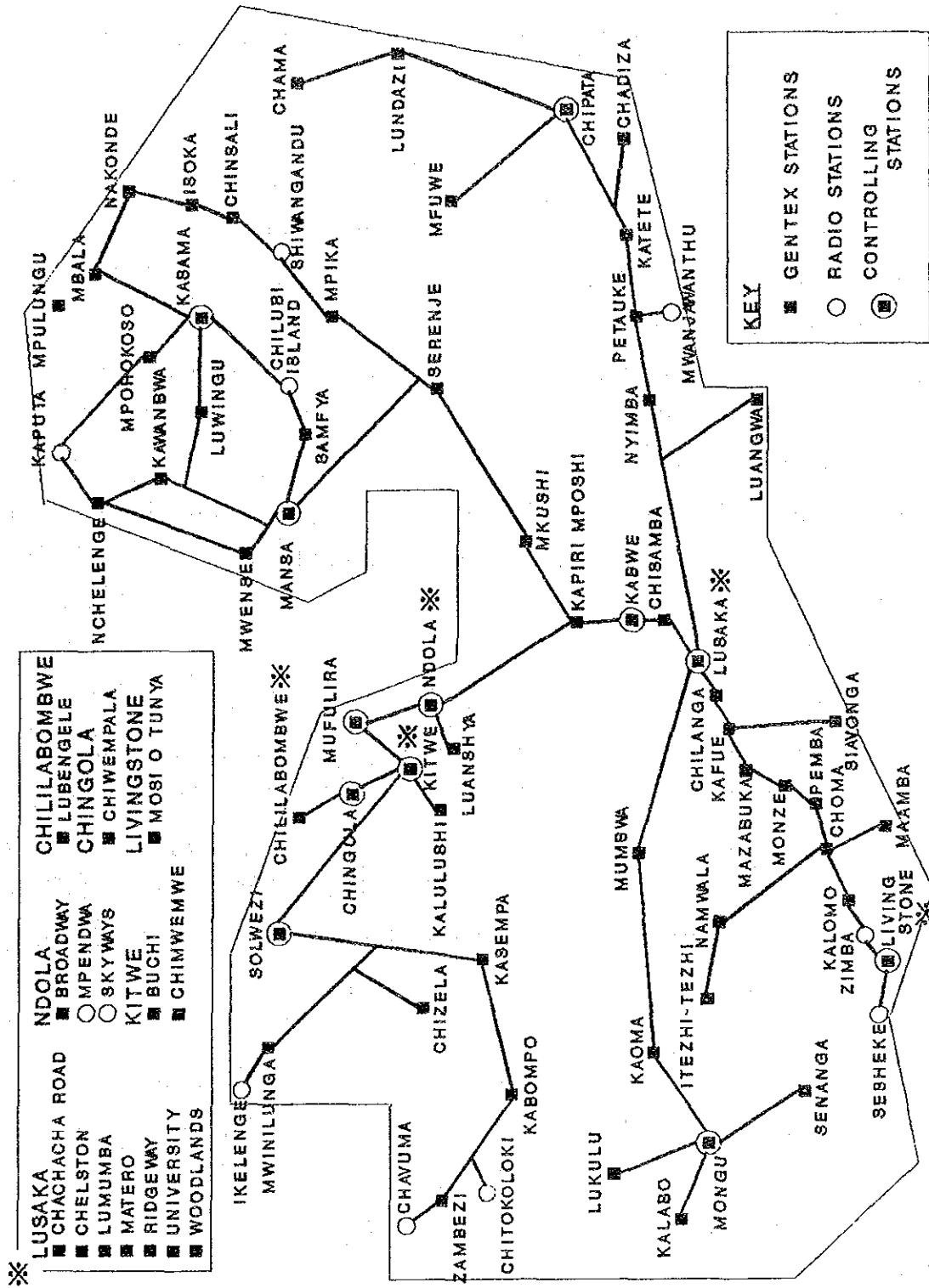


Figure 3-4-7 Gentex and Station

5. On-Going and Planned Project

5.1 On-Going Project

The summary of On-going projects and Support/operational projects are shown in Table 3-5-1 and Table 3-5-2.

Table 3-5-1 On-Going Projects

PROJECT TYPE	PROJECT NO.	PROJECT TITLE	CAPACITY	LOCATON	COST (US \$ MILLION)			YEAR OF COMPLETION
					TOTAL	INTERNAL	FOREIGN	
Switching	132	New Telephone Exchange in Kitwe Area	19,500	Copperbelt	9.90	2.10	7.80	1992
	115	Extension of International Telephone Exchange	2,000	Lusaka	5.60	5.60		1993
Radio & Transmission	140b	Small Capacity Radio Link to Kawambwa Company		Lusaka	0.31	0.16	0.16	1993
	140c	Small Capacity Radio Link to Kafironda Company		Copperbelt	0.19	0.10	0.09	1993
Building	146	Fire Alarm and Detection at Mwembeshi Earth Station		Lusaka (Mwembeshi)	0.24		0.24	1993
Workshop	127b	Electronic Repair Centre		Lusaka	3.00	1.00	2.00	1992

Reference:

- a) Provision and installation of new digital switching equipment at Kitwe Main, Mindoro, Itimpi, Chambeshi, and Kitwe Transit exchange are completed, and others are under construction financed by AfDB in the Project No.132.
- b) Provision and installation of equipment for the expansion of International Telephone Switching Center (ITSC) is made the contract in '92/'93 budget.
- c) Rehabilitation project for Ridgeway Exchange is made the contract financed by Japanese grant aid in 1993.

Table 3-5-2 Support/Operational Projects

PROJECT TYPE	PROJECT NO.	PROJECT TITLE	CAPACITY	LOCATON	COST (US \$ MILLION)			YEAR OF COMPLETION
					TOTAL	INTERNAL	FOREIGN	
External Plant	301	Telephone Cables	62,000		41.60	41.60		1996
	302	External Stores			8.80	5.00	3.80	1996
Building	322	Renovation of Telephone House Building		Ndola	0.21	0.21		1993
	324	Integrated Security Alarm System for Lusaka Exchange		Lusaka	0.77	0.77		1992
Subscribers' Apparatus	304	Telephone Instruments (Public Call Office Equip.)	50,000 (400)		3.00	3.00		1996
	305	Teleprinters	1,500		2.25	2.25		1996
Workshop	312	Transport Workshop		Lusaka	0.50	0.50		1992
Tool	306	Minor Works (Tools and Testgears)			2.30	2.30		1996
	314	Spares (For Telecom. Equipments)			8.30	5.30	3.00	1996
Others	307	Staff Houses			26.70	26.70		1996
	311	Motor Vehicles			11.60	11.30	0.30	1996
	317	Office Equipment and Furniture			1.60	1.60		1996
	321	Trade Fair Stand		Ndola	0.28	0.28		1992
	323	Main Frame Computer		Ndola, Lusaka	1.70	1.70		1993

SOURCE : NATIONAL RECONSTRUCTION THROUGH EFFECTIVE MANAGEMENT, ENHANCED AND ACCOUNTABILITY CAPITAL EXPENDITURE BUDGET (1992 / 93)

5.2 Planned Project

The telecommunications development Plan for ten years (1992-2002), is made to aim provision of facilities for 1 Direct Exchange Line (DEL) to every 100 habitants within a coming 3 years however, proper financial sources are not found. The summary of plan is shown in Table 3-5-3 and the projects to be covered by this long-term plan are indicated by the package No. in column of the Table.

Table 3-5-3 Ten Year Telecommunication Development Plan

PROJECT TYPE	PROJECT TITLE	CAPACITY	LOCATION	COST (US \$ MILLION)			PACKAGE NO.	REMARKS
				TOTAL	LOCAL	FOREIGN		
Switching	Replacement Telephone Exchange	124,100 (lines)		64.00	19.33	44.67	2-9	
	Upgrading of E10B Exchanges	40,000 (lines)		13.00	3.80	9.20	2-9	
	Upgrading of NEAX61 Exchanges	26,300 (lines)		9.20	2.70	6.50	2-9	
	Upgrading of International Telephone Exchange	2,000 (trunks)	Lusaka	5.60	1.60	4.00		On Going
	Telex Exchange	3,000 (lines)	Lusaka	3.50	1.00	2.50	2, 6	
	Packet Switching		Ndola, Kitwe Lusaka	2.20	0.70	1.50	30, 31	
External Plant	Cable Distribution Network	130,500 (lines)		104.40	84.40	20.00	1-9	
Radio & Transmission	Microwave Links	13 (routes)		64.00	22.00	42.00	2-9	
	Spur Links	18 (routes)		8.20	2.60	5.60	2-9	
	Multiaccess Radio Telephone Systems	4,000 (subs.)		47.00	17.00	30.00	10-13	
	Mobile Radio Telephone System		between Lusaka, Kitwe	12.00	4.00	8.00	24-27	
	Radio Monitoring Station			5.14	2.04	3.10		
Satellite	Satellite Communication		Mwembeshi	16.50	4.20	12.30	23	
Subscribers' Apparatus	Private Automatic Branch Exchanges (PABX)	250		7.50	2.50	5.00		
	Telephone Instruments (Psyphones)	160,000 (400)		7.50	2.50	5.00		
	Teleprinters	2,000		6.00	2.00	4.00		
	Facsimile Machines	1,000		1.50	0.50	1.00		
Others	Main Frame Computer		Ndola, Lusaka	1.70	0.50	1.20	22	
	Computers			0.75	0.25	0.50	21	
	Transport	900 (vehicles)		13.50	4.50	9.00	17-20	

6. Current Problems of PTC

Through the field investigations by the study team for each province, various problems have been pointed out and recognized as the issues to be improved.

6.1 Operational Problems of PTC

PTC currently has the following problems.

(1) Low Telephone Charges Leading to Thin Profits.

Telephone charges up to October 1992 and the new charges applied in and after November 1992 are shown in Table 3-6-1.

Table 3-6-1 Telephone Charges

Tariff level	Up to Oct. 1992	From Nov. 1992
Rental	ZK 200/Quarter	ZK 800/Quarter
Installation	ZK 120/Line	ZK1000/Line
Call Charge	ZK 1.7/Call	ZK 13/Call
Subscriber	70,000 approximately	

Source: PTC Financial Staff

(2) Low Collection Rate of Telephone Charges

The telephone charge collection rate in January through June 1992 was 28.4%. The collection rate has been falling significantly due to a number of reasons, including an inefficient collection system and a lack of staff to execute the collection exercise. Another reason is the Government's directive to discontinue the disconnection of defaulting telephone subscribers.

Table 3-6-2 Collection of Telephone Bill

Unit: Kwacha

Jan-Jun 1992	Billed	Collected	Ratio
Telephone	3,700,000,000	1,050,000,000	28.4%
Telex	261,114,715	51,729,288	19.8%
Telegraph	1,801,177	61,784	3.4%
Total	3,962,915,892	1,101,791,072	27.8%

(3) Foreign Exchange Loss

PTC has suffered from considerably big amount of exchange losses during this decade due to the devaluation of the Zambian currency. Partially, the fiscal 1992 devaluation of the Kwacha has had a major effect in the amount of ZK1.5 million on PTC's financial status. Total amount of exchange losses recorded for the past decade was caused by a fluctuating pattern of foreign exchange rate.

The exchange loss is shown in Table 3-6-3.

Table 3-6-3 Foreign Exchange Loss

Year	Total Amount (ZK1000)
1983	3,976
1984	1,422
1985	4,929
1986	29,272
1987	38,979
1988	24,769
1989	82,826
1990	300,662
1991	788,310
1992	1,583,632

Source: PTC Financial Staff

(4) Shortage of Foreign Currency Funds

As PTC operates on a small-scale, it will be difficult for PTC to invest in overhauling and expansion of their facilities with their own funds. It is therefore vitally important to procure outside funds. Zambia has been categorized as LLDC since 1991. This has prevented the country from an opportunity to introduce foreign loans.

(5) Shortage of Skilled Manpower, Materials and Vehicles for Operation and Maintenance

a) Skilled Manpower

Shortage of skilled technicians has been chronic phenomena in Zambia, and it has been exacerbated by the draining of such technicians into the outside of the country looking for higher salaries. Shortage of the technician in PTC is serious especially in the field of external plant, because too many faults occur in the external plant.

b) Materials

Procurement of materials such as spares, tools, instruments for operation and maintenance is almost impossible due to lack of funds, and most of such materials have been procured through projects.

c) Vehicles

Transition of motor vehicle fleet of PTC's telecommunication division, as of the end of September in 1990, 1991 and 1992 is shown in Table 3-6-4.

Table 3-6-4 Transition of Motor Vehicle Fleet

Items	Quantity			% Utilization		
	1990	1991	1992	1990	1991	1992
Headquarters	79	85	89	68.4	62.4	55.1
Northern Region	167	180	229	67.1	43.9	47.2
Southern Region	228	250	284	59.2	57.6	61.6
Total	474	515	602	63.5	53.6	55.2

Source: PTC Financial Department

Quantities of vehicles by type, as of September 1992 are: 314 pickups, 82 station wagons, 78 panel vans, 52 trucks, 61 cars, 10 buses, and 5 others.

According to Table 3-6-4, number of vehicles increased by 27% in the two-year period; however, utilization of vehicles worsened from 63.5% to 55.2% in the same period.

Although PTC's standard economic life for vehicles is set at five (5) years, actual period of utilization varies from more than 5 years to 2 - 3 years depending on the condition of utilization and also on road condition.

Most of non-runners are sent to PTC's garage, but many of them are left without repair due to lack of spares.

6.2 Technical Problems

(1) Shortage of Spare Parts

Generally the stock control of spare parts is not properly done due to weakness of management and budgetary constraints. The availability of telecommunication equipments is becoming lower than the original capacity. The most serious issue is how to get spare parts of NX1E and MCR switching systems. Since these switching systems have no longer been manufactured, it seems to be impossible to get spare parts any more. In the event unavailability of such spares be confirmed, an urgent program to replace the switching equipment should be established.

(2) Signalling System

Some switching systems (i.e., ARK and C23) do not facilitate the MFC signalling system which is indispensable for sending the originating subscriber's number to succeeding exchange for the purpose of ANI (Automatic Number Identification) function. These exchanges cannot provide the automatic subscriber toll dialling (STD) nor automatic international direct dialling (IDD) services.

(3) Low Call Completion Ratio

Call completion ratio in Zambia is around 30 % on an average. This means that the remaining 70 % of calls do not create any income for PTC. The ratio must be improved at least up to 50 % by the year 2002 and targeted up to 60 % by the year 2012, with the provision of well balanced telecommunication facilities.

(4) No Route Diversity

The existing transmission route is based on star-network configuration without any route diversification in physical routing. If there happens some transmission fault on a particular route, the traffic cannot be re-routed to a physically separated alternative route.

To enhance the reliability of the transmission system, the existing star-configuration network should be provided with additional links to enable diversity path (refer to 5.2.2 in SECTION 2).

(5) Low Availability of PCO

The Public Call Office (PCO) is not effectively utilized due to the extreme lack of coins.

(6) Lack of Maintenance Record for External Plant

Plant records for external plant such as facility records, fault record, are not properly maintained in respective sections, i.e., Planning Section, Maintenance Section, maintenance groups of each exchange, etc.

It is very important to maintain the facility records updated at any time, in order to make plans for maintenance and expansion of the huge existing external plant facilities properly.

Refer to Para.1.2 in SECTION 7 "Establishment of External Plant Maintenance Centers".