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 REPORT
(SUMMARY)

AUGUST 1993

NIPPON TELECOMMUNICATIONS CONSULTING CO., LTD.
TOKYO, JAPAN

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

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.

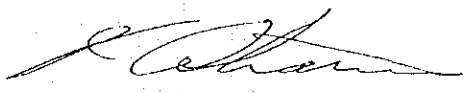
The study aims to formulate the Long Term Telecommunications Network Development Plan (1993 to 2012) in the Republic of Zambia.

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.

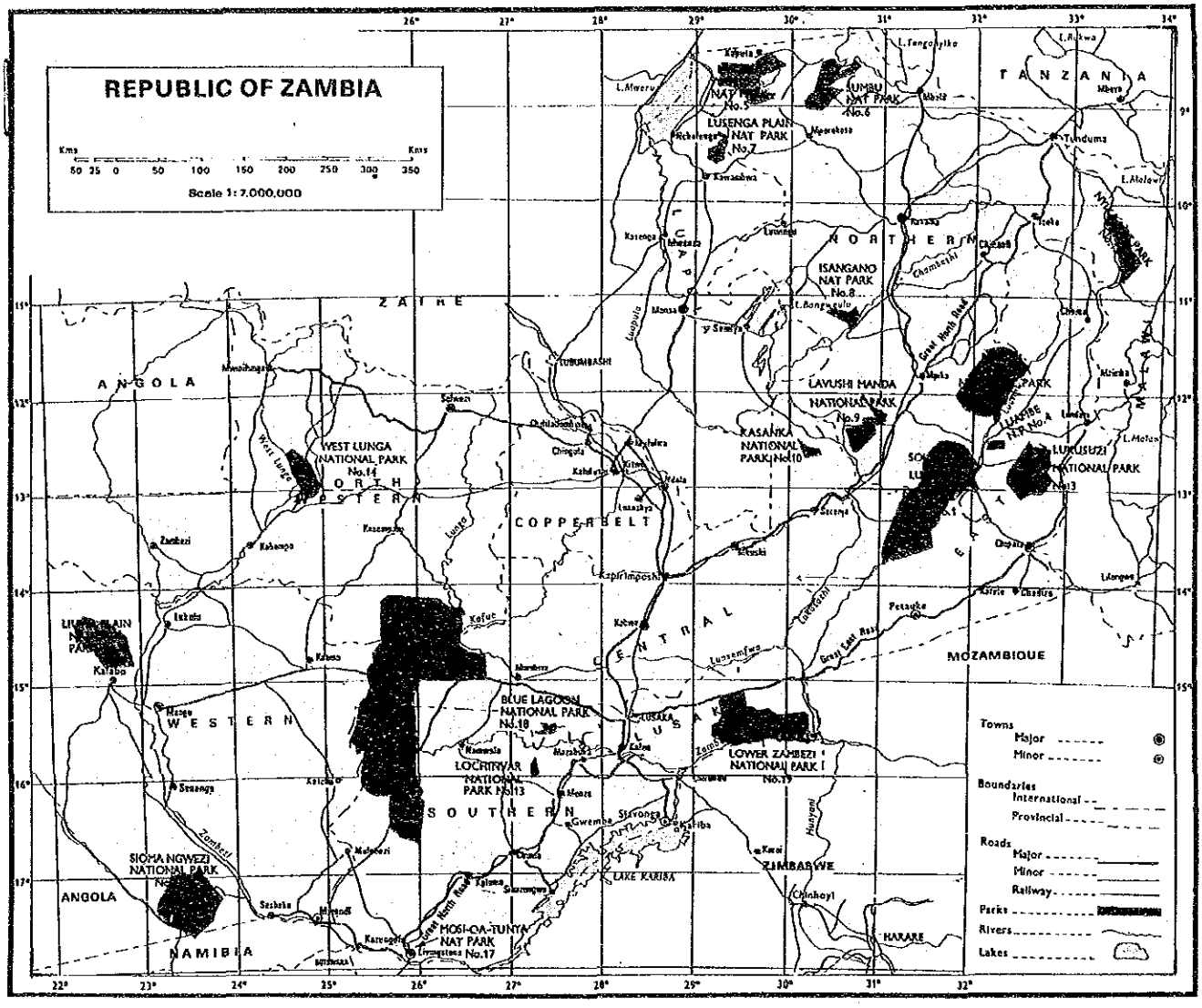
Before closing, we earnestly hope that this report will be effectively used for further development of telecommunications in the Republic of Zambia.

Very truly yours,

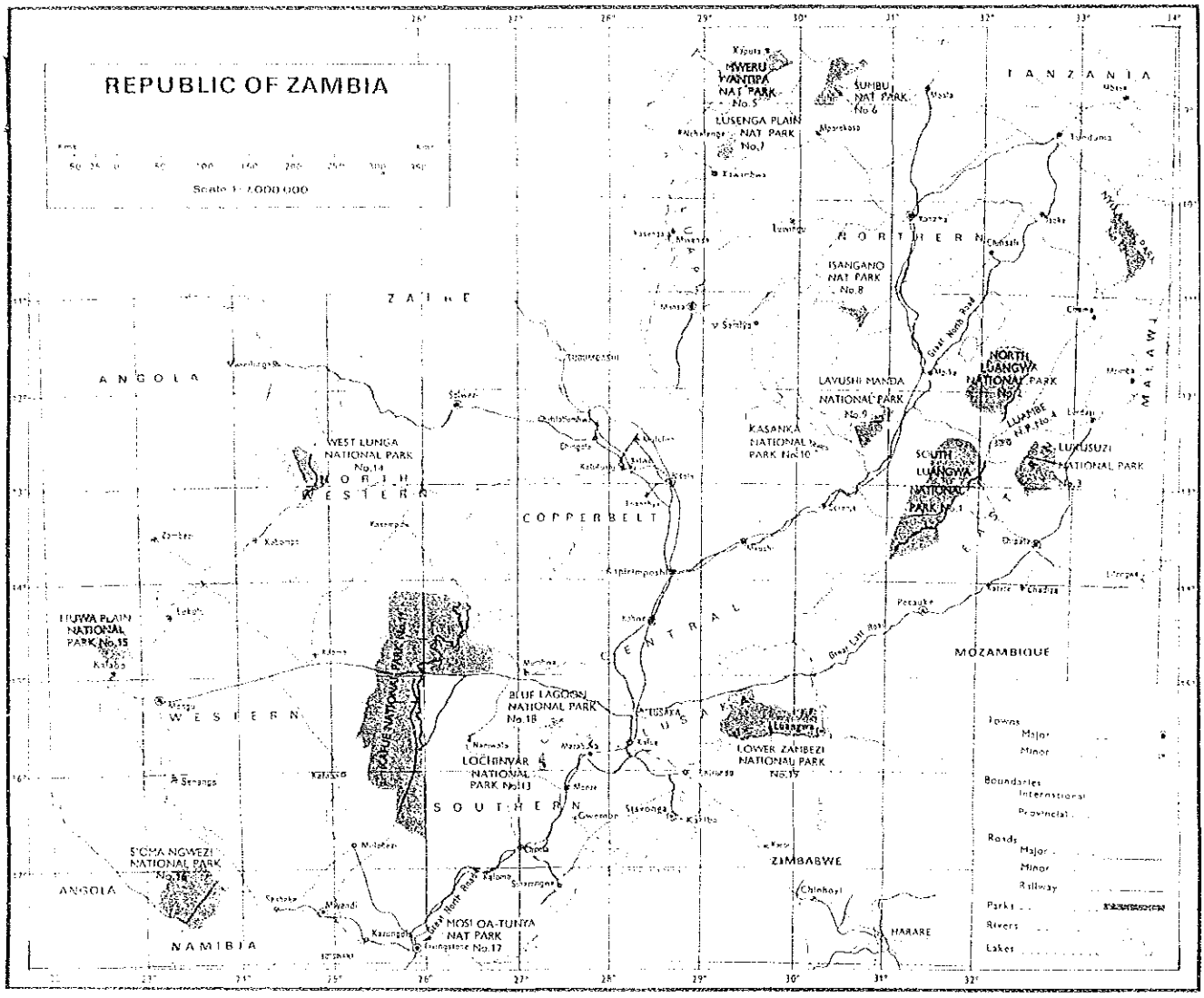


Fujio Aihara
Team Leader
Long Term Plan for Development of
Telecommunications Network in the Republic of Zambia

Republic of Zambia



Republic of Zambia



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

EXECUTIVE SUMMARY

1. Development Target

Items		2002	2012
1 No. of Subscribers	Total	136,300	257,000
	Urban	129,900	244,000
	Rural	6,400	13,000
2 Successful Call Ratio		50%	60%
3 Switching System (No. of L.U)		168,524	307,000
4 Automatization		100%	100%
5 Digitalization		90%	100%
6 External Plant (No. of Cable pairs at MDF)		191,600	316,000
7 No. of Staff		4,361	5,654
8 Staff Efficiency (staff per 1,000 DEL)		32	22

2. Urgent Program

The current PTC problems are as follows:

1. External plant maintenance and new subscriber connection
2. Low telephone tariff and collection of charges
3. Low utilization of vehicles
4. Exchange loss due to fluctuation of foreign exchange rate
5. Lack of foreign funds
6. Shortage of human resources and materials for O&M
7. Shortage of spares for switch equipment manufactured no more
8. Switching equipment with obsolete signal system
9. Low call completion rate
10. Network composition without loop
11. Public call office not usable due to lack of coins
12. Lack of plant record of external plant

To solve current PTC problems, the following urgent programs are to be carried out by self-reliant effort. Three special task force teams and a special assessment team are to be organized to materialize these programs.

Urgent Program	Contents	Cost (M$)
Program 1	Reinforcement of maintenance for subscriber's external plant and elimination of waiting applicants	5.31
Program 2	Improvement of the billing work and reviewing the tariffing policy	0.38
Program 3	Vehicle survival operation	1.31
	Urgent program total cost	7.00

It is recommended that each task force team hires a consultant or specialist in performing its task.

3. Project Packages and Cost Estimate to Achieve the Target

1993 - 2002		2003 - 2012	
Project Package	Cost (M$)	Project Package	Cost (M$)
1 Urgent Program	7.00	6 Urban NW	73.35
2 Urban NW	50.48	7 Urban NW	80.88
3 Urban NW	63.29	8 Urban NW	56.12
4 Urban NW	32.51	9 Urban NW	33.40
5 Urban NW	36.06	12 Rural	17.31
10 Rural	20.63	13 Rural	22.30
11 Rural	19.33	15 EPMC	3.77
14 EPMC	3.69	16 MNS	3.50
17 Vehicles	4.50	19 Vehicles	6.50
18 Vehicles	4.50	20 Vehicles	6.50
22 MF&P Computers	1.24	21 P. Computer	0.25
23 Earth Station	18.09	24 (PCO)	(3.22)
Sub-Total	261.32	Sub-Total	303.88
Total (1993 - 2012)			565.20

Project Packages and Cost Estimates by Private Funds

Packages	No. of Packages	Cost (M$)
Vehicle/Handheld Phone	4	42.34
Radio Paging	2	9.07
Packet Data Com. NW	2	6.47
Total	8	57.88

4. Priority Projects

Package No.	Project	Cost (M$)	Foreign Currency	Local Currency
1	Urgent program	7.00	3.31	3.69
2	Urban NW, Lusaka and Kitwe	50.48	42.89	7.59
10	Rural	20.63	16.69	3.94
Total		78.11	62.89	15.22

5. Financial and Economic Analysis of Priority Projects

5.1 Financial Analysis

If the priority projects are not implemented, the supply capacity will decline as existing facilities become obsolete. As a result, the financial situation of PTC will be extremely worsened.

It is however difficult to justify the investments for the projects with loans, as they require too great investments for small revenues, thus placing great pressure on PTC's operation.

On the other hand, if these projects are launched on grant basis, the expected FIRR will become as follows, promising the improvement of PTC's operation.

Expected FIRR (Grant Base)

Item	FIRR	Payout Period
Project - Urban	61.43%	1.45 year
Project - Rural	18.24%	5.94 year
Project - Urban + Rural	53.86%	2.10 year

5.2 Financial Analysis

The EIRR are analyzed by a customers' willingness to pay and shadow premium referring to the above FIRR.

Economic Benefit Value	Premium to Financial Value	Equity Case EIRR %	Grant Case EIRR %
E.B.1	2.45	11.42	211.23
E.B.2	2.48	11.64	213.04
E.B.3	3.05	16.00	247.46
FIRR	(1.0)	N.A.	53.86

Note: E.B.1 - The premium by interview survey
E.B.2 - The premium is the average value in 10 years
E.B.3 - The premium is the maximum value in 10 years

5.3 Overall Assessment

The priority projects are so-called BHN (Basic Human Needs) projects. If the greater portion of the costs are funded by grants, this will boost expectations that this could be financially sound operation, and justify the projects implementation. It will further significantly contribute to Zambia's economic development and social improvement.

6. Conclusion and Recommendations

6.1 Privatization and PTC's Problems and Countermeasures

(1) Corporate Financial Assessment and Privatization

It is highly recommended that the immediate endeavor be focused on stabilization of the financial situation of PTC, paying due attention to the privatization in coming years. In materializing the Long Term Plan, the corporate accounting will be improved to sound condition in and after the year 2008.

(2) Main PTC's Problems and Countermeasures

Problems	Countermeasures
1. External plant maintenance and new subscriber connection	Urgent program 1
2. Low telephone tariff and collection of charges	Urgent program 2
3. Low utilization of vehicles	Urgent program 3
4. Exchange loss due to fluctuation of foreign exchange rate	Government
5. Lack of foreign funds	Introduction of foreign funds through implementation of the long-term development plan
6. Shortage of human resources	Training and recruiting of able human resources

6.2 Recommendations on Corporate Management

(1) Organization

The new telecommunications entity to be created after the split of PTC should be responsible for provision of reliable national and international telecommunications services.

(2) Liberalization of Customer Premises Equipment

The customer premises equipment to be marketed should meet minimum technical specifications approved by an authorized organization. This will necessitate revision or new constitution of relevant laws and regulations.

6.3 Recommendations on Financial Aspect

(1) Rural Project

The rural project must be treated as a public project for the improvement of infrastructure due to the extremely low profitability. The rural projects should be implemented as projects led by the Government and this should not change, even after privatization.

(2) Currency Exchange Losses

Losses caused by changes in the currency exchange rate place a heavy burden on the finances of PTC. In order to reduce the burden of exchange losses, an on-lent-loan (2-step-loan) is recommended.

(3) Tariffing Principles

It is recommended to refer to the Tariffing Principles for Telecommunications Organizations in the Non-Competitive Sector prepared by the International Chamber of Commerce, 1990, as a useful guideline.

(4) Increase in Telephone Charge

The study was conducted to examine the PTC's cash positions resulting from three different national telephone charges increases, i.e., 10%, 20% and 30% up every 5 years.

a) 10% Case:

In this scenario, telecommunications charges will rise to about 1.5 times their 1993 level by 2012. PTC will start operating at a profit in 2005, three years earlier than the case where telephone charges are not raised. The net cash flow during the project period will total US$105 million.

b) 20% Case:

In this scenario, telecommunications charges will rise to about double the 1993 level by 2012. PTC will start operating at a profit in 2004, and there will be a net cash flow of US$168 million over the project period.

c) 30% Case:

In this scenario, telecommunications charges will rise to about triple the 1993 level by 2012. PTC will start operating at a profit in 2003, with a net cash flow of US$240 million over the project period.

6.4 Recommendations on Technical Aspects

(1) Implementation and Reviewing of Long-Term Development Plan

The short-term plan including annual plans is the implementation plan for the period of 5 years at maximum, and consequently optimization of investment, estimation of project sizes and costs, etc. should be made more accurately. The short-term plan is to be prepared at an interval of 3-5 years, and if there are found any appreciable changes in technology, costs, demand or funds, relating long-term plan should be reviewed accordingly.

(2) Introduction of New Technology

Under the circumstance where the technological advancement is being accelerated, new telecommunications systems applying new technology should be introduced timely as required, taking into account possible expendability, applicability and economy of

the telecommunications network. Network synchronization is indispensable for advanced national digital network except that for ATM (Asynchronous Transfer Mode). It is recommended to introduce the master-slave synchronization system to inter-link exchanges through synchronized digital signals.

(3) Successful Call Ratio

For improvement of the successful call ratio, provision of a well balanced network and reduction of unfavorable behaviors (repeated dialling, hooking, partial dialling, wrong dialling, etc.) are required. To reduce such unnecessary behavior, appropriate public relation will become necessary.

(4) Employment of Consultant

The long-term telecommunications development plan includes a number of new fields for which PTC has very few experienced staff. Therefore it will be necessary to employ experienced consultants to accomplish various projects smoothly.

CONTENTS

LIST OF FIGURES

LIST OF TABLE

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

1. GENERAL

1. GENERAL

1.1 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. The present situations of the neighboring countries in Southern Africa are presented in Figure 1-1.

Zambia's economy is dominated by a single product, i.e., the copper mining, which accounted for approx. 90 percent of the total export and approx. 10 percent of GDP. However, the recent protracted sluggish world 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 a great potential for development of non-copper industries, particularly, of agriculture. For the development, however, much 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, its national economy has not yet been improved and, since 1991, Zambia has been categorized as one of the least developed countries (LLDC) by the United Nations.

To cope with the above situation, the Government of Zambia started the New Economic Recovery Program in 1992. This program aims to stabilize the finance and economy, encourage foreign investments, and also create environments attractive 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. Through the above thorough restructuring, the Government expects that most parastatals will be privatized by 1997, in the view that individual initiative and freedom in the market place are essential for thriving economy. In 1993, Metal Fabricators of Zambia Limited (ZAMEFA), is scheduled to be privatized.

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

Domestic and international telecommunications 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. After the privatization of PTC by government policy, ZIMCO will become a holding company.

For development of telecommunications, Ten Year Development Plan for Telecommunications (1992-2002) was prepared by PTC in April 1992. The total cost for realization of this 10-year Plan is estimated at approx. US$ 400 million. Due to the recent economic depression, investments in telecommunications have been decreasing year by year. For the fiscal year 1992, the investment amounting to approx. US$ 9 million only has been approved for procurement of a part of the plan including International Telephone Switching Center Project. PTC's account is supposed to turn to deficit in 1992 following 1991, owing mainly to a large amount of exchange losses.

The Government of Zambia plans to split PTC into two independent entities, i.e., Postal Service Division and Telecommunications Service Division in 1993, and the provision of customer premises equipment will be liberalized in 1993.

The new entity thus formed will be required to adopt a more market-oriented management to cope with the 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 is urgently necessary 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 accomplish the Economic Recovery Program.

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

In response to the request, Japan International Cooperation Agency (JICA) dispatched the preliminary study team in April, 1992 and the main study team in October, 1992 in accordance with the scope of work agreed upon by and between PTC and JICA.

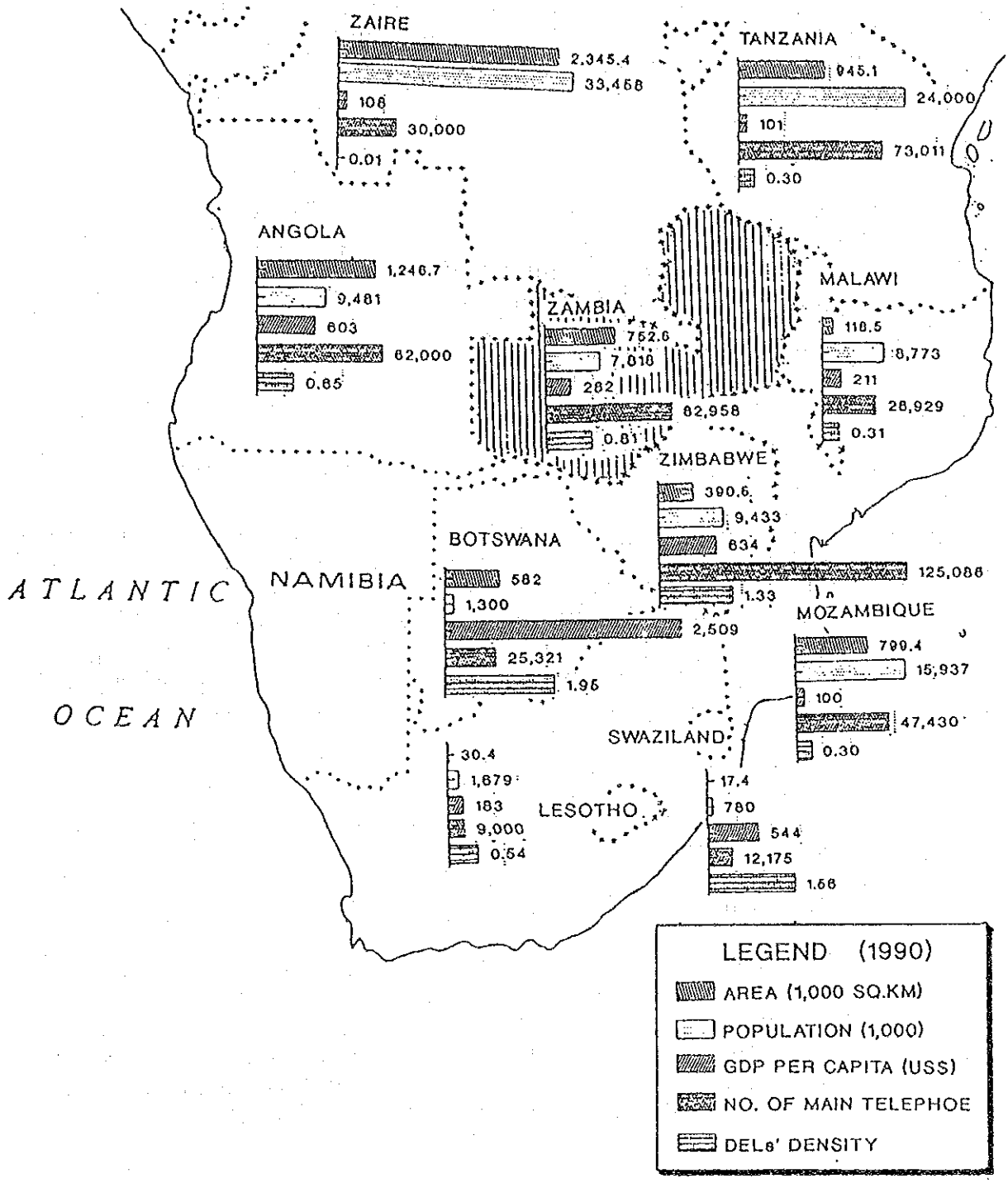


Figure 1-1 Zambia and Surrounding Southern African Countries

1.2 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.

1.3 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.

(1) Data Collection and Analysis

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

a) 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

b) Status Quo of Telecommunications

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

The survey 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

(2) Demand Forecast

Telephone 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 (i.e., Telex, Telegram, Data Communication, etc.) and mobile telephone services, demands have been forecasted based on the corresponding data in other countries.

(3) Telecommunications Development Plan

The development policy and strategy of PTC and also the strategy 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.

For establishing the telephone supply plans, two cases have been studied: (i) to satisfy 100% of the telephone demand in urban areas, and (ii) to satisfy 76%, the worldwide average level.

As a result, the latter, i.e., the 76% demand fulfillment plan has been adopted as it proved preferable in terms of feasibility, both financially and technically.

For rural areas, 3% demand fulfillment which meets the demand by public houses, farmlands, public call offices, etc., has been assumed.

Thus the telecommunications development program has been established through the traffic forecast and the facilities expansion plans prepared.

The operation and maintenance plan has also been prepared on the basis of the telecommunications network plan, and various targets of telecommunications services including the operation and maintenance have been recommended.

(4) Telecommunications Network Expansion Plan and Project Implementation Plan

In this Study, the fundamental technical plan suitable for Zambia has been prepared firstly.

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 to be realized by PTC's self-relient effort.

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.

1.4 Composition of this Report

On the basis of the study results mentioned above, the STUDY REPORT ON LONG-TERM PLAN FOR DEVELOPMENT OF TELECOMMUNICATIONS NETWORK IN THE REPUBLIC OF ZAMBIA has been prepared. The composition of the report is given below.

(1) Summary

It is a summary of the main body of the report.

(2) Main Report

Main body: Status quo of telecommunications, demand forecasts, telecommunications network development plan, network expansion plan and recommendation

(3) Supporting Case Study Data and Project list

(4) Data Book

Detailed data other than the above including the following:

a) Socio-Economic and Financial Data
b) Organization
c) Basic Data on Network and Installation Plan
d) Data on Demand and Traffic Forecast
e) Interview
f) Terrestrial Transmission Route

2. STATUS QUO OF TELECOMMUNICATIONS

2. STATUS QUO OF TELECOMMUNICATIONS

2.1 Posts and Telecommunications Corporation

(1) Organization and Staff

PTC is a limited liability company established on the basis of the Posts and Telecommunications ACT 1975, 1987 and 1988, and owned by Zambia Industrial and Mining Corporation (ZIMCO). ZIMCO is a public corporation established and owned by the Government to promote industries and mining, and control most of government owned enterprises. PTC's budget, investment programs, management, etc., are supervised by the guidelines of ZIMCO and the chairman of the executive committee is one of the executives of ZIMCO. According to the recent policy of the Government, ZIMCO is scheduled to become a holding company and PTC will be split into two, i.e., postal service division and telecommunications service division, in 1993.

The number of technical staff in the telecommunications division of PTC accounts for only approx. one third of the total and the number of staff with university degree, merely 1.6 percent, while the number of staff per 1,000 direct exchange lines is 47.3, considerably higher than that in other countries.

Transition in telecommunication staff in recent 5 years is given in Table 2-1.

Table 2-1 Staffing in Telecommunications Division

Category/Year	1988	1989	1990	1991	1992
Management & Administration	36	38	53	55	47
Engineers	158	189	160	205	191
Technicians	662	669	633	634	670
Operations	867	927	942	1,005	1,004
Others	1,068	1,604	1,797	1,838	1,433
Total	2,791	3,427	3,585	3,737	3,345

(2) Status of Finance

A review on PTC's financial statement 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.

a) Profit and Loss

PTC 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 of 547 million Kwacha or 8.4% loss to turnover due to high inflation and devaluation of Kwacha.

Main causes of loss in 91/92 are as follows:

- The gap between revenues and expenditures pertaining to overseas calls, where PTC 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 the total revenues.

- Provision for bad and doubtful debts increased to 9.7% of the 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 the total revenues.

- Overhead expense items of staff costs and housing expenses, which had been showing decreasing tendency, reversely showed a big increase.

b) Balance Sheet

- 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 10.25 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 PTC's accounting rule. It is necessary that such low equity ratio should be normalized to restore stability in the management of PTC.

- 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 obtained in the previous fiscal years. As a result receivables soared to 4,264 million Kwacha, 2.7 times the previous year. Provision for bad and doubtful debts as of March 31, 1992 was set at 18.1% of the above stated amount.

- Big increase in current liabilities

  As a results of the above stated financial conditions, PTC 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 the previous year.

c) Funds Statement

- Source and application of funds of PTC 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.

- 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. PTC 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.

2.2 Investment Status

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 due to the foreign exchange rate fluctuation. 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.

2.3 Status Quo of Telecommunications Services and Equipment

(1) Telecommunications Services

Telecommunications services in Zambia are classified into the following:

a) Telephone Services
b) Non-telephone Services (Telex, Telegram, Data Communication, etc.)
c) Leased-Line Services

In addition to the ordinary telephone services, such special services are also available as (1) incoming-call restriction, (2) automatic transfer, (3) morning call, (4) call waiting, (5) abbreviated dialling, (6) outgoing call restriction and (7) conference telephone. No mobile telephone service for cars is available, while paging is being utilized in some of hospitals and compounds of factories, etc. Transition of telecommunications services in the past 20 years is shown in Tables 2-2 through 2-4.

Table 2-2 Transition of Telephone Services

Item/F.Year	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 C.O.	47	102	193	301	425
Population (1000)	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 2-3 Non-Telephone Services (Telex and Telegraph)

Item/F.Year	1987	1988	1989	1990	1991
Telex					
SW capacity	2,048	2,048	4,504	4,504	4,504
Term. equipment	1,973	2,048	2,415	2,770	2,875
Trfc (min x 1000)	5,157	5,036	4,711	3,857	2,544
Telegraph					
Total no. (x 1000)	792	701	735	817	900
No. of teleprinters	68	70	71	73	73
Gentex	161	164	172	175	176
No. of leased ccts	-	96	101	101	106

Table 2-4 Leased Circuit Services

Item/F.Year	1987	1988	1989	1990	1991
Within cities or towns	213	222	231	234	247
International	19	21	23	24	26
Total	232	243	254	258	273

(2) Telecommunication Plants

The existing telecommunication plants in Zambia are imbalanced in terms of a "network," since the amount of the external plant is very small as compared with the available switching capacity. The field survey results proved that the existing switching capacity is 120,000 units, but the number of subscribers accommodated is only 70,000, depending on the available capacity of the external plants, while the number of waiting applicants amounts to 60,000. Figure 2-1 shows the above situation. Status of telecommunication plants as of the end of September 1992 is shown in Table 2-5.

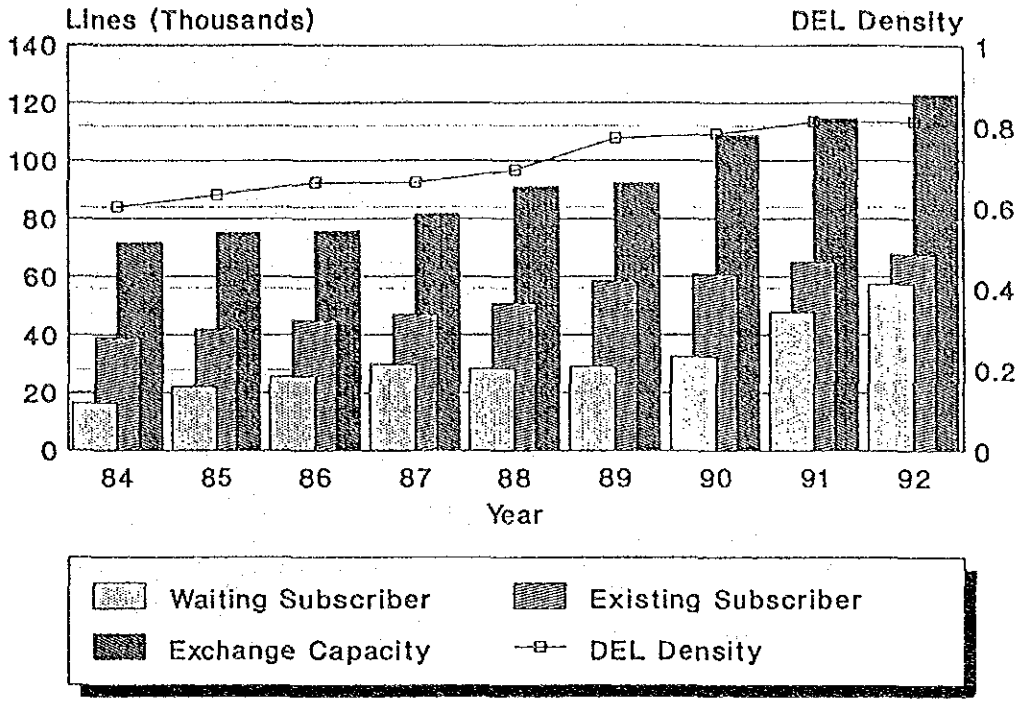


Figure 2-1 Switching Capacity and No. of Subscribers

Table 2-5 Status of Telecommunications Plant

Item	Amount
No. of telephone exchanges	91
Exchange capacity (unit)	122,874
Subscriber cables (pairs dropped)	129,700
No. of subscribers	70,756
No. of waiting applicants	61,868
Telephone density	*0.88*

2.4 Current Problems of PTC

Current problems found in this study are outlined below. To take quick remedial actions for some of the problems, it is recommended to carry out urgent programs.

(1) Low Call Charges and Low Collection Rate

Since November 1992, tariffs for telecommunications including domestic telephone calls have been raised. However, the revised tariffs are still lower than the international level.

The tariffs for international calls are set up on a US dollar basis. Since January 1993, charges for domestic calls in less congested hours have been discounted to 50% of those in congested hours, and for international calls, 75%, reflecting the tariff revision as mentioned above.

The above tariffs should be reviewed in the light of "Tariffing Principles for Telecommunications Organizations in the Non-Competitive Sector" recommended by the International Chamber of Commerce and Industry. A part of the new tariffs is shown in Table 2-6.

Table 2-6 Telephone Tariff

Item	Charges
Basic charge for	
Telephone	800 Kwacha (US$ 2.22)/3 months
Installation fee	2,500 Kwacha (US$ 6.94)/subscriber
Call charge	13 Kwacha (US$ 0.04)/3 minutes

Note: Exchange rate as of January 1993: 360 Kwacha/US$1

The call charge collection rate for the six months from January to June, 1992, was as low as 28%. It was partly attributable to the incomplete quarterly charge-collect system and the lack of staff, but mainly to the enforcement of the Government ordinance to "prohibit the disconnection of telephone lines due to non-payment by subscribers." Then, in January through June 1993, "disconnection due to non-payment" resumed. Table 2-7 gives amounts billed and collected.

Table 2-7 Amounts Billed and Collected for Telephone, etc.

Unit: Kwacha

Item	Billed	Collected	Rate
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%

(2) Low Running Rate of Vehicles

A number of vehicles are not in operation due to lack of spare parts, etc. Hence, PTC's field activities for sales, operation and maintenance have been considerably constrained.

The above has been caused by the current system under which vehicles are purchased without spares other than tire(s).

The PTC's vehicle purchase, operation and maintenance system should be reviewed urgently to elucidate the problems involved, so as to effectuate efficient vehicle operation.

Vehicle running records as of the end of September in 1990, 1991 and 1992 are shown in Table 2-8.

Table 2-8 Status of Vehicle Running

Area	No. of vehicles			% Utilization		
	1990	1991	1992	1990	1991	1992
Headquarters	79	85	89	68.4	62.4	55.1
Northern	167	180	229	67.1	43.9	47.2
Southern	228	250	284	59.2	57.6	61.6
Total	474	515	602	63.5	53.6	55.2

(3) Others

a) Tremendous exchange loss due to changes in foreign exchange rate
b) Lack of fund in foreign currency
c) Shortages of human resources and of equipment and materials
d) Lack of spares for switching equipment, etc. whose manufacturing has stopped already
e) Switching equipment with obsolete signaling system
f) Low call completion ratio
g) No route diversity
h) Public call office which is out of use due to lack of coins
i) Insufficient plant records for external plant

3. DEMAND FORECASTS

3. DEMAND FORECASTS

3.1 Telephone Services

Demand forecasts for telephone services were carried out on three different models i.e., the ITU model, the time-sequential regression model and the modified regression model. After examination of the forecasted demands, the modified regression model which gives medium values have been adopted. Annual total national demands forecasted macroscopically have been distributed to each area and then to each exchange based on the present demand (total number of subscribers plus total number of applicant at present). Forecasted demands by these models are given below.

(1) ITU regression model

The demand forecast is made employing the model formula derived from analysis of regression of correlation between the GDP and the telephone density of 42 countries in the world. The forecasted growth of the GDP is low and the forecasted demand does not change appreciably from the present demand, therefore, it has not been adopted in this study because of its too pessimistic results. The demand forecast on the ITU regression model is given in Table 3-1.

Table 3-1 Telephone Demand by ITU Model

Year	1992	1997	2002	2007	2012
Demand (x 1,000)					
(GDP 2.7%)	92.5	104.7	119.9	140.9	167.0
(GDP 3.7%)	92.5	111.2	135.6	169.3	215.4
Demand Density					
(GDP 2.7%)	1.10	1.07	1.05	1.06	1.09
(GDP 3.7%)	1.10	1.13	1.19	1.28	1.41

(2) Logistic curve model

The demand forecast is made through the forecast formula on the logistic curve drawn from the past trend of business and residential telephone demand. This model is suitable for the cases where the economic activity is active with a greater growth rate of telephone demand, in other words, the values forecasted tend to become greater. Hence this model is not adopted because of its too optimistic result. The demand forecast on this model is given in Table 3-2.

Table 3-2 Telephone Demand by Logistic Model

Year	1992	1997	2002	2007	2012
Total demand (x 1,000)	130.4	179.9	275.8	417.1	621.3
Telphone Density	1.56	1.84	2.42	3.15	4.06

(3) Modified regression model

The modified regression model uses a regression model formula with parameters of the GDP per capita, forecasted population, and past demand. In this study, the forecasted values which fall between the values forecasted by the models, (1) and (2).

Results of the macroscopic demand forecast on the modified regression model are given in Table 3-3.

Table 3-3 Telephone Demand by Modified Regression Model

Year	1992	1997	2002	2007	2012
Total demand (x 1,000)	130.4	161.5	221.1	304.1	418.8
Telephone Density	1.56	1.65	1.94	2.29	2.74

3.2 Non-Telephone Services (Telex, Telegraph)

In general, demand for telex and telegraph tends to decrease according as the telephone and new services, such as facsimile, expands.

In Zambia the telephone services are expected to expand rather moderately and, therefore, demand for telex and telegraph will continue to grow for some years to come.

Demand forecast for telex and telegraph services has been made as shown in Table 3-4, paying due attention to the above trend.

Table 3-4 Demand Forecast for Non-Telephone Services

Year	1992	1997	2002	2007	2012
No. of telex subs.	4,366	5,981	6,953	7,468	7,725
Growth rate	10.0%	4.7%	2.2%	1.0%	0.5%
No. of telegrams	888	1,282	1,846	2,649	3,315
No. of GENTEX term.	176	267	406	618	939

3.3 Mobile Communication Services

Demand for mobile communication services, such as car telephones, handheld telephones and pagers, has been forecasted based on the number of main telephones in Zambia and the statistical data extracted from 27 countries in the world.

PTC has now been suspending the implementation of a contract for installation of the mobile telephone system due to lack of funds, while a private enterprise has proposed an investment in the mobile communications services. Prior to realization of the mobile communications it is necessary to systematize the relevant regulations, tariffs, etc. The demand for Radio-paging service is strongly linked to the diffusion of PCOs (Public Call Offices). The number of Public Call Offices (PCOs) in Zambia is approx. 400. However, most of them are unusable due to lack of coin. There is a plan by foreign aids to replace the equipment so that special coin may be utilized. Table 3-5 shows the demand forecast for car/handheld telephone and paging services.

Table 3-5 Demand Forecast for Mobile Communications Services

Year	1992	1997	2002	2007	2012
Car/handheld	413	1,292	2,015	3,149	4,921
No. of paging term.	2,208	5,799	8,588	12,729	18,847

3.4 Data Communications Services

Although data communications services in Zambia are being provided only through leased circuits, there is a plan to furnish a data communications service by packet.

Taking into account the past tendency of demand for leased circuits and the data extracted from 21 countries, the demand for data communications services has been forecasted. Table 3-6 gives demand forecast for leased circuits and packet data communications.

Table 3-6 Demand Forecast for Data Communications Services

Year	1992	1997	2002	2007	2012
No. of leased circuits	275	694	1,014	1,481	2,168
No. of data terminals	742	1,515	2,084	2,856	3,924

4. TELECOMMUNICATIONS DEVELOPMENT PLAN

4. TELECOMMUNICATIONS DEVELOPMENT PLAN

The telecommunications development plan aims at establishment of development policy, strategy, and targets of the corporate entity in terms of telecommunications services and facility expansion.

4.1 Development Policy

PTC aims to establish, within the next 20 years, a telecommunications operating entity that can furnish telecommunications services with sufficient qualities to satisfy customers and has enough potential to cope with privatization in line with the Government policy.

In view of the above, the long-term telecommunications development policy has been formulated, decade by decade, as follows:

(1) First Stage: (Creation Decade: 1993 - 2002)

a) Establishment of independent telecommunications operating entity.
b) Restructuring of stabilized and flexible telecommunications network.
c) Improvement of billing procedures and establishment of sound corporate finance by new tariffing system.

(2) Second Stage: (Growth Decade: 2003 - 2012)

a) Developing the organization to cope with customers in competitive age.
b) Development of advanced telecommunications network towards ISDN.
c) Establishment of self-reliant, stabilized and sound financial bases.

4.2 Development Strategy

The strategy to be adopted by the telecommunication operating entity split from the PTC in 1993 is proposed in terms of privatization, provision of telecommunications services, tariffing and investment.

It is proposed that the privatization will be realized within the third decade (2013 to 2022), the basic services such as telephone, telegraph, telex, etc. are to be provided by the entity and other services such as mobile/hand-held telephone is to be provided by the private company or in cooperation of the private company and the entity. The development strategy is shown in Table 4-1.

Table 4-1 Development Strategy in Telecommunications Sector

Period	1993-2002	2003-2012	2013-2022
1. Owner	Government	Government	Private
2. Telecom. entity			
Teleph. basic service	Corp.	Corp.	Open
Other serivces	Open	Open	Open
3. Tariff policy	Commission	Commission	Competitive (Commission)
4. Investment to telecom.			
Urban area	Corp. (Grant)	Corp. (Loan)	Corp.
Rural area	Government	Government	Government

4.3 Development Targets

(1) Telephone Supply Plan

The telephone supply volume has been studied separately for the urban area and the rural area placing emphasis on investment efficiency.

a) Telephone supply volume to rural area

For provision of telephone to people scattered in vast rural area, a larger investment will be required comparing with these people in the urban area. Results of this study shows that the construction investment per subscriber in the rural area requires three-fold as much as that in urban area. According to the RASCOM feasibility study report, the amount of investment made by 50 African countries to the rural area in the past five years accounts for approx. 12% in average, of the total amount of investment, while that in Zambia, less than 8%. Although the supply volume to the rural area is set at 10% of the total investment, the finally projected investment amounted to approx. 14% and the supply volume to the rural area accounts for approx. 3% of the total demand. In the rural area, supply will be made firstly to the places with a preference in a society, e.g., hospitals, governmental offices (public organization), schools, large farmlands,commercial and industrial offices and so on, and then shifting gradually to the applicants with a lower preferential order.

Table 4-2 Demand and Supply in Rural Area

Period	2002	2012
Telephone demand	44,400	98,000
Supply volume	6,400	12,960
Telephone density	0.09	0.15

b) Telephone supply volume to urban area

The telephone supply volume to the urban area has been studied with respect to telephone density, investment, financial analysis, etc. for two cases, i.e., Case 1 which assumes 100% supply against the demand, and Case 2 which assumes 76% supply to the demand.

Relationship between the demand and the supply of 42 countries in the world has been analyzed by the ITU model and applying the demand in Zambia to this formula yields 76% of the supply volume. Accordingly this "76%" has been adopted as a supply volume of world level. Relationship between the demand and the supply in the urban area is shown in Table 4-3.

Table 4-3 Demand and Supply in Urban Area

Year	2002	2012
Case 1		
Telephone demand	176,700	320,800
Supply volume	176,700	320,800
Telephone density	3.55	4.72
Case 2		
Telephone demand	176,700	320,800
Supply volume	129,900	244,100
Telephone density	2.61	3.59

(2) Case Study

Resultant total supply volume of telephone in urban and rural areas are given in Table 4-4.

Table 4-4 Parameters Used for Case Study

Item	Case 1	Case 2
1993-2002		
No. of telephone subscribers	183,100	136,300
Telephone density	1.61	1.2
No. of additional subscribers	112,300	65,400
Investment (US$ Million)	321.2	261.3
2003-2012		
No. of telephone subscribers	333,800	257,000
Telephone density	2.19	1.68
No. of additional subscribers	150,700	120,700
Investment (US$ Million)	388.8	303.9
No. of additional subs. (Total)	262,900	186,100
Total investment (US$ Million)	710.0	565.2
Investment/sub. (US$)	2,700	3,037

(3) Financial Projection

Case 1 and Case 2 were prepared as the Long-Term Plan Master Plan in line with the two kinds of telephone densities indicated at the beginning of this section. The economic aspects of both Cases will be examined, focusing on feasibility rather than financial aspects.

Recently, most funds required for large-scale projects in Zambia have been provided through overseas assistance. Over 90% of such funds come from foreign grants.

The above situation has been taken into consideration in comparing the financial aspects of the proposed Long-Term Plans, Case 1 and Case 2. It has also been assumed that the introduction of facilities will be covered by foreign grants for the first 8 years.

The size of the foreign grants has been set at a maximum of US$200 million, given the financial restrictions. The shortfalls will be made up using Long-Term Loans. For the next 12 years, funds needed for investment will be raised through Long-Term Loans. For both Case 1 and Case 2, financial situations in the year 2012 have been evaluated under the cost and revenue conditions.

The financial situations that result from operating the existing network are also forecast and incorporated into the evaluation. The effects of introducing the plans are then examined.

a) Basic Assumptions

- Project life

  1993 - 2012 (19 years)

- Base price

  Nominal basis in the first planning year is applied for this analysis. This means estimated prices and cost in 1993 are used and they are assumed constant during the whole projects.
  No compensation has been made for future inflation.

- Exchange rate

  1 US$ = 360.0 Kwacha

- Foreign Grant Aid

  For first 8 years and Rural Project, the facilities and equipment normally comprising telecommunication networks are obtained from advanced nations, and the greater part of the funds required for the implementation of the plans is covered by foreign grant aids.

However, Zambia itself also must raise a portion of the required funds, i.e., the local currency portion, such as personnel expenses and installations for subscriber lines. This portion is estimated to be about 5% of the total and it is assumed that such funds are raised through equity financing.

- Long-Term Loans

Long-term loans are assumed to be provided by international financial organizations and/or through bilateral assistance.

The conditions for these long-term loans are as follows, using leasing conditions currently applied to PTC.

Interest Rate : 10.0% p.a.

Repayment : 40 times / 20 years
Equal Semi-Annual payment for 20 years
including Grace Period of 5 years

- Tax

  - Income tax

    Income tax of 40% is imposed on taxable income.

  - Sales tax

    Sales tax of 20% is imposed on gross sales.

- Depreciation

In the Long-Term Plan, depreciation is of straight line and runs over 20 years.

b) Financial Situation of Existing Network

PTC currently suffers from a shortage of funds accompanied by accumulating debts. As facilities become obsolete, this situation is expected to deteriorate further. Current operation conditions must be evaluated in order to compare Case 1 and Case 2.

This means that the fund position must be forecast given a condition in which the existing network continues to operate. The financial effects on the both Cases must be incorporated and evaluated.

The current financial situation of PTC has been set as follows:

- Accumulated debts as of March 1992 were given as foreign debts. Repayment of these debts have been included in accordance with the repayment conditions of each loan.

- Existing facilities become increasingly antiquated every year, practically making it difficult to use. Therefore, the supply capacity of existing facilities will decrease each year.

- By maintaining the exchange rate of January 1, 1993 (1US$=360 Zambian Kwacha), no exchange loss will occur from after 1993.

c) Conclusion

In Case 1, the amount of investment required for 1 line unit is lower, owing to economic of scale. However, the amount of investment required to achieve 100% density is extremely large. The forecast financial conditions consequently highlight difficulties in operations along with a continued shortage in funds for the whole project period.

This means that although demand has been totally met and a large number of subscribers have been connected, PTC will find itself in a difficult financial situation with the principal factor being the burden of repaying the large amounts of long-term loans introduced. It is therefore difficult to justify this investment.

Implementing Case 2 will improve PTC's operating conditions, and enable repayment of presently accumulating debts to be completed. Case 2 also demonstrates a sound financial condition, with a surplus of cash. The cash flow statement is described in Table 4-5.

The aim of the Long-Term Plan is to improve PTC's operating conditions while expanding the telephone services. Case 2 should be selected based, with the understanding that by implementing this plan, the privatization of PTC can become an acceptable proposition.

Case 2 and the profit and loss forecast of the facilities already operating show that a grant of US$200 million to be extended from 1994 to 2000 would turn PTC's total result of annual operations into positive figures starting 1996. However, from the year 2000 PTC invests the total amount of US$327 million financed by the proceeds of equity infusion and long-term borrowing. This would increase PTC's depreciation costs, thus the results of operations would be reversed to red figures over the nine years 2004-2012.

The cash flow statement is shown in Table 4-5 (1/2) and (2/2).

Therefore, although the accumulated profit and loss forecast would start to show positive figures from 2001, the organization's operations would start to deterio-

rate again from about 2004, and for several years from 2008 PTC would show a slight accumulated loss. However, the accumulated loss would be offset by profits in 2013, and PTC would start making money from around 2014. The above described PTC's annual profit registration starting 1996 would be attributable to the rapid effect of the investment made under the overseas grant. The cause of the temporary negative operations starting 2004 would be the increased depreciation costs in advance of the realization of the corresponding revenues under the large scale investment which comprises equity and long term loans at the percentage ratio of 30-70%.

Looking at the annual cash flow, PTC registers cash surplus from 1997 and onward. As the accumulated cash flow shows surplus from 2008, the PTC's operations would be stabilized starting that year, notwithstanding the slight accumulated loss for the several years.

Table 4-5 Cash Flow Statement (1/2) (Case 2)

Unit: 1,000 US$

Year	Number of Additional Main Lines (Case 2)	Sales Revenue	Investment Schedule (Case 2)				O/M Interest Depre. Tax	Profit After Tax
			Equity	Loan	Grant (Urban)	Grant (Rural)		
1(93/94)	0	0	0	0	0	0	0	0
2(94/95)	0	0	105	0	1,995	0	5	-110
3(95/96)	0	0	1,311	0	18,729	6,180	71	-1,382
4(96/97)	21,838	10,007	1,724	0	18,297	14,450	7,659	624
5(97/98)	29,757	15,559	2,137	0	34,813	5,790	11,462	1,959
6(98/99)	36,308	21,447	2,712	0	37,988	13,540	15,337	3,398
7(99/00)	42,859	27,354	1,912	0	36,319	0	19,200	6,242
8(00/01)	49,410	34,296	8,185	13,432	11,963	0	24,197	1,914
9(01/02)	55,961	38,485	7,572	17,668	0	0	28,681	2,233
10(02/03)	62,513	41,769	1,350	3,150	0	0	32,331	8,088
11(03/04)	74,585	45,626	6,918	16,142	0	0	36,468	2,241
12(04/05)	86,657	49,459	16,212	37,828	0	0	42,304	-9,057
13(05/06)	98,729	53,304	7,281	16,989	0	5,210	48,558	-2,535
14(06/07)	110,801	57,743	16,983	39,627	0	12,100	54,816	-14,056
15(07/08)	122,871	62,821	6,999	16,331	0	6,690	61,720	-5,898
16(08/09)	134,943	68,154	11,787	27,503	0	15,610	67,821	-11,454
17(09/10)	147,015	72,647	3,348	7,812	0	0	73,699	-4,400
18(10/11)	159,087	77,151	7,803	18,207	0	0	78,422	-9,074
19(11/12)	171,159	81,309	1,950	4,550	0	0	83,035	-3,676
20(12/13)	183,229	85,477	0	0	0	0	85,795	-318
Total	183,229	842,608	106,289	219,239	160,104	79,570	771,581	-35,261

Table 4-5 Cash Flow Statement (2/2) (Case 2)

Year	Accumulate Profit & Loss Case 2 + Exist	Cash Flow		Accumulated Cash Flow	
		Case 2	Case 2 + Exist	Case 2	Case 2 + Exist
1(93/94)	-8,592	0	-16,375	0	-16,375
2(94/95)	-16,444	-105	-16,014	-105	-32,389
3(95/96)	-19,536	-1,311	-8,646	-1,416	-41,034
4(96/97)	-17,084	781	-896	-635	-41,930
5(97/98)	-13,786	2,223	39	1,589	-41,891
6(98/99)	-9,401	3,798	1,245	5,386	-40,646
7(99/00)	-2,455	6,737	3,885	12,123	-36,761
8(00/01)	-70	3,490	690	15,614	-36,071
9(01/02)	2,645	5,070	2,277	20,684	-33,794
10(02/03)	11,430	11,151	8,572	31,835	-25,221
11(03/04)	14,582	6,456	4,092	38,291	-21,129
12(04/05)	9,942	-2,139	1,197	36,152	-19,932
13(05/06)	11,905	5,596	9,014	41,748	-10,918
14(06/07)	2,300	-3,766	-398	37,983	-11,317
15(07/08)	667	4,676	7,849	42,658	-3,467
16(08/09)	-5,496	926	6,265	43,585	2,798
17(09/10)	-4,556	7,731	13,203	51,316	16,000
18(10/11)	-8,240	2,466	8,071	53,782	24,072
19(11/12)	-6,525	7,340	12,945	61,122	37,016
20(12/13)	-1,453	8,716	14,321	69,838	51,338

d) Targets for Telecommunications Development

Development targets for each 10-year period on the basis of the supply plan given above are shown in Table 4-6.

Table 4-6 Targets for Telecommunications Development

Category	1992	2002	2012
Servicse			
1. No. of Subscriber	70,750	136,300	257,000
Urban	69,450	129,900	244,000
Rural	1,300	6,400	13,000
2. Telephone density	0.88	1.20	1.68
Urban area	1.95	2.61	3.59
Rural area	0.03	0.10	0.15
3. Major objective area		Urban	Rural
4. Successful call ratio	30%	50%	60%
Facilities			
1. Automatization	99.9%	100%	100%
2. Digitalization			
Switching	44%	90%	100%
Transmission	5%	60%	100%
3. ISDN			Lusaka
4. Introduce. of new tech.	IDR	Mobile Digital sat.	SDH
Maintenance			
1. External plant (fault/line/year)	1.5	0.5	0.2
Maintenance effici.	95.00%	95.00%	99.00%
2. Micro/w(availability)			
Analog sys.	99.99%	99.99%	99.99%
Digital sys.		99.99%	99.99%
3. Earth station	99.90%	99.99%	99.99%
4. Carrier system	66.30%	99.00%	99.99%
5. Telex	99.90%	99.90%	99.99%
Human resources development			
1. Staff efficiency (staff/1000DEL)	47.3	32.0	22.0
2. No. of staff	3,345	4,361	5,654
3. Composition of staff			
Univ./Col/Sec.sch.	51/1292/978	122/1919/1308	283/2612/1696
Percentage	1.6/38.6/29.2	2.8/44/30	5.0/46.2/30

Note: IDR : Intermediate Data Rate
SDH : Synchronous Digital Hierarchy

5. TELECOMMUNICATIONS NETWORK EXPANSION PLAN

5. TELECOMMUNICATIONS NETWORK EXPANSION PLAN

For the network development, great emphasis is placed upon investment producing higher performances in corporate income, and the scope of subscriber expansion work is determined and the objective areas are selected; the urban area thus selected is the core-belt area (Kitwe - Lusaka - Livingstone) whose demand account for approx.70% of the total. For rural areas, the emphasis is put on such an area that is essential for promotion of economic activities, i.e., public facilities including the public call offices, farmland, etc. Project is to be of totalized facilities enabling to form a regional telecommunication network.

5.1 Urgent Programs

To solve a certain problems among the current problems of PTC, the following urgent programs are to be carried out by self-reliant effort.

Three special task force teams and a special assessment team are organized to settle current PTC problems.

(1) Program 1: Reinforcement of maintenance for subscriber's external plant and elimination of waiting applicants

A special Task Force team is organized for reinforcing the fault correction and the service expansion work for the external plants in Lusaka, Kitwe and Ndola areas to clear waiting applicants (approx. 18,000) and to manage claims from subscribers.

Also to be carried out by this team is reviewing the current standard procedures to contribute towards establishment of the External Plant Maintenance Center to be realized within the Creation decade and Growth decade.

(2) Program 2: Improvement of the billing work and reviewing the tariffing policy.

A special Task Force team is organized to carry out:

a) Collection of unpaid telephone charges,
b) Expediting the start of the operation of the country-wide billing system, and
c) Review of the tariffing system (introduction of a monthly billing system and a revised tariff system based on the estimated costs of telephone, telegraph and telex services). The target for the collection rate towards the end of this program is set at 70%.

(3) Program 3: Vehicle survival operation

Sales, operation and maintenance activities are enhanced through improvement of utilization rate by repairing and overhauling.

A special Task Force team is organized to repair non-runner vehicles to achieve 70% utilization of vehicles as a target. To do this task, it is necessary to estimate and purchase the necessary quantities of spares. The team should review current PTC's rules on procurement as to standard utilization period, redeployment, procurement contract, etc.

Each Task Force team should report the results of their performances and problems, if any, weekly to a manager appointed by the Managing Director.

An assessment team that is organized separately from the above three Task Force teams is required to analyze the reports submitted, to supervise, if necessary, and to report the results to the appointed manager in charge.

It is recommended that each team hires a consultant or specialist to carry out their task.

5.2 Telephone Switching System

(1) Policy of Facility Expansion Plan

Policy of expansion of switching system in this study is as follows:

a) Amount of expansion in this plan is determined on the basis of the supply volumes for the years 2002 and 2012. Rate of number of subscribers accommodated to the total capacity of the facilities is set at 85% in consideration of fluctuation of demand and possible shift in installation period.

b) The obsolete manual switching equipment is replaced by a digitalized automatic switching equipment at the time of expansion.

c) Analog automatic switching equipment is replaced by the digitalized equipment at the time of network expansion in the preferential order as follows:

#1: Equipment with no availability of spare parts,
#2: Equipment whose economic life has been expired.

d) Choice of equipment type is made according to the following criteria based on the capacity at the end of Growth decade:

Capacity at the end of Growth decade	Equipment type
5,000 or more units	Digital switching equipment
less than 5,000 units	Digital remote concentrator with free-run function

(2) Facility Expansion Plan

The facility expansion plan of the switching equipment is given in Table 5-1, and the expansion plan by region, in Figure 5-1.

Table 5-1 Expansion Plan of Switching System

Item	2002	2012
Exist. capacity (Sept. 1992)	128,874	
Exist. capacity (2002)		168,524
Removed capacity	55,758	7,524
Additional capacity	95,408	146,600
Resultant total	168,524	307,000

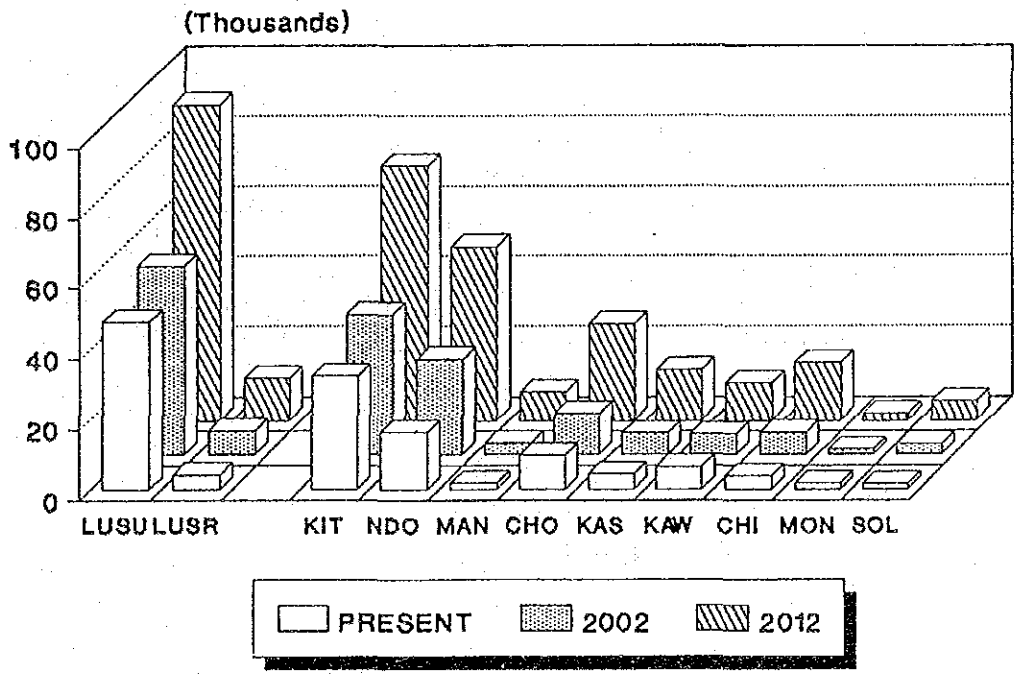


Figure 5-1 Accumulated Capacities of Switching Systems by Year

5.3 Transmission System

(1) Policy of facility expansion plan

The expansion policy of this transmission system in the study is as follows:

a) The capacity of transmission system for years 2002 and 2012 has been determined taking into account the traffic between exchanges, and the transmission capacity required from Zambia National Broadcasting Corporation.

b) The terrestrial microwave system is used as the transmission facilities for backbone route. A ring configuration (loop connection) should be arranged for the main routes to make provision for the specific circuit interruption.

c) Target is set at establishment of the network to cope with the future ISDN through promotion of digitalization.

(2) Facility expansion plan

The terrestrial backbone transmission systems for years 2002 and 2012 are shown in Figure 5-2 and Figure 5-3.

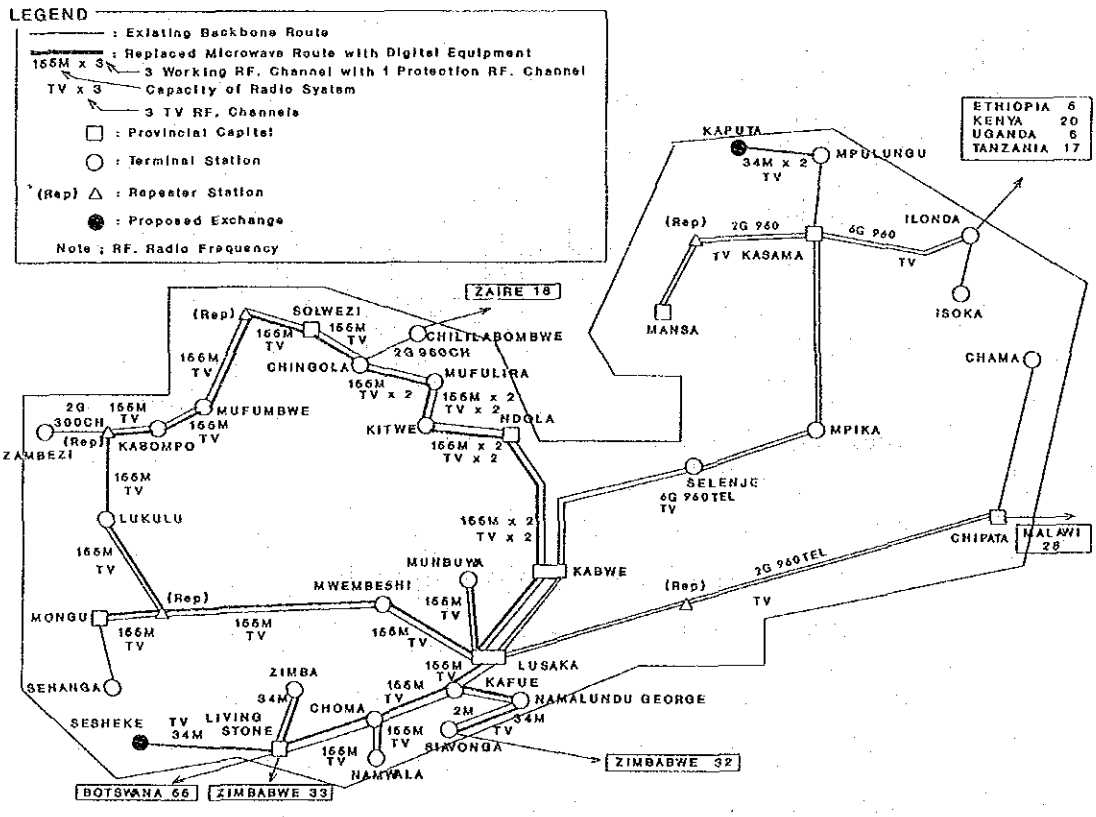


Figure 5-2 Terrestrial Backbone Transmission System (2002)

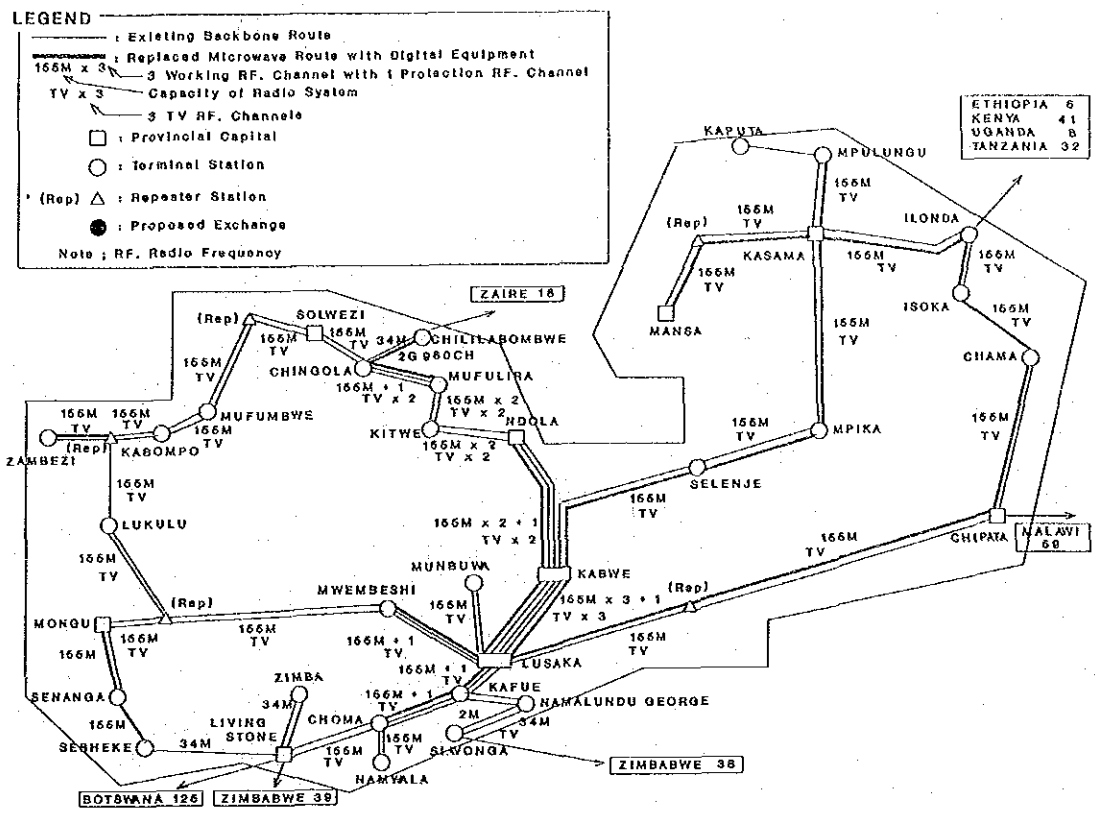


Figure 5-3 Terrestrial Backbone Transmission System (2012)

5.4 External Plant and Subscriber Radio System

(1) Policy of facilities expansion plan

a) The supply volume estimated from the demand forecast has been distributed into individual stations taking into account economical aspect and technical aspect as well.

b) The fundamental technical plan has been prepared in consideration of the unified technical specifications which have been prepared by SADC (Southern African Development Community) and are under study, and PTC's Technical Standards.

c) In the urban area, the external plant is employed while the MARS (Multi Access Radio System) is used in the rural area. Connection of subscriber between the MARS and the repeater station is made by the cable when the distance in between is short, and by the radio system when the distance is long.

(2) Plant expansion plan

Table 5-2 shows the external plant expansion plan in terms of number of lines accommodated into MDF and also number of lines expanded by MARS.

Table 5-2 Summary of Expansion Volume for Provinces

Year	1993	2002			2012		
		Rural		Urban	Rural		Urban
Provinces	Pairs on MDF	M+C	M+S		M+C	M+S	
Lusaka Metro	35,700	100	211	23,900	40	78	35,200
Lusaka	5,700	120	144	2,500	40	134	4,500
Kitwe	42,600	220	558	9,100	120	366	28,200
Ndola	18,400	50	91	10,600	30	61	21,300
Luapula	1,900	160	426	1,300	210	601	3,900
Southern	9,700	520	1,419	1,700	540	1,673	13,200
Northern	4,100	240	565	2,000	210	648	7,300
Central	9,300	260	585	200	110	409	800
Eastern	4,800	280	728	1,900	380	1,171	8,200
Western	2,300	100	181	200	10	29	0
Northwestern	3,300	80	152	400	30	98	1,800
Total	137,800	2,130	5,060	53,800	1,720	5,268	124,400

(Note) - URBAN: Cable pairs number to be terminated to each exchange's MDF.
- M+C: Cable pairs number to be terminated to MARS equipment for rural subscribers.
- M+S: Number of subscribers to be connected by a single radio channel through MARS.

5.5 Project Formation and Implementation Program

(1) Project Formation

Project formation is twofold. One is to form a comprehensive project which covers all the necessary network elements (switches, transmission and external plant), so that, with the completion of the project, the installed systems can function as a regional network (project packages which fall in this category are 8 packages for urban area and 4 packages for rural area). The other is to form a project for a single network element (projects which fall in this category are project other than the urban and rural projects mentioned above). Emphasis is placed on the former. The supply volume provided by the PTC's on-going project is deemed as the existing volume assuming the completion of those projects. The projects planned by PTC are deemed as that belonging to the latter category and these are included in this development plan. The proposed projects are as listed in Table 5-3.

Table 5-3 Proposed Projects

Projects	No. of Packages
Urgent Project	1
Regional Network Project	8
Rural Network Project	4
External Plant Maintenance Center	2
Network Management System	1
Vehicle Procurement, Repair Control	4
Computerization of Routine Work	1
Main Frame Computer for Billing, etc.	1
Replacement of Earth Station Facilities	1
Public Call Office	(1)
Vehicle/Handheld Telephone Project	4
Radio Paging Project	2
Packet/Data Project	2
Total	31

Note: ( ) Sale projects to provide additional PCO services however, installation of these PCO are included in the area project package (Regional Network Project/Rural Network Project).

(2) Estimated Project Costs

In project cost estimation, unit prices have been estimated for each subsystem, based on the prices of the PTC's past contracts, international price levels, etc. The estimated cost per subscriber unit is US$ 2,795, which is somehow expensive because it includes costs for replacement.

Breakdown of the cost estimation is shown in Table 5-4.

Table 5-4 Basic Unit Price Estimated

System	Unit Price (US$)	%
Telephone Exchange	550	19.8
Telex Exchange	15	0.5
Terrestrial Transmission	1,010	36.1
Satellite Earth Station	90	3.2
Subscriber Cables	800	28.6
Associated Facilities	190	6.8
Consultant	140	5.0
Total	2,795	100.0
Rural communication	5,840	

Project costs of the proposed packages are given in Table 5-5.

Table 5-5 Project Costs of Packages

1993 - 2002		2003 - 2012	
Package No.	Costs (USm$)	Package No.	Costs (USm$)
1 Urgent	7.00	6 Urban NW	73.35
2 Urban NW	50.48	7 Urban NW	80.88
3 Urban NW	63.29	8 Urban NW	56.12
4 Urban NW	32.51	9 Urban NW	33.40
5 Urban NW	36.06	12 Rural	17.31
10 Rural	20.63	13 Rural	22.30
11 Rural	19.33	15 EPMC	3.77
14 EPMC	3.69	16 NMS	3.50
17 Vehicles	4.50	19 Vehicles	6.50
18 Vehicles	4.50	20 Vehicles	6.50
22 MF&P Computers	1.24	21 P. Computers	0.25
23 Earth Station	18.09	24 PCO	(3.22)
Total	261.32	Total	303.88
Grand Total 1993 - 2012			565.20

Table 5-6 Project Packages by Private Funds

Package	No. of Packages	Cost (USm$)
Vehicle/Handheld Telephone	4	42.34
Radio Paging	2	9.07
Packet Data Com.NW	2	6.47
Total	8	57.88

The investment amount by the private funds is not included in the financial and economic analysis.

(3) Project Implementation Schedules

The project implementation schedule is shown in Table 5-7.

Table 5-7 Project Implementation Schedule (1/2)

UNIT : Million US$

YEAR (FISCAL)	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	PACKAGE TOTAL
PACKAGE 1 Urgent Program		2.06	4.94																		7.00
PACKAGE 2 Lusaka, Kabwe, Kitwe			15.14	17.67	17.67																50.48
PACKAGE 3					9.49	31.65	22.15														63.29
PACKAGE 4							9.75	22.76													32.51
PACKAGE 5								10.82	25.24												36.06
PACKAGE 6											22.01	51.34									73.35
PACKAGE 7													24.27	56.61							80.88
PACKAGE 8															16.83	39.29					56.12
PACKAGE 9																	10.03	23.37			33.40
PACKAGE 10 Rural (1)			6.18	14.45																	20.63
PACKAGE 11 Rural (2)					5.79	13.54															19.33
PACKAGE 12 Rural (3)													5.21	12.10							17.31
PACKAGE 13 Rural (4)															6.69	15.61					22.30
PACKAGE 14 EPMC (1)				1.11	2.58																3.68
PACKAGE 15 EPMC (2)																	1.13	2.64			3.77
PACKAGE 16 NMS											1.05	2.45									3.50
PACKAGE 17 Vehicle (1)					4.50																4.50
PACKAGE 18 Vehicle (2)										4.50											4.50
PACKAGE 19 Vehicle (3)															5.50						5.50
PACKAGE 20 Vehicle (4)																			5.50		5.50
PACKAGE 21 Computer												0.25									0.25
PACKAGE 22 Main Flame Computer				1.24																	1.24
PACKAGE 23 Earth Station					2.71	9.05	6.33														18.08
PACKAGE 24 PCO																					(3.22)
TOTAL COST	0.00	2.06	26.26	34.47	42.74	54.24	38.23	33.58	25.24	4.50	23.06	54.04	29.48	68.71	30.02	54.90	11.16	26.01	6.50	0.00	505.20

Table 5-7 Project Implementation Schedule (2/2)

YEAR (FISCAL)	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	PACKAGE TOTAL
PACKAGE 25 Mobile Phone (1)								2.80	6.54												9.34
PACKAGE 26 Mobile Phone (2)												1.83	6.10	4.26							12.19
PACKAGE 27 Mobile Phone (3)														0.72	2.37	1.66					4.75
PACKAGE 28 Mobile Phone (4)																		4.82	11.24		16.06
PACKAGE 29 Radio Paging (1)								1.38	3.19												4.57
PACKAGE 30 Radio Paging (2)																1.35	3.15				4.50
PACKAGE 31 Packet Network (1)								1.25	2.89												4.14
PACKAGE 32 Packet Network (2)																		0.70	1.63		2.33
TOTAL COST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.43	12.62	0.00	0.00	1.83	6.10	4.98	2.37	3.01	3.15	5.52	12.87	0.00	57.88

NOTE : .....Line Indicate Preparation Work for Project

_____Line Indicate Excution of Project

(4) Priority Project

Three projects, i.e., [1] Urgent Program, [2] Regional Telecommunications Networks in Lusaka and Kitwe, and [3] Rural Telecommunication have been chosen as the priority project. The first one is an urgent program to accommodate approx. 18,000 waiting applicants through effective utilization of the existing facilities, requiring a small amount of investments. It is expected that this project can be materialized by PTC's self reliant efforts. The second one is a project package for the telecommunications network in the urban area and the transmission link in the core-belt area. This can be a most profitable investment. The third one is the provision of the telecommunications service in a rural area to meet the urgent demand by large-scale farmers.

5.6 Financial and Economic Analysis on Priority Projects

5.6.1 Financial Analysis

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

(1) Main Assumptions

a) Project Financing Scheme

Loan Case:	Equity covers 30% of Project costs Long term loan covers 70% of Project costs
Grant Case:	
Grant portion:	Equipment & Facilities including Engineering Service fee in "Project Costs".
Equity portion:	Preparatory works by PTC, pre-operation costs and Initial Working Capital in "Project Costs".

b) Financial condition

- Long-Term Loans

The conditions for these long-term loans are as follows, using leasing conditions currently applied to Zambian PTC.

Interest Rate: 10.0% p.a.

Repayment: 40 times / 20 years
Equal Semi-Annual payment for 20 years including Grace Period of 5 years

- Short-Term Loans

Conditions of short-term loan applied in case of shortage of funds occurred after the service-in are as follows.

Interest Rate : 61.0% p.a.
Repayment : repaid in next year after borrowing

c) Base price

Nominal basis in first planning year is applied for this analysis. This means estimated prices and cost in 1993 are used and they are assumed constant during the whole projects.

d) Exchange rate

1 US$ = 360.0 Kwacha (January 1, 1993)

e) Sales revenue

Revenue distribution rate is applied here.
The share % of incomes obtained by STD calls are estimated as 40% with the standard construction costs distribution ratio taken into account.

(2) Result of Financial Analysis

a) Project-Urban (Urgent Project + Urban Project)

The results of financial analysis of priority projects to be implemented in the three major cities of Lusaka, Kitwe and Ndola are as follows:

- Loan Case

A financial analysis has been carried out based on an interest rate of 10.0% P.A. and a repayment period of 20 years including 5 years grace periods.

This analysis shows a loss of US$ 7,464,000, giving a loss of US$ 70,568,000 over the project period of 17 years. Consequently, there is a shortfall in funds every year throughout the life of the project, necessitating a large amount of short-term borrowing. From an economic perspective, it will be difficult to fund this project by borrowing.

- Grant Case

This case involves a foreign grant to overcome the problems of profitability, In this model, the cost of preparatory work, pre-operation costs and initial working capital required to install such facilities for the project as transmission and switch are covered by the equity portion, while the costs of equipment and facilities which comprise telecommunications networks are covered by the foreign grant portion. In this case, Zambia only requires a small amount of funds and the project is profitable enough to ensure viability.

Funds remain in surplus throughout the entire project period.

The repayment period for the equity (US$ 3,259,000) required for initial investment is 1.45 years. The project records a cash flow of US$ 30,647,000 throughout the period, giving a FIRR of 61.43%. The profit rate indicates sound financial conditions.

However, the FIRR value is a result of a small equity portion of about 5% in the total investment costs, enabling a sound financial balance with anticipated revenue from charges, Any change in the proportion of equity in total investment costs would affect the FIRR considerably, and thus requires caution.

b) Project-Rural

Under Project-Rural, the aim is to provide telecommunications services with 3,200 lines, to begin with, to rural areas. This would be the first project to be instituted in rural areas with the goal of developing telecommunications throughout Zambia. Consequently, the rationality of implementing such a project must be examined from a policy perspective rather than in terms of profitability,

The results of financial analysis show the same inclination as Project-Urban. Extremely small demand gives an even lower profitability, This precludes funding the project by borrowing, Although projects operating on grants experience financial difficulties in the first few years following the commencement of services, necessitating short-term borrowing, the financial situation gradually improves as demand grows. Throughout the entire 16 year period, the project will register a cash flow of US$ 2,784,000, which gives an FIRR, albeit smalt, of 18.24%.

c) Summary of Project Evaluation

The following Table 5-8 shows tentative FIRR calculations, The table show that priority projects funded by a grant can be very profitable. The figures shown in the tables are just profitable enough for it to be possible to operate existing networks while improving the financial situation, even if operating existing networks continues to result in a financial shortfall.

Table 5-8 Expected FIRR (Grant Base)

Item	FIRR	Payout period
Project-Urban	61.43%	1.45 year
Project-Rural	18.24%	5.94 year
Project-Urban + Rural	53.86%	2.10 year

The result of this financial analysis is detailed in the out put sheets that are attached to ANNEX.

(3) Result of Sensitivity Analysis

Sensitivity Analysis is conducted for Urban + Rural projects.

A further study of the financial status based on major financial indicators and the result of a sensitivity analysis shows the following:

a) Loan Case

- The Debt Service Coverage ratios show less than 1.0 throughout the repayment period, meaning that the funds raised through operations will not be able to cover the majority of the funds required for repayment throughout the period of the projects.

  This indicates, therefore, the necessity for the Zambian PTC to provide a large amount of short term loan. Even if the rate of interest on borrowing is 0.0%, a short term loan will still be needed to make up for the shortage of funds.

- The Cash Break-Even Point indicates that 2 to 4 times the anticipated revenues will be required each year from the first year of operation until the completion of the projects. This supports the above prediction of a fund shortage. Given these conditions, it is difficult to calculate the Financial Internal Rate of Return (FIRR). The scale of the cash flow is so insignificant as to be not worth the reckoning if the projects are to be based on borrowing.

- Even lower interest rates for the long-term borrowing, which constitute 70% of the total investment, will only slightly reduce the formidable fund shortage. For example, even if the interest rate of 10.0% given in the base case is lowered by 6.5% to 3.5%, it is still not possible to calculate the FIRR.

  The above points show that it is difficult to justify making the investment for the projects. The projects require an investment too great for the small revenue anticipated, thus placing great pressure on funds.

b) Grant Case

- The result of sensitivity analysis is summarized in Fig 5-4.
  The Profit-Even Point for each year of the projects is 30% or lower. The Cash Break-Even Point is 23% or lower. These levels point to a sound situation in terms of profits and funds.

- If the Total Investment Costs vary by plus or minus 10% from the base value, the FIRR value also fluctuates by about 8%. Although the total costs of investment do affect the projects' profitability to some extent, they do not have a life or death influence over the projects.

- Fluctuations of sales revenues affect the project's profitability to a relatively large extent. If sales revenues vary from the estimates by plus or minus 20%, FIRR values fluctuate by about 20%. But even where sales revenues drop by 20%, the FIRR of 43.02% remains above 40%. It therefore seems that the profitability of the projects, as those to meet basic human needs, is secured.

- With a small equity portion in the total costs of investment, the results of financial analysis point to preferable profitability. But it should be noted that a decrease in the grant portion attributing to an increased portion of equity in the Total Investment Cost affects the project viability greatly. For example, as noted in the sensitivity analysis, should the grant portion set based on the equity portion decrease by 10% and this decrease is covered using equity, the FIRR will experience a major fall from 53.86% to 22.10%. Similarly, if the foreign grant portion should fall by 20%, the FIRR will decline to 12.61%.

- The above points indicate that the case which uses the grant/equity methods allows the projects to operate with solid profitability, provided the assumed foreign grant can be introduced.

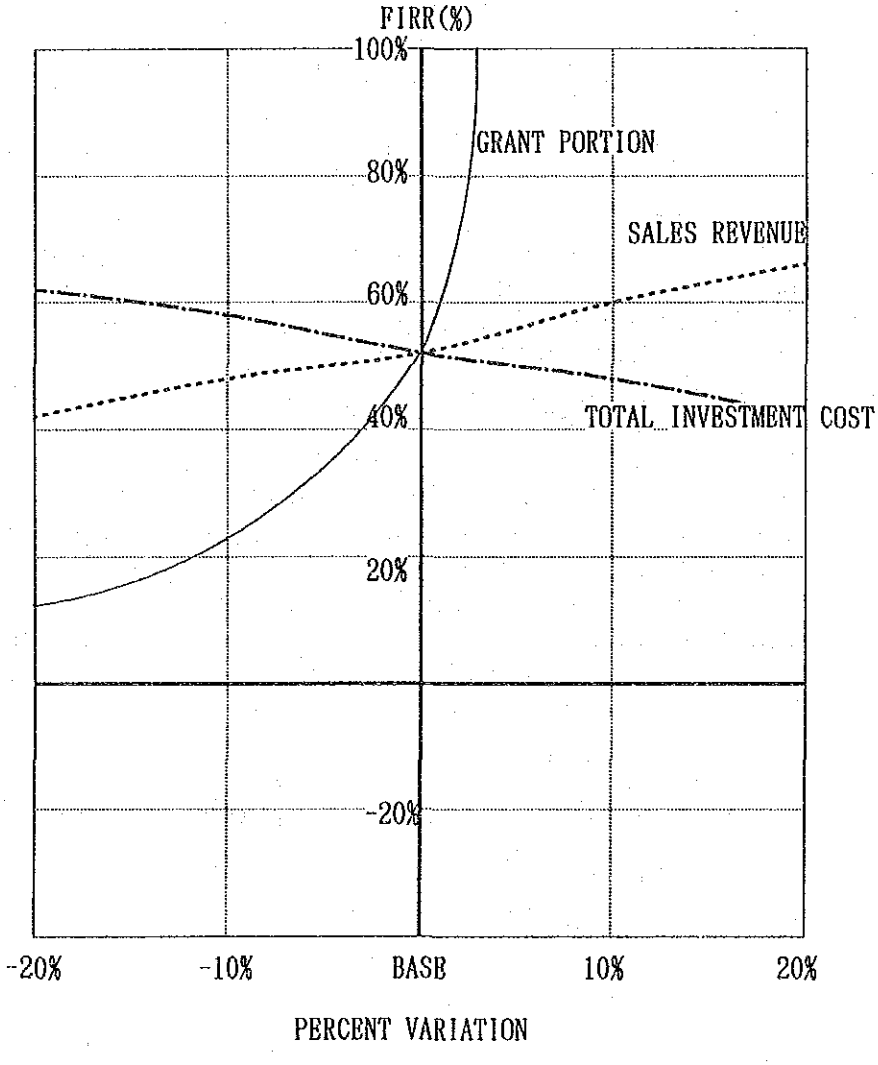


Figure 5-4 Summary of Sensitivity Analysis for Grant Case
IROE % Variation of Financial Parameter

(4) Profitability for Entire PTC

As mentioned, individual priority projects have shown sufficient profitability to justify their implementation provided that grants are given.

PTC will manage these priority projects, as well as existing telecommunications networks. The feasibility of maintaining existing facilities and the administration system, as well as the feasibility of priority projects must therefore be examined. The results of the examination are shown in Table 5-9.

Table 5-9 Expected FIRR

Item	Expected FIRR (Grant Base)	
	Unconsolidated	Consolidated
Project-Urban	114.35%	14.43%
Project-Rural	40.96%	6.73%
Project-Urban/Rural	105.88%	15.34%

a) If the priority projects are not implemented, the supply capacity will decline as existing facilities become obsolete. As a result, the financial situation of PTC will be extremely worsened.

b) Implementing the priority projects funded by foreign grant aids will improve PTC's operating conditions, allowing PTC to repay all debts accumulated to date and, to a certain extent, enjoy a surplus of funds. This trend is particularly clear with Project-Urban, and it has the effect of improving PTC's overall management.

5.6.2 Economic Analysis on priority projects

For the priority projects (Urban + Rural Project) examined in the financial analysis, the Economic Internal Rate of Return (EIRR) will be calculated.

(1) Main Assumption

a) Financial Structure cases

Referring to the two financial bases set in the Financial Evaluation, the following two cases will be analyzed and EIRR on total investment (equity case) and EIRR on equity(Grant case) will be calculated.

- Equity case: Corresponding to the Loan case
  EIRR on total investment
  (100% Equity with elimination of loan borrowing)

- Grant case: Corresponding to the Grant case
  EIRR on Equity, in other words, on total investment paid by PTC.

b) Transfer items

This analysis take transfer items into account.
ex. Sales Tax, Income Tax, Insurance , etc.

c) Sales Revenue

Revenue distribution rate is not applied here.

(2) Economic Value of the Benefit

a) Willingness to Pay

The economic benefits of these priority projects were examined through interviews conducted in the areas targeted under the projects. The interviews conducted during the local surveys were designed to determine the amount beneficiaries would willingly pay.

Table 5-10 Willingness to Pay

Item	Maximum Value
Call Charge	ZK 13 / call
Installation Fee	ZK 3,000 / line
Rental Fee	ZK 4,000 p.a.

b) Shadow premium

It is evident that charges quoted in Zambian Kwacha are increasing each year. However, when they are converted into US dollars, it is clear that the charges are actually decreasing gradually, The highest charge with call charge prices was recorded in 1988, at US$0.06 per call. Subscribers paid charges under the charge system. This means that subscribers understood that the value of the call was US$0.06. As of January 1993, the call charge is priced at US$0.036 per call. This doesn't mean that the value of the call declined, but is rather a cosmetic drop in value resulting from exchange rate fluctuations.

It can be interpreted that a premium is already incorporated in the current charges, The difference between the two, US$0.024 per call, is therefore seen as a shadow premium, and the average and maximum values of the last ten years were applied for the estimate. The same way of thinking was applied to installation and rental fees.

The above mentioned economic premium is to be used as the base value of the economic benefit expected by the project.

- Economic Benefit Case 1 (E.B.1)

  E.B.1: The premium is calculated by outcome of interview survey.

Premium of Call charges per call:	ZK 13	US$ 0.036
Installation fee per line:	ZK 3,000	US$ 8.3
Rental fee p.a.:	ZK 4,000	US$11.1

Next, the premiums that accompany fluctuations in the exchange rates are considered.

- Economic Benefit Case 2 (E.B.2)

  E.B.2: The premium where the average value over the last 10 years is used.

Premium of Call charges per call:	ZK 13.32	US$ 0.037
Installation fee per line:	ZK 3,322	US$ 9.23
Rental fee p.a.:	ZK 6,444	US$17.9

- Economic Benefit Case 3 (E.B.3)

  E.B.3: The premium where the maximum value over the last 10 years is used.

Premium of Call charges per call:	ZK 21.6	US$ 0.06
Installation fee per line:	ZK 5,904	US$16.4
Rental fee p.a.:	ZK14,400	US$40.0

(3) Result of Economic Analysis

The result obtained in this Economic Analysis is discussed here, and summarized in Table 5-11 and Fig. 5-5.

The result of Economic Analysis clearly states that EIRR (Economic Internal Rage of Return) is much higher than the FIRR (Financial Internal Rate of Return) in both base cased. This implies that the economic benefit is very high due to the greatness of people's demand for telecommunication services even though the present tariff in market price is controlled under a relatively low charge.

Table 5-11 Summary of Economic Analysis (EIRR for base case)

Economic Benefit Value	Premium to Financial Value	EIRR	
		Equity Case	Grant Case
E.B.1	2.45	11.42%	211.23%
E.B.2	2.48	11.64%	213.04%
E.B.3	3.05	16.00%	247.46%
FIRR	(1.0)	N.A.	53.86%

The results of this economic analysis is shown in Figure 5-5.

The EIRR in grant case are very high. This is due to the very small investment on PTC side in the total investment cost of which major portion are supplied by a great foreign grant aid.

If the great part of the investment required for the priority projects is covered by foreign grant aid made through bilateral assistance, financially sound operations can be expected, which would justify the project's implementation.

When consideration is given to the anticipated benefits accruing from the implementation of the priority projects indicated in the economic analysis section, while understanding the characteristics of the telecommunications project, which is a public project, then implementing the priority projects covered by foreign grants will contribute to Zambia's economic development and infrastructural improvement. The same implementation is also expected to improve the operations of Zambian PTC and become a cornerstone in PTC's shift to sound operations.

Consequently, launching of these projects are considered promising, especially if the priority projects are undertaken with the help of foreign grant aids. Implementation is likely to contribute to enhancement of economic development and improvement of social welfare of Zambian people.

5.6.3 Overall Assessment

The priority projects are looked upon as BHN (Basic Human Needs) projects which are indispensable for the national economic growth but cannot immediately bring in income. Given the anticipated revenue from charges, the burden is too great to allow the projects to be launched as they require a large amount of investments. Owing to the nature of the project, a normal financial scheme (loan case) funded by equity/loan is not feasible financially.

However, if the greater portion of the costs are funded by foreign grants coming from bilateral assistance, this will boost expectations that this could be a financially sound

operation, and justify the projects' implementation. It will also significantly improve current operations and may allow completion of repayments of accumulated debts.

When the expected benefits accruing from the implementation of priority projects are taken into consideration -- which are indicated in the economic analysis in the next section -- given an understanding of the nature of the BHN-type project, the implementation of the priority projects funded by grants is expected to contribute to Zambia's economic development and social improvement.

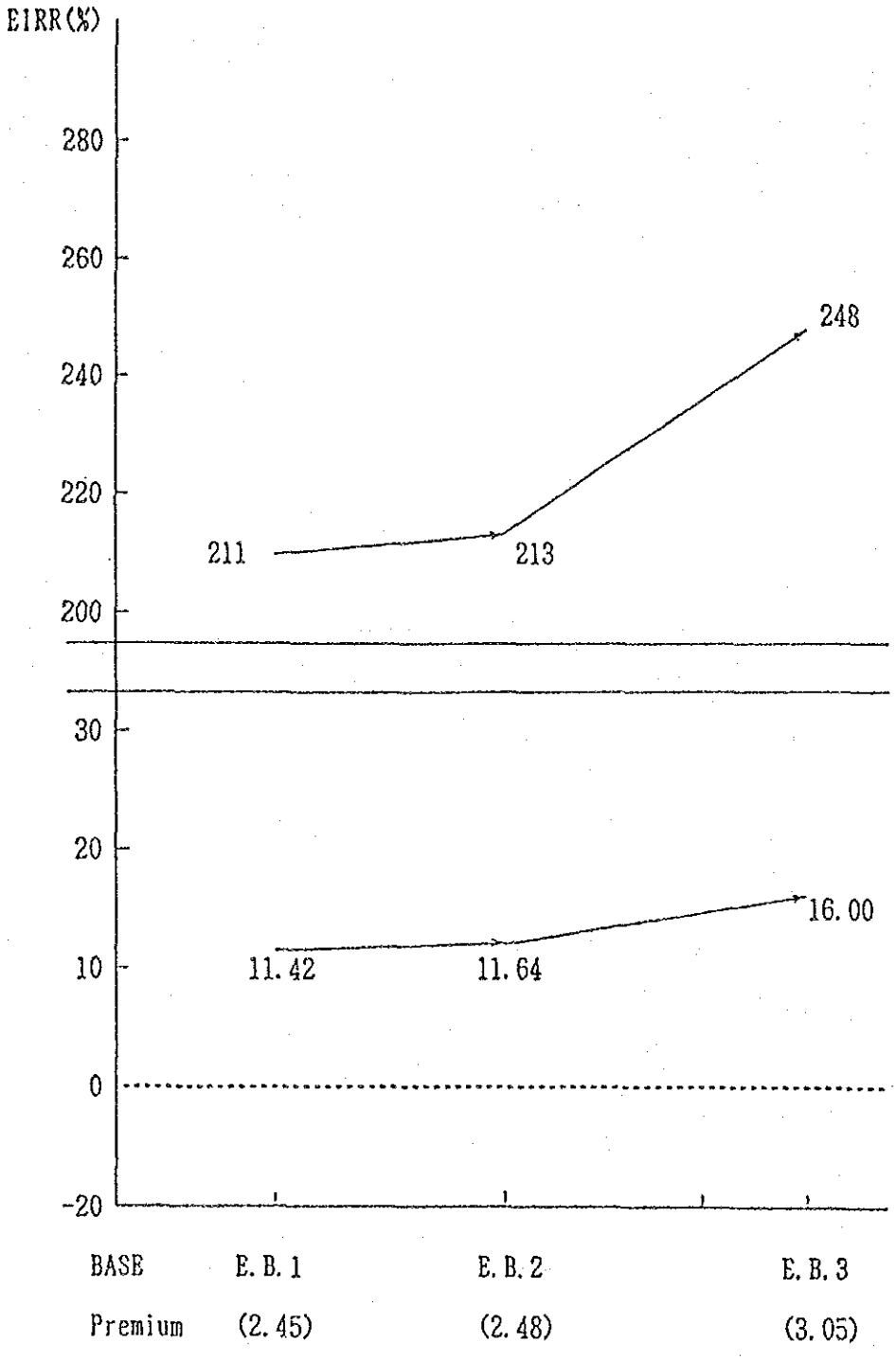


Figure 5-5 Result of Economic Analysis
(Sensitivity of EIRR to Variation of Social Economic Benefit)

6. OPERATION AND MAINTENANCE PLAN

6. OPERATION AND MAINTENANCE PLAN

6.1 Operation and Maintenance

The operation and maintenance (O&M) work includes such routine work as status supervision, system control, fault correction, testing, logistics, human resource management, and so on, and the human resource management includes an appropriate deployment of staff to various positions and staff training.

For efficient operation and maintenance of the telecommunication facilities, routine work is modernized by computers, the external plant maintenance centers are established, and the network management system is introduced.

(1) Modernization of Routine Office Work by Computerization

For improvement of administrative and billing data processing, a set of main-frame computer is to be provided for Lusaka and Ndola, respectively.

To enhance the efficiency of daily work in finance, human resource management, engineering planning, and other O&M related sections, provision of 30 sets of personal computers with software is required in Creation decade and 30 sets of personal computers will be required in Growth decade.

(2) Establishment of External Plant Maintenance Centers

To improve the efficiency of maintenance and thereby lower the number of faults/line/year, External Plant Maintenance Centers (EPMCs) are established in Lusaka and Kitwe in the Creation Decade and in Choma, Chipata and Kasama in the Growth decade. To assist establishment of the EPMC in the Creation decade, employment of two consults for one year is included.

(3) Introduction of Network Management System

The Network Management System is to be introduced in the Growth decade, and the network management center is to be placed in Lusaka, the center of the national telecommunications network. This will contribute to the staff efficiency improvement and also the telecommunications services enhancement.

(4) Improvement of transport means for O&M

Although maintaining a good fleet of vehicles is particularly important for the operation and maintenance of telecommunications network, the present situation of vehicles is not satisfactory as described in para 5.1. To improve this situation, implementation of the vehicle survival operation as an urgent program and provision of vehicles are included as project packages.

(5) Organizations on O&M

Functions of the existing technical service section is to be expanded to cope with problems which are difficult to be solved in the field, by experienced engineers as a sort of consultanting services.

Existing sections within the organization, which can perform more profitably with additional external requirements, should be run on a commercial basis in future. For example, Engineering Workshop and Electronic Repair Center.

6.2 Human Resource Development Plan

The efficiency and composition of staff should be improved to cope with progressive digitalization and gradual expansion of the telecommunications network.

In accordance with the expansion plan, present number of staff, i.e., 3,345 will be increased to 4,361 in 2002 and 5,654 in 2012. As a result, the staff efficiency will be 32 in 2002 and 22 in 2012.

Staff composition in terms of educational qualification should be enhanced as given in Table 4-6.

Reduction of the operation and maintenance costs owing to enhancement of staff efficiency is shown in Table 6-1.

Table 6-1 Operation and Maintenance Cost

Unit: 1,000 US$

Item \ Year	1992	2002	2012
Staff costs	7,352	9,586	12,428
do. (%)	100	130	169
Staff costs*	7,352	14,169	26,720
do. (%)	100	193	363
Other costs	10,727	20,659	38,960
do. (%)	100	193	363
Total	18,079	30,245	51,388
do. (%)	100	167	284
Total*	18,079	34,828	65,680
do. (%)	100	193	363

Note: Items with asterisk denote the costs estimated without taking into account of improvement in staff efficiency.

Staff Training College in Ndola should also be expanded to meet expansion of the telecommunications network and digitalization.

7. CONCLUSION AND RECOMMENDATIONS

7. CONCLUSION AND RECOMMENDATIONS

7.1 Privatization and PTC's Problems and Countermeasures

(1) Corporate Financial Assessment and Privatization

Along with the trend in policy making in Zambia, various ways and means have been taken by the Government for privatization of PTC.

However, for PTC which is currently under dire financial straits, a move towards profitability is of pressing importance. Hence, it is highly recommended that the immediate endeavor be focused on stabilization of the financial situation of PTC, paying due attention to the privatization in coming years.

In materializing the Long-Term Plan, the corporate accounting will be improved to sound condition in and after the year 2008, provided that the projects are implemented with grant in initial years, and with long-term loans after the year 2000, as shown in Table 7-1.

Table 7-1 Investments and Cash flow Statement

Item	1997	2002	2008	2012	Total
No. of Subs	103,513	136,269	196,627	256,985	
Investment	104,781	261,322	490,195	565,112	565,112
Grant	99,504	200,064	239,674		239,674
Loan		34,250	188,670	219,239	219,239
Equity	5,277	27,008	61,851	106,289	106,289
Cash Flow	-41,891	-25,221	2,798	51,338	

In this sense, it can be said that the Long-Term Development Plan is the first step towards the privatization of PTC.

The Long-Term Development Plan herein presented aims to expand the telecommunications services throughout the country, while improving the operating conditions of PTC. It is expected that the successful materialization of this Long-Term Development Plan will surely lead to the privatization of PTC.

It is further expected that the implementation of the Long-Term Plan including materialization of priority projects will greatly contribute to the economic development of the Republic of Zambia, as well as the enhancement of social welfare of the Zambian people.

(2) PTC's Problems and the Countermeasures

Table 7-2 shows the PTC's problems and the countermeasures as mentioned in para. 2.4.

Table 7-2 PTC's Problems and the Countermeasures

Problems	Countermeasures
1. External plant maintenance and new subscriber connection	Urgent program 1
2. Low telephone tariff and collection of charges	Urgent program 2
3. Low utilization of vehicles	Urgent program 3
4. Exchange loss due to fluctuation of foreign exchange rate	Government
5. Lack of foreign funds	Introduction of foreign funds through implementation of the long-term development plan
6. Shortage of human resources for O&M	Training and recruiting of able human resources
7. Shortage of spares for switch. equipment manufactured no more	Replacement to digital switching equipment
8. Switching equipment with obsolete signal. system	Replacement to digital switching equipment
9. Low call completion rate	Provision of balanced network structure
10. Network composition without loop	Provision of the loop for emergency and calamity
11. Public call office not usable due to lack of coins	Assistance program by Denmark
12. Lack of plant record of external plant	Establishment of EPMC

7.2 Recommendations on Corporate Management

(1) Organization

The new telecommunications entity to be created after the split of PTC should be responsible for provision of reliable national and international telecommunications services. It is therefore necessary to review the existing organization to cope with the new environments, taking into consideration the future privatization.

The new organization should have four major functions, i.e., Administration & Finance, Planning & Development, Operation & Maintenance, and Sales, as shown in Figure 7-1.

The Administration & Finance Department deals with budgetary control, treasury, accountancy, human resources and general administration work.

The Planning & Development Department carries out corporate planning, network planning, project engineering and reach and development.

The Operation and Maintenance Department performs actual operation and maintenance work in the southern and northern regions, logistics, and technical services.

The Sales Department executes marketing, customer services, tariffing & billing, as well as promotion of sales of telecommunication services and customer premises equipment.

Existing sections within the organization, which can perform more profitably with additional external requirements, should be run on a commercial basis in future. For example, Engineering Workshop and Electronic Repair Center.

(2) Liberalization of Customer Premises Equipment

Prior to liberalization of the customer premises equipment (CPE), it is necessary to study possible impact of the current CPE's rental system upon the corporate financial performance. From the technical standpoint, a CPE installed by a customer should not exert any unfavorable effect on functions of telecommunications networks. Therefore, the CPE to be marketed should meet minimum technical specifications approved by an authorized organization. This will necessitate revision or new constitution of relevant laws and regulations. In this respect, PTC is urgently recommended to propose the draft criteria on authorization of CPE for government.

Relevant laws or regulations currently promulgated in Japan are given below for reference:

a) Telecommunications business law
b) Regulation on Technical Criteria of CPE for Certification
c) Regulation on Installation, etc.of CPE

d) Radio-Wave Law
e) Regulation on Radio Installation
f) Regulation on Approval of Radio Equipment Model

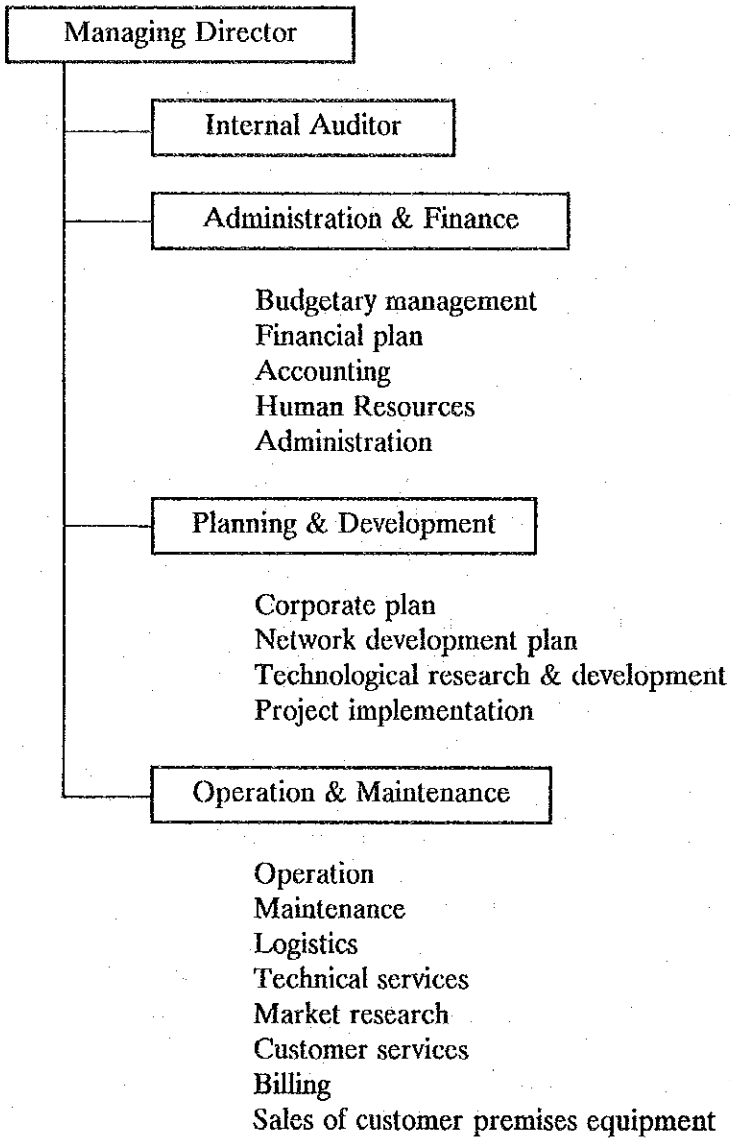


Figure 7-1 New Organization Chart

7.3 Recommendation on Financial Aspects

(1) Rural project

As the financial evaluation of the priority project shows, the profitability of the rural project is extremely low. Because the rural regions are still developing, the growth of demand is minimal, in line with the low growth of incomes, making it difficult to implement a project that requires large capital investment. This is the most striking feature of the rural project. It means that, although a telecommunications network is required to stimulate economic growth, the funds to construct and operate it are in short supply. A project such as this places a considerable burden on Zambian PTC, and is therefore given low priority. Such a project would rate even lower priority after privatization.

It is in the rural areas that future development is expected and, as a prerequisite for such development, the provision of a telecommunications network is considered essential. This project must be treated as a public project for the improvement of infrastructure.

For these reasons, rural projects should be implemented as projects led by the Government and this should not change, even after privatization.

(2) Currency Exchange losses

Losses caused by changes in the currency exchange rate place a heavy burden on the finances of PTC. In this financial analysis, it is difficult to forecast exchange rate fluctuations. Therefore, an assessment was made using the fixed rate of 1993. However, exchange rates are expected to continue fluctuating to some extent. In order to facilitate implementation of the Long-Term Development Plan, it is necessary to reduce the burden of exchange losses.

To solve this problem, an on-lent-loan (2-step-loan) is recommended.

Under this scheme, Zambian PTC would take out loans quoted in kwacha from the Zambian Government (GRZ) and the Government would shoulder the burden of any exchange loss. This would free PTC from unforeseen difficulties arising from exchange losses, and enable the organization to plan for viable operations and progressive investment. As the Government will carry the risk of exchange losses, it must take measures to distribute the burden, through such means as setting appropriate interest rates.

Rural projects requires a large amount of investments, with moderate demand growth and, therefore, not profitable. Hence, the priority of rural projects is low, when the executive entity plans the network expansion, putting emphasis on investment effects. To develop the telecommunications in rural areas, therefore, official investments by the Government is recommended, regarding that the rural telecommunication systems are public facilities.

(3) Tariffing Principles

Current tariff system for telecommunications services in Zambia is the one prepared by PTC and approved by Government.

While the national economy is not stable as in Zambia, frequent revision of the tariff will become necessary, therefore, the telecommunications operating entity needs timely revision of the tariff by an amount acceptable to the public. In the case of a telecommunications entity in fully competitive environment, a reasonable tariff system will automatically be established, however, in the non-competitive environment, there should be an appropriate rule under which new tariff system is to be determined.

It is recommended to refer to the Tariffing Principles for Telecommunications Organizations in the Non-Competitive Sector prepared by the International Chamber of Commerce, 1990, as a useful guideline.

Summary of the principles is given as follows:

a) Costs should be determined on the method of "Fully Distributed Cost".

b) Price structures should be based on cost structures.

c) Price of each component of a service should be determined independently from other components.

d) The price for a service should not include those costs attributable to other services.

e) The costs, the determining processes of the costs, and the prices must be open to responsible independent scrutiny, and must be stable and predictable.

f) Prices must apply equally to all users.

It is recommended to follow to these tariffing principles until the telecommunications services will have to be provided in a fully competitive environment.

(4) Increase in Telephone Charge

In November 1992 telephone charges were raised eight times.

As Table 7-3, the new charges are comparable to those of Zimbabwe and Kenya, but are still lower than technologically advanced nations.

A case study was made based on the premise that telephone charges will not be raised. However, the revenue from telephone charges is a major factor in an assessment of PTC's financial situation and, therefore, a further study was conducted for three cases to examine the cash positions resulting from different charge increases.

The study was made with respect to the Case 2 of the Long-Term Development Plan selected under our previous case study. No increase in international telephone charges is incorporated.

a) 10% Case: 10% increase in telephone charges every five years.

b) 20% Case: 20% increase in telephone charges every five years.

c) 30% Case: 30% increase in telephone charges every five years.

Table 7-3 Tariff Level

	Local Currency	Exchange Rate	US$ Equipment
Zambia	ZK 13.0	360.0	0.036
Zimbabwe	Z$ 0.13	5.08	0.03
Kenya	KS 1.15	31.80	0.04
United Kingdom	BP 0.05	0.556	0.09
France	FF 0.75	5.48	0.14
Japan	JPY 10.0	126.0	0.079

Table 7-4 Telephone Charge

	10%		20%		30%	
	ZK	US$	ZK	US$	ZK	US$
1993	13	0.036	13	0.036	13	0.036
1997	14.6	0.04	15.6	0.043	16.9	0.047
2002	15.73	0.44	18.72	0.052	21.97	0.061
2007	17.303	0.048	22.46	0.0624	28.56	0.079
2012	19.03	0.053	26.96	0.075	37.12	0.103

Table 7-4 indicates telephone charges in each fiscal year, and Table 7-4 provides a calculated cash statements of these three cases.

The projections in each case are based on the current financial situation of PTC. The point in time at which PTC begins to show a profit and the net cash flow over the project period have been calculated for each case as follows:

a) 10% Case

In this scenario, telecommunications charges will rise to about 1.5 times their 1993 level by 2012. PTC will start operating at a profit in 2005, three years earlier than the case where telecommunications charges are not raised. The net cash flow during the project period will total US$ 105 million.

b) 20% Case

In this scenario, telecommunications charges will rise to about double the 1993 level by 2012. PTC will start operating at a profit in 2004, and there will be a net cash flow of US$ 168 million over the project period.

c) 30% Case

In this scenario, telecommunications charges will rise to about triple the 1993 level by 2012. PTC will start operating at a profit in 2003, with a net cash flow of US$ 240 million over the project period.

The main point to emerge from these studies is that a rise in telecommunications charges brings forward the time at which PTC's finances move out of the red.

For PTC, which is currently in dire financial straits, a move towards profitability is of pressing importance. The simplest way to increase its income is to raise charges. However, frequent increases would conflict with the role of a public utility. Hence, there is a need to take such counter-measures as reduction of expenses, more efficient use of personnel, etc.

Table 7-5 Cash Flow Statement for Increase in Call Charges

Unit: 1,000 US$

Year	Present	10% UP	20% UP	30% UP
1993/94	-16,375	-16,375	-16,375	-16,375
94/95	-32,389	-32,389	-32,389	-32,389
95/96	-41,034	-41,034	-41,034	-41,034
96/97	-41,930	-41,270	-40,610	-39,950
97/98	-41,891	-40,501	-39,111	-37,721
98/99	-40,646	-38,466	-36,286	-34,107
99/2000	-36,761	-33,731	-30,701	-27,672
00/01	-36,071	-32,131	-28,191	-24,251
01/02	-33,794	-28,883	-23,972	-19,061
02/03	-25,221	-18,143	-10,859	-3,368
03/04	-21,129	-11,712	-1,866	8,409
04/05	-19,932	-8,004	4,593	17,859
05/06	-10,918	3,695	19,233	35,695
06/07	-11,317	6,156	24,825	44,691
07/08	-3,467	18,788	43,192	69,834
08/09	2,798	30,111	60,583	94,392
09/10	16,000	49,070	85,942	127,311
10/11	24,072	63,264	106,869	156,193
11/12	37,016	82,792	133,466	191,139
12/13	51,338	105,896	167,936	240,203

After the liberalization of subscriber's premises equipment, tariffs should be revised. For example, "rental fee/3 months" should be changed to "subscription fee/month". Through the review of the current system and establishment of proper tariffs, the corporate accounting can be improved.

7.4 Recommendations on Technical Aspects

(1) Implementation and Reviewing of Long-Term Development Plan

Any telecommunications network plan should coordinate with the national socio-economic development programs. In general, the telecommunications network is composed of the urban area networks which can produce a reasonably high Internal Rate of Return (IRR) and the rural area networks produce little or negative IRR. It is recommended, consequently, the supply plan and the associated investment in the rural area should be proceeded with under the auspice of the government.

The Long-Term Telecommunications Development Plan presents a guideline for developing the telecommunications networks over the coming 20-year period, through the study of traffic growth and distribution, demand and supply, future services and facilities, introduction of advanced technologies, targets in finance and service quality, enhancement of security of telecommunications network and so on.

The short-term plan including annual plans is the implementation plan for the period of 5 years at maximum, and consequently optimization of investment, estimation of project sizes and costs, etc. should be made more accurately. The short-term plan is to be prepared at an interval of 3-5 years, and if there are found any appreciable changes in technology, costs, demand or funds, relating long-term plan should be reviewed accordingly. The long-term development plan includes a part of short-term plan to choose preferential projects.

Table 7-6 gives main items of the long-term and short-term plans, and Figure 7-2 shows a number of items to be taken into account in the long-term development plan.

Table 7-6 Long-Term Plan and Short-Term Plan

Item	Long-term plan	Short-term
1. Demand forecast	Provincial-wise (macroscopic)	Exchange-wise (microscopic)
2. Supply plan	Basic figures	Exch.by exch. figures
3. New services and new technology	General tendency	Directive for implementation
4. Utilization of existing network	Nationwide	Exchange(link) by exchange (link)
5. Additional installation	Nationwide	Exchange(link) by exchange (link)
6. Operation and maintenance	General tendency	Substantial deployment
7. Cost estimation	Project by project	Project by project(reviewed)
8. Financing plan	Long-term	Budget updated
9. Project implementation schedule	Long-term	Short-term
10. Tariff system	Long-term	Short-term (reviewed)

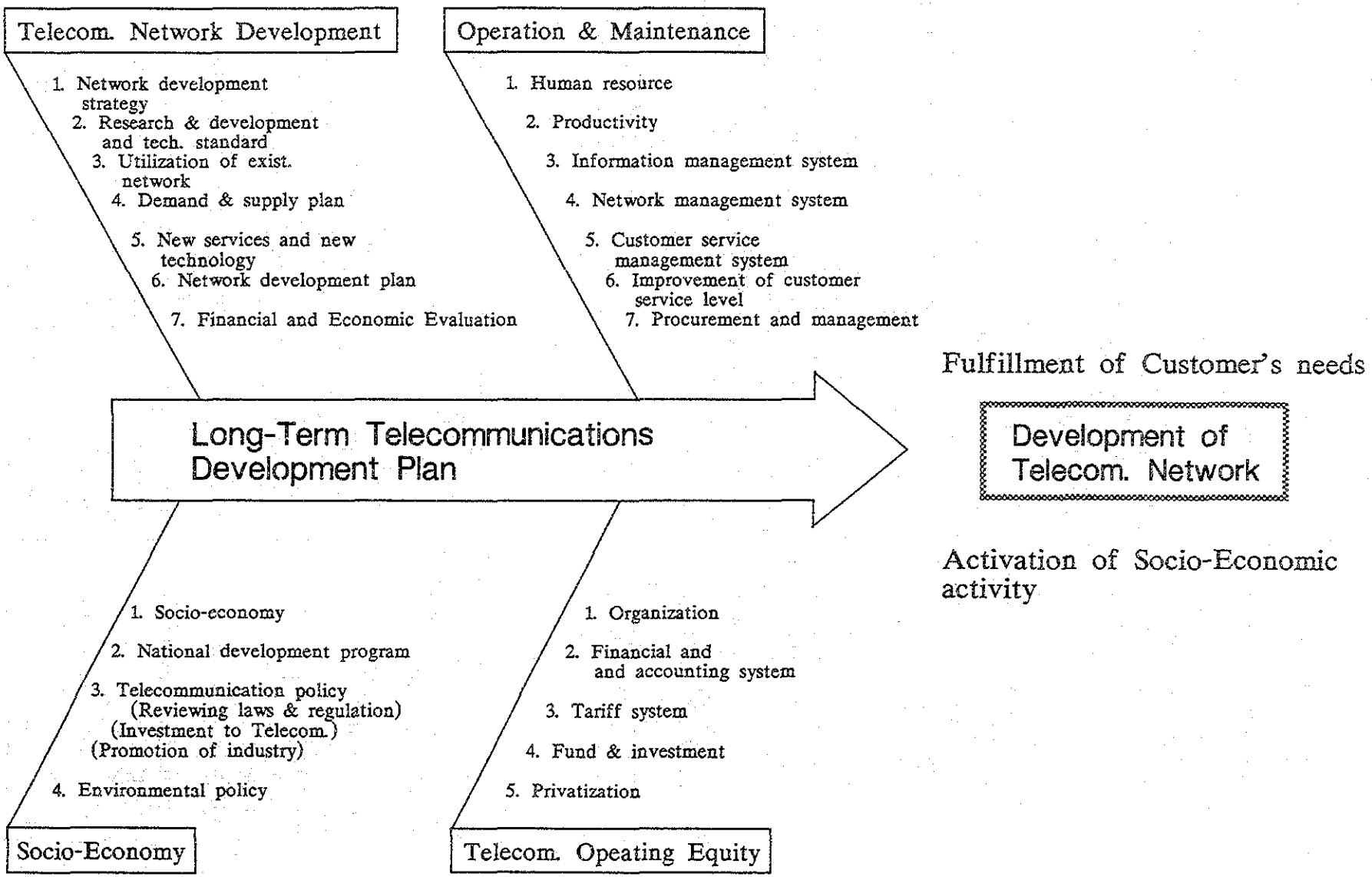


Figure 7-2 Long-Term Telecommunications Development Plan

Satisfactory implementation and enhancement of investment effects require establishment of systems for project management and control, as described below.

a) Liaison and coordination between divisions relevant to the project

To ensure smooth work progress from the preparation of project implementation schedules to the commencement of services to subscribers, and further to the handing-over of the completed system to the maintenance division, it is necessary to maintain close liaison and coordination among the divisions relevant to planning, design, tendering, procurement, installation, subscriber line testing, etc., so that necessary actions can be taken promptly to cope with alterations, if any, leading to satisfactory implementation of the project.

Especially the planning division is required to acquire accurately the contents of contract and alteration thereof, and always maintain and manage the up-to-date plans.

These arrangements will also serve for efficient implementation of the succeeding project.

b) Establishment of information management system

Satisfactory implementation of projects requires establishment of centralized management and exchange of information. Also to be established urgently is the information management system to define the necessary information and to elucidate the origin and destination thereof.

c) Speedy customer services

For speedy customer services, subscriber's data covering the application through the connection should be controlled by computers. Any claim from the subscriber should be centrally managed for quick processing of the matter through the network among relevant divisions.

d) Promotion of national telecommunications industries

The establishment of the Long-Term Plan can also serve for promotion of national telecommunications industries including relevant construction and designing firms since they can expect systematic orders from PTC.

(2) Introduction of New Technology

Under the circumstance where the technological advancement is being accelerated, new telecommunications systems applying new technology should be introduced timely as required, taking into account possible expendability, applicability and economy of the telecommunications network.

Network synchronization is indispensable for advanced national digital network except that for ATM (Asynchronous Transfer Mode). It is recommended to introduce the master-slave synchronization system to inter-link exchanges through synchronized digital signals.

(3) Successful Call Ratio

Presently measured successful call ratio shows a lower figure, approx. 30%, while this report sets the target at 50% in 2002 and 60% in 2012, respectively. For improvement of the successful call ratio, provision of a well balanced network and reduction of unfavorable behaviors (repeated dialling, hooking, partial dialling, wrong dialling, etc.) are required. To reduce such unnecessary behaviors, appropriate public relation will become necessary.

(4) Employment of Consultant

The long-term telecommunications development plan includes a number of new fields for which PTC has very few experienced staff. Therefore it will be necessary to employ experienced consultants to accomplish various projects smoothly as follows:

- Billing System

  To advice on effective billing system and procedures to improve the telephone charge collection rate.

- Program management

  To make good coordination between multiple number of projects to achieve a maximum investment performance to the telecommunications system in Zambia when completed.

- Planning

  The supply plan in the telecommunications development plan needs to be reviewed and updated to cope with then prevailing conditions, and preparation of the plant design, and tender specifications, and tender evaluation when the project is to be implemented.

- Project Management

  Coordination in project implementation, supervision of installation works, witness to commissioning tests, reporting on project and so on are essential for smooth implementation of the project.