

#### **4.3.3 Summary of Additional Cables to be Terminated on MDF**

The number of additional cable pairs to be terminated to the MDF to cater for the supply volume of each province is shown in Table 6-4-8 and that for each exchange is listed in SUPPORTING.

#### **4.3.4 External Plant for Rural Area**

Direct buried/aerial cable is used between MARS terminals and subscribers, in principle.

However, open-wire may also be used either in combination with cables or without any cable for distant subscribers to keep line loss and loop resistance within the limits specified in the transmission plan.

#### **4.4 Rural Telecommunications**

The rural telecommunication systems which are currently available are summarized below including a regional satellite system and the system applying pair cable and/or open-wire.

##### **a) Remote Line Concentrator (RLC)**

RLC is an extension of the subscriber line concentrator to the remote area on 2 Mbit/s PCM transmission links from a host local exchange.

##### **b) Digital Loop Carrier System (DLC)**

DLC is an extension of subscriber lines on 2 Mbit/s PCM transmission cables from a local exchange. There is no line concentrator function.

##### **c) Point-to-Point Digital Radio Subscriber System (DRSS).**

DRSS is an extension of subscriber lines using radio link. A single channel radio is used to connect a subscriber to a local exchange.

##### **d) Multi-Access Radio System (MARS)**

MARS is a digital point-to-multipoints radio transmission system using time-division multiple access (TDMA) technique.

##### **e) Cellular Mobile Telephone System (CMTS)**

CMTS is a radio telecommunication system in which a service area is covered by small radio zones called cells.

f) Pair Cable and Open-Wire

Pair cable/open-wire may not cover subscribers in a wide area and might have suffer from vandalism.

Although RASCOM (Regional African Satellite Communication System) is still under study, the purpose of RASCOM is to provide the rural telecommunication and TV broadcasting for domestic use by using a satellite.

Once implemented, RASCOM will be one of the alternative choices for rural communication.

4.4.1 Selection of System for Rural Telecommunication

Table 6-4-7 shows the characteristics of each system and applicable range.

Table 6-4-7 Rural Telecommunications System

Capacity Range	Suitable Area	Applicability to Zambia
RLC 100-2000	Large Cluster	Out of Range
DLC 30-100	Small Cluster along Road	Poor
DRSS 10-256	Scattered	Good
MARS 30-1024	Scattered & Small Cluster	Good
CMTS 500-10000	Scattered & Movable	Out of Range
RASCOM Over the Country	Scattered	Good
Cable	Within 4 km from Term. station	Poor
Open-wire	Within 45 km from Term. station	Poor

In the rural area, the individual and small scale cluster of subscribers are sparsely distributed in an extensive area where subscribers are far from the exchange and they normally have no good access road to the area center. Auxiliary power supply for the facilities may be required due to poor condition of commercial power supply.

Although many of applicants are in the rural area, it is inevitable to give priority to respective social groups other than the PCO (Public Call Office) in the area, considering the heavy financial constraints.

At the initial stage, services are provided to applicants with high priority such as public group, agriculture group, business group and those who play an important role in the community and in the next stage, for applicants with lower priorities; therefore the systems to be applied in the rural area should be easily expandable in future.

Taking into account the situation mentioned above, the multi-access radio system (MARS) is considered as a most suitable rural telecommunication system in Zambia.

Besides the above, a point-to-point digital radio subscriber system (DRSS) is also recommendable. However, introduction of this system is to be considered based on the findings in the course of detailed design.

#### 4.4.2 Outline of Digital MARS

The following is an outline of digital MARS currently available on the market.

Radio frequency : 1.5/2.4/2.6 GHz Band

Transmission capacity : 2/4 Mbit/s

Max. No. of subscribers : - 260 with 2 Mbit/s transmission capacity.  
- 520 with 4 Mbit/s transmission capacity.

Access system : DAMA (Demand Assigned Multiple Access)

Note : Loss probability of 0.01 and an average traffic of 0.08 Erl./sub. are assumed

Digital MARS is composed of radio subscriber terminals to accommodate subscribers, repeater stations with the same function as the subscriber terminal, and a base station to be set up in a telephone exchange.

Operating status of an entire MARS network can be monitored by the centralized supervisory system to be introduced at the base station.

Configuration of MARS Network is shown in Figure 6-4-3.

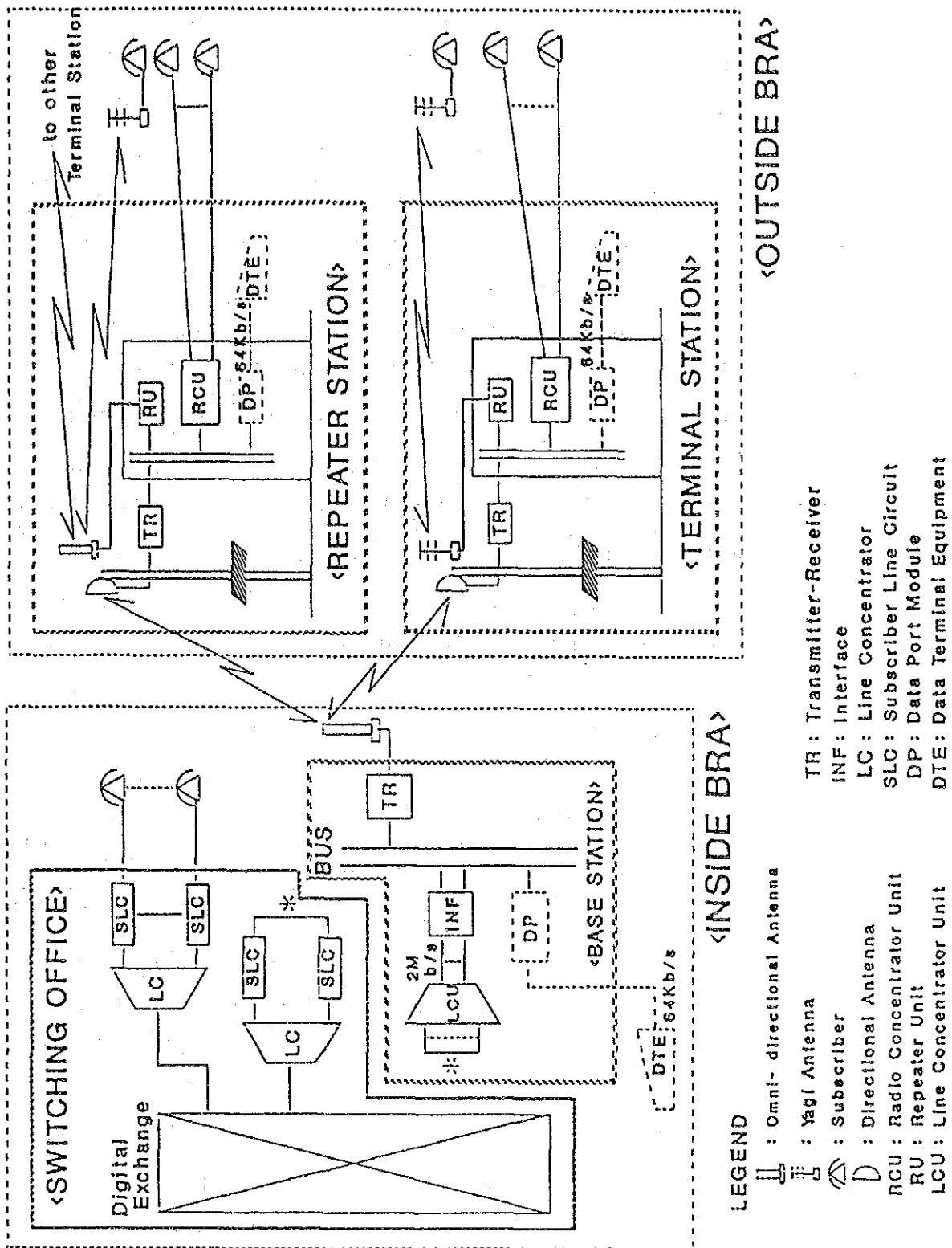


Figure 6-4-3 Configuration of MARS Network

#### **4.4.3 Application Method**

For application of this system to the rural telecommunication, following should be considered in principle.

- a) A base station of MARS with antenna mast is installed within the premises of a host exchange.
- b) The location of a terminal station or repeater station should carefully be selected at the approximate center of the telephone demand in the area in view of economy, and also at a safe place for security.
- c) A single radio channel system is used to connect distant subscribers (more than approx. 4.0 Km distant from the station) to the terminal station.
- d) Direct buried/Aerial cable is used to connect nearby subscribers (less than 4.0 Km) to the terminal station.

Open-wire may also be used either in combination with cables or without any cable for distant subscribers to keep line loss and loop resistance within the limits specified in the transmission plan and to provide services economically.

However, application of aerial cable/open-wire, the proper countermeasures should be provided against vandalism and other natural calamity such as lightning, storm, and falling tree on to cable.

#### **4.4.4 Summary of Subscriber Terminated to MARS**

The total number of subscribers to be terminated to MARS terminal is assumed, considering that 20% of the total supply volume are to be connected through cable. The results is summarized in Table 6-4-8.

Table 6-4-8 Summary of Expansion Volume for Provinces

Year  Provinces	1993  Pairs on MDF	2002			2012		
		Rural		Urban	Rural		Urban
		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
<b>Total</b>	<b>137,800</b>	<b>2,130</b>	<b>5,060</b>	<b>53,800</b>	<b>1,720</b>	<b>5,268</b>	<b>124,400</b>

- (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. Non-telephone and New Services

### 5.1 Telex Network and Telegram Services

#### 5.1.1 Telex Network

The Kitwe telex exchange expansion schedule capacity is shown in Table 6-5-1.

Table 6-5-1 Telex Expansion Schedule

Period	1993/2002	2003/2012
Expansion capacity	4,500	800
Total capacity	6,956	7,756

All transmission lines from provincial capitals should be changed from VFT bearer to TDM (high capacity bearer).

### 5.1.2 Telegram Services

11 telegraph offices out of 84 telegraph offices are still using obsolete equipment to send telegrams. Teleprinters should be installed in these 11 offices to replace the obsolete equipment, during the first decade.

The 11 telegraph offices are given below.

Northern region

CHAVUMA, IKELENGE, CHITOKOLOKI, CHILUBI, ISLAND, KAPUTA, SHIWANGANDU

Southern region

ZIMBA, SESHEKE, MWANJAWANTHU

"Phonogram" services should be provided by all the new telegraph offices for rural customers.

## 5.2 New Services

### 5.2.1 Mobile Telephone

The basic components of cellular radio networks are mobile switching centers (MSCs), base stations, and mobile units. The location of MSCs and base stations in service areas should be decided after carrying out detailed surveys.

By the year 2002

The mobile telephone service will be introduced in Lusaka. 1,000 mobile subscribers will be in operation.

By the year 2012

The mobile telephone service will be introduced in Kitwe, Ndola and the area along the roads connecting Lusaka, Kitwe and Ndola. The capacity of Lusaka mobile exchange will be expanded to meet 1,700 subscribers, and that of Ndola and Kitwe will be 3,200 each.

By the year 2002

Radio-paging service will be introduced in Lusaka. 6,615 paging receivers will be provided to meet the demand.

By the year 2012

In addition to the above area, Radio-paging service will be introduced in Kitwe and Ndola. 12,285 paging receivers will be provided to meet the demand.

### 5.2.3 Packet Network

The packet data communication system configuration consists of the following:

- Packet switching module to be connected to the existing digital exchanges;
- Multiplexer;
- PAD (packet assembly/disassembly);
- Network management and control system (NMCS); and
- Subscriber lines.

In Zambia, NMCS should be located in Lusaka. The exchanges with packet switching module should be introduced in Lusaka and Kitwe during the first decade. The Lusaka exchange should also be provided with the functions as an international gateway. These exchanges should be connected with each other according to CCITT Recommendations X.75. The customer terminals will be connected according to CCITT Recommendation X.25.

Multiplexer/Concentrator should be provided to allow economical access to a packet exchange from packet mode terminals located remotely. The subscriber lines will be connected at various speeds, 300 bit/s and above, and non-packet mode terminal will be connected via PADs.

In the second decade, the packet data communication service areas will be expanded to provincial capitals. Finally, when ISDN will have been established, the packet data network will be integrated into an ISDN network. The installation and expansion planned are shown in Table 6-5-2.



Table 6-5-2 Packet Network Plan (No. of Sub.)

Period	1993-2002	2002-2012
Lusaka	650	800
Kitwe	285	380
Ndola	285	380
Livingstone	100	120
Kabwe	55	80
Chingola	140	160
Choma		60
Chipata		190
Mansa		50
Kasama		130
Solwezi		40
Mongu		20
Total	1,515	2,410

#### 5.2.4 ISDN

The implementation steps toward ISDN will vary depending on various circumstances, such as demand variation, condition of the existing network, financial capacity of operating entity, etc. In any case, however, it will be realized through the following three stages:

##### By the year 2002

The existing analog telephone network is replaced with the digital network up to the line concentration portion through the adoption of digital switching and transmission technologies in major large cities. This will form an IDN with 64kbit/s bearer channels for users to be connected to switching systems through concentrators.

##### By the year 2012

ISDN interface and the common channel signaling are provided to enable the user to access to the service capabilities and/or network facilities of ISDN.

In achieving the evolution of data networks to Narrow-band ISDN, a field trial will be made through a series of extensive tests for the services envisioned for Narrow-band ISDN in the proposed working environments of the systems and equipment concerned. The primary purpose of the field trial is to evaluate the technical performance of the equipment and to evaluate the acceptability of the services by the PTC's customers.

In Zambia, Narrow-band ISDN will be started by the year 2012, in Lusaka as a field trial.

### After the year 2012

The ISDN is achieved after 2012. A variety of dedicated networks, such as telephone network and data communications network, are integrated into an ultimate form of ISDN. This single network will then possess the capabilities of data switching at speeds higher than 144 kbit/s and provide video transmission switching services.

**SECTION 7**

**OPERATION AND MAINTENANCE PLAN**

## **SECTION 7 OPERATION AND MAINTENANCE PLAN**

### **1. General**

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.

Actual work of these activities may vary according to the type of equipment or systems. Telecommunications equipment and systems currently used in Zambia are mostly of analog type and with conventional constructions, excepting for some digital switching equipment. However, they will be digitalized and computerized towards the end of GROWTH Decade. Such digitalization and computerization should require the change of the conventional procedures of O&M and the manpower reinforcement both in number and qualification.

For enhancement of the O&M, the long-term development plan should include the plans described below.

### **2. Operation and Maintenance**

#### **2.1 Modernization of Routine Office Work by Computerization**

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

To enhance the efficiency of daily work in finance, human resource management, engineering planning, and other O&M related sections, provision of thirty (30) sets of personal computers with CPU of INTEL 386-class or equivalent, together with software, is required.

In CREATION Decade, provision of the main-frame computers and personal computers mentioned above is included as Package 22, and in GROWTH Decade, provision of additional 30 sets of the personal computers is included.

#### **2.2 Establishment of External Plant Maintenance Centers**

As seen in Tables 3-1-3 and 3-1-4, the faults/line/year of the external plant has been improved steadily since 1986. However, the maintenance efficiency has never satisfied the target.

To enhance the efficiency of maintenance, it is recommended to establish the External Plant Maintenance Centers (EPMCs) in Lusaka and Kitwe as an initial stage plan.

Functions of each External Plant Maintenance Center are outlined as below:

- (1) To hold up-to-date plant records of the external plants in its own area;
- (2) To have an appropriate supervisory desk to display the status of line faults immediately after a fault claim is received at the test desk in a local telephone exchange;
- (3) To have enough number of skilled technicians;
- (4) To check a line in fault, locate the fault and carry out necessary actions (repair or provisional treatment), if necessary;
- (5) To carry out periodical tests for external plant;
- (6) To provide a temporary connection for some special events, if necessary;
- (7) To maintain the fault records prepared by technicians engaged in maintenance works;
- (8) To provide the on-the-job training for unskilled technicians;
- (9) To have necessary vehicle(s) for transportation;
- (10) To have necessary tools and instruments for maintenance works; and
- (11) To have enough spares and materials required for repair and rehabilitation.

### **3. Human Resources Development Plan**

#### **3.1 Staff Efficiency and Composition**

Staff efficiency of telecommunications sector of PTC is 47.3 staff per 1,000 DEL in 1992 as given in Para. 1.1.2, SECTION 2. This figure belongs to less efficiency group as shown in Table 3-1-2 and Figure 3-1-3.

To cope with progressive digitalization and gradual expansion of the network, the staff efficiency and qualification should be raised as in Table 7-3-1:

Table 7-3-1 Staff Efficiency and Qualification

Year	1992	2002	2012
a) Staff efficiency (Staff/1,000DEL)	47.3	32	22
b) Qualification			
University degree:	52	122	283
(%)	(1.6)	(2.8)	(5.0)
Diploma/Certificate:	1,291	1,919	2,612
(%)	(38.6)	(44.0)	(46.2)
Second. school:	978	1,308	1,696
(%)	(29.2)	(30.0)	(30.0)
c) Technical staff:	1,102	1,771	2,827
(%)	(32.9)	(40.6)	(50.0)
d) Total no. of staff:	3,345	4,361	5,654

To improve the staff efficiency in the telecommunication division, it is recommended to review jobs assigned and performances by individual staff and to prepare an appropriate organization.

Recruitment of excellent staff needs to offer a good payroll; however, it can be realized as a result of earning sufficient revenues.

### 3.2 Staff Training College

Capacity of Staff Training College (STC) should be expanded to meet the human resource development plan given in Table 7-3-1 in the first decade.

Extension of the STC should include provision of additional class rooms for lectures, office accommodation and new student hostel to cater for 100 trainees. Cost for the extension is estimated at US\$4.50 million in foreign currency. However, this extension plan is not included in this Long-Term Development Plan, since the STC is scheduled to become an independent college shortly.

## 4. Introduction of Network Management System

### 4.1 Network Management Plan

For network management, the Telecommunications Management Network is defined by CCITT.

The purpose of a Telecommunications Management Network (TMN) is to support administration in management of its telecommunications network.

A TMN is intended to support a wide variety of application functions covering the operation, administration, maintenance and provision (OAM & P) of a telecommunications network.

The application functions have five major management categories:

- performance management,
- fault (or maintenance) management,
- configuration management,
- accounting management, and
- security management.

Conventional telecommunications systems tend to be vertically integrated, so that they generally do not cooperate well with other systems. That is, they are not horizontally integrated; in other words, they are not architected in a multi-vended environment.

The CCITT Recommendation, M30 defines the TMN and standardizes the interfacing conditions between network elements (NE) and operation systems (OS).

Standardizing certain functional maintenance capabilities (for testing and performance monitoring) and associated operation interfaces enables the interconnection of various different types of operation systems with telecommunications equipment using a set of standardized protocols and interfaces.

To cope with such trend in digitalized telecommunications system, the systems and associated equipment provided according to this development plan may be utilized as a part of the TMN. However, realization of the telecommunications networks almost fully based on the TMN architecture will be within the Growth Decade.

Maintenance functions realizable under the TMN are as follows:

- Alarm surveillance to capture out-of-service conditions immediately upon equipment failures or severe performance degradation.
- In-service performance monitoring before end users are affected.
- Automatic fault location through sectionalization of the trouble to responsible jurisdiction, and further to the module level, if possible.

- In-service or out-of-service testing, for detailed diagnostics, and for sectionalization and fault location, as well as for repair verification.
- Status reporting and control to check and change the state of an NE on demand (e.g., protection switch status, service restore, in/out-of-service), etc.

Thus, the efficiency of maintenance will be improved considerably and the need for routine preventive maintenance will be replaced by the performance monitoring carried out during trouble-free period.

TMN also has a function to collect traffic data from NEs to reconfigure the network or modify its operation to adjust to extraordinary traffic.

#### **4.2 Links to be used for Telecommunications Management Network**

In CREATION Decade, provision of the digital telephone exchanges is scheduled according to the growth of traffic, and adoption of CCITT Common Channel Signaling System No.7 (CCS No.7 Signaling) is proposed.

The signaling links are provided as a part of the CCS No.7 Signaling System between exchanges and the links function not only to transfer call information between exchange processors, but also to support a range of applications and administrative functions, including:

- ISDN;
- Intelligent network;
- Mobile services;
- Network administration, operation and management.

Thus, using the signaling links, the telecommunications management including billing can be realized.

#### **4.3 Provision of Network Management System**

The Network Management System (NMS) is to be provided in an early stage of the Growth Decade, and the Network Management Center (NMC) is to be placed in Lusaka, the center of the national telecommunications network in Zambia.



## **5. 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. 2.3,(2).

To improve this situation, the vehicle survival operation is to be carried out as an urgent remedy and additional and periodical provision of vehicles is included as project packages. The procurement of vehicles is scheduled twice in each decade.

Considering that the present poor utilization is attributable mainly to the lack of spares, it is necessary to procure some spares with vehicles. This may call for reviewing of present rules being used in PTC.

## **6. Organization on Operation and Maintenance**

### **6.1 Reinforcement of Technical Services**

Functions of the technical service section should be expanded to include a sort of consulting services on any difficult problems arising during operation and maintenance, because it seems to be unrealistic to deploy such an experienced engineer to each maintenance center.

### **6.2 Separation of Non-essential Portion**

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.

## **7. Annual O&M Costs**

The annual costs of operation and maintenance are divided into two parts, i.e., staff relating costs and other costs. The staff costs include salaries, housing cost and welfare expenses, while the other costs include equipment cost, motor vehicle expenses, travelling expenses, property costs, printing & stationary expenses, costs for entertainment, promotion & publicity and subscriptions, and miscellaneous expenses.

It is assumed that the staff relating costs are proportional to the number of staff and the other O&M costs, the number of main lines.

The estimated annual O&M costs in 2002 and in 2012 are given in Table 7-6-1.

Table 7-6-1 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.

According to the table, the total O&M cost is increased by 67% in 2002 and by 184% in 2012, and over that in 1994. These figures have been derived taking into account the improvement in staff efficiency. However, without the improvement of the staff efficiency, the total O&M cost increase will be by 93% in 2002 and by 263% in 2012, respectively.

**SECTION 8**

**PROJECT IMPLEMENTATION AND  
COST ESTIMATION**

## **SECTION 8 PROJECT IMPLEMENTATION AND COST ESTIMATION**

### **1. Project Formation**

The project implementation program has been drawn up through the project formation as follows:

#### **1.1 Basic Concept in Project Formation**

Projects to be proposed are grouped into two types of packages, i.e., Area Project Package and Single Project Package.

##### **(1) Area Project Package**

Each package consists of all the necessary elements (minimum project unit) to compose a network for a specific area. In making up packages, due attention has been paid to the following:

- To build up a well-balanced network on area by area basis, so as to achieve effective provision of facilities which permit the connection of maximum number of subscribers; and
- To simplify project formation and program management.

##### **(2) Single Project Packages**

Each package consists of a single project, such as earth station project, network management system project, mobile phone project, etc.

#### **1.2 Area Project Package**

Area project packages proposed are formed by assembling the several minimum project units based on the following conditions:

- The objective area (exchange basis) has a large number of waiters.
- The package can be a comprehensive project which can construct, by itself, a network in the area, facilitating immediate subscriber connections.
- The well-balanced investments must be made, avoiding too heavy investment in one package.

##### **(1) Minimum Project Units**

*A minimum project unit is a project composed only of a sub-system required to be implemented within each decade, and the area project package covering an exchange area basically consists of all the network components (sub-systems), i.e., land, building, switching system, spur transmission link, junction network, subscriber cable network and radio subscriber system, etc.*

(2) Project Package to be Proposed

Expansion and/or replacement of respective Sub-systems are determined based on the expansion policy stated in SECTION 6, and applying the supply volume for each decade. Project packages proposed are summarized in Table 8-1-1 below:

Table 8-1-1 Summary of Project Package

Package No.	Package Description
Package 1	Assembling the projects of urgent program, i.e., program 1 - Enhancement of maintenance and increase of subscribers program 2 - Improvement of billing system program 3 - Vehicle survival operation.
Package 2 - 9	Assembling the projects for urban area include switching, transmission system and external plant projects.
Package 10 - 13	Assembling the projects for rural area include radio subscriber system and external plant projects.
Package 14 - 15	Sole projects to establish External Plant Maintenance Center.
Package 16	Sole project to establish Network Management System (NMS).
Package 17 - 20	Logistics projects to provide vehicles for maintenance of network.
Package 21	Sole project to provide computer for supporting transaction of engineering and administrative job.
Package 22	Sole project to provide Main frame computer for supporting transaction of Billing system.
Package 23	Sole project to replace existing Earth station facilities.
Package 24	Sole projects to provide additional PCO services however, installation of these PCO are included in the area project Package, i.e., Package No.6 - 9,12 and 13.
Package 25 - 28	Sole projects to establish Mobile telephone network.
Package 29 - 30	Sole projects to establish Radio-paging services.
Package 31 - 32	Sole projects to establish Packet network.
Total Project Package number: 32	

## **2. Implementation of Projects and Priority Projects**

### **2.1 Implementation of Projects**

The overall time schedule of project implementation is made in consideration of the following conditions:

- a) The implementation of project packages must be well balanced between the two decades, in terms of both time schedule and quantity.
- b) Activity for the procurement of funding is not included in the time schedule.
- c) The period for engineering services, such as determination of scope in detail, documentation for tender/contract, is included in the schedule as the preparation period for each project package.

The preparation period is indicated in dotted line in the implementation schedule.

The implementation schedule with project costs for each package is shown in Table 8-1-2.

Table 8-1-2 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	2008	2010	2011	2012	PACKAGE TOTAL		
PACKAGE 1		2.06	4.94																			7.00	
Urgent Program																							50.48
PACKAGE 2			15.14	17.67	17.87																		53.28
Lusaka, Kabwe, Kitwe					8.49	31.65	22.15																32.51
PACKAGE 3						8.75	22.76																36.06
PACKAGE 4							10.82	25.24															73.35
PACKAGE 5										22.01	51.34												80.88
PACKAGE 6													24.27	56.61									56.12
PACKAGE 7															16.83	39.28							33.40
PACKAGE 8																10.03	23.37					20.63	
PACKAGE 9																						19.33	
PACKAGE 10																						17.31	
Rural (1)			6.18	4.45																		22.30	
PACKAGE 11																						3.68	
Rural (2)						5.79	13.54															3.77	
PACKAGE 12													5.21	12.10								3.50	
Rural (3)																						4.50	
PACKAGE 13																						6.50	
Rural (4)																						6.50	
PACKAGE 14																						0.25	
EPMC (1)																						1.24	
PACKAGE 15																						1.24	
EPMC (2)																						1.24	
PACKAGE 16																						1.24	
NNS																						1.24	
PACKAGE 17																						1.24	
Vehicle (1)																						1.24	
PACKAGE 18																						1.24	
Vehicle (2)																						1.24	
PACKAGE 19																						1.24	
Vehicle (3)																						1.24	
PACKAGE 20																						1.24	
Vehicle (4)																						1.24	
PACKAGE 21																						1.24	
Computer																						1.24	
PACKAGE 22																						1.24	
Main Flame Computer																						1.24	
PACKAGE 23																						1.24	
Earth Station																						1.24	
PACKAGE 24																						1.24	
PCU																						1.24	
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	28.48	88.71	30.02	54.90	11.16	28.01	6.50	0.00		585.20	

Table 8-1-2 Project Implementation Schedule (2/2)

YEAR (FISCAL)	1983	1984	1985	1986	1987	1988	1989	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	PACKAGE TOTAL	
PACKAGE 25								2.80	5.54												8.34	
Mobile Phone (1)																						
PACKAGE 26												1.83	6.10	4.25								12.18
Mobile Phone (2)																						
PACKAGE 27														0.72	2.37	1.66						4.75
Mobile Phone (3)																		4.82	11.24			16.06
PACKAGE 28																						
Mobile Phone (4)																						
PACKAGE 29								1.38	3.19													4.57
Radio Paging (1)																						
PACKAGE 30																						
Radio Paging (2)																1.35	3.15					4.50
PACKAGE 31								1.25	2.89													4.14
Packet Network (1)																						
PACKAGE 32																		0.70	1.63			2.33
Packet Network (2)																						
TOTAL COSTI	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 Execution of Project



## 2.2 Priority Projects

The three (3) priority project packages are selected from among the project packages described in item 1.2 (2) above, from the viewpoints of desirable investment effects and the urgency.

The priority project packages selected are as follows:

a) Project Package No.1 for Urgent Program, consisting of:

- : the project of external plant maintenance and new subscriber connections for the areas of Lusaka, Kitwe and Ndola,
- : the project for the improvement of billing system aiming at:
  - collection of unpaid charges for telecommunication services;
  - expediting commencement of total operation of an already installed country-wide network for billing system; and
  - examination of charging methodology,
- : the project for the vehicle survival operation aiming at:
  - repairing of faulty vehicles, procurement of parts and organization of vehicles repair teams; and
  - review of criteria for replacement of vehicles, as well as allocation, utilization period and usage of vehicles.

b) Project Package No.2 for Urban Area

A comprehensive project consisting of subsystems of switching, backbone link of transmission and external plant for Lusaka main Exchange, Chelston Exchange, Kitwe Exchange, and Kabwe Exchange.

c) Project Package No.10 for Rural Area

A project for implementation of the rural telecommunications network to cover:

- : Lusaka area - 17 exchanges
- : Kitwe area - 7 exchanges
- : Ndola area - 4 exchanges
- : Luapula area - 5 exchanges
- : Northern area - 11 exchanges
- : Central area - 8 exchanges

In addition to the three (3) priority project packages mentioned above, priority be given to Package No. 23 to replace the existing earth station facilities, in view of the current intention of INTELSAT.

### 2.3 Private Participation Project

It is recommended that the new services categorized in the Package Nos. 25 through 32 be implemented by the introduction of private participation, in compliance with the development policy of the Long-Term Plan stated in the SECTION 3.

## 3. Project Cost Estimation

### 3.1 Unit Cost

The project cost estimation is made based on the unit costs of respective subsystems. The unit cost of each subsystem is so established that it covers the aggregated costs for the whole necessary works and the procurement, taking into account a trend of costs in similar African countries and the past contracted prices for telecommunications projects in Zambia.

In addition to the above, the cost of a consultant (Engineering service) is included as necessary for such works as documentation, negotiation, and settlement of problems to be encountered in the course of implementation. Unit costs of subsystems are shown in the following Table 8-3-1.

Table 8-3-1 Unit Investment Cost

Subsystems	Unit Cost (US\$)	Share (%)
Telephone Switching	550	19.8
Telex Switching	15	0.5
Terrestrial Transmission	1,010	36.1
Satellite Transmission	90	3.2
External Plant	800	28.6
Others (EPMC, Computer, Vehicles)	190	6.8
Engineering Service	140	5.0
Total	2,795	100.0
Rural Telecom. Plant	5,840	

### 3.2 Summary of Project Costs for the Long-Term Plan

The summary of project costs for the Long-Term Plan by project package is shown in the following Table 8-3-2.

Table 8-3-2 Summary of Project Cost

1st Decade (1993 - 2002)		2nd Decade (2003 - 2012)	
Package No.	Cost (M.US\$)	Package No.	Cost (M.US\$)
(Priority Projects)			
1	7.00	-	-
2	50.48	-	-
10	20.63	-	-
<b>Sub Total (1)</b>	<b>78.11</b>		<b>0.00</b>
3	63.29	6	73.35
4	32.51	7	80.88
5	36.06	8	56.12
11	19.33	9	33.40
14	3.69	12	17.31
17	4.50	13	22.30
18	4.50	15	3.77
22	1.24	16	3.50
23	18.09	19	6.50
	-	20	6.50
	-	21	0.25
	-	* 24	(3.22)
<b>Sub Total (2)</b>	<b>183.21</b>		<b>303.88</b>
<b>Total (1) + (2)</b>	<b>261.32</b>		<b>303.88</b>

**[Private Participation Projects]**

1st Decade (1993 - 2002)		2nd Decade (2003 - 2012)	
Package No.	Cost (M.US\$)	Package No.	Cost (M.US\$)
25	9.34	26	12.19
29	4.57	27	4.75
31	4.14	28	16.06
	-	30	4.50
	-	32	2.33
<b>Sub Total (3)</b>	<b>18.05</b>		<b>39.83</b>
<b>Total (1) + (2) + (3)</b>	<b>279.37</b>		<b>343.71</b>
<b>Grand Total</b>			<b>623.08</b>

Note: \* denotes the cost for PCOs to be installed in the GROWTH (2nd) Decade. This cost is distributed to respective area project packages, i.e., Packages No.6 - 9, 12 and 13. In the CREATION (1st) Decade PCOs will be provided by the aid from Danish International Development Agency (DANIDA).

#### **4. Project Digest**

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

- a) Package No. and Project Title.
- b) Objective Area/Location (Exchange Name).
- c) Project Description
  - Sub-system
  - Capacity
- d) Project Cost
  - Sub-system
- e) Implementation Time Schedule
- f) Estimated Subscriber Increment

**SECTION 9**

**FINANCIAL EVALUATION ON PRIORITY PROJECTS**

## SECTION 9 FINANCIAL EVALUATION ON PRIORITY PROJECTS

### 1. General

As detailed in SECTION 5 "LONG-TERM DEVELOPMENT PLAN," the country, Zambia, needs to take a steady approach to the maturation of the Telecommunication Networks. Among the various projects conceived, the projects to be selected with the first priority are financially analyzed in this section.

Project-Urban : LUSAKA-NDOLA-KITWE + Urgent Projects

Project-Rural : Typical Rural Area

#### 1.1 Method of Financial Analysis

The projects are regarded as a business entity in this 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 charges, 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.

The project costs are assumed with their expenditure schedule as shown in SECTION 8. The costs together with other cost items, i.e, operating costs, financial charges, etc. are put into a systematic and consistent framework to permit projections of cost streams which are used in the financial analysis.

Similarly, the supply volume forecasts of the telecommunications services stated in SECTION 5 are used to develop projections of the sales revenues of the projects. The annual cash flow in each project year is thus projected to calculate the Financial Internal Rates of Return (FIRR).

#### 1.2 Main Assumptions for Financial Analysis

##### (1) Project Life

Referring to the Project Implementation Schedule in SECTION 8, the project life for the Financial Analysis is set as follows:

	<u>Project-Urban</u>	<u>Project-Rural</u>
a) Construction Period :	1994 - 1997	1995 - 1996
b) Operation Period :	1996 - 2012	1997 - 2012

(2) Financial Structure

The project size is planned as around US\$ 60 MN for Project-Urban and around US\$ 20 MN for Project-Rural. This size of the capacity of telecommunication network does not allow the projects to stand in financially feasible situation since the call charges receivable from subscribers are to be adjusted in views of public works and/or BHN-(Basic Human Needs)-type projects.

In consideration of an economic difficulty coupled with the above features of telecommunication network projects, the project financing scheme sustained by the Grant-aids of lateral country basis is set as the case to be analyzed (Grant Case), in addition to the conventional financing case (Loan Case).

Loan Case : Equity (owned capital) / Long-Term Loan

Equity (Owned Capital Portion) :

Covers 30% of "Project Costs"

Long-Term Loan Portion :

Covers 70% of "Project Costs"

(Refer to Section 10, Table 8-3-2)

Grant Case : Grant / Equity

Grant portion :

Equipment & Facilities including Engineering Service fee in "Project Costs" (Refer to SECTION 8, Table 8-3-2).

Equity (Owned Capital) portion :

Preparatory works by PTC, pre-operation costs and Initial Working Capital in "Project Cost" (Refer to SECTION 8, Table 8-3-2).

(3) Financial Condition

The total capital required for the Loan Case will be raised as shown in SECTION 8 "Project Implementation."

a) Condition of Long-Term Loan

Interest : 10% p.a.

Debt Repayment : Equal Semi-Annual payment for 20 years, including 5 years period.

b) Condition of Short-Term Loan

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

- Rate of interest = 61% p.a.
- Repayment = repaid in next year after borrowing

(4) Base Price

Nominal basis with 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.

(5) Exchange Rate

1 US\$ = 360.0 Kwacha ( 1993.1.1 )

(6) Taxes and Insurance

a) Sales Tax

Sales tax equivalent to 20% of the tariff imposed.

b) Corporation Income Tax

Corporation Income Tax rate is 40% on taxable income.

c) Insurance

The cost for damage insurance premium is assumed to be approximately 0.375% of the insurance value of Equipment & facilities costs in each project year based on the current insurance system.

(7) Depreciation

The depreciation condition is settled as follows. Full value of all the asset items is depreciated without remaining salvage value.

<u>Item</u>	<u>Depreciation Method</u>
Equipment & Facilities	15 years straight line
Engineering Services	5 years straight line
Pre-operation Costs	5 years straight line
Interest during Construction	5 years straight line



(8) Working Capital

a) Working Capital during the Operation

The amount of Working capital is assumed to be the following for each year of operation.

Account Receivable : Sales Revenue for 2 months  
Accounts Payable : Operating costs for 2 months

b) Initial Working Capital (I.W.C)

The equivalent amount to the working capital required in the first operation year is reserved prior to the service-in of the new communication network.

**2. Sales Projection**

Sales revenue in each project year is estimated incorporating the following:

- Demand Forecast presented in SECTION 4.
- Present Tariff System considering the distances between the assumed usages and BRA (Basic Rental Area)

**2.1 Revenue Items**

Revenue from Telecommunications service of the following three categories.

(1) Call Charges

a) Local Calls :

Call charges within each Telecommunication Exchange Areas

b) STD Calls :

Call charges on the calls exchanged with other Telecommunication Exchange Areas

(2) Installation Fee

This represents the charges imposed on a subscriber when the telephone is newly installed.

(3) Rental Fee

This represents the Quarterly Rental Tariff paid by a subscriber in a fixed amount for his usage of the end terminal.

## 2.2 Present Tariff System

Present PTC's tariff system for telephone subscribers is summarized in the following Table 9-2-1. Zambian telephone system is characterized by accelerative charges for the distances. Call charges within the telecommunication exchange area are constant (Local calls), but charges to other exchange areas (STD calls) depend on distance and duration.

Table 9-2-1 Tariff System ( 1993 )

Item	Price (Kwacha)
Call Charges	13.0/unit
Installation	2,500.0/line
Rental	800.0/Quarterly

Installation fee and rental fee referred to in terms of "Within BRA" and "Outside BRA" and a premium charges are to be borne by a subscriber according to distance from BRA.

## 2.3 Sales Revenue Projection

Revenue elements, i.e., Call charges, Installation fees and Quarterly rental fees, are forecasted for every 5-year span as shown in SECTION 4. The sales revenues of the entire project period have been projected based on the above Demand Forecast and the present PTC's Tariff System.

### (1) Sales Revenue

STD calls (Trunk calls) are the major source of incomes in total revenues obtained by the calls inter-exchanged. As for the estimation of the revenues of STD calls the following calculation method is applied.

#### a) Revenue Distribution Rate

The share % of incomes obtained by STD calls are estimated as 40% with the standard construction costs distribution ratio given in Table 9-2-2 taken into account.

$$\begin{aligned} & [100 - (\text{Toll trunk} + \text{Toll transmission})] \times \\ & 1/2 \text{ (Division with other telephone exchanges)} \\ & = 40(\%) \end{aligned}$$

Table 9-2-2 Construction Cost Distribution Ratio

Item	Ratio
Subscriber's Premise Equipment	10%
Local Subscriber's Line	40%
Local Switching	30%
Toll Trunking	5%
Toll Transmission	15%

b) Revenue Estimation

Annual revenue of calls is calculated by the following formula:

$$AR = BT/BCR/MT \times SCR \times RC \times WD \times CCDR$$

Where,

AR : Annual Revenue

BT : Busy hour originating and terminating traffic

BCR : Busy hour concentration ratio

National : 14.3%

International : 12.5%

MT : Mean holding time of complete calls (180s)

SCR : Successful call ratio (Note)

1993 : 30%

2002 : 50%

2012 : 60%

RC : Revenue per completed call

National Calls;

Local calls : ZK 13.0

STD calls : ZK 78.0

International Calls;

Indian Ocean Region : US\$ 21.9

Atlantic Ocean Region : US\$ 16.5

Terrestrial Route : US\$ 8.4

WD : Annual average of working days (300 days)

CCDR : Construction cost distribution ratio (40%)

(Note): It is assumed that call completion ratio of STD call is improved from the present ratio of 30% to 60% along with the materialization of this Long-Term Plan.

Total Annual Revenue of call charges, Installation fees and Rental fees for these priority projects are shown in Table 9-2-3. The following revenues are those obtained through the operation of the telecommunication network established under the current Long-Term Plan, and do not include the present revenue. The revenues are deemed as the operating income of these priority projects.

Table 9-2-3 Total Annual Revenues for Priority Projects

Project year	Project-Urban		Project-Rural	
	Additional Main Lines	Revenues (1,000 US\$)	Additional Main Lines	Revenues (1,000 US\$)
96/97	16,597	3,410	0	0
97/98	18,927	3,477	272	56
98/99	19,955	3,885	1,085	221
99/00	20,983	4,002	1,628	328
00/01	22,011	4,113	2,171	437
01/02	23,043	4,212	2,714	545
02/03	23,043	4,301	3,256	650
03/04	23,043	4,274	3,256	650
04/05	23,043	4,254	3,256	650
05/06	23,043	4,236	3,256	650
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
12/13	23,043	4,153	3,256	650

### 3. Investment Cost

#### 3.1 Total Investment Cost

The total investment cost detailed in SECTION 8 can be summarized as in Table 9-3-1 for the financial analysis.

Table 9-3-1 Total Investment Cost

Item	Project-Urban	Project-Rural
Equipment & Facilities	53,790	19,546
Engineering Service	3,400	980
Pre-operation costs	290	104
Interest During Construction (Loan Case Only)	(8,408)	(1,616)
Initial Working Capital	532	-9.0
Total Investment Cost (Loan Case Only)	66,420	22,237
Total Investment Cost (Grant Case Only)	58,012	20,621

Depreciation:

Equipment & Facilities	15 years straight line
Engineering Services	5 years straight line
Pre-operation Costs	5 years straight line
Interest during Construction	5 years straight line

#### 3.2 Expenditure Schedule of Total Investment Cost

The total investment cost for priority projects is disbursed in each year of the construction period as shown in Table 9-3-2.

Table 9-3-2 (1/2) Investment Schedule for Project-Urban

(Unit: US\$ 1,000)

Item	Project Year				Total
	-4(94/95)	-3(95/96)	-2(96/97)	-1(97/98)	
Equipment & Facilities	1,625	18,597	16,784	16,784	53,790
Engineering Service	455	1,345	800	800	3,400
Pre-operation Costs	20	98	86	86	290
Interest during Construction (Loan Case only)	(116)	(1,286)	(2,749)	(4,258)	(8,409)
Initial Working Capital	-	518	-5	19	532
Total (Loan Case)	2,216	21,844	20,414	22,947	66,421
Total (Grant Case)	2,100	20,558	17,665	17,689	58,012

Table 9-3-2 (2/2) Investment Schedule for Rural Project

(Unit: US\$ 1,000)

Item	Project Year		Total
	-2(95/96)	-1(96/97)	
Equipment & Facilities	5,838	13,708	19,546
Engineering Service	290	690	980
Pre-operation Costs	52	52	104
Interest during Construction (Loan Case only)	(340)	(1,277)	(1,617)
Initial Working Capital	-	-9.48	-9.48
Total (Loan Case)	6,520	15,718	22,238
Total (Grant Case)	6,180	14,441	20,621

#### 4. Operating and Maintenance Costs

Table 9-4-1 is the summary of the direct operating costs not including interest payment and depreciation. The operating and maintenance costs in the representative years are listed in this Table since the operating costs in every year increase due to the increase in number of terminals.

Expenditures to be incurred for operation and maintenance of the network established under the current Long-Term Plan, excluding those for the present network, are given in Table 9-4-1. The expenditure are deemed as the operating costs in this study.

Table 9-4-1 Operating and Maintenance Cost

Project-Urban		Unit: 1,000 US\$		
Items	Project Year			
	1996	1999	2002	
Staff costs	39	120	200	
Other costs	242	466	687	
Total	281	586	887	

Project-Rural		Unit: 1,000 US\$		
Items	Project Year			
	1997	1999	2002	
Staff costs	22	62	133	
Other costs	15	40	84	
Total	37	102	217	

Staff relating costs include Salaries, Staff Housing, general and social welfare charges, sick leaves, etc.

General expenses present the costs for spare parts, Motor Vehicle expenses, Printing & Stationery, Communications, Travelling Expenses and Miscellaneous items, etc.

## **5. Financial Analysis**

The purpose of the financial analysis is to measure and assess the financial viability of the priority projects under the above mentioned conditions and assumptions. The financial analysis will be performed for the selected base cases set by different financing schemes, namely (1) Loan Case : Equity/Long-term Loan Case, and (2) Grant Case : Equity/Grant Case.

### **5.1 Summary of Financial Statements**

#### **(1) Financial Statements**

The result of this financial analysis is detailed in the output sheets that are attached to the end of this section.

- Income Statements (refer to Annex)
- Cash Flow Statements (refer to Annex)
- Balance sheets (refer to Annex)

#### **(2) Summary of Financial Analysis for the Priority Projects**

The summary of the result of the above financial analysis is shown in Table 9-5-1.

### **5.2 Major Financial Indicators**

The major financial indicators in each operation year are shown in Table 9-5-2. Each indicator is obtained from the following formula:

#### **(1) Net Profit on Equity on Sales Revenue**

(Net Profit after tax) / Equity (Paid-in share capital)

#### **(2) Debt Service Coverage Ratio**

(Net Profit after tax + Depreciation + Interest) / (Repayment + Interest)

#### **(3) Break-Even Points (B.E.P.)**

##### **i) Profit B.E.P. - Sales Revenue**

$(OPC + D + I) \times 1 / r \times 100$



ii) Cash B.E.P - Sales Revenue

$$(OPC + D + I) + (R - D) / (1 - g) + WCI \times 1 / r \times 100$$

where,

OPC : Operating Costs  
r : Sales Revenue at Each Project Year  
R : Repayment of Long-term Loan  
D : Depreciation  
I : Interest on Long-term Loan  
g : Tax rate  
WCI : Working Capital Increase

### 5.3 Sensitivity Analysis

The effects on the profitability of the projects by the changes of conditions assumed in this financial analysis have been analyzed.

The changes of conditions (variable factors) and their variable ranges have been assumed as follows:

(1) Total Investment Cost

+10% and -10% of the fluctuation of the Total Investment Cost at the construction stage excluding Interest during construction, and Initial Working Capital and Reinvestment during operation.

(2) Sales Revenue

+20% and -20% of the fluctuation of the sales revenue in each project year.

(3) Interest on Long-term Loan (Loan Case only)

Decrease of 3.5 and 6.5 Points shows the base value of 10.0% p.a.

(4) Grant Portion Rate (Grant Case only)

-10% and -20% decrease against the required investment costs for Equipment & Facilities and Design & Tendering which are assumed in Grant Case as the Grant element items.

The result of the sensitivity analysis is summarized in Table 9-5-3.

Table 9-5-1 Summary of Financial Analysis

(UNIT : 1,000 US\$)

Project	Project Urban		Project Rural		Project U/R	
	Loan	Grant	Loan	Grant	Loan	Grant
Financial Case						
Total Investment	66,421	58,012	22,238	20,621	88,659	78,633
Project Funding Equity (Own Capital)	19,927	3,259	6,672	734	26,599	3,993
Debt (Long-Term Loan)	46,494	-	15,566	-	62,060	-
Grant	-	54,753	-	19,887	-	74,640
Total	66,421	58,012	22,238	20,621	88,659	78,633
Sales Revenue						
Project Total (Average Annual)	69,451 (4,085)	69,451 (4,085)	8,744 (547)	8,744 (547)	78,195 (4,600)	78,195 (4,600)
O/M Costs, Interest, Depreciation						
Project Total (Average Annual)	138,541 (8,199)	17,247 (1,014)	5,126,462 (320,404)	4,305 (269)	5,265,001 (309,705)	21,552 (1,268)
Income Tax						
Project Total (Average Annual)	1,478 (87)	20,882 (1,228)	0 (0)	1,583 (99)	1,478 (87)	22,465 (1,327)
Net Profit						
Project Total (Average Annual)	-70,568 (-4,151)	31,323 (1,843)	-5,117,716 (319,857)	2,856 (179)	-5,188,284 (-305,193)	34,179 (2,011)
Cash Flow during Operation						
Project Total (Average Annual)	-241,601 (-14,212)	30,647 (1,802)	-13,433,169 (839,573)	2,784 (174)	-13,674,770 (-804,398)	33,431 (1,967)
Expected Project Return (IRROE) Payout Period for Initial Equity	N.A. N.A.	61.43% 1.45 year	N.A. N.A.	18.24% 5.94 year	N.A. N.A.	53.86% 2.1 year

Loan Case: Equity / Long-Term Loan  
 Grant Case: Grant / Equity  
 N.A.: Not Applicable

Table 9-5-2 (1/3) Major Financial Indicators

Project Year	Net Profit on Equity (%)		Debt Service Coverage Ratio		Profit Break Event Point (%)		Cash Break Even Point (%)	
	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant
1(96/97)	5.61	55.58	4.47	45	11	10	7	
2(97/98)	5.52	55.00	4.43	47	14	14	10	
3(98/99)	-37.46	54.69	0.69	292	24	35	14	
4(99/00)	-37.30	55.26	0.53	286	25	36	16	
5(00/01)	-37.18	55.71	0.43	280	26	37	18	
6(01/02)	-35.44	56.06	0.35	268	28	53	19	
7(02/03)	-35.28	57.07	0.30	263	28	53	22	
8(03/04)	-23.88	56.83	0.25	211	28	162	21	
9(04/05)	-22.74	56.73	0.20	207	28	157	21	
10(05/06)	-21.60	56.66	0.17	202	27	152	21	
11(06/07)	-20.44	56.63	0.14	196	27	147	21	
12(07/08)	-19.27	56.62	0.13	191	27	141	20	
13(08/09)	-18.10	56.65	0.12	186	27	136	20	
14(09/10)	-16.92	56.69	0.11	181	26	130	20	
15(10/11)	-15.74	56.76	0.10	175	26	125	20	
16(11/12)	-12.55	58.32	0.10	160	24	126	21	
17(12/13)	-11.36	59.91	0.09	155	22	120	22	

Loan: Equity / Long-Term Loan  
Grant: Grant / Equity

Table 9-5-2 (2/3) Major Financial Indicators

Project Year	Net Profit on Equity (%)		Debt Service Coverage Ratio		Profit Break Event Point (%)		Cash Break Even Point (%)	
	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant
1(96/97)	-52	-16.60	-0.0365		6,290	311	833	166
2(97/98)	-65	-2.30	0.0221		1,595	86	211	43
3(98/99)	-86	9.37	0.0196		1,087	70	155	41
4(99/00)	-120	17.81	0.0164		824	60	124	38
5(00/01)	-177	23.89	0.0127		666	54	105	37
6(01/02)	-258	30.52	0.0094		470	47	336	36
7(02/03)	-409	30.67	0.0057		459	47	325	36
8(03/04)	-652	31.07	0.0035		446	46	312	35
9(04/05)	-1,043	31.47	0.0022		434	45	299	34
10(05/06)	-1,675	31.87	0.0014		421	44	287	34
11(06/07)	-2,690	32.27	0.0009		408	44	274	33
12(07/08)	-4,326	32.67	0.0005		395	43	261	32
13(08/09)	-6,958	33.07	0.0003		383	42	248	31
14(09/10)	-11,196	33.47	0.0002		370	41	236	31
15(10/11)	-18,020	33.87	0.0001		357	41	223	30
16(11/12)	-28,986	35.43	0.0001		144	33	343	33

Loan: Equity / Long-Term Loan  
Grant: Grant / Equity

Table 9-5-2 (3/3) Major Financial Indicators

Project Year	Net Profit on Equity (%)		Debt Service Coverage Ratio		Profit Break Event Point (%)		Cash Break Even Point (%)	
	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant
1(96/97)	4	5.88	4.47	11	45	10	7	
2(97/98)	-9	5.43	1.10	19	146	27	13	
3(98/99)	-44	5.73	0.37	27	362	44	16	
4(99/00)	-49	6.06	0.24	28	346	45	18	
5(00/01)	-58	6.31	0.16	30	332	45	20	
6(01/02)	-71	6.49	0.11	31	313	59	21	
7(02/03)	-91	6.76	0.07	30	291	90	24	
8(03/04)	-120	6.74	0.04	30	244	184	23	
9(04/05)	-180	6.74	0.03	30	238	178	23	
10(05/06)	-277	6.74	0.02	30	232	172	23	
11(06/07)	-434	6.74	0.01	29	226	165	22	
12(07/08)	-686	6.75	0.01	29	220	159	22	
13(08/09)	-1,093	6.77	0.0046	29	214	153	22	
14(09/10)	-1,750	6.78	0.0029	28	208	146	21	
15(10/11)	-2,807	6.80	0.0018	28	201	140	21	
16(11/12)	-4,509	6.97	0.0011	26	187	139	22	
17(12/13)	-7,247	7.18	0.0007	23	153	150	23	

Loan: Equity / Long-Term Loan  
Grant: Grant / Equity

Table 9-5-3 Summary of Sensitivity Analysis

Variable Factor	Variation	Project Urban	Project Rural	Project Urban/Rural
Total Investment (Grant Case)	-10%	66.00	19.79	58.13
	Base	61.43	18.24	53.86
	10%	57.45	16.79	50.15
Sales Revenue (Grant Case)	-20%	50.17	12.24	43.02
	Base	61.43	18.24	53.86
	20%	71.28	22.76	63.36
Interest on Long-Term Loan (Loan Case)	3.5% p.a.	N.A.	N.A.	N.A.
	10.0% p.a.	N.A.	N.A.	N.A.
	6.5% p.a.	N.A.	N.A.	N.A.
Grant Portion Rate (Grant Case)	Base	61.43	18.24	53.86
	-10%	27.99	5.88	22.10
	-20%	16.80	0.85	12.61

NOTE: IRROE (Internal Rates of Return on Equity) figures in all the sensitivity analysis of Loan Case are not applicable (N.A.) due to the financial difficulty to payback the initial investment as detailed in "Results of Financial Analysis."

## 6. Results of Financial Analysis

This report assesses alternative financial arrangements for implementing priority projects, and estimates their profitability. The Government of Zambia is now endeavoring for the recovery of the national economy through development of infrastructures. To this end, Telecommunications are considered to be one of the essential ingredients. The objective projects fall under the BHN (Basic Human Need) category and constitute a part of the program of public projects to develop infrastructures.

At issue when discussing the economics of the projects is the scale of revenues from charges. As Zambia is still developing, demand is expected to grow only slightly, in line with the low growth in income, making it difficult to carry out projects which require large investments. This means that although telecommunications networks are required for economic growth, revenues will be insufficient to finance the construction of such networks.

The profitability of the projects carried out under these conditions would be extremely low, and it would be difficult to carry out such projects using normal financing techniques. An assessment has therefore been set up for a normal equity/loan case (Loan Case), and a grant/equity case (Grant Case).

#### **6.1 Project-Urban (Urgent Project + Urban Project)**

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

##### **(1) Loan Case (Equity/Loan)**

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 projects, necessitating a large amount of short-term borrowing. From an economic perspective, it will be difficult to fund the projects by borrowing.

##### **(2) Grant Case (Grant/Equity)**

This case involves a foreign grant to overcome the problems of profitability. In this model, the cost of preparatory works, pre-operation costs and initial working capital 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 requires a small amount of funds and the projects can be 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. Funds required to build more facilities are also collectible. 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.

## 6.2 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 projects 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 projects will register a cash flow of US\$ 2,784,000, which gives an FIRR, albeit small, of 18.24%.

## 6.3 Sensitivity Analysis for Priority Projects

Priority projects : 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:

### (1) Loan Case

The Debt Service Coverage ratios show 0.0007 to 4.47 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.



(2) Grant Case

Result of Sensitivity Analysis is indicated in Fig 9-6-1.

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.

#### 6.4 Financial Soundness as Total Business Entity

In parallel with the assessment of the priority projects, the financial situation of the PTC in case those projects are not launched will be assumed (Without Case). Then, incorporating the financial return expectable by implementation of the priority projects, the total financial status as a total business entity will be evaluated (With Case).

PTC will construct, manage and operate the priority projects as a part of PTC's business framework. Therefore, the appraisal of priority projects call for the analysis of financial situation foreseen as a whole business entity, which means that consolidated cash position is to be analyzed assuming the financial outputs obtained by the existing facilities. By such analysis, it is obviously proved how the financial position of PTC has been improved as a whole.

(1) Forecast of Cash Position of Existing Facilities

Table 9-6-1 summarizes the cash surplus assumed in the operation of the existing facilities. The details are presented in Section 5.3.3.

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

- a) 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.
- b) Existing facilities become increasingly obsolete every year, leading to at all unusable finally. Therefore, the supply capacity of existing facilities will decrease each year.
- c) By maintaining the exchange rate of January 1, 1993 (1US\$=360 Zambian Kwacha), no exchange loss will occur from after 1993.

Table 9-6-1 Projected Financial Situation of Existing Network

Unit : 1,000 US\$

Year	Expected Revenue	Profit after Tax	Cash flow
1(93/94)	44,435	-8,592	-16,375
5(97/98)	38,094	1,339	-2,184
10(02/03)	28,224	697	-2,579
15(07/08)	26,433	4,265	3,174
20(12/13)	24,509	5,391	5,605

(2) Summary of Financial Analysis as Total Business Entity

Consolidated financial statements are prepared.

- Cash Flow Statement (Table 9-6-2)

The summary of the results of the financial analysis is shown in Table 9-6-3.

The profitability of the projects carried out under these conditions would be extremely low, and it would be difficult to carry out such projects using normal financing techniques. An assessment has therefore been set up for a grant/equity case (Grant Case).

(3) Profitability for Entire PTC

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

Now the significance of these priority projects will be examined in the following from the viewpoint of profitability for the entire PTC.

The results of the examination are as follows:

- 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.

Table 9-6-2 Cash Flow Statement for Total Business Entity (Grant Case)

Unit: 1,000 US\$

Year	Project-Rural		Project-Urban		Project-Urban/Rural	
	Project	Project + Exist	Project	Project + Exist	Project	Project + Exist
1(94/95)	0	-15,909	-1,070	-16,979	-1,070	-16,979
2(95/96)	-265	-7,600	-1,564	-8,898	-1,829	-9,164
3(96/97)	-482	-2,159	4,245	2,568	3,763	2,086
4(97/98)	0	-2,184	3,876	1,692	3,876	1,692
5(98/99)	204	-2,349	5,332	2,779	5,535	2,982
6(99/00)	392	-2,460	5,460	2,608	5,852	3,000
7(00/01)	532	-2,268	5,573	2,773	6,105	3,305
8(01/02)	671	-2,122	5,663	2,870	6,334	3,541
9(02/03)	831	-1,748	5,748	3,169	6,579	4,000
10(03/04)	831	-1,533	5,719	3,355	6,551	4,187
11(04/05)	834	4,170	5,698	9,034	6,532	9,868
12(05/06)	837	4,255	5,678	9,096	6,516	9,934
13(06/07)	840	4,207	5,663	9,030	6,503	9,870
14(07/08)	843	4,017	5,649	8,823	6,492	9,666
15(08/09)	846	6,185	5,637	10,976	6,484	11,823
16(09/10)	849	6,321	5,628	11,100	6,477	11,949
17(10/11)	852	6,457	5,620	11,225	6,472	12,077
18(11/12)	855	6,460	5,583	11,188	6,438	12,043
19(12/13)	825	6,430	5,543	11,148	6,367	11,972

Table 9-6-3 shows FIRR calculated for Case 2. It can be known from the table that priority projects funded by grant aids can be very profitable. The figures in the table prove that it is possible to operate existing networks while improving the financial situation, even if operating existing networks continues to result in a financial shortfall.

Table 9-6-3 The Result of The Financial Analysis

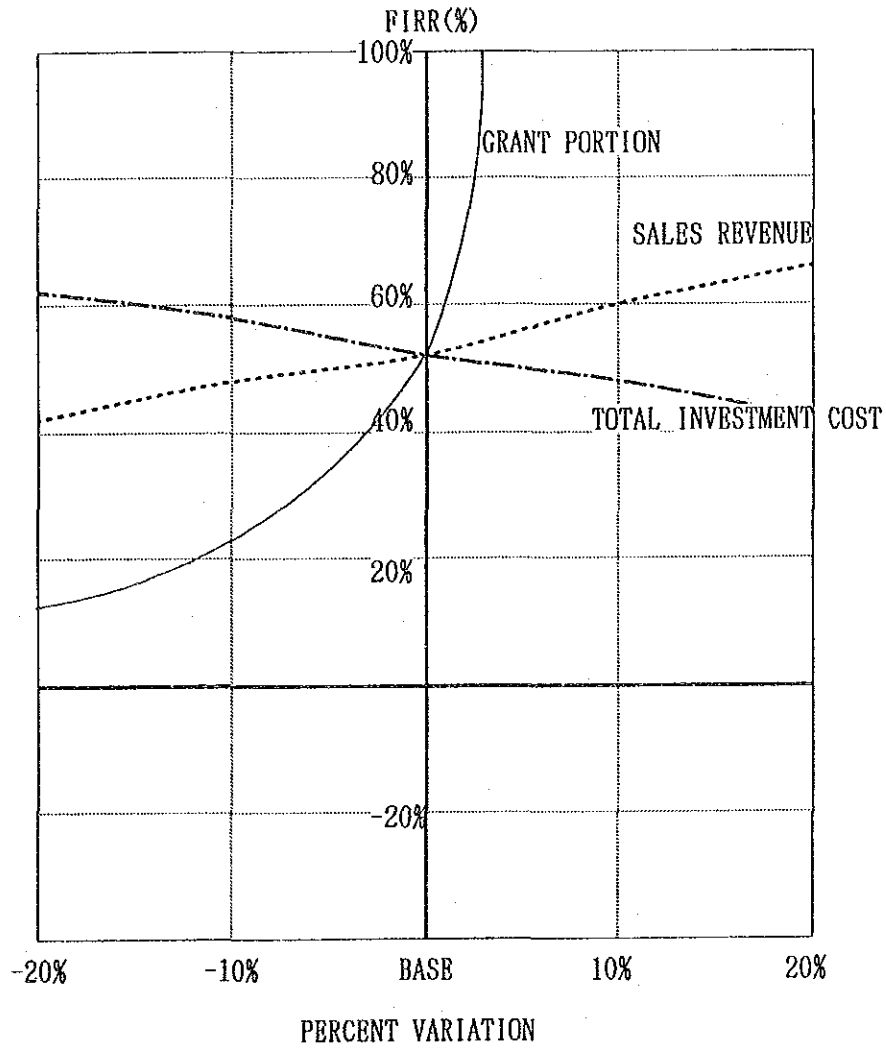
Project Case	Expected FIRR (Grant Base)	
	Unconsolidated	Consolidated
Project-Urban	114.35%	14.43%
Project-Rural	40.96%	6.73%
Project-Urban/Rural	105.88%	15.43%
Existing Network	-	-0.43%

(4) 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.



Total Investment Cost / Sales Revenue / Grant Portion Rate

Figure 9-6-1 Summary of Sensitivity Analysis for Grant Case  
 IRROE % to Variation of Financial Parameter

## **SECTION 10**

# **ECONOMIC EVALUATION ON PRIORITY PROJECTS**

## **SECTION 10 ECONOMIC EVALUATION ON PRIORITY PROJECTS**

### **1. General**

Telecommunication is almost universally recognized as an avenue for raising living standards and a key element of economic development. Thus telecommunication projects have an important impact on individual and social welfare. As economic activity should be expanded on a national scale, telecommunications is acquiring strategic importance for growth and development.

The telecommunication in Zambia, however, is prevented to become mature mainly due to the national treasury problems for development on large scale.

It is clear that there will be adequate demand for the telecommunication service in Zambia as the empirical evidence indicates that people place value on using telecommunications.

In these circumstances, PTC has come to reconsider ways and means for the improvement of the telecommunication systems.

More wider scaled services are to be provided by PTC to satisfy the people's basic needs. The necessity for planning new telecommunication networks is thus raised.

This section covers the Economic Analysis for the priority projects for maturity of the telecommunication networks.

The economic appraisal is undertaken to ascertain the overall impact of the projects on the country's economy. The Financial Analysis prepared in SECTION 9 was made from the viewpoint of an investor, whereas the Economic Analysis is made from that of a government decision concerned with broader economic development objectives of the country.

### **2. Method of Economic Analysis**

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



## 2.1 Economic Benefit of the Priority Projects

Economic Benefit of priority projects will be divided into direct and indirect benefits, which will be assessed separately.

### (1) Direct Benefit

The direct benefit of these projects lays its importance in the economic value. Sales revenues in economic value to be generated by these projects are estimated, based on investigation results concerning user's willingness to pay.

### (2) Indirect Benefit

The improvement of telecommunication networks will contribute a great deal to the improvement of the national well-being not simply in the form of economic benefit but also in terms of social benefit. Such indirect benefits conceivable are:

For residents:

- Greater ease in emergency access to medical institutions.
- Improved emergency communication serving for protection and rescue of human lives.
- Improved efficiency in communication, leading to upgrading and diversification of government and private services.
- Economic effects to enhance business activities.
- Increase in employment opportunities, improvement in security, etc.

For PTC:

- Nationwide expansion of telecommunications service.
- Improvement of telecommunications service.
- Rapid innovation in telecommunications.
- Simplification of network management.
- Creating new services.

With combinations of above effects, national economic growth is promoted.

## 2.2 Economic Costs

For the economic costs, the following items must be considered.

### (1) Initial Investment Costs for Implementation of the Projects

The Equipment and Facilities costs, Engineering services costs, Pre-operation cost and Initial working capital will be necessary as the initial cost for the implementation of the projects.

The economic value of these costs will be calculated by separating the local and foreign currency portions, considering the premiums for the economic value.

(2) Operating and Maintenance Costs

As the operating and maintenance costs, the staff costs, general expenses and insurance charges are required. These expenses must be analyzed economically considering their economic values.

**2.3 Economic Parameters**

The financial value projected in the Financial Analysis will be converted to the economic value using the following factors.

(1) Foreign Exchange Premium

The Foreign exchange premium utilized in converting the market value into economic value is derived from the following Standard Conversion Factor (SCF) formula.

$$SCF = (M + X) / \{(M + T_m) + (X - T_x)\}$$

where,

- SCF : Standard Conversion Factor
- M : CIF value of imports
- X : FOB value of exports
- T<sub>m</sub> : All taxes on imports
- T<sub>x</sub> : All taxes on exports

Each value of the above parameters to obtain SCF and the result of calculation are summarized in Table 10-2-1.

Table 10-2-1 Standard Conversion Factor

Year	Exports(FOB) (M.US\$)	Imports(CIF) (M.US\$)	Tax(Exp) (M.US\$)	Tax(Imp) (M.US\$)	SCF
1986	512	660	nil	132.0	0.898
1987	906	752	nil	150.4	0.917
1988	1,190	828	nil	165.6	0.924
1989	1,429	993	nil	198.6	0.924
1990	1,350	1,298	nil	259.6	0.911
Average SCF					0.915
Foreign Exchange Premium					1.09

- (2) The financial values of costs items presented in SECTION 9 "Financial Evaluation" will be divided into local and foreign currencies, and the local currency portion will be further divided into skilled labor, unskilled labor and local Material. Then the economic values will be calculated using the value of national parameters (premium of economic value) as shown below:

- Local Material	0.86
- Skilled Labor	0.85
- Unskilled Labor	0.54
- Working Capital	1.00
- Foreign Exchange Premium	1.09

### 3. Economic Analysis

#### 3.1 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 (Equity/Loan case)  
EIRR on total investment (100% Equity with elimination of loan borrowing)

Grant Case: Corresponding to the Grant Case (Grant/Equity case)  
EIRR on Equity any, in other words, on total investment paid by PTC.

#### 3.2 Direct Benefit

##### (1) 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. The survey covered 70 samples, who consisted of ordinary households and offices. Table 10-3-1 shows the amount obtained through the survey that beneficiaries would willingly pay.

PTC revised its charges in November 1992, while the survey was carried out for the system under the former charges.

The survey results, however, indicate that the new charges are virtually equivalent to the amounts that would be willingly paid by beneficiaries.

The economic benefits of the projects are calculated based on these amounts that the beneficiaries would willingly pay.

Table 10-3-1 Willingness To Pay

Item	Maximum Value
Call Charge	ZK 13/Call
Installation Fee	ZK 3000/line
Rental Fee	ZK 4000 p.a.

Note: The result of Interview survey is shown in DATA FILE, " Result of questionnaire."

(2) Consumer's Surplus

In consideration of the outcome of interview survey, the total consumer's surplus is estimated in following manner.

In Figure 10-3-1, the present telephone supply is OQ1 and Installation Charge is OP1. Demand relationship is represented by DD' wherein waiting subscribers BC exist. OP2 represents "Willingness to Pay" for subscription, while OQ represents the Number of Installations. Thus, the balance AB presents premium, and as OQ increases the premium decreases, causing the current project benefit from social viewpoint to be equal to the triangle ABC. The AB present premium is based on the "Willingness To Pay" of beneficiaries described in Table 10-3-1.

In this concept, using the demand curve, of consumer's surplus which is indicated in Figure 10-3-1, the amount of consumer's surplus is inversely proportional to expansion percentage of telecommunication facilities invested in the target areas.

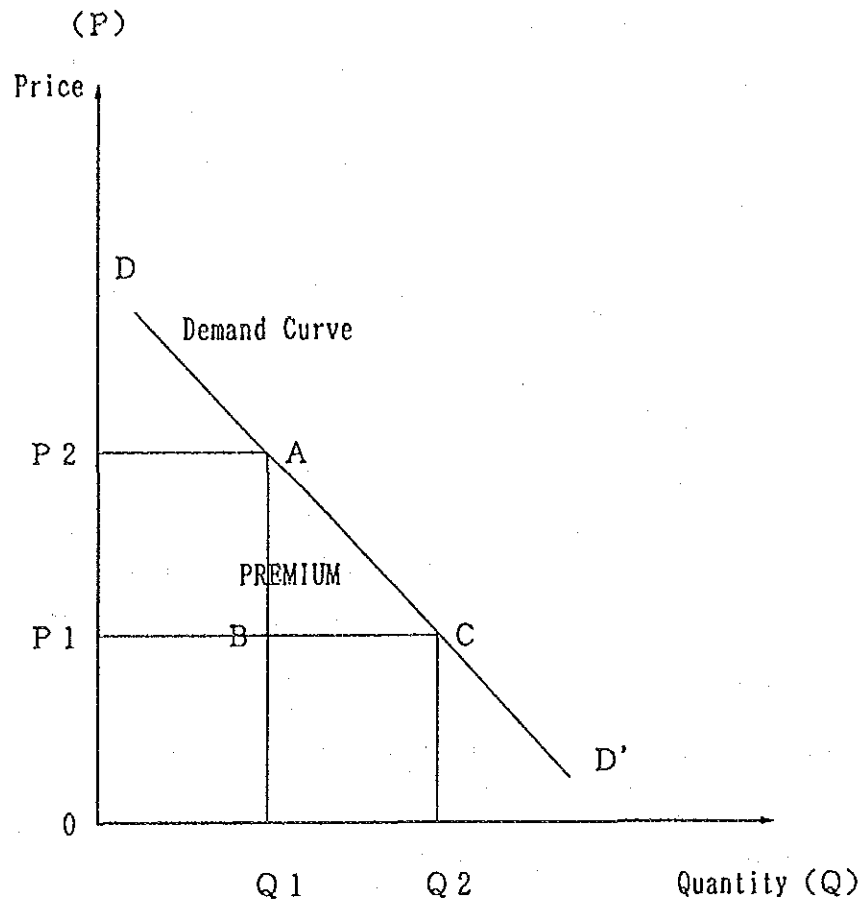


Figure 10-3-1 Consumer's Surplus

(3) Economic Value of the Benefit

The above mentioned consumer's surplus is to be used as the base value of the economic benefit expected by the projects.

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

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

Premium of Call charges	:	ZK 13	US\$ 0.036
Installation fee	:	ZK 3,000	US\$ 8.3
Rental fee	:	ZK 4,000	US\$ 11.1

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

Table 10-3-2 shows the tariff system in Zambia, quoted in Zambian Kwacha. It is evident that charges quoted in Zambian Kwacha are increasing each year. However, when they are converted into US dollars, as indicated in Table 10-3-2, 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 this charge system. This means that subscribers understood that the value of a call was US\$0.06. As of January 1993, the charge is priced at US\$0.036 per call. This does not mean that the value of the call is 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.

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

Premium of Call charges	:	ZK 13.32	US\$ 0.037
Installation fee	:	ZK 3,322	US\$ 9.23
Rental fee	:	ZK 6,444	US\$ 17.9

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

Premium of Call charges	:	ZK 21.6	US\$ 0.06
Installation fee	:	ZK 5,904	US\$ 16.4
Rental fee	:	ZK 14,400	US\$ 40.0

Table 10-3-2 Trace of Telephone Charges

Year	Installation		Rental Fee		Unit Charge	
	Kwacha	US\$	Kwacha	US\$	Kwacha	US\$
1984	25	13.9	72	40.0	0.08	0.04
1985	30	11.05	72	26.5	0.11	0.04
1986	120	16.4	180	24.6	0.21	0.029
1987	120	13.5	180	20.2	0.50	0.056
1988	120	14.6	180	21.9	0.50	0.06
1989	120	9.3	180	13.9	0.65	0.05
1990	120	4.1	180	6.2	1.00	0.03
1991	120	1.94	800	12.9	1.70	0.02
1992	120	0.63	800	4.2	1.70	0.009
1993	2,500	6.94	3,200	8.8	13.00	0.036

The total economic benefits by each Economic Benefit case assumed for E.B.1 - E.B.3 are summarized as shown in table 10-3-3.

Table 10-3-3 Economic Benefit Streams

Project Year	Economic Benefit (US\$'000)		
	E.B.1	E.B.2	E.B.3
1(96/97)	8,257	8,359	10,348
2(97/98)	8,679	8,771	10,776
3(98/99)	10,064	10,175	12,520
4(99/2000)	10,621	10,740	13,214
5(00/01)	11,157	11,283	13,890
6(01/02)	11,661	11,796	14,529
7(02/03)	12,141	12,284	15,138
8(03/04)	12,076	12,219	15,053
9(04/05)	12,028	12,170	14,994
10(05/06)	11,983	12,126	14,940
11(06/07)	11,944	12,086	14,893
12(07/08)	11,908	12,050	14,850
13(08/09)	11,876	12,018	14,812
14(09/10)	11,847	11,990	14,777
15(10/11)	11,820	11,963	14,746
16(11/12)	11,797	11,940	14,718
17(12/13)	11,776	11,918	14,692

### 3.3 Economic Cost Streams

#### (1) Initial Investment Cost for Performance of the priority projects

The total investment and costs in each construction year described in SECTION 8 are re-summarized in Table 10-3-4 for Economic Analysis. The cost is divided into the costs of the skilled, unskilled and local materials. The cost of each item is converted into the economic cost using value of national parameter.

The Economic costs stream is shown in Table 10-3-4.

Table 10-3-4 (1/2) Economic Cost Streams

Equity Case		(Unit: US\$ 1,000)			
Items (Equity Case)		Market Value			
Project Year		-4	-3	-2	-1
Foreign Currency Equipment & Facilities		990	20,110	26,570	15,020
Local Currency					
Local Material		780	4,280	3,600	2,150
Skilled Labour		13	730	780	200
Unskilled Labour		20	1,100	1,170	300
Working Capital		-	518	-14	19
Total		1,803	26,738	32,106	17,689
Items (Equity Case)		Economic Value			
Project Year		-4	-3	-2	-1
Foreign Currency Equipment & Facilities		1,079	21,920	28,961	16,372
Local Currency					
Local Material		671	3,680	3,096	1,849
Skilled Labour		11	620	663	170
Unskilled Labour		11	594	632	162
Working Capital		-	518	-14	19
Total		1,772	27,332	33,338	18,572

Table 10-3-4 (2/2) Economic Cost Streams

Grant Case		(Unit: US\$ 1,000)			
Items (Grant Case)		Market Value			
Project Year		-4	-3	-2	-1
Local Currency					
Local Material		752	352	634	740
Skilled Labour		125	61	137	69
Unskilled Labour		193	92	206	103
Working Capital		-	518	-14	19
Total		1,070	1,029	963	931
Items (Grant Case)		Economic Value			
Project Year		-4	-3	-2	-1
Local Currency					
Local Material		647	303	545	636
Skilled Labour		106	52	116	59
Unskilled Labour		104	50	111	56
Working Capital		-	518	-14	19
Total		857	923	758	770



(2) Operating Cost

The economic value of the cost of the labor and general expenses will be calculated as the cost for operating. The transfer items (insurance on property) are excluded from the financial value estimated, and the rest of the costs are converted into Economic value using value of national parameter as shown in Table 10-3-5.

Table 10-3-5 Economic Value of Operating & Maintenance Costs

(Unit: US\$1000)

Year	Financial Value				Economic Value			
	L/M	S/L	US/L	Total	L/M	S/L	US/L	Total
1(96/97)	242	39	-	281	208	33	-	241
2(97/98)	331	87	-	418	285	74	-	359
3(98/99)	410	134	-	544	352	114	-	466
4(99/2000)	506	182	-	688	435	155	-	590
5(00/01)	594	232	-	826	511	197	-	708
6(01/02)	683	283	-	966	587	241	-	828
7(02/03)	771	333	-	1104	663	283	-	946
\	\	\	\	\	\	\	\	\
17(12/13)	771	333	-	1104	663	283	-	946

4. Assessment of Result of Economic Analysis

EIRR during the economic life span for the Base Cases are calculated using the economic benefit and costs, and shown in Tables 10-4-1 and 10-4-2. In these tables, the economic cash flows by the variation of economic benefit are calculated; in other words, the cash flows and EIRR in relation to the economic values of E.B.1 - E.B.3 are presented. EIRRs, the measures to assess the economic viability, are summarized as shown in Table 10-4-3.

Table 10-4-1 Economic Cash Flow (Equity Case)

(Unit: 1,000 US\$)

Project Year	Economic Benefit (A)			Economic Cost			Economic Cash Flow (A) - (B)		
	E.B.1	E.B.2	E.B.3	Investment	Operating Costs	Total (B)	E.B.1	E.B.2	E.B.3
	-4('94/95)	-	-	-	1,772	-	1,772	-1,772	-1,772
-3('95/96)	-	-	-	27,332	-	27,332	-27,332	-27,332	-27,332
-2('96/97)	8,257	8,359	10,348	33,338	241	33,579	-25,322	-25,220	-23,231
-1('97/98)	8,679	8,771	10,776	18,572	359	18,931	-10,252	-10,160	-8,155
1('98/99)	10,064	10,175	12,520	0	466	466	9,598	9,709	12,054
2('99/00)	10,621	10,740	13,214	0	590	590	10,031	10,150	12,624
3('00/01)	11,157	11,283	13,890	0	708	708	10,449	10,575	13,182
4('01/02)	11,661	11,796	14,529	0	828	828	10,833	10,968	13,701
5('02/03)	12,141	12,284	15,138	0	946	946	11,195	11,338	14,192
6('03/04)	12,076	12,219	15,053	0	946	946	11,130	11,273	14,107
7('04/05)	12,028	12,170	14,994	0	946	946	11,082	11,224	14,048
8('05/06)	11,983	12,126	14,940	0	946	946	11,037	11,180	13,994
9('06/07)	11,944	12,086	14,893	0	946	946	10,998	11,140	13,947
10('07/08)	11,908	12,050	14,850	0	946	946	10,962	11,104	13,904
11('08/09)	11,876	12,018	14,812	0	946	946	10,930	11,072	13,866
12('09/10)	11,847	11,990	14,777	0	946	946	10,901	11,044	13,831
13('10/11)	11,820	11,963	14,746	0	946	946	10,874	11,017	13,800
14('11/12)	11,797	11,940	14,718	0	946	946	10,851	10,994	13,772
15('12/13)	11,776	11,918	14,692	0	946	946	10,830	10,972	13,746

Table 10-4-2 Economic Cash Flow (Grant Case)

(Unit: 1,000 US\$)

Project Year	Economic Benefit (A)			Economic Cost			Economic Cash Flow (A) - (B)		
	E.B.1	E.B.2	E.B.3	Investment	Operating Costs	Total (B)	E.B.1	E.B.2	E.B.3
	-4('94/95)	-	-	-	857	-	857	-857	-857
-3('95/96)	-	-	-	923	-	923	-923	-923	-923
-2('96/97)	8,257	8,359	10,348	758	241	999	7,258	7,360	9,349
-1('97/98)	8,679	8,771	10,776	770	359	1,129	7,550	7,642	9,647
1('98/99)	10,064	10,175	12,520	0	466	466	9,598	9,709	12,054
2('99/00)	10,621	10,740	13,214	0	590	590	10,031	10,150	12,624
3('00/01)	11,157	11,283	13,890	0	708	708	10,449	10,575	13,182
4('01/02)	11,661	11,796	14,529	0	828	828	10,833	10,968	13,701
5('02/03)	12,141	12,284	15,138	0	946	946	11,195	11,338	14,192
6('03/04)	12,076	12,219	15,053	0	946	946	11,130	11,273	14,107
7('04/05)	12,028	12,170	14,994	0	946	946	11,082	11,224	14,048
8('05/06)	11,983	12,126	14,940	0	946	946	11,037	11,180	13,994
9('06/07)	11,944	12,086	14,893	0	946	946	10,998	11,140	13,947
10('07/08)	11,908	12,050	14,850	0	946	946	10,962	11,104	13,904
11('08/09)	11,876	12,018	14,812	0	946	946	10,930	11,072	13,866
12('09/10)	11,847	11,990	14,777	0	946	946	10,901	11,044	13,831
13('10/11)	11,820	11,963	14,746	0	946	946	10,874	11,017	13,800
14('11/12)	11,797	11,940	14,718	0	946	946	10,851	10,994	13,772
15('12/13)	11,776	11,918	14,692	0	946	946	10,830	10,972	13,746

Table 10-4-3 Summary of Economic Analysis

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 result obtained in this Economic Analysis is discussed here, and shown in Fig 10-4-1.

The result of Economic Analysis clearly states that EIRR ( Economic Internal Rate of Return ) is much higher than the FIRR ( Financial Internal Rate of Return ) in both base cases. 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.

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 projects' implementation.

When consideration is given to the anticipated benefits accruing from the implementation of the priority projects, while understanding the characteristics of the telecommunication project, which is a public project, then implementing the priority projects covered by foreign grants will contribute to Zambia's economic development and infrastructure 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 is 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.

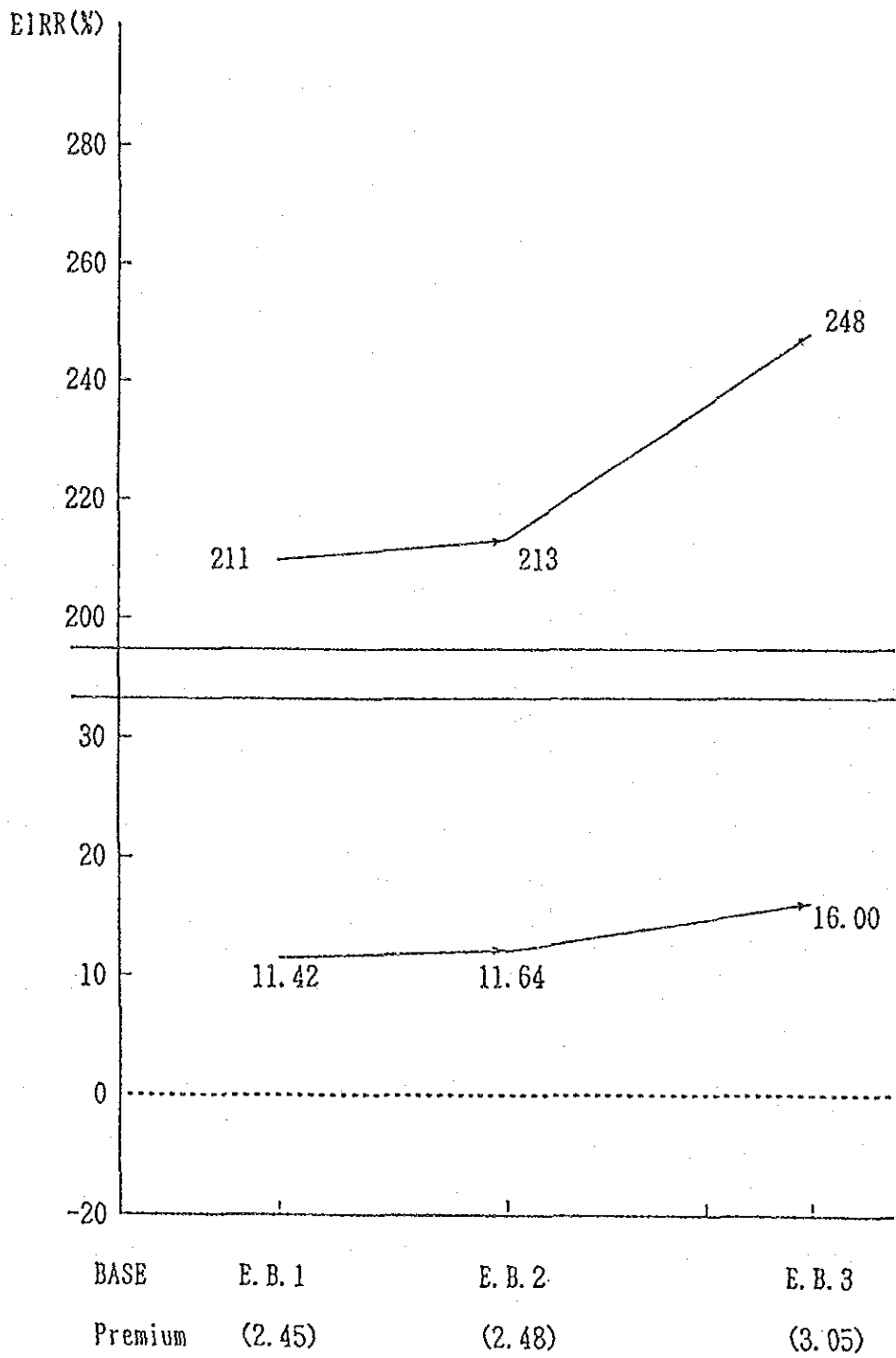


Figure 10-4-1 Result of Economic Analysis  
 (Sensitivity of EIRR to Variation of Social Economic Benefit)

## **SECTION 11**

### **CONCLUSION AND RECOMMENDATIONS**



## SECTION 11 CONCLUSION AND RECOMMENDATIONS

### 1. Privatization and PTC's Problems and the Countermeasures

#### 1.1 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 2008, provided that the projects are implemented with grant in initial years, and with long-term loans after 2000, as shown in Table 11-1-1.

Table 11-1-1 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.



1.2 PTC's Problems and the Countermeasures

Table 11-1-2 shows the PTC's problems and the countermeasures as mentioned in Section 3, para.6.

Table 11-1-2 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	Government
6. Shortage of human resources and materials 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

## 2. Recommendations on Corporate Management

### 2.1 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 11-2-1.

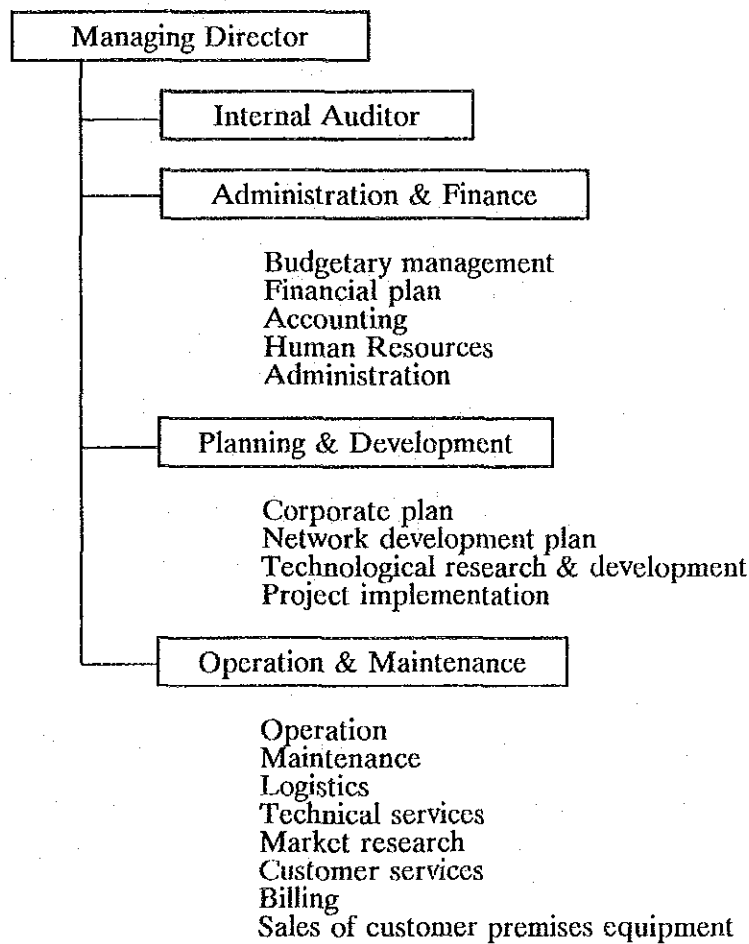


Figure 11-2-1 New Organization Chart

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.

## **2.2 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

### **3. Recommendation on Financial Aspects**

#### **3.1 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.

#### **3.2 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.

#### **3.3 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.

### 3.4 Increase in Telephone Charges

In November 1992 telephone charges were raised eight times. As Table 11-3-1 shows, the new charges are comparable to those of Zimbabwe and Kenya, but are still lower than technologically advanced nations.

In Section 5, 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.

#### (1) 10% Case:

10% increase in telephone charges every five years.

(2) 20% Case:

20% increase in telephone charges every five years.

(3) 30% Case:

30% increase in telephone charges every five years.

Table 11-3-2 indicates telephone charges in each fiscal year, and Table 11-3-3 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:

(1) 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.

(2) 20% Case

In this scenario, call 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.

(3) 30% Case

In this scenario, call 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.

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

Table 11-3-1 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 11-3-2 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 11-3-3 Cash Flow Statement

	0% 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

For reference, additional two cases are studied: 100% increase and 300% increase.

(1) 100% Case:

100% increase in telephone charges in fiscal 1993 and 10% increase every five years.

(2) 300% Case:

300% increase in telephone charges in fiscal 1993 and 10% increase every five years.

The projections in each case are based on the current financial situation of PTC.

(1) 100% Case

In this scenario, telecommunications charges will rise to about 2.9 times the level of January 1, 1993, by 2012. PTC will start operating at a profit in 1997, ten years earlier than the case where telecommunications charges are not raised. The net cash flow during the project period will total US\$454 million.

(2) 300% Case

In this scenario, call charges will rise to about 5.8 times the level of January 1, 1993, by 2012. PTC will start operating at a profit in 1993, and there will be a net cash flow of US\$1,014 million over the project period.

Table 11-3-4 Telephone Charge

	100%		300%	
	ZK	US\$	ZK	US\$
1993	26	0.07	52	0.14
1997	28.6	0.08	57.2	0.158
2002	31.5	0.088	62.9	0.174
2007	34.6	0.096	69.2	0.192
2012	38	0.105	76.1	0.21



Table 11-3-5 Cash Flow Statement

	100%	300%
1993/94	-6,567	2,851
94/95	-13,113	5,723
95/96	-14,704	13,550
96/97	-5,586	37,373
97/98	5,434	64,686
98/99	18,521	95,407
99/2000	35,116	130,984
00/01	49,387	165,595
01/02	66,120	204,032
02/03	92,444	255,773
03/04	115,641	306,419
04/05	137,302	357,568
05/06	168,144	419,946
06/07	190,943	476,337
07/08	227,087	551,747
08/09	263,249	629,452
09/10	308,377	718,409
10/11	350,073	806,228
11/12	398,443	903,019
12/13	454,533	1,014,964

In order to improve the financial situation of PTC urgently while materializing the Long Term Plan, the 300% increase in fiscal 1993 is requisite. However, the telephone charge of ZK52 (US\$0.14) is higher than the level of advanced countries, and not realistic in view of the living standard in Zambia. Since the telephone charges fall under the public utility charge, such high rate will be not practicable.

#### 4. Recommendation on Technical Aspects

##### 4.1 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 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 11-4-1 gives main items of the long-term and short-term plans, and Figure 11-4-1 shows a number of items to be taken into account in the long-term development plan.

Table 11-4-1 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)

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

- 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.

- 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.

- 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.

- 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.

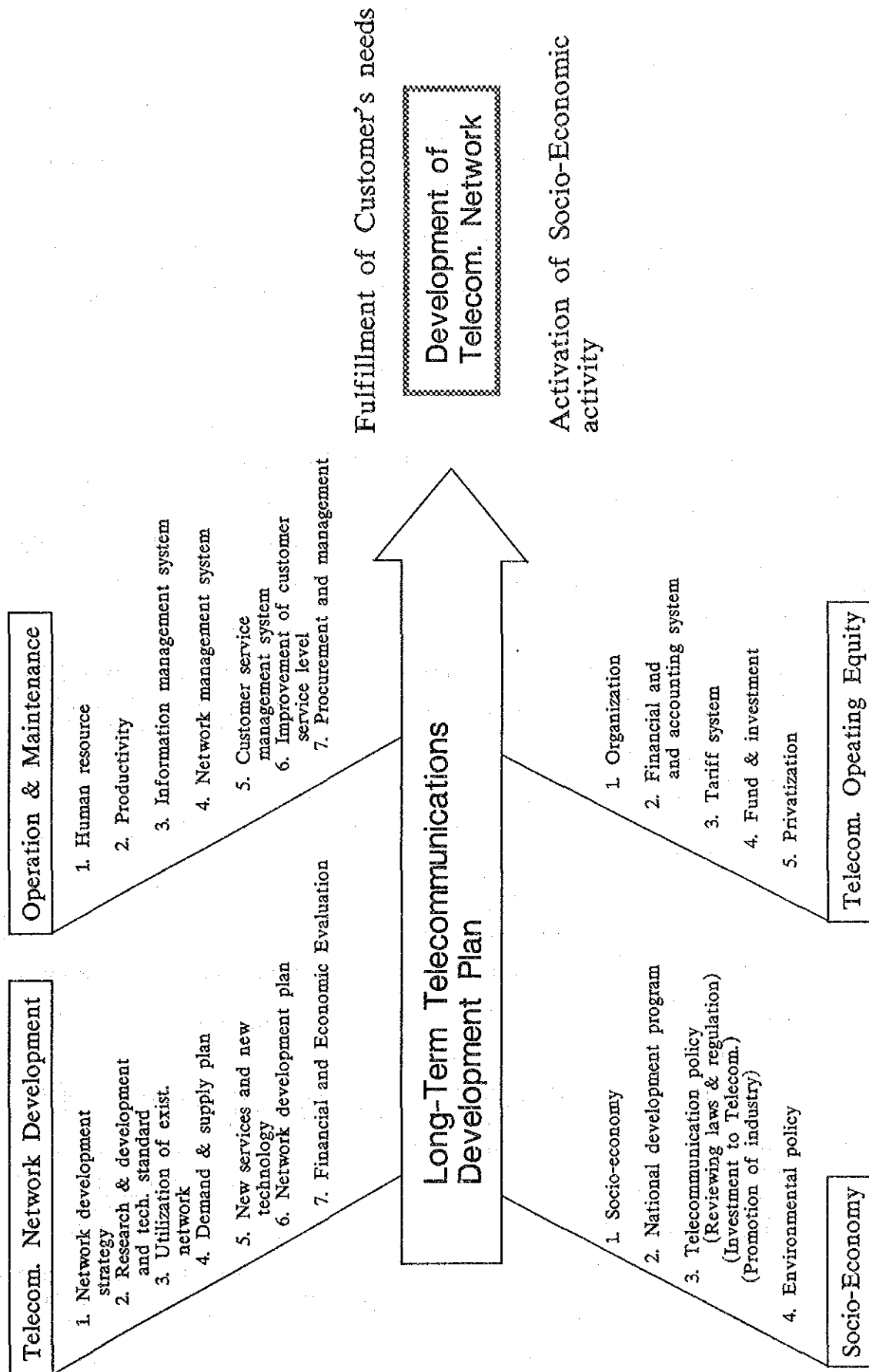


Figure 11-4-1 Long-Term Telecommunication Development Plan

#### **4.2 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.

#### **4.3 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.

#### **4.4 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 pcedures 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.

## **ANNEXES**

**ANNEX 1**

**MINUTES OF MEETING**

MINUTES OF MEETING  
ON THE INCEPTION REPORT FOR THE STUDY  
ON LONG TERM PLAN FOR DEVELOPMENT OF TELECOMMUNICATIONS NETWORK  
IN THE REPUBLIC OF ZAMBIA

The Study Team (The Team) organised by Japan International Cooperation Agency (JICA) and the Advisory Committee for the Study Team visited the Republic of Zambia, and had a series of meetings with the officials of the Posts and Telecommunications Corporation Limited (PTC) on 7th, 8th and 9th of October 1992 in the Conference Rooms of PTC in Ndola and Lusaka.

The list of participants to the meetings appears in attachment 1 of the minutes of the meetings.

Mr. Ngoma, Managing Director of PTC welcomed the Team and expressed his gratitude for cooperation of the Government of Japan.


Mr. S. Takashima, Chairman of the Advisory Committee expressed his appreciation at the cooperation by PTC to formulate Long Term Plan for Development of Telecommunications network in the Republic of Zambia.

The Inception Report presented by the Team was discussed during the meetings and was accepted with minor corrections which do not have bearing on the main context of the report. Paragraph 1.2.2. of the Inception Report was amended as shown in attachment 2 of the minutes of the meeting.

The meeting confirmed the inclusion of the facilities for the transmission of television and radio broadcasting programmes in the Study. The PTC will provide the requirement of the above facilities by the Zambia National Broadcasting Corporation (ZNBC) to the Team.

  
\_\_\_\_\_  
P. NGOMA  
MANAGING DIRECTOR  
POSTS AND TELECOMMUNICATIONS  
CORPORATION LIMITED

  
\_\_\_\_\_  
F. AIHARA  
LEADER  
STUDY TEAM (JICA)

12/10/92  
  
\_\_\_\_\_  
M. C. SOKO  
DIRECTOR OF ECONOMIC AND  
TECHNICAL COOPERATION  
NATIONAL COMMISSION FOR  
DEVELOPMENT PLANNING  
OFFICE OF THE PRESIDENT



LIST OF PARTICIPANTSETC

1. P. NGOMA -- MANAGING DIRECTOR
2. E. M. MUSONDA -- DIRECTOR OF TELECOMMUNICATIONS
3. A. KUMAR -- DEPUTY DIRECTOR  
(PLANNING & DEVELOPMENT)
4. E. CHISOMPOLA -- ACTING ASSISTANT DIRECTOR

ADVISORY COMMITTEE

1. S. TAKASHIMA -- CHAIRMAN
2. Y. SUZUKI -- MEMBER

JICA

1. Y. NISHIMURA -- STAFF

STUDY TEAM

1. F. AIHARA -- TEAM LEADER
2. M. OIKAWA -- MEMBER
3. T. KURODA -- MEMBER
4. Y. KATOH -- MEMBER

Major Amendment to Inception Report

Para 1.2.2 Telecommunications

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

The Corporation is controlled by a Board, of which one of the Executive Directors of ZIMCO is the Chairman. It has two operative Divisions: Postal and Telecommunications each one independent of the other. In addition there is a Corporate department which provides specialised common services to the operative Divisions, that is, financial services, audit services and data processing services. Telecommunications Division comprises of Planning and Development Department, Operations and Maintenance Department, Finance and Accounts Department and Human Resources Development Department.

The PTC continues to develop telecommunications infrastructure with the financial and technical assistance from the World Bank, African Development Bank and from industrialised countries including Japan. The status quo of telecommunications in Zambia is described as follows:

POSTS AND TELECOMMUNICATIONS CORPORATION LIMITED

TELECOMMUNICATIONS DIVISION

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MINUTES OF THE PRESENTATION OF THE INTERIM REPORT ON THE  
STUDY OF THE LONG TERM PLANS FOR THE DEVELOPMENT OF TELE-  
COMMUNICATIONS NETWORK IN ZAMBIA HELD ON DECEMBER 22 AND  
23, 1992 AT THE MINISTRY OF TRANSPORT AND COMMUNICATIONS  
AND PLANNING AND DEVELOPMENT CORPORATION

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DECEMBER 1992

A1 - 4

POSTS AND TELECOMMUNICATIONS CORPORATION LIMITED

TELECOMMUNICATIONS DIVISION

ATTENDANCE

A. Ministry of Transport and Communications

1. Hon A Kashita - Minister
2. S Mpinshi - Deputy Permanent Secretary/Admin & Comms
3. E Hanamwiinga - Senior Telecommunications Engineer

B. JICA Study Team

1. F Aihara - Team Leader
2. M Oikawa - Member
3. T Kuroda - Member
4. H Ishizuka - Member
5. Y Ureshi - Member

C. Posts & Telecommunications Corporation

1. K Siachinji - Team Leader
2. G T Malenga - Member

D. Planning & Development Cooperation - Office of the President

1. Mr Soko - Director of Economic and Technology

A. Opening Remarks

The meeting was brought to order at 0950 hours by the Minister of Transport and Communications Mr A Kashita who welcomed the team.

The JICA Study team leader Mr Aihara introduced the members of his team as well as those from PTC. He further expressed sincere thanks to the Minister for according the study team an opportunity of the meeting despite his tight schedules.

B. Introduction

The topics already agreed to the inception of the interim report and presented in the summary report were introduced. Each member of the team expanded on his area of speciality.

C. Summary of Discussion

From the discussion, the following points were raised:

1. Policy and strategy for the telecommunications sector is very important for proper formulation of development plans.
2. Population growth is 3.28% while GDP by economy was 0.54% between 1982 and 1991.
3. Telephone density of Zambia is 0.8 as compared to Botswana with 1.95 within the same region.
4. Manpower levels seem adequate but lack competent skilled technical staff more especially University graduates. It is hoped that the number of University graduates will be increased by more than double in the first decade.
5. As of November 1992, the existing exchange capacity was 120,000 while only 70,000 subscribers were connected with 50,000 waiters.
6. The total telephone demand was 132,000 in September, 1992 with 70% distributed on the Copperbelt and Lusaka.
7. The average service quality (successful call ratio) in Zambia is 25% while 60% is recommended. It is hoped that this can be boosted to 50% in the first decade and 60% in the next decade. There is a relationship between service quality and revenue collection.
8. Zambia's exchange digitalization ratio is 44% which is relatively good. The target is for 100% digitalization.
9. The number of international terrestrial circuits should be increased to accommodate other countries which might want to transit through Zambia.

10. External plant should be increased to enhance subscriber lines.
11. On-going and planned projects would be difficult to implement due to lack of foreign exchange.
12. The income and expenditure of PTC was affected by foreign exchange losses and devaluation of the local currency.
13. The 1991/1992 operational costs were too high and hence the increase in tariff would have very little impact on the Corporation's income. The staff costs should be increased by revision of salaries.
14. The PTC investment for 1992 was only US\$ 4 million which is too small for any meaningful expansion of the telecommunications network.
15. PTC Problems
  - a. The rental, installation and call charges are too low
  - b. Low collection rate of bills. Billing to be on monthly basis
  - c. Foreign exchange loss. The Government should manage the procurement of loans.
  - d. Shortage of funds for investment to develop the Network. The Government should take care of such investments.
16. Sector Strategy
  - a. The tariff policy should be formulated by the government with the help of experts from PTC and other users
  - b. Investment in rural areas should be done by government due to large investment
17. Rural area development to cost three (3) times more hence financial constraint eminent. 10% of total budget for rural development in these plans.

D. Minister's comments

1. The government appreciated a quick response from the JICA team for it to develop its target as presented in the MMD manifesto.
2. The JICA team to prepare an information report on manning levels to remedy the low level of qualified personnel employment by PTC.

3. JICA team to look at the financing aspect. Proper structuring of equity on performing assets such as telephone exchanges other than investments in building, cars etc.
4. PTC should do more development forecast researches which could be done in conjunction with CSO to determine the three categories of subscribers namely:
  - a. those who need to have telephone service
  - b. those who are on the waiting list
  - c. those who have applied
5. The capacity of the existing exchanges should be well spread out to avoid a situation where some subscribers have more than one telephone line at their residences.
6. PTC should plan their demand by considering the length of time it takes to acquire facilities e.g telephone exchanges.
7. Government, where possible, must invest in the telecommunications industry.
8. Telephone tariffs should be commensurate with the quality of service and capacity.
9. Problems of PTC

The following should be added to the already presented problem:

- a. Level of staff in personnel, corporate and accounts is too big compared to that of engineers for example.
- b. Lack of expenditure control
- c. Irregular telephone connections which lead to loss of revenue
- d. Labour productivity is too low
- e. Low equipment availability and poor equipment being used
- f. No targets in repair, installation and maintenance

4/...

10. Sector strategy

- a. In 1993, the Government is considering introducing a system of franchise or licensing which will afford private companies to provide telecommunications services in areas where PTC cannot provide such services.
- b. Apparatus for the customer premises will be available for sale by approved companies and PTC will compete with other suppliers.

11. Telecommunications Strategy

- a. Revision of salaries at all levels
  - b. Staff training college will be transformed from an in-house institution to be run by a board of government under the supervision of the University of Zambia. Other SADCC countries would use the college facilities. The basic telecommunications training will continue to be run by PTC.
12. The ministry is in agreement with the tariffing principles from the international chamber of commerce, as presented.
13. The PTC headquarters as well as billing centre should shift to Lusaka.
14. The expansion of broadcasting in Zambia is important and the Ministry of Information and Broadcasting together with the Ministry of Transport and Communications will work together to facilitate this facility. The Minister was satisfied with the contents of the summary report and closed the meeting.

E. Director of Planning and Development Cooperation  
Comments

1. Agreed with the contents of the summary of the interim report and Ministers comments with the following additions:-
  - (a) The funding of the telecommunications projects will be 65% and 50% on urban and rural areas, respectively
  - (b) The improvement of the Billing system as the first priority in the urgent program to be taken by P.T.C..



Minutes of Meetings  
on  
Interim Report  
for  
The Study on Long Term Plan For Development of  
Telecommunications Network  
in  
The Republic of Zambia

The meeting was held on 8th January, 1993 at the conference room of the PTC in Ndola to discuss the Interim Report submitted by the Team. The list of participants is attached herewith.

Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Advisory Committee headed by Mr. Yasuo Suzuki and the JICA Study Team (hereinafter referred to as "the Team") headed by Mr. Fujio Aihara to the Posts and Telecommunications Corporation Limited in the Republic of Zambia (hereinafter referred to as "PTC") for presenting and discussing the contents of the Interim Report for the Study on Long Term Plan for Development of Telecommunication Network in the Republic of Zambia (hereinafter referred to as "the Interim Report").

The chairman in his opening remarks thanked the Team for the commendable work they had carried out in accomplishing their assignment on schedule. The chairman invited the JICA team leader to address the meeting.

The JICA team leader in response informed the meeting that the preparation of the Interim Report had been completed. He requested the meeting to feel free in discussing the report and that any additions or deletions would be included in the final report.

After the statements by both the Director of Telecommunications and the JICA team leader, the PTC counterpart representative presented the Interim Report.

The contents of the Interim report as presented were generally accepted with the following observations.


- 1) The meeting observed that the GDP was on the negative trend.
- 2) It was noted that within the Sub Region Botswana had a higher telephone density followed by Zimbabwe. Zambia's telephone density was relatively low, as compared to her neighbors.
- 3) It was observed that the network configurations as observed in the Interim Report did not have enough detailed information and the meeting agreed that more details would be included in the draft final report.

- 4) In view of the proposed digitalization of the transmission network of 60 % in the first decade, it was agreed that the introduction of Synchronous Digital Hierarchy (SDH) should be brought forward to 2002.
- 5) The proposed organization chart was provisional and subject to further scrutiny.
- 6) The total investment cost would be worked out and be included in the final report.

Based on the discussion, compilation of the final draft report is to be finished by May, 1993. The final draft report will be a guideline for the PTC management over the next 20 years. It is expected that the PTC management will change quantitatively in future.

Having concluded the business, the meeting closed at 11:40 hrs.

LUSAKA, 11th January 1993



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P. NGOMA  
MANAGING DIRECTOR  
POSTS AND TELECOMMUNICATIONS  
CORPORATION LIMITED



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F. AIHARA  
TEAM LEADER  
JICA STUDY TEAM



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M. C. SOKO  
DIRECTOR OF ECONOMIC AND  
TECHNOLOGY,  
PLANNING AND DEVELOPMENT  
COOPERATION,  
OFFICE OF THE PRESIDENT

Attachment

List of Participants

PTC

1. P. Ng'oma - Managing Director
2. C. Mugala - Financial Director
3. A. Kumar - Acting Director of Telecomms (Chairman)
4. B. Oriaku - Deputy Director of Telecomms
5. R. Siame - Acting Deputy Director of Telecomms
6. B. Sakalan - Assistant Director - Customer Services
7. J. Munghandila - Chief Engineer - Internal Development
8. M. Kabwera - Assistant Director - Technical Services
9. M. Ketani - Chief Engineer - External Plant
10. J. Haabeka - Acting Chief Engineer - R and T
11. M. Katapa - Chief Engineer - Switching
12. R. Cosh - Deputy Director - Finance
13. K. Siachinji - PTC Counterpart - Leader
14. G. Malenga - PTC Counterpart
15. P. Nduna - PTC Counterpart
16. P. Kunda - PTC Counterpart
17. F. Kumwenda - PTC Counterpart
18. H. Tembo - PTC Counterpart

JICA Advisory Committee

1. Y. Suzuki
2. H. Nagasaka
3. K. Tomita

JICA Study Team

1. F. Aihara - Team Leader
2. M. Oikawa - Member
3. Y. Ureshi - Member
4. R. Katayama - Member
5. T. Satoh - Member
6. N. Matsuda - Member
7. H. Ishizuka - Member
8. T. Kuroda - Member
9. Y. Katoh - Member

Minutes of Meetings  
on  
Draft Final Report  
for  
The Study on Long Term Plan For Development of  
Telecommunications Network  
in  
The Republic of Zambia

A series of meetings were held on 27th, 28th and 31st of May 1993 at conference rooms of the Posts and Telecommunications Corporation Limited (Hereinafter referred to as the PTC) in the Republic of Zambia, for discussion on the Draft Final Report between the Study Team of Japan International Cooperation Agency (Hereinafter referred to as JICA) and the Advisory Committee for JICA and representatives of the PTC.

The participants to the meetings are listed in the Attachment 2 herewith.

The meeting was opened by the PTC Managing Director Mr.P. Ng,oma who welcomed the JICA delegation and the Chairman of Advisory Committee Mr.S.Takashima on behalf of JICA members expressed his appreciation of the cooperation by the PTC staff who may have been directly or indirectly engaged in the Study ensuring that it was conducted smoothly and successfully.

The JICA Study Team presented the following complete sets of the Draft Final Report in accordance with the scope of work;

- a) Draft Final Report (Main Report),
- b) Draft Final Report (Summary),
- c) Draft Final Report (Data Book),
- d) Draft Final Report (Supporting),
- e) Presentation Material.


The observations made during the discussions are listed in the Attachment 1, and principally, the contents of the Draft Final Report were acceptable to all the parties however, the Study Team requested to the PTC to submit further comments or clarification if any, on the Draft Final Report to the Team through the JICA representative office in Lusaka by the end of June 1993.

LUSAKA, 31st May 1993



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P. NG'OMA  
MANAGING DIRECTOR  
POSTS AND TELECOMMUNICATIONS  
CORPORATION LIMITED



---

F. AIHARA  
TEAM LEADER  
JICA STUDY TEAM



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M. C. SOKO  
DIRECTOR OF ECONOMIC AND TECHNOLOGY,  
PLANNING AND DEVELOPMENT COOPERATION,  
OFFICE OF THE PRESIDENT

Attachment 1

- 1) It was observed that two cases for the supply plan were considered for both the urban and rural areas. The supply volume is 13% for the rural area in both cases, and 100% and 76% for Case 1 and Case 2, respectively, for the urban area. For the Long Term, Case 2 was found most appropriate with a total investment of US dollar 565.2 million as compared to US dollar 710 million for Case 1.
- 2) Though the statistics show that there is still demand for telex service in Zambia, it is envisaged that the actual growth of the service won't be significant. Consequently, it has been proposed that the Kitwe Telex exchange be expanded to meet the growth and phase the Lusaka Telex exchange at the end of its useful life time expectancy.
- 3) Urgent Program comprising of enhancement of external plant to accommodate more subscribers, improvement of revenue collection and improvement on repair and replacement utility vehicles. It was strongly recommended that this program will be implemented with immediate effect.
- 4) The PTC has already introduced area task forces and with the re-introduction of telephone disconnections for defaulting customers, the revenue collection rate has improved tremendously from 27.8 % to about 60.0 % of the total billing.
- 5) The introduction of facilities will be expected to be covered mainly by foreign grants in the first ten years and has been estimated at US dollar 200 million. This decision is based on the forecasted financial conditions of the PTC which would result in a burden of repayment of large sums of money if treated as a foreign loan. It is understood that grants should not be treated as loans to the PTC by the Government.
- 6) On the proposed organization chart, it was decided to annex Sales department to Operations and Maintenance.
- 7) The Engineering Workshop and Electronic Repair Center in the existing sections of the PTC organization have been recommended to be privatized immediately in the Report however, the sentence "to be privatized immediately" should read "to be run on a commercial basis in future".
- 8) The Long Term Plan should be used as a guideline. The PTC will be required to prepare a Short Term Plan which should be reviewed periodically like in the case of the Main Frame Computer which should be implemented earlier than proposed.

- 9) The PTC requested that the determination of the tariffing policy be done by an independent commission based on the "Tariffing Principles for Telecommunications Organizations in the Non-Competitive Sector" which is recommended by the International Chamber of Commerce other than being done by the Government as proposed in the Draft Final Report.
- 10) In the determination of the financial projections for the PTC in the Long Term Plan, a number of assumptions were made. Prominent among the assumption is that there will be no further inflation due to the difficulty in determining inflationary trends in Zambia; the exchange rate will remain constant as at the 1st January 1993 rate and that there will be no further exchange losses other than those that have been differed.
- 11) For the priority projects, the high FIRR value is a result of a small equity portion of about 5% in the total investment costs. Any changes in the proportion of equity in total investment costs would affect the FIRR considerably, and thus it is essential that the PTC must take care of a small equity portion.
- 12) Basic financing assumptions are applied for financial projection of Long Term Development Plans.  
  
Loan scheme: Equity covers 30% of project cost long term loan covers 70% of project cost.  
  
Grant scheme: Equity covers 5 % of project costs foreign loan covers 95 % of project cost.  
  
Changing of these equity portions in total investment costs would act on the cash flow statement considerably, and thus it is necessary to take care of the equity portion by the PTC.
- 13) The relevant laws and regulations in view of the liberalization of the telecommunications sector should be done by an independent body.

List of Participants

PTC

1. P. Ng'oma - Managing Director
2. A. Kumar - Acting Director of Telecommunications
3. C. Mugasa - Financial Director
4. B. Oriaku - Deputy Director of Telecomms (O & M)
5. R. Siame - Acting Deputy Director of Telecomms (Planning & Development)
6. W. Tembo - Principal Staff Training College
7. M. Katapa - Chief Engineer - Switching
8. M. Kabwela - Assistant Director - Technical Services
9. J. Haabeka - Acting Chief Engineer - R and T
10. M. Ketani - Chief Engineer - External Plant
11. J. Mufuzi - Acting Assistant Director/Technical Services
12. K. Siachinji - Acting Earth Station Manager

JICA Advisory Committee

1. S. Takashima - Chairman/Ministry of Posts and Telecommunications
2. Y. Suzuki - Member
3. Y. Nishimura - JICA Staff

JICA Study Team

1. F. Aihara - Team Leader
2. M. Oikawa - Member
3. H. Ishizuka - Member
4. T. Kuroda - Member



**ANNEX 2**

**LIST OF DATA COLLECTED**

## SOCIO ECONOMIC

NO	TITLE	PUBLISHED BY	ISSUED DATE	ORIGINAL / COPY	PAGES
1	POSTS AND TELEGRAPHS CHAPTER 795 OF THE LAWS OF ZAMBIA	THE GOVERNMENT PRINTER, LUSAKA		ORIGINAL	227
2	NEW ECONOMY RECOVERY PROGRAMME FOURTH NATIONAL DEVELOPMENT PLAN 1989-1993 VOLUMES I AND II	NATIONAL COMMISSION FOR DEVELOPMENT PLAN	JAN 1989	ORIGINAL	786
3	REVIEW OF THE REGIONAL PROGRAMME OF PROJECTS AGENDA ITEM 6.1	--	--	ORIGINAL	222
4	DEVELOPMENT PLAN	--	--	COPY	--
5	MINISTRY OF DECENTRALISATION, EASTERN PROVINCE FOURTH NATIONAL DEVELOPMENT PLAN FOR EASTERN PROVINCE (1987-1991)	DITTO	OCT 1986	ORIGINAL	132
6	INFORMATION FOR NEWCOMERS TRAFFIC STATISTICS REPORT (SEPT 1987)	THE AMERICAN WOMEN'S CLUB	1989	ORIGINAL	81
7	ENERGY STATISTICS BULLETIN 1974-1990	DEPT. OF ENERGY MINISTRY OF ENERGY AND WATER DEVELOP.	JAN 1992	ORIGINAL ORIGINAL	46
8	LABOUR FORCE SURVEY 1986	THE GOVERNMENT PRINTER, LUSAKA	1989	ORIGINAL ORIGINAL	119
9	COUNTRY PROFILE ZAMBIA 1985	DITTO	SEPT 1986	ORIGINAL	85
10	DITTO (1988/1990)	DITTO	DEC 1990	ORIGINAL	76
11	NATIONAL ACCOUNTS AND INPUT-OUTPUT TABLES 1988	DITTO	AUG 1984	ORIGINAL	91
12	AGRICULTURAL AND PASTORAL PRODUCTION (NON-COMMERCIAL SECTOR) 1982-83 TO 1984-85	DITTO	NOV 1989	ORIGINAL	97
13	DITTO 1985-86	DITTO	NOV 1989	ORIGINAL	95
14	AGRICULTURAL AND PASTORAL PRODUCTION (COMMERCIAL FARMS) 1984-85 HIRED WORKERS ON COMMERCIAL FARMS	DITTO	SEPT 1989	ORIGINAL	55
15	AGRICULTURAL AND PASTORAL PRODUCTION (COMMERCIAL FARMS) 1985-86 1985-86 VALUE OF SALES VS EXPENSES	DITTO	SEPT 1989	ORIGINAL	60
16	AGRICULTURAL AND PASTORAL PRODUCTION (COMMERCIAL FARMS) 1986-87 COMMERCIAL FARM LOANS	DITTO	AUG 1990	ORIGINAL	107
17	THE INVESTMENT ACT, 1991	DITTO	1991	ORIGINAL	21
18	INVESTMENT OPPORTUNITIES IN THE MINING SECTOR	DITTO	MAY 1992	ORIGINAL	12
19	CONSUMER PRICE STATISTICS VOL. 31	DITTO	JUNE 1990	ORIGINAL	13
20	MIGRATION STATISTICS (IMMIGRANTS AND VISITORS)	DITTO	1989	ORIGINAL	32
21	1990 CENSUS OF POPULATION, HOUSING AND AGRICULTURE	DITTO	DEC 1990	ORIGINAL	17
22	INDEX OF INDUSTRIAL PRODUCTION PROVISIONAL FIGURES FOR THE SECOND QUARTER OF 1991	DITTO	NOV 1991	COPY	4
23	DITTO PROVISIONAL FIGURES FOR THE THIRD QUARTER OF 1991	DITTO	JAN 1992	COPY	4
24	QUARTERLY EMPLOYMENT AND EARNINGS SURVEY	DITTO	AUG 1992	COPY	6
25	SELECTED SOCIO-ECONOMIC INDICATORS 1992	DITTO	--	ORIGINAL	32
26	FINANCIAL STATISTICS OF THE CENTRAL GOVERNMENT 1983-1988	DITTO	--	ORIGINAL	17
27	SURVEY OF RENTS LUSAKA-NDOLA	DITTO	APR 1992	COPY	11
28	HEALTH FACILITIES IN ZAMBIA 1992	HEALTH INFO. UNIT	JUNE 1992	ORIGINAL	24

## TELECOMMUNICATIONS

NO	TITLE	PUBLISHED BY	ISSUED DATE	ORIGINAL/COPY	PAGES
1	A STATISTICAL PROGRESS REVIEW ON SERVICES, A REVENUE AND EXPENDITURE FOR THE PERIOD 1981/82 - 1988/89	POSTS AND TELECOMMUNICATIONS CORPORATION LTD.	--	ORIGINAL	65
2	BI-ANNUAL TELEPHONE AND TELEX EXCHANGES STATISTICS REPORT (JUNE 1984)	DITTO	--	ORIGINAL	15
3	DITTO (JUNE 1985)	DITTO	--	ORIGINAL	15
4	DITTO (JUNE 1986)	DITTO	--	ORIGINAL	20
5	DITTO (MAR 1988)	DITTO	--	ORIGINAL	20
6	BI-ANNUAL TELEPHONE, TELEX EXCHANGES AND INT'L OUTGOING/INCOMING TELEPHONE, TELEX AND TELEGRAPH TRAFFIC STATISTICS REPORT (SEPT 1987)	DITTO	--	ORIGINAL	51
7	BI-ANNUAL TELEPHONE AND TELEX EXCHANGES UTILISATION STATISTICS REPORT (SEPT 1988)	DITTO	--	ORIGINAL	32
8	DITTO (SEPT 1989)	DITTO	--	ORIGINAL	46
9	DITTO (MAR 1990)	DITTO	--	ORIGINAL	46
10	DITTO (SEPT 1990)	DITTO	--	ORIGINAL	51
11	DITTO (MAR 1991)	DITTO	--	ORIGINAL	57
12	DITTO (SEPT 1991)	DITTO	--	ORIGINAL	78
13	DITTO (MAR 1992)	DITTO	--	ORIGINAL	64
14	ANNUAL TRAFFIC STATISTICS REPORT FOR THE YEAR 1988/89	DITTO	--	ORIGINAL	29
15	DITTO FOR THE YEAR 1989/90	DITTO	--	ORIGINAL	33
16	"NATIONAL RECONSTRUCTION THROUGH EFFECTIVE MANAGEMENT, ENHANCED PRODUCTIVITY AND ACCOUNTABILITY"	DITTO	--	ORIGINAL	50
17	GENEY PTC 247 MICROWAVE RADIO RELAY PROJECT (LUAPULA-NORTHERN AND EASTERN PROVINCES) SECTION 1 (MARCB 1984)	DITTO	--	ORIGINAL	223
18	CONTRACT PCT 247 MICROWAVE RADIO RELAY PROJECT CONTRACT AMENDMENT NUMBER 1	DITTO	--	ORIGINAL	61
19	1992 ZAMBIA TELEPHONE DIRECTORY	DITTO	--	ORIGINAL	513
20	PROSPECTUS STAFF TRAINING COLLEGE	DITTO	--	ORIGINAL	116

Maps and Others

NO	TITLE	PUBLISHED BY	ISSUED DATE	SCALE	REMARKS
1	CITY OF NOOLA STREET PLAN	THE SURVEYOR-GENERAL	1905	1:15,000	ZS 5P
2	DITTO	DITTO		1:25,000	
3	DITTO	DITTO	1930	1:20,000	
4	MPIKA	DITTO	1989	1:250,000	SC-36-13
5	LWINGU	DITTO	1988	1:250,000	SC-35-12
6	MBALA	DITTO	1988	1:250,000	SC-36-1
7	TUNDUNA	DITTO	1989	1:250,000	SC-36-6
8	KASAMA	DITTO	1989	1:250,000	SC-36-9
9	NPOROKOSO	DITTO	1988	1:250,000	SC-36-5
10	CHINSALI	DITTO	1975	1:250,000	SC-36-10
11	MAP OF GREATER LUSAKA	DITTO	1986	1:50,000	
12	REPUBLIC OF ZAMBIA TOURIST MAP	DITTO	1989	1:1,500,000	
13	REPUBLIC OF ZAMBIA	DITTO	1986	1:15,000	
14	REPUBLIC OF ZAMBIA CIVIL AVIATION CHART	DITTO	1988	1:1,500,000	
15	REPUBLIC OF ZAMBIA TRANSVERSE MERCATOR PROJECTION	DITTO	1988	1:1,250,000	
16	REPUBLIC OF ZAMBIA AIR SERVICES AND AERODRONES	DITTO	1987	1:3,000,000	
17	REPUBLIC OF ZAMBIA RAINFALL	DITTO	1987	1:3,000,000	
18	REPUBLIC OF ZAMBIA FISHERIES MAP	DITTO	1990	1:3,000,000	
19	REPUBLIC OF ZAMBIA TEMPERATURE	DITTO	1987	1:3,000,000	
20	REPUBLIC OF ZAMBIA ZAMBIA ELECTRICITY GENERATION AND TRANSMISSION	DITTO	1986	1:3,000,000	
21	REPUBLIC OF ZAMBIA PROVINCES AND DISTRICTS	DITTO	1986	1:3,000,000	
22	MAP CATALOGUE	DITTO	1989		
23	GENTEX AND RADIO STATIONS	PTC	1988		2D-385
24	EXISTING NATIONAL SWITCHING AND TRUNK NETWORK	PTC	1991		SD-448

- \* THE SURVEYOR-GENERAL MINISTRY OF LANDS AND NATURAL RESOURCES
- \* POSTS AND TELECOMMUNICATIONS CORPORATION LIMITED