

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
ETHIOPIAN TELECOMMUNICATIONS CORPORATION (ETC)**

**THE STUDY
ON
TELECOMMUNICATIONS DEVELOPMENT PLAN
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA**

Volume I (Part 2)

Summary of Feasibility Study

FINAL REPORT

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**PANTEL INTERNATIONAL CO., LTD.
YACHIYO ENGINEERING CO., LTD**

Final Report

The Study on Telecommunications Development Plan
in the Federal Democratic Republic of Ethiopia

VOLUME I (Part 2) SUMMARY OF FEASIBILITY STUDY

Table of Contents

CHAPTER 1	SELECTION OF TARGET AREAS.....	2-1
CHAPTER 2	PROJECTS FOR FEASIBILITY STUDY.....	2-2
CHAPTER 3	CURRENT STATUS OF TELECOMMUNICATION SERVICES IN F/S AREAS.....	2-4
CHAPTER 4	POLICY OF TELECOMMUNICATION DEVELOPMENT PLAN FOR F/S PROJECTS.....	2-5
CHAPTER 5	TELECOMMUNICATION NETWORK DEVELOPMENT PLAN.....	2-7
CHAPTER 6	PROJECT IMPLEMENTATION AND OPERATION/MAINTENANCE.....	2-10
6.1	Project Implementation	2-10
6.2	Operation and Maintenance	2-10
CHAPTER 7	ESTIMATED PROJECT COST.....	2-12
CHAPTER 8	PROJECT EVALUATION.....	2-14
8.1	Financial Analysis	2-14
8.2	Technical Evaluation.....	2-17
CHAPTER 9	RECOMMENDATIONS.....	2-19

CHAPTER 1 SELECTION OF TARGET AREAS

Target Areas for the Feasibility Study (F/S) are selected taking into account of the National Development Plan, and Public Investment Programs. The target projects are selected out of the 46 projects and 8 projects nominated by JICA Study Team, listed in the table of high priority projects agreed with Ethiopian Telecommunications Corporation (ETC), applying the criteria given in the Master Plan (Refer to Supporting Document 13.1).

CHAPTER 2 PROJECT FOR FEASIBILITY STUDY

After discussion by ETC and JICA Study Team, the following three projects have been agreed for the Feasibility Study. Outlines of the F/S projects are shown in Figure-1 and the locations of the areas are given in Figure-2.

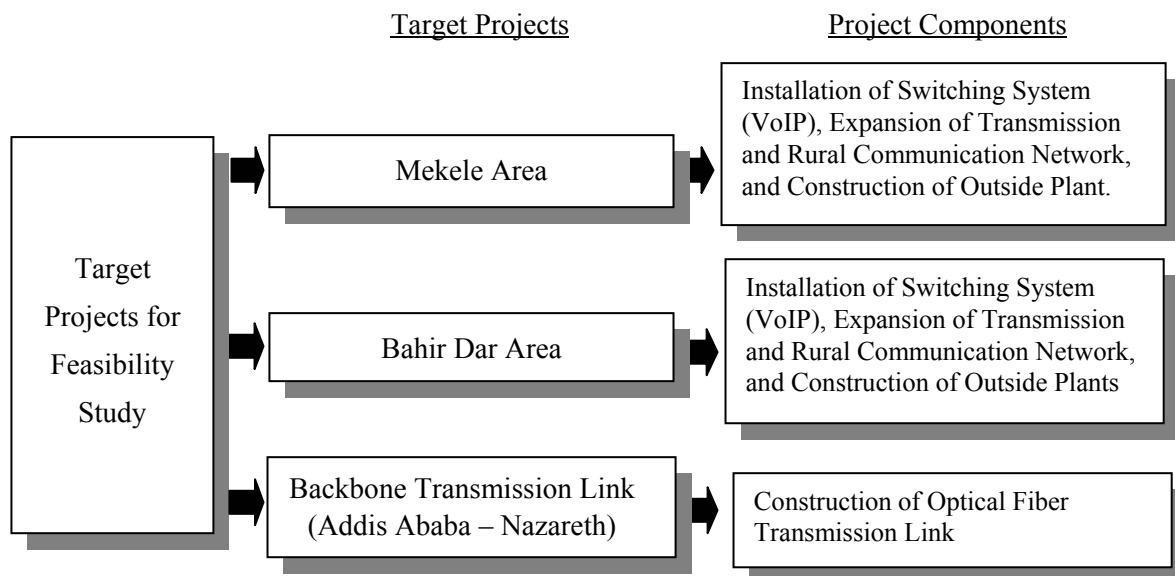


Figure-1 Projects for the Feasibility Study

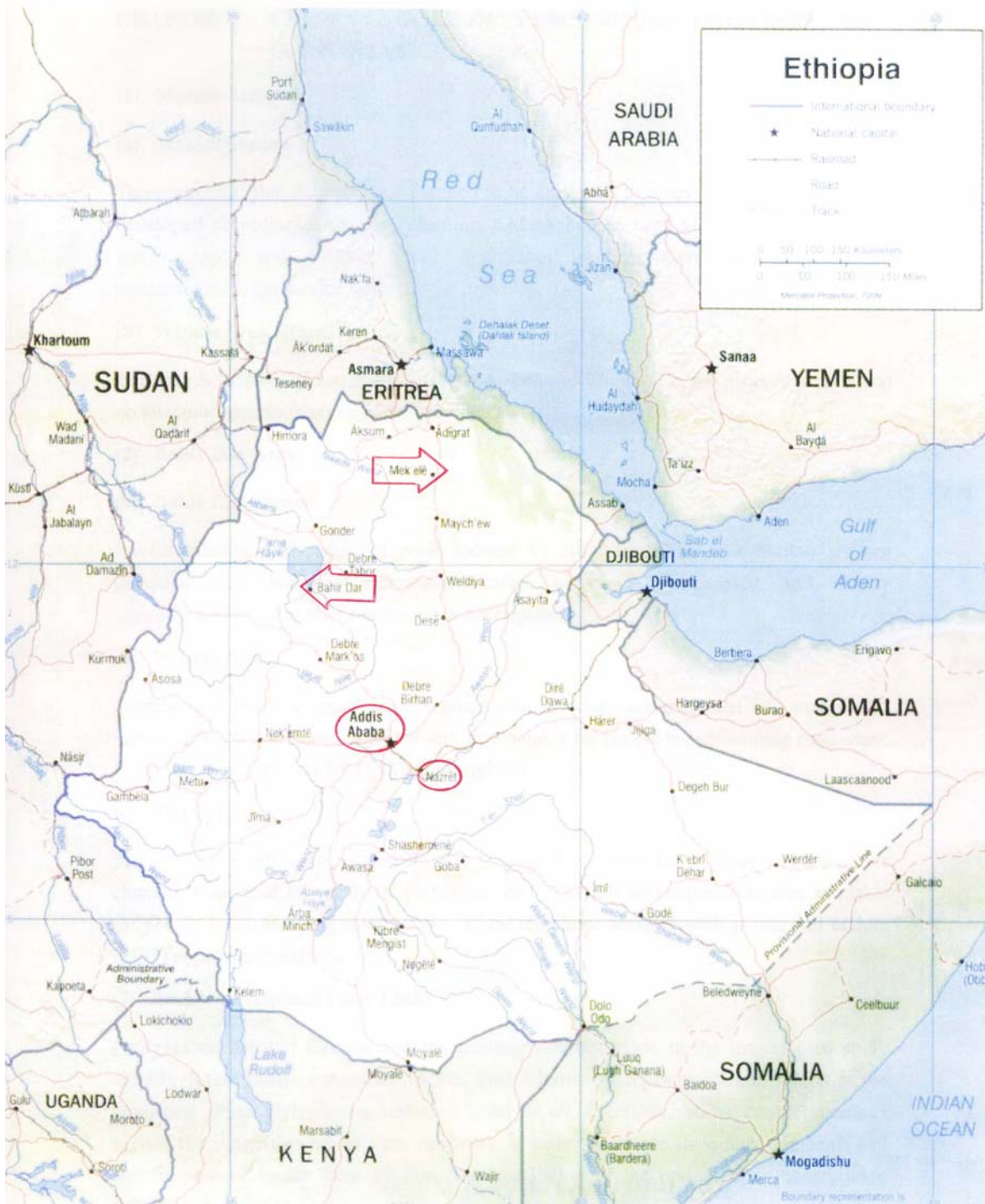


Figure-2 The Locations of the Areas

CHAPTER 3 CURRENT STATUS OF TELECOMMUNICATION SERVICES IN F/S AREAS

(1) Mekele Area

(a) Mekele Station

Telecommunication networks are planned to be expanded to a new residential area being developed according to the city planning. Many houses have already been constructed and water supply and electric power distribution services have been available, while no telecommunication service is provided.

(b) Wukro Area (Rural Areas)

The area is located 40 Km north to Mekele Station. The digital switch of 500 lines (RAX) is in service with 190 subscribers in the city core of Wukro, but is to be replaced due to the malfunctions. The surrounding area is a typical rural area and no telecommunication service is provided so far.

(2) Bahir Dar Area

(a) Bahir Dar Station

New residential and industrial areas located far from the Bahir Dar Station are not provided with sufficient telecommunication services. Expansion and quality improvement of the services in the areas are required.

(b) Woreta Area

Woreta is a small city and telecommunication services are provided by the manual board (3 DRCS lines) for around 100 subscribers. There is no telephone service available for people in the surrounding rural areas. Rural telephone services by PCO are strongly expected.

(c) Merawi Area

Merawi is a small town located 35 Km southwest to Bahir Dar. Only one telephone channel is operating for public telephone service. There is no telephone service available for people in the surrounding rural areas. Rural telephone services with public call offices (PCO) are strongly expected.

(3) Backbone (Optical Fiber Link)

Analyses on demand forecast and the existing network made in the master plan study identify future traffic congestion at Mt. Furi microwave repeater station, which is the branching point of trunk transmission links to all directions. The countermeasure against the congestion is of keen necessity. In order to release the south, southeast and east microwave routes from Mt.Furi, the installation of the optical fiber transmission systems is proposed.

CHAPTER 4 POLICY OF TELECOMMUNICATION DEVELOPMENT PLAN FOR F/S PROJECTS

Following policies are formulated to be applied for F/S projects in order to contribute to social and economic development of the target areas as well as to decrease the disparity of telecommunication services between urban and rural areas.

(1) Mekele Area

(a) Mekele Station

Elimination of areas of no telecommunications in the area (Adi - Sumduhum new residential area) of Mekele Station.

(b) Urban Area of Wukro

The replacement of the malfunctioning RAX switch is to be made providing the new VoIP facilities.

(c) Woreda Village Area of Wukro

Elimination of areas of no access to telephone services by providing PCOs, considering population distribution, socio-economic activities and potentials for development.

(2) Bahir Dar Area

(a) Bahir Dar Station

Expansion and improvement of telecommunication services to areas of insufficient services—airport area, new residential and industrial areas located east to the Blue Nile River.

(b) Urban Areas of Woreta and Merawi

Introduction of VoIP to eliminate waiting lists and to facilitate easy access to Internet and data communication services.

(c) Rural Areas Surrounding Woreta and Merawi

Elimination of areas of no access to telephone services by providing PCOs, considering population distribution, socio-economic activities and potentials for development. A total of 27 candidates (14 in Woreta and 13 in Merawi) were selected as for PCO sites. Besides F/S on the main plan with 27 PCO candidates, F/S was carried out for the optional plan with 14 PCOs in total (7 each in Woreta and Merawi).

(3) Backbone (Optical Fiber Link)

The following two countermeasures will be taken to ease the traffic congestion at Mt. Furi microwave repeater station which connects the Eastern, South-Eastern and Southern regions with the capital city (Addis Ababa).

- a) Construction of new transmission links to bypass Mt. Furi microwave repeater station for diversifying the present traffic concentration at Mt. Furi and Adama West stations.
- b) Application of optical fiber to allow large-capacity transmission links and to assure route diversity from the capital city (Addis Ababa) to the eastern, the southeastern and the southern regions.

CHAPTER 5 TELECOMMUNICATION NETWORK DEVELOPMENT PLAN

(1) Mekele Area

(a) Mekele Station

Station	Facility/Works	Unit	Quantity
Mekele Station	Switching (VoIP) Facilities		
	Gateway (30 ports) (Trunk)	set	67 + 1
	Router	set	6 + 1
	Switching Hub	set	6
	Monitor	set	1
	Outside Plant		
	Manhole	each	20
	Duct	Km	3.9
	Optical Fiber Installation (duct)	Km	4.3
	Pole	piece	467
	Cable Installation (duct)	Km	0.8
	Cable Installation (aerial)	Km	19.3

(b) Wukro Area

Station	Facility/Works	Unit	Quantity
Wukro Exchange	Switching (VoIP) Facilities		
	Gateway (30 ports)	set	17
	Router	set	1
	Switching Hub	set	1
	Transmission/Radio Facilities		
	4M b/s Radio	section	1
Wukro PCO	Transmission/Radio Facilities		
	Base St. (PCO)	set	1
	PCO Terminal	set	7
	4M b/s Radio	section	1

(2) Bahir Dar Area

(a) Bahir Dar Station

Station	Facility/Works	Unit	Quantity
Bahir Dar Station	Switching (VoIP) Facilities		
	Gateway (30 ports) (Trunk)	set	20 + 1
	Router	set	3 + 1
	Switching Hub	set	3
	Monitor	set	1
	Outside Plant		
	Manhole	set	6
	Duct (Steel pipe)	m	410
	Optical Fiber Installation (in-duct)	Km	12.1
	Pole	piece	112
	Cable Installation (aerial)	Km	4.5

(b) Woreta Area

Station	Facility/Works	Unit	Quantity
Woreta Area	Switching (VoIP) Facilities		
	Gateway	set	28
	Router	set	1
	Switching Hub	set	2
	Transmission/Radio Facilities		
	Base St. (PCO)	set	1
	PCO Terminal	set	14 (7)
	Repeater	set	2
	Cable Facilities		
	4M b/s O/F System	section	2
	Metallic Cable	section	2

(c) Merawi Area

Station	Facility/Works	Unit	Quantity
Merawi Area	Switching (VoIP) Facilities		
	Gateway	set	26
	Router	set	1
	Switching Hub	set	2
	Transmission/Radio Facilities		
	Base St. (PCO)	set	1
	PCO Terminal	set	13 (7)
	Repeater	set	1
	Cable Facilities		
	Metallic Cable	section	1

Note: Figures in parenthesis denote the PCO numbers taken in the optional plan for Woreta and Merawi rural telecom network.

(d) Addis Ababa VoIP Center

Station	Facility/Works	Unit	Quantity
Addis Ababa VoIP Center	Main Router	Set	1
	Soft Switch	Set	1
	Servers	Set	1

(3) Backbone (Optical Fiber Link)

Station	Facility/Works	Unit	Quantity
Backbone	Transmission Facilities		
	Rack	unit	4
	STM-16 Interface	unit	4
	ADD/Drop Junction Interface	unit	4
	Cross Connect	unit	2
	Network Management System	unit	1
	DDF	unit	6
	Installation Drawing, O&M Manual	set	1
	Spare	set	1
	Measuring Instruments	set	1
	Material	set	1
	Outside Plant		
	Manhole	set	70
	Duct	Km	12.6
	Pole	piece	1708
	Optical Fiber Installation (duct)	Km	12.6
	Optical Fiber Installation (aerial)	Km	85.4

CHAPTER 6 PROJECT IMPLEMENTATION AND OPERATION/ MAINTENANCE

6.1 Project Implementation

Taking the corporate policy of the decentralization, the regional projects are to be managed by the regional offices. Head Quarter is to take responsibility up to the contract conclusion of the implementation contract, however. The detailed design of the regional project is to be carried out by the regional office considering the importance of the site requirement as well as the site information.

Upon the conclusion of the implementation contract, the project implementation (progress and quality) is to be managed by the Project Management Unit established under the responsibility of the regional manager.

While, H.Q. is to make the overall management of the projects implementation through the bi-monthly progress meeting aiming at the achievement of the corporate level targets of QoS, new subscriber connections, network balancing and other performance indicators.

Project Management unit is to carry out day-to-day supervision, ETC's obligatory works, solution to the site-oriented problems, acceptance test and other quality confirmation, handing over of the completed systems to O/M divisions and making the semi-monthly progress report to H.Q.

(1) Mekele and Bahir Dar Project

Project management units are to be organized under the responsibility of the regional manager.

(2) Optical Fiber Backbone Trunk Transmission Project

Project management unit is to be organized under the responsibility of Telecommunications infrastructure Development Department.

6.2 Operation and Maintenance

The projects are to be composed of the new technologies of VoIP, PCOs and STM-16 over optical fiber with Cross-connect functions, which will be the main components in the future development of Ethiopian telecommunications network.

In this regard, O/M division is to receive the technology transfer from the contractor and the consultant throughout the project implementation.

While, the project is to provide the centralized monitoring system (or S/V system) for remote-control, and most of the new project sites are scheduled to be unattended.

Accordingly not so many O/M staff will be required, but the site patrol for the preventive maintenance will become essential maintenance.

O/M for the new facilities can be established by reinforcement of the current O/M offices of Mekele, Bahir Dar and TR/ITE.

The recommendable additional maintenance staffs are as follows;

	Mekele	Bahir Dar	TR/ITE
Engineer	2	4	2
Technician	4	9	4
Vehicles	2	4	2
PCO Operator	7	14	-

Note: PCO operators may be out-sourcing.

CHAPTER 7 ESTIMATED PROJECT COST

(1) Mekele Area

Expenditure of Donor Country (Unit: 1,000US\$)

	S.W.	Radio	O.S.P.	Total
1. Construction Cost	923	1,116	1,196	3,235
2. Others	-	-	-	614
Total	-	-	-	3,849

Expenditure of ETC (Unit: 1,000US\$)

	S.W.	Radio	O.S.P.	Total
1. New Subscriber Connection	-	-	126	126
2. Tel Sets for PCO	-	2	-	2
3. Shelter	-	24	-	24
4. Road Reinstatement	-	-	54	54
Total	-	26	180	206

(2) Bahir Dar Area

Expenditure of Donor Country (Unit: 1,000US\$)

		S.W.	Radio	O.S.P.	Total
1. Construction Cost	(Main)	1,554	2,232	1,151	4,937
	(Option)	(1,554)	(1,755)	(1,151)	(4,460)
2. Others		-	-	-	645
Total	(Main)	-	-	-	5,582
	(Option)				(5,105)
Difference (Main-Option)					- 477

Expenditure of ETC (Unit: 1,000US\$)

		S.W.	Radio	O.S.P.	Total
1. OSP (Woreta & Merawi)		-	-	625	625
2. New Subscriber Connection		-	-	111	111
3. Road Reinstatement		-	-	170	170
4. Shelter for PCO	(Main)	-	103	-	103
	(Option)		(59)		(59)
5. Tel Sets for PCO	(Main)	-	8	-	8
	(Option)		(4)		(4)
6. Commercial Power for B. Sta.		-	12	-	12
Total	(Main)	-	123	906	1,029
	(Option)		(75)	(906)	(981)
Difference (Main-Option)					- 48

Note: Cost of VoIP Center facilities in Addis Ababa is included in the “Expenditure of Donor Country” for Bahir Dar area. In case Mekele area project is implemented earlier than the Bahir Dar area, the cost of VoIP Center facilities is to be added to the expenditure of Mekele, i.e., 771,000US\$.

Figures in parentheses denote cost for the case of Optional Plan with 14 PCOs.

(3) Backbone (Optical Fiber Link)

Expenditure of Donor Country (Unit: 1,000US\$)

	Transmission	OSP	Total
1. Construction Cost	662	1,846	2,508
2. Others	-	-	457
Total	-	-	2,965

Expenditure of ETC (Unit: 1,000US\$)

	Transmission	OSP	Total
1. Road Reinstatement	-	238	238
Total	-	238	238

CHAPTER 8 PROJECT EVALUATION

8.1 Financial Analysis

(1) Mekele Area

One of the main issues of the master plan of telecommunication sector is addressed on rural development. Development of telecommunications networks has made little progress in rural areas inhabited by approximately 85% of the country's population. Immediate actions are expected to improve the current situation, especially of the rural areas. This project aims at the rural development as one of its objectives and includes the installation of PCOs as the strategic measure to achieve "Tele-access".

The population benefiting from seven PCOs would rise to 50,155, and this would improve the tele-access in the covered area to 60%. Incidentally, the tele-access for the whole of Ethiopia is less than 10%. Tele-access improvement is advocated as one of the project goals, but the project does not guarantee profitability.

The case in which long-term loans are used is calculated first. But large losses are predicted, and it was confirmed that this would not form a calculation base. The results are the same even when the interest rate is set to 0%. In other words, the original capital could not be returned though the budget required for operation could be covered.

It must be concluded that setting up this project as a base for long-term loans is difficult.

The case is then calculated in which foreign grant aid is used to resolve the problem of profitability facing this project. The result of the financial evaluation indicates high profitability with an FIRR of 23.40%. It is confirmed that a little profit will be achievable through the operation if the preparatory work required for project implementation is set as the self-financing portion and 91.74% of the necessary funds are obtained through foreign grant aid.

The results of the above assumption show that the financial position is positive over the entire period, and no financial shortage will arise.

The results show that if at least the initial investment can be covered by foreign aid, operation is somehow possible. However, it must be remembered that the self-financing ratio covering the investment costs in the FIRR figures above is only 8.26%, and only the operating costs can be covered by the predicted revenue. Fund procurement using long-term loans is definitely not advisable. It is clear that the project would simply leave a negative impact on the main ETC operations. Cross subsidies will therefore be applied from the high-profit mobile-phone business and urban projects in Addis Ababa.

In the present development stage of the Ethiopian telecommunications sector, eliminating cross subsidies is one feat that is not possible.

(2) Bahir Dar Area

The Ethiopian government is currently making progress with rural development, and Bahir Dar, Mekele, Nazareth, Awassa, and Dire Dawa are currently being focused on as development bases. Bahir Dar is a regional city with high development potential as a popular sightseeing location.

This project proposes installing PCOs (public call offices) as a strategic measure for improving “Tele-access”.

A total of 27 candidates were selected as PCO sites, i.e., 14 in Woreta and 13 in Merawi. Financial analysis was carried out for the plan with 27 PCOs and also for an optional plan with 14 PCOs, which is about half of candidates selected.

The population benefiting from the creation of 27 PCOs will reach to 224,000, improving tele-access to 60% in the area covered. While in case of 14 PCOs, distance to PCO becomes longer compared with 27 PCOs case for some of the communities located in a distant PCO coverage area; however, it is still within a walking distance range described in the M/P (5-10km). Therefore, the estimated tele-access and beneficiaries will remain unchanged. By reducing the number of PCOs to 14, project cost can be reduced by about 525,000 thousand US\$, and the optional plan is in line with the scenarios of the M/P, i.e., to construct 5,000 PCOs by 2020 and to increase tele-access to 87% over the country.

The tele-access for the whole of Ethiopia is less than 10%.

However, PCO projects have no profitability. Though “Tele-access” would be improved, the evaluation results confirm that implementing these will be difficult with financing schemes using normal loans.

These results demonstrate typical evaluation results for the Rural Development Project. They indicate that operating costs only can somehow be covered by the revenue from the project alone, assuming that foreign grant aid is used for initial investment.

It must however be remembered here that a FIRR value, 8.88% (9.17%) is calculated, since the percentage of self-financing is low at 17.09% (17.75%). The figures in parenthesis above denote for the optional plan cases. As shown in the sensitivity analysis, the FIRR value fluctuates greatly if the percentage of self-financing increases.

Viewing the evaluation results in mind, it can be evaluated that the operating costs can somehow be covered by the revenue from the project, and that implementing this project will contribute to the development of the Ethiopian telecommunications sector. Expected cash flows were then performed using Foreign Grant Aid to overcome the problems of profitability surrounding this project. The results show that if at least the initial investment can be covered by Foreign Grant Aid, operation is somehow possible.

The use of funds raised through long-term loans (or subsidiary loan of the foreign aid) is not suited to this project. The project will have a negative impact on the operations of the ETC organization, requiring large cross subsidies from the high-profitability mobile-phone and Addis Ababa projects.

(3) Backbone (Optical Fiber Link)

This project is an expansion project for the most important (Addis Ababa to Nazareth) section of the Ethiopian backbone transmission system. The Master Plan includes plans for a rapid increase in the number of subscribers over the 5 years from 2003/04 to 2007/08, but the existing network can not provide capacity capable of handling the increased traffic arising from new subscribers. Continuing to operate depending on the current capacity will result in lower call completion rates. There is therefore an immediate need for expansion of the transmission systems corresponding to the core transmission infrastructure.

The result of the financial evaluation indicates high profitability with an FIRR of 33.85%. Looking at the balance of payments situation, the financial position is positive over the entire period, and there is no need to inject supplementary funds to cover fund deficits.

The importance of this project within the Master Plan is confirmed based on the results above. As mentioned in Chapter 8 (Sector Business Strategy) of the Master Plan, ETC operation is not possible without cross subsidies if the rollout target is to be achieved. The implementation of cross subsidies therefore requires the implementation of a high-profit project. This project is anticipated to form one of the projects supporting cross subsidies. The evaluation results indicate sufficient profitability when viewed for the project alone, and show sufficient repayment ability even if high-interest long-term loans are used. However, the role demanded on this project is to “create as much surplus as possible to support low-profitability projects”. In order to achieve this, it is therefore desirable to utilize low-interest ODA loans (soft loans) or foreign grant aid.

The future role of ETC in the Ethiopian communications sector is described in the Master Plan as shown below.

“At the present development stage in Ethiopia, total transfer of the communications sector to the private sector is not feasible from the standpoint of national security and the spread of a universal service. Regarding the division of roles between the government and private sector, a business model proposed that the private sector operates mobile-phone services and the ISP business, and the government provides basic communications services (fixed-phone service, international communications, maintenance and operation of national backbone, and rural development). Ultimately, ETC will carry out the functions of an asset company.”

Considering the role of this project based on this concept, it is confirmed that the project is in an important position in building the business foundation for ETC.

8.2 Technical Evaluation

(1) Rural PCO

Master plan recommends new DRCS with wide band IP solution for PCO network in rural area. Internet and mail services are now widely deployed through the world, in which higher speeds of transmission is required. Worldwide tendency will certainly be to rush at developing higher speed of transmission like a Gb/s and Tb/s basis. The higher the speed in transmission, the better service would be, but the investment would be limited. It is, therefore, recommended constructing a practical and feasible network infrastructure to meet the regional social needs. The new telecommunication network to be constructed must comply with the requirement of IP system, which will be applied for all telecommunication networks in future.

ETC's intention is to expand transmission lines with wide band and high-speed solutions for multimedia applications for socio-economic infrastructure of rural areas, such as remote education, remote medicine, remote medical service etc. As shown in the table below,

- 1) wide band solution is given only by the DRCS proposed,
- 2) the DRCS complies with the future IP network requirement and
- 3) installation cost and annual operation and maintenance cost will be cheaper than that of VSAT

The terrestrial transmission system will be better solution taking a long-range view.

Item	Proposed DRCS (Wide Band IP)
Network	Wide Band IP Data Speed: 64 kb/s~256 kb/s
Telephone	VoIP (Voice over IP) Variable Voice Coding: 5.6k / 8k / 64 kb/s
Internet (E-mail, web etc.)	Wide Band IP Variable Data Speed: up to 256 kb/s
Comments	<ol style="list-style-type: none"> 1) Voice CODEC can be selected according to the services of line. (Four (4) times as many as channels can be obtained at 8 kb/s CODEC in stead of 64 kb/s.) 2) Valuable speeds of lines such as high speed data; Internet, telephones etc. are automatically assigned. 3) High speed internet is available due to being composed of IP network.

(2) Urban Areas

Introduction of FTZ will make possible to provide quality telecommunication services to the areas located far from the stations.

In the near future, switching equipment will be replaced to VoIP equipment over the world. Introduction of VoIP as pilot projects hiring a foreign consultant will contribute to training of engineers and technicians for nation-wide development of the system.

(3) Backbone (Optical Fiber Link)

The following benefits will be generated by construction of the optical fiber links.

- a) Route diversity can be secured for the links from the capital to the eastern, the southeastern and the southern regions.
- b) Enhanced backbone for reliable operation and quick recovery at times of troubles can be established by connecting to the on-going projects (Eighth 5-year Development Plan).
- c) After completion of the project, optical junction network in Addis Ababa can be promoted. Cost reduction in installation of cable ducts in some sections will become possible.
- d) The project will make possible backup to the existing and future microwave links concerned. Further, it will render possible to cope with increased traffic demands of the future in backbone.

CHAPTER 9 RECOMMENDATIONS

In order to maximize the benefit of the projects under this Feasibility Study, the efforts of ETC as well as the support of the Ethiopia Government will become essential.

Following recommendations are addressed on ETC's obligations for the successful implementation of the projects under this Feasibility Study.

(1) Recommendations on Mekele Area Project

i) PCO

- a) Wide-band communication is applied for PCOs for use of IP in the future. Effective use of the communication system for distant medi-care and distant learning can be and should be encouraged in consultation with relevant authorities and related organizations to enhance these social services.
- b) For the expansion of PCOs over the country, rural electrification has to be enhanced. Coordination with EEPSCO will be required.
- c) Since up to 15 PCOs can be connected from one base station, continuous efforts to increase the coverage or beneficiaries shall be paid.

ii) VoIP

Respecting the worldwide trend of the technology development (Information and Communication Technology – ICT), this F/S has introduced the VoIP of the current new technology. Considering the manufacturing status of the digital switching system, VoIP will take place the switching functions in the near future.

In order to pave the smooth way to introduce the new system, ETC is requested to study and prepare the following items;

- Interface conditions of VoIP with the existing switching system.
- Numbering plan of VoIP
- Technical details of Gateway keeper (Soft-switch)

iii) Outside Plant

a) Optical Fiber

Numbers of fiber cores are designed to correspond to current and future demands. When actual demands arise, ETC shall satisfy the demands by efficiently utilizing the installed fibers. In case ETC obtains additional information on future demands during detail design, the number should be reviewed.

b) New Subscriber Connection (In-house wiring)

At present, arrestors are not installed at the entrance point to customer's premises. Considering the transfer of ETC's services for installation and maintenance on customer premises equipment to the private sector, and increasing connections of computers, arrestors are to be installed to avoid current fusion from power lines and to protect from

lightning. Installation of arrestors shall be assured in accordance with construction manuals.

(2) Recommendations on Bahir Dar Area Projects

i) PCO

- a) Wide-band communication is applied for PCOs for use of IP in the future. Effective use of the communication system for distant medi-care and distant learning can be and should be encouraged in consultation with relevant authorities and related organizations to enhance these social services.
- b) For the expansion of PCOs over the country, rural electrification has to be enhanced. Coordination with EEPCO will be required.
- c) As the result of the evaluation shows, there would be no significant differences between the two, the main plan with 27 PCOs and optional plan with 14 PCOs, in the FIRR and populations benefiting from the project.

PCOs are not a form of economic infrastructure targeting specific individuals or households, but rather a component of social infrastructure highly public in nature, targeting large and unspecified sections of the population. It is important to be aware that unlike demand for fixed telephone and mobile phone services, which target "units" of either individuals or households, PCOs aim to serve the region concerned, in other words the "collective" target of all inhabitants.

Therefore, it is confirmed that it can be established PCO network without decreasing the beneficiaries by selecting the PCOs in appropriate locations.

From the perspective of the donor country, if there were no change in the population benefiting from the project, or any greater advantage, it can be justified as an appropriate plan to set up 14 PCOs as indicated in the optional plan from the standpoint of minimising cost.

Under a Master Plan that aims to cover the whole of Ethiopia with 5,000 PCOs, there is no spare capacity *allowing more PCOs than necessary to be installed in certain areas.*

- d) PCOs are planned to be installed in rural areas of Woreta and Merawi, where the situation of the PCO sites couldn't be confirmed through the site survey for F/S due to the bad road conditions in the rainy season. ETC's additional site survey for the site confirmation as well as the acceptance of the PCO installation by the site community shall be appreciated.

ii) VoIP

Respecting the worldwide trend of the technology development (Information and Communication Technology – ICT), this F/S has introduced the VoIP of the current new

technology. Considering the manufacturing status of the digital switching system, VoIP will take place the switching functions in the near future.

In order to pave the smooth way to introduce the new system, ETC is requested to study and prepare the following items;

- Interface conditions of VoIP with the existing switching system.
- Numbering plan of VoIP
- Technical details of Gateway keeper (Soft-switch)

iii) Outside Plant

a) Design of Optical Fiber

The objective service areas are located in the far area of more than 10Km from Bahir Dar exchange.

Considering the cost effectiveness as well as the high service quality, F/S applied the “Fiber to Zone” system.

Numbers of fiber cores are designed to correspond to current and future demands. When actual demands arise, ETC shall satisfy the demands by efficiently utilizing the installed fibers. In case ETC obtains additional information on future demands during detail design, the number should be reviewed.

b) New Subscriber Connection (In-house wiring)

At present, arrestors are not installed at the entrance point to customer’s premises. Considering the transfer of ETC’s services for installation and maintenance on customer premises equipment to the private sector, and increasing connections of computers, arrestors are to be installed to avoid current fusion from power lines and to protect from lightning. Installation of arrestors shall be assured in accordance with construction manuals.

(3) Backbone Transmission (Optical Fiber Link)

a) Arrangement and Expansion of Connection Interfaces to the Existing Network

In the project of the backbone, large-capacity optical links with STM-16 system are introduced. Interfaces with the existing facilities are uniformly designed at STM-1 level since interfaces of STM-16 will be too large for the connections to the existing network. As planned in the Eighth 5-year Development Plan of ETC, ETC intends to develop the backbone system by STM-1 level. It is recommendable that ETC should continue to apply the policy to all projects for backbone development.

b) Loop Configuration of Existing Transmission Network

For the integration with the existing network and to enhance the functions for reliable operation and maintenance with increasing traffic demands, loop configuration should be

considered by introduction of facilities of cross-connections to the existing links. There are many SDH microwave transmission links without cross-connection facilities. It is feared that these links may be obstacles for reliable and speedy back-up operation of the backbone network.

c) Prompt Replacement of Analogue Link (Sebesibe Washa – Shashemene)

To make full use of potential and to take full benefits of large capacity of STM-16 system, the analogue link from Sebesibe Washa routing to the southern region should promptly be replaced. By the replacement, construction of back-up transmission link to the southern region to Moyale will complete.