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No. 2

Japan International Coooperation Agency (JICA)

Ministry of Infrastructure (MOI)
Post and Telecommunication Authority (PTA)

THE MASTER PLAN STUDY
FOR
DEVELOPMENT OF RURAL TELECOMMUNICATION SYSTEM
IN
MONGOLIA

FINAL REPORT

VOLUME I

SUMMARY

FEBRUARY 2003

Japan Telecommunications Engineering and Consulting Service (JTEC)
and
Pacific Consultants International (PCI)
TOKYO, JAPAN

CURRENCY AND EQUIVALENT UNITS
(As of July, 2002)

Currency Unit	=	Mongolian Tugrik (Tg)
US$ 1.00	=	Tg 1,099.47
Tg 1,000	=	US$ 0.9095

Currency Unit	=	Japanese Yen (JPY)
JPY 1,000	=	US$ 8.361
US$ 1.00	=	JPY 119.60

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PREFACE

In response to a request from the Government of Mongolia, the Government of Japan decided to conduct a master plan study for Development of Rural Telecommunication System in Mongolia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Mongolia a study team headed by Mr. Hideo MITSUHASHI, Japan Telecommunications Engineering and Consulting Service, three times between March 2002 and February 2003. In addition, JICA set up an advisory committee headed by Mr. Junichi Shioya, Deputy Director, International Cooperation Division, Ministry of Public Management, Home Affairs, Posts and Telecommunications of Japan, which examined the Study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Mongolia, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and this final report was prepared.

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

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

February 2003

Takao Kawakami
President
Japan International Cooperation Agency

Mr. Takao Kawakami
President
Japan International Cooperation Agency

February 2003

Dear Mr. Takao Kawakami

Letter of Transmittal

It is a great pleasure for us to submit to you the Master Plan Study Report for Development of Rural Telecommunication System in Mongolia.

This report has been prepared by Japan Telecommunications Engineering and Consulting Services (JTEC) and Pacific Consultants International (PCI), based on a contract with JICA. The study team conducted the works from March 2002 to February 2003.

The study aims at formulating the master plan for the development of rural telecommunication system in Mongolia up to the year 2020 and feasibility study for priority projects which will be implemented by the year 2006 in Mongolia.

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

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

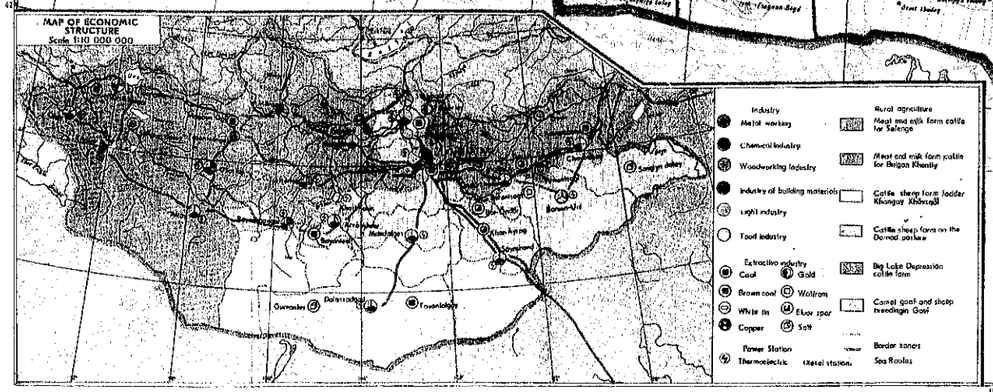
Finally, we earnestly hope that this report will contribute to future telecommunications development in Mongolia.

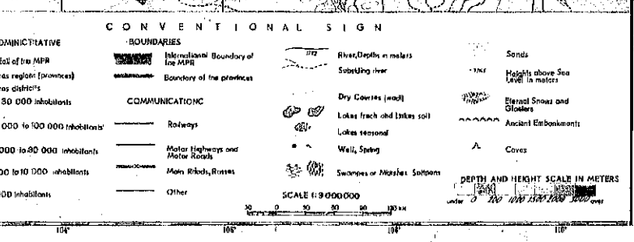
Very truly yours

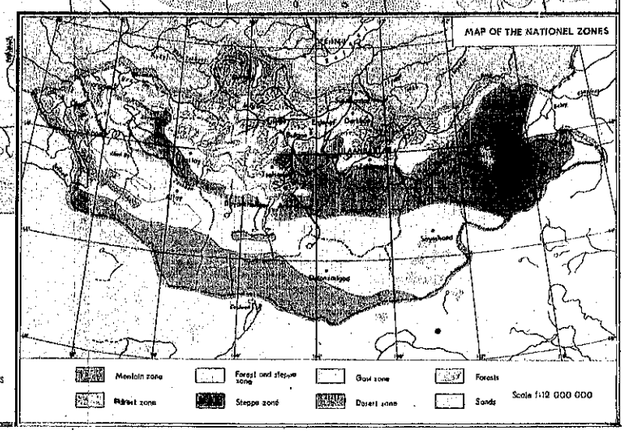
Hideo Mitsuhashi

Hideo Mitsuhashi
Team Leader
Master Plan Study for Development of
Rural Telecommunication System in Mongolia

MAP OF MONGOLIA







EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

I. Master Plan Study

1.1 General

This Report summarises the Telecommunications Master Plan for Development of Rural Telecommunication System in Mongolia up to the year 2020 and the Feasibility Study on the priority projects. The objectives of this Master Plan Study are to formulate the Master Plan up to the year 2020 for the development of the rural telecommunication system covering the whole Mongolian territory, to conduct the feasibility study on the priority projects identified urgent through the Master Plan Study, and to pursue the technology transfer to the counterparts of the Mongolian side in the course of the study. The study period is from the end of March 2002 to the middle of February 2003.

1.2 Objective Areas and Facilities of Master Plan Study

The telecommunications facilities in Mongolia consist of (i) international telecommunications facilities for the communication with foreign countries, (ii) telecommunications facilities in the national capital and local major cities (or the Aimag centres), (iii) trunk transmission facilities to connect the capital city and the major cities, (iv) telecommunications facilities in towns and villages (or the Sum centres) scattered around the local major cities, and (v) local transmission facilities to connect the towns and villages (the Sum centres) with the major city (the Aimag centre). People in Mongolia can enjoy better communication through telephone services when the above facilities function harmoniously. This Master Plan covers the areas and facilities of the above (iv) and (v) only.

1.3 Information Technology Innovation

As a result of the rapid information technology innovation in the last several years, now many people in the world have an opportunity to enjoy Internet services and to access various information all over the world from their home using the Internet. The conventional telephony using the public switched telephone network (PSTN) is in the technology transition period to the network of voice over Internet protocol (VoIP), due to the recent and rapid information technology innovation.

1.4 Main Purpose of Rural Development

One of the most important social issues in Mongolia is a gap between urban and rural areas. The Government of Mongolia recognises that rural telecommunications development is essential to meet basic human needs, such as education and medical care, in the rural areas. Expecting telecommunications facilities to contribute to meeting human basic needs and developing rural economy, the Government puts the construction of telecommunications facilities to a high priority in its development policy and asks foreign donors for aid.

1.5 Development Framework and Key Development Targets

The key development targets have been made up to 2020 trough the study as the framework of the Master Plan. Among them the demand forecasts of the telephone and IT services are as shown in Table 1.

Table 1 Demand Forecast of Telephone and IT

Index	Sub-Indexes	Area	Present Status (2001 and 2002)	Development Targets			
				Short-Term Target		Medium-TermTarget (2009-2013)	Long-Term Target (2014-2020)
				(2003-2005)	(2006-2008)		
Demand Forecast (DELs)	Fixed Telephone Service (PSTN)	Whole Country	167,587	196,637	218,424	270,212	370,489
		Whole Aimags	92,138	105,747	115,954	143,128	196,140
		Sum Centre	28,795	32,801	35,806	44,318	60,780
	Mobile Telephone Service	Whole Country	208,083	271,983	319,908	420,025	592,151
		Whole Aimags	110,367	142,189	166,056	218,035	307,364
		Sum Centre	35,525	45,372	56,064	65,985	97,687
	Total of Fixed and Mobile Telephone Services	Whole Country	375,670	468,620	538,332	690,237	962,640
		Whole Aimags	202,505	247,936	282,010	361,163	503,504
		Sum Centre	64,320	78,173	91,870	110,303	158,467
	Internet Services	Whole Country	9,000	81,087	135,137	172,590	210,042
		Whole Aimags	450	23,184	40,234	57,350	74,466
		Sum Centre	-	5,081	8,891	15,559	22,227
DELs/100 Inhabitants	Fixed Telephone Service (PSTN)	Whole Country	6.95	7.68	8.17	9.38	11.64
		Whole Aimags	5.70	6.34	6.82	7.96	9.92
	Mobile Telephone Service	Whole Country	8.62	10.62	11.97	14.59	18.61
		Whole Aimags	6.83	8.52	9.77	12.13	15.55
	Total of Fixed and Mobile Telephone Services	Whole Country	15.57	18.30	20.14	23.97	30.25
		Whole Aimags	12.53	14.86	16.60	20.09	25.47
	Internet Services	Whole Country	0.37	3.17	5.06	5.99	6.60
		Whole Aimags	0.03	1.39	2.37	3.19	3.77

This Master Plan aims to increase the telephone line density of the fixed telephone service per 100 inhabitants in the whole country from 6.95 lines now to 11.64 lines in the year 2020, and for the rural areas from 5.70 lines now to 9.92 lines in the year 2020. As for the Internet, it aims to increase the subscriber density per 100 inhabitants in the whole country from 0.37 subscribers now to 6.60 subscribers in the year 2020, and for the rural areas from 0.03 subscribers now to 3.77 subscribers in the year 2020.

1.6 Project Implementation Plan and Cost Estimate

The Sums are prioritised with four (4) ranks from "P-1" to "P-4". The Sums of "P-1" are planned to implement the project for the first stage of Phase-I, or the period from the year 2003 to the year 2005. Those of "P-2" are for the second stage of Phase-I, or the period from the year 2006 to the year 2008. Those of "P-3" for the Phase-II from the year 2009 to the year 2013, and those of "P-4" for the Phase-III from the year 2014 to the year 2020. Main scope of facilities plan and cost estimate are shown in Tables 2 and 3.

Table 2 Main Work Volume of Facilities Plan

Items		Facilities	Short-Term		Medium-Term	Long-Term	Total
			(2003-2005)	(2006-2008)	(2009-2013)	(2014-2020)	
Switchin System		Line Unit	27,460	15,020	14,580	5,040	62,100
Transmission System	Optical Fibre Cable	Length (Km)	37	26	69	74	206
		SDH Section	9	4	7	9	29
	Microwave	Terminal Sation	84	46	76	42	248
	VSAT	Earth Sation	19	12	22	2	55
Access System	Wired	Cable Pair	33,440	19,133	12,712	3,377	68,662
	Wireless	Cell Sation	30	3	4	5	42
Power Plant			-	-	-	-	-
IT Services	IT Spots	Sites	122	60	103	54	339

1.7 Analysis of Financial and Economic Aspects

As for the financial analysis of the Master Plan, there can be two basic cases (Case A: including Duty and VAT, Case B: excluding Duty and VAT) regarding its income and cash flow projections. However, in order to eliminate the burden of taxes, Case B and its sensitivity are analysed.

Financial Internal Rate of Return on Investment (FIRROI) of Case B, which indicates viability of investment, is 1.871%. FIRROI would improve up to 2.926% when a multiplier effect of the following occurs: increase in revenues (+5%), decrease in capital investment (-

10%), and decrease in operation and maintenance costs (-10%). In that case, the positive profit for a single year would be realised in the 12th year and the total amount of the required subsidies would be reduced to 4.8 million US dollars.

Table 3 Cost Estimate of Facilities Plan

(US$ 1,000)

Item		Short-Term		Medium-Term	Long-Term	Total
		(2003-2005)	(2006-2008)	(2009-2013)	(2014-2020)	
Switchin System		6,535	7,457	7,135	3,245	24,372
Transmission System	Optical Fibre Cable	1,421	787	1,547	1,492	5,247
	Microwave and VSAT	18,479	8,888	17,742	8,783	53,892
	Sub-total	19,900	9,675	19,289	10,275	59,139
Access System	Wired	9,035	5,169	3,434	913	18,551
	Wireless	3,519	567	567	567	5,220
	Sub-total	12,554	5,736	4,001	1,480	23,771
Power Plant		7,272	6,094	10,690	4,802	28,858
IT Services	IT Spots	1,245	615	1,035	540	3,435
Total		47,506	29,577	42,150	20,342	139,575

Economic Internal Rate of Return (EIRR), which is a useful tool to clarify the magnitude of economic contribution of the Master Plan, is calculated at 7.66%, by applying the " Travel Cost" method based on the field survey results.

The Master Plan, as stated in Section 1.2, targets facilities in the rural areas among all the telecommunications facilities in Mongolia. In the rural areas, small sized telecommunications facilities are deployed at many little Sum centres or settlements scattered in the vast territory requiring a massive investment, while the revenues are very small in contrast with those in the urban areas. Consequently, FIRROI and EIRR are low.

Financial and economic analyses lead to the peculiar results according to study content, scope, preconditions, etc. As the latest examples of Mongolia's telecommunications sector, a master plan study on telecommunications network in Ulaanbaatar city, made with technical cooperation by JICA in 1996, reported that FIRROI was 8.5 % and EIRR 14.9 % and a feasibility study on development of rural telecommunication services including Aimags, made with technical cooperation by ADB in 1997, reported that FIRROI was ranged from 4.2 to 5.8% for multiple scenarios. If three Aimag centres were added to the feasibility study of this Master Plan, FIRROI would increase to about 5% from 2.197% for the selected 22 Sum centres.

Telecommunications facilities will benefit people most when a variety of facilities function together. Even though FIRROI and EIRR are low for the telecommunications facilities in the rural areas, it should be appropriate to properly evaluate the integrated effect of those facilities serving as vital parts to the upgrading of nationwide telecommunications services.

1.8 Recommendations

Recommendations are made for a smooth and effective implementation of the Master Plan towards the year 2020 on institution, organization, management, human resource development, technical affairs, financing, etc. Especially, the following on the institution and rural telecommunications development policy are emphasized:

1.8.1 Universal Service Obligations Fund

The rural telecommunications network, part of the national telecommunications network, has special features such as small sized facilities deployed at many little Sum centres or settlements scattered in the vast territory requiring a massive capital investment and less revenues compared to those in the urban areas. The Universal Services Obligation Fund (USOF), which is collected from the revenues of telecommunications operators from the urban subscribers, aims to subsidise the initial investment costs, and operation and maintenance costs for the rural telecommunications services. MT has subsidised the rural operation and maintenance cost internally. The Government promulgated a regulation on USOF in September 2002 in order to involve the other mobile telephone operators, in addition to the amendment of the Telecommunications Act in 2001. It is an urgent task for the Government to modify the shortcomings of the present laws and regulations.

1.8.2 Digitisation of Trunk Transmission System

Among the trunk transmission systems that connect the telecommunications facilities in the capital city and the rural major cities, 40 % are digitised, though the remaining 60% are still of an analogue type. For the effective and smooth implementation of the rural telecommunications system construction, the digitisation of such analogue type trunk transmission systems is essential for the development of the rural telecommunications system, including the common use of the trunk transmission systems, though such trunk transmission systems are not the objectives of this Master Plan. Therefore it is recommended that the digitisation of such analogue transmission systems should be performed before the

completion of the rural telecommunications facilities in order to utilise such completed facilities most.

1.8.3 Joint Owning and Leasing Company of Trunk Transmission Systems

The existing trunk transmission network systems that cover the country are owned by PTA, and the other telecommunications operators, such as Mongolian Railway Company (MRC) and MobiCom. In the case of the telecommunications operators intending to expand their services in the rural areas, they have two options; i.e. use of a part of such exiting trunk transmission systems by lease, or construction of a new trunk transmission system by themselves.

It is highly recommended that the unused transmission capacity of the newly installed trunk transmission system with huge investment costs and advanced technology should be leased to other operators with a fair rate of lease rental, in order to recover the investment cost earlier. The establishment of a joint venture company that leases trunk transmission systems is also recommended in order to utilise the trunk transmission systems most, as a national policy.

1.9 Comprehensive Assessment of Master Plan

In order to assure and realize the Master Plan, the results of the Master Plan have been analysed and assessed comprehensively about its appropriateness from social, technical, economic, financial, management and organisational, and environmental protection aspects.

Under this Master Plan, the present densities of both fixed telephone and Internet services in the whole territory of Mongolia will be increased remarkably by the year 2020, and those in the rural areas will also be improved by the year 2020, and the digital divide between the urban and rural areas will be reduced.

The development of the rural telecommunications system has special features such as small sized facilities deployed at many little Sum centres or settlements scattered in the vast territory and less revenues compared to those in the urban areas. In order to implement the project as originally planned, USOF is required for the construction, operation and maintenance cost of such rural telecommunications facilities.

The Master Plan as a whole is evaluated as appropriate, although its implementation requires solution of the expected financial difficulties. The implementation will produce

ripple effect on the whole rural society, meeting broader social needs, such as rural economy invigoration, rural industry development, prevention of natural disaster, and administrative service improvement, including educational, poverty reduction, medical and health care services, although the quantification of the benefits is difficult.

II. Feasibility Study

2.1 Selection of Priority Projects

In order to select a priority project, at first priority Aimags are selected in consideration of economic zones, Aimags, Sums, needs and potential for rural development, economic indicators of rural areas and Sums' technical factors. Then the priority Aimags are studied and analysed according to the national development policy. Sums are comprehensively analysed and evaluated taking into account the following: the evaluation of priority Sums by PTA, the planned integrated Sums, demand in 2002, and others. Finally three Aimags of Uvurkhangai, Selenge and Darkhan-Uul are selected as the priority projects for the Feasibility Study. Sums selected for the Feasibility Study are 22 in total.

2.2 Work Volume

The Feasibility Study is focused to design the network in Sum centres and links to connect them with Uvurkhangai, Selenge and Darkhan-Uul Aimag centres. The Project is established under the conditions that the proposed expansion and improvement are realised solely as part of MT network which is possessed by PTA.

Table 4 Main Work Volume of Feasibility Study Projects

Items		Facilities	Quantities
Switching System		Number of Exchanges	22
		Line Unit	6,580
Transmission System	Optical Fibre System	Cable Length (km)	9.4
		Multiplessor	8
	Mincrowave System	Number of Links	44
Access System	Wired System	Number of Exchanges	18
		Cable Pairs	6,500
	Wireless System	Number of Exchanges	4
		Number of Cell Stations	20
IT Services	IT Spot	Number of Spots	22

2.3 Total Cost Estimate

The total cost for the feasibility study projects is estimated as follows:

Table 5 Total Cost Estimate for Feasibility Study Projects

(US$ 1,000)

Items		Total Cost	Foreign Currency Portion	Local Currency Portion
Switchin System		2,062	2,057	5
Transmission System	Optical Fibre System	609	521	88
	Microwave System	4,927	4,285	642
Access System	Wiered System	1,764	1,273	491
	Wireless System	2,743	2,652	91
Power Plant		243	216	27
IT Services		248	0	248
Contingency		630	550	80
Consultancy Fee		1,008	1,008	0
Total		14,234	12,562	1,672

2.4 Financial Evaluation

The financial evaluation of the feasibility study project assumes that the project evaluation period is 2005 to 2020 (16 years), consisting of one year of "construction" and 15 years of "operations", and that all revenues and costs are expressed at the fixed prices at the end of 2001; and that the exchange rate is fixed at Tugrug 1,102 for one US dollar (at the end of 2001). In the basic case analysis, Financial Internal Rate of Return on Investment (FIRROI) is 2.197%.

The single year cash flow would be positive every year of operations. Positive profit would be realised in the 7th year of operations. Compared to the Master Plan, both cash flow and profitability are improved and financial self-sufficiency would be achieved in the 10th year of operations. Theses figures clearly indicate financial soundness of the project. Although the value of FIRROI is not much different from that of the Master Plan, total difference exists in substance. Subsidies would be necessary for 6 years, but the total amount would be as small as 600,000 US dollars. If the subsidies are disbursed from USOF, a discounted front-end lump sum payment can be adopted to minimise the amount of subsidies.

In the sensitivity analysis, when revenues increase by 10 %, FIRROI would be 3.249%, bringing financial self-sufficiency in the 4th year of operations. The total subsidies

would be decreased to 100,000 US dollars. When capital investment is decreased by 15%, FIRROI would become 3.665% and the project would show positive profit for the whole operation period, making subsidy unnecessary.

2.5 Implementation Plan

The implementation plan for the rehabilitation and expansion project for the rural telecommunications system in Mongolia shall be formulated in consideration of:

(a) Executing the project under the "Turn-key" basis;
(b) Hiring a consultant;
(c) Starting the project as earlier as possible to make use of this feasibility study, because the circumstances may be changed, necessitating a review of this feasibility study, if project commencement is delayed;
(d) Advancing the preparation work for the local work portion left to PTA, depending on the conditions required by the donor, such as the access road construction, building construction and modification; and
(e) Keeping the rules and procedures of Mongolian Government with those of the overseas donors providing the finance.

2.6 Recommendations

The following recommendations are issued as a result of the feasibility study:

(a) Digital Switching System;
(b) Digital Transmission System;
(c) Access Network System;
(d) Power Supply Facilities;
(e) IT Facilities;
(f) Land and Building;
(g) Project Implementation;
(h) Operation and Maintenance Plan;
(i) Human Resource Development and Training Plan; and
(j) Financial Aspect.

2.7 Comprehensive Assessment of the Project

The Project under the feasibility study has been comprehensively studied and assessed whether it is appropriate or not in consideration of social, economic, technical, financial, management and organizational aspects.

The Project is judged as appropriate as a whole. Although financing the capital investment as well as creating a system to cover operational deficit still remains as the critical issue, there should be noted that substantial benefits that cannot be quantified will be realised in terms of rural development, economic benefit, and meeting social and human development needs, such as educational, poverty reduction, medical and health care services.

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EXECUTIVE SUMMARY

PART I SUMMARY OF MASTER PLAN STUDY

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Acronyms

CCS	: Common Channel Signalling
CRC	: Communications Regulatory Commission
DAMA	: Demand Assigned Multiple Access
DEURAS	: Detect Unlicensed Radio Station
DG	: Diesel Generator
DLC	: Digital Loop Carrier
DNC	: Destination Network Code
DP	: Distribution Point
E-10B	: Type of Switch of Alcatel in France
EIRR	: Economic Internal Rate of Return
EWSD	: Type of Switch of Siemens in German
FIRR	: Financial Internal Rate of Return
FIRROI	: Financial Internal Rate of Return on Investment
FIRROE	: Financial Internal Rate of Return on Equity
F/R	: Final Report
F/S, FS	: Feasibility Study
GDP	: Gross Domestic Product
GNP	: Gross National Product
GRDP	: Gross Regional Domestic Product
HF	: High Frequency
IC/R	: Inception Report
ICT	: Information and Communication Technology
IMT-2000	: International Mobile Telecommunications 2000
INTS	: International Transit Switch
IP	: Internet Protocol
ISC	: International gateway Switching Centre
IT	: Information Technology
IT/R	: Interim Report
ITU	: International Telecommunications Union
ITU-T	: International Telecommunications Union
JICA	: Japan International Cooperation Agency
JTEC	: Japan Telecommunications Engineering and Consulting Service
LAN	: Local Area Network
MDF	: Main Distribution Frame

MIX	: Mongolia Internet Exchange
M/M	: Minutes of Meeting
MOI	: Ministry of Infrastructure
MP, M/P	: Master Plan or Master Plan Study
MRC, MRZ	: Mongolian Railway Company
MT	: Mongolian Telecom
MTC	: Mongolian Telecommunications Company
MW	: Microwave System
NDC	: National Destination Code
NEAX-61	: Type of Switch of NEC in Japan
NMS	: Network Management System
OM, O&M	: Operation and Maintenance
OMC	: Operation and Maintenance Centre
PABX, PBX	: Private Automatic Brach Exchange or Private Branch Exchange
PC	: Personal Computer
PC	: Primary Centre
PDH	: Plesiochronous Digital Hierarchy
PMP, P-MP	: Point-to-Multi Point
P/R	: Progress Report
PSTN	: Public Switched Telephone Network
PV	: Photovoltaic
QOS	: Quality of Service
SDH	: Synchronous Digital Hierarchy
STM	: Synchronous Transfer Mode
Tg.	: Tugrig (Mongolian Currency Unit)
UNDP	: United Nations Development Program
UNESCO	: United Nations Educational , Scientific, and Cultural Organization
USD, US$, US¢	: United States Dollar, United States Cent
UB	: Ulaanbaatar
VAT	: Value Added Tax
VoIP	: Voice-over-IP
VSAT	: Very Small Aperture Terminals
WAN	: Wide Area Network
WCS	: WLL Cell Station
WLL	: Wireless Local Loop
WRC	: World Radio Communication Conference

WWW	: World Wide Web
xDSL	: Digital Subscriber Line

PART I

SUMMARY OF MASTER PLAN STUDY

PART I SUMMARY OF MASTER PLAN STUDY

1. INTRODUCTION

1.1 General

This Report covers a telecommunications master plan up to the year 2020 and a feasibility study for priority projects which will be implemented by the year 2006, for the Master Plan Study for Development of Rural Telecommunication System in Mongolia.

The report consist of:

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

The study has been carried out in accordance with the work plan and schedule of the study which were discussed and agreed upon between Ministry of Infrastructure/Post and Telecommunication Authority, hereinafter referred to as MOI/PTA, and Japan International Co-operation Agency, hereinafter referred to as JICA. The study work has been done both in Mongolia and in Japan.

1.2 Background of the Study

Recognising that the rural telecommunications network development is essential to improve such basic needs of life as education, medical care, etc., and in consideration of the gap found between the urban and rural areas, the Government of Mongolia intends to establish a telecommunications network which could contribute to life level improvement in the rural areas and the local economic development. The rural telecommunications network development is an important theme of the country to be placed under the international assistance.

The telephone density remains still low. The density marked 15.05 lines per 100 inhabitants as a national average as of December 2001, though a total of 358,000 lines were counted including all kinds of telephone facilities. In rural areas, the telephone density was

far less or only 2.27 lines per 100 inhabitants in the rural area, or in the area except the national capital Ulaanbaatar and major cities. And the mobile telephone was available only in a few Aimag centres and in very few Sum centres.

MT (Mongolia Telecom) is a sole telecommunications operator which provides basic telecommunications services such as telephone, facsimile, and telex. MT offers the services with the facilities leased from PTA. With the adoption of the Telecommunications Law in 1995, followed by basic institutional reforms, major advancements were made in bringing telecommunications services' quality closer to the international standards. The nucleus of the urban telecommunications networks is rather well.

In spite of major improvement of the situation in the capital city, the rural dweller's telecommunications service needs were not met. The network in rural areas, especially that of the level lower than Aimag centres, remains intact. The telecommunications facilities are composed of aged analogue switches, microwave radio links, and open wire transmission links introduced by Russia in 1980s. The poor quality of communication of such telecommunications facilities could be a reason bringing about isolation from modern society.

Mongolia is a vast country with sparse population. Commercial investment to the rural areas is very difficult, even latest technologies are applied, for such conditions. It is essential for the Government of Mongolia, where it wishes to realise the development of the telecommunications network in such rural areas as a long term target, counts on the possibility of various funding schemes including state expenditure, international loan, and/or contribution of operator.

In such context, the Government of Mongolia requested the Government of Japan to conduct a master plan study for development of rural telecommunications network which covers the whole rural areas of the country, and contributes to the development in the rural areas. In reply to the request, JICA dispatched a preliminary study team in September 2001 and concluded Scope of Work (S/W) and Minutes of Meetings (M/M).

1.3 Objectives and Scope of the Study

The objectives of the Master Plan Study are as follows:

- To formulate a Master Plan up to the year 2020 for the development of the rural telecommunication system covering the whole Mongolian territory.
- To conduct the feasibility study(s) on the priority projects identified urgent through the Master Plan Study.
- To pursue the technology transfer to the counterparts of Mongolian side (the implementing agencies are MOI/PTA) in the course of the Study.

1.4 Overall Time Schedule of the Study

The Study period is from the end of March 2002 up to the middle of February 2003. The time schedule of the Master Plan Study by study stage is shown in Figure 1-1.

Study Stages	2002					2003
First Study in Mongolia	3.5M					
First Work in Japan		2M				
Second Study in Mongolia			2M			
Second Work in Japan				1.5M		
Discussion of Draft Final Report					2W	
Preparation of Final Report						1.5M
Submission of Report	IC/R P/R		IT/R		DF/R	F/R

IC/R: Inception report
P/R: Progress Report
IT/R: Interim Report
DF/R: Draft Final Report
F/R: Final Report

M: Months
W: Weeks

Figure 1-1 Work Schedule of the Study

1.5 First Study in Mongolia

During the First Study in Mongolia from March 27 to July 5, 2002, the Study Team carried out the following work together with PTA counterparts:

(a) Explanation and discussion of the Inception Report submitted from the team;
(b) Collection of data and information;
(c) Analyses of data and information collected;
(d) Field survey of the selected Aimags and Sums;
(e) Socio-economic and rural development study;
(f) Telecommunication demand forecast;

(g) Telecommunication traffic forecast;
(h) Study of long-term development targets and strategies;
(i) Preparation, discussion and finalization of Progress Report; and
(j) Technological transfer through the field survey and preparation of development framework.

1.6 First Work in Japan

During the First Work in Japan from July 18 to August 7, 2002, the Study Team prepared a draft master plan based on the results of the First Study in Mongolia. The draft master plan consists mainly of the following:

(a) Telecommunications networks plan;
(b) Numbering plan of Sums;
(c) Telecommunications network facilities plan;
(d) *Project implementation and cost estimate;*
(e) Financial plan;
(f) Operation and maintenance plan;
(g) Institution, organisation and management plan;
(h) Human resources development plan;
(i) Spectrum management plan;
(j) Project evaluation;
(k) Implementation plan;
(l) Identification of priority project(s); and
(m) Conclusion and recommendation.

1.7 Second Study in Mongolia

During the Second Study in Mongolia from September 1 to October 30, 2002, the Study Team carried out the following work together with counterparts:

(a) Explanation and discussion of the Interim Report submitted from the study team;
(b) Selection of priority projects for feasibility study;
(c) Collection of data and information for feasibility study;
(d) Field survey for priority projects selected for feasibility study;
(e) Explanation and discussion of feasibility study and outlines of project scope;
(f) Preparation of a Working Paper for feasibility study;

(g) Explanation and discussion of Working Paper; and
(h) Technology transfer through field survey and project basic design.

1.8 Second Work in Japan

During the Second Work in Japan from November 15 to November 28, 2002, the Study Team prepared a draft final report consisting of a master plan and feasibility study for three (3) Aimags. The Study Team carried out the following works:

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

1.9 Third Study in Mongolia

During the third study in Mongolia from December 9 to December 23, 2002, the Study Team carried out explanation and discussion of a draft final report with MT/PTA personnel, counterparts and other officials from organisations concerned. Content of the draft final report has been basically accepted. Technical transfer seminar was also carried out.

1.10 Third Work in Japan

During the third work in Japan from January 27 to February 14, 2003, the Study Team prepared a final report consisting of a master plan and feasibility study for three Aimags, based on the result of explanation and discussion on the draft final report.

1.11 Organisation

The study has been carried out with close relation among the parties concerned through the study period. Figure 1-2 shows the organisations concerned with the study.

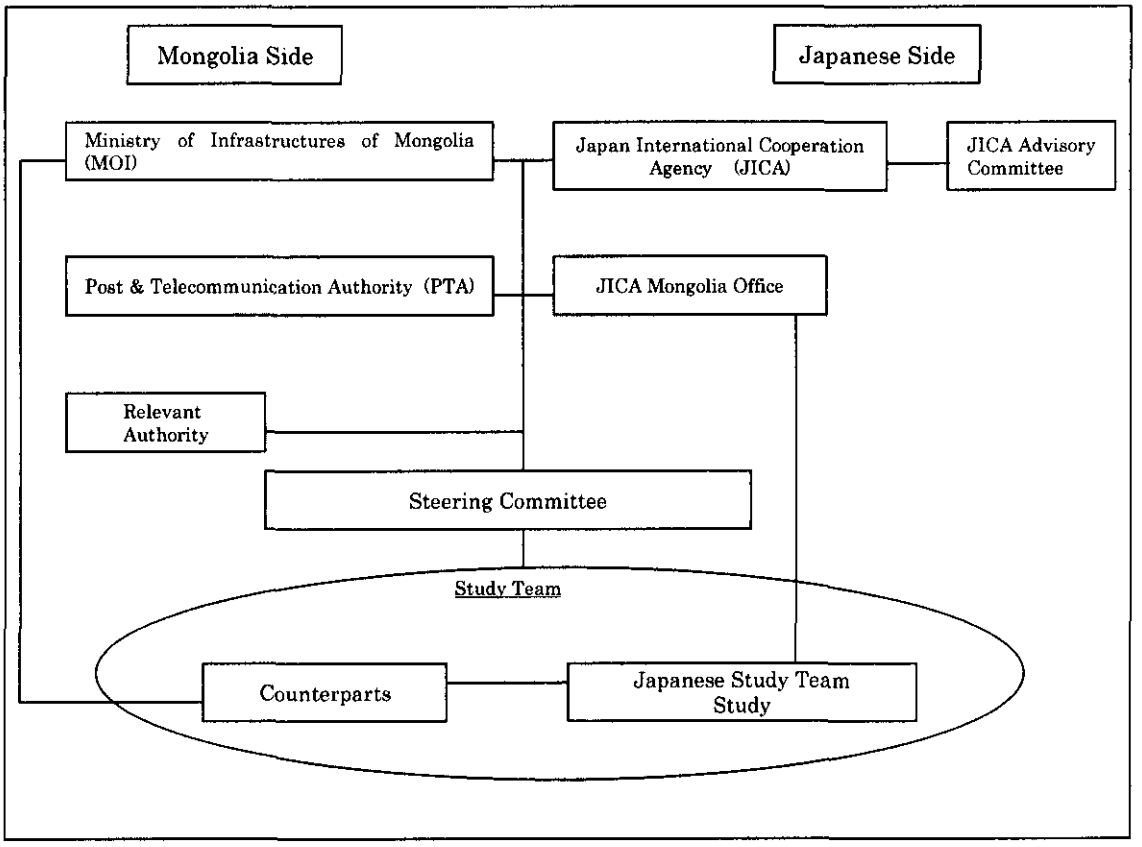

Figure 1-2 Organisation for the Study

1.12 JICA Study Team

The JICA Study Team members participated in this study are listed in Table 1-1.

Table 1-1 List of JICA Study Team Members

Name of Member	Duty-in-charge	Belonging to
Mr. MITSUHASHI Hideo	Team Leader, Telecommunication Services	JTEC
Mr. KUBO Katsuhei	Socio-Economic and Financial Analysis	JTEC
Mr. KUSANO Makine	Rural Development	PCI
Mr. UCHIYAMA Suzuo	Demand Forecast	JTEC
Mr. ISHIHARA Yasuo	Network Planning, Traffic Forecast, Switching System	JTEC
Mr. ISHIGAKI Hideaki	Radio System, International Facility Plan, Radio Frequency Management	JTEC
Mr. OKAMOTO Masazumi	Outside Plant Plan (Cable Work, Civil Work and Subscriber Terminal)	JTEC
Mr. HOSODA Tomio	Transmission Network Plan, Transmission Facility Plan	JTEC
Mr. KASAI Takashi	Power Plant Facility Plan	PCI
Mr. MIHARA Noboru	IT Network Plan, IT Demand Forecast	PCI
Mr. MARUYAMA Iwao	Operation and Maintenance Plan	JTEC
Mr. TANAKA Makoto	Organisation and Management Plan, Human Resource Development Plan, Institute Issue	JTEC
Mr. NEGISHI Yukio	Administrative Support	JTEC
Ms. ABIKO Sanae	Interpreter	JTEC

Note: JTEC: Japan Telecommunications Engineering and Consulting Services
PCI: Pacific Consultants International

1.13 Counterparts from Mongolian Side

Counterparts from Mongolian side officially assigned and participated in this study are listed in Table 1-2. In addition, many officers other than mentioned in the table below have co-operated to the study team through the study period. Table 1-3 shows the attendees who made comments.

Table 1-2 List of Counterparts

Duty-in-charge	Name	Affiliated to
Chairman (Leader)	Mr. N. Nansaljav	PTA
Socio-Economic and Financial Analysis	Mr. T. Ganbat Mr. N. Norovjav	PTA PTA
Rural Development	Mr. D. Naranbayar Ms. N. Bolormaa	MT PTA
Demand Forecast	Mr. Ts. Usukhbayar	PTA
Network Planning, Traffic Forecast, Switching System	Mr. N. Bilgee Mr. B. Davaatseren	PTA PTA
Radio System, International Facility Plan, Radio Frequency Management	Mr. M. Naranbaatar	CRC
Outside Plant Plan (Cable Work, Civil Work and Subscriber Terminal)	Ms. Uugantsetseg Mr. S. Tugsbileg	PTA PTA
Transmission Network Plan, Transmission Facility Plan	Mr. N. Baatarsuren Mr. Ch. Davaajav	PTA PTA
Power Plant Facility Plan	Mr. D. Agchbayar	PTA
IT Network Plan, IT Demand Forecast	Mr. Ch. Zolbayar Mr. G. Enkhbayar	PTA PTA
Operation and Maintenance Plan	Mr. T. Ochir Mr. D. Tserenchimed	PTA PTA
Organisation and Management Plan, Human Resource Development Plan, Institute Issue	Mr. Ts. Bold Mr. B. Amgalanbat	PTA MOI

Table 1-3-1 List of Attendees Who Made Comments

Name	Affiliated to	Duty in Charge
Mr. G. Basanjav	MOI	Director, Policy and Coordination Department of Road, Transport, Information, Communication and Tourism (PCDRTICT)
Mr. N. Naranmandakh	MOI	Senior Officer, PCDRTICT
Mr. G. Battur	PTA	General Director
Mr. B. Davaastseren	PTA	Deputy Director General
Mr. O. Battogtokh	CRC	Deputy Director General
Mr. B. Baatar	CRC	Director
Ms. U. Tamir	CRC	Director
Mr. M. Mend-Ochir	CRC	Director
Mr. N. Bolor	MT	Technical Director

Table 1-3-2 List of Members of Scientific and Technical Council of Communication Sector (Non-executive) /STCCS/

Name	Degrees	Duty in Charge
Mr. B. Sukhbaatar	Sc. D., Prof, CEng.	Director of STCCS
Mr. Ts. Bold	Ph. D., Assist. Prof.	Secretary of STCCS
Mr. N. Nansaljav	Ph. D., Asisst. Prof., CEng.	Member of STCCS
Mr. G. Tsogbadrakh	Ph. D. Prof., CEng.	Member of STCCS
Mr. B. Damdinsuren	Ph. D., Prof., CEng.	Member of STCCS
Mr. L. Batkhisig	Ph. D., CEng.	Member of STCCS
Ms. G. Bayarsuren	Ph. D.	Member of STCCS
Mr. I. Norovjav	M. Sc.	Member of STCCS

1.14 JICA Advisory Committee

Member of JICA advisory committee and project officers of JICA Headquarters are listed in the following Tables 1-4 and 1-5, respectively.

Table 1-4 List of JICA Advisory Committee Members

Name	Duty-in-charge	Affiliated to
SHIOYA Junichi	Chairman Telecommunication Policy	Deputy Director, International Cooperation Division, Telecommunications Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications
ISHIZUKA Hiroshi	Member Rural Communication Plan	Assistant Director, Technology Policy Division, Information and Communications Policy Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications

Table 1-5 List of Project Officers of JICA Headquarters

Name	Duty-in-charge	Affiliated to
ENDO Hiroaki	Project Officer	Second Development Study Division Social Development Study Department, Japan International Co-operation Agency
OKUDA Hisakatsu	Project Officer	Second Development Study Division Social Development Study Department, Japan International Co-operation Agency

2. SOCIO-ECONOMIC STATUS AND NATIONAL & RURAL DEVELOPMENT PLANS OF MONGOLIA

2.1 Geographic Situation

Mongolia is an entirely inland country on the geographic coordinates of 46 degrees north and 105 degrees east, neighbouring on China, Russia and Kazakhstan with the total land boundaries of 8,162 km. Its total area is 1,566,500 square km (about 4 times of Japan), composed of six basic natural types such as 1) Alpine belt, 2) Mountain Taiga, 3) Mountain Forest Steppe belts, 4) Steppes, 5) Arid Steppe zones and 6) Desert zone spreading horizontally in Mongolia. Mongolia's average altitude is 1,580 metres above sea level. Mongolia has typical dessert and continental climate with large seasonal and daily temperature fluctuations.

2.2 Demographic Trends

The population of Mongolia was 2,379.5 thousand at the end of 2000, out of which 54.0% or 1,284.9 thousand stood for the urban residents (Ulaanbaatar & Aimag Centres), while 46.0% or 1,094.6 thousand stood for the residents of rural areas (Sums & Bags). Current population growth rate of the country is 1.4% on average. This Master Plan Study deals with the population of rural areas and Aimag Centres in macroscopic socio-economic approach.

2.3 Economic Activities

Mongolia is in its process of transition towards the market economy. The government has been closely following sound macro-economic policies, supported by the international donor community. Herding is a traditional way of life of Mongolians and the livestock-breeding sector is occupying about 90% of agricultural products. Percentage ratio of herdsmen's households to all households of Mongolia was 35% at the end of 2000. In 2000 agriculture's weight to GDP decreased sharply (by 17%) to 33.4% from the levels of 37-38% for the previous years due to the worst zud disasters, foot and mouth disease and drought. Mining, trade and commerce, transportation and communications sectors showed remarkable expansion. Thus, the growth rate of GDP in 2000 decreased to 1.1% from previous years 3-4% since the countries economy restarted to show positive growth.

2.4 Future Socio-Economic Trends

The long-range socio-economic framework, consisting of the forecasts of population and GDP, are formulated after reviewing and analysing the data secured from MOFE and other sources such as UNDP, World Bank, etc.

Table 2-1 Summary of Population Forecast Frame 2001-2020

in thousand persons

	2001	2008	2013	2020	Annual Growth
Total Population	2,412.8	2,673.3	2,879.4	3,181.9	1.46%
o/w Aimag Centres and Rural areas	1,616.6	1,699.1	1,797.7	1,976.6	1.04%
Ulaanbaatar	796.2	974.2	1.081.7	1,205.3	2.24%

Table 2-2 GDP/GRDP Forecast Frame 2001-2020

in Tg. mln

	2001	2008	2013	2020	Annual Growth
GDP	639,600	890,553	1,147,462	1,669,189	4.97%
GRDP	321,079	436,371	562,256	817,903	4.45%
GDP per Capita in Tg.	265,084	333,134	398,511	524,582	3.46%
in US$	590.9	742.6	888.3	1,169.3	
GRDP per Capita in Tg.	198,612	256,831	312,769	413,783	3.37%
in US$	442.7	572.5	697.2	922.4	

2.5 National Development

The establishment and development of Ulaanbaatar, Darkhan and Erdenet as well as of the respective Aimag centres since 1930's enriched lifestyle of Mongolians by making them settled there and contributed to expedite the national economic and cultural development. On the other hand, the activities of industrialisation and urbanisation processes were carried out without paying careful attention, neither to protection and preservation of the environment nor to the concerted territorial allocation with nomadic lifestyle of the population. The migration movement is increasing constantly and resulting in excessive concentration of population in Ulaanbaatar, Darkhan, Erdenet and the regions along the main railway line that aggravates social issues such as unemployment and poverty. Those issues are still awaiting effective solutions. It should be needed to create relatively similar living conditions across the whole territory of Mongolia. In June 2001 the Mongolian parliament

approved the regional development policy paper "Policy of Regional Development of Mongolia" that contained the following points for the elaboration of the regional development:

(a) To establish the development balance throughout Mongolia by the regional way of development.
(b) To create the appropriate environment for the government structure, economy, society, culture, allocation of population, city construction, international cooperation, state policy coordination structure and operational guidelines promoting rural development in the economic regional areas.

The policy paper indicates the need for establishment of the five economic regions as follows. Such economic regions, which are further composed of Aimags, Sums, districts and other settlements within their territories, should be set by the respective regional ways of development, based on an integrated but comparatively independent structure among regional, urban and rural areas as follows:

(a) Western region: Bayan–Ulgii, Govi-Altai, Zavkhan, Uvs and Khovd Aimags
(b) Khangai region: Arkhangai, Bayankhongor, Bulgan, Orkhon, Uvurkhangai, and Khuvsgul Aimags
(c) Central region: Govisumber, Darkhan-Uul, Dornogovi, Dundgovi, Umnugovi, Selenge and Tuv Aimags
(d) Eastern region: Dornod, Sukhbaatar and Khentii Aimags
(e) Ulaanbaatar region: Capital city, districts and satellite cities

Table 2-3 Priority Area of Industrial Development by Regions

Regions	Priority Area of Industries and Services
Western	Livestock husbandry using natural herding pasture, cropping with irrigation system, small and medium processing plants
Khangai	Livestock husbandry using natural herding pasture, cropping with irrigation system, tourism, health centres, vacation camps, small and medium industries, mining, processing plants
Central	Livestock husbandry using natural herding pasture and farming, cropping with irrigation system, tourism, health centres, vacation camps, small and medium industries, mining, processing plants, other high intellectual capacity manufacturing and services
Eastern	Livestock husbandry using natural herding pasture and farming, cropping with irrigation system, tourism, small and medium industries
Ulaanbaatar	All high intellectual capacity manufacturing and services, international banking and financial networks

The review of the National Development Program having the target year of 2021 was ordered by the presidential decree of Mongolia dated 20th March 2002. It includes the review of all programs concerning the National Development that are currently being implemented and those being deliberated for finalization. Also the decree has given ministries the instruction to clarify the ideology of the development of Mongolia and elaboration of each program. For conducting the review work the decree directed ministries to actively involve the political parties, scientific organisations and non-government organisations and representatives of the public in the process of elaboration, discussion and agreement on the draft program.

2.6 Rural Area Overview and Development Issues

The review for grasping the overview of existing conditions in rural area of Mongolia in conjunction with the rural development by effective telecommunication supports was carried out. Possibilities including eventual position of the rural telecommunication development were studied from the viewpoint of rural development needs, through examination of sector development needs in consideration of social services improvement and economic development potentiality.

A diagnosis has been made as comparative analysis of 21 Aimags of the country from the viewpoints of social services needs and economic development potential. Overall development priority among the four regions (except for Ulaanbaatar) is evaluated in accordance with the weighted average score index of each region in consideration of the numbers of Aimag within each region. The evaluation points are from one (top ranking) to three (lowest). Within each region, the evaluation score of Aimags are ranked by points in the identical manner with the regions from one (top ranking) to three (lowest).

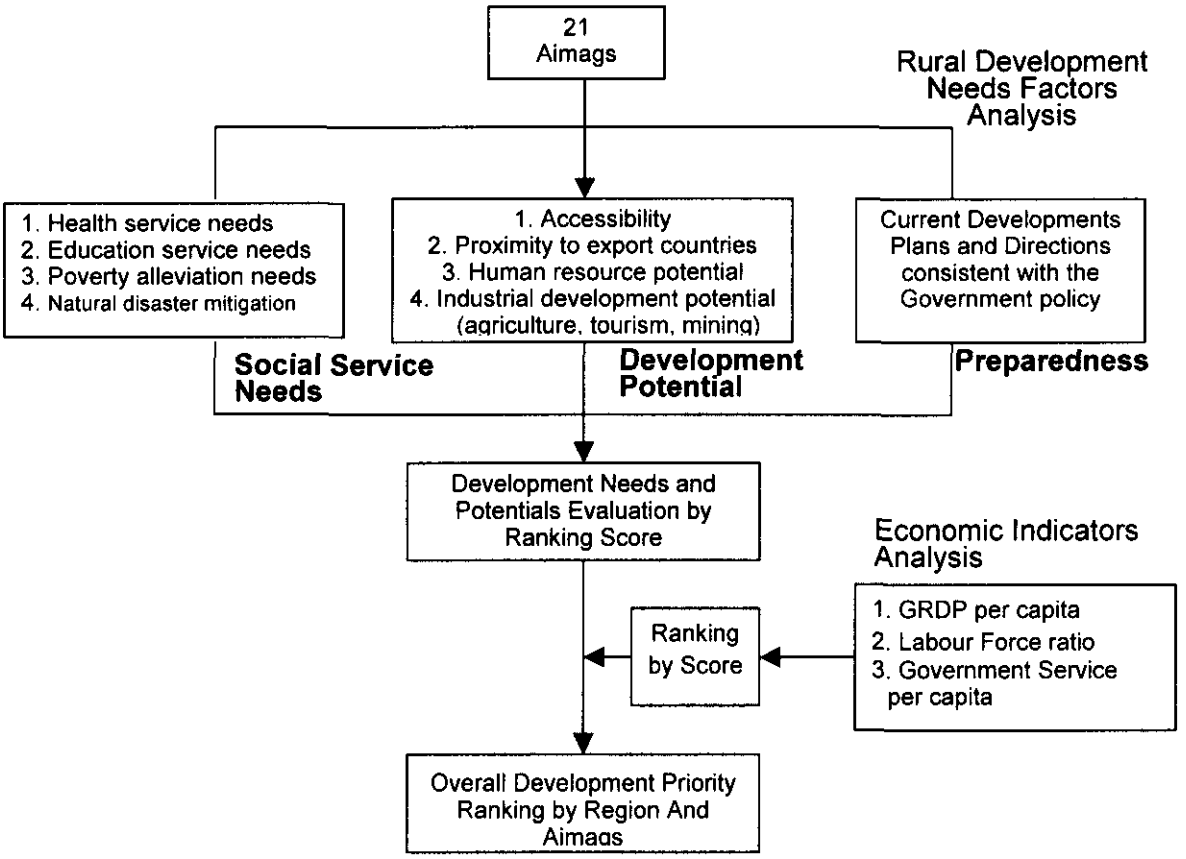

Figure 2-1 Analysis Flow for Development Potential and Needs in Rural Area

Table 2-4 Overall Development Priority Ranking by Regions and Aimags

Region	Ranking	Aimag	Ranking
Western Region	3	1.Bayan-Ulgii	3
		2.Uvs	2
		3.Khovd	2
		4.Zavkhan	1
		5.Govi-Altai	2
Khangai Region	1	6.Khuvsugul	2
		7.Arkhangai	1
		8.Bayankhongor	2
		9.Bulgan	2
		10.Orkhon	3
		11.Uvurkhangai	1
Central Region	2	12.Selenge	2
		13.Darkhan-Uul	3
		14.Tuv	2
		15.Dundgovi	2
		16.Umnugovi	1
		17.Govisumber	3
		18.Dornogovi	2
Eastern Region	3	19.Khentii	1
		20.Sukhbaatar	2
		21.Dornod	3

3. PRESENT TELECOMMUNICATIONS SECTOR

3.1 Telecommunications Sector

The administrative authorities supervising the telecommunications business and services in Mongolia is Ministry of Infrastructure (MOI) and the implementing agency is Post and Telecommunications Authority (PTA). The telecommunications sectors of Mongolia is developing in keeping with the basic policy which was set forth in the Mongolian Telecommunications Policy Statement of 1994, and updated by the 1998 Mongolian Telecommunications Sector Policy Statement (MTSPS), based on the Network Master Plan to 2010. The Statement was amended in December 2001. Telecommunications sector in Mongolia counts two (2) fixed telephony service providers, two (2) mobile service providers, eight (8) Internet service providers, in addition to more than 10 cable TV operators.

3.2 Telecommunications Networks Operated by MT

Mongolia Telecom (MT) now provides all the basic telecommunication services. The network operated by MT is a complete network which covers whole the country, consisting of transmission links, switching systems and subscriber access facilities. The transmission systems, switching systems and access facilities operated by MT are mostly assets of PTA leased to MT.

The fixed telephone land lines, which are mostly of MT network, counted 130,000 for 2.4 millions population, or 5.5 lines per 100 inhabitants as national average as of 2001. The total of land lines and mobile/wireless telephones came up to 358,000. So the national telephone density recorded 15.0 lines per 100 inhabitants as a total. The majority of mobile phones are registered in Ulaanbaatar, Darkhan, Erdenet, and surrounding cities. MT's telephone main lines were 5.0 lines per 100 inhabitants on the national average, and 9.7 lines per 100 inhabitants in Ulaanbaatar (including Baganuur and Nalaikh), the national capital, in 2001.

Table 3-1 National Telephone Density

Population and telephone terminals			Telephone density	Note
Population		2,379,500	---	
Telephone terminals	Fixed land line	130,000	5.5%	MT + MRC
	Mobile and WLL	228,000	9.6%	MobiCom + Skytel
	Total	358,000	15.0%	

Note: MRC means Mongolia Railway Company, and WLL stands for wireless local loop.

3.3 Telecommunications Networks Operated by Other Operators

Private and government-run companies render telecommunication services other than the basic ones. The services include mobile telephone service, wireless local loop network service and Internet service. The operators are Mongolian Railway Company (MRC), MobiCom Corporation, Skytel Company, MagicNet Company, Datacom Company, Railcom Company, Incomnet LLC. Among them, only MobiCom and Skytel Company offer mobile phone service. Table 3-2 shows the growth of the service by Modicum and Table 3-3 shows the growth of the service by Skytel.

Table 3-2 Mobile Telephones and WLL Phones of MobiCom

Year	1997	1998	1999	2000	2001
Mob card	---	2,647	17,543	74,482	160,000
Mobicom	2,416	2,718	3,059	3,474	10,000
Mobiphone (WLL)	---	---	1,976	2,044	10,000
Total	2,416	5,365	19,519	80,000	190,000

Table 3-3 Mobile Telephones of Skytel

Year	1999	2000	2001
Subscribers	10,000	23,000	38,000

The MRC's fixed line telephone network covers populated areas along the railway connecting the northern border to Russia and the southern border to China. The MRC network is made up with the optical fibre cable transmission system having its gateway switch in Ulaanbaatar. The number of MRC's subscribers is around 10,000, including 4,000 lines in Ulaanbaatar.

3.4 Internet Providers

The Mongolia Internet Exchange (MIX) was inaugurated on April 20, 2001 in order to save traffic congestion in the satellite link by inter-local transactions, and to improve the country's future capacity for the use of e-commerce, to reduce costs for Internet service providers (ISPs) and to increase connection speed for Mongolians. Currently, there are eight (8) ISP serving clients in Mongolia.

4. PRESENT TELECOMMUNICATIONS NETWORK FACILITIES

4.1 Switching Network

The switching network of Mongolia consists of Public Switched Telephone Network (PSTN) of MT and another PSTN of MRC. The telephone network of MT consists of four (4) levels, that is, the international gateway switch (ISC), the national transit switch (NTS), the primary centre switch (PSC) in Aimag centre, the PBX or manual switch of Sum centre, and the transmission link connecting them. The telecommunications devices in Sum centres are mainly PBX, but in some cases it is manual switching device. The ISC and NTS are located in Ulaanbaatar, the PSCs are located in each of Aimags and District cities, 23 points in total. The NTSs and PSCs accommodate the subscriber lines in the same manner as the local exchanges do.

The switching systems in Ulaanbaatar are digital. They are NEAX of international gateway switch, and EWSD and E-10B of national transit and local switch. The capacity of existing switching facilities is 141,000 line units in total, including 73,000 line units in Ulaanbaatar. Sum centre's switching system is PBXs and manual consoles. Most of the PBXs are analogue and made in Russia. Many of them were products made in 1980's and 1990's, but switches made in 1970' are also in use.

The switching systems of exchange in Aimag centres are connected radially with the NTS switching units located in Ulaanbaatar, though the transmission links run connecting the Aimag centre exchanges in series in some routes.

4.2 Transmission System

The national telecommunication backbone network of MT is made up with 4,000 km of microwave transmission link, about 900 km of which is digital. As spur links, over 30,000 km of open wire lines connect Aimag centres to Sum centres. The first optical fibre cable transmission system of STM-1 of 12 fibre cores was introduced in 2000 along the railway under a project financed by Japanese Yen Loan, and owned by MRC for their railway business and PSTN services carried by them. The second optical fibre cable transmission system, which is extended from Ulaanbaatar to Aimags in Eastern areas, is expected to complete shortly.

In the areas where terrestrial communications is not feasible and had no access to the optical fibre backbone transmission network system or the digital microwave backbone

transmission network system, VSAT (Very Small Aperture Terminal) provides both data and voice communication. By foreign aid projects, 19 VSAT satellite earth stations were put into operation to improve the rural telecommunication network in remote Aimags from Ulaanbaatar during the period from year 1998 to year 2002.

While most advanced technologies in transmission are employed in Mongolia, analogue technologies are still widely used in Aimags. Analogue equipment is facing difficulties in maintenance because of spare-parts shortage, and does not totally meet various needs of digital age.

4.3 Access Network

As the wired access network for Sum centres in rural areas, the small size of aerial copper cables is laid out in two or three directions from the telecom centres. Majority of such cables are deteriorated and of shortage in capacity.

Recently HF and VHF radio transceiver equipment was introduced for the emergency communication purpose between Sum centres and Bags by the grant aid scheme from the Government of Japan. The radio transceiver equipment is not able to connect automatically with the PSTN. However, it is expected that digitisation of rural telecommunications network will bring in automatic connection with PSTN.

In addition to the above conventional copper cable system, WLL (Wireless Local Loop) telephone service started in January 1999 in Ulaanbaatar.

4.4 Mobile Telephone Services

MobiCom Corporation was established in 1996 as the first Mongolian cellular telephone service operator and it is now providing the services with the GSM network in 11 cities including Ulaanbaatar. The second operator Skytel started the services in 1999 and it is now providing services with the AMPS and the CDMA network in major cities. The total mobile subscribers are about 218,000 in 2002. Both operators are planning to complete the service extension to all Aimag centres by the year of 2005.

4.5 IT Services

First Internet e-mail service in Mongolia started in 1994. Full Internet services appeared on the market in early 1996, and at present eight (8) ISPs are operating. In 2001, in

order to alleviate traffic congestions on the satellite link caused by inter-local transactions among the Mongolian ISPs, and also to provide users better latency time of the local transactions and to reduce rental fee of international leased lines, Mongolia Internet Exchange (MIX) was established. Internet services are now expanded up to Aimag centres and a part of Sum centres

4.6 International Telecommunications Network

The international telecommunications network to/from foreign countries are made up with digital satellite communication system.

MT provides PSTN communications with 324 international circuits connecting directly eight (8) destinations in foreign countries, while four (4) private international call operators provide the service on VoIP. Railwaycom started recently the international call service through its optical fibre network led to Russia in the north and China in the south.

The telecommunications network in Mongolia is consisted of the Intelsat Standard A Satellite Station, International Switch (INTS), National Transit Switch (NTS) and digital microwave transmission link connecting them. The Satellite Station is at Naran Earth Station and the transit switch is in the capital Ulaanbaatar.

4.7 Power Facilities

Majority of the telephone offices in Sum centres is not provided with reliable or stable electricity, although main power or emergency diesel generators or other sources of power supply is available. The use of renewable energy with small-scale solar panels makes the power supply for the VHF or HF transceivers at the selected Sum centres. Some telecom offices at Sum centres are supplied with electricity generated by photovoltaic (PV) systems alone. Telecom offices located at some Sum centres receive power from grids, or Aimag diesel generating (DG) stations, or Sum DG stations. Main power supply for the microwave repeater stations is by means of diesel generators at Aimag centre or Sum centres, including the electricity supply by PV systems.

Power supply from grids is comparatively stable, while power supply from Aimag DG stations is less stable than that from grids, but efforts have been made to improve reliability and stability of power supply. The power supply from DG stations in Sum centre is of a low standard; operating hours of most of the DG stations are limited to night time, thus making it quite difficult to feed electricity to telecom offices on a 24 hours-a-day basis.

5. DEVELOPMENT FRAMEWORK AND STRATEGIES

5.1 Development Framework and Strategies

The objective of this Master Plan is to set up a framework, in quantitative and in recognising the actual situation, for the establishment of the future information network at the rural areas in Mongolia which will support the socio-economic development of the rural areas. To reduce a gap of the telephone services and the new IT services between the urban and rural areas, the Government of Mongolia intends to perform the following development framework and strategies.

(a) To digitalise and expand the existing telecommunications network in Sum centres to realise automatic dialling and to replace the aged equipment, including the transmission system between Aimag centres and Sum centres.
(b) To introduce and expand the IP-network (including Internet) to contribute the information welfare to the rural dwellers and to contribute socio-economic development of the rural areas.

For setting-up this Master Plan Study, special attention was paid to the following items:

(a) To respect the basic policy of MTSPS 2001;
(b) Maximum use of the existing equipment;
(c) Realistic and cost-effective works in Phase-I (up to 2008) period for the section of the priority project(s) among these works; and
(d) To review the works planned in Phases-II (up to 2013) and III (up to 2020) period in appropriate timing whether the plans are in line with the technical trend and innovation and conform with the demand of the area at the time.

5.2 Planning Period and Target Years of the Master Plan

This Master Plan Study covers long-term development for the telecommunications network up to 2020 in the whole Mongolia. The planning period up to 2020 is divided into phases with milestones as target years, i.e., a short-term plan up to 2008, a medium-term plan up to 2013 and a long-term plan up to 2020.

5.3 Key Development Targets

Table 5-1 shows the outline of development targets.

Table 5-1 Key Development Targets up to 2020

Indexes	Sub-Indexes	Area	Present Satus (2001 and 2002)	Development Targets			
				Short-Term Target, (2003-2005)	(2006-2008)	Medium-Term Target	Long-Term Target
Socio-Economy	Population	Whole country	2,412,818	2,561,461	2,673,259	2,879,374	3,181,944
		Whole Aimags	1,616,618	1,667,961	1,699,059	1,797,674	1,976,644
	GDP per Capita (US$ Constant in 1995)	Whole country	590.9	669.5	742.6	888.3	1,169.3
	GRDP per Capita (US$ Constant in 1995)	Whole Aimags	442.7	503.8	572.5	697.2	922.4
Demand Forecast (DELs)	Fixed Telephone Service (PSTN)	Whole country	167,587	196,637	218,424	270,212	370,489
		Whole Aimags	92,138	105,747	115,954	143,128	196,140
		Sum centre	28,795	32,801	35,806	44,318	60,780
	Mobile Telephone Service	Whole country	208,083	271,983	319,908	420,025	592,151
		Whole Aimags	110,367	142,189	166,056	218,035	307,364
		Sum centre	35,525	45,372	56,064	65,985	97,687
	Total of Fixed and Mobile Telephone Services	Whole country	375,670	468,620	538,332	690,237	962,640
		Whole Aimags	202,505	247,936	282,010	361,163	503,504
		Sum centre	64,320	78,173	91,870	110,303	158,467
DELs/100 Inhabitants	Fixed Telephone Service (PSTN)	Whole country	6.95	7.68	8.17	9.38	11.64
		Whole Aimags	5.70	6.34	6.82	7.96	9.92
	Mobile Telephone Service	Whole country	8.62	10.62	11.97	14.59	18.61
		Whole Aimags	6.83	8.52	9.77	12.13	15.55
	Total of Fixed and Mobile Telephone Services	Whole country	15.57	18.30	20.14	23.97	30.25
		Whole Aimags	12.53	14.86	16.60	20.09	25.47
Supply Volume (DELs)	Fixed Telephone Service (PSTN)	Sum centre	10,521	20,646	29,302	42,391	60,780
Switching Capacity (Line Units)	Fixed Telephone Service (PSTN)	Sum centre	19,724	37,178	47,812	58,898	62,100
Demand Forcast of IT and Data	Internet Services	Whole country	9,000	81,078	135,137	172,590	210,042
		Whole Aimags	450	23,184	40,234	57,350	74,466
		Sum centre	-	5,081	8,891	15,559	22,227
DELs/100 Inhabitants for IT and Data	Internet Density	Whole country	0.37	3.17	5.06	5.99	6.60
		Whole Aimags	0.03	1.39	2.37	3.19	3.77

5.4 Fulfilment Plan

The fulfilment plan of the fixed telephone demand in the rural areas is as follows:

(a) The telephone density of all Aimags in 2020 is about 10 per 100 inhabitants for fixed telephones and about 15 per 100 inhabitants for mobile phones, and about 25 in total.

(b) During the Phase-I, 100 % of the fixed telephone demand in Sum centre will be fulfilled in the major Sums of the major Aimag and the major Sums in the other Aimags where much initial cost is not required. Accordingly the target fulfilment will be 50% in the earlier stage and 80% at the latter stage of the Phase-I.

(c) The automatic dial connection from the HF transceiver in Bag will be obtained through the digitisation at Aimag or Sum centres during the Phase-I.

5.5 Network Expansion Plan

The key points of the network expansion plan in the rural areas are described bellow. Table 5-2 shows the targets of the network expansion plan.

Table 5-2 Network Expansion Plan up to 2020

Items		Facilities	Short-Term		Medium-Term	Long-Term	Total
			(2003-2005)	(2006-2008)	(2009-2013)	(2014-2020)	
Switchin System		Line Unit	27,460	15,020	14,580	5,040	62,100
Transmission System	Optical Fibre Cable	Length (Km)	37	26	69	74	206
		SDH Section	9	4	7	9	29
	Microwave	Terminal Sation	84	46	76	42	248
	VSAT	Earth Sation	19	12	22	2	55
Access System	Wired	Cable Pair	33,440	19,133	12,712	3,377	68,662
	Wireless	Cell Sation	30	3	4	5	42
Power Plant			-	-	-	-	-
IT Services	IT Spots	Sites	122	60	103	54	339

(a) The demand fulfilment will be performed by the expansion of the PSTN network at the initial stage of the Phase-I, and be performed by the introduction of the IP network at the latter stage of the Phase-I. During the Phases-II and III, the expansion will be made with VoIP and the existing PSTN network will be replaced with a VoIP network.

(b) Facilities in Sum centres, including transmission routes between Aimag centres and Sum centres, will be totally digitised by 2020.

(c) The automatic dial connection will be realised through a DLC, PBX, or small switching node of PSTN at the major Sums in the Phase-I. The IP network at the major Sums will enable people automatic dial connection through a gateway of trunk lines. The automatic dialling at all Sums by the IP network will be realised in the Phases-II an III.

(d) HF transceivers in Bags will be connected to PSTN by operators in Aimag or Sum centres. The introduction of the IP network will make automatic dial connection possible during the Phases-II an III.

(e) The Internet will be introduced in some Sums in the Phase-I. The high speed Internet will be introduced at some Sums in the Phases-II and III. The Internet will be available in Bags with wireless IP access systems in the Phases-II and III.

(f) IT spots (having PCs, a printer, a telephone set and a facsimile for services such as present Internet cafes offer) will be established at all Sums in the Phases-I and II.

(g) To design the proposed telecommunications network in consideration of the following:

(i) The network is economical in not only the installation but also the operation;

(ii) The network is made up applying latest technologies;

(iii) The network is capable to fulfil every new application of the fixed telephone service; and

(iv) The network is capable to approach to the Internet world, covering the country of Mongolia and all other world.

5.6 Service Quality and Operational Efficiency Improvement

The improvement targets of the service quality and operational efficiency are shown in Table 5-3.

Table 5-3 Service Quality Improvement Targets up to 2020

Indexes	Sub-Indexes	Area	Present Status (2001 and 2002)	Improvement Targets			
				Short-Term Target		Medium-Term Target	Long-Term Target
				Phase-I		Phase-II	Phase-III
				(2003-2005)	(2006-2008)	(2009-2013)	(2014-2020)
Service Quality for Fixed Telephone (PSTN)	Call Completion Rate	Whole Country	55% (2002)	58%	60%	64%	70%
	No. of Faults (/Year/100 DEL)	Whole Country	42% (2001)	40%	34%	28%	22%
		Aimag Centre	44% (2001)	40%	35%	30%	23%
	Fault Clear Rate Within 24 Hours	Whole Country	50% (2002)	60%	70%	80%	95%
Operational Efficency (PSTN)	Number of Staff	Whole Country	4,508 (2001)	3,950	3,540	2,850	3,340
		Sum Centre	987 (2001)	711	637	513	601
	DEL/Staff	Whole Country	26.48 (2001)	49.01	65.90	94.96	110.87
		Sum Centre	10.66 (2001)	29.04	45.99	82.64	101.10

6. FUNDAMENTAL TECHNICAL PLAN

6.1 General

The fundamental technical plan for forming telecommunications networks in Mongolia is based principally on the ITU recommendations. The technical plan is subject to consent to the Communications Regulatory Committee (CRC), though the network providers or service providers are free to determine their own standard. The technical plan submitted to CRC is studied, before approval issuance, from technical point of view in consideration of the existing network, trends of the world, and ITU Recommendations. Should the interests of existing provider and the new applicant be not consent, the application is to be placed under coordination of CRC.

6.2 Network Configuration

The present telecommunications network in Mongolia is sorted roughly into three (3) classes. The national network has been formulated placing the MT network in the centre.

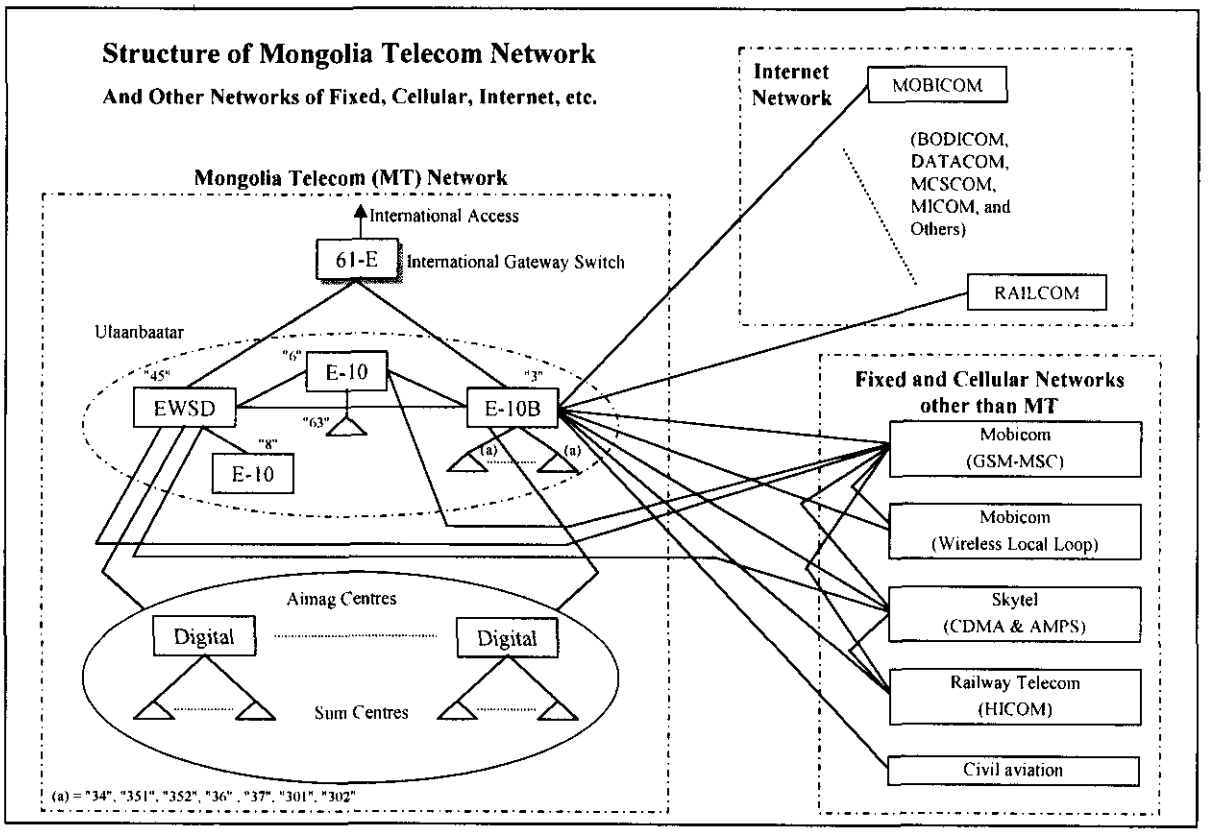

Figure 6-1 Networks of Mongolia Telecom (MT) and Others

The telecommunications network of Mongolia is formed with various technologies ranging from optical fibre connection of the latest digital technology to open wire connection of the outmoded technology. It is made up with digital telephone switching system, VSAT satellite communication system, optical fibre transmission system, digital/analogue microwave transmission system, open wire transmission system and copper cable access network, asynchronous subscriber digital line (ADSL). IP technology is also applied to the Mongolian network.

6.3 Switching Network Hierarchy

MT's telecommunications network is a network wherein the local exchanges are connected to the transit exchange in a star-shape. The national switching network is consisted of such levels as:

(I) International gateway Switching Centre (ISC),
(II) National Transit Centre (NTC),
(III) Provincial Switching Centres (PSC), and
(IV) Sum Centres.

6.4 Network Configuration of Master Plan

The network to be proposed in this Master Plan Study is focused to that which links the Aimag centre with Sum centres and that in Sum centre. The network capacity in Aimag will be increased to meet the demand fulfilment plan of each target year, that is, 2008, 2013, and 2020. The existing switching system may be replaced with a new concept switch or a switch node device of new technology to meet the requirements of IP-based network, provided that the life of existing equipment is over and IP network is available at the relevant Aimag centre. The target network be shifted to IP-based network by the year 2020 through three (3) phases. Selected Aimag-Sum transmission links and Sum centre networks should be digitised by 2008, and others be digitised and shifted to IP-based network by phases by 2020.

6.5 Numbering Plan

Telephone number of Mongolia consists of Country Code (CC), National Destination Code (NDC) and Subscriber Number (SN). The maximum number of digits of the telephone number (CC + NDC + SN) of Mongolia is 13. The national significant number, or the part consisted of NDC and SN, in Mongolian network is 8 to 10 digit in length. The former (8

digits) is for the fixed telephone lines in Ulaanbaatar and mobile/WLL network. The latter (9 to 10 digits) is for the land line network in Aimag centres and Sum centres.

The numbering capacity of telecommunications networks in Mongolia may not be sufficient in some areas in the near future, as the Government encourages the participation of new telecommunication service provider. The shortage in numbering may be found in:

(a) Access Code (AC) for the international call operator;
(b) Operator Selection Code (OSC) for mobile network operator; and
(c) Subscriber Number (SN) range of some Sum centres.

Regarding the AC for international call operator, it is preferred to separate the international call service networks into two (2) categories, that is, a) PSTN and b) IP-based network. Each of them should be given a code to differentiate the network. The possible shortage in the numbering capacity in the future on OSC for mobile/WLL network will be solved by a combination of:

(a) Separation of networks other than mobile/WLL from the group "9X"; and
(b) Insertion of one (1) digit between the first digit and the second digit.

It is preferred to take action in line with "Item (a)" above as soon as possible. The separation could be followed by an insertion of one (1) digit, if more shortage is foreseen. Exchanges codes in Ulaanbaatar shall be modified to complete the above separation of the non-mobile/WLL networks from Network Identification Code (NIC) "9". It is recommended to insert "5" before existing "92", "94", and "98", which are all non-mobile/WLL networks, "2" before MT exchange codes. The numbering range of the Sum centre in 2020 will not be sufficient in some cases This could be resolved to apply four (4) digits to subscriber number in such cases.

6.6 Signalling Plan

MT has applied specifications of the signalling system of CCS No. 7 protocol, which ITU-T Recommendations indicate, to the sections between most digital exchanges introduced under past projects. The relevant signalling system will be applied to the links between digital exchanges in the future too. ITU-T R2 signalling system is applied to the sections of analogue microwave transmission system and VSAT system.

The international gateway switch NEAX-61 installed in Ulaanbaatar is now connected with foreign countries exchanges with ITU-T No. 5 signalling system. The domestic side of the switching unit is functioning with ITU-T No. 7 signalling system. The international side is under upgrading construction to add the function of the ITU-T No. 7 signalling system. MT is going to adopt the ITU-T CCS No. 7 signalling system where it is applicable as it is an international standard of international telephony network.

6.7 Charging Plan

The automatic telephone call of MT network is charged in proportion to its duration in digital exchanges in the national capital and Aimag centres. The call within Sum centre is charged by month. The duration is converted to equivalent number of call units based on the tariff. Since the tariff system is revised by various reasons, the switching system shall be flexible to meet such changes.

MT digital switching equipment at transit point, which is actually the Aimag centre, is equipped with detailed billing function. The switching system records the charge data in two ways, that is, subscriber meter and detail information. The detail information includes data required for compiling detail bills for subscribers, which includes calling party's number, starting/completed time of payable communication, called parties number, exchange code, etc. The charge nodes should be local exchanges, transit exchanges and gateway switches for international connection. The gateway switch which has a link to/from the network of operators other than MT is equipped with charging function. Local calls should be charged at local exchange. Trunk calls should be charged at transit switching. International calls should be charged at international switching centre. As to the inter-network calls, the call charge data is obtained at MT gate way switches.

6.8 Quality Standard

The Technical Comittee-3 in the National Centre for Standardisation and Meteorology (NCSM) have set up procedures to keep Quality of telecommunication Service in Mongolia, based on ITU recommendations. Mongolia should set up an objective for speech quality and improve their network to achieve the objective. Connection Loss Probability is required for better customer service and to calculate number of circuits from traffic as well. Objective of delay in time from end of dialling to sending of ring-back tone should be set up for better service to customers.

6.9 Inter-Network Connetion

There are several telecomminications operators in Mongolia; telephone operatores, mobile telephone operators, WLL operatores, Pager operators, Internet service providers. Their networks are currently inter-connected in Ulaanbaatar. Along with network development of each operators, the points of interface will be scattered gradualy to remote areas from Ulaanbaatar, because it is one of business matters for telecommuncation operataors to bypass other operators' PSTN network for cost saving and try to make points of interface near to customers as many as possible.

There are many things to be considered for inter-networks connection with other operators: location of point of interface, singalling methode, numbering plan, billing methods, tariff (access charge), procedure of maintenace and operation, and etc. As for numbering plan, proper Destination Network Codes (DNC) to each of coming new carrier operatorss should be provided to have the options to establish the direct inter-network connection each other. At points of interface, there will be propably gateway switchs by which networks of defferent operators are conneted each other. Gateway switch usually gather billing informations related to the other operators, and act as demarcation point of maintenace and operation.

As for an interface with the access network, V5 Interface has been standardized as a common platform of the subscriber line interface which connects the switching system and the access network in accordance with ITU-T Recommendations. An interconnection interface is necessary to interconnect between the existing networks and new common carrier networks. For this purpose the following system should be standardized, that is;

(a) Numbering Plan;
(b) Tariff System;
(c) Types of Interconnections and Responsibility of Business Operators; and
(d) Interconnection Method.

7. DEMAND FORECAST AND FULFILMENT PLAN

7.1 Macroscopic Demand Forecast of Fixed Telephone

The national demand forecast of the fixed and mobile telephones in Mongolia is done, applying the ITU model, since the demand growth estimate has a close correlation between GDP per Capita and the telephone density per 100 inhabitants in general. Two (2) macroscopic demand forecast models of (i) 45 ITU Asian countries group and (ii) all ITU country group with same GDP value as Mongolia was analysed in applying the ITU models for Mongolia. Finally the first model of macroscopic demand forecast model (i) was selected. The following three (3) scenarios for the macroscopic demand forecast are formulated.

① Low growth demand forecast is estimated on the assumption of the growth rate of GDP per Capita (at 1995 constant price in US Dollar) at about 4%.

② Medium growth demand forecast is estimated on the assumption of the average annual growth rate of GDP per Capita (at 1995 constant price in US Dollar) at about 5% averagely obtaining in the Asian countries.

③ High growth demand forecast is estimated on the assumption of high growth rate of GDP per Capita (at 1995 constant price in US Dollar) at about 7.5%.

The results of the demand forecasts in low, medium and high growths are summarized in Table 7-1.

Table 7-1 Three (3) Scenarios for Fixed Telephone Demand Forecast

Scenarios	Formula for Demand Forecast	Results of Forecasted Demand at 2020 Number of Fixed Telephone/Telephone Density
①Low Growth	$y=0.2595\ x^{0.5090}$	2020; Fixed Telephone: 327,800, Density: 10.30
②Medium Growth	$y=0.4392\ x^{0.7869}$	2020; Fixed Telephone: 414,600,Density: 13.03
③High Growth	$y=0.0058\ x^{1.104}$	2020; Fixed Telephone: 543,500, Density: 17.08

y = Density; x = GDP per capita.

Out of three (3) scenarios of the whole country's demand forecast as described in Table 7-1, the medium growth scenario is selected to be more appropriate one for the demand forecast of the fixed telephone in Mongolia.

The national demand forecast of the fixed telephone is distributed to 21 Aimags in relation to the following manners:

(a) Weighted ratio of GRDP per Capita between the national GDP per Capita and the rural GRDP per Capita;
(b) Provisional telephone density with weighted ratio;
(c) Provisional demand of Aimag with provisional telephone density; and
(d) Final distribution weight is determined, considering an adjusted macroscopic demand of national base.

The demand forecast distributed to Aimags is further distributed from Aimag centre and Sum centres in relation to the following manners:

(a) Population weight of each Sum is calculated as a ratio to the total population;
(b) Demand weight of each Sum is calculated as a ratio to the total demand;
(c) Provisional weight is calculated as the total of the above (a) and (b); and
(d) Adjusted weight is calculated as the above (c) divided into 2 (2 weights).

The summary of the demand forecast of the fixed telephone is shown in Table 7-2.

Table 7-2 Summary of Demand Forecast of Fixed Telephone

	Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Demand	Total of Sum Centres	28,795	29,797	30,798	31,800	32,801	33,803	34,804	35,806	37,508	39,211
	Total of Aimag/Districts	92,138	95,540	98,943	102,345	105,747	109,149	112,552	115,954	121,389	126,824
	Ulaanbaatar	75,449	79,309	83,169	87,029	90,890	94,750	98,610	102,470	107,393	112,316
	National Total	167,587	174,849	182,112	189,374	196,637	203,899	211,162	218,424	228,782	239,139
GDP	Aimag	443	461	480	498	517	535	554	573	597	622
	Ulaanbaatar	892	913	934	955	976	997	1,018	1,039	1,073	1,106
	National Total	591	613	634	656	678	699	721	743	772	801
Pop.	Aimag	1,616,618	1,628,395	1,640,173	1,651,950	1,663,727	1,675,504	1,687,282	1,699,059	1,718,782	1,738,505
	Ulaanbaatar	750,840	774,820	798,801	822,781	846,761	870,741	894,722	918,702	938,977	959,252
	National Total	2,412,818	2,450,024	2,487,230	2,524,436	2,561,641	2,598,847	2,636,053	2,673,259	2,714,482	2,755,705
Teledensity	Aimag	5.70	5.86	6.02	6.18	6.34	6.50	6.66	6.82	7.05	7.28
	Ulaanbaatar	10.05	10.21	10.36	10.52	10.68	10.84	11.00	11.15	11.41	11.68
	National Total	6.95	7.12	7.30	7.47	7.65	7.82	8.00	8.17	8.41	8.66

	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Demand	Total of Sum Centres	40,913	42,616	44,318	46,670	49,021	51,373	53,725	56,077	58,428	60,780
	Total of Aimag/Districts	132,258	137,693	143,128	150,701	158,274	165,847	173,421	180,994	188,567	196,140
	Ulaanbaatar	117,238	122,161	127,084	133,836	140,588	147,340	154,093	160,845	167,597	174,349
	National Total	249,497	259,854	270,212	284,537	298,863	313,188	327,513	341,838	356,164	370,489
GDP	Aimag	647	672	697	729	762	794	826	858	890	922
	Ulaanbaatar	1,139	1,173	1,206	1,273	1,340	1,407	1,474	1,541	1,607	1,674
	National Total	830	859	888	928	969	1,009	1,049	1,089	1,129	1,169
Pop.	Aimag	1,758,228	1,777,951	1,797,674	1,823,241	1,848,808	1,874,375	1,899,943	1,925,510	1,951,077	1,976,644
	Ulaanbaatar	979,528	999,803	1,020,078	1,036,729	1,053,381	1,070,032	1,086,683	1,103,334	1,119,986	1,136,637
	National Total	2,796,928	2,838,151	2,879,374	2,922,598	2,965,823	3,009,047	3,052,271	3,095,495	3,138,720	3,181,944
Teledensity	Aimag	7.51	7.73	7.96	8.24	8.52	8.80	9.08	9.36	9.64	9.92
	Ulaanbaatar	11.94	12.20	12.46	12.87	13.28	13.69	14.10	14.52	14.93	15.34
	National Total	8.90	9.14	9.38	9.71	10.03	10.35	10.68	11.00	11.32	11.64