SUPPORTING FOR HUMAN RESOURCE DEVELOPMENT

Supporting for Human Resource Development

1. Current Official Task and Official Tasks under Telecom Act

Official Task: Current	Job Description	Official Task: Under the Telecom Act	Remark
		Study and define strategic plans for the development of telecommunications	
		Formulate policies, plans, programs, projects and obtain funding for the development of telecommunications	
Draft national telecommunications regulation and legislation	DT*	Study and draft regulations on the set up, management and use of telecommunications development funds for further submission to the Government for approval	
Determination of standardizations for telecom equipment and radio telecommunications	DT	Study and define technical standards: select the technology for telecommunications equipment and provide the rules and instruction for the use of that equipment within the country	
Study on telecommunications technologies	DT	**	
Promotion and supervision of the enterprises	DT	Study, propose or decide the issuance of licenses for the setting up, extension, suspension and termination of telecommunications business	
Maintenance of the relationship with ITU, ITU-T, ITU-R, APT, etc.	DT	Coordinate and cooperate with foreign countries and international organizations to create favorable conditions for the development of telecommunications	
Notification of frequency to ITU-R / Liaison of International Organization	DRFM		
Technological study on switching and data communications	DT	**	
Study and inspection of switching and data communication equipment	DT	**	
Study and inspection of radio communication equipment	DT	**	
Study on frequency pricing and relation with Intersputnik and Intelsat organization	DT	The administration and the use of the satellite position and orbit	
Recording the radio communication statistics	DT		
Recording the switch and data communications statistics	DT		
Technical study on radio communication HF, VHF, UHF, SHF, EHF	DT		

Official Task: Current	Job Description	Official Task: Under the Telecom Act	Remark
Study on telecommunications tariffs and accounting rates	DT	Study and propose regulations on tariffs, copyrights and other service charges	
Draft regulation on frequency management	DRFM	Management and allocation of the national radio frequency	
Promotion and Monitoring the application of regulation on frequency management	DRFM	**	
Frequency allocation and revocation	DRFM	**	
Preparation of import permission of radio equipment and license to authorized users	DRFM	**	
Billing for allocated frequency	DRFM		
Recording the allocated frequencies	DRFM		
Monitoring the allocated frequencies and search for free of use frequencies and unauthorized frequency	DRFM	**	
Inspection and adjustment of radio stations causing harmful interference	DRFM	**	
Monitoring and measuring the frequency causing harmful interference	DRFM	**	
		Administration of the country code top level domain name; the management of service providers and customers	
		Study, propose or decide the issuance of licenses for the setting up, extension, suspension and termination of telecommunications business	

Notes: *DT: Division of Telecommunications, DRFM: Division of Radio and Frequency Management.
**: These tasks are included in the "Article 21 Contents of Inspection" as shown below.

1.1 Article 21 Content of the Inspection

The key issues of the telecommunications inspection are as follows:

1. Inspection of the planning, surveys, and designs for the construction and installation of telecommunications facilities,
2. Inspection of safety standards and environment protection in the construction and installation of telecommunications facilities,
3. Inspection of technical standards and technology of the telecommunications facilities and equipment,
4. Monitoring of radio frequencies,
5. Inspection of the standard of services including the financial accounting records used in the telecommunications business,

6. Inspection of the implementation of telecommunications law, bidding documents, construction contracts and installation of telecommunications facilities, the fulfillment of contracts on telecommunications activities which the government has authorized a person or an organization to enter into an agreement within or outside the country, and contract agreements that the Government has signed with foreign countries.

1.2 Article 22 Forms of Inspection

There are three forms of telecommunications inspection as follows:

1. Regular inspection
2. Inspection with prior notification,
3. Immediate inspection.

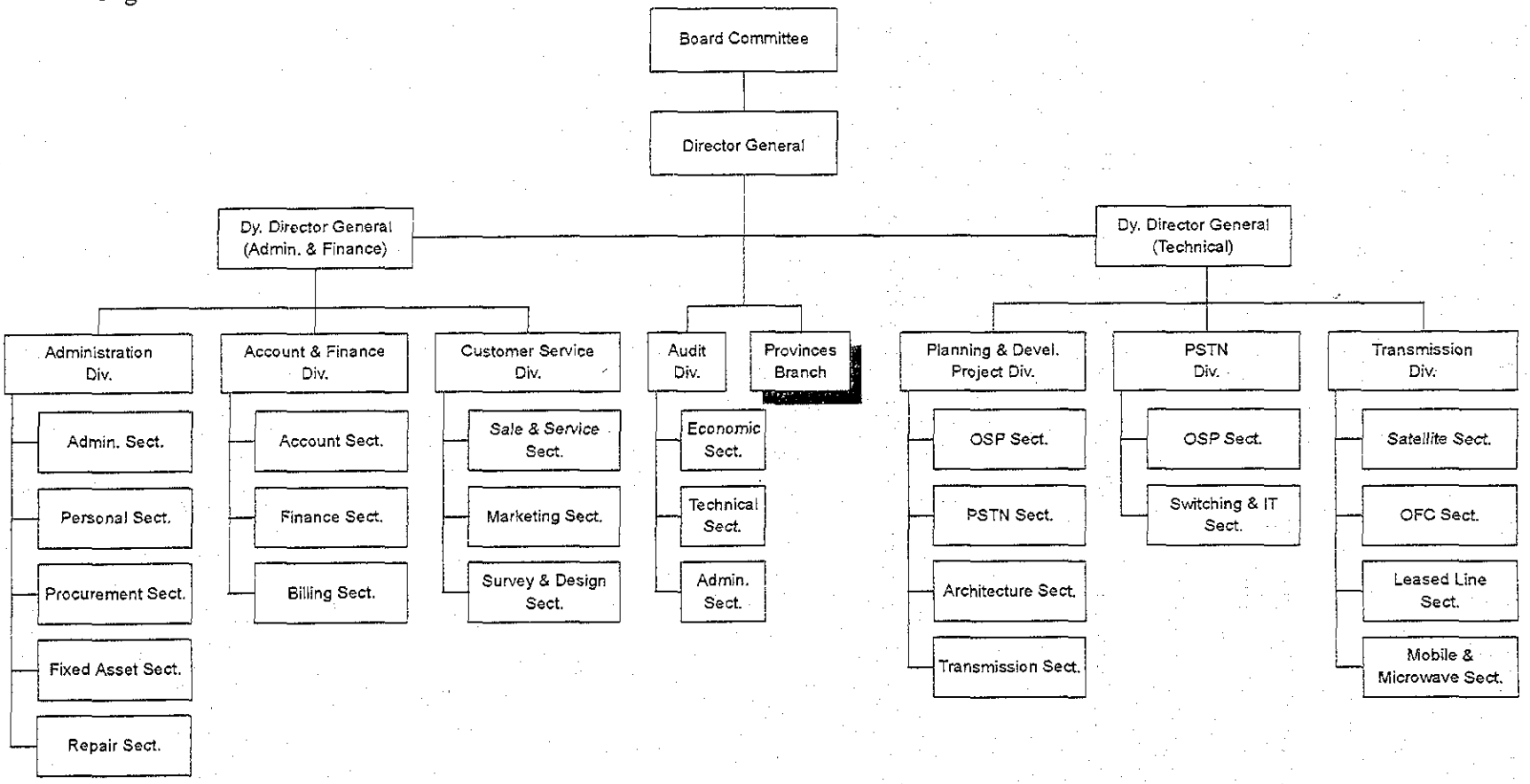
Regular inspection is conducted under a regular plan and within a limited time.

Inspection with prior notification is conducted beyond the provision of the plan when it is deemed necessary, without prior notification to the inspect person.

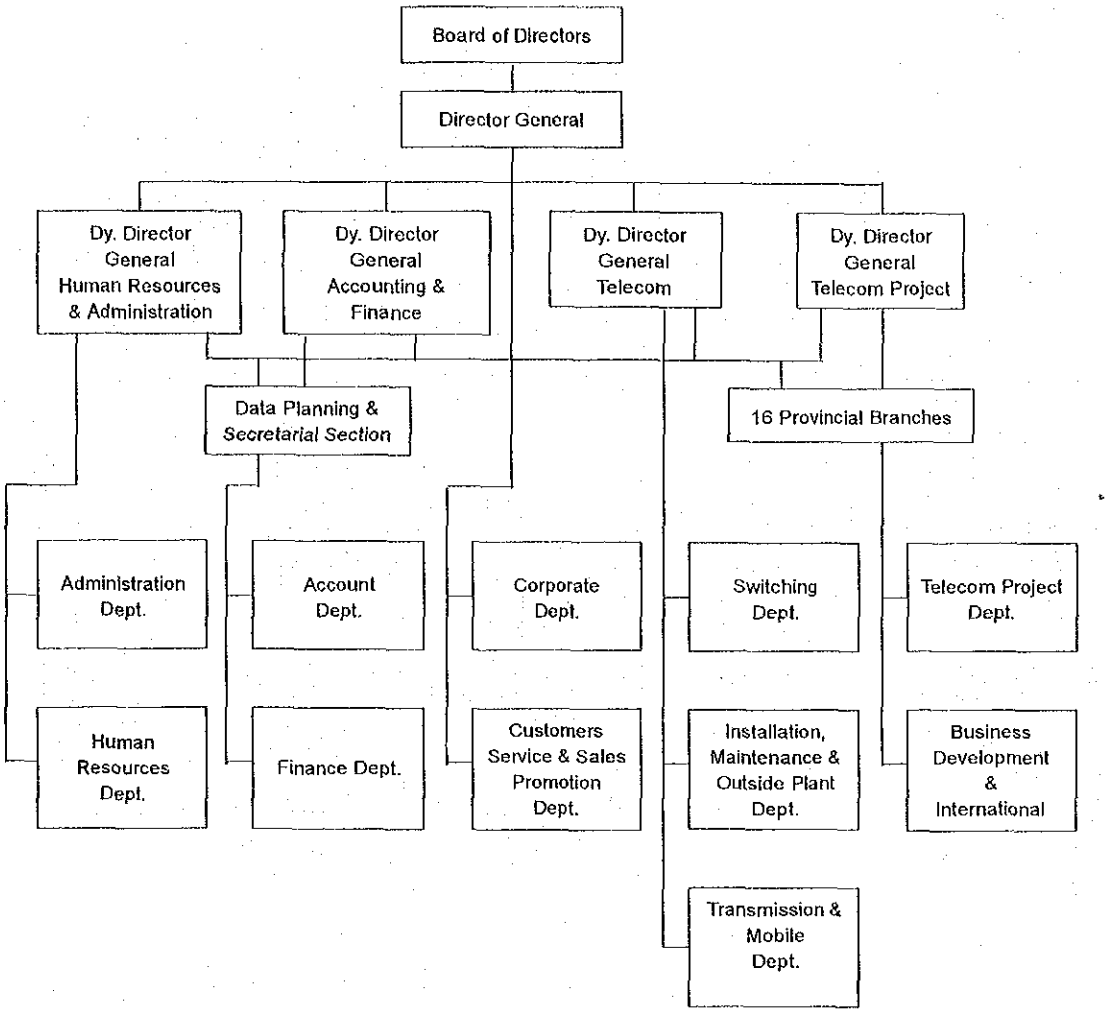
Immediate inspection is directly conducted without prior notification to the inspected person.

In conducting telecommunications inspections, the authorities of the inspection organization shall strictly exercise their duty in accordance with the law and regulations.

2 Organization Chart of ETL



3 Organization Chart of LTC



4 Number of Staff by Province and by Description (1999)

No.	Description	Telecom					Fin, Accounting & Marketing			Administration			Total
		Manager	Engineers	Technician I	Technician II	Workers	Manager	Officers	Workers	Manager	Officers	Workers	
I.	Vientiane Municipality	41	86	161	48	22	27	103	16	14	64	7	589
II.	Provinces	52	53	160	73	26	25	55	14	14	26	1	499
1	Phongsaly Province	2	4	3	3	3	2	3	1		2		23
2	Luangnamtha Province	3	2	9	4		1	2	1		1		23
3	Bokeo Province	1	1	11	6		1	1			1		22
4	Oudomxai Province	4	2	11	2	1	1	4		1	2		28
5	Luangprabang Province	2	8	14	11		1	6	3	1	4		50
6	Xayabouli Province	3	2	13	7		1			1	1		28
7	Houaphanh Province	3	3	6	4	3	1	2		1	2		25
8	Xiengkhuang Province	4	5	7	4	1	1	3	1	1	1		28
9	Vientiane Province	4	6	12	2	1	2	4	1	1	3		36
10	Bolikhamxai Province	2	4	13	9		1	3		1	1		34
11	Khammouane Province	5	4	14	1		1	5		1	4		35
12	Savannakhet Province	4	4	16	7	4	2	12	2	2	1		54
13	Champasack Province	4	3	18	7	2	3	7	1	3	1	1	50
14	Salavanh Province	4	1	3	1	9	2	2	2		1		25
15	Sekong Province	3	2	3	2	1	2	1	1		1		16
16	Attapeu Province	4	2	7	3	1	3		1	1			22
	TOTAL I + II	93	139	321	121	48	52	158	30	28	90	8	1,088

Source: -ditto-

5 Curriculum: Implemented

Code	SUBJECT	SWITCH	RADIO Trans-mission	OUT-SIDE PLANT
C01				
	1.1.1.1.1.1 MATHEMATICS			
	Arithmetics & Calculator	◎	◎	
	Algebra	◎	◎	
	Decibel	◎	◎	
	Trigonometry	◎	◎	
	Logarithms	◎	◎	
C02	**PHYSICS**			
	Heat	◎	◎	
	Movement	◎	◎	
	Mechanics	◎	◎	
	Sound	◎	◎	
	Light & Optics	◎	◎	
	Nuclear Physics	◎	◎	
C03	**FOREIGN LANGUAGE (ENGLISH)**	◎	◎	◎
C07	**TELECOMMUNICATIONS**			
	Signals: Spectra & Frequency Conversion	◎	◎	
	Analog Mod & Det (AM, FM, PM)	◎	◎	
	Discrete Transmissions (Sampling, PAM, PPM)	◎	◎	
	FDM & TDM	◎	◎	
	Quantizing, Coding & PCM	◎	◎	
	Interference & Noise	◎	◎	
	Principle of Switching		◎	
	Radio Communication Systems	◎		
	Transmission Systems	◎		
	Outside Plant Systems	◎	◎	
	Satellite Communications Systems	◎		
	Data Communications Systems	◎	◎	
	ISDN	◎		
	Digital Transmission Systems		◎	
	Quality Evaluation & Error Performance		◎	
	Digital Modulations		◎	
	Frames Structure		◎	
C09	**COMPUTER SCIENCE**	◎	◎	
SW1	**SWITCHING TEQUNIQUE I**			
	Analogue Switching	◎		
	Digital Switching	◎		
SW2	**SWITCHING TEQUNIQUE II**			
	Common Control Equipment	◎		
	Main Switching Equipment	◎		
	Trunk Line Equipment	◎		
	Subscriber Line Equipment	◎		

Code	SUBJECT	SWITCH	RADIO Trans-mission	OUT-SIDE PLANT
SW3	**SWITCHING TEQUNIQUE III**			
	Line Signalling/Numbering	◎		
SW4	**SWITCHING TEQUNIQUE IV**			
	System Software	◎		
SW5	**SWITCHING TEQUNIQUE V**			
	Optical Switching	◎		
SW6	**SAFTY & ACCIDENT PRECAUTIONS**	◎		
RT1	**MICROWAVES**			
	Propagation		◎	
	Line Parameters & Smith Chart		◎	
	Line Elements		◎	
	Antenna		◎	
	Microwave Electronics		◎	
RT2	**DIGITAL MULTIPLEX SYSTEMS**			
	Primary Multiplexer		◎	
	DSMX (Digital System MultipleXing)		◎	
	Modems		◎	
	DDF (Digital Distribution Frame)		◎	
RT3	**MICROWAVE SYSTEMS**			
	Cinfigulation		◎	
	EOW (Engineering Order Wire) System		◎	
	Power Supply		◎	
	Towers		◎	
	Passive Reflectors		◎	
RT4	**RADIO COMMUNICATION SYSTEMS**			
	Radio Transmitters		◎	
	Radio Receivers		◎	
	HF Systems		◎	
	VHF/ UHF Systems		◎	
RT5	**SATELLITE COMMUNICATIONS**			
	Theory of Satellite Communications		◎	
	Radio Transmitter		◎	
	Radio Receiver		◎	
	Antenna System		◎	
RT6	**OPTICAL FIBER SYSTEMS**			
	Optical Fibers; M/M, S/M		◎	
	Optical Transmitters		◎	
	Optical Receivers		◎	
RT7	**SAFTY & ACCIDENT PREVENTION**		◎	

Code	SUBJECT	SWITCH	RADIO Trans-mission	OUT-SIDE PLANT
OP1	**OUTSIDE PLANT MATERIAL**			
	Cables: Direct Burried, Duct, Aerial, Indoor			◎
	Closures: Heat Shrin Cable, Xyvulkanizing, Universal			◎
	Distribution Points: MDF, CCC, DP, Indoor Box			◎
	Dust System: Manholes, Pull Boxes, Pipes, Duct Liners			◎
	Protection: Earthing / Grounding Arrestors			◎
	Poles: Crossam, Guys			◎
	Maintenance & Measurement			◎
OP2	**EXTERNAL PLANT PLANNING**			
	Local Cable Network: Component Design, Calculation			◎
	Exchange & RSU Location			◎
	Short, Medium, & Long Term Plans			◎
	DP Symbols & Drawings			◎
OP3	**INSTALIATION PLANT PLANNING**			
	Planning			◎
	Civil Work			◎
	Cable Work			◎
	Assemly Units			◎
	Measurements			◎
	Construction Test			◎
	Acceptance Test			◎
OP4	**SUBSCRIBER TERMINALS**			
	Telephone Sets			◎
	PBX			◎
	Telefax			◎
	Modems			◎
	Public Telephone			◎

6 Specialized Short-term Courses (Source: TCTI)

The actually implemented courses/contents are checked "X" in the last row.

RADIO UNIT

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
R1	Basic Principles of Digital Transmission	2 Weeks	Technical/High Technician	• To understand the functional block diagram of basic digital transmission. • To understand the principles of PCM as applies to Digital Transmission.	• Introduction to Digital Transmission Principles • Time Division Multiplexing. • Fundamentals • PCM Sampling • PCM Quantifying • PCM Encoding, Decoding CODECS • Concept of Analogue to Digital Conversion • Digital Line Code • Signal impairment is Digital Transmission. • Transmission Quality • Digital Modulation Methods • Digital Radio System used in LTC network	X X X X X X X X
R2	Optical Fiber Cable Transmission System	2 Weeks	Technical/High Technician completing course R1. Engineers working in transmission system	• To understand the basic principles of optical transmission • To understand the optical source and detector • To design the optical transmission system	• Basic fundamentals of optical transmission • Optical source and detector • Line code • System design • Transmission standard and quality	X
R3	Rural Telecom. Operation and Maintenance System Course (OSC)	12 Weeks	Engineer / High Technician	• To understand basic technological principles of Rurtel system • To know the components of the RURTEL system and their functions • To use a personal computer to operate RURTEL software (DOS 5.0) • To initiate and apply corrective and preventive maintenance • To interpret and apply knowledge of basic • To statistics in order to evaluate system data • To report on O+M status	• Introduction to Lao Telecom network including RURTEL • Fundamentals of digital electronics, microprocessor and pulse code modulation as applied in RURTEL system • Basic components of RURTEL like BET, CST, RSV, SST • Operation & maintenance system of RUSTLE using personal computer • Data statistics • Preventive & Corrective Maintenance procedures • Trouble - shooting	X X X X X X

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
R4	Rural Telecom. Field Maintenance Course (FMC)	2 Weeks	Technician / High Technician	● To know basic components and their functions of the RURTEL system ● To apply knowledge of tools and test equipment ● To identify functional status ● To apply knowledge of technical and organizational functions and procedures to ensure preventive and corrective maintenance procedures are executed in accordance with O+M guidelines ● To apply maintenance procedures ● To demonstrate an O+M proceedings	● Introduction to LAO telecommunication network including RURTEL ● Basic components of RURTEL like EBT, CST, RST, SST ● Operation & maintenance procedures as applied in RURTEL using personal computer. ● Installation & maintenance of cable network & subscriber terminal. ● Trouble shooting	X X X
R5	Operation & Maintenance of Alcatel Microwave Transmission System	2 weeks	Technician / High Technician completing course R1, Engineers working in transmission system	● To understand the basic block diagram of the Alcatel micro wave system ● To understand the function of each module ● To understand the operating principles and troubleshooting techniques of the system ● To operate and maintain the Alcatel m/w system in practice ● To interpret various alarms generated in the supervisor system ● To rectify various faults in the system and maintain the log	● Basic block diagrams of the system ● Complete m/w transmission network of the country ● *Review of Digital Transmission System* ● Introduction of ALCATEL Microwave system ● Function of each module in the microwave system ● Operation principle of the system ● *Supervisory sub-system* ● Flow chart and Troubleshooting techniques ● Familiarization of basic test and maintenance equipments ● Practical sessions for operation and maintenance of the system. ● ALCATEL Microwave network in the country	X X X X X X X
R6	Data Communication & Packet Switch Network	2 Weeks	*Engineer /* Technician / High Technician working experience in Data Communication	● To understand the basic principles of data communication. ● To understand modem & multiplex used on data communication. ● To understand *legend network architecture.* ● To understand the concept of OSI layers. ● To understand the principles of packet switching.	● Basic concept of data communication ● Communication media ● Modems & Multiplex equipment for data communication ● *Legend network architecture* ● Concept of OSI layers. ● Protocols modem TCP/IP ● Interface standard ● *Wide area network* ● Different type of Packet Switching, ISDN. ● New technologies like Frame relay, ATM, SDH/S ONNET.	X X X
R7	Satellite Communication & VSAT	4 Weeks	Engineer / High Technician experienced in	● To understand the basic principles & configuration of satellite communication. ● To understand the functioning of INTELSAT	● Basic theory & configuration of Satellite Communication, ● Concept of Ground & Space System	X X

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
			Transmission /Microwave Network	organization. ● To understand the different services offered on INTELSAT. ● To understand the operation of Satellite Earth Station. ● To understand the operation & maintenance of VSAT.	● Launching of a Satellite into an orbit. ● INTELSAT and its functioning ● Different services offered by Intelsat like IDR, TDMA SCPC & DCME etc. ● Function and block diagram of Satellite Earth station and equipment like ➢ Ground Communication Equipment ➢ Low noise Amplifier ➢ High noise Amplifier ➢ Antennas ➢ Power equipment ● Type of equipment used in Satellite Earth station, in Lao, P.D.R. and its special features ● Functioning of VSAT System and its network architectures. ● C Band & KU- band VSAT ● VSAT Network ● Future development	X X X X X X X X X
R8	TDMA / CDMA Techniques and WLL	2 Weeks	High Technicians, completing course R1 Engineers working in transmission systems	● To understand the basic principle of Time Division / Multiplexing, Time Division Multiple Access techniques and their applications, ● To understand the principle of Code Division Multiple Access technique and its applications, ● To understand and interpret the merits and demerits of Wireless Local Loop over the conventional copper loop, ● To understand the principle of operation of WLL systems based on TDM / TDMA and CDMA techniques, ● To understand various types of WLL systems based on TDM / TDMA and CDMA techniques,	● Review of Digital Transmission system ● Introduction of TDMA technique ● Application of TDMA ● Introduction of CDMA technique ● Applications of CDMA ● Introduction of WLL ● Copper local loop vs Wireless local loop ● TDM/TDMA based and CDMA based WLL systems	X X X X X X
R9	Introduction to Internet	2 Weeks	Engineers / High Technicians with working experience in Data Communication	● To understand LAN, WAN, MAN and development of the world wide computer network the INTERNET, ● To understand the concept of Internet, ● To understand the features and facilities in the Internet, ● To use the various features (applications) such as e-mail, www, etc., ● To understand the concept of home page and http,	● Concept of Computer networking ● Concept of Circuit switching, Message switching and ● Packet switching ● Design feature of computer communications network ● Introduction of LAN, WAN and MAN ● TYMNET, ARPANET etc ● Protocols: concept of OSI layers	X X X X X X X

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
				• To understand the concept of addressing system, • To understand the various protocols such as TCP / IP etc.,	• Development of the worldwide computer network - the Internet • Features and facilities of the Internet • Addressing system in the Internet • Concept of home page, www and http • Practical sessions on the Internet	X X X X X

Switching Unit

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
S1	Fundamentals of Digital Switching System	2 Weeks	High Technician / Technician	• To understand the fundamentals of digital switching system • To understand the basic principles of SPC switching system.	• Different types of switching system from conventional electromechanical to SPC digital system. • Electronic switching system • Time division multiplex techniques • Hardware configuration of TDM switching system. • Software for switching system • Introduction of SPC switching systems as being used in Lao telecommunication network. • Telephone Traffic.	X X X X X
S2	Operation & Maintenance Fujitsu Fetex 150	6 Weeks	Engineer/High Technician and knowledge in MS DOS	• To understand the system structure of fetex 150 • To understand the operation of SCWS, TWSM, Magnetic tape control • To understand the speech path sub system & subscriber control • To perform the changes if necessary do trouble-shooting & clear the fault up to PCB level	• System Structure of Fetex 150. • Introduction & configuration of system control work station • Magnetic tape control • Hard ware configuration • Serial interface adapter (SIA) & channel to channel adopter (CCA) • Control processing sub system (CPS) • Software interface for SIA, CCA & CSE • Maintenance of FM, SIA, CCA. • Change in official data • Diagnostic trouble analysis • Traffic measurements	X X X X X X X
S3	Operation & Maintenance of Siemens EWSD System	6 Weeks	Engineer / High Technician experienced in exchange and knowledge of MS	• To understand the system of the Siemens EWSD and its modules. • To understand the function of DLU, LTG, CP, SN etc. • To refer the different documents of EWSD exchange • To carryout operation & maintenance task of EWSD	• Introduction to EWSD system • EWSD's HW system architecture • Function of different module of EWSD like DLU, LTG, CPSN, MB, CP, CCNC, & CCG • EWSD SW system architecture	

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
			DOS	exchanges ● To understand call setup & subscriber administration ● To understand different facilities of EWSD exchange	● Operation & Maintenance procedures manuals. ● Exchange configuration documents ● Input / Output structure of CP 1 13. ● Peripheral units of the system ● Call processing & call set-up ● Subscriber facilities ● Data saving ● Traffic observation & measurement	
S4	Signalling in Telephone Network & CCITT No 7 Signalling	4 Weeks	Engineer / High Technician experienced in exchange	● To understand different types of signalling in an exchange ● To understand the principle of R2 (digital) & No 5 signalling ● To understand the principal of C7 Signalling.	● Different types of Signalling like subscriber, trunk line, backward, forward signalling etc. ● Principles of R2 signalling Function of signals used in R2 Signalling codes ● Principles of No 5 signalling Function of signals used in No 5 Signalling codes ● Principle of No 7 signalling & its basic structure ● Advantage of No 7 signalling over other system. ● Protocols & parameters of No 7 signalling ● Routing & interconnection using No 7 signalling.	X X
S5	Operation & Maintenance of A/C Plants	4 Weeks	Technician / High Technician experienced in Power Plant maintenance	● To understand refrigeration cycle used in air-conditioning plant ● To understand & identify different components of A/C plant ● To understand & operate A/C Plant ● To trace out faults and repairs air conditioning equipment	● Basic refrigeration cycle ● Different components & their function ● Control device & control cells ● Fault finding technique ● Operation & maintenance of window & split type units	
S6	Operation & Maintenance of Power Plant	2 Weeks	Technician experienced in Power Plant	● To understand operation of diesel generator set, rectifier and battery ● To analyze different alarms ● To measure specific gravity, terminal voltage of the battery and the output voltage and current of the rectifier ● To fill the records and report forms ●	● Functional & operation description of diesel generator, Rectifier & battery ● Alarm signals ● Trouble shooting in rectifier and control panel, ● Falling records and report forms	
S7	Traffic Engineering	1 Week	Switching / Transmission	● To understand basic traffic terminologies, ● To understand Erlang formulas.	● Basic terminologies in traffic ● Properties of Telephone Traffic	

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
			Engineer	● To carryout traffic measurement traffic fore casting ● To evaluate the whole system by monitoring traffic & other statistical data.	● Enlarge B- formula & exercise ● Blocking in Tenders Currents ● Alternate Routine ● Routine Principle ● Traffic measurements ● Traffic fore casting, dimensioning & routing. ● Delay System	
S8	GSM Mobile Cellular System	3 Weeks	High Technician / Engineer working experience in Exchange	● To understand the basic concept of GSM mobile cellular system. ● To understand the network structure of GSM system working in Lao telecom network. ● To understand basic principle of operation & maintenance of GSM system.	● Background & basic concept of GSM system. ● Network structure ● GSM Switching system ● Radio network in GSM ● Traffic handling ● Traffic registration ● Signalling ● Securities ● O& M concept of the system	X X X X X X X X X
S9	Introduction to ISDN	2 Weeks	Engineers / High Technician with working experience in Digital exchange	● To understand the basic concept of Integrated Services Digital Network. ● To understand the concept of Network terminator. ● To understand the concept of No. 7 signalling. ● To understand the concept of various features of ISDN.	● Review of PSTN ● Introduction of ISDN ● Network terminator ● Review of R2 signalling ● Concept of signaling system used in ISDN ● Features and Applications of ISDN ● ISDN network in the country	

Management Unit

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
M1	Induction course for new staff (Technical)	4 Weeks	New recruits	• To understand existing telecommunication network. • To understand the existing organization and facilities provided by LTC • To understand the expansion program of LTC. • To understand the operation & maintenance	• History & background of telecommunication development in Lao, P.D.R.. • Organizational structure of LTC and functions &responsibilities of different department. • Existing facilities & system in different field like switching, transmission & outside plant. • Expansion program of LTC and long term planning. • Operation & maintenance procedure of existing telecommunication network. • Financial position of LTC. • Computerization in LTC.	
M1	Induction course for new staff (Non Technical)	2 Weeks	New recruits	• To understand existing telecommunication network. • To understand the existing organization and facilities provided by LTC • To understand the expansion program of LTC. • To understand personnel & financial system of LTC	• History & background of telecommunication development in Lao, P.D.R.. • Organizational structure of LTC and functions & responsibilities of different department. • Existing facilities & system is different field like switching transmission outside plan. • Expansion program of LTC and long term planning. • Personnel & Financial system of LTC. • Financial position of LTC. • Computerization in LTC.	
M2	Trainers ' Training	3 Weeks	Instructors and subject matter experts	• To analyze the training needs of the target group • To design & organize the training program • To prepare lesson plan and select proper teaching method • To conduct training • To evaluate the training product and feedback from the trainees	• Role of training in organization • Course development process • Training needs analysis • Principles of teaching learning process • Adult learning process • Design on the job training and participatory approach • Section of proper training methods • Preparation of training materials • Evaluation of trainees and trainers • Listening skills • Communication skills • Motivation	
M3	Management Skill	2 Weeks	Senior officer in Telecommunica-ti on Organization	• To explain managerial role with reference to their job and responsibilities. • To improve their leadership, communication and'	• Organization role • Fundamentals of management skill • Team work	

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
				division making qualities in their job.	• Leadership • Planning of the work • Communication Skills • Motivation • Decision Making • Delegation of authority	
M4	Financial Management	2 Weeks	Officers working in finance department	• To understand financial concept of telecommunication business To understand basic concepts of accounting and financial management practiced in LTC.	• Financial concept in telecom administration. • Concepts in financial management • Corporate financial management. • Balance sheet, profit & Laos account. • Various method of budgeting • Telecom accounting • National & International Tariff. • International total accounting rate (TAR) and international traffic accounting.	

Cable (Outside Plant) Unit

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
C1	Basic Outside Plant Network	2 Weeks	Experienced in Outside Plant	• To describe the structure and elements of SOP network. • To describe the function of a) Main distribution frame (MDF) b) Cross Connecting Cabinet (CCC) c) Distribution point (DP) • To describe different kinds of underground, aerial, submarine cable and indoor wire. • To read, understand & draw the OSP diagram.	**Module 1: Basic OSP** • Structure & elements of OSP • Symbols & maps used in OSP • Different types OSP Cables • Different components of OSP like MDF, CCC, DP, Poles & accessories • Reading & drawing of OSP network diagram • Overview & Design of Cable Network • Junction Cable Network • Safety Rules	
C2	Outside Plant Planning	2 Weeks	Experienced in Outside Plant	• To prepare fundamental plan of OSP network. • To estimate the requirement of OSP materials; cables, poles etc. for an exchange area.	Planning Overview. • Design consideration • Demand survey & forecasting. • Location of exchange & coverage area • Fundamental cable & duct plan	

Code	TITLE	Duration	Entry Level	Course Objectives	Course Contents	
					Cable Planning ● Preparation of duct, primary cable & secondary cable network plan. ● Splicing schedules ● *Preparation of estimate & costing* ● Preparation of final OSP cable plan	
C3	Outside Plant Installation Practice	4 Weeks	Completed Basic OSP course (C1)	● To supervise laying of ducts, construction of manholes, joint boxes, cabinets, DP etc. ● To install self supporting aerial cable, underground directly buried cable and underground duct cable. ● *To make splicing of aerial & u/g cables* ● To enclose the joint & test.	Module 2: Laying of ducts, construction of m/w and joint boxes ● Trenching for laying of ducts ● Laying PVC duct & GI pipes ● Use of duct spacer ● Protection of ducts and sealing of ducts ● Types of manholes & joint boxes ● Construction of manhole & joint box ● Construction of base for cross-connecting cabinet ● Earthing of the cabinet Module 3: Self-supporting Aerial Cable Installation. ● Erection of poles, stay & push brace ● Installation S/S aerial cable & DP ● Splicing, enclosing & testing. ● Earthing. Module 4: Underground Cable Installation ● Laying of direct buried u/g cable ● Rodding & testing of ducts ● U/g duct cable pulling ● Cable splicing, enclosing and vault enclosing ● Testing	
C4	Cable splicing	2 Weeks	Completion of basic OSP course (C1)	● To understand basic color code of the telephone cable ● To understand the assembly of the cable and manufacturing of the cable ● To carryout twist joint, single wire connection & modular connection ● To carryout the enclosing of a joint ● To test	● Basic Color Codes & Types of insulation (Plastic foam) ● Assembly of cable ● Manufacturing of cable ● Jointing methods a) Twist Joint b) Single wire joint using connector c) Modular connection d) Practice	

Code	TITLE	Duration	Entry Level	Course Objectives	*Course Contents*	
					● Different types of heat shrink enclosure ● Enclosing practice of a joint ● Testing of a cable joint	
C5	Maintenance of OSP network	1 Week	Completed basic OSP course	● To use different types of maintenance tools ● *To measuring instrument* ● To localize the fault and rectify ● To test	● Different types of faults and their causes ● Different types of tools and measuring instruments ● Record keeping ● Fault localization & maintenance ● Safety rules of maintenance	
C6	Optical Fiber Cable Communication System	6 Weeks	Completed basic OSP course	● To understand & describe basic parameter of optical fiber cable (OFF) and different type of OFC. ● *To understand & describe optical fibre transmission system* ● To install self supporting aerial and u/g OFC ● To splice OFC by using connector & fusion method ● To measure different parameters of OFC system	Module 1: Basic optical Parameters ● Different types of OFC ● Physical construction of OFC ● Manufacturing of OFC Module 2: OFC transmission System ● Configuration of OFC Comm. system. ● Multiplexing / De-multiplexing ● Optical devices ● Electrical to optical conversion & vice versa Module 3: Installation & Splicing of OFC ● Installation of OFC a) directly busied b) duct c) self-supporting aerial ● Fusion Splicing Method ● *Connector Splicing Method* ● Enclosing OFC joint Module 4: Measurements ● *Measuring instruments* ● Optical power & loss measurements ● Fault location	
C7	Subscriber Installation Practice	1 Week	Completed basic OSP course	● To carry out indoor wiring ● To allot the primary & secondary pairs and do the jumpering in MDF, & Cabinet ● To install subscriber terminals and test	Module 1: Subscriber Installation ● Indoor wiring ● Provision of primary & secondary pair ● *Jumpering in MDF and CCC* ● Installation of drop-wire & subscriber terminal set ● Testing & recording	

7 Demand of Human Resources in Telecommunication Sector

7.1 Teledensity and Line Productivity

Using the ITU data in 2001, the function of line productivity and teledensity was formulated. The result is:

ln(LP)=0.37218 x ln(TD) + 3.45723

(17.25) (48.83) R^2=0.6092

LP: Line Productivity (Number of lines per employment)

TD: Teledensity (Lines per 100 habitants)

( ): t-value (Both coefficients are not null)

R^2: Determination Coefficient

Using this formula, the employment of telecommunication sector in Lao P.D.R. is estimated[1].

The result of the calculation before adjustment is illustrated as follows.

Table 7.1 Number of Employment (Non-adjusted)

	Teledensity	N. of Lines	Employer
2000	30.70	47,887	1,560
2005	48.16	184,012	3,821
2010	53.89	285,377	5,296
2015	60.09	438,375	7,295

Source: Study team estimates.

The figures in the column of 2000 are the theoretical value to extrapolate the actual figures. Comparison of the difference between theoretical value and actual value indicates that the theoretical value is much larger than the actual value. The estimated values, therefore, are also to be over-shot. Introducing the principal of facilities (e.g. the criteria of manned switching center) and the adjustment between theoretical value and actual value require the change of the calculated figures. The result of the adjusted value tabulated as follows.

Table 7.2 Number of Employment (Adjusted)

	2001	2005	2010	2015
Number of Main Lines	52,600	184,012	285,377	438,375
Teledensity (per 100 inhabit)	1.46	3.07	4.15	5.56
Line Productivity	41.4	65.7	67.9	74.3
Number of Employment	1271	2,800	4,200	5,900

Source: Study team estimates.

1 From the Demand analysis, Teledensity and number of lines are forecasted in 2005, 2010 and 2015. To insert the values of teledensity in each year to the formula, the line productivities are calculated. The line productivity is formulated as number of lines divided by the employment so the number of employment in each year is calculated as the forecasted lines divided by the line productivity respectively.

7.2 Adjustment by side information

The estimates of the employment illustrated in Table 7.2 are assumed to be fully satisfied the telephone demand. On the other hand, the supply of facility is not sufficient for the demand. Therefore further adjustment is required. In the year 2005, 2010 and 2015, the sufficient rate (the rate that facility supply is divided by demand) is estimated around 56%, 98% and 100% respectively. So the adjustment using by the rate was carried out. The results are tabulated as follows.

Table 7.3 Number of Employment (Adjusted by side information)

	2001	2005	2010	2015
Number of Main Lines	52,600	104,000	285,000	438,000
Teledensity (per 100 inhabit)	1.46	1.73	4.15	5.56
Line Productivity	41.4	54.7	69.5	74.2
Number of Employment	1,271	1,900	4,100	5,900

Source: Study team estimates.

7.3 Estimates by Job-types

Based on the total number of the employment (Table 7.3) and the existing data (Chapter 4), the Job-type of employment (Technical, Administrative, Manager, Engineer, Technicians, Officer, etc.) and its provincial distribution are estimated. The structure of the job-type of employment is assumed as constant. The special distribution of the employment, on the other hand, is assumed to gradually change to be equilibrium between Vientiane Municipality and other provinces.

Table 7.4 Number of Employment (Job-types and Spatial Distribution)

		2001			2005			2010			2015		
		Vientiane	Provinces	Total	Vientiane	Provinces	Total	Vientiane	Provinces	Total	Vientiane	Provinces	Total
Technical	Manager	49	59	108	72	90	162	147	205	352	206	307	513
	Engineers	103	60	163	150	92	242	312	209	521	430	313	743
	Technician	250	265	515	365	407	772	758	918	1,676	1,046	1,378	2,424
	Worker	26	30	56	39	45	84	80	102	182	110	154	264
	Sub-total	428	414	842	626	634	1,260	1,297	1,434	2,731	1,792	2,152	3,944
Administration & Finance	Manager	49	44	93	71	68	139	148	154	302	205	231	436
	Officer	200	92	292	292	142	434	606	318	924	837	479	1,315
	Worker	27	17	45	40	26	67	84	59	143	115	88	204
	Sub-total	276	153	430	403	236	640	838	531	1,369	1,157	798	1,955
Grand Total		704	567	1,272	1,029	870	1,900	2,135	1,965	4,100	2,949	2,950	5,899

Source: Study Team estimates

8 Proposed Curriculum

The followings is model Curriculum prepared by the team.

Code	SUBJECT	SWITCH	RADIO Trans-mission	OUTSIDE PLANT
C01	**MATHEMATICS**			
	Arithmetics & Calculator	◎	◎	◎
	Algebra	◎	◎	◎
	Decibel	◎	◎	◎
	Trigonometry	◎	◎	◎
	Logarithms	◎	◎	
	Statistics & Probability	◎	◎	
	Binary Numbers	◎	◎	
C02	**PHYSICS**			
	Heat	◎	◎	◎
	Movement	◎	◎	◎
	Mechanics	◎	◎	◎
	Sound	◎	◎	◎
	Light & Optics	◎	◎	
	Nuclear Physics	◎	◎	
C03	**FOREIGN LANGUAGE (ENGLISH)**	◎	◎	◎
C04	**ELECTRICITY**			
	Phase, Frequency	◎	◎	◎
	Magnetism	◎	◎	◎
	DC Theory	◎	◎	◎
	AC Theory	◎	◎	◎
	Transformers	◎	◎	◎
	Power Supply Inc. UPS	◎	◎	
C05	**ELECTRONICS**			
	Semiconductors	◎	◎	
	Diode: Kind, Characteristics, Function	◎	◎	
	Transister: Kind, Characteristics, Function	◎	◎	
	Analogue Circuits	◎	◎	
	Digital Circuits	◎	◎	
	Microprocessor	◎	◎	
	Microcomputer	◎	◎	
C06	**ENGINEERING DRAWING**	◎	◎	
C07	**TELECOMMUNICATIONS**			
	Signals: Spectra & Frequency Conversion	◎	◎	
	Analog Mod & Det (AM, FM, PM)	◎	◎	
	Discrete Transmissions (Sampling, PAM, PPM)	◎	◎	
	FDM & TDM	◎	◎	
	Quantizing, Coding & PCM	◎	◎	
	Interference & Noise	◎	◎	

Code	SUBJECT	SWITCH	RADIO Trans-mission	OUTSIDE PLANT
	Principle of Switching		◎	
	Radio Communication Systems	◎		
	Transmission Systems	◎		
	Outside Plant Systems	◎	◎	
	Satellite Communications Systems	◎		
	Data Communications Systems	◎	◎	
	ISDN	◎		
	Digital Transmission Systems		◎	
	Quality Evaluation & Error Performance		◎	
	Digital Modulations		◎	
	Frames Structure		◎	
C08	**COMMUNICATION NETWORK**			
	Network Classifications	◎	◎	
	Public Services	◎	◎	
	Private Services	◎	◎	
	Network Configuration	◎	◎	
	Future Services	◎	◎	
	Network Hierachy	◎		
	Network Plant	◎		
	Numbering Plan	◎		
	Routing Plan	◎		
	Signaling Plan	◎		
	Changing Plan	◎		
	Traffic Theory	◎		
	Traffic Measurement	◎		
	Circuit Calculation	◎		
	Trunking Diagram	◎		
	Traffic Estimation	◎		
	Equipment Calculation	◎		
C09	**COMPUTER SCIENCE**	◎	◎	
C10	**MANAGEMENT**	◎	◎	
SW1	**SWITCHING TEQUNIQUE I**			
	Analogue Switching	◎		
	Digital Switching	◎		
	Telecommunications Quality	◎		
SW2	**SWITCHING TEQUNIQUE II**			
	Common Control Equipment	◎		
	I/O Equipment, Signalling/Numbering	◎		
	Main Switching Equipment	◎		
	Trunk Line Equipment	◎		
	Subscriber Line Equipment	◎		
	Test Equipment	◎		

Code	SUBJECT	SWITCH	RADIO Trans-mis sion	OUTSIDE PLANT
SW3	**SWITCHING TEQUNIQUE III**			
	Line Signalling/Numbering	◎		
	Regular Signalling	◎		
	CCITT Signalling Systems	◎		
	Charging	◎		
SW4	**SWITCHING TEQUNIQUE IV**			
	System Software	◎		
	HLDC (High Level Data link Control procedure)	◎		
SW5	**SWITCHING TEQUNIQUE V**			
	ATM Switching	◎		
	Optical Switching	◎		
SW6	**SAFTY & ACCIDENT PRECAUTIONS**	◎		
RT1	**MICROWAVES**			
	Propagation		◎	
	Line Parameters & Smith Chart		◎	
	Line Elements		◎	
	Antenna		◎	
	Microwave Electronics		◎	
RT2	**DIGITAL MULTIPLEX SYSTEMS**			
	Primary Multiplexer		◎	
	DSMX (Digital System MultipleXing)		◎	
	Modems		◎	
	DDF (Digital Distribution Frame)		◎	
RT3	**MICROWAVE SYSTEMS**			
	Cinfigulation		◎	
	Hop Calculation		◎	
	DRS (Digital Radio System)		◎	
	EOW (Engineering Order Wire) System		◎	
	Protection Switching		◎	
	Power Supply		◎	
	Towers		◎	
	Passive Reflectors		◎	
RT4	**RADIO COMMUNICATION SYSTEMS**			
	Radio Transmitters		◎	
	Radio Receivers		◎	
	HF Systems		◎	
	VHF/ UHF Systems		◎	
	Cellular Telephone Systems		◎	
RT5	**SATELLITE COMMUNICATIONS**			
	Theory of Satellite Communications		◎	
	Radio Transmitter		◎	
	Radio Receiver		◎	
	Antenna System		◎	

Code	SUBJECT	SWITCH	RADIO Trans-mis sion	OUTSIDE PLANT
RT6	**OPTICAL FIBER SYSTEMS**			
	Optical Fibers; M/M, S/M		◎	
	Optical Transmitters		◎	
	Optical Receivers		◎	
	OLTE / OLRE*		◎	
	FDP		◎	
	Splicing of Fibers		◎	
RT7	**SAFTY & ACCIDENT PREVENTION**		◎	
OP1	**OUTSIDE PLANT MATERIAL**			
	Cables: Direct Burried, Duct, Aerial, Indoor			◎
	Closures: Heat Shrin Cable, Xyvulkanizing, Universal			◎
	Distribution Points: MDF, CCC, DP, Indoor Box			◎
	Dust System: Manholes, Pull Boxes, Pipes, Duct Liners			◎
	Protection: Earthing / Grounding Arrestors			◎
	Poles: Crossam, Guys			◎
	Electronic Equipment: RSU, Line Concentrator			◎
	Maintenance & Measurement			◎
OP2	**EXTERNAL PLANT PLANNING**			
	Local Cable Network: Component Design, Calculation			◎
	Exchange & RSU Location			◎
	Short, Medium, & Long Term Plans			◎
	DP Symbols & Drawings			◎
OP3	**INSTALIATION PLANT PLANNING**			
	Planning			◎
	Civil Work			◎
	Cable Work			◎
	Assemly Units			◎
	Measurements			◎
	Construction Test			◎
	Acceptance Test			◎
OP4	**SUBSCRIBER TERMINALS**			
	Telephone Sets			◎
	PBX			◎
	Telefax			◎
	Modems			◎
	Public Telephone			◎

9 Model Training Equipment

The Model Training Equipment is only reference.

Course	Name of Equipment	Quantity	Ref.
Basic	Logic Circuit Training Kit	3	
Basic	Pulse Circuit Training Kit	3	
Basic	Counter Circuit Training Kit	2	
Basic	AD-DA Converter Training Kit	2	
Basic	Frequency Modulator/Demodulator Training Kit	2	
Basic	60 MHz Digital Storage, Oscilloscope	1	
Basic	Function Generator	2	
Cable	Optical Fiber Cutter	10	
Cable	Tape Dividing Tool	6	
Cable	Optical Fiber Cable Holder	30	
Cable	Optical Fiber Cable (1,000m)	5	
Cable	CTF	1	
Cable	Optical Loss Test Set & Accessories	1	
Cable	Fusion Splicer	2	
Cable	Optical Fiber Cable	2	
Cable	MT Connector Assembling Machine	2	
Cable	Optical Time Domain Reflectometer MW0947B SMF 1.31/1.55UM Unit, Z0240 Spare Parts;Thermal Roll Paper	2	
Computer C	PC	12	
Computer C	Software	1	
Computer C	Network Printer	1	
Computer C	Computer (with a built-in wide ultra SCSI Board)	2	Training of LAN
Computer C	Uninterrupted Power Supply	2	Training of LAN
Computer C	Router, Main Body	3	Training of LAN
Computer C	Computer (Work Station)	10	Training of LAN
Computer C	Printer	2	Training of LAN
Computer C	Switching Hub	3	Training of LAN
Computer C	Cable Tester	2	Training of LAN
Computer C	ISDN Simulator	1	Training of LAN
Computer C	Network Analytical Software Set	1	Training of LAN
Computer C	Note Book PC	1	Training of LAN
Computer C	Projector	1	
Lab	System Data BSC (WSC)	1	
Lab	Basic Software	1	
Lab	System Data for BTS	1	
Lab	Installation Materials for BTS	1	
Lab	Operation and Maintenance, Terminal for BSC (WSC)	2	
Lab	Attenuator Set and Distributor	1	
Lab	Documents for BSC (WSC)	1	
Lab	Basic Frame	1	
Lab	Installation Materials for BSC (WSC)	1	
Lab	Interworking Function Equipment Frame	1	
Lab	Basic Frame (BTS)	1	

Course	Name of Equipment	Quantity	Ref.
Radio	Transmission Measuring Set	1	
Radio	Frequency Counter	2	
Radio	Power Meter	1	
Radio	High Frequency Amplifier	1	
Radio	Variable attenuator	2	
Radio	Attenuator Set	4	
Radio	Supervisory and Control/Equipment LCT	2	
Radio	Supervisory and Control/Equipment OM & P Module	4	
Radio	Spares (Common Module only)	1	
Radio	Spectrum Analyzer	1	
Radio	Digital MicroSystem Analyzer	1	
Radio	Synthesized Sweep Generator	1	
Radio	Microwave Transmitter-Receiver Terminal	1	
Radio	Microwave Transmitter-Receiver Terminal with S/D	1	
Radio	Microwave Transmitter-Receiver Repeater E/W,W/O S/D	1	
Radio	In-plan Training Kit	1	
Radio	Standard Installation Materials	1	
Radio	Display	1	
Switch	Operation and Maintenance Terminal	7	
Switch	Magnetic Tap Unit Pack	1	
Switch	Magnetic Tools	1	
Switch	Documents for host	4	
Switch	Software right to use (Host)	1	
Switch	MDF (Host)	1	
Switch	Installation materials (Host)	1	
Switch	Office Data	1	
Switch	Rectifier (50A x 4)	1	
Switch	Battery (300AH x 2)	1	
Switch	MDF (Remote)	1	
Switch	Installation materials (Remote)	1	
Switch	Rectifier (50A x 1) Additional	1	
Switch	Payphone	2	
Switch	Installation Materials for LE	1	
Switch	Software righ to use for LE	1	
Switch	Office Data for LE	1	
Switch	Interface Option Protocal	1	
Switch	Support Software	1	
Switch	Digital Switching Exchange Equipment (Host Line and Trunk Frame)	1	
Switch	Basic Frame	1	
Switch	Digital Switching Exchange Equipment (Remote Basis Frame)	1	
Switch	Call Simulator	1	
Switch	Line Trunk Frame	1	
Switch	Teaching Material for Digital Echange	1	

Course	Name of Equipment	Quantity	Ref.
Transmission	Optical Power Meter	2	
Transmission	Stabilizer Source	1	
Transmission	PCM Channel Analyzer	1	
Transmission	Data Transmission Analyzer	1	
Transmission	Resistance Attenuator	1	
Transmission	Analog Oscilloscope	2	
Transmission	2M PCM Multi-plexer	2	
Transmission	Ringing Generator	2	
Transmission	ETS V-Rack	3	
Transmission	Distribution Frame	3	
Transmission	Accessories - LCT	3	
Transmission	Accessories-Portable, Control Terminal	1	
Transmission	Accessories-Signaling Test Set	1	
Transmission	Accessories- Test Core Set	1	
Transmission	Documentation	1	
Transmission	SDH/PDH/ATM Analyzer	2	
Transmission	Optical Spectrum Analyzer	1	
Transmission	STM-1 & STM-4 Add-Drop Multiplexer	3	
Transmission	Installation Materials	1	

SUPPORTING FOR FINANCIAL AND ECONOMIC EVALUATION

Supporting for Financial and Economic Evaluation

1. Economic Benefit

1.1 Theory

The purpose of the economic analysis is to encourage that investment be efficient in using the national resources. Economic Internal Rate of Return (EIRR) is used to measure the return on investment (economic cost) from the viewpoint of the national resources. EIRR is the rate (er), which equalizes the present value of economic cost (eC) to the present value of the economic benefit (eB) associated with the project.

$$\sum_{t} \frac{(eB_t - eC_t)}{(1 + er)^t} = 0$$

where: t is the time,
eBt is economic benefit of the time t, and
eCt is economic cost of the time t.

Economic cost is converted from the financial cost by eliminating a transfer of payment within a country. This is due to reflect the opportunity cost of the national economy used for the project. On the other hand, economic benefit is the difference in economic return between with and without the project.

A frequently used indicator to calculate the economic benefit of the telecommunication services is 'consumer surplus'. The consumer surplus, which is a difference between willingness to pay and the actual payment, can be identified by the demand curve.

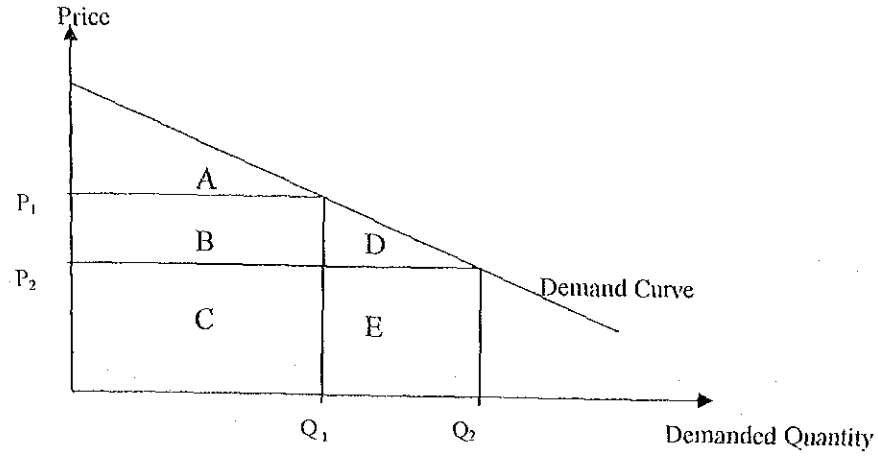
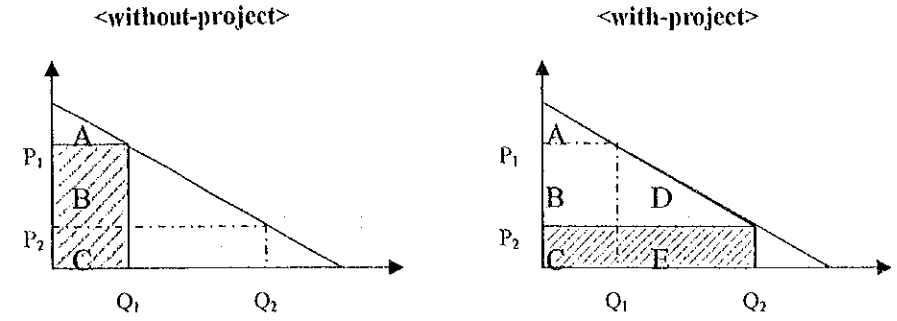


Fig. 1.1 Demand Curve

A consumer is willing to purchase more quantity as the price goes down. As illustrated in Fig. 1.1, a consumer wishes to purchase quantity Q_1 at the price P_1, and pay the sum of Square B and Square C, which is equal to the supplier's revenue. The consumer surplus at the price P_1 is the area Triangle A (See Fig. 1.1).

Then at the price P_2, a consumer wishes to purchase Q_2 and pay the sum of Square C and Square E. The consumer surplus at the price P_2 is the sum of Triangle A, Square B, and Triangle D.

Supposing that P_2 is the price offered by the project while P_1 is the price before the project, the economic benefit of the project becomes difference in the consumer surplus and the supplier's revenue between with and without project; i.e. sum of Triangle D and Square E (See Fig. 1.2).

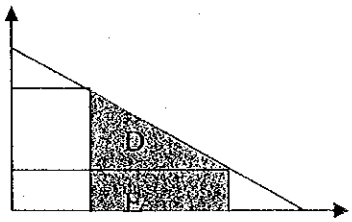


Consumer Surplus: Triangle A

Supplier's Revenue: Square B and Square C

Consumer Surplus: Triangle A, Square B, and Triangle D

Supplier's Revenue: Square C and Square E



	Economic Benefit with the project	A+B+C+D+E
—	Economic Benefit without the project	A+B+C
	Net Economic Benefit of the project	D+E

Fig. 1.2 Economic Benefit of a Project Calculated by the Consumer Surplus

1.2 Application

The theory discussed in the previous section is applied in the telecommunication services in Lao PDR. The 'with-project' demand curve is identified by the relative unit price (kip/minute) in correlation to the annual traffic per subscriber (minutes) in each province. Firstly, the relative price ratio was calculated by the ratio of the household consumption in each province to that in Vientiane Municipality (Source: NSC (1999) The Households of Lao P.D.R.). Secondly, the nominal unit price, classified by the service and by the province (source: LTC), is divided by the relative price ratio (Table 1.1). Thirdly, the relative-price demand curve is identified through the regression analysis between the relative unit price and the annual traffic. Finally, the obtained demand curve from the relative unit price was converted into the nominal unit price. This methodology is used for identifying the demand curve for the fixed phones and the mobile phones.

Table 1.1 Estimation for identifying the demand curve of the domestic calls (with-project)

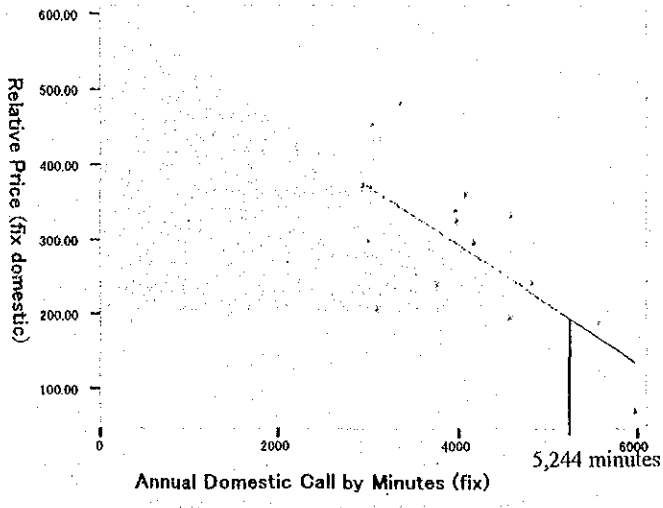
Province x	Monthly Household Consumption (1997/98) (A)	Relative Price Ratio (A) in province x /(A) in Vientiane =(B)	Nominal Unit Price for Domestic Calls in 2001 (kip/minute) (C)		Relative Unit Price for Domestic Calls in 2001 (kip/minute) (C/B)		Annual Domestic Call per Subscriber in 2001 (minutes)	
			Fix	Mobile	Fix	Mobile	Fix	Mobile
Vientiane M.	68,430 kip	1.00	65	168	65	168	5,975	4,098
Phongsaly	24,020 kip	0.35	179	-	510	-	11,668	-
Luangnamtha	26,890 kip	0.39	144	-	367	-	2,944	-
Oudomxay	23,500 kip	0.34	154	213	447	621	3,050	3,424
Bokeo	32,360 kip	0.47	158	219	334	462	3,959	610
Luangprabang	30,290 kip	0.44	144	196	325	443	4,567	3,592
Huaphanh	22,370 kip	0.33	156	-	477	-	3,352	-
Xayaboury	47,320 kip	0.69	203	-	294	-	3,005	-
Xiengkhuang	35,530 kip	0.52	151	211	291	407	4,158	3,868
Vientiane P.	45,730 kip	0.67	135	185	202	277	3,096	3,281
Borikhamxay	40,780 kip	0.60	140	206	234	345	3,734	3,166
Khammuane	37,470 kip	0.55	104	196	190	357	4,557	4,172
Savannakhet	35,010 kip	0.51	94	190	184	372	5,572	3,811
Xaysomboon	28,090 kip	0.41	-	-	-	-	-	-
Saravane	31,760 kip	0.46	149	219	320	472	3,972	491
Sekong	29,820 kip	0.44	154	-	354	-	4,073	-
Champasack	33,480 kip	0.49	116	195	237	398	4,812	3,910
Attapeu	29,130 kip	0.33	155	-	365	-	3,023	-
Weighted Average[1]			86	175			5,244	4,003

Monthly Household Consumption (1997/1998) data is obtained from State Planning Committee (1999), The Households of Lao P.D.R.. Per subscriber unit price and traffic in 2001 was estimated from the data on the number of subscribers and call charges provided by LTC. The destination of the long distance call is predicted by the traffic matrix data.

[1] The data on fixed phones in Phonesaly are excluded from calculating the weighted averages.

(1) Fixed Phones-Domestic Call (with-project)

Consumer Surplus of the domestic calls from fixed phone in 2001 was calculated as 809,163 Kip per subscriber per annum, and the demand curve is supposed to stay fixed along the line; Unit Price=394.459 -0.059*traffic (Fig. 1.3).



Demand Curve of the relative unit price vs. traffic (estimated without Phonesaly)

Relative Unit Price= 607.208-0.07878*traffic (R_2=0.488, P-value 0.3%)

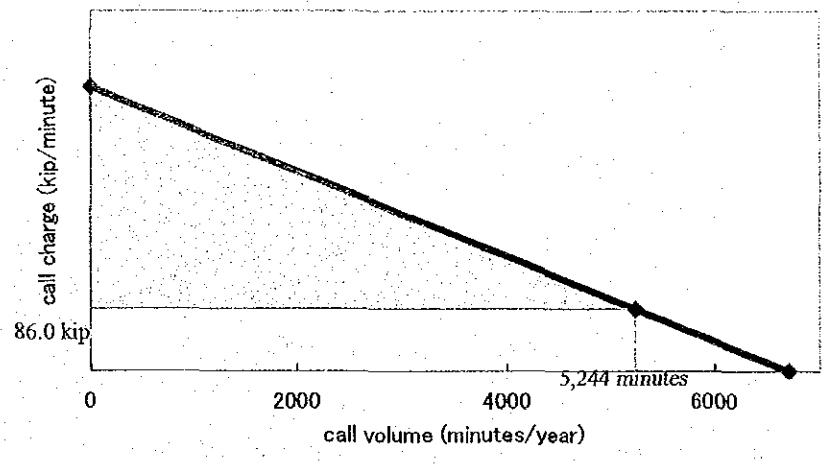
Average Call Volume: x=5,243.5 minutes

Average Price: y (relative) =132.131 y (nominal)=85.836

Relative Price/Nominal Price=1.539 times

⇩

Nominal Unit Price=394.459 -0.059*traffic



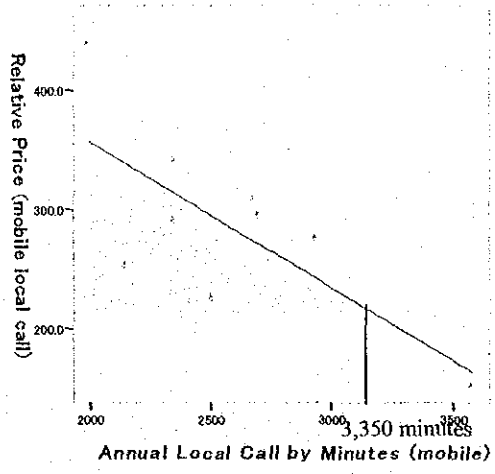
Consumer Surplus=5,243.7*(394.459-85.836)/2=809,163Kip

Fig. 1.3 Consumer Surplus of the Local Calls from the Fixed Phones

(2) Mobile Phones-Local Call (with-project)

The demand curve of the mobile phone was only identifiable for the local calls.

The consumer surplus of the local calls from the mobile phone in 2001 was calculated as 562,853Kip per subscriber per annum, and the demand curve stays fixed along the line; Unit Price=486.0816 -0.1*traffic (Fig. 1.4).



Demand Curve of the relative unit price vs. traffic (estimated without Bokeo and Saravane)

Relative Unit Price= 601.526-0.122*traffic (R_2=0.541, P-value 2.4%)

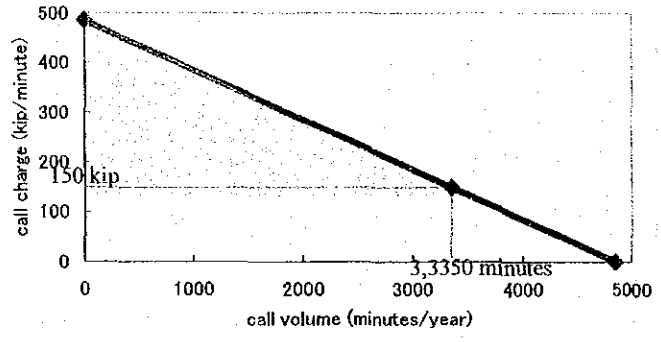
Average Call Volume: x=3,349.501 minutes

Average Price: y (relative) =185.626 y (nominal)=150

Relative Price/Nominal Price=1.2375 times

⇩

Nominal Unit Price=486.0816 -0.1*traffic



Consumer Surplus=3,349.501*(486.0816-150)/2=562,853Kip

Fig. 1.4 Consumer Surplus of the Local Calls from the Mobile Phones

(3) Domestic calls from the public phones (without-project)

The 'without-project' of the domestic call from the fixed phones is assumed to be the use of the public phones. The slope of the demand curve for the public phones is assumed to be the same as that for the with-project. The average unit price is estimated to be 259.875 kip/minute from the billing data of LTC in 2001. On the other hand, average annual traffic per person is estimated to be 279.77 minutes based on the result of the national telecommunication survey (hereafter called the 'Survey'). The estimated demand curve for the public phone user is: Unit Price =276.3418-0.059* traffic per person (minutes).

In addition to the charges for the public phone calls, the public phone users pay for access fees such as fuel for motorbikes and transport fees for the bus. Accordingly, the actual payment for the phone call is higher than what is paid for the public phones. However, the Survey was not able to identify the national average of the access fees because the answers significantly vary among the samples. Moreover, some users access to the public phones when they have some other business to do, for example, going to markets. For estimation of the consumer surplus, it is assumed that users pay 100 kip per minute for the access fee and that four people share one fixed-phone. Accordingly, the obtained economic benefit per person is multiplied by four.

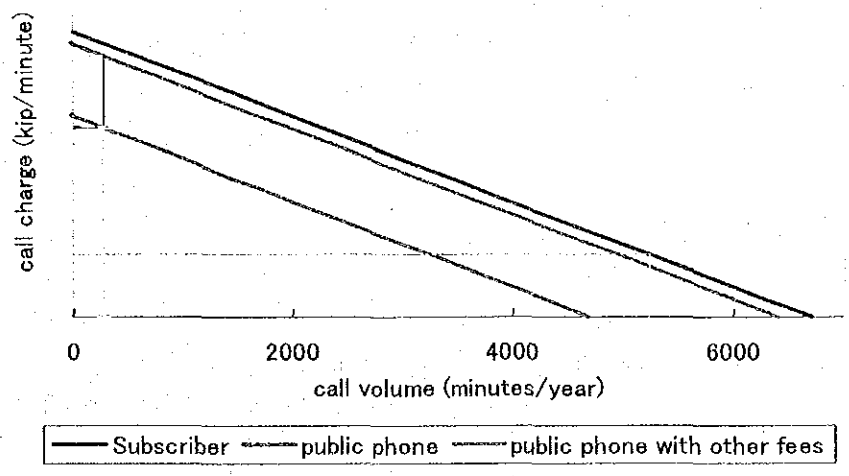


Fig. 1.5 The Demand Curves for with- and without project of the fixed phones (domestic calls)

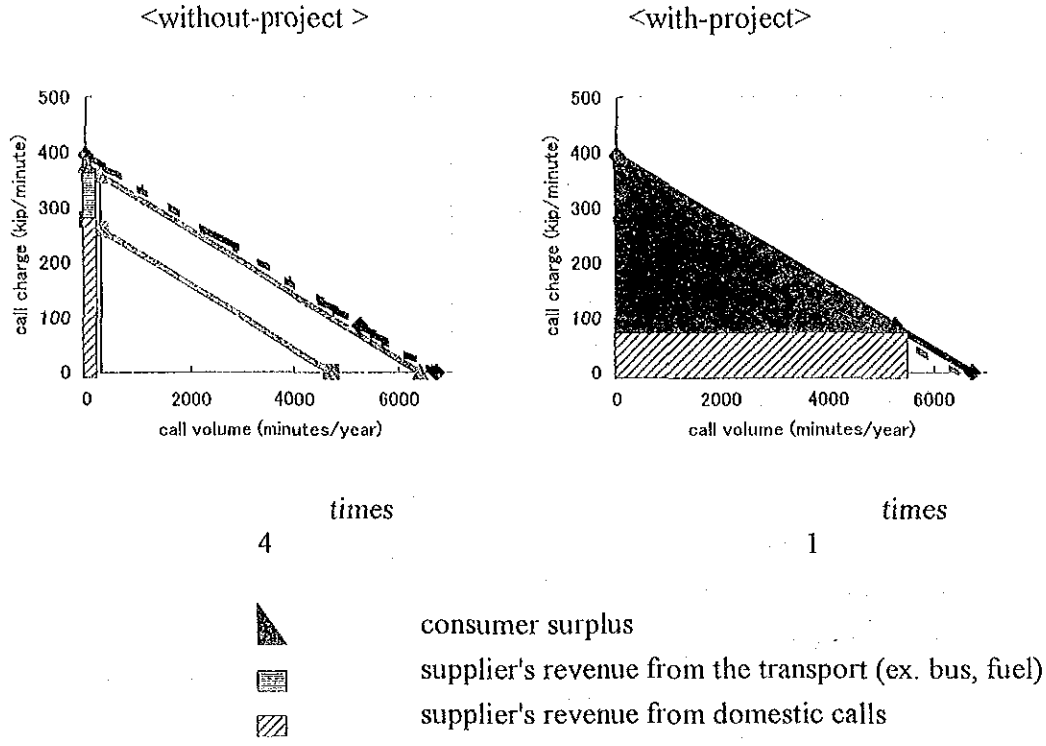


Fig. 1.6 The Economic Benefit of with- and without project of the fixed phones (domestic calls)

a) without-project (public phones)

supplier's revenue

i. telecom revenue 259.875 kip/minute x 279.77 minutes = 72,705 kip

ii. transport revenue (assumption)

100 kip/minute x 279.77 minutes = 27,977 kip

consumer surplus

(376.342 kip-359.875kip)x279.77 minutes/2 =2,303 kip

102,985 kip

b) with-project

supplier's revenue (telecom)

85.836 kip/minute x 5,243.5 minutes = 450,081 kip

consumer surplus

(394.459kip-85.836 kip)x5243.5minutes/2 = 809,132 kip

1,259,213 kip

Economic benefit of providing fixed phone for domestic calls in 2001

1,259,213 kip - 102,985 kip *4= 847,273 kip /subscriber /year

(67.3% of the economic benefit of with-project)

As for the mobile phones, only one person occupies the phone. Accordingly, 91.8% of economic benefit of with-project is used for calculating the economic benefit of without-project for the local call of the mobile phones [(1,259,213-102,985)/1,259,213=91.8%].

(4) International Call from fixed and mobile phones (with-project)

The consumer surplus of the international call is estimated in US$ in the aggregate of the fixed and the mobile phones because the international call charges are calculated in US$ and the same tariff is given between the two types of the phones.

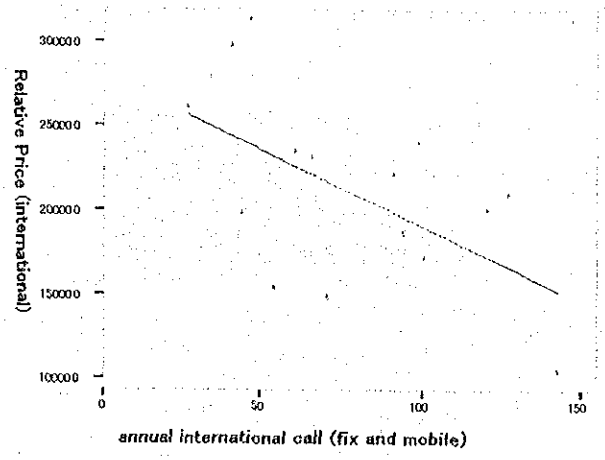
Table 1.2 Data for identifying the demand curve of the international calls (with-project)

	Relative Price Ratio	International Calls in 2001	
		Relative Unit Price (kip/minute)	Traffic per Subscriber (minutes)
Vientiane M.	1.00	10,144	143
Phongsaly	0.35	28,899	209
Luangnamtha	0.39	25,815	27
Oudomxay	0.34	29,538	41
Bokeo	0.47	21,451	15
Luangprabang	0.44	22,917	66
Huaphanh	0.33	31,031	47
Xayaboury	0.69	14,669	71
Xiengkhuang	0.52	19,537	44
Vientiane P.	0.67	15,179	54
Borikhamxay	0.60	17,022	101
Khammuane	0.55	18,526	94
Savannakhet	0.51	19,827	120
Xaysomboon	0.41	24,741	-
Saravane	0.46	21,856	61
Sekong	0.44	23,278	127
Champasack	0.49	20,733	99
Attapeu	0.33	23,830	122
Weighted Average[2]		19,639	123

Per subscriber traffic in 2001 is estimated from the data on the number of subscribers and call charges provided by LTC. The nominal unit price, 10,144 kip/minute, is also estimated from the LTC data on the international tariff and traffic classified by the destination. Since the country destination is not classified by the origins of calls, the same nominal unit price is used for all the provinces.

[2] Weighted averages are estimated without the data of Phonesaly and Bokeo.

The consumer surplus of the international calls in 2001 was calculated as $29.78 per subscriber per annum.



Demand Curve of the relative price vs. traffic (estimated without Bokeo and Phonesaly)

Relative Price= 28,068.812-90.329*International Call (R_2=0.32, P-value 2.8%)

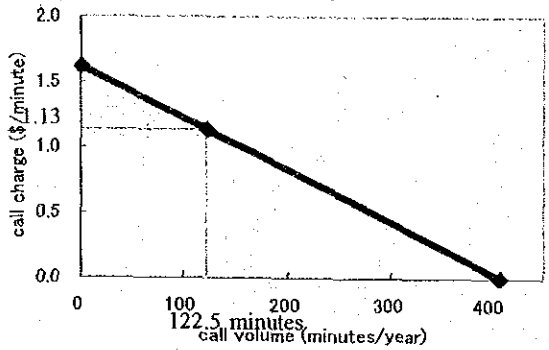
Average Call: x=122.5

Average Price: Relative Unit Price =19,639 kip Nominal Unit Price=$1.1328[3]

Relative Price/Nominal Price=17,336.23

⇩

Nominal Unit Price=$1.619-0.003969*International Call



consumer surplus=122.5 minutes *($1.619-$1.1328)/2=$29.78

Fig. 1.7 Consumer Surplus of the international Calls (Fixed & Mobile)

[3] The unit price is converted from the local currency by the official mean rate in 2001; 8,954.58Kip.

(5) International calls from the public phones (without-project)

The 'without-project' of the international calls from the fixed and mobile phones is assumed to be the use of the public phones. The slope of the demand curve for the public phones was assumed to the same as that for the with-project. The average unit price was estimated to be 14,201.6 kip/minute or $1.586/minute from the billing data of LTC in 2001. On the other hand, average annual traffic per person was estimated to be 12.9 minutes based on the result of the national telecommunication survey.

Like the domestic calls, the access fee to use the public phone is assumed as 100 kip/minute or $0.01/minute for this analysis. In contrast to the domestic calls, the international callers are limited within the subscribers. It is assumed that 1.5 persons share one fixed-phone for international calls and that one person uses one mobile phone. Accordingly, obtained economic benefit of the public phone is multiplied by 1.5 only for the fixed phones.

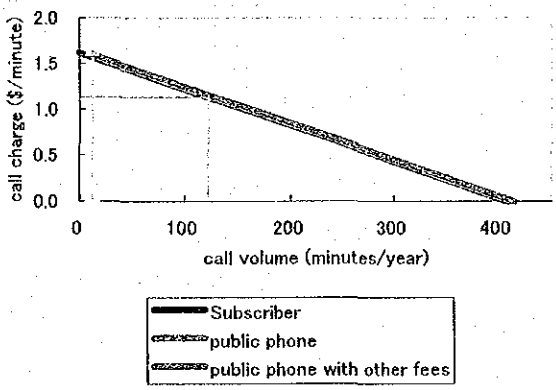


Fig. 1.8 The Demand Curves for with- and without project of the fixed and mobile phones (international calls)

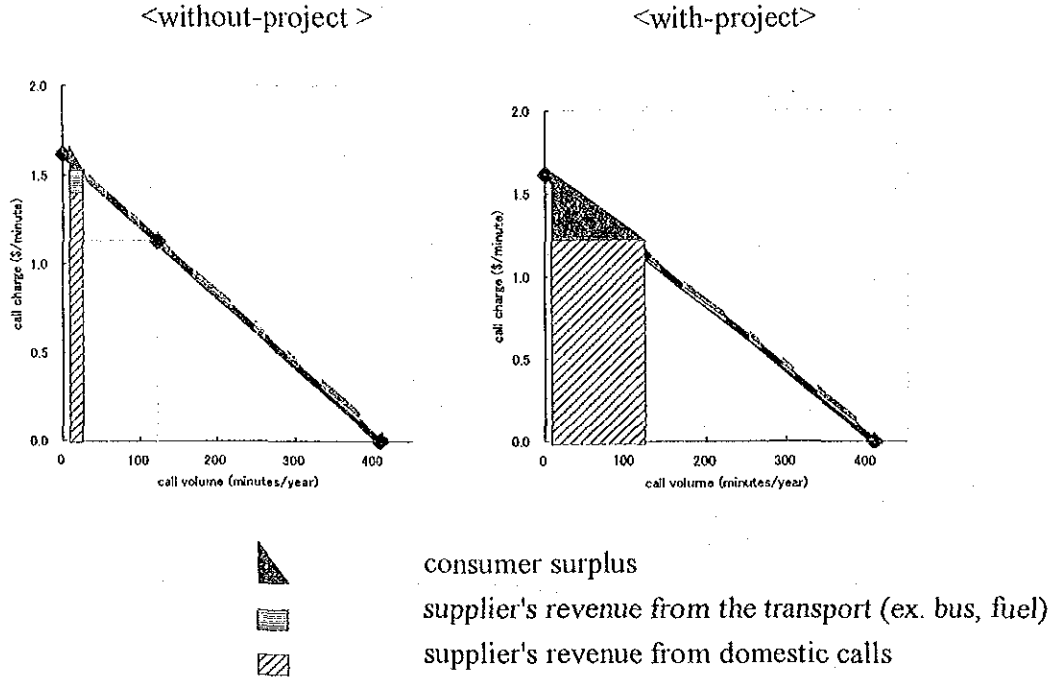


Fig. 1.9 The Economic Benefit of with- and without project of the fixed and mobile phones (international calls)

a) without-project (public phones)

supplier's revenue

i. telecom revenue $1.586/minute x 12.9 minutes = $20.46

ii. transport revenue (assumption)

$0.011/minute x 12.9 minutes = $0.14

consumer surplus

($1.648-$1.597)x12.9 minutes/2 = $0.33

$20.93

b) with-project

supplier's revenue (telecom)

$1.133 /minute x 122.5 minutes = $138.79

consumer surplus

($1.619-$1.1328)x122.5minutes/2 = $29.78

$168.57

Economic benefit of subscribing fixed phone for international calls in 2001

$168.57 - $20.93 *4= $84.85 /subscriber /year (81.4% of with-project)

Economic benefit of subscribing mobile phone for international calls in 2001

$168.57 - $20.93= $147.64 /subscriber /year (87.6% of with-project)

(6) Internet (with-project)

The demand curve of the Internet was identified from the distribution of Internet users by the service menu provided by LTC. All the users are assumed to have used the Internet at maximum usage hours within the monthly charges. The identified demand curve is: unit price=1.292-0.009644*Monthly Usage Hours (R^2=0.878, P-value less than 0.1%). The average consumer surplus is estimated to be 179,621 Kip per subscriber per annum in 2002.

Table 1.3 Data for identifying the demand curve of the Internet (with-project)

Service Name	Number of Subscribers (as of July, 2002)	Unit Price per Account ($/hour)	Usage Hours per Account	Log-in accounts
Starter 1	15	1.0	6	1
Casual 1	325	1.2	10	1
Casual 2	87	1.2	15	1
Pro 1	91	1.04	25	1
Pro 2	35	0.94	35	1
Busi Pro 1	61	0.82	50	1
Silver 1	2	1.0	15	4
Golden 3	7	0.77	37	15

Source: LTC

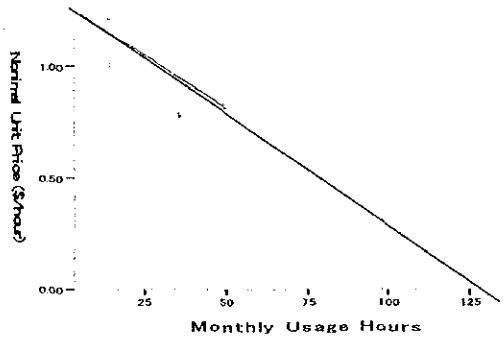


Fig. 1.10 Consumer Surplus of the Internet

Unit Price = 1.292-0.009644*Monthly Usage Hours (R^2:0.878, p-value: less than 0.1%)
Average Usage Hours: 18.43 hours/month, Average Unit Price: $1.1145
Average Consumer Surplus=(1.292-1.1145)*18.43/2*12*9,542 kip[4] =187,290kip

It is difficult to conceptualize without project situation for the Internet because it all depends on how the usage style of the uses. For example, some people may use the Internet for E-Commerce and may succeed in generating revenue while some people may use it mostly just for E-mail. In this analysis, 20% of the economic benefit of the Internet (the usage charges and dial-up fees) is hypothetically deducted as the compensation of the set for the economic benefit generated from without-project.

[4] Estimated official Exchange Rate (mean) in 2002.

2. Per Subscriber Revenue

2.1 Price Setting and Financial Revenue

Per-subscriber-revenue is considered in relation to the price setting. The telephone charges in Lao P.D.R. are set low for the domestic calls and high for the international calls; however, the competition facing to the international calls by the substitute goods, such as VoIP and E-mail, calls for the needs to balance the tariff settings.

There is no relationship between the level of the domestic call charges and the income level of the nation. Regardless of the income level, the domestic call charges are likely to stay twice as much as the level in Lao P.D.R. (see Fig. 2.1). However, in theory, increase in price is likely to result in quantity demanded.

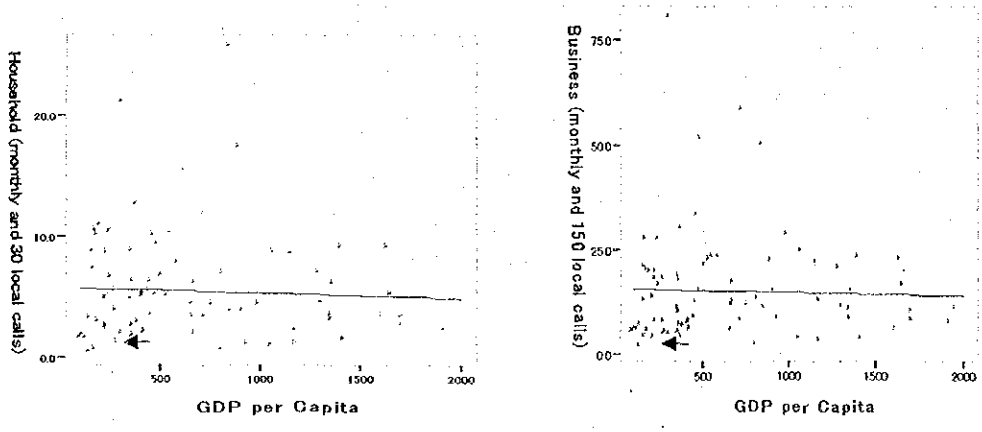


Fig. 2.1 Domestic call charges and GDP per capita (2000)

(◀—— : Lao P.D.R. after the price increase in March, 2003)

Above plots represent the sum of the monthly charge and three-minute local calls. The local call charges are multiplied by 30 for the households and by 50 for the business users.

Source: ITU (2002) *World Telecommunication Development Report*, Geneva: ITU

The demand curve implies the level of pricing that maximizes the supplier's revenue. When the demand curve is explained in the equation of y=a-bx where y is 'unit price', and x is 'quantity demanded'; the price that maximizes the supplier's revenue is at a/2. Up to the price reaching to a/2, the reduction of the price is offset by the increase in the quantity demanded, and the supplier's revenue increases. This situation is called 'price elastic'. On the other hand, after the price goes lower than a/2, the reduction in price will not be compensated by the

increase in quantity demanded, and the supplier's revenue decrease. The latter situation is called 'price inelastic'.

(1) Domestic Call Charges - Fixed

Fig. 2.2 shows the demand curve (left graph) for the domestic calls from the fixed phones and the revenue estimation (right graph) in reflection to the price change. The average unit price in 2001 was estimated as 85.8 kip/minute. The domestic call charge will be increased by 60 kip/minute by March, 2003, and the average price is predicted to be 146 kip/minute if the call ratio between local and long distance remains the same. Supposing that the demand curve does not shift, the supplier's revenue will be maximized by increasing the price by another 51 kip/minute, or to 197 kip/minute.

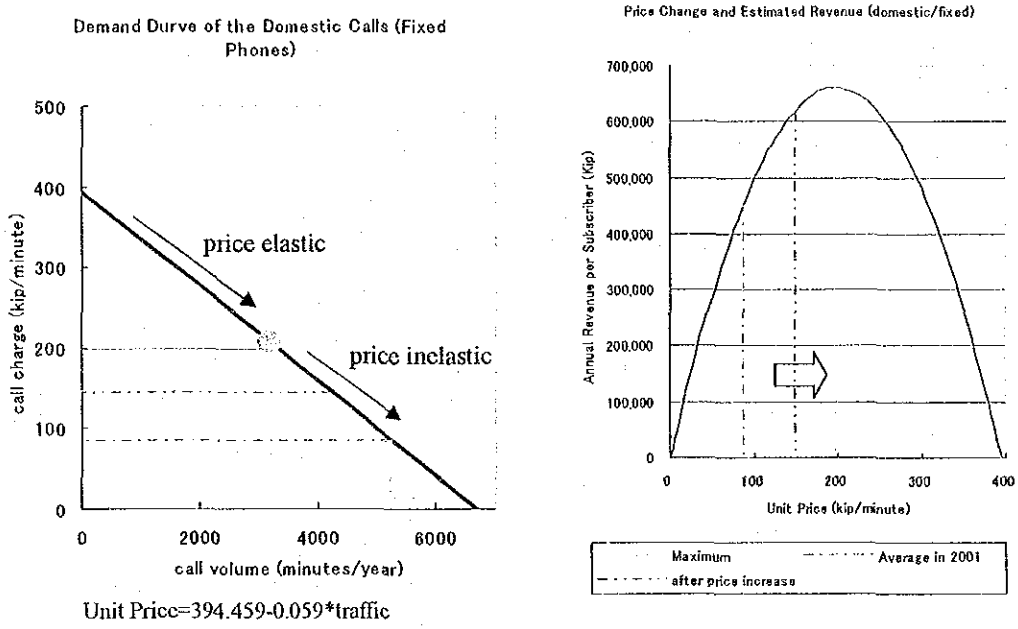


Fig. 2.2 Price Change and the Revenue (domestic/fix)

The effect of the monthly charge on the number of subscribers has not been identified. In this analysis, the monthly charge is assumed to increase to 50,000 kip by 2010 step by step.

(2) International Calls – Fixed and Mobile

The average international call charge in 2001 was $1.13/minute, but the rate is

predicted to decrease to $1.02/minute because of the tariff reduction effected in July, 2001. Supposing that the demand curve does not shift, the supplier can maximize revenue by decreasing the average unit price to $0.81/minute (see Fig. 2.3).

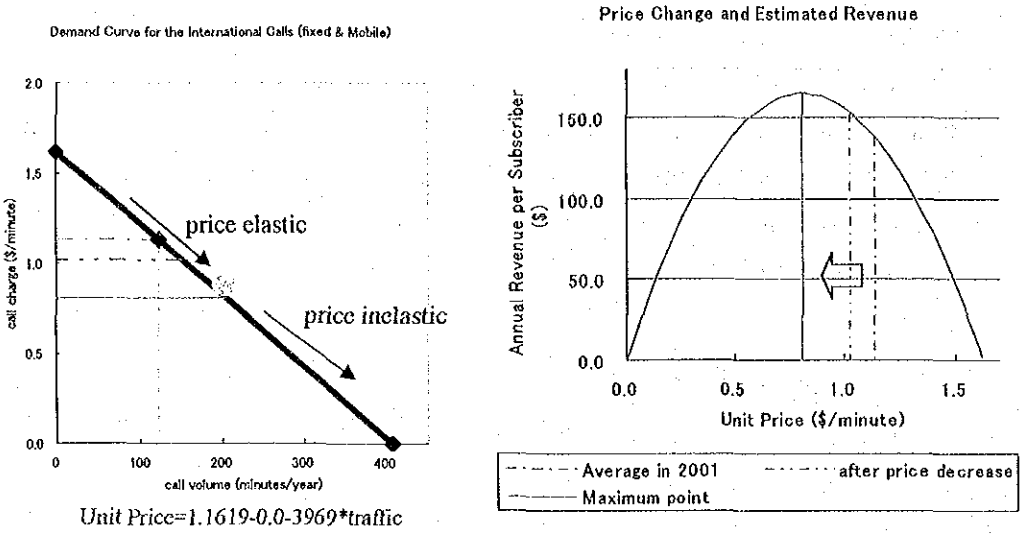


Fig. 2.3 Price Change and the Revenue (international / fix & mobile)

The discrepancy between the domestic call charges and international call charges has been modified by increasing the former from April, 2002 and decreasing the latter in July, 2001. As a result, the revised price respectively moved closer to the optimal point. Based on the demand curve in 2001, further change would increase the revenue only by 7%. However, the demand curve for the international calls is likely to shift to left due to the competition faced by substitute goods such as VoIP and E-mail. Decreasing the international call charge is unavoidable in order to keep the demand.

In this analysis, it is hypothetically assumed that the demand curve for the international call shifts to the point where the traffic stays constant at the optimal price point based on the demand curve in 2001 (122.5 minutes, $0.81/minute). Accordingly, it is assumed that the optimal point moves to $0.65/minute in 2010[5].

[5] The ratio of the countries of destination for the international calls is assumed to be constant.

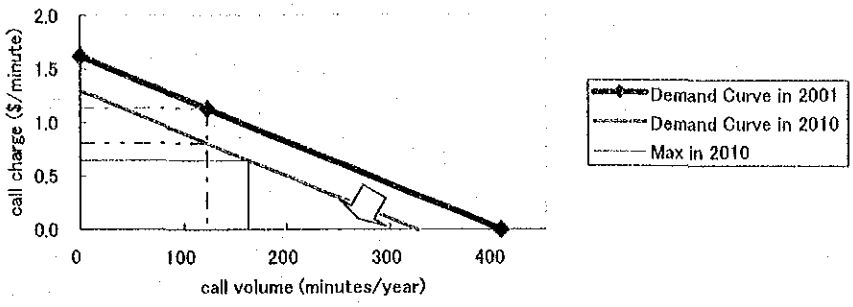


Fig. 2.4 Shifting the Demand Curve (international / fix & mobile)

Table 2.1 is the price assumption for the fixed phones. The connection charge is calculated as $80 per subscriber.

The international call charges from the mobile phones and the fixed phones are the same, and the international traffic volume from the mobile phones is currently quite high. However; to be modest, it is assumed that the calling ratio of the mobile phone users is one sixth of that of the fixed phones.

(3) Domestic Calls – Mobile

Similar to the methodology discussed above, the local calls of the mobile phone is assumed to be increased to 243 kip/minute by 2010.

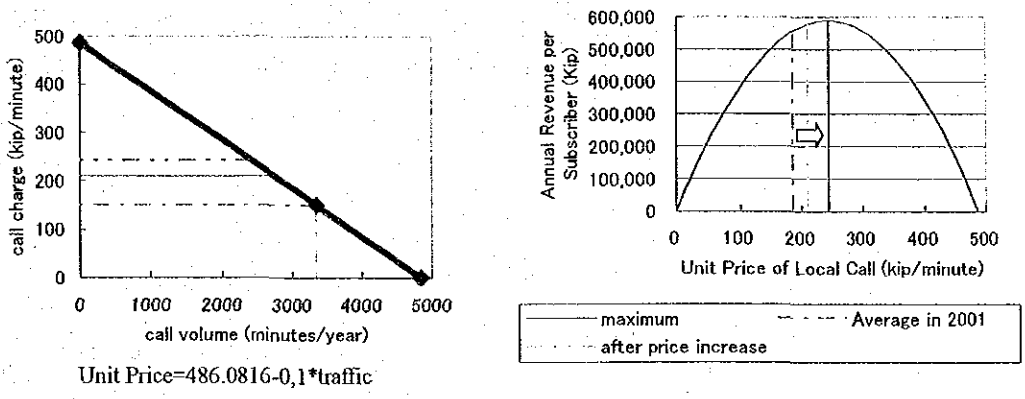


Fig. 2.5 Price Change and the Revenue (mobile/local)

The demand curve for the long distance call and monthly charge has not been identified, and the prices are assumed to be constant. Table 2.2 shows the price setting and revenue per subscriber of the mobile phone. The connection charge is calculated as $50 per subscriber.

(4) Internet

In accordance with the demand curve identified from the use of the internet in July, 2002, the optimal price for the internet is estimated to be $0.65/hour, which equals to 67 hours of usage time per month.

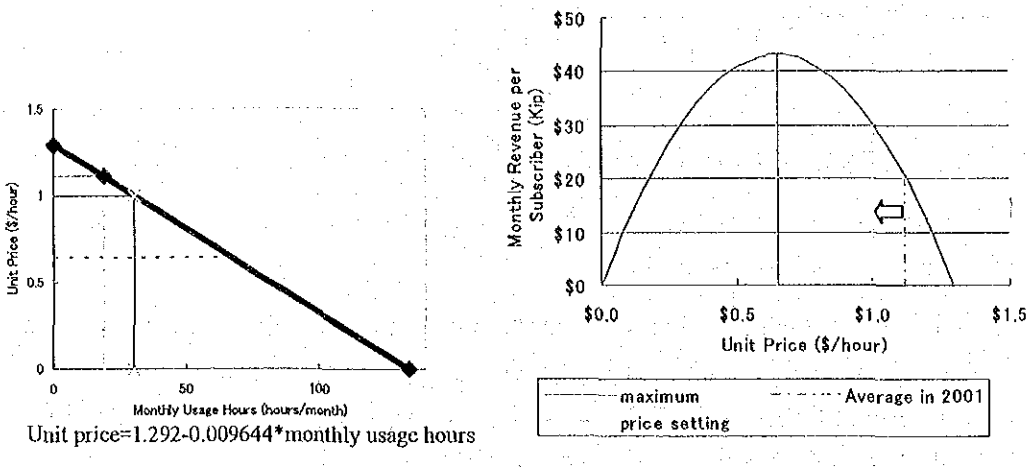


Fig. 2.6 Price Change and the Monthly Revenue (internet)

Yet, due to increasing competition, the demand curve is assumed to shift to left. In this analysis, the demand curve is hypothetically assumed to reach to the point at (50 hours/month, 0.48$/hour) in 2010, but the customers are in average assumed to use Internet one hour every day. The target price is set at 30 hours/day in accordance with the shifting the demand curve. Table 2.3 shows the price setting and revenue per subscriber of the Internet. ADSL users are assumed to pay $200 for connection and $20 for monthly fee in addition to the Internet access charges.

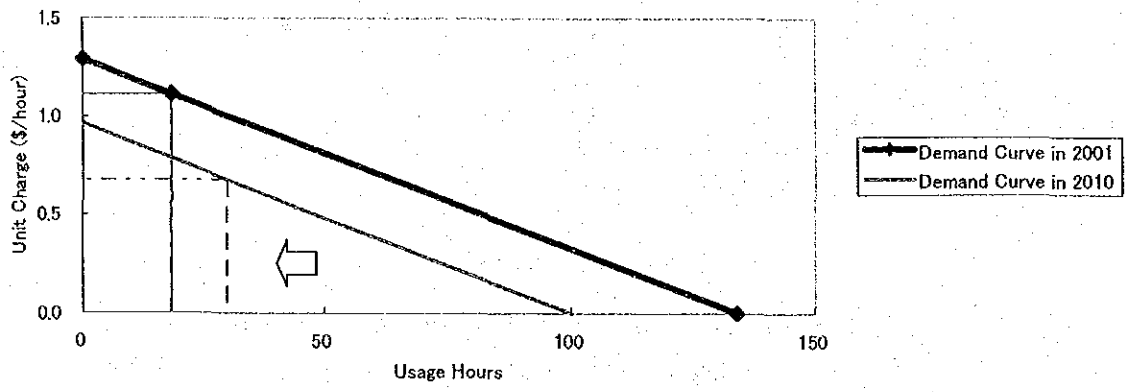


Fig. 2.7 Shifting the Demand Curve (internet)

Table 2.1 Pricing Scenario and Revenue per Subscriber (Fixed Phones)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Unit Price												
Monthly Subscription (kip/month)	12,585	15,838	19,932	25,085	31,569	39,730	50,000	50,000	50,000	50,000	50,000	50,000
Domestic Call Charge (kip/minute)	154	161	168	175	183	191	200	200	200	200	200	200
Outgoing International Call ($/minute)	$0.96	$0.90	$0.84	$0.79	$0.74	$0.69	$0.65	$0.65	$0.65	$0.65	$0.65	$0.65
Traffic Per Subscriber (minutes/year)												
Domestic Call	4,082	3,965	3,843	3,715	3,581	3,442	3,296	3,296	3,296	3,296	3,296	3,296
Outgoing International Call	138	144	149	154	158	161	164	164	164	164	164	164
Annual Revenue per Subscriber (thousand kip)												
Monthly Subscription	151	190	239	301	379	477	600	600	600	600	600	600
Domestic Call	627	636	645	651	656	659	659	659	659	659	659	659
Outgoing International Call	1,351	1,366	1,371	1,367	1,355	1,337	1,313	1,350	1,388	1,425	1,462	1,498
Incoming International Call	405	410	411	410	406	401	394	405	416	427	439	449
Total	2,535	2,602	2,666	2,729	2,796	2,873	2,966	3,015	3,063	3,111	3,159	3,207

Table 2.2 Pricing Scenario and Revenue per Subscriber (Mobile phones)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Unit Price												
Monthly Subscription (thousand kip)	123	127	131	135	140	144	148	152	156	161	165	169
Monthly Subscription ($)	12	12	12	12	12	12	12	12	12	12	12	12
Local Call Charge (kip/minute)	214	219	224	228	233	238	243	243	243	243	243	243
Long Distance Call Charge (kip/minute)	353	353	352	352	352	352	352	331	331	331	331	331
Outgoing International Charge ($/minute)	$0.96	$0.90	$0.84	$0.79	$0.74	$0.69	$0.65	$0.65	$0.65	$0.65	$0.65	$0.65
Traffic per Subscriber (minutes/year)												
Local Call	2,717	2,671	2,625	2,578	2,530	2,481	2,431	2,431	2,431	2,431	2,431	2,431
Long Distance	654	654	654	654	654	654	654	654	654	654	654	654
Outgoing International	23	24	25	26	26	27	27	27	27	27	27	27
Annual Revenue per Subscriber (Thousand Kip)												
Monthly Subscription	1,473	1,523	1,573	1,623	1,674	1,725	1,776	1,827	1,877	1,927	1,977	2,027
Local Call Charges	582	585	587	589	590	590	591	591	591	591	591	591
Long Distance Charges	231	231	230	230	230	230	230	217	217	217	217	217
Outgoing International	225	228	228	228	226	223	219	225	231	237	244	250
Incoming International	68	68	69	68	68	67	66	68	69	71	73	75
Total	2,579	2,634	2,687	2,738	2,788	2,835	2,881	2,926	2,985	3,043	3,101	3,159

Table 2.3 Pricing Scenario and Revenue per Subscriber (Internet)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Unit Price												
Unit Price (kip/hour)	10,228	9,986	9,716	9,416	9,085	8,722	8,325	8,563	8,800	9,036	9,270	9,502
Unit Price ($/hour)	$1.00	$0.94	$0.89	$0.84	$0.78	$0.73	$0.68	$0.68	$0.68	$0.68	$0.68	$0.68
Usage Hours per Subscriber per Month	21	22	24	25	27	28	30	30	30	30	30	30
Monthly Charge Internet (ADSL)	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Annual Revenue (thousand kip/subscriber)												
Internet	1,278	1,326	1,371	1,412	1,448	1,477	1,499	1,541	1,584	1,626	1,669	1,710
ADSL	2,454	2,538	2,622	2,706	2,790	2,875	2,960	3,044	3,129	3,212	3,296	3,378
PSTN (dial up users)	1,640	1,816	2,011	2,227	2,466	2,731	3,024	3,024	3,024	3,024	3,024	3,024

(50% of the Internet access charge is counted as the revenue while the other 50% is supposed as the revenue of the Internet Service Provider, whose CAPEX is not included in the analysis.)

2.2 Per-Subscriber-Economic Benefit

In accordance with the price scenario, the economic benefit per subscriber is calculated (Table 2.5, Table 2.6, and Table 2.7). The estimated rate of the economic benefit of the without-project in relation to the with-project is used throughout the evaluation (Table 2.4)[6].

Table 2.4 Base assumptions for calculating the Economic Benefit

Category		Economic Benefit (With-Project)	The ratio of economic benefit in without-project against the economic benefit of with-project
Initial Charge		supplier's revenue	20.0%
Monthly Charge		supplier's revenue	20.0%
Call Charge	fixed / domestic	consumer surplus and supplier's revenue	32.7%
	mobile / local	consumer surplus and supplier's revenue	8.2%
	mobile /long distance	supplier's revenue	20.0%
	fixed /outgoing international	consumer surplus and supplier's revenue	18.6%
	mobile / outgoing international	consumer surplus and supplier's revenue	12.4%
	fixed & mobile/ incoming international	supplier's revenue	20.0%
Access Charge	Internet	consumer surplus and supplier's revenue	20.0%

[6] The demand curves of the following items were not identified. Accordingly, the economic benefit are only calculated from the supplier's revenue and 20% of discount is made for the economic benefit of without-project.

a. Initial fees of the fixed, mobile, and Internet.
b. monthly subscription fee of the fixed phones and mobile phones
c. long distance call of the mobile phones
d. Internet access fee (ADSL, PSTN)

Table 2.5 Economic Benefit per Subscriber (fixed phones)

(thousand kip)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Economic Benefit (With-Project)												
Consumer Surplus												
Domestic Call	492	464	436	407	378	349	320	320	320	320	320	320
Outgoing International Call	468	520	571	621	668	713	756	743	728	712	731	749
Supplier's revenue												
Monthly Revenu	151	190	239	301	379	477	600	600	600	600	600	600
Domestic Call	627	636	645	651	656	659	659	659	659	659	659	659
Outgoing International Call	1,351	1,366	1,371	1,367	1,355	1,337	1,313	1,350	1,388	1,425	1,462	1,498
Incoming International Call	411	416	417	416	412	407	399	411	422	433	445	456
Economic Benefit (Without Project)												
Monthly Revenue	30	38	48	60	76	95	120	120	120	120	120	120
Domestic Call	366	360	353	346	338	330	320	320	320	320	320	320
Outgoing International Call	338	351	361	370	378	381	385	389	394	398	408	418
Incoming International Call	82	83	83	83	82	81	80	82	84	87	89	91
Net Economic Benefit	2,684	2,761	2,833	2,903	2,976	3,054	3,143	3,172	3,199	3,226	3,280	3,333

Table 2.6 Economic Benefit per Subscriber (mobile phones)

(thousand kip)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Economic Benefit (With-Project)												
Consumer Surplus												
Local call	369	357	345	332	320	308	295	295	295	295	295	295
Outgoing International call	78	87	95	103	111	119	126	124	121	119	122	125
Supplier's revenue												
Monthly Revenu	1,473	1,523	1,573	1,623	1,674	1,725	1,776	1,827	1,877	1,927	1,977	2,027
Local Call	582	585	587	589	590	590	591	591	591	591	591	591
Long Distance Call	231	231	230	230	230	230	230	217	217	217	217	217
Outgoing International Call	225	228	228	228	226	223	219	225	231	237	244	250
Incoming International Call	69	69	70	69	69	68	67	68	70	72	74	76
Economic Benefit (Without Project)												
Monthly Revenue	295	305	315	325	335	345	355	365	375	385	395	405
Local Call	79	77	76	76	75	74	73	73	73	73	73	73
Long distance Call	46	46	46	46	46	46	46	43	43	43	43	43
Outgoing International Call	38	39	40	41	42	42	43	43	44	44	45	46
Incoming International Call	14	14	14	14	14	14	13	14	14	14	15	15
Net Economic Benefit	2,557	2,598	2,637	2,674	2,709	2,742	2,774	2,808	2,854	2,898	2,948	2,997

Table 2.7 Economic Benefit per Subscriber (Internet)

(thousand kip)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Economic Benefit (With-Project)												
Consumer Surplus of Internet	128	150	175	204	237	276	321	330	339	349	358	366
Supplier's revenue												
Internet	1,278	1,326	1,371	1,412	1,448	1,477	1,499	1,541	1,584	1,626	1,669	1,710
ADSL	2,454	2,538	2,622	2,706	2,790	2,875	2,960	3,044	3,129	3,212	3,296	3,378
PSTN (dial up)	1,640	1,816	2,011	2,227	2,466	2,731	3,024	3,024	3,024	3,024	3,024	3,024
Economic Benefit (Without Project)												
Internet	281	295	309	323	337	351	364	374	385	395	405	415
ADSL	491	508	524	541	558	575	592	609	626	642	659	676
PSTN(dial up)	328	363	402	445	493	546	605	605	605	605	605	605
Net Economic Benefit from ADSL Users	3,086	3,210	3,334	3,457	3,580	3,703	3,824	3,933	4,042	4,150	4,257	4,364
Net Economic Benefit from Dial up Userss	2,436	2,633	2,845	3,074	3,321	3,587	3,875	3,917	3,958	3,999	4,040	4,081

3. Base data and Assumptions

(1) Capital Expenditure (CAPEX)

The breakdowns of the Capital Expenditure (CAPEX) are shown in Table 3.1 and in Table 3.2. 25% of the expenditure on the transmission is excluded from the calculation since the traffic estimate based on the price and traffic assumption as discussed in the previous section shows that the portion is for the use of the subscribers before 2004 (Fig.3.1) [7]. Likewise, another 25% of the expenditure on the transmission is excluded in the analysis without the mobile phones (Fig. 3.2).

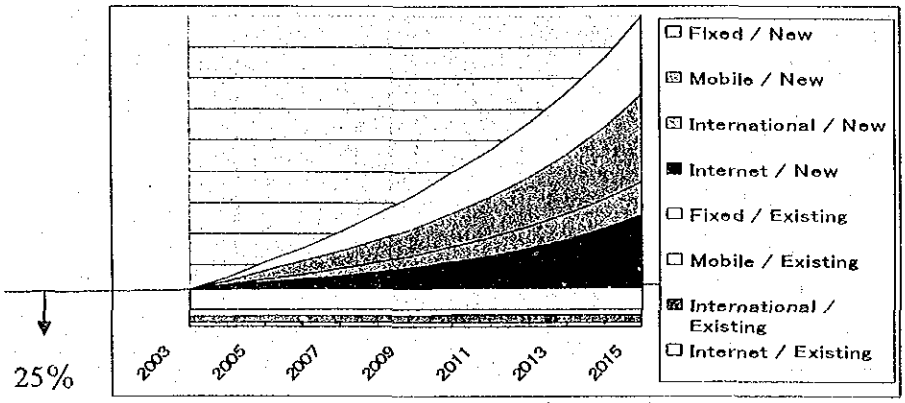


Fig. 3.1 Traffic ratio between with-and without- project (with mobile phones)

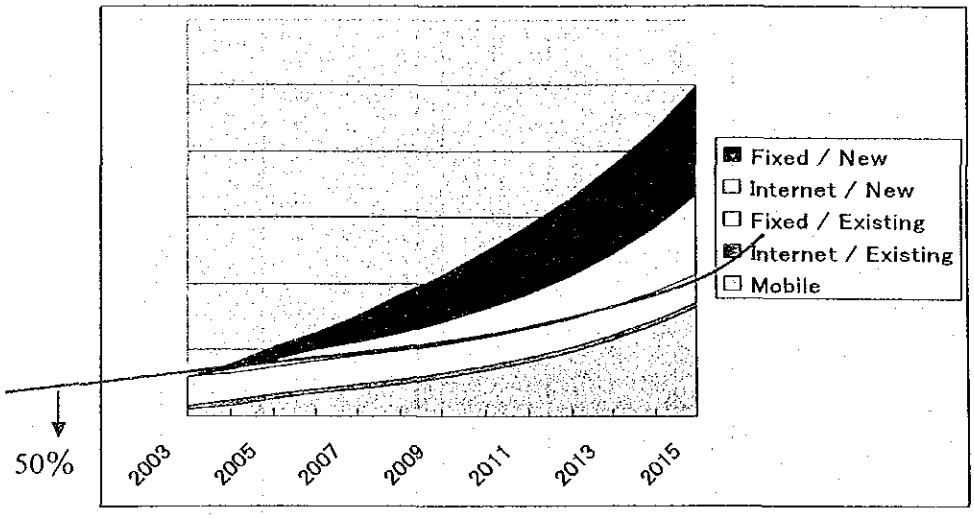


Fig. 3.2 Traffic ratio between with-and without- project (without the mobile phones)

[7] 25% of the bandwidth is assumed to be reserved for IP network in preparation for the growing demand towards ICT.

(2) Beneficiaries

The beneficiaries of the investment are all the new subscribers of fixed phones, mobile phones, and Internet from 2004 to 2015. The number of the subscribers for the fixed phones is set at the lower value between the demand and the supply in the respective province.[8] The additional number of subscribers from 2004 is calculated from the average number of subscribers in each year (Table 3.3 and 3.4). For the mobile phones and Internet, 100% of the demand as forecasted in Chapter 4 in the Main Report is assumed to be supplied by the end of each year (Table 3.5 and 3.6).

[8] The number of the demand is articulated in the micro approach in Chapter 4 while the number of supply is in accordance with the switching installation plan discussed in Chapter 7.

Table 3.1 CAPEX (1st Scenario with mobile phones)

(Unit: Thousand US $)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Equipment (CIF)													
Switching	2,920	515	5,441	6,872	2,519	3,945	4,618	5,211	4,921	3,406	4,091	3,762	48,220
Transmission	18,113	9,575	1,533	1,533	1,533	1,533	1,533	8,075	8,075	8,075	8,075	8,075	75,725
Mobile	9,720	9,234	7,776	3,402	7,776	3,888	5,832	9,720	9,720	3,402	19,440	16,038	105,948
Outside Plant	4,543	801	8,463	10,689	3,919	6,136	7,184	8,106	7,655	5,298	6,363	5,853	75,009
IP	3,058	3,058	708	708	708	708	708	995	995	995	995	995	14,631
Rural	987	987	1,184	1,184	1,184	1,184	1,184	1,480	1,480	1,480	1,480	1,480	15,293
Subtotal	39,340	24,168	25,104	24,387	17,638	17,393	21,059	33,587	32,845	22,657	40,444	36,203	334,826
Installation													
Switching	324	57	605	764	280	438	513	579	547	378	455	418	5,358
Transmission	3,623	1,915	307	307	307	307	307	1,615	1,615	1,615	1,615	1,615	15,145
Mobile	4,860	4,617	3,888	1,701	3,888	1,944	2,916	4,860	4,860	1,701	9,720	8,019	52,974
Outside Plant	2,120	374	3,949	4,988	1,829	2,864	3,353	3,783	3,572	2,473	2,969	2,731	35,004
IP	306	306	71	71	71	71	71	10	10	10	10	10	1,015
Rural	493	493	592	592	592	592	592	740	740	740	740	740	7,647
Subtotal	11,726	7,762	9,411	8,422	6,966	6,215	7,751	11,587	11,344	6,917	15,509	13,533	117,142
Total	51,065	31,930	34,515	32,809	24,604	23,609	28,810	45,174	44,189	29,573	55,953	49,737	451,968
adjustment for transmission	(5,434)	(2,873)	(460)	(460)	(460)	(460)	(460)	(2,423)	(2,423)	(2,423)	(2,423)	(2,423)	(22,718)
CAPEX	45,632	29,057	34,055	32,349	24,144	23,149	28,350	42,751	41,767	27,151	53,530	47,314	429,250

Table 3.2 CAPEX (2nd Scenario with mobile phones)

(Unit: Thousand US $)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Equipment (CIF)													
Switching	2,920	515	5,441	6,872	2,519	3,945	4,618	4,853	4,713	3,156	3,541	3,681	46,774
Transmission	18,113	9,575	1,533	1,533	1,533	1,533	1,533	1,643	1,643	1,643	1,643	1,643	43,563
Mobile	9,720	9,234	7,776	3,402	7,776	3,888	5,832	9,556	9,432	3,258	18,399	15,242	103,515
Outside Plant	4,543	801	8,463	10,689	3,919	6,136	7,184	7,550	7,331	4,910	5,508	5,727	72,760
IP	3,058	3,058	708	708	708	708	708	995	995	995	995	995	14,631
Rural	987	987	1,184	1,184	1,184	1,184	1,184	1,480	1,480	1,480	1,480	1,480	15,293
Subtotal	39,340	24,168	25,104	24,387	17,638	17,393	21,059	26,076	25,593	15,442	31,566	28,768	296,535
Installation													
Switching	324	57	605	764	280	438	513	539	524	351	393	409	5,197
Transmission	3,623	1,915	307	307	307	307	307	329	329	329	329	329	8,713
Mobile	4,860	4,617	3,888	1,701	3,888	1,944	2,916	4,778	4,716	1,629	9,199	7,621	51,757
Outside Plant	2,120	374	3,949	4,988	1,829	2,864	3,353	3,523	3,421	2,291	2,571	2,672	33,954
IP	306	306	71	71	71	71	71	10	10	10	10	10	1,015
Rural	493	493	592	592	592	592	592	740	740	740	740	740	7,647
Subtotal	11,726	7,762	9,411	8,422	6,966	6,215	7,751	9,919	9,739	5,350	13,242	11,781	108,283
Total	51,065	31,930	34,515	32,809	24,604	23,609	28,810	35,995	35,332	20,792	44,808	40,549	404,818
adjustment for transmission	(5,434)	(2,873)	(460)	(460)	(460)	(460)	(460)	(493)	(493)	(493)	(493)	(493)	(13,069)
CAPEX	45,632	29,057	34,055	32,349	24,144	23,149	28,350	35,502	34,840	20,299	44,315	40,056	391,749

Table 3.3 Estimated Number of Subscribers for the Fixed Phones in Mid-Year (1st Scenario)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Vientiane Mun	47,775	51,481	54,425	67,825	96,975	118,675	133,275	147,025	158,935	171,917	184,719	198,475	213,213
Phongsaly	313	438	563	569	662	812	812	1,137	1,462	1,762	2,177	3,002	4,139
Luangnamtha	1,096	1,212	1,341	1,546	1,845	2,203	2,474	2,900	3,250	3,963	4,863	5,275	6,496
Oudomxay	1,282	1,408	1,547	1,780	2,132	2,431	2,538	3,238	4,358	5,246	6,275	7,287	8,761
Bokeo	505	543	584	681	852	979	1,012	1,262	1,822	2,294	2,643	3,046	3,509
Louangprabang	5,969	7,775	10,127	8,320	8,182	11,382	11,982	14,632	17,232	18,810	20,748	22,055	23,629
Huaphanh	678	737	801	914	1,090	1,299	1,549	1,847	2,167	2,574	3,298	4,213	5,197
Xayabury	654	794	964	785	762	1,012	1,012	1,262	1,862	3,022	4,192	4,852	5,840
Xiengkhuang	2,351	2,967	3,744	2,845	1,512	1,612	3,054	4,404	4,412	4,587	4,997	5,479	5,911
Vientiane	1,873	2,669	3,805	4,704	5,191	5,730	6,324	6,979	7,866	9,031	10,368	11,903	13,666
Borikhamxay	3,328	4,778	6,859	6,684	5,882	6,732	7,332	7,682	7,953	8,253	8,334	8,427	8,510
Khammnane	5,319	7,414	10,334	10,877	9,720	9,720	9,970	12,220	14,470	15,190	17,089	19,079	20,215
Savannakhet	9,179	13,085	18,653	18,933	18,740	21,840	23,390	27,765	32,520	35,817	39,314	43,152	47,365
Saravane	1,409	1,857	2,448	2,710	2,886	3,266	3,606	4,016	4,341	4,951	5,786	6,252	7,041
Sekong	366	485	642	812	992	1,130	1,368	1,568	1,929	2,460	2,825	3,246	3,733
Champasack	5,331	6,470	7,852	9,469	11,558	13,708	16,428	20,428	24,026	26,675	29,092	31,908	35,258
Attapu	239	267	299	351	431	529	649	796	982	1,216	1,506	1,864	2,308
Xaysomboun	0	0	0	0	0	403	987	1,431	1,854	2,207	2,628	3,129	3,725
Total	87,661	104,376	124,983	139,801	169,411	203,461	227,761	260,592	291,439	319,972	350,852	382,642	418,512

Table 3.4 Estimated Number of Subscribers for the Fixed Phones in Mid-Year (2nd Scenario)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Vientiane Mun	47,775	51,481	54,425	67,825	96,975	118,675	133,275	147,025	158,935	171,917	184,719	198,475	213,213
Phongsaly	313	438	563	569	662	812	812	1,137	1,462	1,762	2,062	2,062	2,512
Luangnamtha	1,096	1,212	1,341	1,546	1,845	2,203	2,474	2,900	3,250	3,963	4,713	4,750	5,750
Oudomxay	1,282	1,408	1,547	1,780	2,132	2,431	2,538	3,238	4,358	5,246	5,826	5,938	6,838
Bokeo	505	543	584	681	852	979	1,012	1,262	1,822	2,294	2,484	2,512	2,662
Louangprabang	5,969	7,775	10,127	8,320	8,182	11,382	11,982	14,632	16,882	18,460	20,748	21,605	22,752
Huaphanh	678	737	801	914	1,090	1,299	1,549	1,847	2,167	2,574	3,298	4,213	5,197
Xayabury	654	794	964	785	762	1,012	1,012	1,262	1,662	2,472	3,282	3,432	3,997
Xiengkhuang	2,351	2,967	3,744	2,845	1,512	1,612	3,054	4,404	4,412	4,587	4,997	5,392	5,652
Vientiane	1,873	2,669	3,805	4,704	5,191	5,730	6,324	6,979	7,866	9,031	10,368	11,903	13,666
Borikhamxay	3,328	4,778	6,859	6,684	5,882	6,732	7,332	7,682	7,832	7,982	8,132	8,282	8,282
Khammnane	5,319	7,414	10,334	10,877	9,720	9,720	9,970	12,220	14,470	14,820	16,719	19,019	19,785
Savannakhet	9,179	13,085	18,653	18,933	18,740	21,840	23,390	27,765	32,520	35,817	39,314	43,152	47,105
Saravane	1,409	1,857	2,448	2,710	2,886	3,266	3,606	4,016	4,341	4,951	5,786	6,252	7,041
Sekong	366	485	642	812	992	1,130	1,368	1,568	1,929	2,429	2,568	3,021	3,521
Champasack	5,331	6,470	7,852	9,469	11,558	13,708	16,428	20,428	24,026	26,675	29,092	31,908	35,258
Attapu	239	267	299	351	431	529	649	796	982	1,216	1,506	1,864	2,308
Xaysomboun	0	0	0	0	0	403	987	1,431	1,854	2,207	2,628	3,129	3,725
Total	87,661	104,376	124,983	139,801	169,411	203,461	227,761	260,592	290,768	318,400	348,240	376,908	409,263

Table 3.5 Estimated Number of Subscribers of the Mobile Phones

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Year End													
1st Scenario	50,900	77,460	120,210	141,552	167,024	197,535	234,243	278,615	330,400	392,290	466,412	555,376	662,410
2nd Scenario	50,900	77,460	120,210	141,552	167,024	197,535	234,243	278,615	324,810	380,655	446,718	525,629	629,545
Average													
1st Scenario	42,098	64,180	98,835	130,881	154,288	182,280	215,889	256,429	304,508	361,345	429,351	510,894	608,893
2nd Scenario	42,098	64,180	98,835	130,881	154,288	182,280	215,889	256,429	301,713	352,733	413,687	486,174	577,587
Difference between With and Without													
1st Scenario	-	22,082	56,737	88,783	112,190	140,182	173,791	214,331	262,410	319,247	387,253	468,796	566,795
2nd Scenario	-	22,082	56,737	88,783	112,190	140,182	173,791	214,331	259,615	310,635	371,589	444,076	535,489
New Subscribers													
1st Scenario		26,560	42,750	21,342	25,472	30,511	36,708	44,372	51,785	61,890	74,122	88,964	107,034
2nd Scenario		26,560	42,750	21,342	25,472	30,511	36,708	44,372	46,195	55,845	66,063	78,911	103,916

Table 3.6 Estimated Number of Subscribers of the Internet

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Year End													
Internet (Dial UP)	7,592	10,559	15,402	18,689	22,712	27,647	33,718	41,209	49,827	60,300	73,043	88,570	107,514
Internet (ADSL)		500	750	824	905	994	1,092	1,200	1,342	1,501	1,679	1,878	2,100
Average													
Internet (Dial UP)	4,973	9,076	12,981	17,046	20,700	25,179	30,683	37,464	45,518	55,063	66,671	80,807	98,042
Internet (ADSL)		250	625	787	865	950	1,043	1,146	1,271	1,422	1,590	1,778	1,989
Difference between With and Without													
Internet (Dial UP)	-	4,103	8,008	12,073	15,727	20,206	25,710	32,491	40,545	50,090	61,698	75,834	93,069
Internet (ADSL)	-	250	625	787	865	950	1,043	1,146	1,271	1,422	1,590	1,778	1,989
New Subscribers													
Internet (Dial up)		2,967	4,843	3,287	4,023	4,935	6,071	7,491	8,618	10,473	12,743	15,527	18,944
Internet (ADSL)		500	250	74	81	89	98	108	142	159	178	199	222

(3) Exchange Rate

Kip-to-US $ Exchange rate is estimated based on the purchasing power parity model. Official mean rate of the year is used for the base exchange rate.

$Et = Et\text{-}1(1+\Delta\theta t/\theta t\text{-}1+\Delta PLt/PLt\text{-}1-\Delta PUt/PUt\text{-}1)$

where Et is the exchange rate of year t,

PPLt is the purchasing power parity conversion factor of Lao P.D.R. against USA in year t,

PLt is the inflation rate of Lao P.D.R. year t,,

PUt is the inflation rate of USA in year t, and

θt is the conversion factor of year t as defined in $\theta t = Et / PPLt$.

Table 3.7 Exchange Rate Estimation

	2000	2001	2002	2003	2004	2005	2006	2007
Inflation Lao*1 (ΔPLt/PLt-1)	23.20%	8.00%	7.20%	5.00%	5.00%	5.00%	5.00%	5.00%
Inflation USA*2 (ΔPUt/PUt-1)	3.40%	1.60%	1.80%	2.50%	2.50%	2.50%	2.50%	2.50%
Conversion Factor (Δθt/θt-1)	1.16%	1.16%	1.16%	1.07%	0.98%	0.89%	0.80%	0.71%
Exchange Rate (E)*3	7,888	8,955	9,542	9,883	10,227	10,574	10,923	11,274

	2008	2009	2010	2011	2012	2013	2014	2015
Inflation Lao*1 (ΔPLt/PLt-1)	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Inflation USA*2 (ΔPUt/PUt-1)	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Conversion Factor (Δθt/θt-1)	0.62%	0.54%	0.45%	0.36%	0.27%	0.18%	0.09%	0.00%
Exchange Rate (E)	11,626	11,979	12,332	12,685	13,036	13,385	13,731	14,075

$\theta_{(1990)}$*3	=	4.30
$\theta_{(2000)}$*3	=	4.87
$\Delta\theta_t/\theta_{t-1}$	=	1.2%
$PPL_{(1990)}$	=	164.7
$PPL_{(2000)}$	=	1621.2

*1 IMF (2002), Country Report No. 02/65, pp.56 prediction up to 2004.
*2 Consumer Price Index for Urban Consumers, Bureau of Labor Statistics, US Department of Labour, US Congressional Budget Office (2002), The Budget and Economic Outlook: Fiscal Years 2003-2012
*3 World Bank (2002), World Development Indicators, p.301

(4) Standard Conversion Factor

The equipment cost in the CAPEX, used in the financial analysis, is converted into the economic cost by the shadow exchange rate. The shadow exchange rate takes into account of the fluctuation in the market price. The shadow exchange rate is obtained from the following equation.

Shadow Exchange Rate = Official Exchange Rate/Standard Conversion Factor

Standard Conversion Factor = (M+X)/((M+T*m*)+(X-Tx))

Where M means total imports (CIF),

X means total exports,
Tm means import tariff and
Tx means export tariff

As shown Table 3.8, the standard conversion factor is estimated as 0.986.

Table 3.8 Standard Conversion Factor

	1997	1998	1999	2000	Average
Total Imports (M)	706	552.8	524.8	535.3	
Total Exports (X)	359	369.5	310.8	330.3	
import tariff estimate (Tm)	20.7	14.2	16.6	-	
export tax estimate (Tx)	3.0	3.1	5.0	-	
Standard Conversion Factor (SCF)	0.984	0.988	0.986	-	0.986
annual average official rate	1259.98	3298.33	7102.03	7887.64	
	1996/97	1997/98	1998/99	1999/00	
import tariff (Tm)-billion kip	47	50	99	138	
export tax (Tx)-billion kip	6	8	24	44	

Source: For M and X, IMF (2002), International Financial Statistics Volume LV, Number 8
For Tm and Tx, IMF(2002), Lao People's Democratic Republic: Selected Issues and Statistical Appendix[9]

(5) *Conversion Factor for the Labor Cost*

The labor cost of non-managers is converted into the economic cost with the conversion factor at 0.927, which is one minus the unemployment rate in Lao P.D.R. in 2000.

Table 3.9 Unemployment Rate in Lao P.D.R.

1996	1997	1998	1999	2000
3.1%	3.9%	5.6%	6.8%	7.3%

Source: ADB (2001) Country Economic Review 2001

The result of the financial and economic evaluation is discussed in Chapter 11.3 in the Main Report.

[9] Tm and Tx are data from October to September. The figures are adjusted to calendar year in the calculation.