2   Method of Approach for Demand Forecast in Lao P.D.R.

2.1   Introduction

Telecommunications demand would be generated by factors in relation with national economic development status such as average disposal income, level of education, level of investment, degree of electrification. Other factors would be the level of telecommunications network and political-will to expand the telecommunications services. It can be seen that economies of the countries that are undergoing the tradition towards a market economy have much higher than expected levels of telecommunications development because of their dependence on new communications for tourism, banking and new ICT management system.

There is another important tendency that mobile cellular subscribers would overtake fixed-line subscribers. This tendency could be enforced by the following country's environment. Firstly, mobile cellular subscribers would overtake fixed-lines subscribers in case that number of mobile subscribers is still less than fixed-line subscribers at present, particularly in insufficient telecommunications network countries. Secondly, where there is competition in the mobile market but not for fixed lines, there is a higher likelihood of a crossover point being reached earlier. Thirdly, as a cultural factor, mobile tends to take off quicker in countries that have a younger, more urbanized population. It also does well in cities where citizens spend a large percentage of their time commuting to work.

Throughout the history of telecommunications, real telecommunications service demand is much high numbers than their supply capacity. ITU has measured "Waiting List" for fixed-line service as a measurement of potential demand in the country. On the other hand, there is no equivalent for mobile service. Because *once mobile base stations are established, consumers can just go and buy a mobile phone, as far as they can afford it.* Investment decisions are shifted from the operator (often the State), to the individual consumer.

The following descriptions show the present impressions of telecommunications services qualities in Lao P.D.R. based on the Lao Telecommunications Demand Survey Results (2001) conducted by JICA Study Team.

(1)   Type of Telecommunication Tools in Lao P.D.R.

In Lao P.D.R., the lack of access to information and knowledge was cited as a significant barrier to generating more income in villages. Radio is a key source of news and information due to its comparatively wide coverage, the

relatively low cost of a radio receiver and the fact that radio can reach illiterate sections of the population. According to the national statistical center, 52 percent of Laotian households had a radio in 1997. Some 30 percent of households had a television in 1997 compared to less than four percent of households with a telephone; less than one percent of the population uses the Internet. In Lao P.D.R., the basic information about what is the telecommunications service is lacking except major provincial capitals.

The demand survey outcomes indicate that telecommunication services infrastructure in the country, especially in those four cities (Luangphrabang, Vientiane, Savannakhet and Pakse district centers) and surrounding areas where the survey was conducted, is still in the developing stage. Presently, the existing types of telecommunication services include fixed phone (for most areas) and fax, mobile and Internet (mainly for big cities or city centers only) are not fully utilized even in Capital city of Vientiane. Particularly, fax, mobile and Internet services are not commonly recognized among people who lives in the rural areas. Thus, demand results for new value-added telecommunications services analyzed by this demand survey could not be fully reflected their opinions.

(2)   Condition of Telecommunication Use and Means

Telecommunication services are one of key public utilities that are essential for people, business communities and society as a whole. However, the survey showed that more than half of the households and institutions interviewed did not have telephones (including mobile) connected due to unavailability of lines and high costs of installation. This limits use of other telecommunication devices, such as fax and Internet, which were found unpopular or even unknown in many city suburbs and provincial districts. On the other hand, the number of public phones in each city or town was also limited and often out of service. Other problems of telecommunication services include low reliability of lines, being engaged and noisy and insufficient number of lines (for almost all devices), narrow service area (mobile), and slow access (Internet) and repair. In this demand forecast study, above constraints are not considered for calculation of telecommunications service demand in the Macro Demand Approach. It is set that people can receive and access satisfied telecommunications services with an affordable charge as a prerequisite condition.

(3) Issues for Telecommunication Service Improvement

Based on the problems and needs of the target groups, it is important to expand telecommunication services more to local districts and surrounding areas of city centers to satisfy the needs of rural communities, especially telephone services. Furthermore, it is necessary to improve quality of mobile phone and internet services by increasing area coverage, high speed performance while maintaining competitive prices, which are affordable for both users and service providers. These also require applications of modern telecommunication technologies and sufficient backbone infrastructure enabling service providers to expand their service capacity and increase service quality as well.

(4) Demand for ICT Telecommunication Services (Internet and Leased lines)

The market of Internet services is developing in four surveyed main cities. The number of both individual and institutional users increased remarkably during 1998-2000 from 11 to 36 percent and then it slowed down to 21 percent in 2001 (for the institution). However, it is expected that the trend would go up in future if the existing problems (slow access, limited service areas, expensive fees, etc.) are solved quickly retain existing clients and acquiring new customers. For forecasting future telecommunications services, particularly for value-added services, the demand pattern of this category should be adjusted to the neighboring countries' experiences.

Table 2.5 below shows the various demand forecast methodologies by type of telecommunication services, such as fixed telephone, telex and telegram, cellular mobile telephone, radio paging services, and leased circuit services. Again, a certain coefficient factor should be multiplied to the calculation results obtained by the regression curve for including the potential demand factor of the country at any type of telecommunication services due to the lack of appropriate waiting list data in the country.

Table 2.5   Various Macro Demand Forecast Methodology for Telecommunication Services

Types of Services	Demand Methodology	Subject to:	Results	General Evaluation/Tendency
1) Fixed Telephone	1) ITU World regression model (other countries' telephone demand density) or/and 2) Historical/ past trend of telephone numbers or/and 3) Population growth rate	1) GDP per Capita projection 2) Population projection (national & local) 3) Waiting projection 4) Socio-economic characteristics for local demand allocation	Telephone density per 100 people at target year	- Increasing with the economic growth level of the country
2) Telex and Telegram	1) Historical/ past growth rate	1) Expansion ratio of facsimile and data communication	No of telex subscribers	- Decreasing rapidly. In general, telex and telegram services will be integrated into ICT services if available. However, still important communication tools in rural areas.
3) Cellular Mobile Telephone	1) Market segmentation analysis by questionnaire and/or interviews (field survey) 2) Regression model (Cellular mobile telephone ratio to main lines in the world)	1) Past diffusion ratio 2) A correlation between the cellular mobile subscribers per 1,000 population and fixed telephone subscribers per 100 population (mature telephone infrastructure and developed economies. 3) A correlation between the cellular mobile subscribers per fixed telephone subscribers and fixed telephone subscribers per 100 population (poorly developed fixed-link network country) 4) Price of cellular mobile terminal	No. of subscribers	- Explosive growth with poor main telephone line infrastructure as an alternative to the fixed-link (main telephone line) infrastructure. - The cellular mobile telephone penetration ratio to main telephone lines in some developing countries, such as Thailand, Malaysia and Philippines, is relatively high growth in spite of low-density group.
4) Radio Paging Services	1) Regression model	1) Correlation between main telephone density and radio paging terminal density. 2) Regression model (Number of radio paging terminals in period t, Population in period t, and Number of main lines in period t)	No. of subscribers (Paging density per 1,000 population)	- Radio paging demand is closely linked to the diffusion of public payphone and main telephone lines.
5) Leased Line Services (Telex, Voice, Data and Packet services)	1) Regression model 2) Share analysis for telex, voce data and Packet services	1) Correlation between main telephone line densities and leased lines service densities. 2) Regression model (Number of data services in period t, Population in period t and Number of main lines in period t)	No. of packet terminals and packet ports (Leased lines for packet data service)	- A portion of the demand in data communication's terminals, such as data services and packet terminals will be a portion of the demand for ICT services. Some internet users also will become the demand of ICT services.

Source: Tabulated based on the ITU Data Book and Study Reports

Supporting for Telecommunications Demand Forecast

The following section describes three types of forecast methods for telecommunications demand for Lao P.D.R., namely, Macro Demand Approach and two Micro Demand Approaches (Target Demand Approach and Socio-economic Demand Approach). In this Report, the telecommunications demand will be projected up to the year of 2015 in Lao P.D.R. using a Macro Demand Approach and a Target Demand Approach. The base year for these forecasts will be set at 2000 population by district (estimated figures by National Statistical Center), and successive forecasts will be calculated for 2005, 2010 and 2015.

Procedures of three telecommunications demand forecast for Lao P.D.R. are outlined in diagram below and detailed descriptions are follows.

Macro Demand Approach

Target Demand Approach (Micro Demand Method I)

Socio-economic Demand Approach (Micro Demand Method II)

Projected GDP per Capita in 2005, 2010 and 2015 (Lao PDR)

Population by District in 1995 Census/ 2000 Census

Present demand (2000) Number of subscriber lines & number of waiting applicants (if any)

Results of National Telecommunication Survey (Questionnaires and Interviews for Households and Institutions)

ITU Regression model (GDP/Capita & Densities of telephone, Mobile, Value-added services of other countries' experiences)

Population Projection by District in 2005 (Urban & Rural P...

Population Projection by District in 2010 (Urban & Rural I...

Population Projection by District in 2015 (Urban & Rural by District, if available)

Evaluation of household income & expenditure classification & telephone subscriber by district level

Telecommunications (Telephone, etc) density in 2005, 2010 & 2015 (Lao PDR)

Results of National Telecommunications Survey (Questionnaires and Interviews for Households and Institutions)

Number of households demanding telecommunications in 2005

Number of households demanding telecommunications in 2010

Number of households demanding telecommunications in 2015

Total population projection in 2005, 2010 & 2015 (Lao P.D.R.)

Target Telecommunications Service Scenario by District in 2005, 2010 and 2015 (Target Demand Approach)

Share estimates (telephone, mobile phone, value-added services) for telecommunications demand in 2005, 2010 & 2020

Growth of income per household up to 2015 by using:
1. GDP growth rate
2. Population growth rate

...ustment factor (1<) for grasping the potential demand in the country

Demand for Telephone by District in 2005, 2010 and 2015

Demand for Mobile phone by District in 2005, 2010 and 2015

Demand for Value-added Services by District in 2005, 2010 and 2015

No. of households demanding Telephones in 2005, 2010 and 2015 (Exponential model in 2000-2015)

No. of households demanding Mobile phones in 2005, 2010 and 2015 (Exponential model in 2000-2015)

No. of households demanding Value-added Services in 2005, 2010 and 2015 (Exponential model in 2000-2015)

Telecommunications Demand in 2005, 2010 and 2015 by **Macro Demand Method** (Lao P.D.R).

Telecommunications Demand in 2005, 2010 and 2015 by **Micro Demand Method (I)**

Telecommunications Demand in 2005, 2010 and 2015 by **Micro Demand Method (II)**

Evaluation of the results by three Methods

Appropriate Telecommunications Demand Forecast in 2005, 2010 and 2015 for Lao P.D.R.
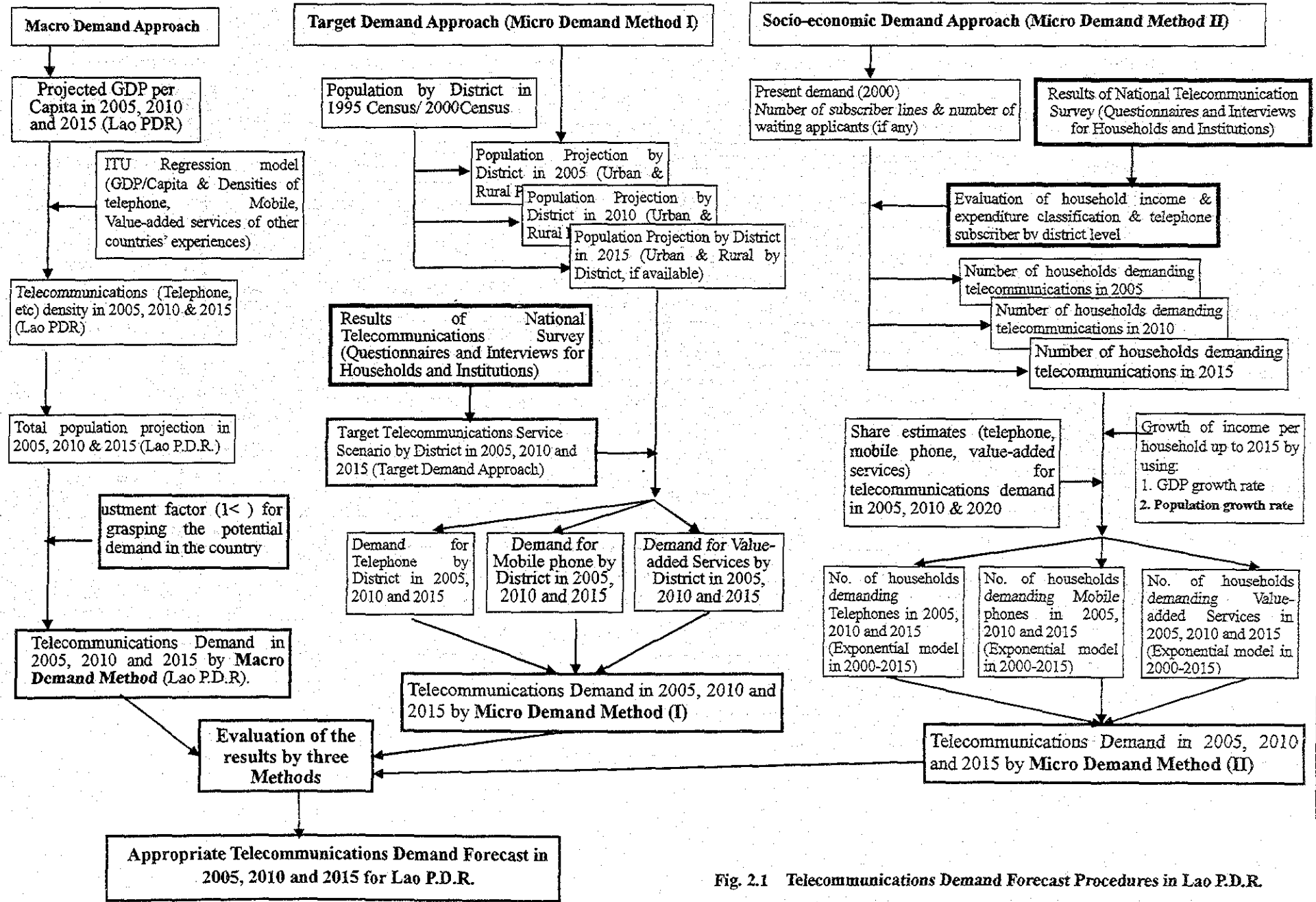
Fig. 2.1   Telecommunications Demand Forecast Procedures in Lao P.D.R.

2.2   Macro Demand Forecast Methodology (Regression Model)

In the previous section (Section 1.2), it is described that a national level demand (Macro Demand Forecast by DETECON and ITU studies as a example) can be projected through the study of the correlation between the telephone supply density (per 100 population or inhabitants) and GDP per capita using the data in other countries experiences (supply regression curve).

GDP per capita $y = 0.0087x^{0.9002}$
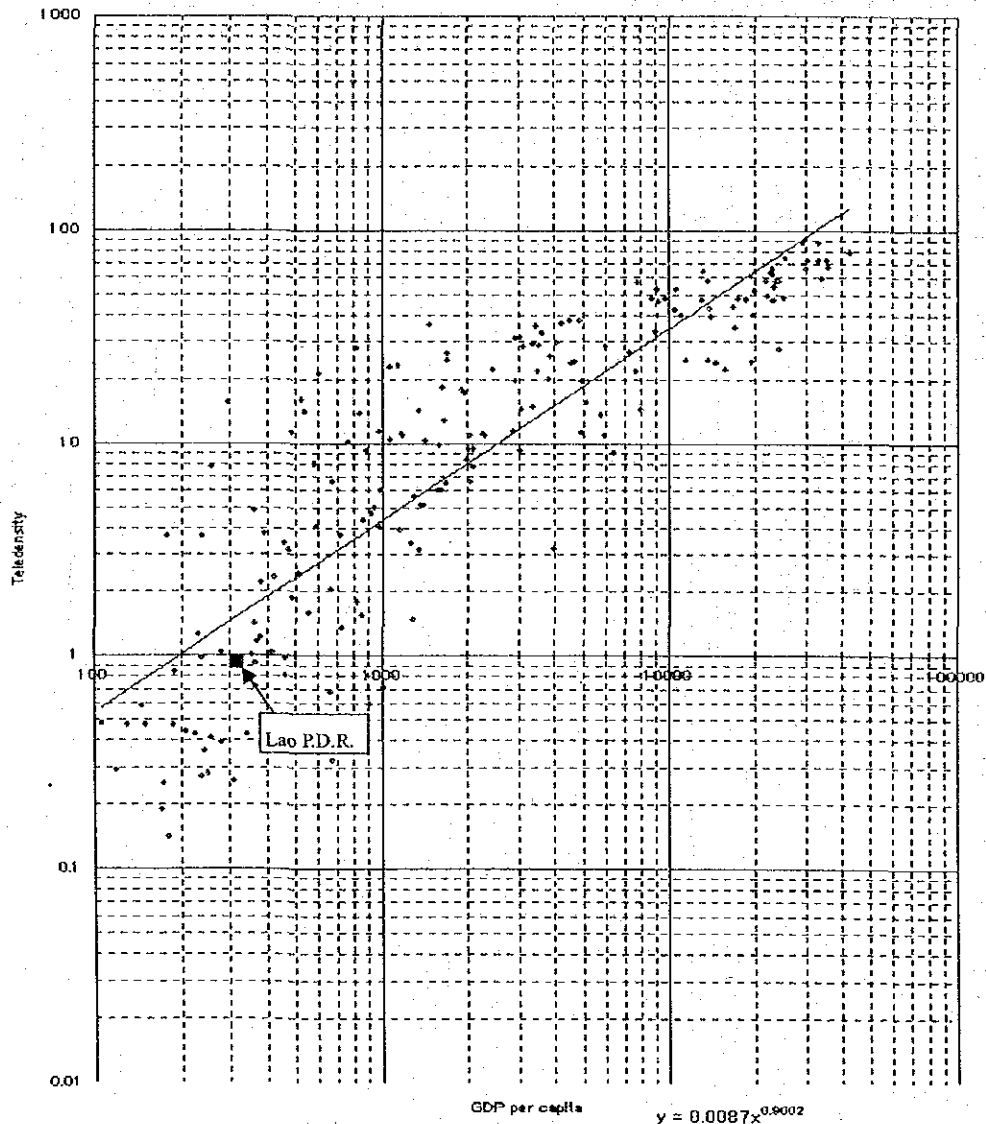
Source: ITU, "World Telecommunication Development Report 2002"

Fig. 2.2   Growth of Countries and Development of Telecommunications (GDP per Capita & Fixed Main Line Teledensity)

Source: ITU, "World Telecommunication Development Report 2002"

$$y = 0.0018x^{1.0944}$$
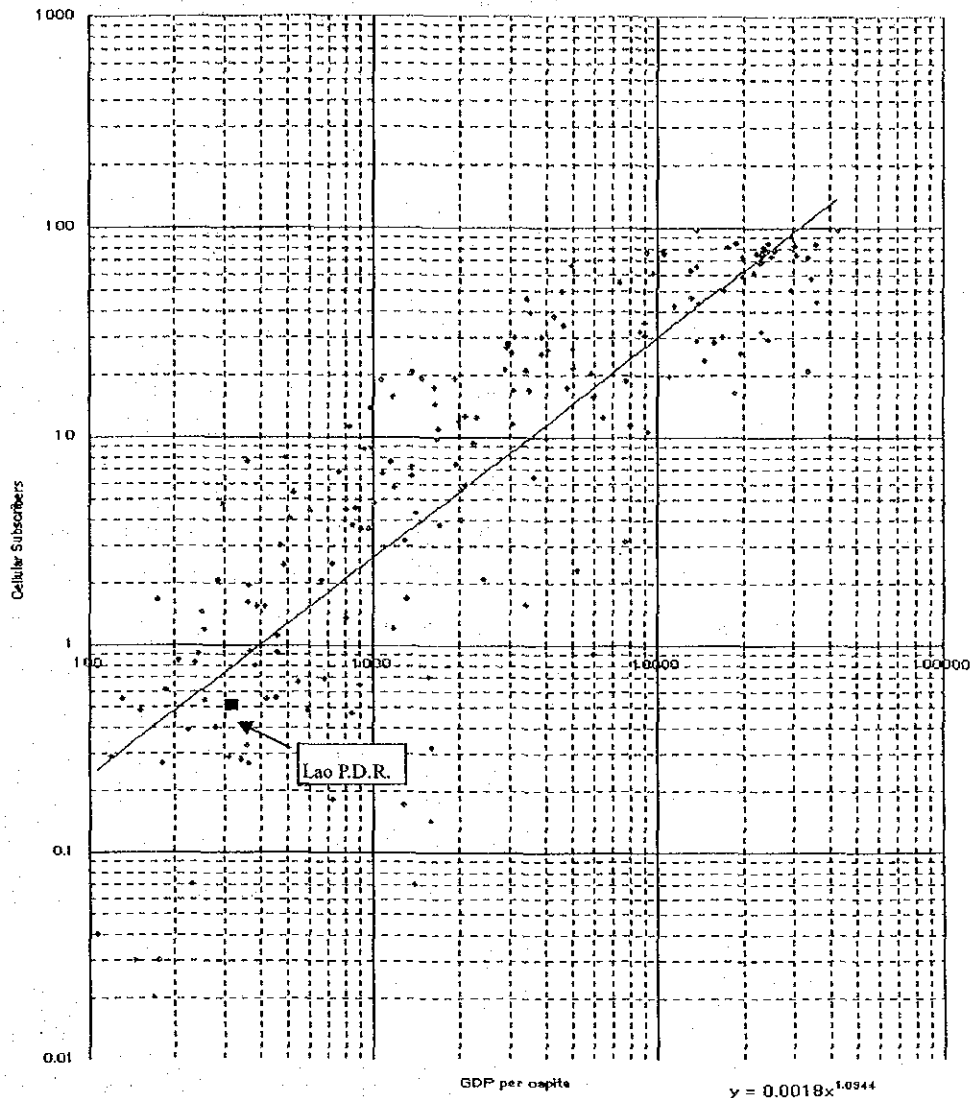
Fig. 2.3   Growth of Countries and Development of Telecommunications (GDP per Capita & Cellular Phone Teledensity)

Another modified regression methodology can be applied for national demand forecast using the telephone demand density (consist of the number of the existing main lines and registered waiting applicants) and GDP per capita.   Obviously, the *calculation result obtained by a regression curve using a previous DETECON and* ITU Macro Demand Forecast Methods do not include the potential demand, such as those who cannot afford to install telephone lines at their homes or offices and those who live in the remote areas far from the existing installed telephone lines. Generally speaking, this potential demand is much larger in developing countries where the telephone line network and capacity has not been well developed and

expanded within the country, such as Lao P.D.R.

Thus, in this chapter, the following formulation of telecommunications demand (in case of fixed telephone) is applied to forecast national telecommunications demand with potential demand in the country:

Total Telephone Demand in the country at year X =

Number of Main Lines at year X +

Number of Waiting Applicants (if any) at year X

Subject to: Number of Waiting Applicants =Potential Demand at year X

However, waiting applicants lists within the country are not fully recorded in many developing countries including Lao P.D.R.. In case of Lao P.D.R. number of waiting applicants is registered only at Vientiane area. Thus, a certain coefficient factor should be multiplied to the above equation for absorbing the remaining potential demand in the country. Adjusted equation will be as follows:

Total Telephone Demand in the country at year X =

[Number of Main Lines at year X] x(multiply)

[Coefficient Factor Z (Subject to: 1<Z)]

Coefficient Factor Z for Lao P.D.R. is driven from other developing countries' experience. The Coefficient Factors in the developing countries varies between 2.09 (Cambodia) and 1.04 (Malaysia) according to 1999 data and between 1.95 (Cambodia) and 1.07 (Thailand) in 2000 data (see Tables 2.2 and 2.3)

Table 2.4 shows low-income countries which are designated based on the GDP per capita corresponding with 2005, 2010 and 2015 Lao GDP per capita range which is planned in the "2020 socio-economic strategy plan". Thus, target level of telecommunications service (teledensity) in Lao P.D.R. by 2015 could be considered at the levels of Philippines or Sri Lanka at present.

Table 2.2 Coefficient Ratio for Potential Demand in Selected Counties in 1999 data

Country	1999 Population	GDP/ Capita (1998)	①Telephone Supply Density (1999)	②Telephone Supply lines (1999)	③Telephone Waiting list	④Telephone Total Demand lines(②+③)	Coefficient Ratio (④/②)
Developing Countries	Million Population	US$	per 100 population	x1,000.	x1,000.	x1,000	
Cambodia	10.95	196	0.25	27.7	n.a.	n.a.	---
Nepal	22.37	209	1.13	253.0	274.6	527.6	2.09
Lao P.D.R.	5.30	249	0.65	34.5	VET(8.3)	(42.8).	(1.24)
Bangladesh	126.95	265	0.34	433.0	172.1	605.1	1.40
India	998.06	435	2.66	26,511.3	3,680.6	30,191.1	1.14
Pakistan	134.51	466	2.22	2,986.1	298.0	3,284.1	1.10
Indonesia	209.25	605	2.91	6,080.2	n.a.	n.a.	---
Sri Lanka	18.64	854	3.64	679.2	225.3	904.5	1.33
Philippines	74.45	898	3.88	2,892.4	900.2	3,792.6	1.31
Thailand	60.86	1,862	8.57	5,215.6	419.5	5,635.2	1.08
Malaysia	21.83	3,333	20.30	4,430.8	160.0	4,590.8	1.04
Developed Countries							
Canada	30.49	20,098	65.45	19,956.6	0.0	19,956.6	1.0
U.K.	59.50	23,810	56.72	33,750.0	0.0	33,750.0	1.0
Japan	126.51	30,105	55.75	70,530.0	0.0	70,530.0	1.0
U.S.A.	272.69	32,414	67.30	183,520.6	0.0	183,520.6	1.0

Source: ITU, "World Telecommunication Indicators", March 2001

Table 2.3 Coefficient Ratio for Potential Demand in Selected Counties in 2000 data

Country	①Telephone Supply Lines (2001)	②Telephone Waiting List (2000)	③Telephone Total Demand Lines (①+②)	Coefficient Ratio (④/②)
Developing Countries	x 1,000	x 1,000	x 1,000	
Cambodia	33.5	n.a.	n.a.	
Nepal	298.1	283.4	581.5	1.95
Lao	52.6	5.9	58.5	1.11
Bangladesh	514.0	181.5	695.5	1.35
India	34,732.1	3,680.6	38,412.7	1.11
Pakistan	3,400.0	298.0	3,698.0	1.09
Indonesia	7,949.3	n.a.	n.a.	-
Sri Lanka	828.0	269.5	1,097.5	1.33
Philippines	3,100.0	n.a.	n.a.	-
Thailand	5,973.5	415.2	6,388.7	1.07
Malaysia	4,738.0	n.a.	n.a.	-
Developed countries				
Canada	20,319.3	0.0	20,319.3	1.00
U.K.	34,710.0	0.0	34,710.0°	1.00
Japan	76,000.0	0.0	76,000.0	1.00
U.S.A.	190,000.0	0.0	190,000.0	1.00

Source: ITU, "World Telecommunications Development Report 2002"

Table 2.4   GDP per capita and Fixed-line Telephone Density by Country

Year		2000(1999)					2005					2010					2015		
Lao GDP/capit →		US$350			Lao forecasted	US$500 ↔ US$550				Lao forecasted	US$700 ↔ US$750				Lao forecasted	US$950 ↔ US$1,125			
Range of Referenced Data(1998)		US$300-400			Range of Referenced Data	US$450-600				Range of Referenced Data	US$600-850				Range of Referenced Data	US$850-1,225			
	Code	Target Range	US$300-400	No. of Fixed Tel	Teledensity	Code	Target Range	US$450-600	No. of Tele. Line	Teledensity	Code	Target Range	US$600-850	No. of Tele. Line	Teledensity	Code	Target Range	US$850-1,225	No. of Tele. Line	Teledensity
1	12	Cent. a	$302	9,900	0.28	1 / 1	Afghan	$523	29,000	0.13	1 / 2	Angola	$620	96,300	0.77	1 / 68	Bolivia	$1,072	502,500	6.17
2	15	Comoros	$382	6,500	0.96	2 / 3	Armenia	$537	547,300	15.53	2 / 7	Bhutan	$624	11,800	1.80	2 / 82	Georgia	$899	671,500	12.31
3	23	Ghana	$372	158,600	0.81	3 / 4	Azerbaijan	$537	730,000	9.48	3 / 11	Cameroon	$664	94,600	0.64	3 / 84	Guyana	$881	64,000	7.49
4	30	Kenya	$395	304,600	1.03	4 / 26	Haiti	$452	70,000	0.87	4 / 14	China	$768	108,715,800	8.58	4 / 88	Jord	$1,191	565,300	8.72
5	31	Kyrgyzstan	$350	355,800	7.62	5 / 44	Nicaragua	$453	150,300	3.04	5 / 16	Congo	$700	22,000	0.77	5 / 102	Philippin	$898	2,892,400	3.88
6	32	Lao P.D.R.	$249	34,500	0.65	6 / 46	Nigeria	$551	410,000	0.38	6 / 17	Cote d Ivoir	$818	219,300	1.51	6 / 106	Sri Lanka	$854	679,200	3.64
7	38	Mauritania	$394	16,500	0.64	7 / 47	Pakistan	$466	2,986,100	2.22	7 / 27	Honduras	$839	279,200	4.42	7 / 110	Syria	$1,134	1,600,000	9.93
8	39	Moldova	$374	555,300	12.68	8 / 50	Senegal	$520	165,900	1.79	8 / 24	Guinea	$677	46,200	0.59					
9	40	Mongolia	$388	103,400	3.95	9 / 58	Turkmenistan	$582	358,900	8.19	9 / 29	Indonesia	$605	6,080,200	2.91					
10	48	Rwand	$306	12,700	0.17	10 / 62	Zambia	$463	83,100	0.93	10 / 64	Albania	$806	140,400	3.65					
11	49	S Tome & Principe	$358	4,500	3.15	11 / 63	Zimbabwe	$520	239,000	2.07	11 / 69	Bosnia	$836	367,900	9.58					
12	54	Sudan	$364	251,400	0.87						12 / 75	Djibouti	$846	3,800	1.40					
13	57	Togo	$322	38,200	0.85						13 / 93	Maldives	$717	22,200	7.97					
14	60	Viet Nam	$335	2,105,900	2.68						14 / 99	Papua N. G.	$843	59,800	1.27					
15	61	Yemen	$348	291,400	1.67						15 / 115	Ukraina	$834	10,074,000	19.89					
		Average	$349	283,280	2.53			$509	524,509	4.06			$746	8,415,900	4.38			$990	996,414	7.45

Average GDP per Capita & Fixed Teledensity by income group				
Low Income Country	$616		4.32	Equation: $Y = 131.1 \times X + 49.1$
Lower Middle Income Countries	$1,621		11.99	

Based on this assumption, the Coefficient Factor Z for Lao P.D.R. was set at the level of 1.30 according to the coefficient index of Sri Lanka and Philippines (refer to Tables 2.2 and 2.3 above).

The following Table shows the image of the results after the Macro Demand Approach has been taken for estimating the future telecommunications demand in Lao P.D.R.

Table 2.5   Telecommunications Demand Forecast in Lao P.D.R.(framework)

	1996	1997	1998	1999	2000	2001	2005	2010	2015	2020
Teledensity	0.41	0.48	0.55	0.65	0.79	0.91	Figures will be obtained by the Regression analysis by ITU world data package with Coefficient Factor of potential demand in the country.			
Fixed Telephone Subscribers	19,468	24,553	28,472	34,493	40,853	48,557				
Mobile Phone	3,790	4,915	6,453	9,048	13,773	29,545	↑	↑	↑	
Telex	60	60	58	--	42	46				
Internet Subscribers					2,610	n.a.				
GDP per capita (US$)			$320		$350		$500-550 (Projected by SPC)	$700-750 (Projected)		$1,200-1,500 (Projected)
Population:thd)				5,091.	5,218.	5,321.				

Note: The results derived from these data does not bare the present and future potential demand which exists largely in the developing countries due to a poor telecommunications network and its capacity.

2.3 Micro Demand Forecast Methodology

(1) Target Demand Approach

Macro Demand Approach (see Section 2.2) followed by the regression analysis method can only estimate nation-wide telecommunications demand. It could not indicate telecommunications service demand by district level in Lao P.D.R. Demand allocation by district using the population ratio is not appropriate method for Lao P.D.R. due to majority of population belongs to either rural (less telephone service) or remote area (no telephone service).

As a micro demand forecast method, district telecommunications demand was estimated for the years of 2015 as an example, according to a target telecommunications demand level (Scenario for 2015). The telecommunication service level for each district at each target year will be set for calculation of its demand. Thus, a national telecommunications demand at a target year will be obtained by the aggregation of district demands at the same year.

Tables 2.6 to 2.10 are supplementary data for setting up the "Criteria for Target Approach Scenario in 2005, 2010 and 2015 by District Level"(see Table 2.11). District teledensity of Vientiane municipality is, for example, given by consideration of other country's large city teledensity experiences (Table 2.6: Large City Teledensity and Rest of Country Teledensity in 1999"). Also, fixed-line teledensity and cellular phone ratio (cellular phone ratio to total subscribers) by district is applied by consideration of "Cellular Subscribers Teledensity and Percent of Total Telephone Subscribers in other country's experience" (Table 2.10). The "Ratio of Cellular Phone Subscribers to Fixed Phone Subscribers and Total Subscribers" is analyzed for determining the cellular phone ratio by district (Table 2.9). With these Tables, target ratio of cellular phone subscribers to total subscribers by district category (capital, regional, provincial, district center, remote district center) is determined for each target year in Lao P.D.R.. Criteria for target approach scenario at each target year by district category are summarized in Table 2.11.

Table 2.6   Regional Disparity of Telephone Line Density in Selected Countries

Country	Year	Primacy City (A)	Other areas (B)	National Average	(A)/(B)
Thailand	1998	36.1	4.7	8.4	7.7
	2000	38.4	5.4	9.2	7.1
Malaysia	1998	30.0	18.9	19.5	1.6
	2000	28.2	19.8	20.3	1.4
Indonesia	1998	22.5	1.8	2.7	12.5
	2000	24.7	2.1	3.1	11.8
Philippines	1998	9.2	0.9	2.1	10.2
	2000	14.2	2.4	4.0	5.9

Source: ITU, World Telecommunication Development Report, 1999 and ITU, World Telecommunication Development Report, 2002

Table 2.7　Large City Teledensity and Rest of Country Teledensity in 1999

		year	2000(1999)						2005						2010						2015		
		Lao GDP/capit	US$350					forecasted	US$500		US$550			forecasted	US$700		US$750			forecasted	US$950		US$1,125
		Range of Referenced Data(199	US$300-400			Range of Referenced Data			US$450-600			Range of Referenced Data			US$600-850			Range of Referenced Data			US$850-1,225		
	Code		Largest City Teledensity		Rest of country Teleden		Code		Largest City Teledensity		Rest of country Teleden		Code		Largest City Teledensity		Rest of country Teleden		Code		Largest City Teledensity		Rest of country Teleden
1	12	Central Africa R	1.53		n 0.03	1	1	Afghan	1.01		0.04	1	2	Angola	2.06		0.44	1	68	Bolivia	11.49		5.03
2	15	Comoros	...		...	2	3	Armenia	20.56		13.10	2	7	Bhutan	26.75		0.91	2	82	Georgia	28.89		7.70
3	23	Ghana	5.43		0.25	3	4	Azerbaijan	18.42		6.09	3	11	Cameroon	3.94		0.32	3	84	Guyana	10.08		6.13
4	30	Kenya	7.11		0.47	4	26	Haiti	...		...	4	14	China	29.45		6.70	4	88	Jord	23.23		4.15
5	31	Kyrgyzstan	19.72		5.26	5	44	Nicaragua	7.37		1.61	5	16	Congo	...		...	5	102	Philippin	14.55		1.61
6	32	Lao P.D.R.	...		...	6	46	Nigeria	1.10		0.29	6	17	Cote d Ivoir	5.73		0.51	6	106	Sri Lanka	24.54		2.91
7	38	Mauritania	1.75		0.23	7	47	Pakistan	6.22		1.74	7	27	Honduras	9.88		3.10	7	110	Syria	14.11		9.17
8	39	Moldova	30.43		8.83	8	50	Senegal	5.42		0.79	8	24	Guinea	1.87		0.22						
9	40	Mongolia	10.13		1.70	9	58	Turkmenistan	15.51		7.11	9	29	Indonesia	16.33		2.27						
10	48	Rwand	4.27		0.04	10	62	Zambia	2.45		0.61	10	64	Albania	9.28		2.76						
11	49	S.Tome & Princ	7.32		0.48	11	63	Zimbabwe	7.52		0.96	11	69	Bosnia	47.96		6.60						
12	54	Sudan	4.49		0.20							12	75	Djibouti	1.84		0.26						
13	57	Togo	3.29		0.23							13	93	Maldives	26.38		2.25						
14	60	Viet Nam	13.27		2.15							14	99	Papua N.G.	...		...						
15	61	Yemen	7.69		1.15							15	115	Ukraina	41.80		17.82						
		Average	7.76		1.40				7.78		2.94				14.88		2.94				18.13		5.24

Source: ITU "World Telecommunication Indicators", March 2001

Average GDP per Capita & Fixed Teledensity by Incom Group

Teleden	Large City	Whole Country
Low Income	9.20	3.82
Lower Middle Income	25.06	11.71
Whole Asia	25.85	7.65

Equation:

$$Y = 2.01 * X + 1.52$$

Subject to: X=Overall country teledensity in 1999

Table 2.8   Cellular Subscribers Teledensity and Percent of Total Telephone Subscribers in 1999

year			2000(1999)						2005						2010						2015		
Lao GDP per			US$350					US$500		US$550				US$700		US$750				US$950		US$1,125
nge of Referenced Data(199			US$300-400			Range of Referenced Data			US$450-600			Range of Referenced Data			US$600-850			Range of Referenced Data			US$850-1,225	
	Code	Target Range	Cellular Teledensity	No. of Cellular Subscriber Line	as% of total telephone subscribers in 1999		Code		Cellular Teledensity	No. of Subscriber Line	as% of total telephone subscribers in 1999		Code		Cellular Teledensity	No. of Subscriber Line	as% of total telephone subscribers in 1999		Code		Cellular Teledensity	No. of Subscriber Line	as% of total telephone subscribers in 1999
1	12	Central Africa	0.12	4,200	29.70	1	1	Afghanistan	...	----	...	1	2	Angola	0.19	24,000	19.90	1	68	Bolivia	5.16	420,300	45.50
2	15	Comoros	...	----	...	2	3	Armenia	0.23	8,100	1.50	2	7	Bhutan	...	---	...	2	82	Georgia	1.88	102,500	13.20
3	23	Ghana	0.36	70,000	30.60	3	4	Azerbaijan	2.34	180,000	19.80	3	11	Cameroon	0.03	4,200	5.30	3	84	Guyana	0.33	2,800	4.20
4	30	Kenya	0.08	23,800	7.20	4	26	Haiti	0.31	25,000	26.30	4	14	China	3.42	43,296,000	28.50	4	88	Jordan	1.83	118,400	17.30
5	31	Kyrgyzstan	0.06	2,600	0.70	5	44	Nicaragua	0.90	44,200	22.70	5	16	Congo	0.12	3,400	13.40	5	102	Philippines	3.83	2,850,000	49.60
6	32	Lao P.D.R.	0.17	9,000	20.80	6	46	Nigeria	0.02	25,000	5.70	6	17	Cote d Ivoire	1.77	257,100	54.00	6	106	Sri Lanka	1.22	227,900	25.10
7	38	Mauritania	...	---	...	7	47	Pakistan	0.21	278,800	8.50	7	27	Honduras	1.24	78,600	22.00	7	110	Syria	0.02	4,000	0.20
8	39	Moldova	0.41	18,000	3.10	8	50	Senegal	0.95	87,900	34.60	8	24	Guinea	0.32	25,200	35.30						
9	40	Mongolia	1.32	34,600	25.10	9	58	Turkmenista	0.09	4,000	1.10	9	29	Indonesia	1.06	2,221,000	26.80						
10	48	Rwanda	0.15	11,000	46.50	10	62	Zambia	0.31	28,200	25.30	10	64	Albania	0.29	11,000	7.30						
11	49	S.Tome & Pri	...	----	...	11	63	Zimbabwe	1.51	174,000	42.10	11	69	Bosnia	1.37	52,600	12.50						
12	54	Sudan	0.05	13,000	4.90							12	75	Djibouti	0.04	300	3.10						
13	57	Togo	0.38	17,000	30.80							13	93	Maldives	1.05	2,900	11.70						
14	60	Viet Nam	0.42	328,700	13.50							14	99	Papua N.G	0.15	7,100	10.60						
15	61	Yemen	0.16	27,700	8.70							15	115	Ukraina	0.43	216,600	2.10						
		Average	0.25	37,307	14.77				0.62	77,745	17.05				0.77	3,080,000	16.83				2.04	532,271	22.16

Source: ITU "World Telecommunication Indicators", March 2001

Note: As a % of total telephone subscribers is obtained by dividing the number of cellular subscribers by the total number of telephone subscribers (sum of the main telephone lines and the cellular subscribers) and multiply by 100.

GDP per Capita

Cellular mobile	Cellular Teledensity		% of Telephone Subscribers
Low Income Country	1.38		24.20
Lower Mid	2.28		16.00
Upper Middle	13.40		40.20
High Income	33.70		39.20
Whole Asia	4.52		35.20

$Y = -24.4 * X + 993.9$

Y: Cellular Teledensity

X: % of Telephone Subscribers

Table 2.9　Ratio of Cellular Phone Subscribers to Fixed Phone Subscribers and Total Subscribers

	Year	2000(1999)					2005					2010					2015		
	Lao GDP/cap	US$350		forecasted US$500		US$550		forecasted US$700		US$750		forecasted US$950		US$1,125
	Range of Referenced Data	US$300-400		Range of Referenced Dat	US$450-600		ange of Referenced Da	US$600-850		nge of Referenced Da	US$850-1,225
	Code	Target Range	US$300-400	Ratio of Cellular to Fixed(%)	Ratio of Cellular to Total(%)	Code	Target Range	US$450-600	Ratio of Cellular to Fixed(%)	Ratio of Cellular to Total(%)	Code	Target Range	US$600-850	Ratio of Cellular to Fixed(%)	Ratio of Cellular to Total(%)	Code	Target Range	US$850-1,225	Ratio of Cellular to Fixed(%)	Ratio of Cellular to Total(%)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1	12	Central Africa	$302	42.4%	n29.8%	1	Afghan	$523	—	—	2	Angola	$620	24.9%	20.0%	68	Bolivia	$1,072	83.6%	45.5%
2	15	Comoros	$382	—	—	3	Armenia	$537	1.5%	1.5%	7	Bhutan	$624	—	—	82	Georgia	$899	15.3%	13.2%
3	23	Ghana	$372	44.1%	30.6%	4	Azerbaijan	$537	24.7%	19.8%	11	Cameroon	$664	4.4%	4.3%	84	Guyana	$881	4.4%	4.2%
4	30	Kenya	$395	7.8%	7.2%	26	Haiti	$452	35.7%	26.3%	14	China	$768	39.8%	28.5%	88	Jord	$1,191	20.9%	17.3%
5	31	Kyrgyzstan	$350	0.7%	0.7%	44	Nicaragua	$453	29.4%	22.7%	16	Congo	$700	15.5%	13.4%	102	Philippin	$898	98.5%	49.6%
6	32	Lao P.D.R.	$249	26.1%	20.7%	46	Nigeria	$551	6.1%	5.7%	17	Cote d Ivcire	$818	117.2%	54.0%	106	Sri Lanka	$854	33.6%	25.1%
7	38	Mauritania	$394	—	—	47	Pakistan	$466	9.3%	8.5%	27	Honduras	$839	28.2%	22.0%	110	Syria	$1,134	0.3%	0.2%
8	39	Moldova	$374	3.2%	3.1%	50	Senegal	$520	53.0%	34.6%	24	Guinea	$677	54.5%	35.3%					
9	40	Mongolia	$388	33.5%	25.1%	58	Turkmenistan	$582	1.1%	1.1%	29	Indonesia	$605	36.5%	26.8%					
10	48	Rwand	$306	86.6%	46.4%	62	Zambia	$463	33.9%	25.3%	64	Albania	$806	7.8%	7.3%					
11	49	S.Tome & Prin	$358	—	—	63	Zimbabwe	$520	72.8%	42.1%	69	Bosnia	$836	14.3%	12.5%					
12	54	Sudan	$364	5.2%	4.9%						75	Djibouti	$846	3.4%	3.3%					
13	57	Togo	$322	44.5%	30.8%						93	Maldives	$717	13.1%	11.6%					
14	60	Viet Nam	$335	15.6%	13.5%						99	Papua New	$843	11.9%	10.6%					
15	61	Yemen	$348	9.5%	8.7%						115	Ukraina	$834	2.2%	2.1%					
		Average	$349	13.2%	11.6%			$509	14.8%	12.9%			$746	36.6%	26.8%			$990	53.4%	34.8%

	1996	1997	1998	1999	2000	2001		2005 (forecasted)	2010 (forecasted)	2015 (forecasted)
Number of Fixed Telephone Subscribers	19,468	24,553	28,472	34,493	40,853	48,557		170,387	271,309	431,205
No. of Cellular/Mobile Subscribers	3,790	4,915	6,453	9,048	13,773	29,545		113,591	271,309	646,808
Ratio of Cellular to Fixed Subscribers	19.5%	20.0%	22.7%	26.2%	26.2%	60.8%		66.7%	100.0%	150.0%
Ratio of Cellular to Total Subscribers	16.3%	16.7%	18.5%	20.8%	25.2%	37.8%	Target Proportio	40.0%	50.0%	60.0%
	Ratio of Cellular Phone to Total Subscribers by Dist r				Capital Districts (Part of Vientiane Municipality), Regional Center Districts & High Potential Districts (Districts of Regional Commercial & Industrial Promotion Areas)			45.0%	55.0%	65.0%
					Provincial Capital District Centers and High Potential Districts (Tourism, Border Trade and Industrial Promotion Areas)			25.0%	35.0%	55.0%
					Other Districts along main national roads or Mekhon river			0.0%	15.0%	30.0%
					Other Rural and Remote District			0.0%	0.0%	20.0%
Annual Growth Rate of Fixed Telephone Subscribers		26.1%	16.0%	21.1%	18.4%	18.9%				
1996-2001 Average Annual Growth Rate (Fixed Phone)	20.1%							28.5%	9.8%	9.7%
Annual Growth Rate of Cellular Phone Subscribers		29.7%	31.3%	40.2%	52.2%	114.5%				
1996-2001 Average Annual Growth Rate (Cellular/Mobile)	50.8%						5 year interval AAGR	30.9%	19.0%	19.0%

Category	Fixed Telephone Lines (PSTN)	Mobile Phone Subscribers	Other Value-added Services (leased circuit services, Internet)
Capital District Vientiane Municipality - Chanthabuly, - Sikhottabong, - Xaysetha, - Sisattanak, - Naxaithong - Xaythany, - Hadxaifong, - Sangthong, - Mayparkngum	Capital areas are with high teledensity. Telephone services are provided throughout municipality, and the main lines/100 population is expected to be very high in these districts with high socio-economic activities near future. Teledensity is set between 10-25, 15-30 and 25-35 in 2005, 2010 and 2015 respectively. Central districts in Vientiane Municipality (Chanthabuly, Sikhottabong, Xaysetha, Sisattanak and Handxaifong districts) are given relatively highest teledensity comparing with remaining districts. These districts (5 districts) are set the highest at 35 teledensity in 2015. Other peripheral districts (Naxaithong, Xaythany, Sangthong and Maypathgum districts) have relatively less teledensity comparing with above central districts. Rural teledensity of these capital districts is set between 1.0-5.0, 3.0-8.0 and 5.0-10.0 in 2005, 2010 and 2015, respectively.	Rapid mobile penetration ratio can be expected in these districts due to introduction of competitive environment among new comer's operators. The mobile phone ratio will reach at 70 %, 100% and 150 % of main line in 2005, 2010 and 2015, respectively. The ratio of Mobile Phone to Total Subscribers (the sum of Fixed and Mobile subscribers) is set at 45.0 %, 55.0% and 65.0 % in 2005, 2010 and 2015 respectively.	**Leased Circuit Services (country as a whole):** There are no leased circuit services for market. Demand of leased circuit services could be required from large-scale private establishments (more than 100 emp.:108 in 2000), Embassies and international organizations (30+), foreign-aid offices (15÷), central and provincial hospitals(26), university (1) and Banks/branches (57+) as well as advance public research institutions including government facilities in Lao P.D.R.. Roughly, the potential demand of leased circuit services would be around 130 in 2000. In this report, it is assumed that the potential demand of leased circuit would be increased by 7 % annually as same as the growth rate of economic development plan in Lao P.D.R.. The calculation results with this assumption is 182, 255 and 358 facilities in 2005, 2010 and 2015 respectively. Total requirements at each capital district would be given by proportion of district population to national population at each target year. **Internet Hosts /points of Internet users (country as a whole):** Internet demand users refer to the numbers of computer penetration. In Lao, computer penetration is still very low: 0.28 per 100 inhabitants (16,000 units). This ratio is 30 % of fixed-line teledensity (0.93 fixed teledensity). Also, there are only 165 hosts (connected directly linked to the worldwide Internet network). Host per 100 inhabitants is 0.0029 in 2001. About one hundred times smaller than computer penetration. However, in LDCs, the growth of Internet uses with rapid computerization may drastically increase the numbers of host computers in the future. Thus, the estimated numbers of host computers connected to Internet users are set to 30 % of fixed teledensity in 2000, 35 % in 2005, 40 % in 2010 and 50 % in 2015 Total requirements at each regional capital district would be given by proportion of district population to national population at each target year.

Regional Center District - Khanthabuly - Luangphrabang - Pakse - Thakhek	Higher teledensity and higher telecommunication service level are expected as a regional center. Telephone services are provided throughout district (urban) area. Teledensity in urban area is set at 20, 25 and 35 teledensity in 2005, 2010 and 2015 respectively. Rural teledensity is in general set between 0.5-1.0 by 2015.	Like Vientiane area, mobile services are expected to expand further quickly. Rapid mobile penetration is set in these districts. Thus, the ratio of Mobile Phone to Total Subscribers (Fixed and Mobile subscribers) is set at 25.0 %, 35.0% and 55.0 % in 2005, 2010 and 2015 respectively.	**Leased Circuit Services:** Numbers of leased circuits services are included above calculation. Demand of leased circuit services could be required from large-scale private establishments (more than 100 emp.), international organizations, foreign-aid offices, provincial hospitals, and Banks/branches as well as public research and educational institutions including government facilities. Total requirements at each regional capital district would be given by proportion of district population to national population at each target year. **Internet Hosts /points of Internet users:** Total requirements at each regional capital district would be given by proportion of district population to national population at each target year
Other Provincial Capital Districts and Special Districts (Tourism spots, Special Economic Zone, Agro-industrial areas) **13 provincial capitals** - Phongsaly district, - Namtha district, - Xay district, - Huoixai district, - Xamneua district, - Xayabury district, - Pek district, - Phonhong district - Pakxanh district - Saravane district - Lamarm district	Medium teledensity as a provincial capital district. Telephone services are mainly provided within urbanized area, but these penetration ratio is not so high. Teledensity will be set about 5-10, 15 and 20 in 2005, 2010 and 2015 respectively. As one of the basic principles for telecommunication development in Lao, the provincial capital districts have higher priority for development (to give high quality of telecommunication services), say, to arrange high quality of telecommunication services by 2010. Rural teledensity of these provincial capital districts is set between 0.0-0.5, 0.0-1.0 and 0.5-1.0 in 2005, 2010 and 2015, respectively. Phonhong capital district with other districts (Thoulakhom, Keo oudom, Kasy and Vangvient) in Vientiane province are given higher development potentialities because socio-economic activities of Vientiane municipality and tourism area would be spilled over in peripheral municipalities. Vangvieng district is as well given high teledensity as a well-known international tourism spot in Lao P.D.R.. Pakxanh district in Borlkhamxay province and Saravane distirict in Saravane province were received relatively higher teledensity among other provincial capital districts because these districts were along either the national road	Mobile services could start by 2010 and its services will be limited only in the central town areas. The ratio of Mobile Phone to Total Subscribers (the sum of Fixed and Mobile subscribers) is set at 0.0 %, 15.0% and 30.0 % in 2005, 2010 and 2015 respectively.	**Leased Circuit Services:** Limited services are expected in these districts, even in the central town areas except designated SEZ or tourism areas. Total requirements at each provincial capital district would be given by proportion of district population to national population at each target year **Internet Hosts /points of Internet users:** Total requirements at each provincial capital district would be given by proportion of district population to national population at each target year

- Samakkhixay *district* - Xaysomboun district	13 or *Mekong riverbank.* Other provincial capital districts such as Phongsaly, Namtha, Xay, Huoixai, Xamneua, Pek, Lamarn, Samakkhixay and Xaysombone *districts are set the lowest* teledensity among the Capital districts.		
Rural /Remote District 130 district	Mountainous and isolated areas with very low teledensity. *Telephone services are provided only district town area.* Teledensity is between 0-3, 0-5 and 3-5 in districts located in plain areas in 2005, 2010 and 2015, respectively. Between 0.05 and 1.0 teledensity in urban area of rural districts located in mountainous areas. Among 130 district except central capital and provincial capital districts, Thaphabath and Pakkading in *Borikhamxay, Nongbok, Hinboon and Xebangfay in* Khammouan, Outhoomphone, Songkhone, and Xaybuly in Savannakhet, Lakhonepheng and Khongxedon in Saravane, Sanasomboon, Pathoomphone, Phonthong and Khong are received relatively higher teledensity because these districts were along either the national road 13 or Mekong river plain corridor (relatively high economic activity zone).	Minimum mobile service can be start in these districts at the central town areas by 2015. The ratio of Mobile Phone to Total Subscribers (the sum of Fixed and Mobile subscribers) is set at 0.0 %, 0.0% and 2a0.0 % in 2005, 2010 and 2015 respectively.	**Leased Circuit Services** No services are expected in these districts, even in the central town areas except industrial development promotion areas or tourism areas. Total requirements at each regional capital district would be given by proportion of district population to national population at each target year **Internet Hosts /points of Internet users** Total requirements at each regional capital district would be given by proportion of district population to national population at each target year

Source: JICA Study Team

The following Table shows the image of the results after the Micro Demand Approach has been taken for forecasting the future telecommunications demand by province and district level.

Refer to **Table 2.11**

Table 2.12   Fixed Telephone Lines Demand Forecast by District (Sample Form)

	Population Projection by District in 2005 (Urban & rural)	Target Telecommunications Service Scenario by District in 2005 (Target Demand Approach)	Telephone Demand in 2005	Population Projection by District in 2010 (Urban & rural)	Target Telecommunications Service Scenario by District in 2010 (Target Demand Approach)	Telephone Demand in 2010	Population Projection by District in 2015 (Urban & rural))		Target Telecommunications Service Scenario by District in 2015 (Target Demand Approach)		Telephone Demand in 2015
Savannakhet province							Urban Population	Rural Population	15-20 Regional Center, 10-15 Provincial & 3-5 District Teledensity	0.5-1 Teledensity	Number of Fixed Main Lines
Khanthabouly district							107,254	107,947	0.2000	0.0100	22,530
Outhoomphone district							18,879	100,054	0.0500	0.0100	1,945
Songkhone district							8,999	132,056	0.0500	0.0100	1,771
Atsaphone district							1,435	69,421	0.0300	0.0050	390
Total							172,783	984,684	Urban Coefficient	Rural Coeff.	32,477
18 provinces											
& 133 districts											
(1995 Census)											

(2) Socio-economic Demand Approach

With country's economic growth and development impact, telephone penetration of both fixed-line and mobile subscribers will be increased.   Historically, our experience shows that the richer households could afford telephone services earlier and better.   Income distribution of households could be related to the demand level of telecommunications services.   This was right tendency at the period that the fixed-line telephone services were only choice for a customer at the market.   However, this tendency is changing drastically at present due to the expansion and availability of cellular mobile phones services within the LDCs. Correlation between the level of household income group and telephone penetration ratio (fixed and mobile) has been weak (see ITU report).   Under this newly introduced environment in telecommunications sector, Socio-economic Demand Approach which is shown in the previous diagram (Figure 2.1 could not be an appropriate approach for obtaining telecommunications demands for Lao P.D.R..   Thus, in this study, only socio-economic methodology is introduced for more detail concern.

3   Demand Results of Macro Demand Approach (Regression Model)

3.1   Constraints of Using a Regression Model

Demand forecast of the telephone, mobile phone and Internet services would be projected in this section based on the correlation between telephone density and GDP per capita in other countries. However, it should be cautioned that the results derived from these data, even using the latest data, could suggest only the supply side demand or the expressed demand (including the waiting applicants if available) in the country, and do not bare the present and future potential demand which exists largely in the developing countries due to a poor telecommunications network and its limited service capacity. Thus, the Coefficient Factor (Z) will be applied to take this potential demand factor into the telecommunication demand forecast in Lao P.D.R. Due to the missing of waiting applicant data in Lao P.D.R. except Vientiane municipality, the supply regression curve will be applied as a basic forecast equation in Lao P.D.R.. This equation will be modified by the potential demand (Coefficient Factor Z1, Z2 and Z3 based on the development scenarios) to project the future telecommunications demands of the years of 2005, 2010 and 2015 in this country.

According to the ITU study analysis, the relationship between telecommunications (traditionally measured by teledensity, or fixed lines per 100 inhabitants) and economic development (as measured by GDP per capita) is shown as a tendency of fixed-line teledensity being correlated with a whole host of other factors that also rise as a nation's wealth rises (e.g. average disposable income, level of education, level of investment, degree of electrification, etc.) However, this relationship is particularly weak at either end of the scale. Where GDP per capita is low, such as below US$ 8,000 per capita, R2 is only 0.55. Where GDP per capita is high, such as above US$32,000 per capita, the relationship suggests that a higher GDP per capita can actually cause a decline in fixed-line teledensity. ITU study suggests that GDP per capita can sometimes be misleading as an indicator of wealth.

3.2   Results of Demand Forecast by Macro Demand Approach

The following Table shows the preliminary telecommunications demand results by Macro Demand Approach based on the regression model. Those figures that shown in this table will be modified after the further discussions with related agencies in Lao P.D.R.

Fixed Telephone Lines

According to the Telecommunications Demand Results by Macro Demand Approach., fixed telephone demand without waiting demand (without potential demand) would be 137,000-149,000 telephone lines in 2005, 214,000-227,000 in 2010 and 319,000-371,000 in 2015. With waiting demand (with potential demand: Coefficient Factor-1.3 point), total demand for fixed telephone lines would increase to 178,000-194,000 in 2005, 278,000-296,000 in 2010 and 415,000-483,000 in 2015.

Mobile Telephones

Mobile phone demand with waiting demand (with potential demand) would be 117,000-128,000 in 2005, 278,000-296,000 in 2010 and 622,000-725,000 in 2015. Rocket-like expansion will be simulated for forecasting cellular mobile phone penetration. Crossover point to fixed-line subscribers is positioned at the year of 2010.

Table 3.1 Telecommunications Demand Results by Macro Demand Approach (Regression Model)

	2000	2005		2010		2015	
		(Lower Est.)	(Higher Est.)	(Lower Est.)	(Higher Est.)	(Lower Est.)	(Higher Est.)
Population Projection in 2005, 2010 and 2015 (SPC projection)	5,200,000	5,900,000	5,900,000	6,800,000	6,800,000	7,700,000	7,700,000
Estimated GDP per Capita (SPC projection)	$350	$500	$550	$700	$750	US$950*1	US$1,125*1
Fixed Teledensity 2001 Regression Figures (derived from ITU world country data)	1.688	2.327	2.535	3.150	3.352	4.147	4.828
Telephone Lines: Without Waiting Demand (w/o Potential Demand)	87,800 (Exist:47,887)	137,300	149,600	214,200	227,900	319,300	371,800
Coefficient (Potential Demand Ratio))*2		1.30	1.30	1.30	1.30	1.30	1.30
	Waiting Demand 5,900 (ITU Data)						
Satisfied Telephone Lines: including Waiting Demand (with Potential Demand)	53,787	178,490	194,480	278,460	296,270	415,090	483,340
Mobile Density	(Exist:9,048)						
(Mobile ratio: 0.66 ~ 1.5 /telephone line) **Coefficient (Potential Demand Ratio)**		0.66	0.66	1.00	1.00	1.50	1.50
Satisfied No. of Mobile phone: with Waiting Demand (with Potential Demand)		117,803	128,357	278,460	296,270	622,635	725,010
2001 Regression Figures (derived from ITU world country data)	0.876	1.276	1.411	1.819	1.957	2.510	3.000
No. of Mobile phone: without Waiting Demand (w/o Potential Demand)	45,600	75,300	83,200	123,700	133,100	193,300	231,000
Reference: Figures driven from Cellular Regression Line							

*1: Calculated from SPC projection

*2: Predicted from Indonesia, Thailand, Malaysia and Philippines cases.

4 Micro Demand Approach

4.1 Results of Demand Forecast by Target Demand Approach

Result of Target Demand Approach is shown Table 4.1 below. Detailed calculation procedures are in Appendix 2.

Table 4.1 Result of Demand Forecast by Target Demand Approach

	Method	2000/2001	2005	2010	2015
Fixed-line Subscribers	*Target Setting*	47,887 (2000)	184,012 (3.07)	286,287 (4.16)	438,470 (5.56)
Cellular Mobile Subscribers	*Target Setting*	13,773 (2000) 29,545 (2001)	120,209 (2.00)	278,616 (4.05)	662,416 (8.40)
Total Telephone (Fixed + Mobile)	*Target Setting*	61,660	304,221 (5.07)	564,527 (8.21)	1,100,885 (13.97)
Internet Hosts with Domain Names	*Proportion of Fixed-lines*	165 (Table 4.4)	761	1,217	2,151
International Call (Outgoing)	*Plan (10-7 % annual growth rate by phase)*	Table 4.3	5,100,000 calls	7,153,000 calls	10,032,000 calls

Source: JICA Study Team

International Outgoing (Country as a whole):

International Outgoing Demand would be increased by the factors of industrial and service sector development in the country. According to the "Socio-economic Development Strategy for 2020" by State Planning Committee, annual growth rates of industry and service sector are targeted at 10-11 percent and 8-9 percent up to 2005, respectively and an annual GDP growth rate is also set at around 7 percent toward 2020 (table 4.3). An average of growth rates over the last three years is only 4.2 percent per annum. Thus, for International Outgoing Projection, growth rate is set at 10 percent per annum during 2000 to 2005, and 7 percent per annum afterwards till 2015. The estimated number of international calls for the year of 2005, 2010 and 2015 is shown in Table 4.2 based on above assumption. However, impact of VoIP or price elasticity (decreasing of international telephone charge) is not considered at this point. Obviously, amount of International calls tends to be increased according with the reduction of their call charges as well as the long-distance calls in the country. Thus, International outgoing projection shown in Table 4.3 below should be considered as a minimum level.

Table 4.2   Recent Socio-Economic Strategy for 2020, 2010 and 2005 in Lao P.D.R.

SPC Report	'01-'05	'01-'10	'01-'20
Estimated Population	5.9 million (2005)	6.7 million (2010)	8.3 million (2020)
Population Growth Rate		2.4percent p.a.	2.2 % p.a.
Annual GDP growth rate	Around 7-7.5% p.a.	Around 7% p.a.	Around 7% p.a.
GDP per Capita (US$)	US$ 500-550 (Y2005)	US$ 700-750 (Y2010)	US$ 1,200-1,500 (Y2020)
Objectives by interval	- 4-5% annual growth (agriculture), - 10-11% a.g.(industry) - 8-9% a.g. (service), - Agriculture :47% of GDP - Industrial : 26% of GDP - Service: 27% of GDP	-Increase of import-substitute productions. -Improvement of basic infrastructures: electricity, hydro-power, processing industry, special economic zones border trade zones -Further serious opening up economic, trade and investment cooperation with foreign countries.	- Increased GDP share for industry and service sectors
Telecommunications	- It is expected that Lao will reach 2.2 teledensity.		

Source: Source: SPC "Socio-Economic Development Strategy for 2020, 2010 and Five years Socio-Economic Plan (2001-2005)", 2001 (translated document)

Table 4.3   International Outgoing Projection, 2005-2015 (Unit: thousand call)

Outbound	1998	1999	2000	Proportion ('00)	Annual growth	2005 (Proj)	Proportion ('05)	Annual growth	2010 (Proj)	Proportion ('10)	Annual growth	2015 (Proj)	Proportion ('15)
Thailand			2,040	64.4%		3,315	65.0%		4,507	63.0%		6,019	60.0%
Others			1,127	35.6%		1,785	35.0%		2,646	37.0%		4,013	40.0%
Total Calls	2,793	3,007	3,167	100.0%	10 %	5,100	100.0%	7.0 %	7,153	100.0%	7.0 %	10,032	100.0%
	Actual Figure: 4.2 % per annum			2000 -05			2005 -10			2010 -15			

Note: 10 % growth rate during 2000 to 05 is corresponding with the Industrial and Service Sector growth in SPC Plan.

7 % growth rate during 2005 to 15 is corresponding with the GDP growth forecast in SPC Plan.

Internet Hosts with Domain Names (country as a whole):

Internet Hosts demand with Domain Names refer to the numbers of computer penetration. In Lao, computer penetration is still very low: 0.28 per 100 inhabitants (16,000 units). This ratio is 30 % of fixed-line teledensity (0.93 fixed teledensity). Also, there are only 165 hosts (connected directly linked to the worldwide Internet network with Domain Names). Host per 100 inhabitants is 0.0029 in 2001. About one hundred times smaller than computer penetration. However, in LDCs, the growth of Internet uses with rapid computerization may drastically increase the numbers of host computers in the future. Thus, the estimated numbers of host computers connected to Internet users with domain

names holders are set to 0.32 % of fixed teledensity (0.92) in 2000, 0.45 % (T.D. 2.84) in 2005, 0.45% (T.D. 3.95) in 2010 and 0.50 % (T.D.5.47) in 2015.

Numbers of Internet Subscribers in 2005, 2010 and 2015 would be forecasted at 18,400 users, 42,900 users and 109,600 users, respectively. Also, number of Internet Hosts with Domain Names (ADSL mostly) would be estimated at 761 units, 1,217 units and 2.151 units in 2005, 2010 and 2015, respectively.

However, these Internet demand by users and hosts (with DNs) do not include that waitning demand (potential demand) in the country. Thus, practical Internet demand may much larger than those forcecasted numbers when telecommunications infrastructutre are satisfactorily developed and Internet service charges become an affordable price for Lao residents.

Table 4.4 Projection of Internet Hosts with Domain Names in 2005, 2010 and 2015 (unit: line)

	2001 (Current)	2005 Forecast	2010 Forecast	2015 Forecast
Number of Fixed Telephone	48,484	184,012	286,287	438,470
Ratio of Internet Subscribers to Fixed Telephone Subscribers	5.8% (current)	10.0 % (planned)	15.0 % (planned)	25.0 % (planned)
Number of Internet Subscribers	**2.800 users (current)**	**18,400 (users)**	**42,900 (users)**	**109,600 (users)**
Fixed Teledensity	0.92 *	2.84	3.95	5.47
Ratio of host density to fixed-line teledensity	0.32 % (Calculate)	0.45 % (Plan)	0.45 % (Plan)	0.50 % (Plan)
Hosts per 100 inhabitants.	0.0029 *	0.0127	0.0177	0.0273
Population (NSC data)	5,640,000*	5,998,000	6,876,000	7,882,000
No. of Internet Hosts with Domain Names	163 (165*)	761	1,217	2.151

Note:*: Based on the 2002 ITU World Telecommunication Development Report

Source: JICA Study Team

Total requirements at each regional capital district would be given by proportion of district population to national population at each target year.