CHAPTER 7

DEMAND FORECAST

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7.1 Overview of the Information Services

(1) Convergence of Telecommunication, Media and IT Sectors in the Global Market

The telecommunications, media and IT (Information Technology) sectors are converging into a single information services market; e.g., computing over the telecommunications network, voice communication over the Internet Protocol (**IP Telephony/ VoIP**). The legacy telecommunications service, i.e., POTS over PSTN (Public Switched Telephone Network) per se is converging into a information service on a single information infrastructure such as the Internet.

A fundamental **"paradigm shift"** is taking place away from conventional modes of operation, commerce and interaction. The phenomenon is most fully represented by the immeasurable and wholly unanticipated growth of **the Internet** as a new communication medium, even a new society.
(http://www.itu.int/itudoc/osg/colloq/)

The latest trends of converging telecommunication services in the global market have been briefly reviewed:

Voice:

Voice over the Internet, i.e., voice communication amongst computers, that attracted a lot of users recently is going to be replaced with the VoIP, due to the inherent natures of the Internet. Loss and/or delay of the IP packets over the Internet deteriorates the quality of real-time application, i.e., voice communications. The telecommunications, media and IT (Information Technology) sectors are converging into a single information services market; e.g., computing over the telecommunications network, voice communication over the Internet Protocol (**IP Telephony/ VoIP**). The legacy telecommunications service, i.e., POTS over PSTN(Public Switched Telephone Network) per se is converging into a information service on a single information infrastructure such as the Internet.On the other hand, VoIP is implemented over the private backbone networks managed by a carrier or an Internet Telephony Service Provider (ITSP) among the VoIP gateways to take the advantage of its cost performance since it bypasses an access charge to be paid to the carrier who claims that an access charge should levied on to an ITSP.
On the other hand, the price of legacy telephone services has been falling down to

become comparable with that of ITSP, especially in the arena of international telephone services since the introduction of ISR (International Simple Resale) that bypasses the settlement rate procedure.

Mobile:

N-CDMA(Narrow Band CDMA) systems begin to override the existing TDMA systems in the developed countries. N-CDMA system is deemed advantageous over the TDMA because of its better quality of voice transmission, faster transmission of data and ease of frequency coordination. In parallel, W-CDMA systems capable of transmitting data up to the rate of 2Mbps may be deployed somewhere else before full proliferation of N-CDMA.

Wireless Personal Communication Service (PCS) has been long anticipated to be an ubiquitous (anyone, anytime and anywhere) information service. The critical issues to be addressed in deploying PCS are: 1) a competitive pricing scheme as compared with that for CMTS shall be established beforehand and 2) the coverage of PCS, comparable to the CMTS, shall be secured from the outset of PCS.

Internet:

Commercial use of the Internet may be the most challenging and promising in the era of the Information Society to come. However, full commercial use of the Internet obliges the regulators to give the solutions vis-à-vis Intellectual Property Right (IPR), Privacy, Security, Technical Standards, etc.

Two of the major issues discussed by the APEC TEL (APC Working Group on Telecommunications) and concluded in the third Ministerial Meeting held in Singapore, June 1998 are concerned with the Internet service and the Electronic Commerce (EC) as follows:

(a) Approval of "APEC Blueprint for Action on **Electronic Commerce**;

(b) Agreement to organize the task force team on the fair allocation of the cost for **the Internet** backbone; and

(c) MRA (Mutual Recognition Arrangement on Conformity Assessment for Telecommunications Equipment) Declaration

(2) Current Status of Information Services Market in Viet Nam

While deploying POTS over PSTN, the trends and experiences of New Technology elsewhere, e.g., VoIP, ATM (Asynchronous Transfer Mode), W-CDMA (Wideband Code Division Multiple Access), etc., especially concerned with QoS (Quality of Service), pricing scheme and evolution of the Internet shall be examined and evaluated carefully in order to focus upon the coming era of **Information Society**.

(a) POTS demand is still large and dominant though the convergence of information services markets may take place sooner or later.

(b) The Teledensity has grown considerably at the higher rate than expected.

(c) The CMTS (Cellular Mobile Telephone Service) market is emerging rapidly not only in major cities but also in the provincial capitals thanks to the recent reduction of handset prices and expansion/ extension of the coverage areas.

(d) The market of the Internet service may also emerge in parallel to the emerging market of CMTS, which is still subject to uncertainty at this moment.

7.2 Method of Approach

7.2.1 POTS

(1) International/ National Model (GDP/capita vs. Teledensity)

Demand forecast for POTS (Plain Old Telephone Service) is carried out in accordance with the method of approach presented herein, based on the hypothesis that the demand derived is marketable judging from the historical trend of the "affordability parity" defined.

The method of approach employed here is an integration of **"top-down and bottom-up"** and **"backward estimate and forward forecast"** approaches (Refer to **Appendix I-7-1** for further detail) as depicted below:

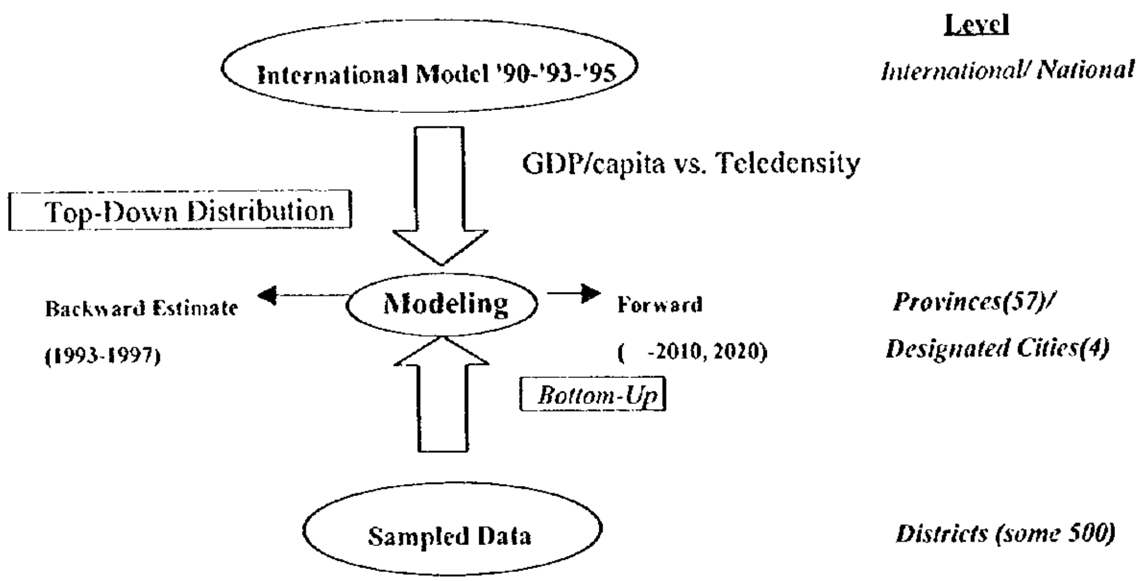


Figure 7.2.1-1 Method of Approach

It is well known that GDP (Gross Domestic Product) per capita in a specific country has a strong correlation with the Teledensity (Main Lines/ 100 Inhabitants). However, simple application of a regression formula derived from available data, in a specific year and for a specific country, to an estimate of POTS has been misleading as evidenced by the fact that Vietnam accomplished connecting lines, in 1996, more than about 1.6 times as many as the estimate deducted from a regression formula.

It has been found out the regression formulae differ from year to year a regression formula is derived and that the following are the appropriate formulae to estimate the marketable demand for the years, 1990, 1993 and 1995, respectively using the data contained in "Yearbook of Statistics- Telecommunication Services 1986-1995:

(a) GDP/capita vs. Teledensity- 126 Economics 1990

$y = 0.0008\ x^{1.1283}$ ($R^2 = 0.8831$)

(b) GDP/capita vs. Teledensity- ITU/Detecon 1993

$y = 0.0022\ x^{1.009725}$ (R^2: unknown)

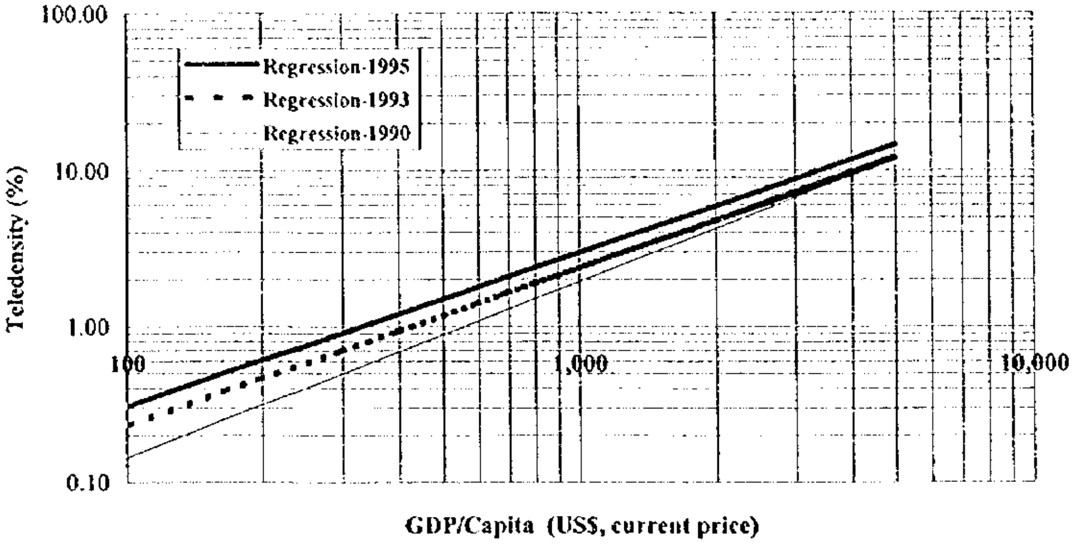
(c) GDP/capita vs. Teledensity- 125 Economics 1995

$y = 0.0033\ x^{0.9857}$ ($R^2 = 0.8275$)

where y : teledensity (main lines/ 100 inhabitants, %)

x: GDP/capita (US Dollar, current price)

A comparative figure among the formulae above is shown hereunder implying that GDP/capita required for the people to reach the teledensity of 1.0 and 10.0 decreases as years go through 1990 to 1995, presumably, owing to the technical innovation and competition among vendors in the market economy.



Required GDP/capita to achieve Teledensity of 1/100 and 10/100 (current price)

Year	Teledensity (%)	
	1.0	10.0
1990	US$ 560	US$ 4,280
1993	US$ 430	US$ 4,190
1995	US$ 330	US$ 3,400

Figure 7.2.1-2 GDP/capita vs. Teledensity

(2) Comparative Study with Other Asian Economies

A comparative study with other Asian economies, i.e., Korea RP., Thailand and China P.R., has been carried out to observe the historical growth rate of Teledensity over several years to conclude that:

(a) The gradient of the fitted curves of the past and forecasted POTS for Viet Nam becomes closer to that of other Asian countries depending on the level of GDP though shifted owing to the reduction of telecommunications prices over the years described earlier, as shown in **Appendix I-7-3**.

(b) The gradient of time-series fitted curve, over the period 1993-1997, shall not be used as a reference formula to avoid over-estimate;

(c) The regression formula for 1995 is employed as the reference formula for the Study, since the backward estimate has been carried out over the period 1993-

1997:

$$y = 0.0033\, x^{0.9557} \qquad (R^2 = 0.8275,\ 125\ \text{Economies})$$

(d) The formula is applied backward to the past years 1993 through 1997 in order to derive a correction factor, i.e., Affordability Parity (AP) to be defined somewhere else;

(e) The affordability parities for the respective provinces/ designated cities are found increasing over the years without exception.

Considering that:

i) The gradient of the historical Teledensity curves differ from country to country mainly due to different fluctuation patterns as to the exchange rates over those years for the countries cited;

ii) The formulae of historically regressed curves for respective countries:

Vietnam:	$y = 6 \cdot 10^{-7} x^{2.5605}$	(1993-1997)
China P.R:	$y = 7 \cdot 10^{-9} x^{3.1158}$	(1986-1997)
Thailand:	$y = 0.0003\, x^{1.2535}$	(1986-1997)
Korea RP:	$y = 0.0897\, x^{0.6724}$	(1986-1997)

iii) The exchange rates between US dollars and various currencies were stable for Thailand and Korea RP (rather appreciated) for that period. On the contrary Vietnamese and China's currencies had been depreciated constantly over the observation periods to result in a steep slope of the fitted curves.

iv) The gradient of the Korean fitted curve is the least steep among the four countries reflecting the fact that Teledensity 1997 went beyond 40 that was almost at the level of saturation of Teledensity.

Besides, a formula to indicate the correlation between Teledensity and GDP per capita for 1997 has been derived utilizing the data of more than 40 countries, most of which are categorized as the middle and high GDP groups:

$$y = 0.0174\, x^{0.8004} \qquad (R^2 = 0.8957)$$

Time-Series GDP/capita vs. Teledensity in Comparison with 1990-1995-1997 Regressions

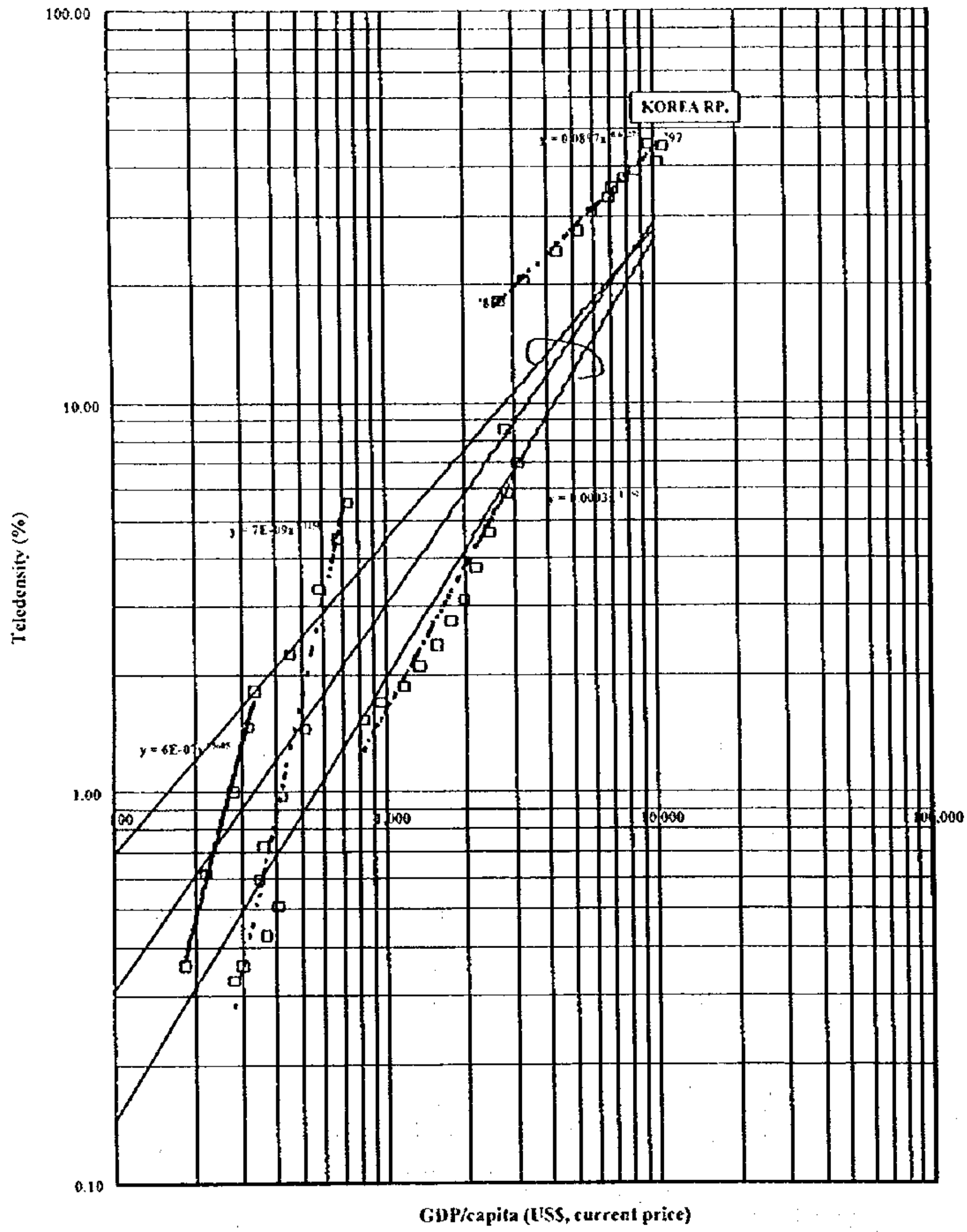


Figure 7.2.1-3 Teledensity in Comparison

(3) Backward Estimate 1993-1997 and Affordability Parity (AP)

"Backward estimate (1993-1997)" has been carried out in order to compare the backward estimate and actual Teledensity achieved at the layer of province or designated city, defining :

[Affordability Parity (AP)]=

[Actual Teledensity]/[Backward Estimate of Teledensity]

The affordability parity defined here implies that those who live and earn income out of what they produce in a province of high APs in comparison with others who have lesser APs can afford "telephone services" much more easily from the viewpoint of their income level.

It is assumed that APs will increase in line with a logistics or modified exponential curve over the time as GDP/capita or income grows. A generic figure of a "logistic curve" appears hereunder.

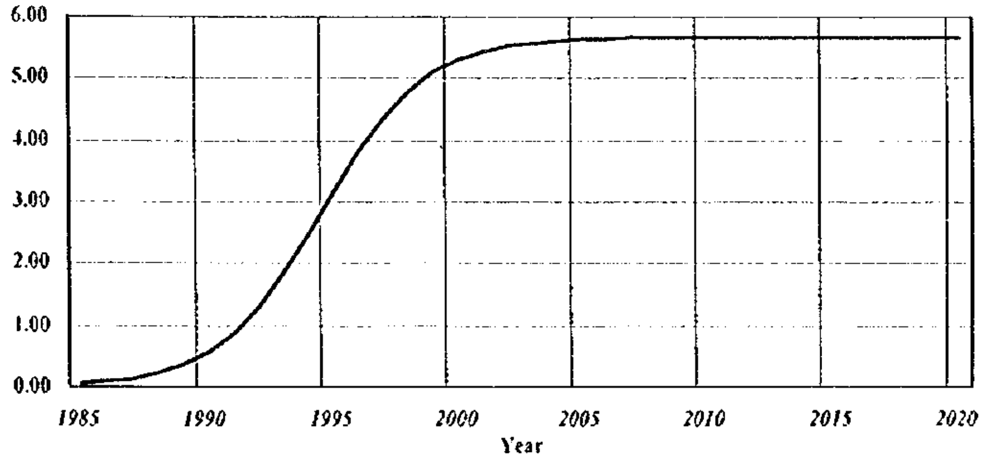


Figure 7.2.1-4 A Generic Logistic Curve

Depicted hereunder is actual AP '96 (Affordability Parity in 1996) at the layer of province, which is used for a simulation of the demand forecast though actual APs tend to increase over the time as is explained in 7.2 Market Forecast.

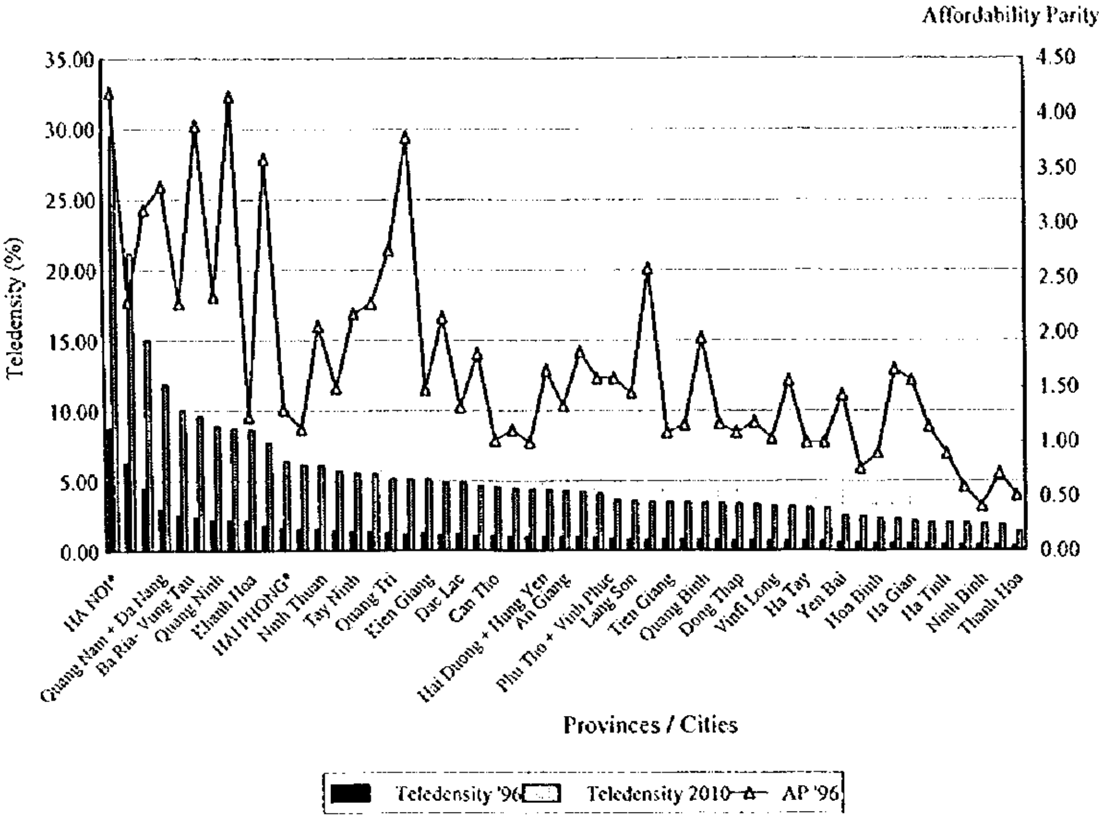


Figure 7.2.1-5 Teledensity vs. Affordability Parity (Simulation)

Backward estimate has been made with reference to:

Formula 1995 $y = 0.0033\ x^{0.9857}$

APs for 1996 have an implication, to some extent, the inherent nature of affordability to procure telephone services for the inhabitants in a region as is enumerated hereunder:

Table 7.2.1-1 Affordability Parity (AP) 1996

Region	Highs and Lows (Province/ City)	AP '96	Regional Average AP
Northern Upland	□ Bac Can + Thai Nguyen □ Tuyen Quang	2.59 0.59	1.21
Red River Delta	□ Ha Noi □ Ninh Binh	4.19 0.41	1.78
North Central	□ Quang Tri □ Thanh Hoa	2.76 0.51	1.06
Central Coast	□ Da Nang + Quang Nam □ Khanh Hoa	3.13 1.23	1.79
Central Highlands	□ Lam Dong □ Dac Lac	3.89 1.32	2.06
Southeast	□ HCM City □ Dong Nai	2.75 1.12	2.08
Mekong River Delta	□ Bac Lieu + Ca Mau □ Can Tho	4.15 1.01	1.19
National Average AP			1.58

(4) A Simulation of Forward Forecast

Presented herein is, rather than a forward forecast toward 2010, a simplified simulation based on the assumptions detailed hereunder in order to justify the method of approach and to grasp a bird's eye-view of all the process concerned with the actual "demand forecast" to be made elsewhere.

(a) A Simulation (A Preliminary Forecast)

A simulation of POTS demand forecast has been made based on the following simplified assumptions in order to grasp the picture of POTS demand in 2010 before the "Modeling" would be carried out for forecasting demand for POTS at the level of provinces or designated cities, resulting in three categories of areas, i.e., Urban, Remote and Rural.

Assumption 1: **Population** will grow uniformly all over the provinces/ designated cities at the annual rate of **2.0%** up to 2010.

Assumption 2: **GDP growth rates** have been applied uniformly at the rates of **6.5%, 9.0%, 12%** for Scenario 1, Scenario 2, Scenario 3, respectively as described earlier elsewhere.

Assumption 3: **AP (Affordability Parity)** has been defined and **fixed at the level in 1996** to carry out a simulation for POTS demand in 2010. AP for 1996 has been derived and applied to this simulation, though it increases over the time.

Assumption 4: Modeling of provinces/ designated cities into Urban, Remote and Rural has been made based on those Assumptions 1-3 above.

Assumption 5: Those areas categorized as "rural" have low APs of generally less than unity resulting in quite a large difference in Teledensities among rural, remote and urban areas. The Government intends to lessen the gap among Urban, Remote and Rural areas by initiating a "supply policy":
"Policy Initiative" indices for remote and rural areas are multiplied to the forecast formulae to derive the supply volume in addition to APs, i.e., 1.20, 1.30, respectively for simulation.

Depicted below is a detailed flow of the simulation:

(Demand) = (Marketable Demand) - (Affordable POTS)

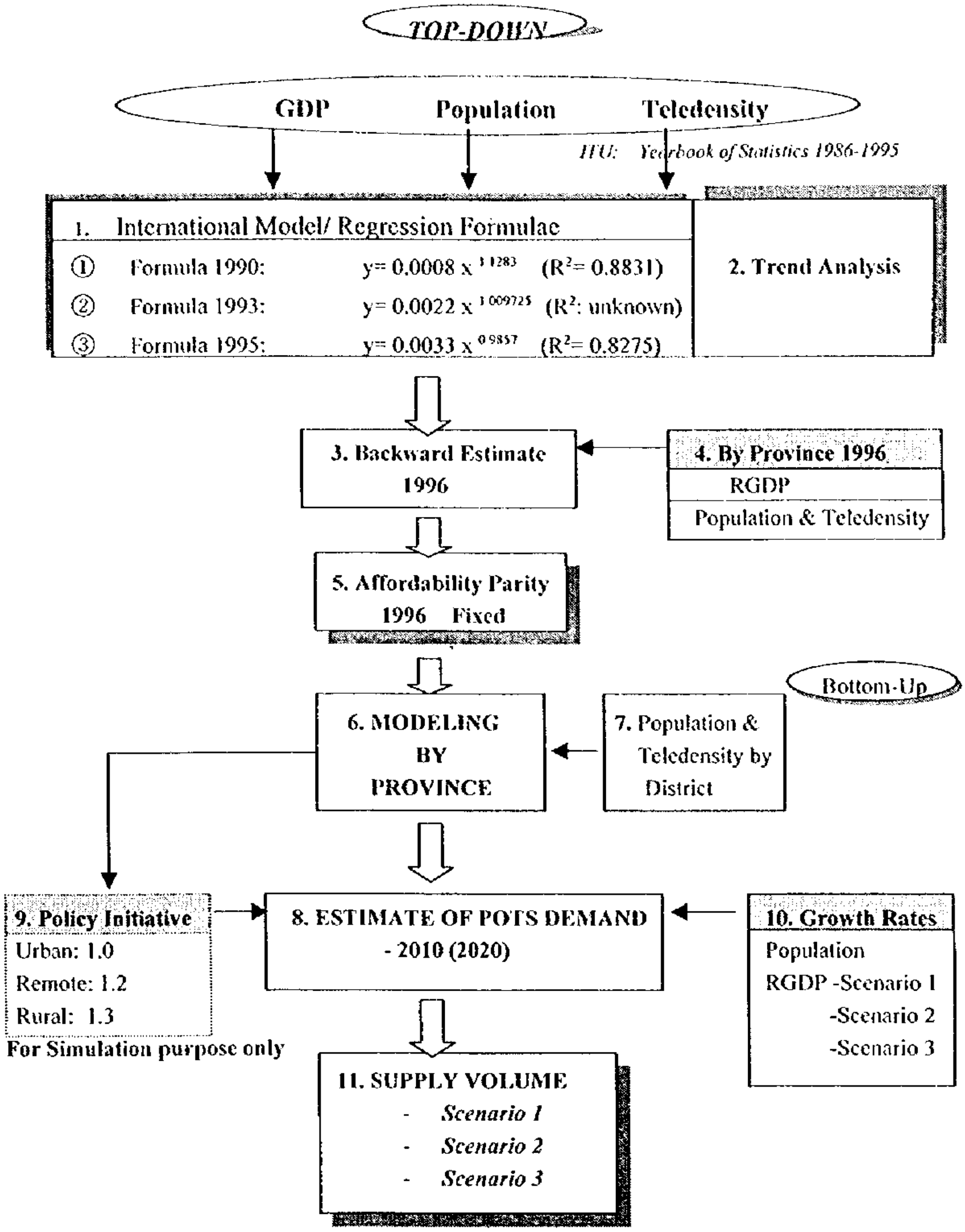


Figure 7.2.1-6 A Simulation of POTS Demand Forecast

(b) Implications of Simulated Results

The results of this simulation are enumerated hereunder implying (i) a rather conservative forecast since growing APs were not taken into account, (ii) the disparity among Urban, Remote and Rural areas will be lessened to some extent by the year 2010, (iii) Teledensity for Urban, Remote and Rural areas will be around 12.8-23.2, 3.8-6.9 and 1.5-2.8, respectively.

Table 7.2.1-2 Result of Simulation

	Areas	Main Lines				Teledensity	
		1996	Share (%)	2010	Share (%)	1996	2010
Scenario 1	Urban			1,291,025			12.77
	Remote			744,937			3.80
	Rural			1,024,157			1.52
	National			**3,060,119**			**3.15**
Scenario 2	Urban	527,061	47.5%	1,698,744	42.2%	6.88	16.80
	Remote	253,434	22.8%	980,197	24.3%	1.70	5.00
	Rural	329,620	29.7%	1,347597	33.5%	0.64	2.00
	National	**1,110,115**	**100%**	4,026,538	**100%**	**1.44**	4.14
Scenario 3	Urban			2,342086			23.16
	Remote			1,351,413			6.89
	Rural			1,857,953			2.75
	National			5,551,453			5.71

Unless the "Policy Initiative" to narrower the spread of Teledensity among Urban, Remote and Rural areas is taken, the spread in Teledensity would have been widened. Even though the "policy initiative" indices, 1.3 and 1.2 are employed for Rural and Remote areas tentatively, those indices are, of course, subject to the financial viability study that would be carried out at the later stage of this Study.

(c) Preconditions between A Simulation and Actual Forward Forecast

Preconditions set forth for a simulation and an actual forward forecast, as a matter of course, may differ from each other in terms of Affordability Parity (AP), GDP Growth Rate, Population Growth Rate and Policy Initiative. Those are summarized hereunder:

Table 7.2.1-3 Preconditions between A Simulation and Actual Forward Forecast

In the Study Flow	Simulation	Actual Forward Forecast
1. Affordability Parity (AP)	□ AP 1996 fixed	□ AP will grow following a logistic curve or a modified exponential curve. □ The trends of APs over the time differ from province to province.
2. GDP Growth Rate	□ Uniformly applied throughout provinces - Scenario 1: 6.5% - Scenario 2: 9.0% - Scenario 3: 12.0%	□ **1998-2000: 6.5% (Alternative: 4.0%)** □ From 2001 onward: **- Scenario 1: 7.0%** **- Scenario 2: 8.0%** **- Scenario 3: 10.0%** □ **Differs from province to province.**
3. Population Growth Rate	□ National AGR: 2.0% □ Uniform	□ National AGR: 1.8% down to 0.9% □ Differ from province to province.
4. Policy Initiative	□ Tentative - Rural: 1.3 - Remote: 1.2 - Urban: 1.0	□ Government's Initiative □ **Intra-Province Disparity to be lessened.**
5. Expected Result	□ **Underestimate**	□ Appropriate

(5) Modeling by Sampled Data

It has been found that the main lines deployed are concentrated in the center of provinces/ cities from fifty two (52) sets of data (out of 61 provinces/ cities) collected in the course of site visits by the end of August through the beginning of September 1998.

Those data collected demonstrated greater difference in 1) teledensity, and 2) user categories, i.e., business, and residential users. It is advised that this kind of data collection in compliance with the standard data forms should be carried out consecutively and periodically in order to maintain the consistency of data for updating the telecommunications development master plan whenever required.

In addition to the overall Teledensity Map for the 52 areas, exemplary pictures as to Nghe An, Thua Thien-Hue and Da Nang out of the data collected for fifty two (52) provinces/city are presented in terms of differentiated teledensity from districts to districts:

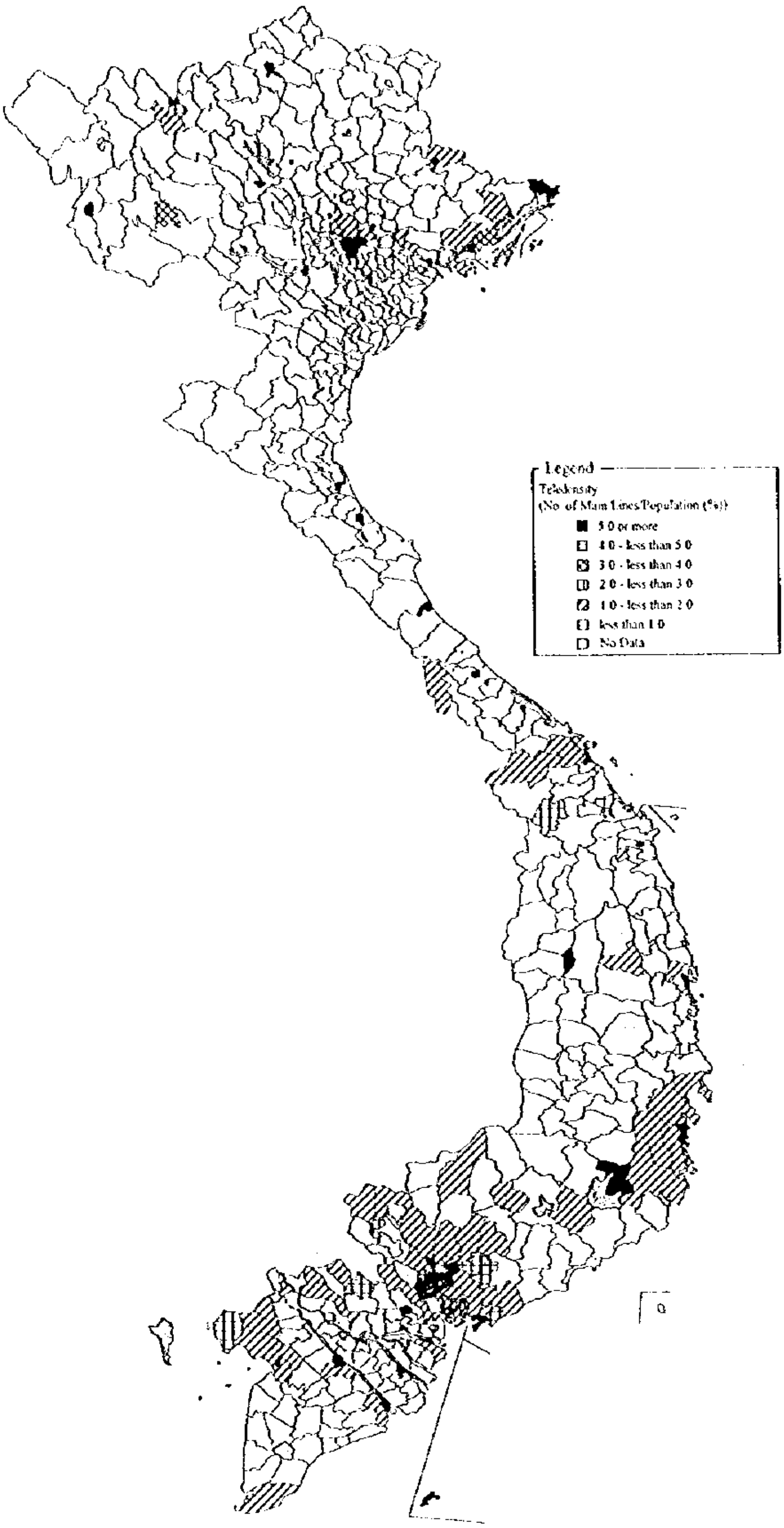
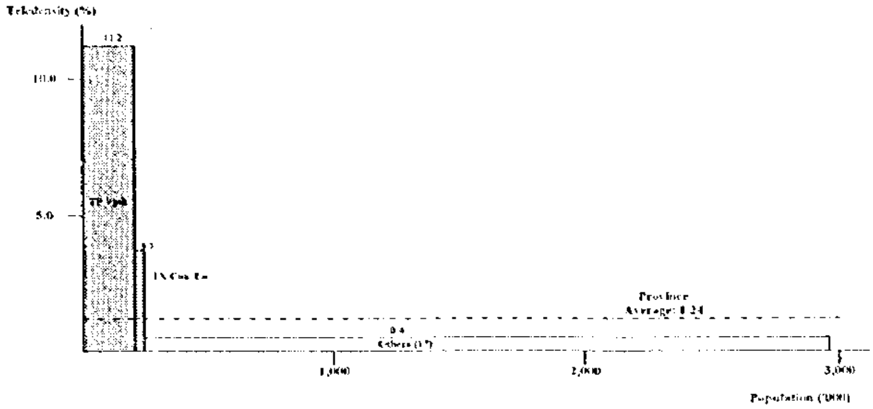
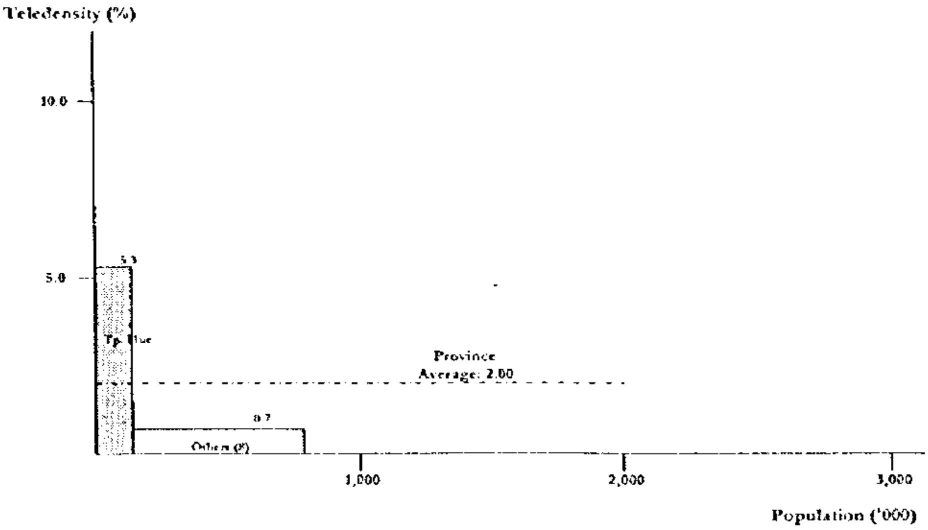


Figure 7.2.1-7 Teledensity of 52 Provinces/ Cities

1. Nghe An (June 1998)



2. Thua Thien Hue (June 1998)



3. Da Nang (June 1998)

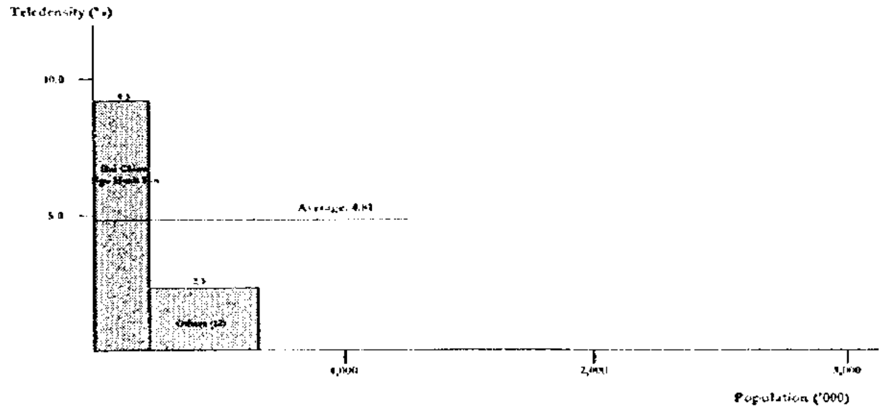


Figure 7.2.1-8 Teledensity Disparity

Despite rapid economic growth, over 70 per cent of Vietnam's population still live in rural areas. Yet only 53% of the telephone lines in the country are in non-urban areas. As a result, teledensity in urban areas stood at 6.9 in 1996 compared to 1.7, 0.6 in remote, rural areas, respectively. While rural teledensity has grown at a faster rate than urban, the lower base means that access will improve only by an additional 5.2, 2.1 lines in remote, rural areas, respectively compared to 16.3 in urban areas even in the case of Scenario 3 for 2010 in this simulation.

It took about 5 years for Thailand to double its national Teledensity 1991 through 1995 due to a large disparity between rural and urban teledensity.

The disparity of Teledensity is "**fractal**" not only in Vietnam but also in most of the developing countries as abstracted hereunder:

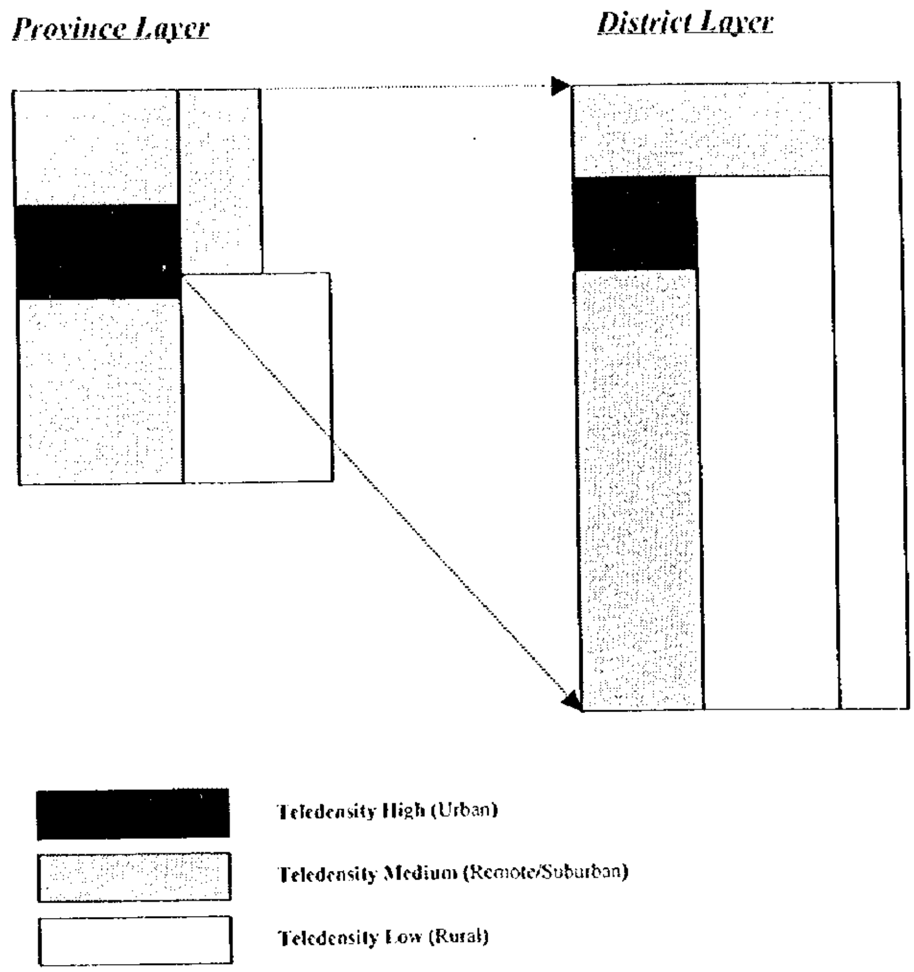


Figure 7.2.1-9 Disparity of Teledensity

(6) Database Required for A Simulation of Demand Forecast

At least the following data is required, in compliance with the method of approach presented herein, to carry out a simulation prior to actual "demand forecast" for POTS at the level of Provinces/ Designated Cities.

Table 7.2.1-4 Database Required for A Simulation of Demand Forecast

Objective	Data Contents	Prospective Source
1. International Model	□ Historical data of telecommunications services	ITU: Yearbook of Statistics
2. Trend Analysis	□ Output of the above	n.a.
3. Backward Estimate	4. RGDP, Population & Teledensity for the past of at least 7 years by Province	MPI, DGPT
5. Affordability Parity	(to be calculated)	n.a.
6. Modeling	7. Population & Teledensity by District	MPI, DGPT
8. POTS Demand	(to be calculated)	n.a.
9. Policy Initiative	□ Strategy	The Government
10. Growth Rates	□ Population & RGDP	Long-Term Socio-Economic Development Plan by Gov't

An ordinary spreadsheet application has been utilized throughout the Study; the most serious difficulty the demand analyst faced was centered on the availability of consistent data concerned.

7.2.2 Services Other than POTS

(1) Cellular Mobile Telephone Service (CMTS)

Cost is the main constraint which prevents mobile cellular from being a viable alternative for first-time telephone users in developing countries. Even where mobile service tariffs are competitive with or lower than fixed-line ones, mobile handset prices can still be a major barrier.

Keys to successfully deploy the cellular mobile/ paging services are:

- □ to extend and expand the **coverage areas** as fast and economically as possible;
- □ to lower the **tariff** down to the level as competitively as possible for the services.

Method of approach to be employed in forecasting the market will be based on the following:

- the market of Cellular Mobile Telephone Service will grow in parallel to the growth of POTS market, among others, business users of POTS;
- the paging services will fade away in the long run, being replaced with the cellular mobile services as the tariff and the prices of handsets are lowered.

(a) Business Users of POTs

The ratio of business users out of main lines connected, switch occupancy ratio as well as mobile cellular subscribers as of June 1998 are detailed in **Appendix I-7-7**: Business Users, Switch Occupancy, CMTS and Internet Users on a sampling basis.

The Mobile Index (MOBIX) is defined in consideration that penetration of cellular mobile users has the strong correlation, as in the case of POTS, with (i) Teledensity and (ii) business users which could be a potential users for mobile services:

[MOBIX]=100 x [Teledensity] x [Business Users / Main Lines Connected], province layer

Teledensity incorporates GDP per capita and trends of APs over the time implying the affordability as applied to POTS. The prospective users of cellular mobile services are initially the business users of POTS, which is reflected in the definition formula of MOBIX above.

Depicted hereunder is a correlation between MOBIX and Cellular Mobile penetration on a sampling basis (21 provinces excluding Da Nang and Nghe An):

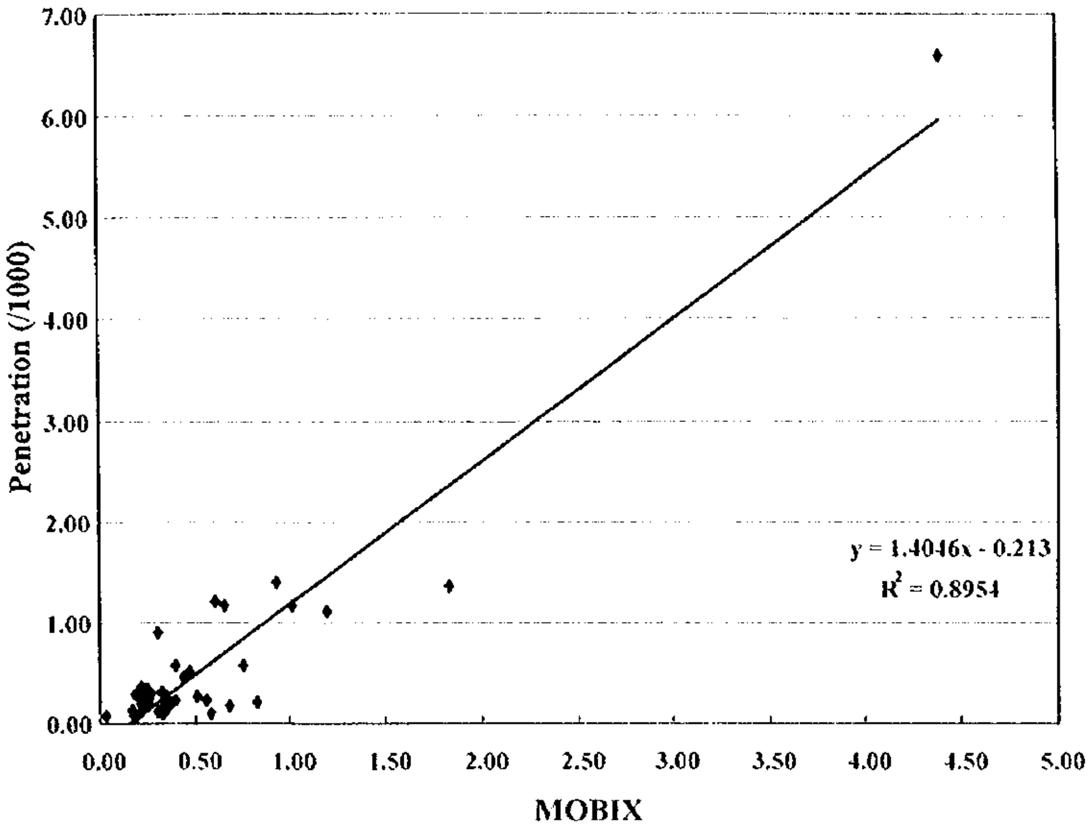


Figure 7.2.2-1 Mobile Index vs. Mobile Penetration

(b) Japan's Case

Japan has become the second largest market of mobile communications services in the world immediately after a drastic price reduction of handsets though tariff for mobile communications is quite highly set as compared with other developed countries. The figure below indicates the latest development of mobile communications services among the contenders in Japan; the aggregate number of cellular mobile telephone users was tripled in two years, March 1996 through 1998.

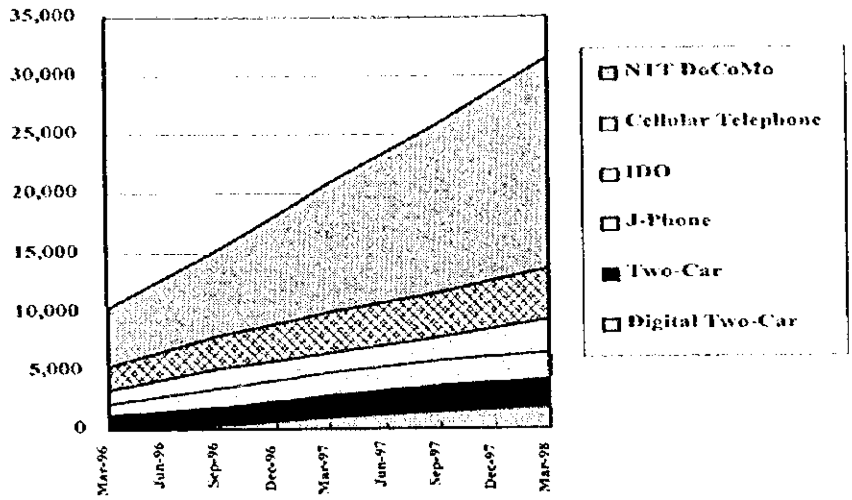


Figure 7.2.2-2 Development of Mobile Communications Service in Japan

(2) Paging Service

The number of paging users had been increasing progressively before the advent of the cellular mobile telephone service as shown in the following table:

Table 7.2.2-1 Users of Paging Services

Year	1993	1994	1995	1996	1997	June 1998
Paging Users	13,800	40,000	71,950	111,000	120,000	126,400

The number of paging users will not grow as progressively as before or rather will maintain the level of users for some time from now onward unless otherwise the tariff for the cellular mobile telephone service became comparable with that for the paging service.

(3) Fax/ Telex/ Data Services

Customer Premises Equipment (CPE) had better be deregulated from the government's control to lower the price of the terminal equipment.

(4) Public Payphone

Public payphones especially PCOs (Public Call Offices) situated in rural areas have been playing an important role to furnish the inhabitants in such areas with the accessibility to the basic telephone services.

The cardphone system, on the contrary, has been progressively deployed mainly in major cities as enumerated below:

Table 7.2.2-2 Cardphones

Year	1993	1994	1995	1996	1997	June 1998
Cardphone Posts	330	500	812	1,100	1,400	1,800

(5) Internet Service

(a) Method of Forecast

It is quite difficult to predict the future of the Internet market in Vietnam and is subject to uncertainty at this pre-matured stage of telecommunication development under the Government control. Besides the index similar to MOBIX employed for CMTS prediction has never been found to indicate significant relationship between the Internet users and Teledensity, i.e., RGDP, through examination of the latest data supplied by DGPT in July 1999.

A rather qualitative approach, instead, is taken in order to analyze the trends of the growth of the Internet users for three cases, i.e., pessimistic, moderate and optimistic ones:

- Pessimistic Case: the users will **double in five (5) years** with its saturated figure fifty (50) times as many as the predicted number of users in 1999 End.
- Moderate Case: the users will **double in three (3) years** with its saturated figure fifty (50) times as many as the predicted number of users in 1999 End.
- Optimistic Case: the users will **double in two (2) years** with its saturated figure fifty (50) times as many as the predicted number of users in 1999 End.

It is assumed, in addition, that the Internet users would grow along a logistic curve for all the cases above.

(b) Trends

Establishment of the joint venture companies among Common Carriers, Internet Service Providers (ISPs) and Contents Providers is taking place all over the world in order to achieve an efficient management over the Internet service, anticipating a synergy effect in providing Internet service.

Sony, TOYOTA/Teleway and IIJ (Japan's leading Internet Access Provider) agreed to establish a joint-operation company named "Crosswave

Communications" at the end of September 1998. They target at business users of the Internet in Japan, especially multi-national corporations. Sony takes the advantage of a experienced contents provider; Teleway owns their own backbone circuits as well as fiber optics access circuits to major business users; IIJ (Internet Initiative Japan) boasts of their experience as well as know-how as to extending their Internet backbone throughout the globe, such as so-called A-bone linking Asian countries.

Crosswave Communications recently announced its challenging plan to provide data communications services over the SONET switchless backbone network, IP over WDM (Wave Division Multiplex), of KDD's fiber optics cables based on the IRU (Indefeasible Right of Use) with KDD.

Indefeasible Right of Use: Unless otherwise consensus among the parties concerned, e.g., owner, partners, sponsors, financiers, etc., is reached, the holder of IRU retains the **permanent right of use** of the cable constructed and operated by the owner and operating company.

(c) Shift of Revenue Sources to the Internet

"Even with their lower costs of operation, content business on the Web do not yet generate adequate revenues. Unlike newspapers and magazines that rely on subscriptions for some of their revenue, most Web businesses currently shy away from charging subscriptions in favor of building an audience and attracting advertising and direct marketing/transactions revenues. Though growing, these revenue sources are still small.

At this early stage of development, it is unclear how quickly Internet content businesses will draw readers or viewers from traditional media sources such as newspapers, magazines and television. As it happens, advertising and subscription revenues flowing to the Internet are likely to increase. Even if the total audience for a newspaper or a TV sitcom does not decline, advertisers may shift spending to the Internet if they feel that it provides a more effective means to reach their audiences.

Current trends in classified and local advertising spending indicate a shift already taking place. Newspapers have been watching their share of classified advertising dollars shrink as real estate agents, car dealers and owners, and businesses looking to hire employees increase their advertising in niche publications, direct mail and online services. A 1996 Newspaper Association of America study points out that newspaper publishers could lose as much as 50 percent of their classified ad dollars in the next five years if

current trends continue. If that happens, the average newspaper's operating margin, now 14 percent, would drop to 3 percent. To maintain revenues from classifieds and to attract local advertising dollars, newspapers have been quick to establish Web sites featuring classified ads and city guides."
(Source: http://www.ecommerce.gov/)

(d) N-ISDN/ ASDL as Internet Access

N-ISDN (Narrow Band ISDN) service might alleviate the difficulty the Internet users face when accessing the Internet via modems.

Whereas, "The issue for telco is how to evolve a customer from ISDN to ADSL based Internet access with minimal cost and inconvenience to both telco and customer. One factor that helps smooth this transition is the fact that if a line has been conditioned already for ISDN (e.g., loading coils removed) then this aspect of development effort doesn't need to be repeated for ASDL. A particular issue of concern is what degree of compatibility is possible if the customer has already invested in ISDN specific CPE and other application software (e.g., for video conferencing telephony) and wishes to run such applications. (ADSL Forum "Technical Paper TR-004 TR-004" December 1997)

Meanwhile, the requirement for further bandwidth as Internet access has brought about ASDL (asynchronous Subscriber Digital Line) as a prospective technology to realize a high-speed subscriber line over the existing copper wires instead of fiber optics subscriber lines.

Besides ITU-T standardized the technical specifications concerned with ASDL in October 1998 as follows:

- Rec. G.dmt (ASDL up to 6Mbps) > Rec. G.922.1 together with Annex C
- Rec. G.lite (ASDL up to 1.5Mbps) > Rec. G.922.2 together with Annex C

Annex C to the both recommendations above is concerned with DBM (dual bitmap) technology to reject the interference from ISDN circuits.

The rationale for ADSL advantages to the user in terms of Access, Cost and Quality are (http://ADSL.com):

Table 7.2.2-3 Advantages of ASDL

Type of Advantage	Rationale
Access	ADSL provides access of workers to corporate LANs and WANs, and expands the customer reach for small and large businesses alike; irregular access to ASDL service because of network limitations and/or inability to pay could raise customer satisfaction and regulatory problems as the service becomes more widespread.
Cost	Consensus is that prices will have to drop considerably to be attractive to a large audience, but that this is possible within 2-3 years; if so ADSL will be competitive with alternative technologies, but more expensive than low speed network access. The advantage of ADSL resides in value added rather than reduced costs.
Quality	The technical quality of connectivity is substantially increased because of high speed access, which reduces wait times and enables applications such as video-conferencing; service providers in this industry (OECD countries) have a long history of high reliability, high quality network service; the experience of ADSL customer to date is largely positive, and it is reasonable to expect (although by no means guaranteed) that high service quality and customer support will be maintained as deployment spreads.

"The ability to use the telephone and PC simultaneously without a second line will also appeal to many online users. Of course, these characteristics generate other advantages by enabling applications like interactive games, telework, distance learning, etc. Moreover, when compared to cable modems, the ADSL per subscriber line service provide more security than the shared cable modem. That element of security is important for services like online banking.

Problems with crosstalk, distance limitations, and the likelihood that a good portion of the copper in the ground is not "ADSL ready," i.e., bridge taps, damage, or wetness, could all substantially affect network implementation and ADSL performance.

The type and pricing of the applications, as well as the ways in which these applications improve the lives of users, will be critical for ADSL's success. ADSL is only useful if it can provide desired services at an acceptable price point.

In the North American and European context, the driver, at least for the SOHO market, is widely considered to be the Internet access. For the critical mass of users, the application alone is very price elastic. Conventional wisdom places the price point at a maximum of $ 40/mo in the U.S.

The speed and ubiquity of actual deployment will vary considerably depending on the region or country. Factors such as the level of an installed ISDN base, the existence of cable competition, the state of the existing local loop architecture, regulatory environments regarding local loop unbundling, the level of Internet access, content provision, and pricing, as well as individual teleco's strategies will create different conditions for ADSL on a country-by-country basis.

Taken together, these observations suggest that effective implementation of ADSL, the needs of potential ADSL users, and variation in national and regional business environments deserve more attention. ADSL deployment is expected to increase rapidly in the next 2-3 years. Its longer term prospects will be powerfully shaped by the ability of industry players to understand and respond to these issues." (http://www.ADSL.com/ July 1998)

7.3 Market Forecast

7.3.1 POTS (Plain Old Telephone Service)

(1) POTS 1991-1998

POTS is a still dominant service in Vietnam. Historical development of POTS appears below:

Year	Main Lines Connected ('000)	Teledensity (%)	Incremental Main Lines ('000)	Growth Rate of Main Lines (%)
1991	115.4	0.17	-	-
1992	156.6	0.23	41.2	35.8%
1993	254.5	0.36	97.9	62.5%
1994	442.7	0.62	188.2	73.9%
1995	734.4	1.01	291.7	65.9%
1996	1,110.1	1.49	375.8	51.2%
1997	1,407.5	1.86	297.4	26.8%
1998 Est.	1,706.9	2.28	299.4	21.3%

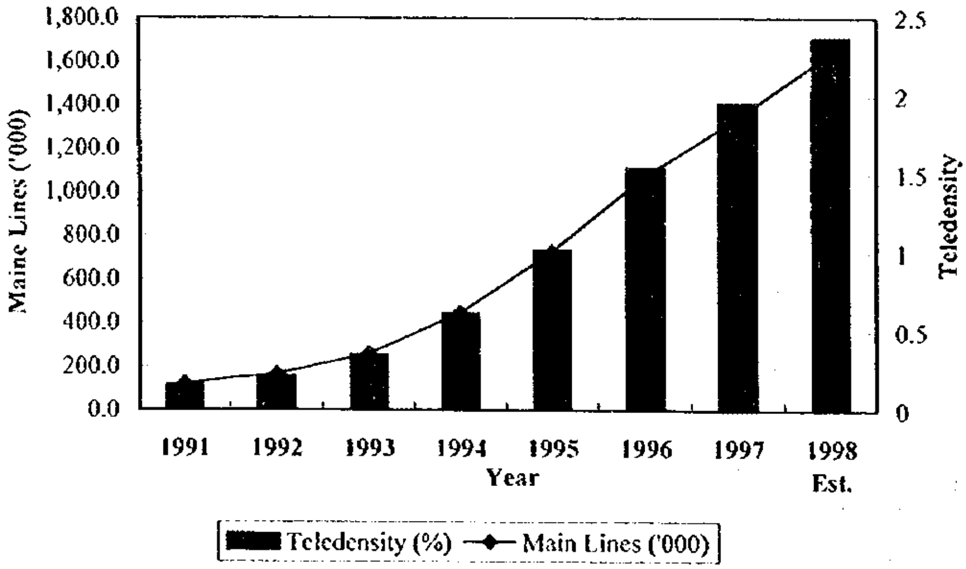


Figure 7.3.1-1 Development of POTS in Vietnam

A remarkable increase of the main lines connected has been observed from 1991 through 1998.

(2) Trend of APs over 1993-1997

A simulation carried out to establish a concrete forecast method has proven that the affordability parity (AP) defined is a good indicator for the market forecast and that all the APs examined province by province 1993 through 1997 indicate an increasing trend. The highest and average APs 1997, region by region, are presented hereunder:

(a) Northeast Region	**Quang Ninh:**	2.45	(highest)
		1.72	(regional average)
(b) Northwest	Hoa Binh	1.64	(highest)
		1.48	(average)
(c) Red River Delta	**Ha Noi**	4.77	(highest)
		2.68	(average)
(d) North Central	**Thua Thien-Hue**	2.71	(highest)
		1.56	(average)
(e) South Central Coast	**Da Nang**	3.53	(highest)
		2.51	(average)
(f) Central Highlands	**Lam Dong**	4.64	(highest)
		2.58	(average)
(g) Southeast	**Ho Chi Minh City**	2.45	(highest)
		1.96	(average)
(h) Mekong River Delta	Long An	1.69	(highest)
		1.40	(average)

National Average in 1997 **1.99**

The newly divided provinces in 1996 out of those provinces, Bac Thai, Vinh Phu, Ha Bac, Hai Hung, Nam Ha, Qung Nam- Da Nang, Song Be and Minh Hai, have been assimilated/ grouped into the same group as the following existing provinces at the time of split, taking into account **GDP/capita** and **Affordability Parity** (AP) as shown in Figure 7.3.1-3.

Table 7.3.1-1 Assimilation of APs

Provinces Split in 1996	New Provinces after 1996	Provinces Assimilated to:
1. Bac Thai	□ Bac Kan □ Thai Nguyen	□ Son La □ Lao Cai
2. Vinh Phu	□ Phu Tho □ Vinh Phuc	□ Dong Thap □ Cao Bang
3. Ha Bac	□ Bac Giang □ Bac Ninh	□ Yen Bai □ Lang Son
4. Hai Hung	□ Hai Duong □ Hung Yen	□ Ben Tre □ Thai Binh
5. Nam Ha	□ Ha Nam □ Nam Dinh	□ Ha Tinh □ Dong Thap
6. Quang Nam- Da Nang	□ Da Nang □ Quang Nam	□ Ha Noi * □ Dong Thap
7. Song Be	□ Binh Duong □ Binh Phuoc	□ Dong Nai ** □ Lang Son
8. Minh Hai	□ Bac Lieu □ Ca Mau	□ Lang Son □ Tien Giang

Note: * 2-year ahead, ** 1-year behind

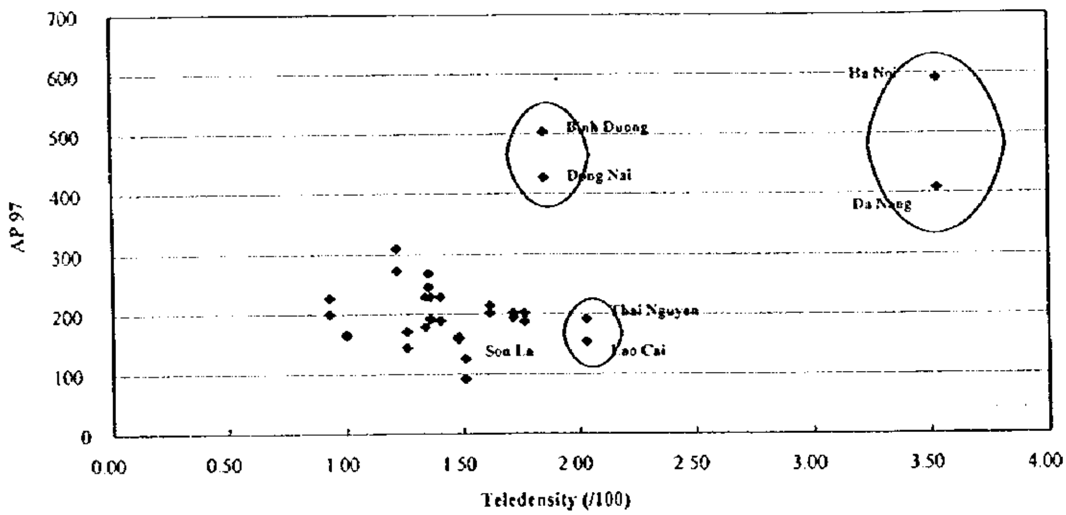


Figure 7.3.1-2 Grouping of Provinces 1997

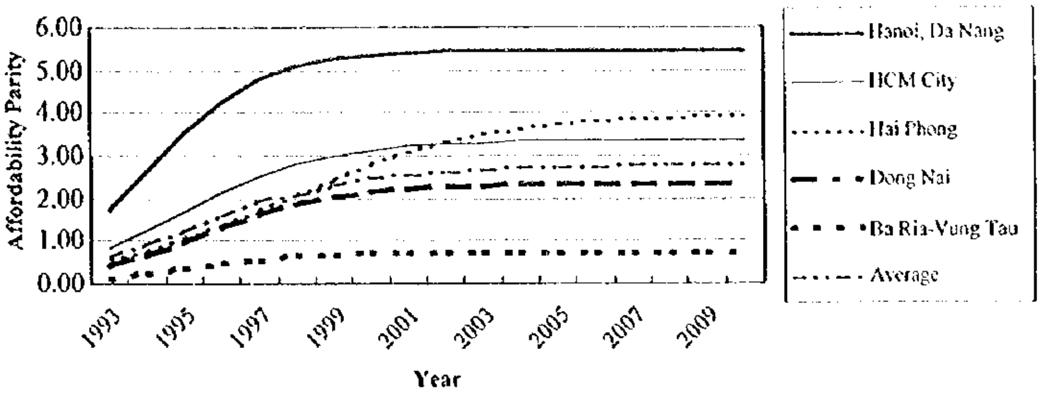


Figure 7.3.1-3 Trends of AP Growth 1993-2010

(3) Modeling of Provinces

Modeling the provinces as a whole into three categories, i.e., Urban, Remote and Rural, is carried out simply based on the expected Teledensity in 2000 (Main Scenario 3).

Urban Teledensity: more than **5.0** (Population Share: 12.2%)

- Ha Noi 13.45
- HCM City 10.10
- Da Nang 7.53
- Khanh Hoa 5.17

Remote Teledensity: more than **3.0** (Population Share: 13.0%)

- Ba Ria- Vung Tau 4.68
- Binh Duong 3.97
- Hai Phong 3.81
- Lam Dong 3.59
- Quang Ninh 3.47
- Kien Giang 3.24
- Dong Nai 3.08
- Ninh Thuan 3.03
- Binh Thuan 3.03

Rural: Other than Urban and Remote (48 provinces out of 61 provinces/cities)
(Population Share: 74.8%)

VNPT categorizes the provinces as follows:

Table 7.3.1-2 Provincial Category by VNPT

1. Rapidly developing	2. Potential Economic Growth Region	3. Agricultural Regions	4. Mountainous, Highlands Regions
GDP/capita > US$300 Teledensity: high			Least GDP per capita Teledensity: low
1. Ha Noi 2. HCM City 3. Hai Phong 4. Da Nang 5. Vung Tau 6. Khanh Hoa 7. Binh Duong 8. Dong Nai 9. Quang Ninh 10. Lam Dong 11. Hue	1. Hai Duong 2. Vinh Phuc 3. Phu Tho 4. Bac Ninh 5. Nam Dinh 6. Nam Ha 7. Thai Binh 8. Thanh Hoa 9. Nghe An 10. Quang Ngai 11. Phu Yen 12. Ninh Thuan 13. Binh Thuan 14. Binh Phuoc 15. Long An 16. An Giang 17. Kien Giang 18. Can Tho 19. Tay Ninh 20. Tien Giang 21. Lang Son 22. Thai Nguyen 23. Ha Tay 24. Dac Lac	1. Bac Giang 2. Ninh Binh 3. Quang Binh 4. Quang Tri 5. Yen Bai 6. Binh Dinh 7. Ben Tre 8. Vinh Long 9. Tra Vinh 10. Bac Lieu 11. Ca Mau 12. Soc Trang	1. Ha Giang 2. Tuyen Quang 3. Cao Bang 4. Lao Cai 5. Yen Bai 6. Bac Can 7. Lai Chau 8. Son La 9. Hoa Binh 10. Hung Yen 11. Ha Tinh 12. Gia Lai 13. Kon Tum

The target set forth by the Government for POTS deployment is to lessen the disparity among rural, remote and rural areas. 12.2%, 74.8% out of total national population reside in urban, rural areas, respectively. Therefore, the same incremental volume of main lines in urban areas will raise its Teledensity 6.1 (= 74.8/ 12.2) times as much as that in rural areas to result in widening the current disparity between urban and rural.

In the course of a simulation, the tentative policy indices of 1.0, 1.2, and 1.3 were adopted to apply for Urban, Remote, Rural, respectively. Those indices are taken into consideration when distributing the supply volume intra-provincially, which is detailed in 7.2.1 (7) Weighted Distribution on a District Layer.

(4) Main Forecast -2010, 2020

(a) Main Lines (x 1,000)

					Actual						*Forecast*	
Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2010	2020
Scenario 1									2,099.5	2,398.3	5,837.3	11,911.7
Scenario 2	115.4	156.6	254.5	442.7	734.4	1,110.1	1,407.5	1,792.0	2,099.5	2,398.3	6,554.8	14,719.4
Scenario 3									2,099.5	2,398.3	7,659.6	18,093.6

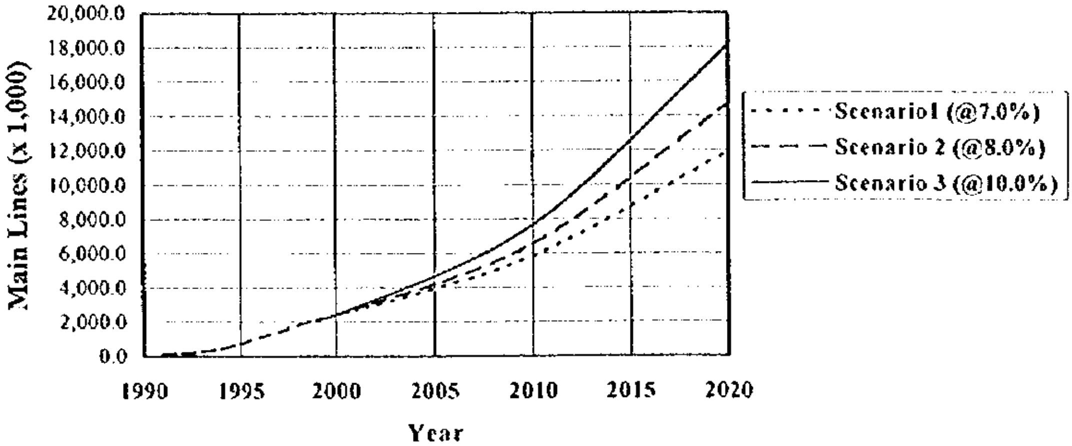


Figure 7.3.1-4 Forecast of Main Lines

(b) Teledensity

Teledensity will grow as shown below if all the demand has been fulfilled in accordance with the respective scenarios:

Year	Main Lines (x 1,000)			Teledensity			Incremental Main Lines		
	Scenario 1	*Scenario 2*	*Scenario 3*	*Scenario 1*	*Scenario 2*	*Scenario 3*	*Scenario 1*	*Scenario 2*	*Scenario 3*
1997	1,407.5	1,407.5	1,407.5	1.86	1.86	1.86	-	-	-
1998	1,792.0	1,792.0	1,792.0	2.33	2.33	2.33	384.5	384.5	384.5
1999	2,002.3	2,099.5	2,099.5	2.68	2.68	2.68	210.3	307.5	307.5
2000	**2,398.3**	**2,398.3**	**2,398.3**	**3.01**	**3.01**	**3.01**	396.0	298.8	298.8
2001	2,703.6	2,735.3	2,778.1	3.34	3.38	3.43	305.3	337.0	379.8
2002	3,008.6	3,079.3	3,176.4	3.65	3.74	3.86	305.0	344.0	398.3
2003	3,316.5	3,433.9	3,597.5	3.96	4.10	4.30	307.9	354.6	421.1
2004	3,631.0	3,803.1	4,046.5	4.27	4.48	4.76	314.5	369.2	449.0
2005	3,955.6	4,191.1	4,529.0	4.59	4.86	5.25	324.6	388.0	482.5
2006	4,293.4	4,602.0	5,050.9	4.90	5.26	5.77	337.8	410.9	521.9
2007	4,657.6	5,039.7	5,618.3	5.23	5.68	6.33	364.2	437.7	567.4
2008	5,021.2	5,508.4	6,237.5	5.58	6.12	6.93	363.6	468.7	619.2
2009	5,416.9	6,012.0	6,915.5	5.91	6.59	7.58	395.7	503.6	678.0
2010	**5,837.3**	**6,554.8**	**7,659.6**	**6.32**	**7.09**	**8.29**	420.4	542.8	744.1
2020	*11,911.7*	*14,719.4*	*18,093.6*	*11.60*	*14.33*	*17.62*			

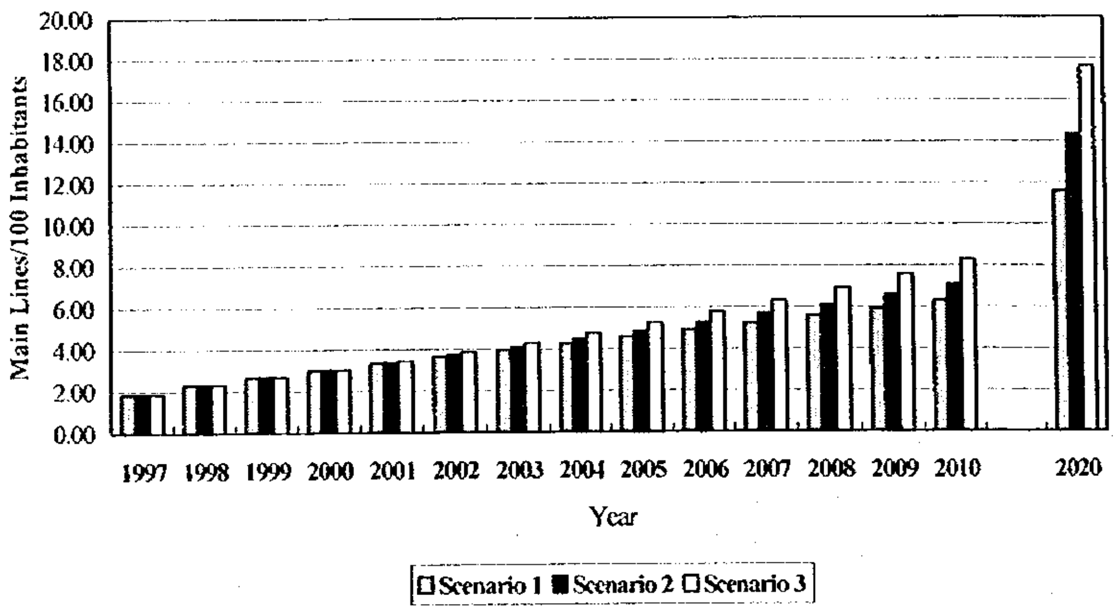


Figure 7.3.1-5 Teledensity Growth

(5) Alternative Forecast --2010, 2020 at GDP Growth Rate 4.0% (1998-2000)

An alternative POTS demand forecast is carried out in addition to the scenarios 1 through 3 in terms of annual GDP growth rates, which is detailed below:

Table 7.3.1-3 Alternative Plan

	Annual GDP Growth Rates Assumed at the National Level		
	1998-2000	*2001-2020*	
Alternative	4.0%	Alternative Scenario 1	7.0%
		Alternative Scenario 2	8.0%
		Alternative Scenario 3	10.0%
Main	6.5%	Main Scenario 1	7.0%
		Main Scenario 2	8.0%
		Main Scenario 3	10.0%

An alternative (scenario 3) POTS market forecast at the national level has resulted in the following, as compared with the main scenario 3:

Table 7.3.1-4 Alternative Scenario 3

	1997	1998	1999	2000	2005	2010	2020
Main Lines	**1,408**	**1,792**	**2,051**	**2,289**	**4,320**	**7,306**	**17,387**
(Main Scenario 3)	*(1,408)*	*(1,792)*	*(2,100)*	*(2,398)*	*(4,529)*	*(7,660)*	*(18,094)*
Teledensity	**1.86**	**2.33**	**2.62**	**2.87**	**5.01**	**7.91**	**16.93**
(Main Scenario 3)	*(1.86)*	*(2.33)*	*(2.68)*	*(3.01)*	*(5.25)*	*(8.29)*	*(17.62)*

Note: *The italics figure in the bracket() above is estimated based on the Main Scenario 3.*

(6) Key Economic Regions (KEYs)

The key development areas have been defined by the Government as shown below, where GDP growth rate is expected at higher level than other areas with the industrialization being promoted:

(a) Northern Key Economic Region (NKEY)

Those cities and provinces designated as NKEY are:

- Ha Noi
- Hai Phong
- Quang Ninh
- Hai Duong
- Hung Yen

(b) Central Key Economic Region (CKEY)

Those designated cities and provinces as CKEY are:

- Da Nang

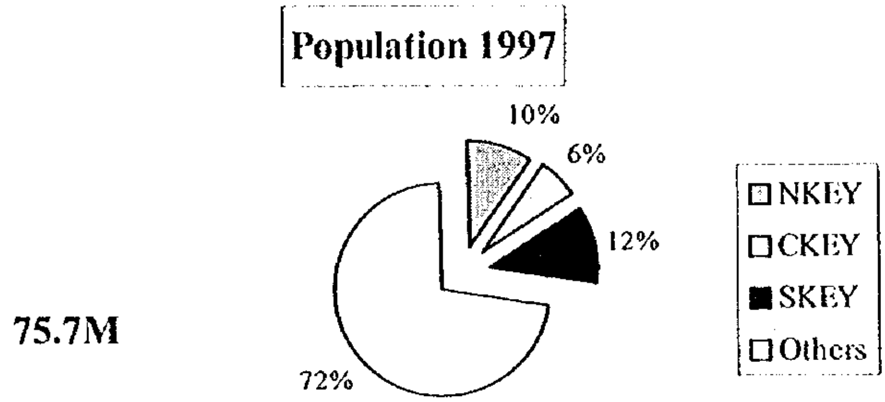
- Quang Nam
- Thua Thien- Hue
- Quang Ngai

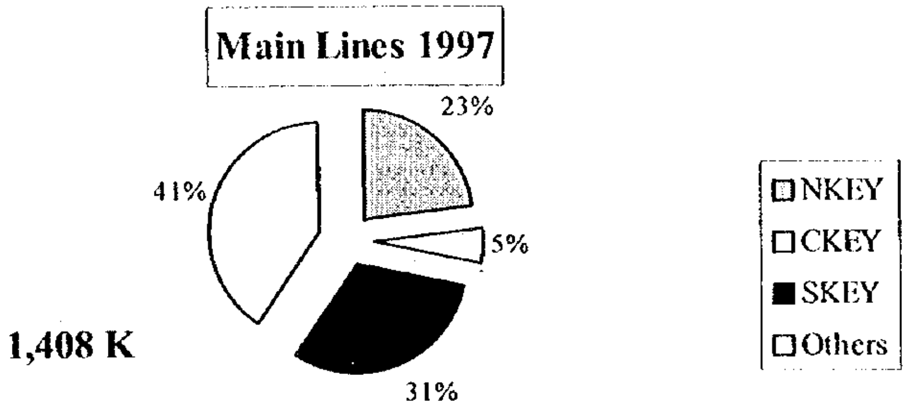
(c) Southern Key Economic Region (SKEY)

Those designated cities and provinces as SKEY are:

- Ho Chi Minh City
- Binh Duong
- Binh Phuoc
- Dong Nai
- Ba Ria- Vung Tau

In a word, only 28% out of the population, i.e., the inhabitants in the key economic regions as above generate 50% of GDP 1997 and hold almost 60% of the total main lines in Vietnam as depicted below:





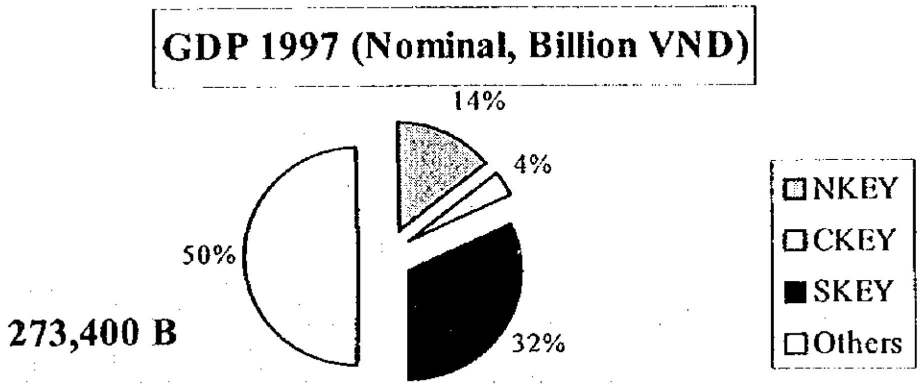


Figure 7.3.1-6 Disparity in 1997

(7) Exemplary Weighted Distribution on a District Layer

(a) General

The disparity in Teledensity among the provinces/cities appears also among the districts in a specific province/city. Modeling of the Teledensity on the layer of Ha Noi city is carried out as an example in order to distribute the whole marketable demand in Ha Noi to the districts. This kind of effort to alleviate the Teledensity disparity is rather against the idea of "market-oriented economy" since the affordability parity (AP) as well as Teledensity is, in general, lesser in the rural districts.

A province/city falls into three categorized areas district by district, i.e., **urban** (where **teledensity ≥10.0), remote/suburban (10.0> teledensity ≥3.0)** and **rural areas (3.0> teledensity),**. The share of main lines in the respective areas will be used to derive the incremental supply of main lines for the corresponding areas being multiplied by the respective weighting factors.

Supply to Remote/Suburban, Rural districts is weighted by the factor of 1.05, 1.10 respectively to derive the supply weight for Urban areas with the total supply volume not exceeding the annual incremental volume estimated.

Suppose the existing main lines in August 1998 (: **Reference Time**) of a specific province were distributed amongst its districts as follows:

Table 7.3.1-5 Weighted Supply Distribution

Districts	Teledensity	Main Lines August 1998	Category	Supply Weight
A	$a \geq 10.0$	X	Urban	W_{ur}
B	$10.0 > b \geq 3.0$	Y	Remote/Suburban	1.05
C	$c < 3.0$	Z	Rural	1.10
Total/ Average		T		1.00

where:

$T_{REF} = X + Y + Z$ (total existing main lines at the reference time)

T_{1997}: total existing main lines of a province in 1997

T_{1998}: total forecasted main lines of a province in 1998

Supply Volume for Remote/Suburban, Rural, Urban Areas for 1998: S_{re}, S_{ru}, S_{ur} respectively:

$S_{re} = (T_{1998} - T_{1997}) \cdot (Y / T_{REF}) \cdot 1.05$

$S_{ru} = (T_{1998} - T_{1997}) \cdot (Z / T_{REF}) \cdot 1.10$

$$S_{ur} = (T_{1998} - T_{1997}) - (S_{re} + S_{ru}) = (T_{1998} - T_{1997}) \cdot (X / T_{REF}) \cdot W_{ur}$$

$$\therefore \; W_{ur} = S_{ur} / [(T_{1998} - T_{1997}) \cdot (X / T_{1997})]$$

(b) Teledensity Disparity in Ha Noi

The weighted distribution of the annual supply volume to the wards/districts in Ha Noi has been carried out based on the method explained earlier:

Enumerated and exemplified hereunder is the intra-city disparity of Teledensity amongst the wards/districts of Ha Noi as of August 1998:

Table 7.3.1-6 Disparity of Teledensity in Ha Noi

Wards/Districts	Teledensity	Main Lines (Existing/ Forecasted)			Population	Category	Supply Weight
	August 1998		1997	1998	August 1998		
Noi Thanh	17.73	230,145	-	+ 48,539	1,297,800	Urban	0.993
Tu Tien	12.10	20,032	-		165,600	Urban	0.993
Gia Lam Thanh Tri Dong Anh Soc Son	3.43	34,371	-	+ 7,050	1,000,700	Suburban	1.05
Total/ Average	11.55	284,548	247,262	302,851[1/]	2,464,100	Urban	1.00

Note: 1/ The figure is based on the latest data provided by DGPT in February 1999.
2/ 302,851 = 247,261 + 48,539 + 7,050

In the case of Ha Noi as above, the supply weight for Urban Area 0.993 was derived as follows:

$T_{REF} = 284,548$

$T_{1997} = 247,262$

$T_{1998} = 302,851$

$X = 230,145 + 20,032 = 250,177$

$Y = 34,371$

$Z = 0$

$S_{re} = (302,851 - 247,262) \cdot (34,371/284,548) \cdot 1.05 = 7,050$

$S_{ru} = 0$

$S_{ur} = (302,851 - 247,262) - 7,050 = 48,539$

$W_{ur} = 48,539/[(302,851 - 247,262) \cdot (250,177/284,548)] = 0.993$

It is concluded that the weighted distribution of the annual supply among the wards/districts would not give much effect to the Teledensity disparity, even if the weighting factor 1.05 is maintained over ten years 1997 through 2007 for suburban districts as shown below:

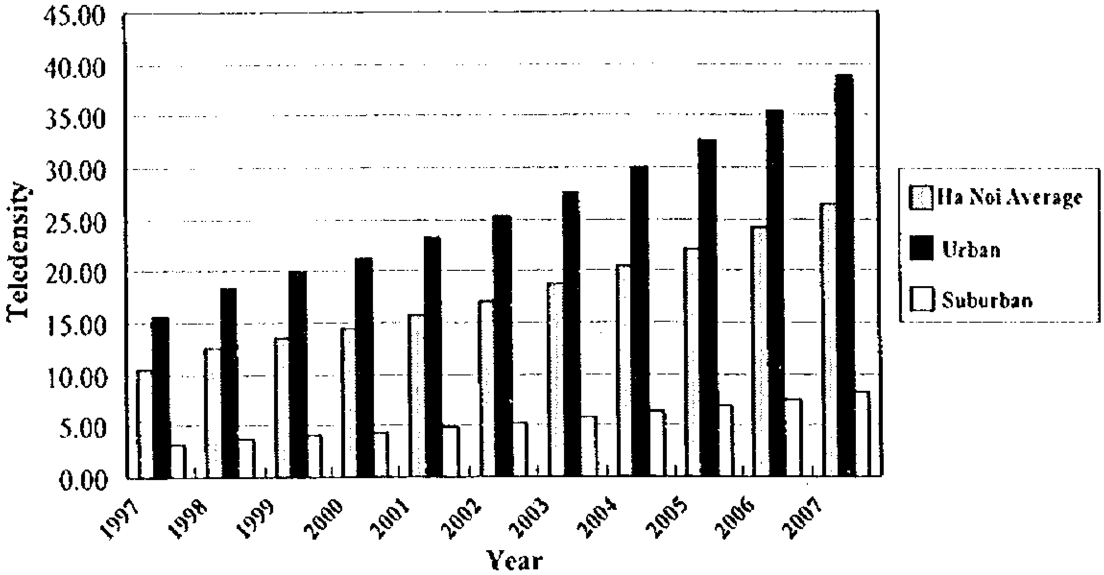


Figure 7.3.1-7 Teledensity in Ha Noi for 1998 and 2007

7.3.2 Cellular Mobile Telephone/ Paging Service

(1) Cellular Mobile Telephone Service (CMTS)

The CMTS market has been forecasted based on the method of approach described in 7.2.2 (1). The supplementary conditions applied to the market of CMTS are:

(a) The ratio of business users out of the main lines is assumed to follow the formula: $y= - 0.028 \cdot x + 0.7124$ (minimum: 30%) with the business user ratio confined only to Yen Bai and Ha Noi as an upper bound due to the extended variation of data as shown below:

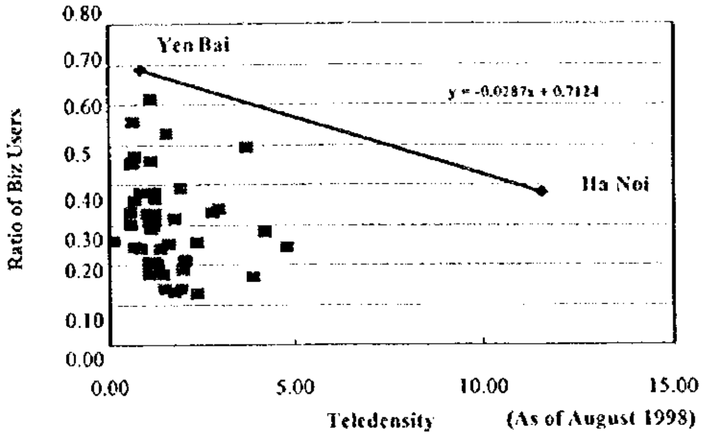


Figure 7.3.2-1 Ratio of Business Users vs. Teledensity

(b) The modified business user ratios for the respective provinces are derived from the formula given above. This modified business user ratios are applied to the corresponding Teledensities as explained in 7.1.2 (1) (a) to derive [MOBIX], which is then applied to the formula, y= **1.4046·x – 0.213**, where y: Mobile Penetration and x: MOBIX.

(c) To summarize the procedures for (a) and (b) as above, **Penetration of CMTS (Y)** is expressed in terms of **Teledensity (X)** as follows:

$$Y = 1.4046x\,[\mathrm{MOBIX}] - 0.213$$
$$= \mathbf{140.46\cdot(-0.028\cdot X + 0.7124)\ \cdot X - 0.213}$$

where [MOBIX]= 100·[Business User Ratio]·[Teledensity]

(d) A logistic curve is fitted to the number of CMTS users immediately after the saturation of the penetration of CMTS derived from the generic formula using MOBIX and Teledensity as applied to the provinces other than Ha Noi, Da Nang and Ho Chi Minh City.

(e) It is assumed that the logistic curves fitted for Ha Noi, Da Nang and Ho Chi Minh City will reach their saturation level at 300/1000 inhabitants (100/1000 for other cities/provinces).

(f) Estimated CMTS penetration per 1000 in 1999 End for Ha Noi, Da Nang and Ho Chi Minh City is 20.8, 6.8 and 33.0, respectively.

(g) Once the penetration reaches its peak based on the formulae given in (c) as above, the following formula of "logistics curve" are applied to the respective cities as follows:

- Ha Noi $y = 300/(1 + 22.7934675 \cdot Exp(-0.3797158 \cdot t))$
- Da Nang $y = 300/(1 + 55.0481917 \cdot Exp(-0.3603923 \cdot t))$
- HCM City $y = 300/(1 + 12.9887543 \cdot Exp(-0.4092449 \cdot t))$

where y: CMTS penetration (users/1000 inhabitants);

t= 1 where the formula given in (c) as above reach the values of their upper boundaries; CMTS penetration doubles in two (2) years where t= 3.

(h) The smoother that is defined as under and multiplied over the all of "raw" figures of CMTS users in order to fill the gap and to maintain the consistency between the forecasted and actual figures of the Internet users.

[Smoother] = [Users in June 1999] / [Users at the end of 1998]

(i) The results of derivation (Scenario 3) appears below:

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
NKEY	63,553	89,527	125,656	171,190	237,489	316,766	411,103	516,816	627,797	736,912	837,850	932,274
CKEY	6,883	7,611	8,482	9,247	9,952	10,594	11,158	14,533	19,139	25,410	33,877	45,136
SKEY	184,525	196,256	207,424	214,825	308,191	434,262	596,501	793,052	1,014,764	1,246,086	1,469,907	1,671,748
Others	40,279	47,538	56,073	64,665	73,285	81,937	90,636	99,398	108,233	117,142	126,101	136,482
National Whole	295,240	340,962	397,635	462,927	628,920	843,559	1,109,401	1,423,799	1,769,933	2,125,550	2,467,738	2,785,640

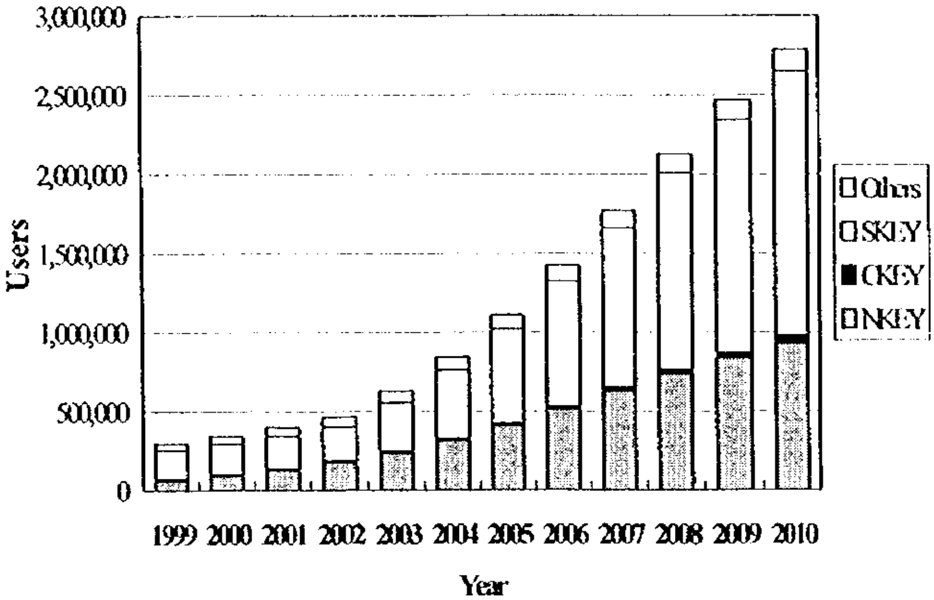


Figure 7.3.2-2 Forecast of CMTS Users

SKEY (Southern Key Economic Region)	**CKEY** (Central Key Economic Region)	**NKEY** (Northern Key Economic Region)
□ Ho Chi Minh City	□ Da Nang	□ Ha Noi
□ Binh Duong	□ Quang Nam	□ Hai Phong
□ Binh Phuoc	□ Thua Thien- Hue	□ Quang Ninh
□ Dong Nai	□ Quang Ngai	□ Hai Duong
□ Ba Ria- Vung Tau		□ Hung Yen

(2) Paging Service

The market forecast for the paging service has been carried out based on the past trend at the national level by fitting the past data on to a logistic curve at the national level, assuming that the paging service users would reach its saturated level at approximately140,000 users, i.e., 110% of the users in June 1998 (= 126,400 x 1.1).

Paging users might churn to the cellular mobile telephone service (CMTS) in the absence of PCS (Personal Communication Service) at this moment in Vietnam, judging from the slight difference in tariff between CMTS and paging service.

Table 7.3.2-1 Paging Subscribers

Year	1993	1994	1995	1996	1997	June 1998
Subscribers	13,800	40,000	71,950	111,000	120,000	126,400

The logistic formula derived is as follows:

$$y = 139{,}040 / [1 + 19.6768269 * \mathrm{Exp}(-0.9928689 * t)]$$

1993: t= 1

Depicted hereunder is the forecast of paging service:

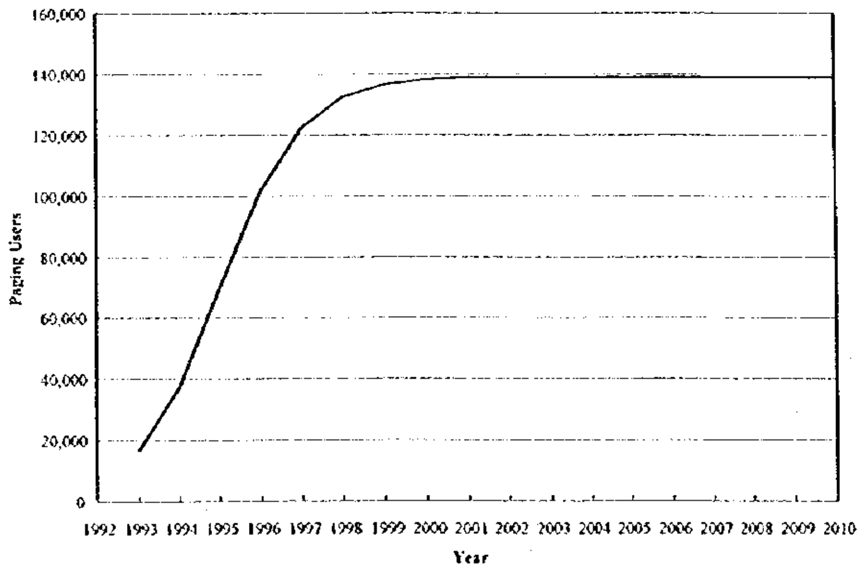


Figure 7.3.2-3 Forecast of Paging Service

7.3.3 Internet Service

(1) Current Internet Service

It is extremely difficult and uncertain to make accurately a long-term forecast of the Internet market in Vietnam at this currently pre-matured stage of telecommunication development under the Government control. However, a qualitative approach is taken here to grasp the trends of the Internet market in Vietnam, rather than a quantitative one as applied to the POTS as well as to CMTS.

Three cases, i.e., pessimistic, moderate and optimistic are examined assuming the following:

(a) Pessimistic Case: the Internet users will double in five (5) years aiming at the level of fifty (50) times as many as the users at the end of 1999.

(b) Moderate Case: the Internet users will double in three (3) years aiming at the level of fifty (50) times as many as the users at the end of 1999.

(c) Optimistic Case: the Internet users will double in two (2) years aiming at the level of fifty (50) times as many as the users at the end of 1999.

Shown below is the number of Internet service users as of June 20, 1998:

Table 7.3.3-1 Internet Service

ISP (Internet Service Provider)	Service Area	Users (Dial-up + Direct)
VNPT Vietnam Posts and Telecommunications	Nationwide	5,394
FPT The Corporation for Financing and Promoting Technology	Nationwide	1,755
Saigon Postel	Ho Chi Minh City	190
Information Technology Institution	Ha Noi	743
Total (As of June 1998)		8,082

(2) Internet Users

Most of the current Internet users seem to be the Government Agencies and large-scaled enterprises judging from the smallness of the figure as given above, though the user profile in Vietnam is not given.

Depicted hereunder is the Internet user's profile in Japan 1997 for reference (Source: Ministry of Posts and Telecommunications of Japan):

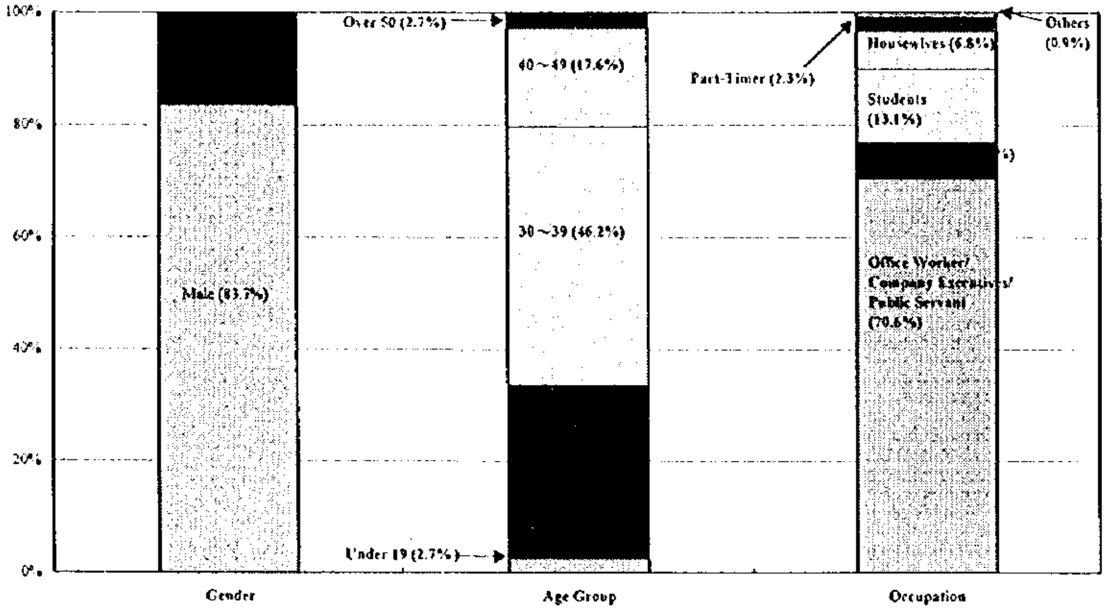


Figure 7.3.3-1 Profile of Internet Users in Japan 1997

(3) Forecast

Optimistic forecast of the Internet users up to the year 2020 is enumerated hereunder:

Table 7.3.3-2 Forecast of Internet Users (Optimistic)

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2020
Uses ('000)	42	60	84	118	165	228	312	419	552	710	888	1,078	2,129

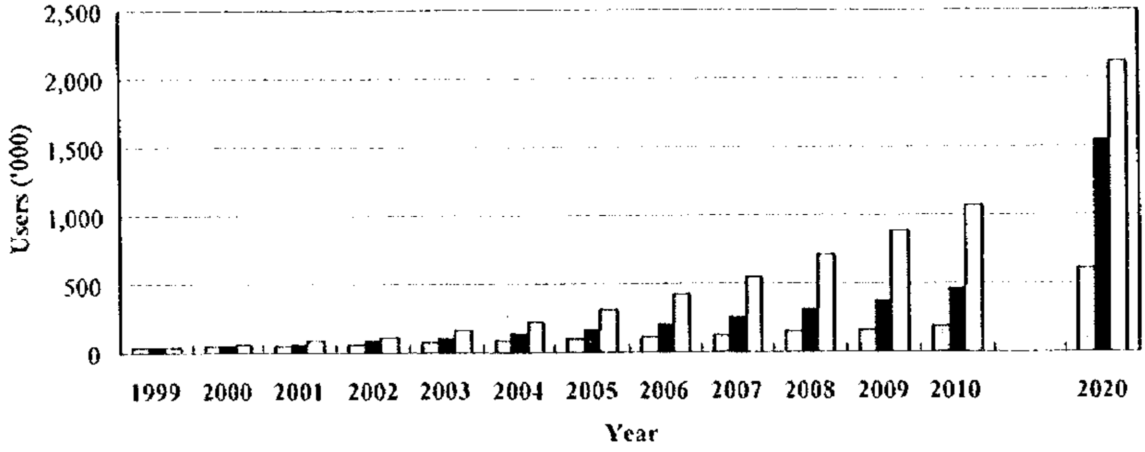


Figure 7.3.3-2 Forecast of Internet Users

(4) Managerial Consideration on ISPs

There had been a number of independent Internet Service Providers (ISPs) in the U.S. since the Internet emerged from the technology of ARPANET (Advanced Research Program Agency Network) originated in the US military network before they were acquired/merged by/with the common carriers. The following table shows the financial status of the major independent ISPs for 1996 to indicate that they suffered from a large amount of loss:

Table 7.3.3-3 Financial Status of ISPs in the USA

ISP	Revenue 1996 (US$ Million)	Profit/ Loss (US$ Million)
PSINet	89.8	- 55.1
Netcom	120.5	- 44.3
Digex(*)	9.7	- 14.6
MindSpring	18.1	- 7.6
BBNPlanet(**)	71.9	- 22.5
Earthlink(*)	20.2	- 21.8

(*) latest 3 quarters — February 17, 1997

(**) latest 2 quarters

The table below shows the some of the ISPs in the U.S. acquired by the carriers to resolve the financial difficulties they had been facing. (The *italic ISPs* appear also in the table above.)

Long Distance Carrirer	Regional Carrier	ISP	Remarks
MCI WorldCom →	→ August 1996	UUNET	Acquired
	GTE → May 1997	*BBNPlanet*	Acquired
ICG →	→ January 1998	*Netcom*	Acquired
IXC →	→ February 1998	*PSINet*	Licensed Capacity
←	← January 1998		Sold Stocks

Figure 7.3.3-4 Acquisition of ISPs by the Carriers

The current financial position of FTP, one of the four ISPs in Vietnam, is unlikely to encourage a new entrant in Vietnamese ISP market unless otherwise the tariff for leased lines to ISPs is reduced down to an appropriate level as far as Internet accessing hours of end-users remain at a comparatively low level:

"FTP has officially provided Internet services since last December (1997) in Ha Noi and early February in HCM City. The company is now serving about 1,300 subscribers in Ha Noi and 1,250 in HCM City.

Statistics from FTP show that the company's monthly turnover is about VND800 million as of last August. However, the system's operational costs are about VND750 million a month.

The company uses seven 64 kbps channels connected to VDC in Ha Noi which costs it about VND325 million a month.

....

According to statistics, the average Internet accessing time of a Vietnamese end-user is about five hours per month while a foreign subscriber surfs 30 hours a month on average." ("Viet Nam News" September 16, 1998)

(6) Tariff Comparison

The charge imposed onto the users comprises telecommunication (local call) to be paid to the carriers and Internet Access charges to be paid to the ISPs. The figure below compare the tariff to be paid by the users among the major cities in the world on the same conditions: 1) for dial-up users 2) 15-hour accessing time (day time) of the Internet per month 3) per-month basis 4) in February 1998 (US$$1.^{00}$=VND$12,974.^{50}$)

The charge for local call and Internet access in the case of Ha Noi is derived as follows:

- Local Call Charge $[50{,}000^{VND/mo} + (15^{hr} \times 60^{mo} - 450^{mo}) \times 65^{VND/mo}]/12{,}974.5^{VND}$
  $= US\$6.1$
- Internet Access $(50{,}000^{VND/mo} + 15^{hr} \times 60^{mo} \times 400^{VND/mo})/12{,}974.5^{VND}$
  $= US\$31.6$

The total monthly charge levied on an individual Internet user in Ha Noi is comparative with other major cities presented in the figure below, though Internet accessing charge in Ha Noi is far greater than the local call charges to be paid to the carriers.

Internet accessing traffic is of course price-elastic; reduction of the Internet accessing charge might encourage an end-user to generate higher accessing traffic to the Internet though it might adversely influence the financial position of an ISP on the contrary.

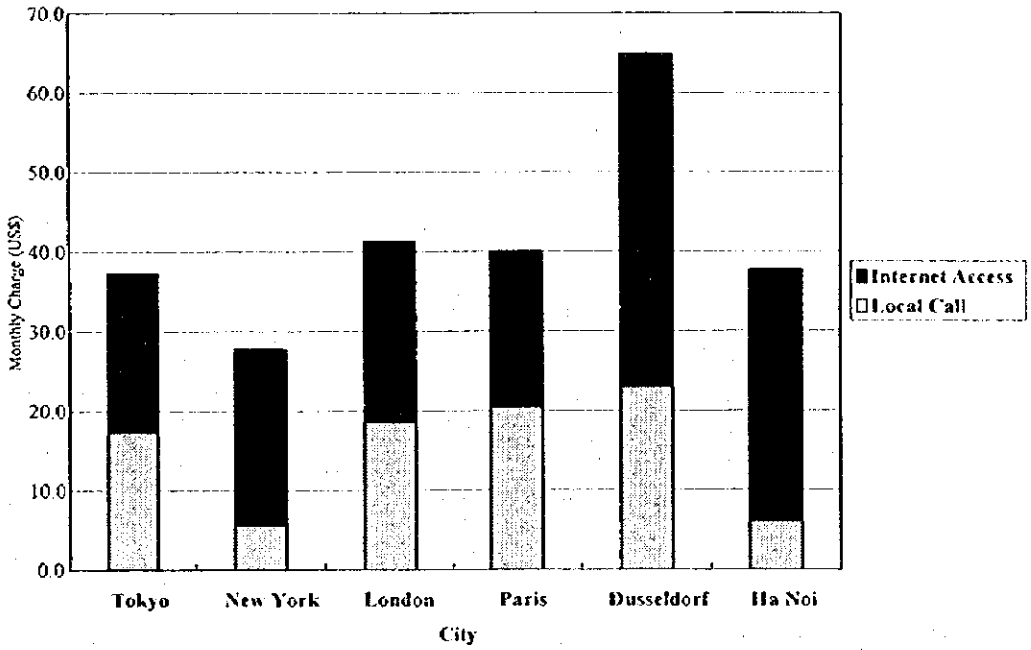


Figure 7.3.3-5 Tariff Comparison of the Internet Services

(7) Regulatory Environments

"There is an equally fundamental evolution occurring in attitudes and assumptions concerning the role of regulation and definition of the public interest in communications. That evolution is being driven largely by the **globalization of trade** and economic and social benefits being fostered by convergence(of technologies and markets in telecommunications).

It is becoming increasingly apparent that telecommunications should be seen as goods or services that can be traded, and can also directly affect all other forms of international economic activity. The Internet in particular is fostering a new wave of **global commerce without borders**, potentially forcing changes in national and bilateral policies.

In most developing countries, the infrastructure necessary for seamless integration of converging industries is not yet in place, and **policies** are being designed to attract and support **infrastructure investment**.

By promoting development of integrated (convergent) telephone and television services, for example, or **widespread Internet access**, countries with less developed infrastructures can be in position to "leap-frog" development stages, taking advantage of scope economies and **recent market and technological trends** to achieve advanced networks sooner and more efficiently."

(Source: http://www.itu.int/itudoc/osg/colloq/)

Since the Internet was opened to commercial usage, it has grown dramatically as it demonstrated potential for business to reach consumers; **Electronic Commerce (EC)** is said the most promising application in promoting economic activities executed over the infrastructure of the Internet. However, the regulator environments shall be restructured prior to the full deployment of EC in Vietnam as is done somewhere else in the world, in one way, from the viewpoint of generic EC applications such as:

- Supply chain management (SCM)
- Video on demand
- Remote banking
- Procurement and purchasing
- Online marketing and advertising
- Home shopping

And in another way, from the viewpoint of regulatory framework such as:

- WTO Agreement reached in 1997 as to Electronic Transaction
- Commercial Codes as to Digital Signature/ Electronic Contract/ Digital Cash
- Interoperability
- Security measures such as Authentication/ Encryption

"The genius and explosive success of the Internet can be attributed in part to its decentralized nature and to its tradition of bottom-up governance. These same characteristics pose significant logistical and technological challenge to existing regulatory models, and government should tailor their policies accordingly.

Electronic commerce faces significant challenges where it interacts with existing regulatory schemes. We should not assume, for example, that the regulatory frameworks established over the past sixty years for telecommunications, radio and television fit the Internet. Regulation should be imposed only as a necessary means to achieve an important goal on which there is a broad consensus. Existing laws and regulations that may hinder electronic commerce should be reviewed and revised or eliminated to reflect the needs of the new electronic age." (The White House, "A Framework for Global Electronic Commerce" July 1, 1997)"

Appearing in **Appendix II-1-4 (Volume II)** is the sample terms of reference for Technical Assistance in Restructuring Regulatory Framework for Successfully Facilitating and Deploying Electronic Commerce (EC) that might applicable also to Vietnam.

7.3.4 2-Point Logistic Curve Fitting for the Forecast of Internet Users

(1) Application of 2-Point Logistic Curve Fitting

A 2-Point Logistic Curve Fitting is employed for the services of the Internet and CMTS (Cellular Mobile Telephone Service) where technical innovation as well as competitive pricing is taking place progressively to result in the reduction of the prices of handsets, PCs, etc. Besides such services were introduced recently to give rise to scarce past records as compared with POTS.

The assumptions placed for the forecast of the Internet users are:

i) The number of the Internet users will double in five(5), three(3) and two(2) years for "Pessimistic, Moderate and Optimistic" cases, respectively.

ii) The saturation of the Internet users will take place at the level of 50 times as many as the current users in 1999 (= [Actual Users in 1998 End] + ([Actual Users in 1999 June] – [Actual Users in 1998 End], a single moving average).

iii) A 2-point logistic curve fitting is applied province/city by province/city.

(2) Mathematical Derivation

A generic formula of 2-Point Logistic Curve is expressed:

$$y = S / [1 + a \cdot Exp(- k (t-t_0))]$$

where
- y: dependent variable
- a: coefficient 1
- k: coefficient 2
- t: year
- t_0: base year
- S: level of saturation to be assumed

Substituting (y1, t1) and (y2, t2):

$$y_1 = S / [1 + a \cdot Exp(- k (t-t_1))]$$
$$y_2 = S / [1 + a \cdot Exp(- k (t-t_2))]$$

Taking natural logarithmic onto both sides of the equations above:

$$\ln y_1 = \ln S - \ln [1 + a \cdot Exp(- k (t-t_1))]$$
$$\ln y_2 = \ln S - \ln [1 + a \cdot Exp(- k (t-t_2))]$$

Subtracting the equations above with each other:

$$k (t_2-t_0) + k (t_1-t_0) = \ln ((S- y_2)/y_2) - \ln ((S- y_1)/y_1)$$
$$\therefore\ k = (1/ (t_2 + t_1 - 2t_0)) \cdot \ln [(y_1/y_2) \cdot ((S- y_2)/(S- y_1))]$$

Substituting k obtained as above into the original formulae, a is derived:

$$a = [(S/y_1)- 1]/ Exp[- k(t-t_1)] \text{ or,}$$
$$a = [(S/y_2)- 1]/ Exp[- k(t-t_2)]$$

(3) Formulae Derived

The forward-looking formulae derived, as to the "Internet users in Ha Noi," based on the assumptions and the mathematical way of derivation described above are:

Table 7.3.4-1 Formulae Derived for the Internet Users in Ha Noi

Case	Formula
Optimistic [1/]	y = 670,250 [4/]/[1 + 70.0145818 * Exp (-0.3568832 * t [5/])]
Moderate [2/]	y = 670,250/[1 + 62.1619113 * Exp (-0.2379222 * t)]
Pessimistic [3/]	y = 670,250/[1 + 56.518815 * Exp (-0.1427553 * t)]

1/ Initial Users (1999) doubles in 2 years.
2/ Initial Users (1999) doubles in 3 years.
3/ Initial Users (1999) doubles in 5 years.
4/ 670,250 = 13,405 (Initial Users) x 50 (times)
5/ t = 1 in 1999

Depicted hereunder is the actual application of the formulae above to the case of Internet users in Ha Noi:

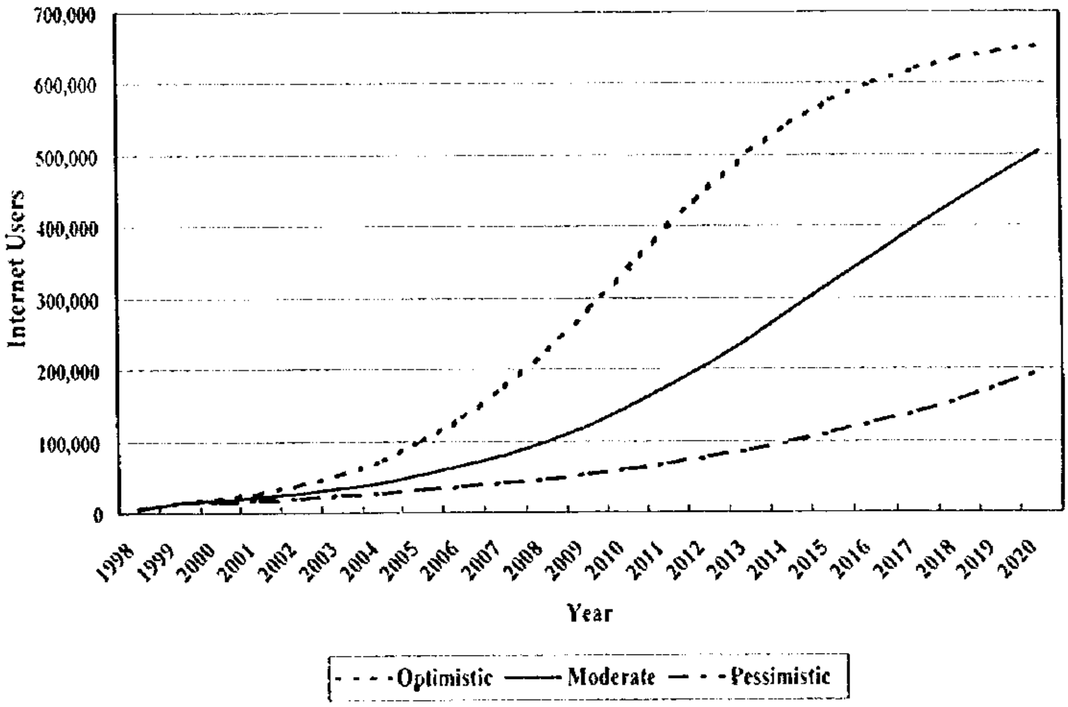


Figure 7.3.4-2 Internet Users in Ha Noi (3 Cases)

CHAPTER 8

TRAFFIC FORECAST

CHAPTER 8 TRAFFIC FORECAST

Traffic forecast is made for performing future network plan. Forecasting method and related parameters are described in this chapter.

8.1 Outline of Traffic Forecast

This clause describes the summary of forecasting method and forecasted result of each parameter.

8.1.1 Reference Traffic

(1) Busy Hour Traffic Per Subscriber

Busy hour traffic per subscriber is expressed as CR (Calling Rate). CR is calculated from the following regression Formula 8.1.1-1 and Formula 8.1.1-2:

For Urban Provinces (Ha Noi and Ho Chi Minh City):

$CR = 0.05\ X^{-0.2758}$ .... Formula 8.1.1-1

For Other Provinces:

$CR = 0.0393\ X^{-0.2046}$ .... Formula 8.1.1-2

X: Telephone penetration ratio

(2) Forecast Result of CR in the Future

The forecast result of CR for 61 provinces by 2010 is shown in Table 8.1.1-1, which was modified based on the VNPT data.

Table 8.1.1-1 CR (Calling Rate) by Province

No	Province	Abbreviation	2000	2005	2010	Remarks
1	HA NOI	HNI	0.087	0.077	0.068	
2	Hoa Binh	HBH	0.084	0.072	0.067	
3	Lao Cai	LCI	0.083	0.074	0.068	
4	Lang Son	LSN	0.085	0.073	0.067	
5	Bac Ninh	BNH	0.084	0.079	0.074	
6	Bac Giang	BGG	0.083	0.078	0.073	
7	Cao Bang	CBG	0.086	0.079	0.074	
8	Thai Nguyen	TNN	0.082	0.074	0.067	
9	Bac Can	BCN	0.084	0.074	0.067	
10	Phu Tho	PTO	0.085	0.075	0.067	
11	Vinh Phuc	VPC	0.085	0.074	0.067	
12	Tuyen Quang	TQG	0.084	0.071	0.064	
13	Yen Bai	YBI	0.085	0.080	0.075	
14	Son La	SLA	0.083	0.071	0.065	
15	Lai Chau	LCU	0.084	0.071	0.064	
16	Ha Giang	HGG	0.082	0.077	0.071	
17	Ha Tay	HTY	0.084	0.072	0.067	
18	Thai Binh	TBH	0.083	0.077	0.071	
19	Hai Duong	HDG	0.080	0.068	0.059	
20	Hung Yen	HYN	0.082	0.068	0.059	
21	HAI PHONG	HPG	0.077	0.066	0.059	
22	Quang Ninh	QNH	0.078	0.071	0.064	
23	Ha Nam	HNM	0.083	0.077	0.071	
24	Nam Dinh	NDH	0.085	0.074	0.068	
25	Ninh Binh	NBH	0.084	0.073	0.067	
26	Thanh Hoa	THA	0.085	0.074	0.068	
27	Nghe An	NAN	0.086	0.075	0.069	
28	Ha Tinh	HTH	0.083	0.077	0.071	
29	Quang Binh	QBN	0.084	0.072	0.067	
30	Quang Tri	QTI	0.085	0.078	0.073	
31	Thua Thien- Hue	TTH	0.081	0.073	0.066	
32	DA NANG	DNG	0.068	0.061	0.055	
33	Quang Nam	QNM	0.085	0.077	0.070	
34	Quang Ngai	QNI	0.083	0.075	0.068	
35	Binh Dinh	BDH	0.082	0.072	0.067	
36	Gia Lai	GLI	0.084	0.078	0.073	
37	Kon Tum	KTM	0.083	0.076	0.071	
38	Dac Lac	DLC	0.083	0.074	0.069	
39	Phu Yen	PYN	0.086	0.078	0.072	
40	Khanh Hoa	KHA	0.072	0.064	0.059	
41	Lam Dong	LDG	0.078	0.072	0.067	
42	Ninh Thuan	NTN	0.081	0.074	0.069	
43	HO CHI MINH	HCM	0.094	0.082	0.072	
44	Binh Thuan	BTN	0.080	0.073	0.067	
45	Dong Nai	DNI	0.080	0.072	0.066	
46	Binh Duong	BDG	0.072	0.062	0.055	
47	Binh Phuoc	BPC	0.085	0.076	0.069	
48	Tay Ninh	TNH	0.085	0.078	0.072	
49	Ba Ria- Vung Tau	VTU	0.074	0.067	0.061	
50	Long An	LAN	0.085	0.074	0.068	
51	Tien Giang	TGG	0.085	0.076	0.071	
52	Ben Tre	BTE	0.086	0.074	0.066	
53	Tra Vinh	TVH	0.086	0.080	0.074	
54	Vinh Long	VLG	0.086	0.076	0.070	
55	Can Tho	CTO	0.086	0.078	0.072	
56	Dong Thap	DTP	0.085	0.076	0.071	
57	An Giang	AGG	0.084	0.070	0.062	
58	Kien Giang	KGG	0.079	0.067	0.061	
59	Ca Mau	CMU	0.085	0.076	0.070	
60	Bac Lieu	BLU	0.085	0.074	0.067	
61	Soc Trang	STG	0.086	0.075	0.067	

8.1.2 Traffic Distribution Ratio

Traffic distribution ratio of each intra-district, inter-district, inter-province and international traffic is calculated from the following formulas:

(1) Inter-district ratio(D1)

$D1 = 0.0092Ln(X) + 0.1223$ .... Formula 8.1.2-1

(2) Inter-province ratio(D2)

$D2 = -0.0092Ln(X) + 0.1177$ .... Formula 8.1.2-2

(3) International ratio(D3)

$D3 = -0.0031Ln(X) + 0.0126$ .... Formula 8.1.2-3

(4) Intra-district (D4)

$D4 = 1 - D1 - D2 - D3$ .... Formula 8.1.1-4

X: Telephone penetration ratio
D1: Inter-district ratio
D2: Inter-province ratio
D3: International ratio
D4: Intra-district ratio

8.1.3 Point to Point Traffic

Point to point traffic is estimated by applying Gravity method. The forecast result of point to point traffic in the future is attached to Appendix I-8-1.

8.2 Data Analysis

The collected data during this study and data analysis method are described in this clause.

8.2.1 Collected Data

The collected data are as shown below:

(1) Yearly total number of calls and yearly total telephone-call minutes of intra-province call for each province in 1994 to 1997

(2) Yearly total number of calls and yearly total telephone-call minuets of inter-province call for each province in 1991 to 1997

(3) Yearly total number of calls and yearly total telephone-call minutes of international

call for each province in 1991 to 1997

(4) Number of telephone subscribers in 1991 to 1997

(5) Surveied traffic matrix between 61 provinces in 1997

(6) Number of telephone subscribers of 34 provinces in 1998

(7) International traffic (call minutes) in 1st and 2nd quarters in 1998.

8.2.2 Analysis Method of CR

The analysis method of the busy-hour traffic per subscriber is shown below:

(1) Total Traffic Volume

Total traffic consists of intra-district, inter-district, inter-province and international traffic. Inter-district, inter-province and international traffic can be estimated from billing data collected in this study. However, non-charge telephone-call minutes for intra-district call is not included in billing data. Therefore, non-charge telephone-call minutes per subscriber per month needs to be assumed in order to forecast busy hour CR in the future. The assumption method is described as follows:

(a) The relation among non-charge telephone-call minutes (per subscriber per month), the average CR and toll traffic distribution ratio is expressed as Figure 8.2.2-1 based on the following conditions:

i) Collected data such as yearly total telephone-call minutes of intra-province, inter-province and international call are used

ii) Some extent of non-charge telephone-call minutes per subscriber per month are assumed

iii) CR is calculated from call minutes based on the following assumption:

- Number of usage days : 290
- Call completion ratio : 0.8
- Busy hour concentration ratio : 0.1
- Low to high ratio : 1.2

(b) Mean value CR (Erl/sub) and toll traffic distribution ratio are assumed as follows based on the hearing from VNPT.

i) National average CR is 0.08 (Erl/sub)

ii) Distribution ratio of toll traffic is 14 (%)

(c) Finally, 340-minutes is obtained as an non-charge telephone-call minutes per subscriber per month from Figure 8.2.2-1 in consideration of matching with the condition that national average CR is 0.08 (Erl/sub) and the toll traffic distribution ratio is 14 (%).

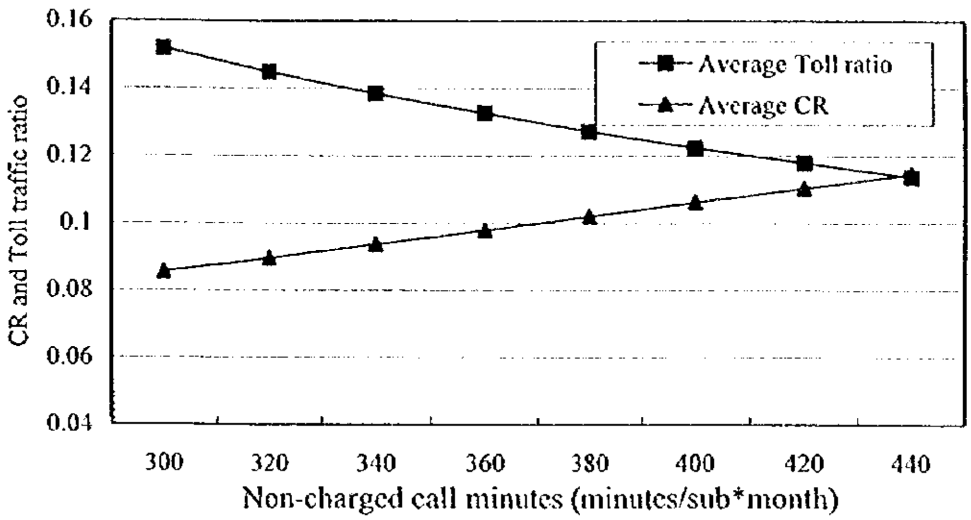


Figure 8.2.2-1 Non-charged Call Minutes, CR & Toll Traffic Ratio

(2) Relation between CR and Various Parameters

CR of each province is calculated based on the yearly total telephone-call minutes of intra-province, inter-province, international and above-mentioned non-charge telephone-call minutes. The relations between CR and various parameters are described as follows:

(a) Relation between the number of subscribers and CR

There is no significant correlation between the present number of subscribers and CR.

(b) Relation between the telephone penetration ratio and CR

There is no significant correlation between present telephone penetration ratio and CR.

(c) Relation between GDP and CR

There is no significant correlation between present GDP and CR.

(d) Variation of CR

From analysis of the above (a) to (c), the parameter having significant correlation with CR can not be found out. It may be considered for the reason why the significant correlation does not exist that the telephone penetration ratio in Vietnam is still low. The penetration ratio of most of the provinces is about 1%.

(3) High Traffic Subscriber and Low Traffic Subscriber

The following analysis is executed using population, telephone penetration ratio, number of business subscribers and number of residential subscribers by 34 provinces in 1998. The relation between "ratio of business subscribers to population" and "telephone penetration ratio" is shown in Figure 8.2.2-2, and the relation between "ratio of residential subscribers to population" and "telephone penetration ratio" is shown in Figure 8.2.2-3.

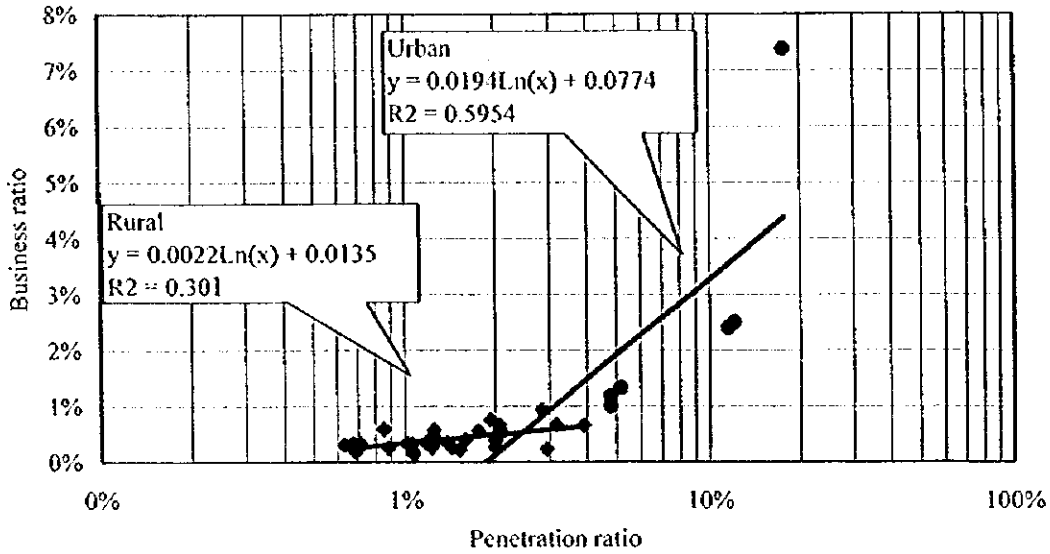


Figure 8.2.2-2 Business Subscribers Ratio and Penetration Ratio

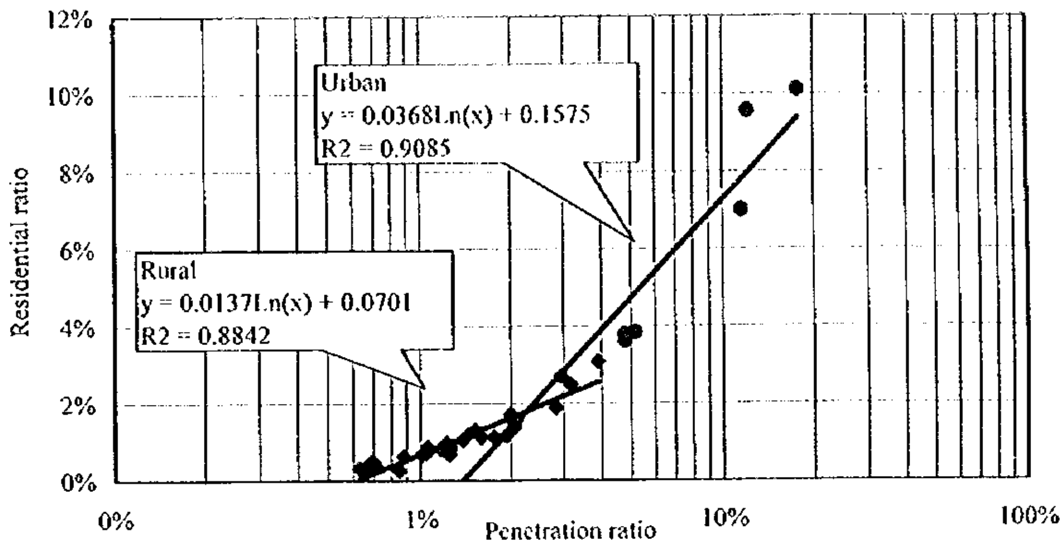


Figure 8.2.2-3 Residential Subscribers Ratio and Penetration Ratio

Four kinds of regression formulas can be obtained from these Figures.

The following three kinds of subscriber classes are assumed from the view point of traffic :

- The business subscriber traffic is high.
- The residential subscriber traffic at present is medium.
- The residential subscribers who will increase newly from now are low traffic subscribers

The relation between "the ratio of three (3) classes of subscribers to population" and "telephone penetration ratio" is shown in Fig. 8.2.2-4 based on the above-mentioned assumption.

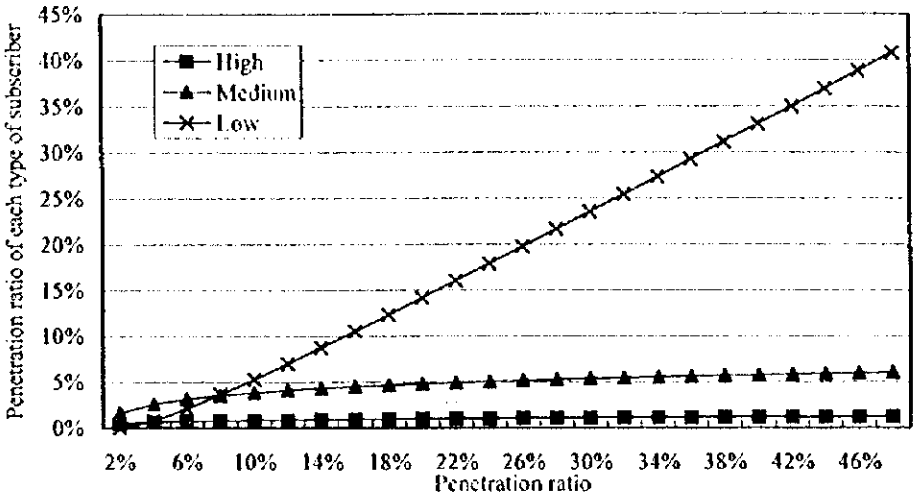


Figure 8.2.2-4 Types of Subscriber and Penetration Rate

The ratio of subscribers of each class is calculated by the following formulas:

For Urban Province (Ha Noi and Ho Chi Minh City):

(a) High traffic subscriber ratio (Y1)

$$Y1 = 0.0194Ln(X) + 0.0774 \quad \text{.............. Formula 8.1.1-1}$$

(b) Medium traffic subscriber ratio(Y2)

$$Y2 = 0.0368Ln(X) + 0.1575 \quad \text{.............. Formula 8.1.1-2}$$

(c) Low traffic subscriber ratio (Y3)

$$Y3 = 1 - Y1 - Y2 \quad \text{........................... Formula 8.1.1-3}$$

For Other Province:

(a) High traffic subscriber ratio (Y1)

$$Y1 = 0.0022Ln(X) + 0.0135 \quad \text{.............. Formula 8.1.1-4}$$

(b) Medium traffic subscriber ratio (Y2)

$$Y2 = 0.0137Ln(X) + 0.0701 \quad \text{.............. Formula 8.1.1-5}$$

(c) Low traffic subscriber ratio (Y3)

$$Y3 = 1 - Y1 - Y2 \quad \text{.............................. Formula 8.1.1-6}$$

X: Telephone penetration ratio
Y1: High traffic subscriber ratio
Y2: Medium traffic subscriber ratio
Y3: Low traffic subscriber ratio

(4) Penetration Ratio and CR

Relation between penetration ratio and CR can be plotted as Figure 8.2.2-5 based on the above-mentioned formulas and the following assumption:

(a) High traffic subscriber : 0.12 Erlang/Sub
(b) Medium traffic subscriber : 0.08 Erlang/Sub
(c) Low traffic subscriber : 0.04 Erlang/Sub

Furthermore, the following regression formula showing the relation between penetration ratio and CR can be obtained from Figure 8.2.2-5.

For Urban Provinces (Ha Noi and Ho Chi Minh City):

$CR = 0.05 X^{-0.2758}$ .... Formula 8.2.2-7

For Other Provinces

$CR = 0.0393 X^{-0.2046}$ .... Formula 8.2.2-8

X: Telephone penetration ratio

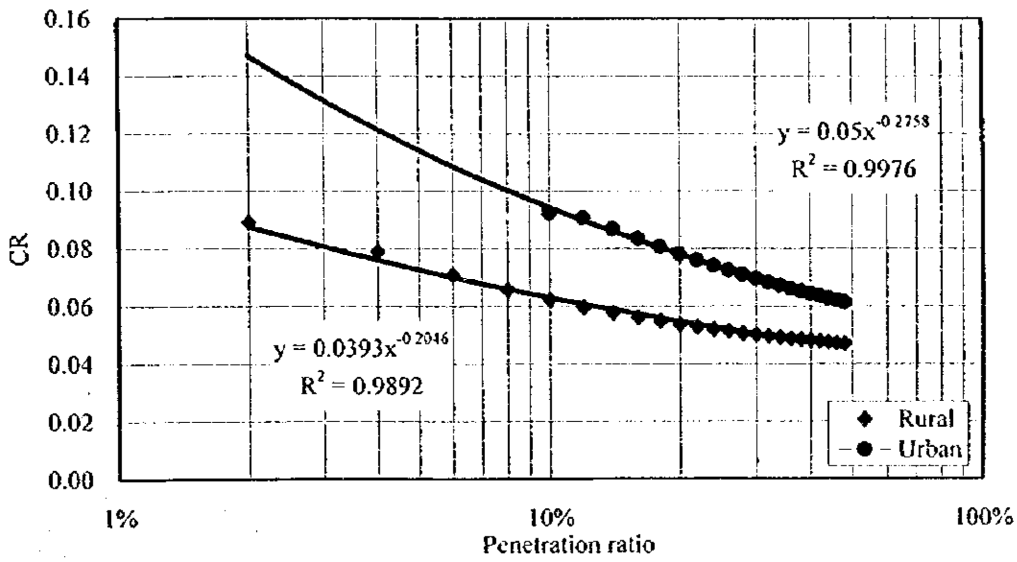


Figure 8.2.2-6 Penetration Ratio and CR

8.2.3 Analysis Method of Traffic Distribution

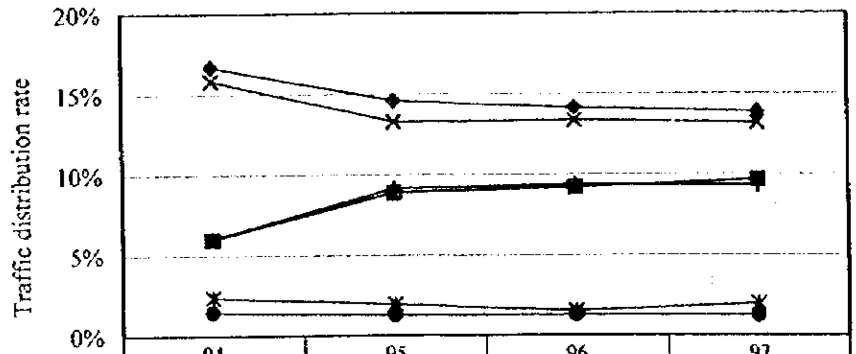
(1) Relation between Traffic Distribution Ratio and Other Parameters

There is no significant correlation between traffic distribution ratio and the penetration ratio, and also there is no correlation between traffic distribution ratio and GDP.

(2) Time Series Variation of Traffic Distribution Ratio

The traffic distribution ratio from 1994 to 1997 is analyzed from collected data. The average and median of the traffic distribution ratio in inter-district, inter-province and international call are shown in Figure 8.2.3-1. The distribution ratio of toll (inter-province) traffic is in a decreasing trend, and the distribution ratio of an inter-district traffic is in an increasing trend.

Traffic distribution ratios for high traffic subscribers, medium traffic subscribers and low traffic subscribers are defined as Table 8.2.3-1 based on Figure 8.2.3-1 and the similar assumption defined in clause 8.2.2 (3).



	94	95	96	97
Average (Toll)	0.166872702	0.145906171	0.141246623	0.138530496
Median (Toll)	0.158231684	0.132931251	0.133676933	0.131672708
Average (International)	0.023781331	0.019559751	0.015335197	0.019504786
Median (International)	0.014444006	0.012825869	0.013007123	0.012454664
Average (Inter-district)	0.060212396	0.091617454	0.093732702	0.092852543
Median (Inter-district)	0.059866354	0.088988531	0.092079631	0.096526519

Figure 8.2.3-1 Traffic Distribution Ratio by Year

Table 8.2.3-1 Traffic Distribution Ratio

Type of subscriber	Intra-district	Inter-district	Inter-province	International
High Traffic subscriber	73 %	7 %	17 %	3 %
Medium Traffic subscriber	74 %	10 %	14 %	2 %
Low Traffic subscriber	75 %	13 %	11 %	1 %
Standard Deviation	-	3 %	3 %	1 %

The relation of the telephone penetration ratio and a traffic distribution ratio is analyzed using Table 8.2.3-1 and Figure 8.2.2-4 which shows the relation between "telephone penetration ratio" and "the ratio of three (3) classes of subscribers to population". The following regression formulas are obtained as the result of analysis.

(a) Inter-district ratio(D1)

D1 = 0.0092Ln(X) + 0.1223 .... Formula 8.1.2-1

(b) Inter-province ratio(D2)

D2 = -0.0092Ln(X) + 0.1177 .... Formula 8.1.2-2

(c) International ratio(D3)

D3 = -0.0031Ln(X) + 0.0126 .... Formula 8.1.2-2

(d) Intra-district (D4)

D4 = 1-- D1 – D2 – D3......... Formula 8.1.1-3

X: Telephone penetration ratio
D1: Inter-district ratio
D2: Inter-province ratio
D3: International ratio
D4: Intra-district ratio

Figure 8.2.3-2 can be expressed from these regression formulas.

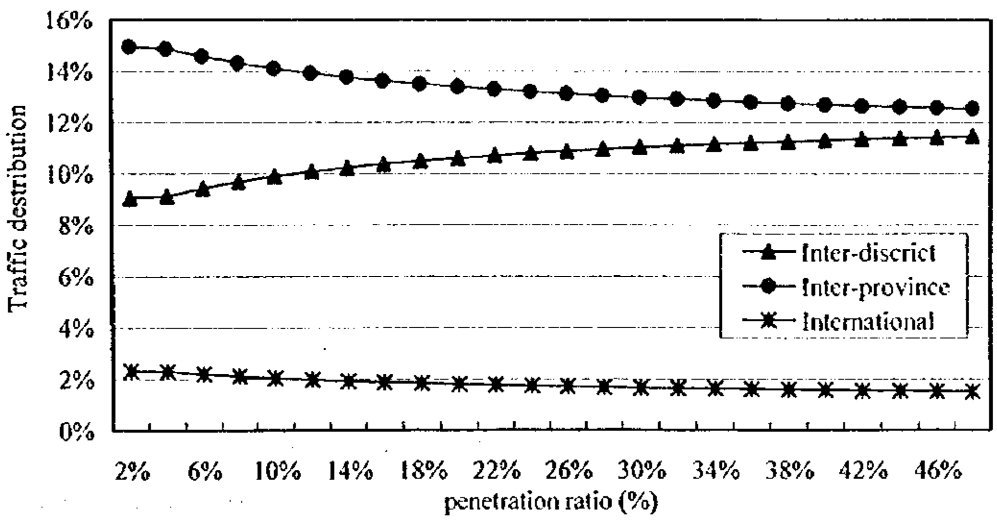


Figure 8.2.3-2 Penetration Ratio and Traffic Distribution Ratio

8.2.4 Analysis Method of Point to Point Traffic

(1) Forecast of Point to Point Traffic in the Study

Point-to-point traffic is estimated by applying Gravity method. Gravity method takes account of originating/terminating traffic of each of switch and transmission distance between switches. The forecast result of point-to-point traffic in the future is attached to Appendix I-8-1.

(2) Methods of Forecasting the Point to Point Traffic

The Gravity model which has been selected to use in this study due to the unavailability of traffic matrix in basic year.

A general survey of the traffic forecasting process is given in Figure 8.2.4.-1. Because of the variable nature of traffic and the uncertainty of the forecasting demand for connections, even the best methods cannot provide traffic forecasts which are completely reliable.

To reduce the level of uncertainty, the importance of traffic forecasts being so great, a constant improvement in the basic data is necessary. The complete process of calculating traffic matrices should be repeated as often as possible. The automation of these calculations, which are particularly long and tedious, will facilitate both the regular updating of forecasts and the systematic exploration of the possible directions of network evolution.

(3) Forecasting for Initial Traffic Matrix

GAS 3 of ITU (General Network Planning) studied and published in 1983 how to formulate the Network Planning. In Chapter IX "Forecasting for Network Planning", the following three ways are proposed to formulate the initial traffic matrix.

(a) First Case: Traffic measurements are available

In case traffic measurements are available, the boxes of the initial traffic matrix corresponding to direct circuits are then obtained directly, and the others from the percentage per direction. Use of gravity model is necessary to check and complete a matrix.

(b) Second Case: No traffic measurements are available

i) Traffic is assumed to be equally distributed. This method is very approximate. This is used where great accuracy is not vital.

ii) Coefficients of affinity are used. The coefficients of preference are determined directly by the planner.

iii) Gravity models.

This method calculates the coefficients of affinity from the distance.

The formulas to be used are referred to GAS 3.

(4) Forecasting Future Point-to-Point Traffic Matrix

The coefficient of affinity which indicates the intensity of a point to point traffic is analyzed from initial traffic matrix, obtained from (3) above.

Extrapolation of the traffic flows from the flows of the initial point-to-point traffic is made in such a way that not only should the new flows have a geographical distribution that resembles as close as possible that of the initial matrix, but the sum of these flows, for each center should also correspond to the values established previously for each category of traffic identified. These two objectives often prove contradictory and therein lies the major difficulty of extraporating traffic matrices. Gravity model is also applied for forecasting future point-to-point traffic matrix.

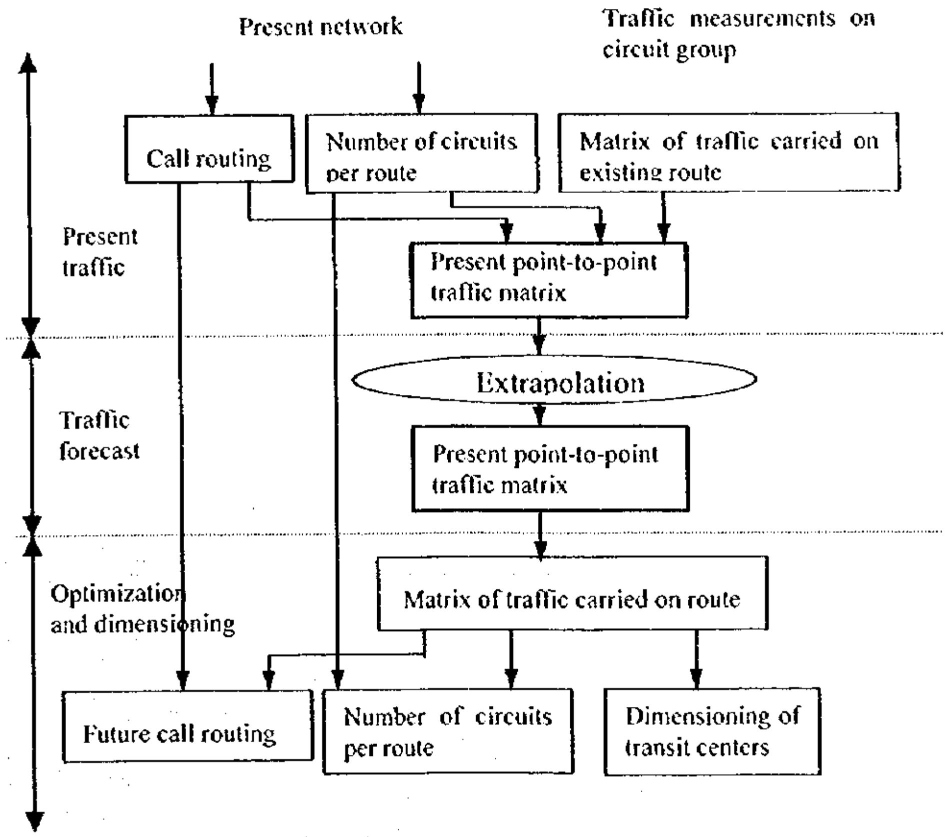


Figure 8.2.4-1 Traffic Forecast Process

8.3 International Telephone Traffic Forecast

8.3.1 Forecast of Total Chargeable Minutes (Outgoing + Incoming) of International Telephone

The total chargeable minutes of international telephone to and from Vietnam from 1998 through 2010 have been forecasted based on the following parameters:

a : Basic growth rate, which consists of rate of growth by popularization of the service and that by increase in foreign trade and tourism.

b : Growth rate of Gross Domestic Product (GDP) per capita

c : Impact on growth of enhancement in domestic network (e.g., improvement in completion rate)

d : Impact on growth of additional increase in subscribers

The method of getting the growth rate for each planned year is first to obtain item a above and to estimate items b, c, d respectively, and then super-impose b, c and d on a.

The historical data regarding the international telephone calls, GDP per capita, population and number of domestic telephone subscribers are shown in the below.

Table 8.3.1-1 Historical Data regarding International Telephone Services

	1991	1992	1993	1994	1995	1996	1997
GDP(Billion VND)	31,286	33,991	36,736	39,982	186,499	203,919	221,872
GDP per capita(US$)	122	143	181	214	273	311	329
Population(M)	67.77	69.41	71.03	72.51	73.96	75.36	76.71
International Telephone Total Traffic(M Minutes)	14	41.5	82.9	144	207.5	273	344
International Telephone O/G Traffic (M Minutes)	2.7	14.3	19.9	32.8	44.5	52.4	53.5
International Telephone O/G Traffic (M calls)	0.29	1.03	3.56	8.34	12.62	15.63	19.37
No. of Domestic Telephone Subscribers (K)	N/A	N/A	206	350	596	889	1,190
No. of International Direct Telephone Circuits	N/A	659	950	1,647	2,972	4,285	4,875

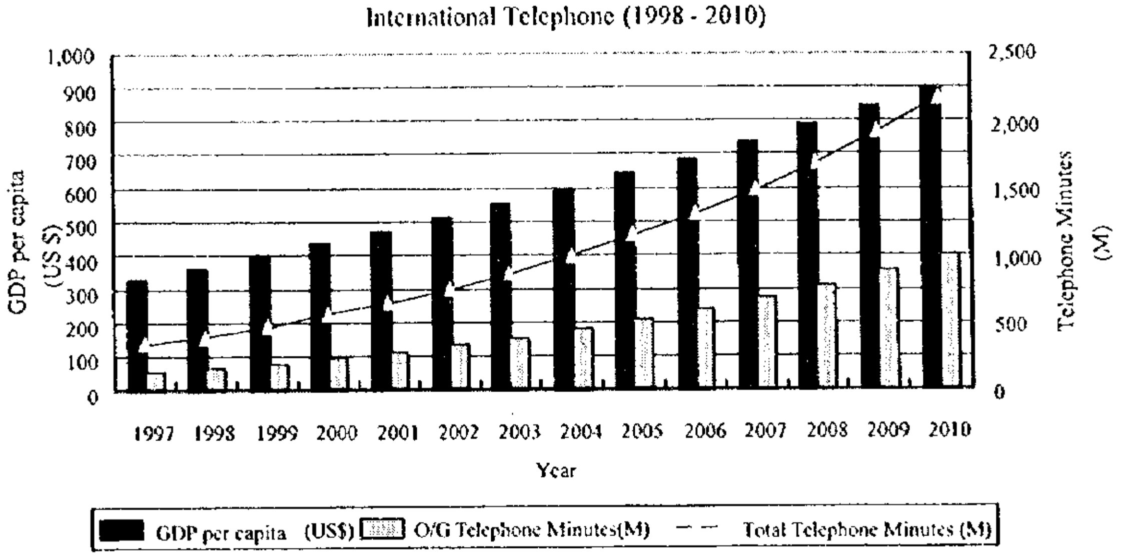


Figure 8.3.1-1 Forecasting International Telephone for 1998 through 2010

The fundamental growth rate of international telephone traffic has been obtained by fitting the following exponential curve to the above historical data through the method of least squares:

$$\mathbf{Log_{10}\ TPMTOT = -247.82 + 0.12537 * YEAR} \quad (R^2 = 0.989)^*$$

Where: TPMTOT= Total Telephone Minutes (M)

YEAR= four digits of Christian era

* Multiple correlation coefficient denoted by R

From this formula, the basic annual growth rate in 1994 to 1997 has been estimated to be 33.4 percent, because $10^{0.12537} = 1.334$.

As to the super-imposing growth rates by the GDP per capita, enhancement in domestic network and additional increase in subscribers, the estimated figures based upon various kinds of studies are shown below together with basic and total growth rates.

Table 8.3.1-2 Estimated Growth Rates

Year	Basic Growth (%)	Factor on GDP per capita Growth (%)	Factor on Domestic network Growth (%)	Factor on Subscribers Growth (%)	Total Growth (%)
Existing (1997)	33.4	1.5	0.2	3.3	38.4
~2000	20.0	1.0	0.2	1.1	22.3
~2005	15.0	0.8	0.2	0.5	16.5
~2010	12.5	0.7	0.2	0.3	13.7

The forecast of IDD calls (Outgoing + Incoming) for 1998 through 2010 has been estimated based on the data obtained from VNPT. The curve fitting by means of the method of least squares applied to the total telephone minutes in relation to the GDP per capita are given on the above Figure 6.3.2-2 and the following formula has been used:

Log Y = 1.8729 X – 2.1973

Where: Y = Total Telephone Minutes (M)

X= $\log_{10}$GDP per capita (US $)

In the long range forecasting, the degree of uncertainty increases, and saturation effect cannot be avoidable even for currently growing services as telephone. Therefore, a common practice in long range forecasting is to choose as fitting curve one of growth curves, such as Gomperz or logistic curve. In this master plan, the international telephone traffic for the period up to the year 2020 has been forecasted by the following Gomperz curve formula:

$$\mathbf{TPMTOT=118{,}418*(0.0063)^{0.971035\ \hat{}\ t}}$$

Where: TPMTOT = Total Telephone Minutes (M)

t = 1 (2003), 2(2004), 3(2005) ----------

The forecasted demand for international telephone traffic calculated by the above is shown in Table 6.3.1-2.

Table 8.3.1-2 International Telephone Traffic Forecast Vietnam-World (Outgoing+Incoming)

Year	GDP per capita(US $)	O/G Telephone Minutes (M)	Total Telephone Minutes (M)
1998	362	67	393
1999	398	81	470
2000	438	97	562
2005	643	208	1,155
2010	902	405	2,177
2015	1,206	719	2,499
2020	1,556	1,192	2,980

In economic modeling especially, explanatory variables are used to forecast international traffic. Some of the most important of these variables are the following: exports, imports, degree of automation, quality of service, time differences between countries, tariffs, consumer price index and gross national product.

Other explanatory variables, such as foreign business travelers and nationals living in other countries, may also be important to consider. It is recommended that data bases for explanatory variables should be as comprehensive as possible to provide more information to the forecasting process.

8.4 Forecast for Number of International Circuits

In planning a telecommunication network, the objective is to determine the numbers, sizes, locations and boundaries of exchanges, and the arrangements and quantities of junctions between them, in such a way as to minimize total cost, subject to meeting the stipulated standards of performance (including grade of service, reliability and quality of transmission).
Regular or periodical traffic measurement is essential in order to check the adequacy of equipment provision and to obtain reliable traffic data as a basis for planning the growth of the system. The cost of collecting and analyzing traffic data in a large network, but is justified by the benefits of improved service and of plant saving which are made possible by accurate traffic estimates.

8.4.1 Basic Concept of Circuit Planning

The basic concept to plan the number of international telephone circuits is as follows:

(1) Country to Country grade of service
To provide an adequate number of circuits to carry an estimated traffic under an objective of grade of service and appropriate routing plan.

(2) Route diversity
To improve the network reliability, circuits should be distributed to a certain destination to all-available broad band routes, and terminating appropriate central offices.

(3) Cost-effectiveness
To establish new direct circuits, with such a destination as can be expected the improvement of service quality and/or the division of revenue, or in accordance with a commencement of new service.

8.4.2 Traffic Forecast

Network is planned assuming that 24-hour traffic is offered to the network. However, heavy traffic and sharpened peak traffic may be offered under abnormal situation such as big events, new year greeting etc.

The measure against abnormal network situation is a matter of "Network Management".

In general network planning is the first step for establishing network in order to meet to the forecasted busy hour traffic volume. However, the average busy hour traffic may be vary on different days, so that successive daily busy hours cannot, in general, be regarded as part of a continuous equilibrium process.

These variations are considered to be three.

(1) Long-term growth or decline of traffic

(2) Cyclical variations, weekly or seasonal

(3) Random variations, due to unpredictable factors affecting the general level of demand in an exchange or route on a particular day

There are two different strategies for deriving future international circuit quantities. One is called the direct Erlang forecasting strategy that is based on forecasting the offered busy hour Erlang traffic and that is a more direct method where the necessary data is available. The other one is called the composite forecasting strategy that is based on forecasting monthly paid minutes and various traffic – dependent conversion factors.

ITU Recommendation E.506 describes in detail on the subject.

(1) Direct Erlang Forecasting

Direct Erlang forecast strategy is used for short – term planning, the traffic carried in Erlangs, or measured usage, for each relation would be regarded as the base data in forecasting traffic growth.

(2) Composite Forecasting

Composite forecast is used for medium-term or long-term planning, based on historical international accounting data of monthly or annual paid minute traffic and a number of factors which are used for converting a paid-minutes forecast on the basis of the accounting data into busy hour Erlang forecasts.

It is recommended to use the following formula to estimate mean offered busy-hour traffic (in Erlang) from the Micro-forecasts (in annual paid-minutes).

$$E = (A * M * D * H)/(60 * \eta)$$

Where E: the estimated mean traffic in Erlangs offered in the busy-hour

A: the total annual paid minutes (Micro-Forecasts)

M: Busy month to year ratio (e.g. M=month/year: 9.58%)

D: Weekday to busy month ratio (e.g. D=day/month: 4.38%)

H: Busy hour to weekday ratio (e.g. H=hour/day: 8.88%)

η : the efficiency factor, i.e. Paid minutes to circuits holding time ratio (e.g. η = paid/hold: 0.889)

After calculation of the offered busy-hour traffic (in Erlang), the number of required circuits can be obtained by using the Erlang B Formula substituting the adequate loss probability.

Table 8.4.2-1 shows the number of international circuits for telephone between Vietnam and the World.

The required number of circuits was calculated from these Erlang values by using a loss probability of 1 % in accordance with the ITU-T Recommendations E520.

Table 8.4.2-1 Required Number of International Circuits for Telephone between Vietnam and the World according to the Estimated Traffic Forecasting Data

Year	ITC-1(Ha Noi)	ITC-2(Ho Chi Minh)	ITC-3(Da Nang)	Total
1997	849 (1,632)	1,925 (2,913)	144 (330)	2,918 (4,875)
1998	965 (1,666)	2,143 (2,897)	162 (450)	3,270 (5,013)
1999	1,147	2,615	191	3,953
2000	1,365	3,120	225	4,710
2005	2,760	6,361	440	9,560
2010	5,157	11,936	807	17,900

Note: a parenthesized figure ( )shows the number of actual telephone circuits.

8.4.3 Distribution of Exchanges

International Switching Center (ITC in case of Vietnam) should be located considering the following three factors:

a. Traffic demand distribution on area by area

b. Switching system failure

c. Natural disaster such as flood

From the economical viewpoint, ITC shall be located in the center of large traffic volume area such as Metropolitan City. In order to secure the communication in case ITC failed such as total system down of switching system, it is desirable that two ITC's are at least operated in the same area. From the viewpoint of security against natural disaster, at least two ITC's shall be located in different cities.

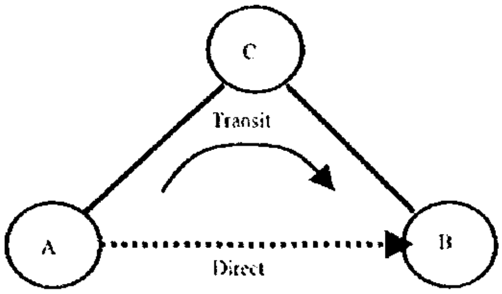
In Vietnam three ITC's in different cities are working currently, ITC-1 (Ha Noi), ITC-2 (Ho Chi Minh) and ITC-3 (Da Nang).
Existing international gateways are now connected via transit switch with domestic public switch network to carry the international telephone calls originating from the subscribers that can be divided into three areas (Northern Area, Southern Area and Central Area).
The diversification of the International Telephone calls to and from Vietnam has been shown in the following Table 8.4.3-1.
From this table it shows almost international telephone traffic in Vietnam is now carried by two ITC's (Ho Chi Minh and Ha Noi). Under the current traffic situation it seems that the third ITC gateway function is not requested.

Table 8.4.3-1 Traffic Distribution of ITC (as of end of 1997)

	ITC-1(Ha Noi)	ITC-2(Ho Chi Minh)	ITC-3(Da Nang)
Total Minutes Ratio	25 %	71 %	4 %
O/G Minutes Ratio	32 %	67 %	1 %
I/C Minutes Ratio	24 %	72 %	5 %
IN :OUT Minutes Ratio	80:20	85:15	95:5
International Circuit Accommodation Ratio	33 % (1,632)	60 % (2,913)	7 % (330)
International :Domestic Traffic Ratio	3:97	5:95	5:95

8.4.4 Economic Aspects of Circuits Cost

When arranging international circuits, it is desirable to maintain direct circuits with countries as much as possible, from the standpoint of national interests. For communication reliability as well, and excessive dependence on a particular transit point is not desirable. However, the facility redundancy, economy, intentions of the other countries, and other factors have to be considered as important factors when establishing direct circuits. This section studies an economic aspect for a direct and relayed circuit particularly in terms of break-even analysis.
First, let us assume that a country A has started studying whether or not a direct telephone circuit should be established with a country B. Let us further assume that the traffic between these two countries is currently handled via a third country C.



Under current international customs and practices, a telecommunication rate between a direct and transit route is same, and there can be no difference in revenue of the terminal countries. This means that only expenditure, namely cost, should be compared between a direct and transit route in break-even analysis. For the purpose of comparison, the cost can be annual or monthly. For the sake of convenience here the annual cost has been chosen.

(1) Annual Cost for Transit Traffic

When a transit route handles the communications to a country B, the cost can be generally obtained by the mathematical formula shown in the following.

$$Y1 = 1/2 \times R \times M + 1/2 \times P \times M + \alpha$$

Where Y1: annual cost for handling traffic (to country B)

P: accounting rate per minutes

M: total annual chargeable minutes

R: transit rate per minutes in S.T.P (Switched Transit Plan)

α : other cost (switching system, domestic transmission line, operation cost, etc.)

Of these amounts, 1/2 x R x M is the compensation cost in S.T.P. to be paid to the transit country (In S.T.P., each of the terminal countries pays half the transit cost to the transit country). 1/2 x P x M is the compensation cost to be paid to the destination country.

(2) Annual Cost for Direct Traffic

The cost for the same traffic volume when handled by a direct circuit will be as follows.

$$Y2 = C \times N + 1/2 \times P \times M + \alpha$$

Where Y2: annual cost for handling traffic (to country B)

N: number of circuits required for the traffic

C: annual half circuit cost for the direct route

The C x N portion is the circuit cost. The 1/2 x P x M portion is the compensation cost to be paid to the country on the other end of the circuit. Installation of a direct circuit will be more economical when Y1 > Y2. Note here that the same element 1/2 x P x M + α appeared in the last two terms. Therefore, we have only to make the first term for comparison.

Y (transit) = 1/2 x R x M

Y (direct) = C x N

As a example, suppose R=1.5 GF/min. = US $ 0.686/min. for transit rate and C=US $ 4680/year.

Y (transit) = 1/2 x 0.686 x M = 0.343 x M

Y (direct) = 4,680 x N

The number of required circuits N in Y (direct) will be obtained with respect to M from the table of Erlang B formula, supposing the busy hour concentration rate of 15 % and the average working days of 300 days. The calculated results of Y(transit) and Y(direct) are summarized in the figure 6.4.4-1 shown below.

In the figure, the point where Y (transit) and Y (direct) cross each other is the break-even points. For this we get M=55,000 Minutes/year and N=4, in this rather typical case, we can say that a direct circuit is more advantageous when there is a traffic in excess of approximately 60,000 Minutes/year.

This concept of break-even points is very much important especially for such countries as Vietnam, where the total traffic level is far below saturation and the number of destination countries is rather limited. In these countries, as the total traffic grows very rapidly, traffics to and from many countries are expected to pass their own break-even points one after another. In light of securing independence and sovereignty in telecommunications, monitoring and forecasting traffic on a country by country basis is indispensable, too.

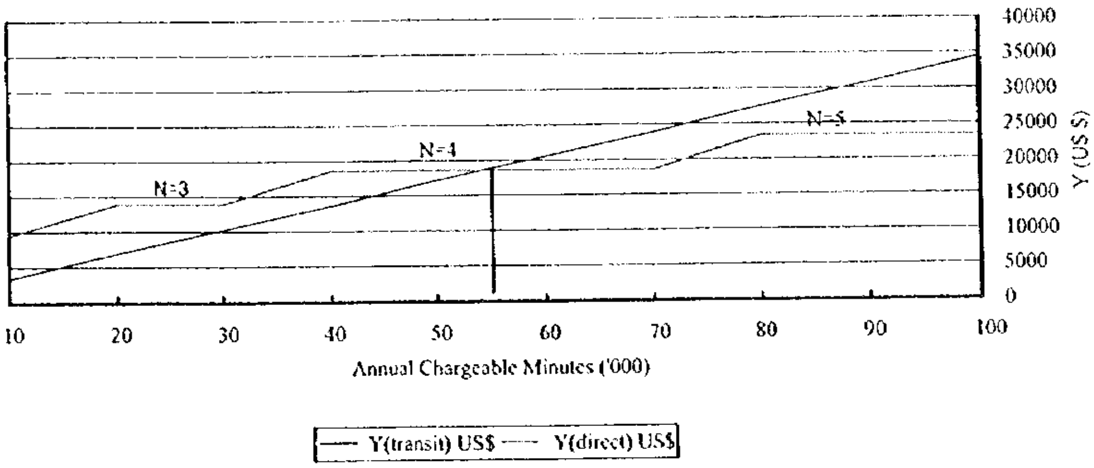


Figure 8.4.4-1 Comparison Between Direct and Transit

CHAPTER 9

FORMATION OF DEVELOPMENT INDICATORS

CHAPTER 9 FORMATION OF DEVELOPMENT INDICATORS

9.1 Basic Concept of Master Plan

(1) Telecommunications Needs in Vietnam

To realize higher economic growth, equitable distribution of social benefits and attracting foreign investment, the Government of Vietnam has been strongly emphasizing the needs for adequate, efficient and reliable infrastructures in the national development policy. In the policy, telecommunications development is placed as highest priority for the industrial development, higher productivity of agriculture and enhancing efficiency in the service sector.

(2) Telecommunications Position and Role in Vietnam

P&T sector has an infrastructure component of the national economy and a service production sector. Demand for telecommunications to serve Communist Party, State, people and socio-economic development is a basis for development. Telecommunications policy has been established by DGPT keeping with the Economic Policy Statement of the Government of Vietnam to achieve universal service covering the whole country including all villages. This implies easy access to basic telecommunication facilities such as telephone, mobile and data to all at affordable and reasonable prices.

On February 22, 1996 Prime Minister promulgated 110/ttg Decision to approve the development of Posts and Telecommunications Sector in 1996 - 2000 including target of the plan and main responsibilities of telecommunications sector.

(3) Planning Period and Target Year of the Master Plan

This master plan covers long-term development for the telecommunications networks up to 2010 in whole Vietnam. The planning period up to 2010 is divided into several milestones as target years i.e. a short-term plan up to 2000 (Phase A), a medium-term plan up to 2005 (Phase B) and a long-term plan up to 2010 (Phase C).

9.2 Target Level of Telephone and Cellular Mobile Density

9.2.1 Targets up to 2010

DGPT intends to achieve that the telephone and cellular mobile services are to be made available on demand nationwide. The respective short-term, medium term and long-term plans up to 2010 are summarized in Table 9.2.1-1. 100% demand fulfillment will be attained by the year 2000.

Telephone density is a vital index, which clearly shows the state of development in telecommunications for a country. By the end of 1998, telephone density in Vietnam was 2.33 per 100 people with 1.8 million main telephone lines. Table 9.2.1-2 shows the telephone density in neighboring countries for reference.

Table 9.2.1-1 Targets of Telephone and Cellular Mobile Density Up to 2010

	Existing (1998)	Phase A 2000	Phase B 2005	Phase C 2010
Telephone Density per 100 people	2.33	3.01	5.23	8.29
Total main lines (000)	1,792	2,398	4,529	7,660
Cellular Mobile Density per 100 people	0.30	0.44	1.12	1.74
Total cellular mobile users	234	347	968	1,607

Table 9.2.2-3 Telephone Density in Neighboring Countries

End of 1996

Name of Country	Telephone Density	Main Lines
Singapore	51.33	1,562,700
Malaysia	18.32	3,771,300
Thailand	7.00	4,200,200
China	4.46	54,947,000
Philippines	2.49	1,787,000
Indonesia	2.13	4,168,000

Source: ITU

9.2.2 Supply Volume

The supply volume up to the year 2010 is established based on the demand. In consequence, all the planning components consisting of supply plan, network plan, facility plan, manpower plan, etc. are prepared based on the above condition.

9.3 Target Level of the Development in Rural and Remote Areas

9.3.1 General

Over the past years, P&T sector has mobilized several trillion VND to invest in the network. Annual growth rates of telephone sets reached nearly 60%. However telephone density is still low and telephone service is mainly concentrated in cities and towns. Based on the obtained data and information through the site survey in several provinces, the telephone penetration ratios in urban and remote/rural areas differ greatly. Therefore, it is important to develop the telecommunications network in rural and remote areas.

In addition, the access network systems to be applied should be selected from the economical/technical viewpoints considering the specific features of each area.

9.3.2 Target Level

To reduce a gap of telephone services between urban and rural/remote area, the introduction of telephone services in rural/remote areas shall be carried out by DGPT. And at least each commune should have one telephone line by the year 2010. Table 9.3.2-1 shows the number of communes which have the telephone sets from 1991 to 2000.

Table 9.3.2-1 Number of Communes with Telephone Sets

Year	No. of Communes
1991	780
1992	1,018
1993	1,603
1994	3,914
1995	5,566
1996	6,226
1997	(6,551)
1998	(6,877)
1999	(7,493)
2000	(8,000)

Note : Total no. of Communes in 1996 is 9997.
( ): Plan

It is estimated that the telephone services have not yet been provided in about 3,000 communes. To provide telephone services in these communes, the following target for access networks is established: (Table 9.3.2-2)

- Metallic cable : 50% of communes (1,500 communes)
- Radio subscriber system : 40% of communes (1,200 communes)
- VSAT system : 10% of communes (300 communes)

Table 9.3.2-2 Target Number of Communes to be Served

	Phase A 2000	Phase B 2005	Phase C 2010	Total
Metallic Cable	200	500	500	1,200
VSAT	50	125	125	300
WLL	300	600	600	1,500
Total	550	1,225	1,225	3,000

9.3.3 Access Network System in Rural and Remote Areas

In remote and rural areas, the telecommunications network has not yet been developed due to geographical conditions and economical conditions. Therefore, the access network in rural and remote areas will be introduced considering the demand and geographical distribution. The access network will be expanded according to the following criteria:

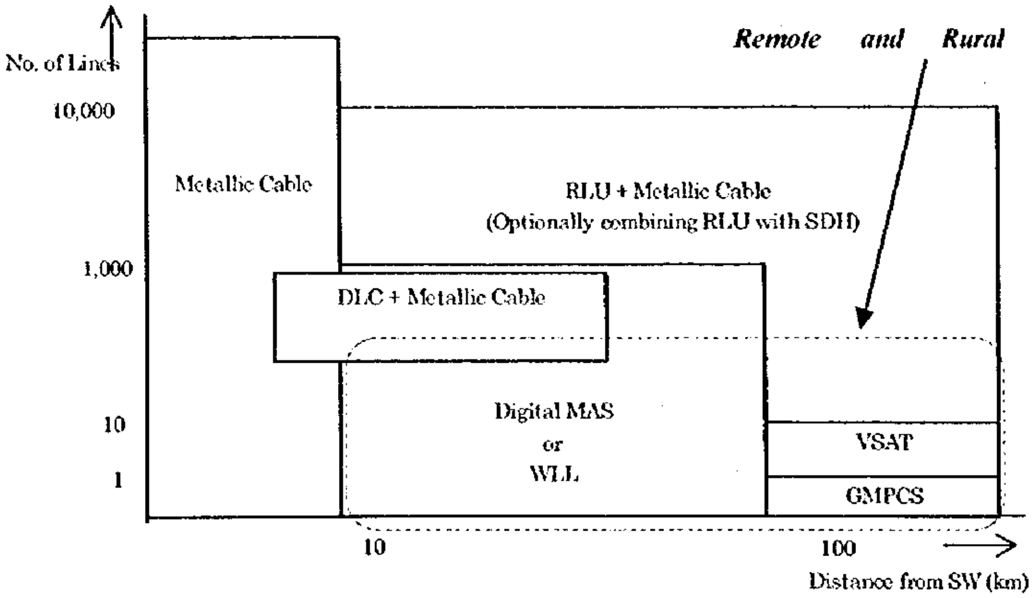


Figure 9.3.3-1 Application Criteria for Access Network

The above application criteria should be considered based on the actual demand conditions. The major access systems are as follows:

(1) Application of Metallic cable

(2) Utilization of DLC

(3) Utilization of Trunk Line and Small Exchange

(4) Utilization of digital MAS/WLL

In rural and remote areas, where several tens of telephone lines are required, several types of digital MASs and WLLs, so the selection of the system to be applied shall be carried out from the various viewpoints.

(5) Utilization of VSAT

In isolated areas far from the existing terrestrial telecommunications network, the utilization of VSATs is very efficient from the economic viewpoints, because the cost of VSAT is independent of distance, and its capacity is within several channels in each site.

(6) Utilization of GMPCS

In isolated areas, where only one (1) telephone line is required, it is useful that fixed line such as access line for commune office apply the fixed terminal of GMPCS. The charges for GMPCS are expensive, so the application of the system should be limited to the commune office or other governmental office in each commune.

9.3.4 Telephone Network in Rural and Remote Areas

Based on the above consideration, the telephone network in rural and remote areas can be conceptually designed as follows:

(1) Type-1

This network is expanding the ordinary network to rural/remote areas. Therefore, the construction cost depends on the location to be covered by the network. In the case that the target area is not so far from the existing network and there is no restriction for construction of network, this type of network is applicable by using the ordinary telephone systems.

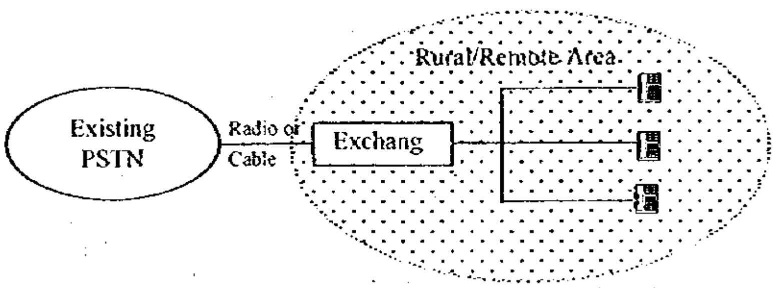


Figure 9.3.4-1 Type-1 Network Configuration

(2) Type-2

This network is combination of DLC and metallic cable systems in rural/remote areas. In the case that the demand in rural/remote area is concentrated in small area, this network is suitable. The approach link between the existing PSTN and DLC can be selected considering the distance, difficulty of cable construction and so on.

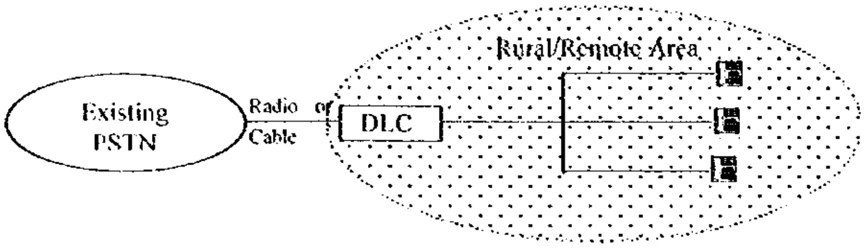


Figure 9.3.4-2 Type-2 Network Configuration

(3) Type-3

Type-3 applies a radio subscriber system or WLL in the rural/remote areas. In the case that the distance between the existing PSTN and rural/remote area is long and demand is not so large, the radio subscriber system or WLL is suitable.

Corresponding to the demand conditions such as scale of demand and area width, the radio subscriber system or WLL can be selected among various types of radio systems.

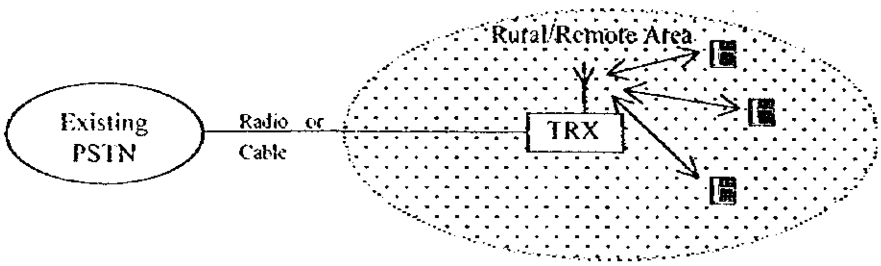


Figure 9.3.4-5 Type-3 Network Configuration

(4) Type-4

This network applies satellite communications system such as VSAT. The network does not require terrestrial (trunk) network, so this network is suitable in areas far from the existing network or isolated areas. Compared with the above network, this system can provide only a limited number of telephone lines, so this network is suitable for the areas with small demand.

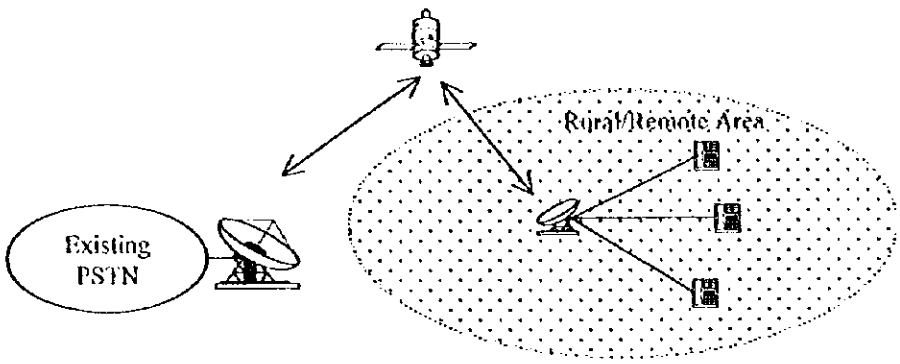


Figure 9.3.4-6 Type-4 Network Configuration

(5) Type-5

This network applies fixed terminals of GMPCS in rural/remote areas. The system provides only one (1) line per subscriber. The access charge of this network is more expensive than the above types of network, so this network would be applied to the specific/important subscribers.

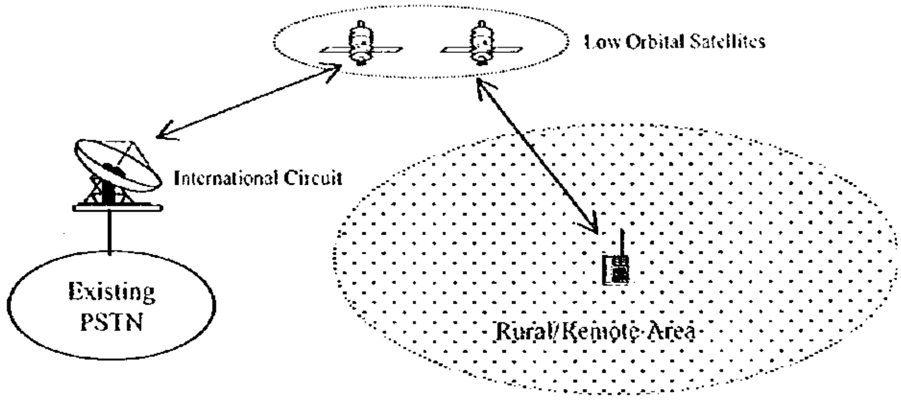


Figure 9.3.4-7 Type-5 Network Configuration