Figure 8.1.3-10   Adjusted Micro Demand per 100 Persons in the Surrounding Area

The demand figures for this report are shown as follows.

Table 8.1.3-5   Telephone Demand and Telephone Demand per 100 Persons

		1992 (2535)	1997 (2540)	2002 (2545)	2007 (2550)
Telephone	BMA	2,133,026	3,563,796	5,040,245	6,054,703
	Nakhon Pahtum	51,040	84,868	138,381	202,268
Demand	Samut Sakhon	59,736	88,179	121,821	156,012
	Ayutthaya	41,621	57,133	76,618	100,511
Telephone	BMA	25.25	38.35	49.91	55.57
Demand per	Nakhon Pahtum	8.54	13.07	19.75	26.87
100 Persons	Samut Sakhon	19.83	26.60	33.43	39.21
	Ayutthaya	5.61	7.11	8.85	10.87

8.2 Other Telecommunications Services

8.2.1 Methodologies of Demand Forecast for Other Services

In order to estimate the demand forecast for other serservices, the following methodologies are used.

1) Definition of New Services

Generally, the following services are called as new services:
- No similarity to existing services,
- Improved services,
- Existing services but targeted to different market segments.

In other words, the services that the demand forecasts can not be conducted by using historical data due to the lack of data.

In this study, services which have not yet been provided by TOT are called new services such as ISDN services, free dial service. Services which have been already provided by TOT are called other services, such as cellular mobile telephone, paging phone, leased circuit services.

2) Methodology of Demand Forecast

a) Intuition Method

According to ideas or opinions given by experts concerning their rich experience and knowledge, forecasts are conducted. This method is applied for forecasting new services.

b) Search Method

This method depends on past and present demand structure, and the present situation can be assumed to continue. One such method is regression analysis. Consumer goods are forecasted by this method.

c) Standard Method

First of all, a landmark shall be set and then the matter to be done at each check point is decided. The Apollo Project in U.S.A is a famous example. For new

service forecasts, this method is applied ("X,XXX subscribers at 199X"), and then the plan to provide the service is established.

d) Feed-Back Method

This lies between search method and standard method. The feed-back is set between a result of search method and a landmark, and then the next action is decided by reviewing the result of the search method.

In the above methods, the standard method and feed-back method are called "Plan". However, it is difficult to distinguish between Plan and Demand forecast, in addition, it is not effective to make this distinction. These forecasts must be linked indispensable to each other rather than to be distinguished.

3) Characteristics of Demand Forecasts of New Services

a) The market scales and the use of new services must be previously set due to the lack of past data. Besides, if the set of the market scale and the use of new service would be wrong, the forecaster can not obtain the accurate result even if a sophisticated method is applied.

b) The error of result would become high if the service function or the merits of use could not be well understood by the customers. Therefore, the process of informing the customers is important.

c) The price is the most important parameter to forecast the demand. By changing the price, how much the demand is changed shall be estimated.

d) It is difficult to predict the other company's action concerning the new service; therefore, after offering the new service into the market, the demand would be changed by other company's actions.

In conclusion, the demand forecast for a new service tends to contain an element of error. However, this is not a sufficient reason to evaluate all the parameters which are affecting the forecast at the same time. On the contrary, the forecasted value tends to be unstable. Therefore, it is recommended to keep the forecasting of demand simple by focusing on the major elements of the demand.

4) Correlation between Forecast and Plan

a) Planning Stage

In this stage, many ideas are planned and developed generally. The demand forecast in this stage is not requested at high accuracy due to limited expenditure for the planning stage.

b) Development Stage

After getting an evaluation of the plan from the planning stage, a concrete product is developed such as a prototype and is test-marketed. At this time, the demand forecast is often conducted; however, it is for feed-back purpose only the development of the products.

c) Establishment of Business Stage

After the specification of the product has been decided, the most stage is more concrete in that it establishes the business. The demand forecast is requested to be carried out at high accuracy in order to decide the factory scale, and to secure the material and manpower. The analysis of correlation between the price and the demand shall be considered.

d) Implementation Stage

This stage occurs after providing a new service into the market. Generally, it is not necessary to conduct the new demand forecast, however, a review of the demand conducted at the establishment of business is sufficient. If the demand forecast conducted at the establishment of business did not correlate with actual result, the forecast shall be re-forecasted.

5) Actual Method of Demand Forecasts

a) Method depending on Investigation of Customer's Intention

This demand forecast is conducted on the questionnaire of the customers basis. In this questionnaire, the concepts of new service are introduced to the customer, and the intention of purchase whether the customer has an intention to use the new service or not is grasped.

b) Method of Estimation from Similar Product or Substitution Service

If a similar or substitution service to a new product is not provided, this method can not be applied; however, if these are provided, this method can produce highly accurate results at low cost.

c) Method Through Test Marketing

Prior to providing a new service at full-scale, the new service is provided as a test-case in an exclusive area. In addition, an investigation of distributing the new service belongs to this category.

d) Method by Interview

This method can reconfirm customer's intentions concerning a new service directly. The difference from item a) is to be able to reconfirm the customer's intentions directly without any preparation such as answers and, choices.

6) Merits and Demerits of Each Method

Demand for a product, not just for a new product, can be considered as categorized by the following figure.

```
┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│ Recognition  │─────▶│    Trial     │─────▶│    Repeat    │
└──────────────┘      └──────────────┘      └──────────────┘
                            ▲                      ▲
                            │                      │
                      ┌──────────────┐      ┌──────────────┐
                      │  Evaluation  │      │  Evaluation  │
                      └──────────────┘      └──────────────┘
```
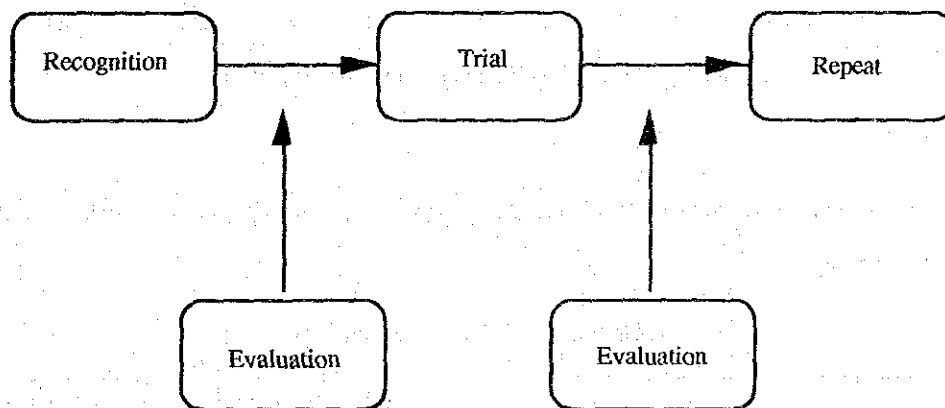
Figure 8.2.1-1   Process of Generation of Demand

The recognition is that a customer recognizes the existence of the product, and the existence is retained in the customer's memory. After the customer recognizes the product, the product is evaluated before a decision to use the product is made, that is, whether the product has a value for use.

If the evaluation result is all right, the first action to purchase the product, that is to say Trial, is generated. Once the trial is generated, the customer can evaluate the function and the merits by using the product.

After purchasing the product, if, at the second evaluation, the product can be considered as a good product, the customer will become a re-user of the product. It is necessary to remark the re-user for a consumption product which is purchased at high frequency.

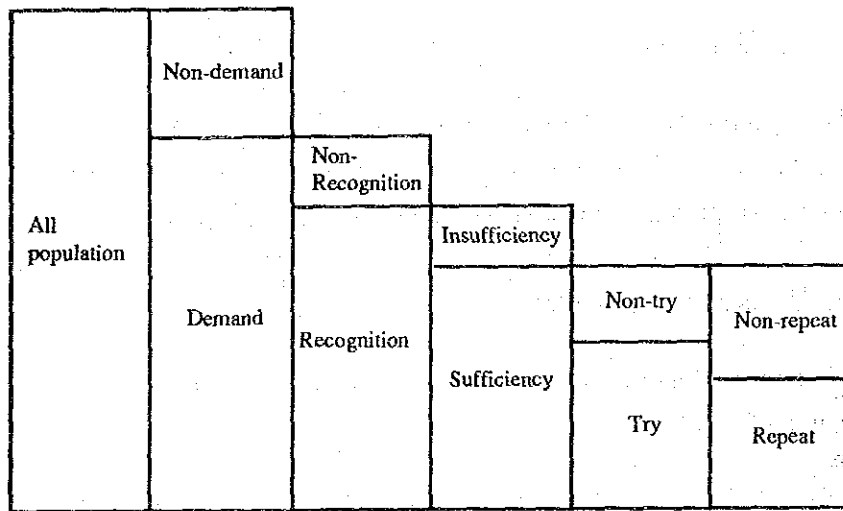Figure 8.2.1-2 shows the relationship between five steps.

Figure 8.2.1-2   Five Steps of Demand Generation

The merits and demerits of each method on the process of generation of demand stated is shown below.

Table 8.2.1-1   Merits and Demerits

	Demand Population	Recognition	Evaluation of before trial	Trial	Estimation after trial	Repeat
Depending on investigation	S	N	S	N	N	N
Estimation from similar product	S	S	N	M	N	M
Through test marketing	S	S	S	S	S	S
By interview	S	N	N	M	N	M

S: Suitable
M: Moderate
N: Not suitable

In this study, in order to grasp the customer's intentions for telecommunication network services, a marketing research by means of questionnaires and holding several seminars was conducted. Therefore, the merits and demerits are shown in Table 8.2.1-2 in detail.

Table 8.2.1-2   Merits and Demerits of Marketing Research

Method	Merit	Demerit
By questionnaire and interview	a) Easily Conducted b) Being conducted prior to providing a new service c) Collect unexpected data d) Collect detailed data	Forecast-error may be large due to unknown service

7)   Estimation of New Service Demand

a)   Process of Demand Forecast

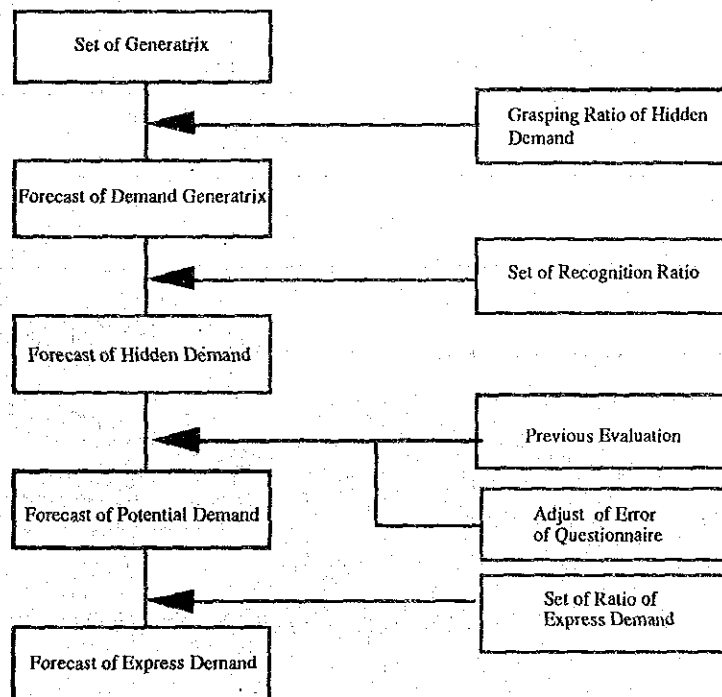The process of the demand forecast is shown in Figure 8.2.1-3.

Figure 8.2.1-3   Flow Chart of Demand Forecast of New Services

8.2.2 Outline of Forecasted Demand

In this section, forecasted result of the demands for other telecommunication services is discussed, which existing services and new services. Figure 8.2.2-1 shows the existing services such as mobile telephone subscribers, paging phone, leased circuit and facsimile terminals. Figure 8.2.2-2 shows the new services, which are not provided in Thailand yet.
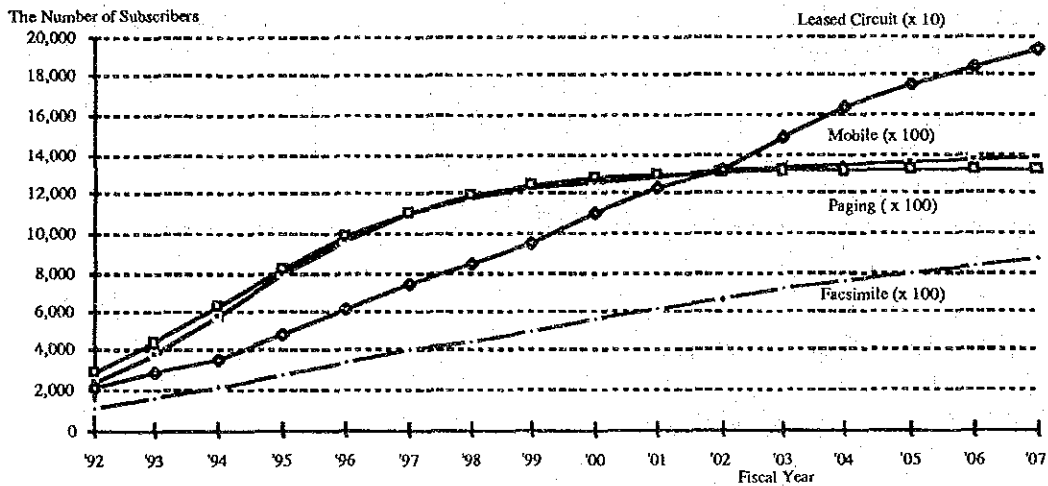

Figure 8.2.2-1 Existing Service Trends in the Whole Kingdom
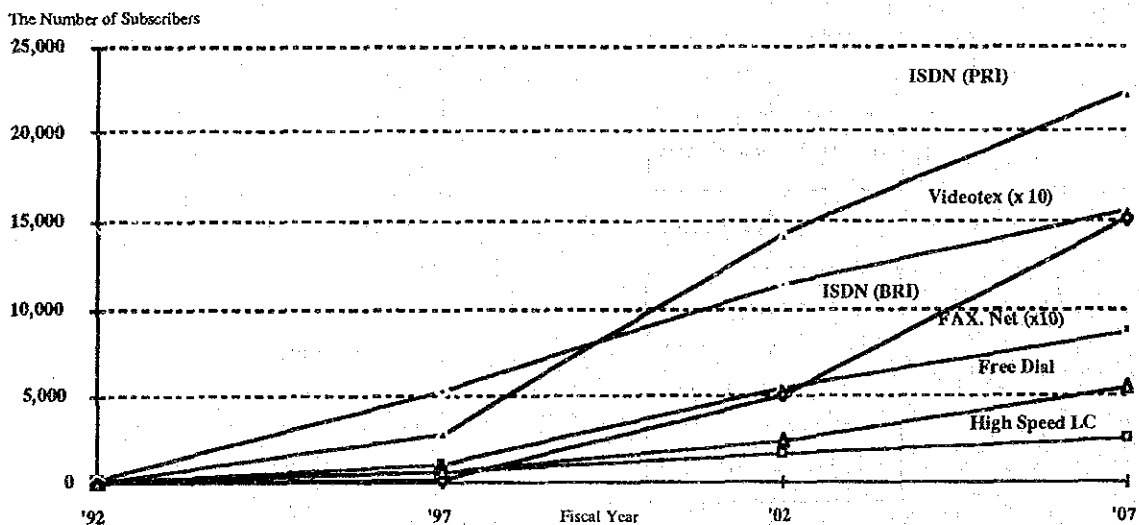

Figure 8.2.2-2 New Service Trends in the Whole Kingdom

The demand forecast in each service is basically estimated with nation wide range because of being difficult to get the exact time series data in the study area.

8.2.3 Mobile Telephone

1) Analysis of Mobile Telephone

Table 8.2.3-1 shows the development of the mobile telephone service in Thailand. The mobile telephone service started in 1986. The service has rapidly increased during the passed six years. The rapid increase is expected to continue with this pace in the next decade.

Table 8.2.3-1   Mobile Telephone Service Development (Whole Kingdom)

Year	TOT		CAT	Total	No. of Mobile /
	470 MHz	900 MHz	800 MHz		100 persons
1986	822			822	0.002
1987	4,413		1,116	5,579	0.01
1988	10,612		6,972	17,584	0.03
1989	20,936		14,171	35,107	0.06
1990	31,981		31,242	63,223	0.11
1991	42,712	36,486	44,243	123,541	0.22

(Source: TOT, August 1992)

To understand the development trend of the mobile telephone service in the world, the number of subscribers of mobile telephone service in several countries are shown in Table 8.2.3-2.

Table 8.2.3-2 (1/2)   Present State of Mobile Telephone Service in European Counties
(as of Dec. 1991)

Country	No. of Subscriber	Destiny per 100 persons	Country	No. of Subscriber	Destiny per 100 persons
Belgium	53,054	5.36	Netherlands	114,200	0.77
Denmark	174,352	33.9	Norway	231,903	5.55
Finland	283,427	57.2	Spain	102,915	0.26
France	366,560	6.53	Sweden	580,223	6.83
Germany	512,894	6.57	Switzerland	171,563	2.60
Italy	544,128	9.45	United Kingdom	1,226,600	2.14

(Source: Financial Times Business, Dec. 1991)

Table 8.2.3-2 (2/2)　Present State of Mobile Telephone Service in the world
(as of Mar. 1991)

Country	No. of Subscriber (x 1,000)	Destiny per 1,000 persons
USA	5,440	2.23
UK	1,110	1.95
Canada	629	2.45
Japan	868	0.70

(Source: Tetecommunictions. Vol. 54 No. 54, February 1992)

2)　Demand Forecast

a)　Demand Forecast for the Short-term

To estimate the short-term demand, an exponential curve model is considered to be more suitable than a logistic curve because rapid demand growth is expected. The exponential curve model is given as follows:

$$D_t = a \times b^t$$

where

D_t :　the number of mobile telephone subscribers in year t,

a,b :　coefficients,

t　:　year $(1988 = -1.5,\ 1989 = 0.5,\ 1990 = 0.5, 1991 = 1.5)$

By using the data from 1988 to 1991 in Table 8.2.3-1, the coefficients, a and b, are estimated by the least square method. The estimation result is as follows.

$a = 46.857$

$b = 1.904$

b)　Demand Forecast for the Long-term

Although this increasing trend is expected to continue for a while, the demand is supposed to saturate at a certain level. Therefore a logistic curve model for a long-term forecast should be employed.

$$D_t = \frac{K}{1 + m \times EXP(-at)}$$

where

D_t　　: the number of mobile telephones per 100 persons period t,

8 - 46

K : saturation level (number of mobile telephones per 100 persons),

m, a : coefficients.

The saturation level K is decided to be 2 by taking the growth of mobile telephone service in the world and development of mobile telephone service in Japan into consideration. By using the data from 1988 to 1991 in Table 8.2.3-1, the coefficients, m and a, are estimated by the least square method. The estimation method is as follows:

K : 2.0 per 100 persons,

m : 15.93

a : 0.678

c) Forecasted Demand for Mobile Telephone

As mentioned above, the exponential model is employed to estimate the demand for 1992 and the logistic model is used for the long-term forecast. The estimation result is shown in Table 8.2.3-3 and Figure 8.2.3. The forecasting process is shown in APPENDIX.

Table 8.2.3-3   Forecasted Demand for Mobile Telephone (whole kingdom)

Year	Whole Country Demand	Density per 100 persons
1992	234,000	0.40
1997	1,091,000	1.75
2002	1,311,000	1.99
2007	1,383,000	2.00

If the price of a mobile telephone terminal would become approximately a half of the present price around FY2000, the number of mobile telephone service subscribers will drastically increase; however, a certain portion of subscribers will switch to personal communications network services.
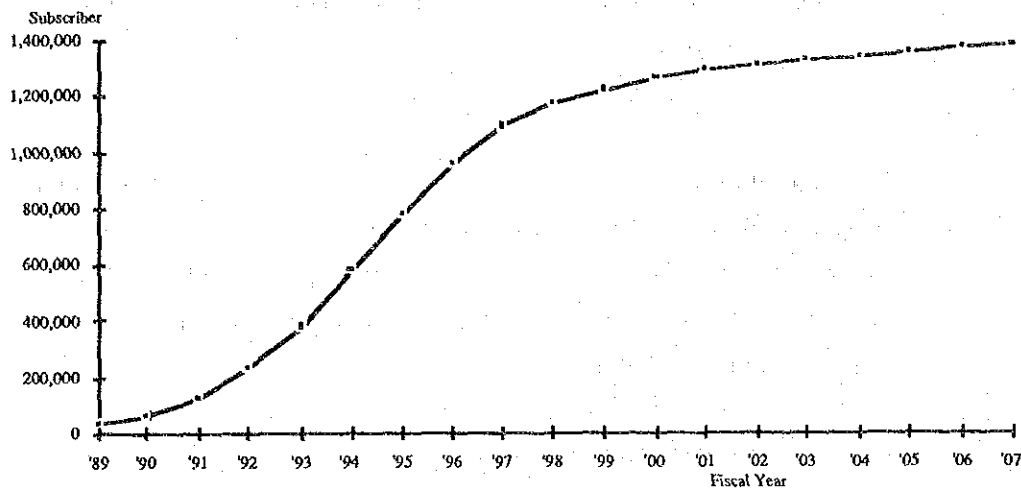
Figure 8.2.3 Estimation Results of Mobile Telephone Demand (whole Kingdom)

8.2.4 Paging Phone

1) Analysis of Paging Phone

The paging phone service in the Kingdom started in 1984. At the beginning of the service, the growth rate of the number of subscribers was rather low, but after the introduction of digital pager service (Pa clink, Phonelink and Page phone) it has been increasing rapidly as shown in Table 8.2.4-1 and Figure 8.2.4-1. The number of subscribers per 100 persons is 0.33 as of 1991.

Table 8.2.4-1 Transition of Paging Phone Subscribers in the Whole Kingdom

	'84	'85	'86	'87	'88	'89	'90	'91
Phonelink (TOT)							59,607	80,453
Page phone (TOT)								17,258
Paclink (CAT)				17,000	20,000	40,000	60,000	80,000
CAT	6,233	7,992	7,953	6,091	6,791	7,518	9,970	10,000
Total	6,233	7,992	7,953	23,091	26,791	47,518	129,577	187,711
Population (thousand)	50,583	51,796	52,969	53,873	54,961	55,538	56,341	57,196
Penetration (per 100 persons)	0.01	0.02	0.02	0.04	0.05	0.09	0.23	0.33

Note : Phonelink, Pagephone and Paclink are offered with a concession basis.

In order to understand the paging phone's penetration status of other countries, the numbers of subscribers and penetration ratio of European countries are shown in

Table 8.2.4-2. Penetration status of the main countries in the world are also shown in Table 8.2.4-3.

Table 8.2.4-2 Present State of Paging Phone in European Countries

(as of December 1991)

Country	Subscribers	Penetration #	Country	Subscribers	Penetration #
Austria	84,329	1.11	Luxembourg	4,463	0.89
Belgium	136,000	1.37	Netherlands	299,000	2.01
Denmark	50,805	0.99	Norway	97,532	2.32
Finland	40,330	0.81	Portugal	16,017	0.15
France	238,503	0.43	Spain	83,000	0.21
Germany	336,765	0.43	Sweden	130,956	1.54
Iceland	2,254	0.92	Switzerland	42,133	0.64
Ireland	8,427	0.24	UK	675,000	1.12
Italy	127,366	0.22			

Source : Fintech : Mobile Coms. (93), Dec. 19, 1991
Note; # : per 100 persons

Table 8.2.4-3 Penetration Status of Main Countries in the World (1991)

Country	Penetration (per 100 persons)
Singapore	12
Hong Kong	11
Taiwan	5
Japan	4
U.S.A	4
Canada	2

Source :Telecommunications, Vol. 55, No 54, 92-2

2)   Demand Forecast

Figure 8.2.4-1 shows the growth status of the total number of paging phone subscribers in the past years. From the figure we know that the number of subscribers is increasing in a exponential curve with a parameter of year t which can be expressed by the following expression.

$$Y = a \times b^t \qquad (1)$$

where

Y   : the number of subscribers in year t

a,b   : constants

The regression curve calculated using the data of past years is shown in Figure 8.2.4-1.
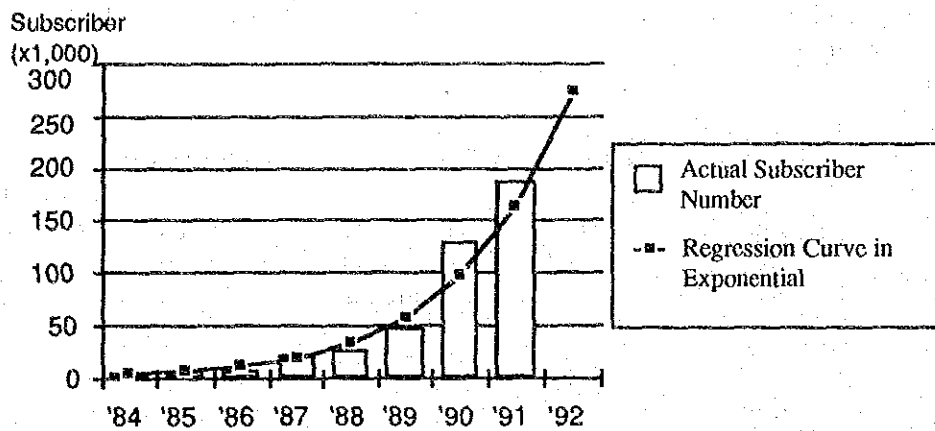
Figure 8.2.4-1   Trend of the Number of Subscribers in the Past Years

Although this increasing trend is expected to continue for a period, the demand is supposed to saturate at a level. The magnitude of the demand at the saturation level may depend on the difference of relative price between paging phone and cellular mobile telephone and the deference of function between them. For instance, if it becomes possible in cellular mobile telephone system to identify visible information such as a originating subscriber's number by using NO 7 signaling system, one of the main advantages of having paging phone will lose. In forecasting the long term demand, though such factors mentioned above should be considered, the Study Team simply applied a logistic curve which is derived from the increasing trend in the past years.

A logistic curve is expressed by the following expression;

$$Y = \frac{K}{1 + m \times EXP(-at)} \quad - - - - - - - - - \quad (2)$$

where

Y   : the number of paging phone subscribers

K   : saturation level

a,m   : coefficients

t   : year

Using the data in the past years, K,m and a can be gotten as follows;

K = 1,321,000

m = 37.691

a = 0.5867

Substituting above coefficients, expression (2) is expressed as follows;

$$Y = \frac{1321000}{1 + 37.691 \times EXP(-0.5867 \times t)} \text{ - - - - - - - - -} \qquad (3)$$

The results of the calculations are shown in Table 8.2.4-4 and Figure 8.2.4-2. According to the table the number of paging phone subscribers in 2007 is 1,320,000 and its penetration ratio is 1.91 per 100 persons. Taking the status of the countries shown in Table 8.2.4-2 and Table 8.2.4-3 into account the Study Team adopts the results of the calculations . The calculation process is expressed in APPENDIX.

Table 8.2.4-4 Forecasted Paging Phone Demand and Estimated Penetration
Whole Kingdom

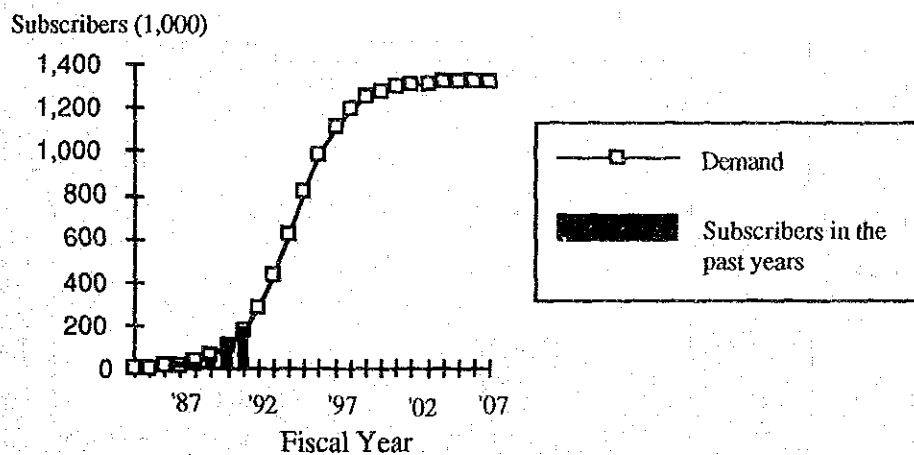| Year	Demand (thousand)	Population (thousand)	Penetration (per 100 persons)
1992	286	58,041	0.49
1997	1,108	62,102	1.78
2002	1,307	65,865	1.98
2007	1,320	69,165	1.91

Subscribers (1,000)

Figure 8.2.4-2 Forecasted Demand in the Whole Kingdom

8.2.5 Leased Circuit Service

1) Leased Circuit

a) Analysis of Leased Circuit Development in Thailand

Table 8.2.5-1 and Figure 8.2.5-1 show the present state of leased circuit service in Thailand. The number of leased circuits has been increasing remarkably in the last years. The growing rate of the total shows 8.7% in 1989, 12.5% in 1990 and 4.5% in 1991. The growing rate of computer use shows 36.8% in 1989, 35.2% in 1990 and 1.9% in 1991. It seems that the demand for leased circuits from many firms such as banks and manufacturers has been increasing recently.

Table 8.2.5-1   Development of Leased Circuit Service in Thailand

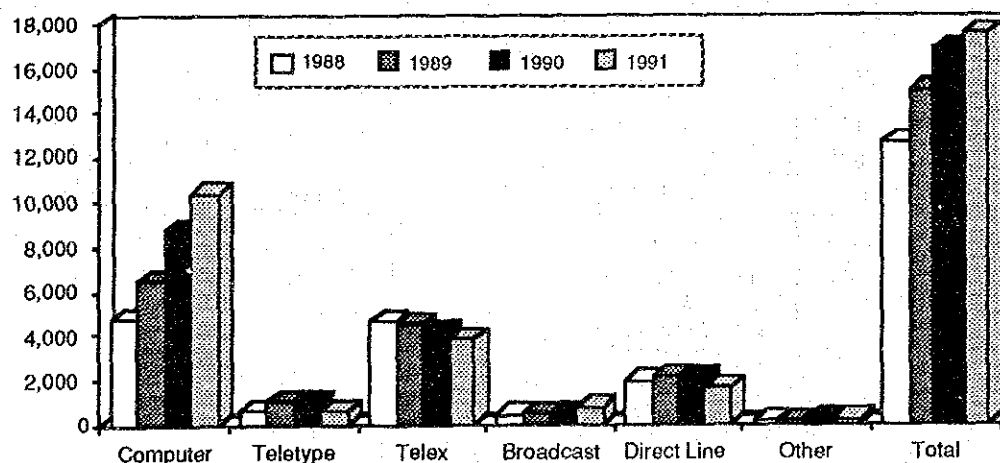|	Computer	Teletype	Telex	Broadcast	Direct Line	Other	Total
1988	4,730	705	4,672	458	1,925	140	12,630
1989	6,472	1,081	4,581	499	2,185	171	14,989
1990	8,751	1,007	4,194	454	2,118	338	16,862
1991	10,438	566	3,847	812	1,692	265	17,620

Source: TOT , July 1991

Figure 8.2.5-1   Present State of Leased Circuit in Thailand

The time series data on the leased circuit service in Thailand has been got saturation already. However, more and more leased circuit service will get increased in the near future, by evolving the establishment of corporate communication networks

after the fulfillment of the telephone demand. Therefore, the forecasting method no employing the time series data is used. Table 8.2.5-2 shows the development of business telephone and leased circuit in Thailand from 1988 to 1991. In the table, ratio between business telephone and leased circuit is 4.6 % in 1988 and it has slowly grown to 4.9 % in 1990, however, the ratio reduces to 3.9 % in 1991.

Table 8.2.5-2   Relationship Between Business Telephone an Leased Circuits (whole kingdom)

Year	No. of Business Telephone	No. of Leased Circuit	Ratio (Leased C./Business Tel)
1988	276,541	12,630	4.6 %
1989	305,363	14,989	4.9 %
1990	343,342	16,862	4.9 %
1991	450,525	17,620	3.9 %

Note :   Ratio is between the number of leased circuits and the number of business telephones of each year.

b)   Development of Leased Circuit in Japan

Table 8.2.5-3 shows the development of business telephone and leased circuit in Japan from 1981 to 1990. In the table, the ratio between business telephone and leased circuit development is 3.24 % in 1981 and it slowly grows to 5.15 % in 1990.

Table 8.2.5-3   Development of Business Telephone and Leased Circuit Service in Japan
(unit : thousand)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Business Telephone. (A)	12,500	12,824	13,161	13,470	13,709	14,250	14,837	15,542	16,355	17,475
Leased Circuit (B)	424	449	473	499	534	574	644	747	825	901
Ratio (%) (B/A)	3.39	3.50	3.59	3.70	3.40	4.03	4.34	4.81	4.50	5.15

The development process between business telephone and leased circuits in Japan in Table 8.2.5-3 have a strong relationship as shown in Figure 8.2.5-2.
A regression line is given, employing the least square method, as follows:

Ln = - 863.9 + 0.1021 x Bn,

Ln : number of leased circuits (thousand),

Bn : number of business telephone subscribers (thousand),

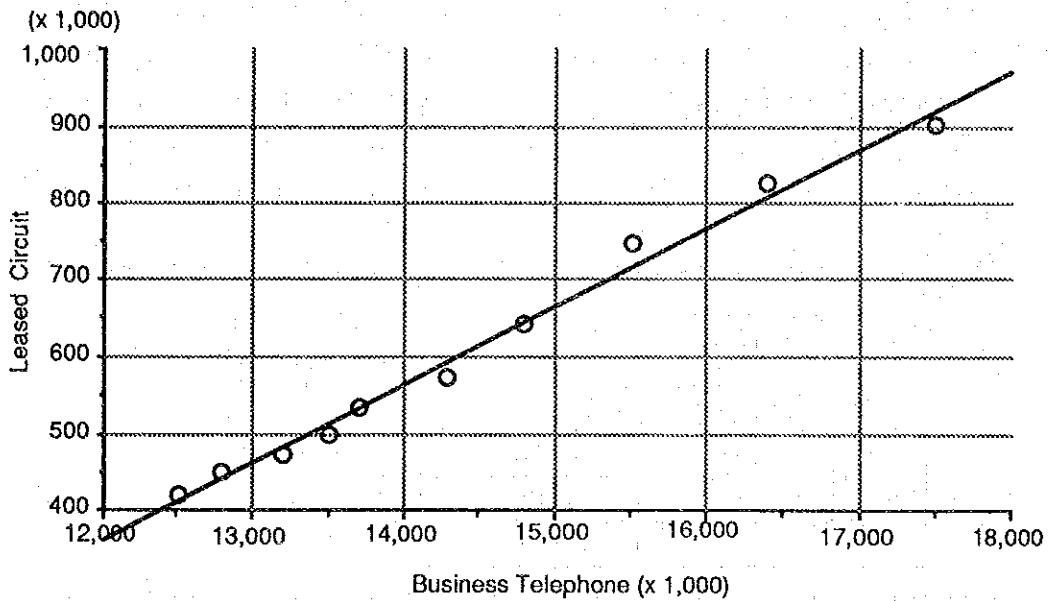Coefficient of correlation (R)=0.995.

(x 1,000)

Figure 8.2.5-2   Relationship Between Business Telephone and Leased Circuit in Japan

c)   Method of Demand Forecast

The data in Table 8.2.5-2 is not employed for the demand forecast by the reason
previously mentioned. Therefore, the demand for leased circuit is estimated by
using the percentage of the leased circuit to the business telephone in Japan. The
estimation process is shown in APPENDIX.

d)   Forecasted Result of Demand

Table 8.2.5-4 shows the forecasted result of demand for the leased circuit service in
Thailand.

Table 8.2.5-4   Forecasted Demand for Leased Circuit Demand

	1992	1997	2002	2007
Leased Circuit (A)	21,000	74,000 (74,021)	132,000 (132,009)	193,000 (193,177)
Business Telephone. (B)	506,649	1,480,413	2,303,814	2,985,728
Percentage (%) (C)	4.23	5.00	5.73	6.47

Note: A = B x C / 100

2) High Speed Digital Leased Circuit (HSLC)

a) Analysis of High Speed Digital Leased Circuit Service

In order to estimate the number of the high speed digital leased circuits in near future, the case in Japan is examined as shown in Table 8.2.5-5 and Figure 8.2.5-3.

Table 8.2.5-5   Development of High Speed Line and Leased Line in Japan
(unit: thousand)

Year	Leased Circuit	H.S.L.C	H.S.L.C / L.C	Growth Ratio
1983	473			
1984	499	0.03	0.005%	-
1985	535	0.64	0.12%	2,270 %
1986	575	2.23	0.39%	233 %
1987	646	4.41	0.70%	106 %
1988	747	6.46	0.86%	46 %
1989	829	8.56	1.03 %	32 %

Source: 'White paper on Communications' ,Ministry of Post and Telecommunication, 1990
Note: L.C :Leased Circuit
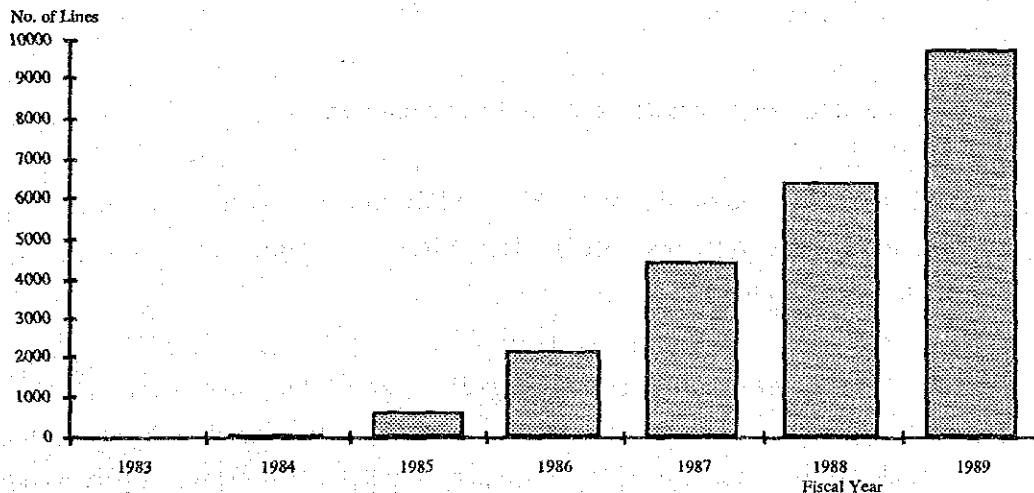   HSLC: High Speed Digital Leased Circuit

Figure 8.2.5-3   Development of High Speed Digital Leased Circuit Service in Japan

The high speed digital leased circuit service in Japan, in this case over 64 kb/s, is supposed to make offerings of various enhanced services possible .

According to the results of the marketing research stated in Chapter 10. The sectors such as financial, wholesale, transportation and communications are interested to use their computers as a central component of their networking systems. They will be big users for this service. The demand for the high speed digital leased circuit is established using the percentage of the high speed digital leased circuit to the leased circuit, which percentage in obtained from the time series data in Japan. Table 8.2.5-5 shows its percentage. The merit of the usage on this service is as follows:

i)   Kb/s class

-    High speed computer communications between customers' own establishments or with other companies,

-    Transfer of high speed facsimile and color facsimile messages and high density still pictures,

ii)   Mb/s class

-    Various and integrated services for customers' own establishments or with other companies (private network) such as computer communications and LAN,

-    For CAD/CAM,

-    Visual communications such as TV-conference.

From the above merits, this service is used for mostly private networks, therefore, though the demand will not occur without its sales promotion, some target figures for the sales will have to be set.

The demand for the high speed digital leased circuit is estimated using the percentage of the high speed digital circuit to the leased circuit, which percentage is obtained from the time series data in Japan. Table 8.2.5-6 shows its percentage.

Table 8.2.5-6   Percentage of HSLS. to Leased Circuit in the Whole Kingdom

Year	Percentage of H.S.D.L.S	No. of Leased Circuits
1997	1.04 %	58,914
2002	1.82 %	93,045
2007	2.38 %	105,800

b)   Forecasted Demand for High Speed Digital Leased Circuit Service

The result of demand forecast is shown in Table 8.2.5-7 and Figure 8.2.5-4 The usage of the high speed digita speed leased circuits is not only for private networks but also for support of ISDN services, and to secure the reliability of the private networks. The estimation process is described in APPENDIX.

Table 8.2.5-7   Forecasted Demand for High Speed Leased Circuit Demand

Year	(A) No. of High Speed Leased Circuits	(B) No. of Leased Circuits	(C) Ratio to Leased Circuit (%)
1997	800	74,021	1.04
2002	2,400	132,009	1.82
2007	4,600	193,177	2.38

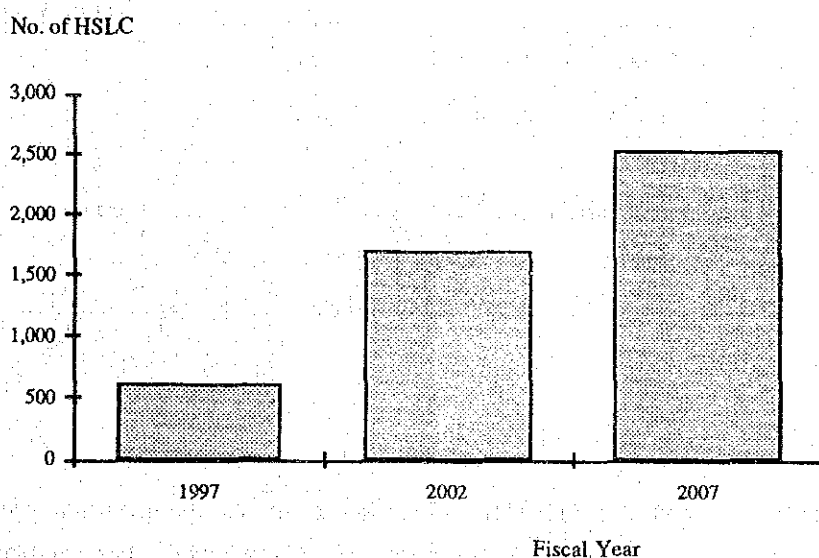Note: (A) = (B) x (C) / 100

No. of HSLC

Figure 8.2.5-4   Forecasted Number of High Speed Digital Leased Circuits

8 - 57

8.2.6 Facsimile Communications

1) Analysis of Facsimile Service

Facsimile terminals in Thailand have been already deregulated for users to purchase freely by themselves. In addition, Thailand allows customers to connect them with ordinary telephone network; therefore, its accurate number is difficult to estimate. The development of facsimile terminals in Thailand is shown in Table 8.2.6-1.

Table 8.2.6-1   Development of Facsimile Terminal in Thailand

Year	BMA	Provincial	Total
1988	5,274	762	6,036
1989	8,115	1,029	9,144
1990	9,003	1,301	10,304

Source : Bureau of Operation TOT September 1992

As mentioned above, it seems that the figures in the table does not completely include all facsimile terminals. The Study Team considered that these figures cover just a small portion, about 20%, of the all facsimile terminals. According to the customer's opinions in the marketing research stated in Chapter 11, most customers who already have some facsimile terminals want to have more facsimile terminals. Therefore the figures in Table 8.2.6-1 are revised as shown Table 8.2.6-2 in accordance with the customer's opinions.

Table 8.2.6-2   Revised Number of Facsimile Terminal
(whole kingdom)

Year	Business Telephone	Facsimile Sub.	Revised Fax. Sub.	Rate X	Rate X'
	A	Y	Y'=5 x Y	X=Y/A	X'=Y'/A
1988	277,000	6,036	30,180	0.02	0.11
1989	305,000	9,144	45,720	0.03	0.15
1990	343,000	10,304	51,520	0.03	0.15

2) Demand Forecast for Facsimile Terminal

To estimate the demand of facsimile subscriber terminals, the growth curve of the ratio of facsimile terminal to business telephone in Japan is referred. The relationship between business phone and facsimile terminal in Japan is shown Figure 8.2.6-1. In the figure,

the ratio has increased from 1 % to 25 % in the passed ten years in Japan. The Study Team expects the ratio in Thailand will grow up in the same way to Japan.
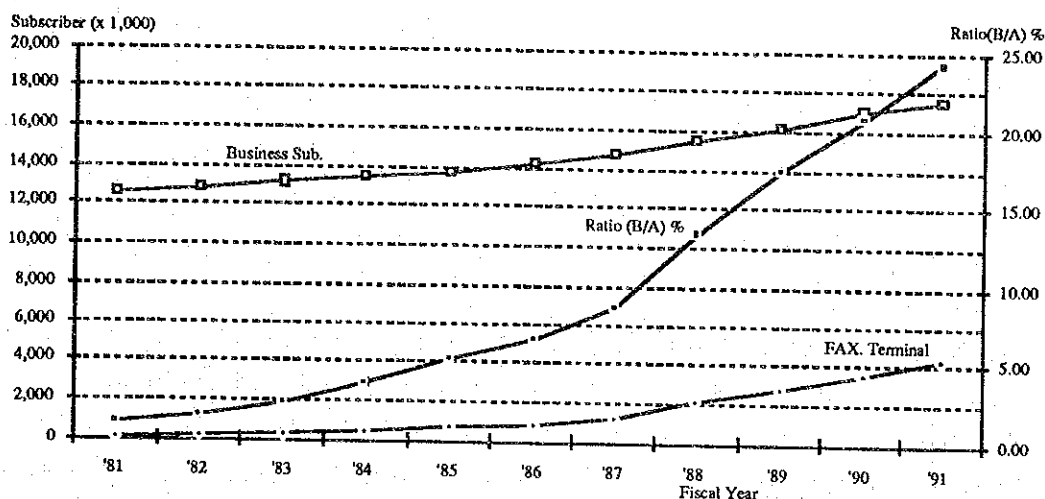
Figure 8.2.6-1   Relationship Between FAX. Terminal and Business Telephone in Japan

To forecast the demand for facsimile terminal, necessary figures are selected from Table 8.2.6-2 as shown in Table 8.2.6-3.

Table 8.2.6-3   Development of Number of Facsimile Terminal (whole kingdom)

Year	Business Telephone	Revised Fax. Sub.	Rate X'
	A	Y'=5 x Y	X'=Y'/A
1988	277,000	30,180	0.11
1989	305,000	45,720	0.15
1990	343,000	51,520	0.15

By using the ratio of facsimile terminal to business telephone and the relationship of the number of business telephone in the table, the following model is gotten.

$D_F = a + b \times D_B$

where

D_F : the number of facsimile terminals in each year,

a, b : constants,

D_B : the number of business telephones in each year.

By using the figures in Table 8.3 4-3, applying the least square method , a and b are gotten as follows:

a = -53,561
b = 0.31

Final formula is shown as follows:

$D_F = -53,561 + 0.31 \times D_B$

The forecasted demand for the facsimile terminal is shown in Table 8.2.6-4 and Figure 8.2.6-2. The estimation result seems suitable in comparison with the Figure 8.2.6-2. In that figure, the ratio of facsimile terminal to business telephone is around 25 % in 1991, however, the Study Team expects the ratio in Japan will increase more in the near future. The calculation method is described in APPENDIX.

Table 8.2.6-4　Forecasted Facsimile Subscriber Terminal (whole kingdom)

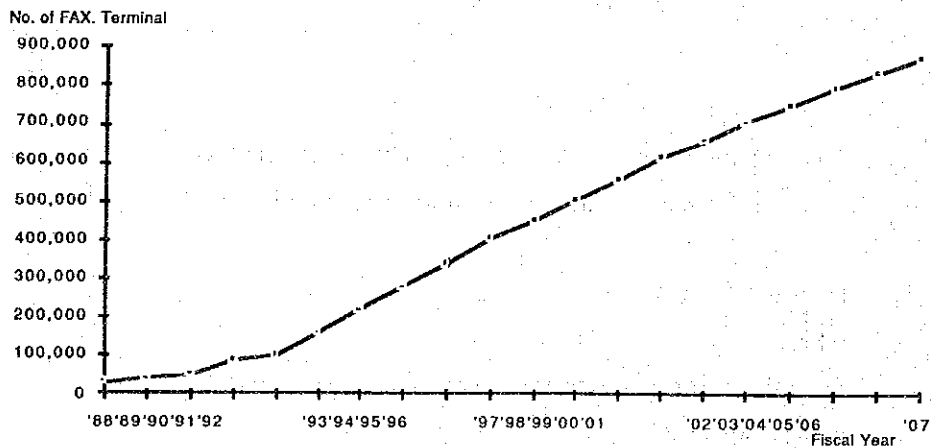| Year	No. of FAX.(A)	No. of Business Telephone (B)	Ratio (A/B)
1992	104,000	450,525	0.21
1997	405,000	1,480,413	0.27
2002	661,000	2,303,814	0.29
2007	872,000	2,985,728	0.30

Figure 8.2.6-2　Forecasted Number of Facsimile Terminal

3) Demand Forecast for Facsimile Service on Facsimile Network

   a) Facsimile Network Service Development in Japan

      To estimate the demand for facsimile network service subscriber, the development of that in Japan is examined. Figure 8.2.6-3 shows the development of facsimile network service in Japan.
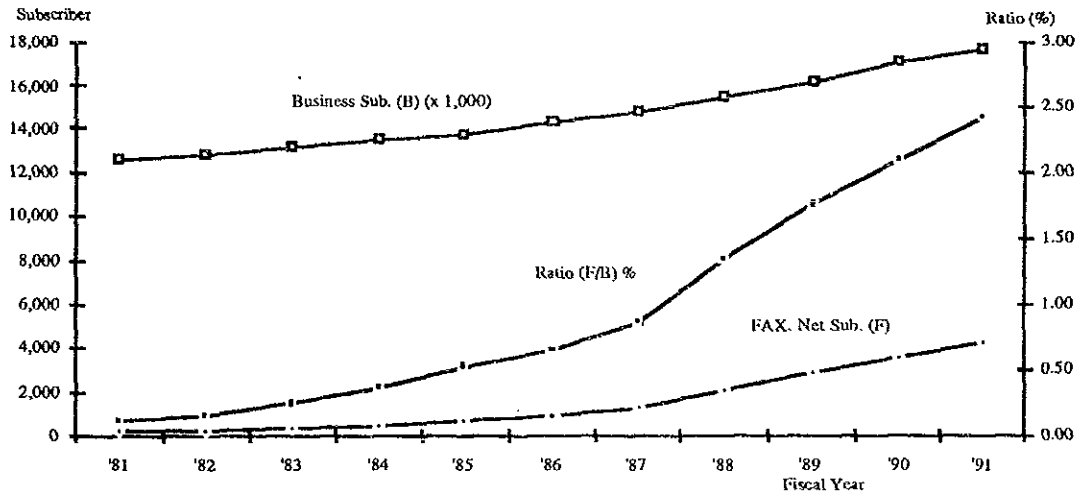
Figure 8.2.6-3   Facsimile Service Development in Japan

As shown in the figure, the ratio of facsimile network service to business telephone has increased rather radically from 1984 to 1991. The ratio reached to around 2.7 % in 1991. The development of the facsimile network service in Japan is estimated to saturate in around 2000. The saturation level K for the facsimile network service is estimated to be a 3 % of facsimile network to the business telephone. Because the growth ratio has been already saturated from 1988 to 1991.

   b) Demand Forecast for Facsimile Network Service

      The Study Team estimates that the growth of facsimile network service in Thailand will progress in the same way to Japan. The logistic curve model is, therefore, employed to estimate the demand of facsimile network service as follows:

$$DN = \frac{K}{1 + m \times EXP(-at)}$$

      where,

      DN : the percentage of facsimile network subscriber to business telephone in year t,

K   : saturation level,

m, a : constants,

t   : Year (t=0, 1997).

Each value of the formula is given by using the facsimile service growth curve in Japan as follows:

K = 3 (No. of FAX Net. subscriber per 100 business telephone subscribers)

m = 4.107

a = 0.834

By substituting above coefficients, final formula is expressed as follows:

$$D_N = \frac{3}{1 + 4\ 107 \times EXP(-0.834t)}$$

Note;

K : When a and m values are calculated in case of Japan, t was set a zero (0) on 1986. The Study Team, however, sets t as a zero (0) on 1997 in case of Thailand. Because the Study Team assumes the facsimile network service will be begun at least in 1992 in the county.

The demand of number of facsimile network subscribers is estimated by following formula.

Y = D_N x Bn

where,

Y : the number of facsimile network service subscribers,

Bn : the number of business telephones.

The forecasted demand is shown in Table 8.2.6-5 and Figure 8.2.6-4. The estimation process is describe in APPENDIX.

Table 8.2.6-5   Forecasted Demand for Facsimile Network Service (whole kingdom)

Year	No of Fax. Net Subscribers	No. of Business. Telephones	Percentage (%)
1997	11,000	1,480,413	0.76
2002	53,000	2,303,814	2.32
2007	87,000	2,985,728	2.92
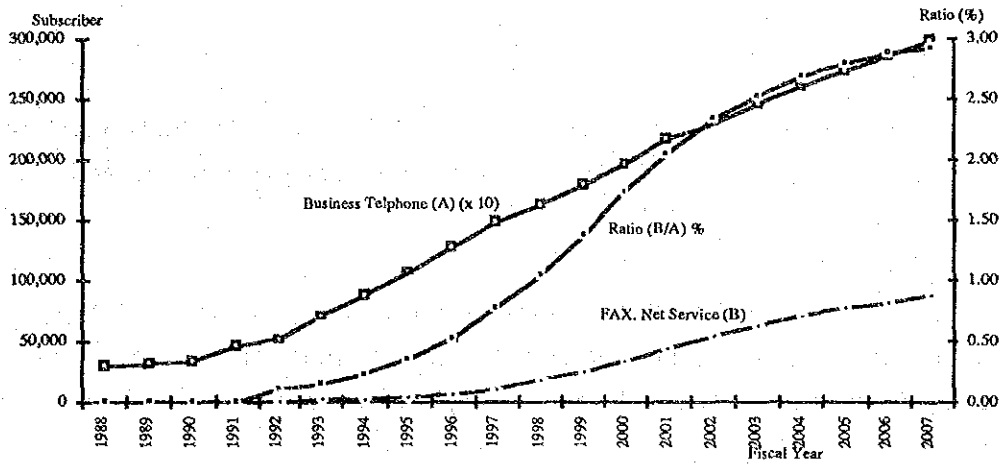
Figure 8.2.6-4   Forcasted Facsimile Network Service Subscriber (whole kingdom)

8.2.7 Videotex Service

1) Analysis of Videotex Service

Since there has been not the videotex service in Thailand, the Study Team examined various procedure to estimate the demand of videotex service in Thailand as shown in Appendix.

Finally, the Study Team estimated the demand for the videotex service by applying the same procedure to the mobile telephone service demand forecast. The following model is applied as well as for the cellular mobile telephone service forecast in the long-term.

$$\frac{Dt}{Nt} = \frac{K}{1 + m \ \times \ EXP(-at)}$$

where

Dt   : The number of people who have potential to subscribe the videotex service in period t

Nt   : The number of the telephone lines (unit : 100 lines)

K   : Saturation level (number of videotexs per telephone)

      BMA   : 0.22 per telephone line

      Province : 0.004 per telephone line

m, a   : Coefficients

Note:

1)   K value 0.22 in the BMA is applied the videotex per telephone line in France, and 0.004 in the provincial area is applied that in U.K.

2)   constant a and m are applied the same value to the mobile telephone service demand forecast.

2) Forecasted Demand for Videotex Service

The forecasted videotex service demand is shown in Table 8.2.7-1 and Figure 8.2.7-1.

Table 8.2.7   Forecasted Demand for Videotex Service (whole kingdom)

Year	Demand	Year	Demand
1992	2,000	2002	114,000
1997	53,000	2007	155,000

No. of Subscribers (x 1,000)
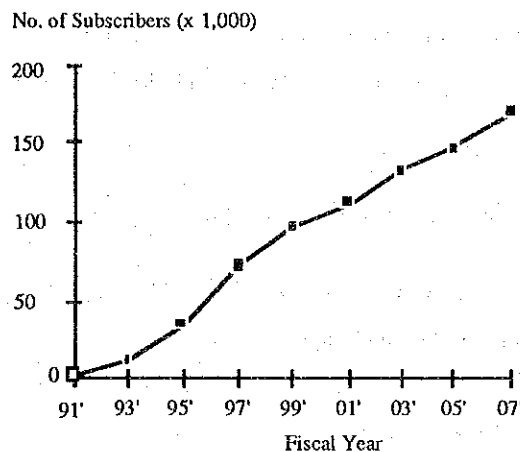
Figure 8.2.7 Forecasted Demand for Videotex Service (whole kingdom)

Despite the saturation was applied the same as France to estimate whole country, in Thailand, the demand does not go up in comparison with other services. However, the number of personal computers is over the estimated demand. In order to involve telephone users in this service , some counter measures to be considered are picked up below:

a) Focusing user such as travel agency, wholesale,

b) Managing data base to secure qualitative information,

c) Enhancing transaction capability to develop home user such as shopping, reservation, home banking, Dealing,

d) Active cooperation with excellence information provider,

e) Applying various tariff system,

f) Providing individual service to segmented user,

g) Providing gate way service,

h) Providing terminal equipment at low price,

i) Involve personal computer holder to videotex network at low cost,

However, recently, in U.S.A, some companies have withdrawn from gate way service or decided to stop providing the services because the communication protocol standardization between the videotex terminal and an external information center has not been achieved. In addition, the running cost to maintain the gate way service is increasing. Therefore, in spite of the personal computer holder would be supposed to be the videotex user, it would take a long term until the holder comes to this service.

8.2.8 ISDN Services

In order to understand customers needs toward telecommunications services, a marketing research has been conducted. The result is stated in Chapter 11 and the detail data is attached in the ANNEX 8.

1) Present State of ISDN Service in Main Countries

In order to understand the penetration of ISDN service, subscribers of ISDN service in main countries are examined as follows:

a) ISDN Services in Japan

The development of ISDN services in Japan is shown in Table 8.2.8-1 and Figure 8.2.8-1, 2.

Table 8.2.8-1 Development of ISDN Services in Japan

BRI (64 kb/s)

	1988 Jun.	1989 Mar.	1990 Mar.	1991 Mar.	1991.Nov.
No. of Lines	221	1,198	6,574	27,313	62,635
No. of Users	56	244	1,153	6,009	n.a.

PRI (1.5 Mb/s)

	1989 Jun.	1989 Sep.	1989 Dec.	1990 Mar	1990 Jun.
No. of Lines	21	49	72	117	187
No. of Users	10	14	21	33	55

	1990 Sep.	1990 Dec	1991 Mar.	1991 Nov.
	284	402	560	1,176
	91	123	209	n.a.

No. of Lines

No. of Users

70,000 — — — — — — — — — — — — — — — — — 7,000

60,000 — — — — — — — — — — — — — — — — — 6,000

50,000 — — — — — — — — — — — — — — — — — 5,000

40,000 — — — — — — — — — — — — — — — — — 4,000

30,000 — — — — — — — — — — — — — — — — — 3,000

20,000 — — — — — — — — — — — — — — — — — 2,000

10,000 — — — — — — — — — — — — — — — — — 1,000

0 — — — — — — — — — — — — — — — — — 0

88' Jun.　89' Mar.　90' Mar.　91' Mar.　91' Nov.

No. of
Subscribers
No. of Users
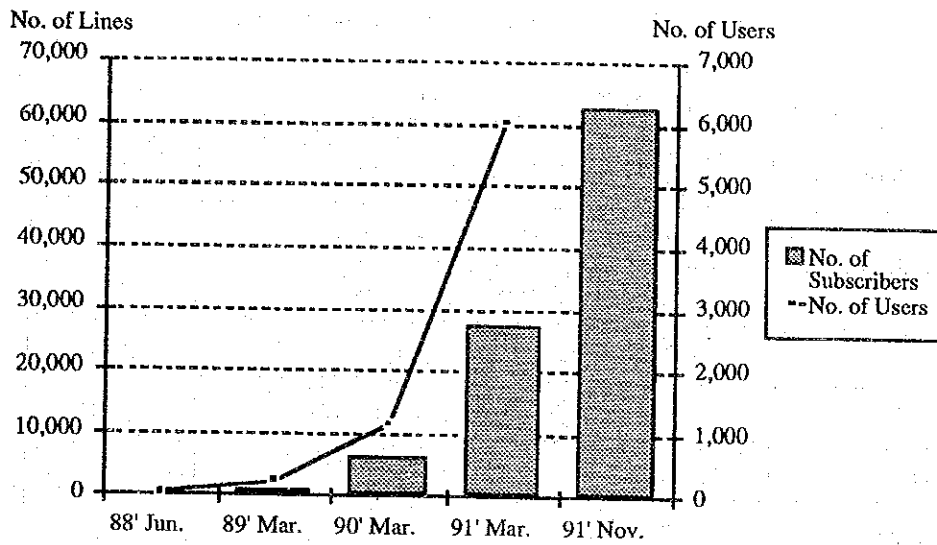
Figure 8.2.8-1　Development of ISDN-BRI Services in Japan

No. of Lines

No. of Users

1,200 — — — — — — — — — — — — — — — — — 250

1,000 — — — — — — — — — — — — — — — — — 200

800 — — — — — — — — — — — — — — — — —

600 — — — — — — — — — — — — — — — — — 150

400 — — — — — — — — — — — — — — — — — 100

200 — — — — — — — — — — — — — — — — — 50

0 — — — — — — — — — — — — — — — — — 0

89' Jun.　90' Mar.　91' Mar.　91' Nov.

No. of
Subscribers
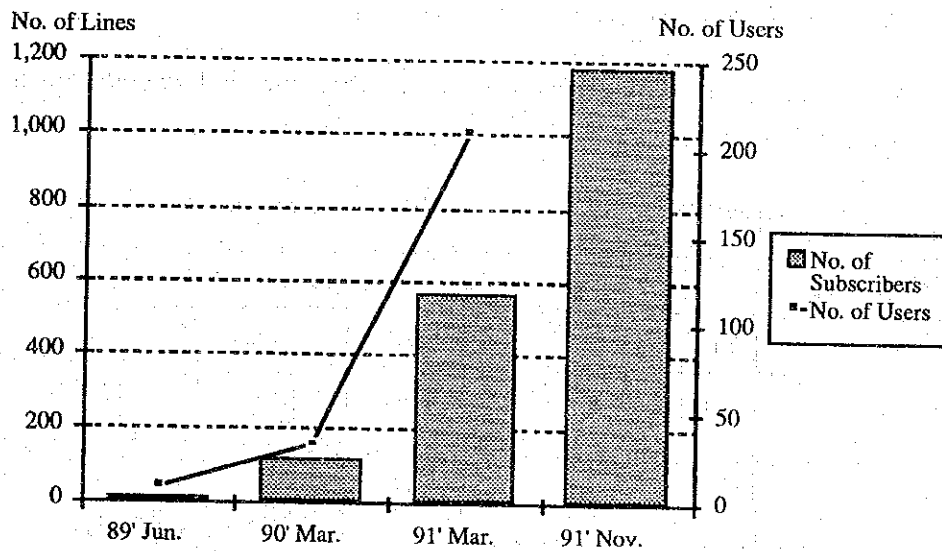No. of Users

Figure 8.2.8-2　Development of ISDN-PRI Services in Japan

How many lines for the ISDN services are subscribed by business users in March 1991 is shown in Table 8.2.8-2.

Table 8.2.8-2   ISDN Service Subscription in Japan

BRI

Business Category	Number of Lines	Ratio
Finance	9,505	35%
Manufacturing	7,538	28%
Services	3,687	14%
Trade, Sales	2,431	9%
Public Ser.	1,994	7%
Const.,Real Est.	1,284	5%
Publishing	874	3%
Total	27,313	100%

PRI

Business Category	Number of Lines	Ratio
Finance	52	9%
Manufacturing	246	44%
Services	154	28%
Trade, Sales	27	5%
Public Ser.	39	7%
Const.,Real Est.	27	5%
Publishing	15	3%
Total	559	100%

b)   ISDN Services Subscription in the World

How many lines for the ISDN services are subscribed in five countries is shown in Table 8.2.8-3.

Table 8.2.8-3   Present State of ISDN Services in the World

Country Name	Carrier	No. of Lines		as of
England	British Telecom	BRI	900	1991.6
France	France Telecom	BRI PRI	7,500 2,000	1991.6
Germany	DBPT	BRI PRI	36,409 3,205	1991.5
USA	Pacific Bell	BRI	1,400	1990.12
Singapore	Singapore Telecom	BRI	260	1991.5

3)   Demand Forecast Model

By taking the result of the marketing research into consideration and the development trend of ISDN services in Japan and in the world, the ISDN service demand forecasts in Thailand are conducted by using the number of companies in this sector.

The Potential demand model is expressed as follows:

$$\frac{Dt}{Nt} = \frac{K}{1 + m \cdot EXP(-at)},$$

where

Dt   :   The number of telephones in period t

Nt   :   The number of telephone lines (unit : 100 lines),

K   :   Saturation level (number of ISDN telephones lines.

BRI

BMA :   3 0 per 100 telephone lines,

Provincial area :   1.5 per 100 telephone lines,

PRI :

BMA :   0.06 per 100 telephone lines,

Provincial area :   0.03 per 100 telephone lines,

m,a :   Constant.

In this study, the following parameters were used:

$$m : \frac{KNt - Dt}{Dt \cdot EXP(-at)},$$

BRI

Provincial area :   452,

BMA :   297,

PRI

Provincial area :   40,

BMA :   22,

a: Estimated,

Provincial area :   0.5,

BMA :   0.5.

4)   Forecasted Demand for ISDN Services

Since the result of the estimation by using the above formula was quite different from the trend of ISDN service development in Japan, the number of forecasted subscribers were revised in accordance with the trend of ISDN development in Japan. The estimation process is described in APPENDIX.

The forecasted demand for ISDN services is shown in Table 8.2.8-4.

Table 8.2.8-4   Forecasted Demand for ISDN Services

(unit: thousand)

	Year	1992	1997	2002	2007
BMA	BRI	0.43	21.0	429	1,180
	PRI	0.02	3.0	11	18
Prov.	BRI	0.24	5.0	77	327
	PRI	0.01	0.3	3	4
Total	BRI	0.67	26.0	506	1,507
	PRI	0.03	3.0	14	22

Note: Figure of Prov. includes the Surrounding Area's demand

8.2.9   Message Service

1)   Analysis of the Mail Service

This service is rather targeted for non-business users. The service concept is shown in Figure 8.2.9-1.
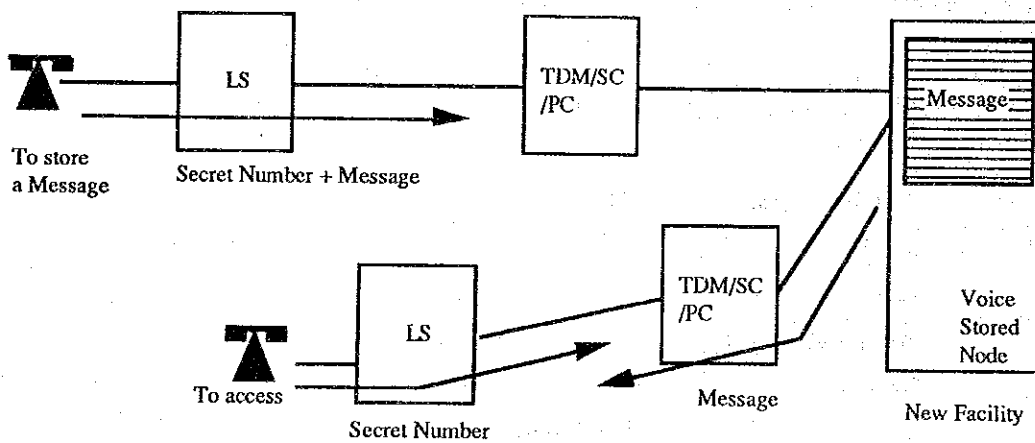

Figure 8.2.9   Service Concept

a)   Record

i)   Contact the voice storing center by dialing "# ABCD",

ii)   Dial a secret number which was assigned to the group by the center,

b)   Replay or record additional message

i)   Contact the voice storing center by dialing "# ABCD",

ii)   Dial the secret number,

iii) Replay or record additional messages. The maximum of 10 messages are allowed to be recorded.

2) Demand Forecast

a) Message Service Development in Japan

To estimate the demand for message service, the development of that in Japan is examined. The ratio between the total number of calls and the number of message service calls is shown in Table 8.2.9-1.

Table 8.2.9-1 Trend of the Ratio Between the Number of Telephone Lines and the Number of Message Service Calls in Japan

(thousand)

Year	No. of Calls per year (A)	No. of Message Service Calls per year (B)	Ratio (B/A)
1986	71,800,000	138,600	0.00193
1987	75,900,000	148,900	0.00196
1988	67,800,000	156,950	0.00231
1989	71,800,000	173,930	0.00242
1990	72,600,000	177,640	0.00245
1991			*0.00251

note: *the estimated figure

b) Estimation of the Demand for Message Service in Thailand

The trend of the ratio between the number of telephone calls and the number of message service calls in Japan is used to estimate that in Thailand. The Study Team expects the message service will be begun in 1992.

The development of the number of local calls in Thailand is shown in Table 8.2.9-2. In the table, the figures in from 1991 to 1997 are estimated by using a linear line formula on the growth curve from 1986 to 1990.

Table 8.2.9-2 Development of the Number of Local Call in Thailand

(thousand)

Year	No. of Calls per Year	Year	No. of Calls per Year
1986	1,576,000	1992	3,099,000
1987	1,627,000	1993	3,379,000
1988	1,861,000	1994	3,659,000
1989	2,100,000	1995	3,939,000
1990	2,738,000	1996	4,218,000
1991	2,819,000	1997	4,449,000

Source: TOT "Statistical Data"

Note; The figure of 1991 and 1992 are calculated by using the growth curve of the number of calls.

c) Forecasted Demand for Message Service in Thailand

As mentioned above, the ratios of the message service calls to the number of telephone calls from 1986 to 1991 in Table 8.2.9-1 are applied to that from 1992 to 1997 in Thailand.

The forecasted demand for message service is shown in Table 8.2.9-3.

Table 8.2.9-3 Forecasted Demand for Message Service

(thousand)

Year	No. of Message Calls (A)	Ratio (A/B)	No. of Tel. Call (B)	Year	No. of Message Calls	No. of Tel. Call (B)	Ratio (A/B)
1992	5,983	0.0019	3,099,000	1995	9,541	3,939,000	0.0024
1993	6,629	0.0020	3,379,000	1996	10,321	4,218,000	0.0025
1994	8,470	0.0023	3,659,000	1997	11,299	4,498,000	0.0025

8.2.10   Free Dial Service

1) Analysis of Free Dial Service

The concept of the free dial service is shown in Figure 8.2.10-1. The call charge is paid by the called party.
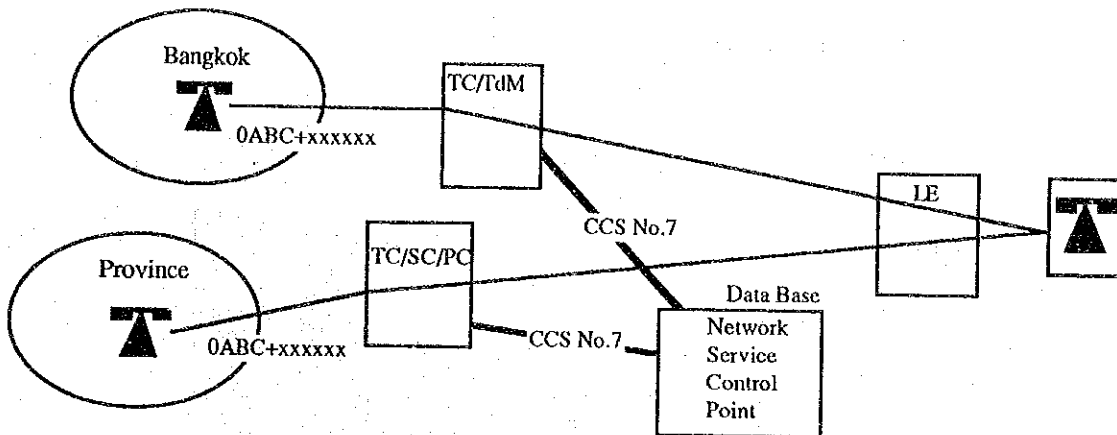
Figure 8.2.10-1 Service Concept

According to the marketing research, most respondents do not have interest in this service. The time for this service in Thailand has not yet come. However, after eliminating waiting applicants, TOT should consider how it can increase the traffic volume. CCS No.7 will be introduced during the seventh ESDP of TOT. CCS No.7 will be able to support this service.

2) Demand Forecast

a) Development for Free Dial Service in Japan

To estimate the demand for free dial service, the development of that in Japan is examined. Table 8.2.10-1 and Figure 8.2.10-2, 3 show the service development in Japan.

Table 8.2.10-1 Development of Free Dial Service in Japan

Year	1985	1986	1987	1988	1989	1990
No. of Lines	2,000	14,000	43,000	80,000	143,000	213,000

No. of Calls (x 1,000)
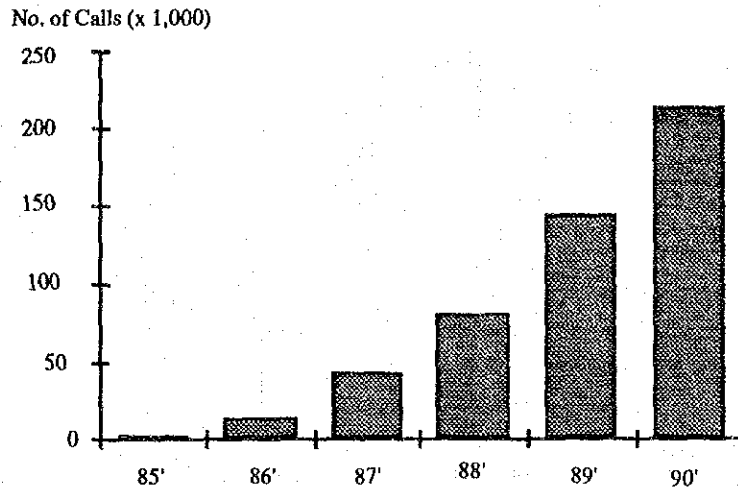
Figure 8.2.10-2   Development of Free Dial Service in Japan

No. of Calls (x 1,000)

Fiscal Year
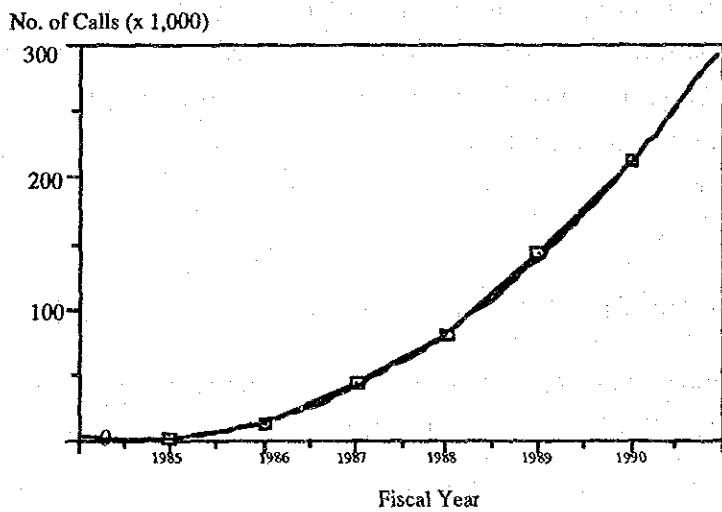
$y = 4.67 + 9.82 \times X + 7.22 \times X^2 + 0.037 \times X^3$ (thousand) , $R = 1.00$

Figure 8.2.10-3   Development of Free Dial Service in Japan

According to the result of the marketing research, retailers' responses are higher than the other businesses. This service is a useful way to sell goods; therefore, they expressed their interest in this service.

b)   Demand Forecast

As the telecommunication services in Thailand are different from those in Japan, the demand for free dial service in Thailand is estimated as approximately, 3 % of the

trend in Japan. The service is that the percentage of business telephone lines in Thailand to that in Japan (17,091 thousand) in 2.4 % in 1990.

Table 8.2.10-2 shows assuming the free dial service states in 1992.

In the table,

t = 1   correspondents to 1992,

t = 6   in 1997,

t = 11   in 2002,

t = 16   in 2007.

Table 8.2.10-2   Forecasted Demand for Free Dial Service in Japan

(thousand)

Year	85'	86'	87'	88'	89'	90'	95'	00'
t	1	2	3	4	5	6	11	16
Observed Data	2	14	43	80	143	213		
Estimated Data	2.1	14.2	41.2	82.1	140.7	213.7	819.5	1847.4

For applying the forecasted demand for free dial service in japan to that in Thailand, the initial year (t=0 in 1985) is set in 1992.

The forecasted demand is shown in Table 8.2.10-3.

Table 8.2.10-3   Estimation Result of Free Dial Service Demand in Thailand (whole kingdom)

(thousand)

Year	1992	1997	2002	2007
No. of Lines	0.1	6.4	24.6	55.4

CHAPTER 9

OBJECTIVES AND STRATEGIES OF TELECOMMUNICATIONS IN THE LONG-TERM PLAN

CHAPTER 9 OBJECTIVES AND STRATEGIES OF TELECOMMUNICATIONS IN THE LONG-TERM PLAN

9.1 Present and Future Issues in the Study Area

Today, telecommunications play important roles as a part of essential and indispensable infrastructure to support various socioeconomic activities, not only commercial, banking, transportation, agriculture, and industries, but also education, broadcasting, first-aid services, medical cares, etc. Present socioeconomic activities can not be carried out without sufficient telecommunications services.

As describe in Chapter 2, Thailand has been experiencing a remarkable economic progress. Many industrial estates and parks have been developed year after year in the Study Area. There is, therefore, a pressing need to expand the telecommunications services more rapidly than ever before in order to support the further development of the area as well as to promote the prosperity of people.

As pointed out in "A Master Plan Study on Telecommunications Development in the Kingdom of Thailand" (hereinafter referred to as "the Master Plan"), the telecommunications situation of the BMR is quite different from those in the provincial areas because of the special economic and social position that the BMR has in Thailand.

As one of the state enterprises, TOT has been making considerable efforts to render better telecommunications services to the customers since its establishment in 1954. The present services offered by TOT in the Study Area, however, are not sufficient neither in quantity nor quality. Operation and maintenance performance also needs to be improved.

Main issues to be considered are as follows:
- large number of waiting applicants for the ordinary telephone service,
- insufficient telecommunications services,
- inefficient operation and maintenance,
- shortage of management resources.

9.1.1 Large Number of Waiting Applicants

There were approximately nine hundred fifty thousand (950,000) waiting applicants in the BMA, and two hundred eighty thousand (280,000) applicants in the Surrounding Area as of May 1990. In order to provide enough telephone lines for waiting applicants, TOT has already

adopted a new management scheme, i.e. Build, Transfer and Operation (BTO) method for its immediate facility expansion. Under this scheme, TOT provides an concession to a private firm by letting it install two million subscriber lines in the BMA during its seventh ESDP period. TOT adopts the same method in the provincial areas. TOT gives a concession to another private firm to install one million subscriber lines in the provincial areas.

9.1.2   Insufficient New Telecommunications Services

The demand for new telecommunications services has been increasing in the Study Area. More enhanced voice and non-voice services have to be introduced by means of ISDN and CCS No.7 to enter into "information society" from industrial society.

In spite of TOT's considerable efforts in these years, the service quality is yet to be improved in comparison with the international standards. The successful call rate in the BMA is 47.6% in 1990. One reason is that the network capacity has become small for the increasing telephone and traffic demand. The other reason for the this low figure is high fault occurrence rate.

Approximately 50% of the faults occurred in outside plant. They increase unsuccessful calls. Improvement of outside plant facilities is, therefore, expected to upgrade the service grade to a considerable extent. However, the replacement of deteriorated facilities have not been carried out systematically yet. TOT has made every effort for network expansion to meet the huge demand; however, network systems and facility management, preventive maintenance activities, rehabilitations and reformations, renewal and modernization remain to be improved.

Hence, improvement of maintenance works and activities for the expanded networks and facilities is necessary in the next stage for upgrading the service quality.

9.1.3   Inefficient Operation and Maintenance

Maintenance activities, started from corrective maintenance in the early stage with "Repair when Broken", then reached a more developed stage of the preventive maintenance with "prevent faults and breakdowns". They have recently become "controlled maintenance" as the final stage in developed countries on the basis of Maintenance Management Systems (MMS). MMS has four management methods: service quality control, maintenance management by targets, deteriorated plant management, and extraordinary failure recovery system.

MMS is necessary for the whole telecommunications networks and facilities. Updated plant records and subscriber records are the basis for all these operation and maintenance activities.

As the first step, MMS is planned to be realized through reinforcement of Outside Plant Maintenance Center (OPMC).

For improvement of the management system, TOT has been decentralizing the organization to enhance the managerial autonomy. The decentralization has been completed in the provincial areas; however, it was not completed in the BMA yet. In the BMA, the decentralization in the outside plant and transmission sections have been completed in August 1991; however, the switching section has not been completely decentralized, yet. The reorganization of the switching section in the BMA will be finished by the end of 1992 when the maintenance and operation system will be restructured. The organization system in the BMA will be examined in comparison with metropolitan areas in other countries. Thus, the operation and maintenance system should be examined in the view point of effective and economical telecommunications services offerings.

As mentioned before, TOT let the private firm participate in supporting the part of the TOT's telecommunications operational field. Therefore, TOT should establish control and cooperation with them as the leading telecommunications government enterprise in the country.

9.1.4   Shortage of Management Resources

TOT has finished the reorganization to provide suitable telecommunications services for the customers in the provincial areas. The organization structure should, however, be designed in a more flexible manner so that it can be changed as the operation scale and conditions change in order to achieve the most efficient operation for meeting the needs of the society.

Human Resources development is also important as a part of human resources management. It is necessary to establish a human resources development system, because severe shortage of engineers and technicians is expected in the telecommunications field in the near future.

9.2   Long-term Development Objectives

Referring the Master Plan and taking the above mentioned situations in the present telecommunications of the country into consideration, the following four long-term objectives, which are the same ones in the Master Plan, are set forth in formulating the long-term plan in the Study Area, to assign various projects for the improvement of the telecommunications services both in quantity and quality to the respective areas and periods.

1) Fulfillment of telephone demand,
2) Upgrade of service qualities,
3) Diversification of services,
4) Improvement of management.

For the sake of formulation, the period of the Long-term Plan in the Study Area is divided into three phases as follows:

Phase-1:   from FY 1993 to FY 1997,
Phase-2:   from FY 1998 to FY 2002,
Phase-3:   from FY 2003 to FY 2007.

9.3   Development Strategies and Targets

To achieve the four objectives mentioned in the previous section, the following strategies are formulated.

9.3.1   Fulfillment of Telephone Demand

TOT still holds a large number of waiting applicants in the Study Area. POTS (Plain Old Telephone Service[1]) has been the principal service of TOT. Hence, the elimination of waiting applicants should be the most important objective in the long-term plan. The following targets and strategies are employed.

1) Reduction of Waiting Applicants

Targets:	Elimination of Waiting Applicants
the BMA:	Phase-1
the Surrounding Area:	Phase-2

TOT has already adopted the BTO scheme for the network expansion. TOT allows the private firm to install two million subscriber lines in the BMA during its seventh ESDP period. Therefore, the number of waiting applicants will be expected to be eliminated in the BMA by the end of the Phase-1. The telephone density in the area is expected to reach 38 main telephone lines per 100 inhabitants.

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[1] POTS means the ordinary telephone service.

In the Surrounding Areas, 75 % of the potential subscribers will be connected to the network in the Phase-1. The telephone density will reach 5 per 100 inhabitants in Ayutthaya, 10 per 100 inhabitants in Nakhon Pathom and 20 per 100 inhabitants in Samut Sakhon. All the waiting applicants are connected to the network by the end of the Phase-2. The telephone density will reach 9 per 100 inhabitants in Ayutthaya, 20 per 100 inhabitants in Nakhon Pathom and 33 per 100 inhabitants in Samut Sakhon.

2) Public Telephone

In order to provide sufficient telephone call opportunity in the outside, the public telephone density should be increased as those of developed countries level. The following targets are employed.

Target:	Public Telephone Density per 1,000 Inhabitants		
	Phase-1	Phase-2	Phase-3
the BMA:	4	6	8
the Surrounding Area:	2	3	4

9.3.2 Upgrade of Service Qualities

During the fourth and fifth ESDP period, TOT has made every effort to expand the telephone network for meeting the significant increasing demand. However, according to the market survey, requirement for the quality of the services has also been increasing year after year in the Study Area. In this Long-term Plan, the replacement of deteriorated facilities, the improvement of network management system, and the enhancement of telecommunications network reliability are mainly employed.

1) Targets for Upgrading the Service Quality

The following targets are selected for upgrading the service quality.

a) Completion of Network Digitization

Switching Systems

Target:	100% Digitization
the BMA:	Phase-2
the Surrounding Area:	Phase-1

b) Decrease Outside Plant Faults

Target:

	Fault Rate per 1,000 lines per month		
	Phase-1	Phase-2	Phase-3
the BMA:	25	20	15
the Surrounding Area:	30	20	15

2) Strategy for Upgrading the Service Quality

The following strategies are employed to achieve the above targets for upgrading the service quality.

a) Replacement of Deteriorated Facilities

i) Replacement of Crossbar Switching and Transmission Systems and Facilities

It is clear that service grade is lowered by the XB switching systems; however, their replacement should be considered and carried out in the viewpoint of new services introduction by taking facility expansion space and replacement and investment costs into consideration. This project will be carried out from the Phase-1.

The analog and PCM-30 transmission systems also needed to be replaced with fiber optical transmission systems in accordance with the XB switch replacement as they are linked with the XB switches.

ii) Rehabilitation of Subscriber Cables and Wires

In the installation process of outside plant facilities, the replacement of deteriorated subscriber cables will be carried out during the long-term plan period. Particularly, paper insulated cables should be replaced with jelly filled cables.

b) Improvement of Operation and Maintenance

i) Establishment of Network Management System

In order to manage the expanding switching and transmission facilities, establishment of an integrated network management system is required. For this purpose, the integrated switching and transmission network management system should be established during the Long-term Plan period. Furthermore, the establishment of an overall network management system is considered in the Phase-2.

ii) Reinforcement of Outside Plant Maintenance Center (OPMC)

Reinforcement of the Outside Plant Maintenance Center (OPMC) should be achieved from the Phase-1 in order to realize Maintenance Management Systems (MMS). The improved OPMC will be expanded through the Phase-1 to the Phase-3.

c) Improvement of Telecommunications Network Reliability

The improvement of the network management involves the improvement of facilities such as switching network, transmission network, subscriber network; however, the improvement of network reliability against faults, accidents, and disasters is considered in this long-term plan. The network reliability should be improved through the long-term plan.

d) Improvement of the Test and Development Sector

Generally, indoor equipment and facilities for switching and transmission are seldom affected or damaged by external factors such as heat because air conditioners always keep room conditions in the same level of humidity and temperature.

However, outside plant is directly affected and damaged by external environmental conditions, such as humidity, heat, cold, rainfall, wind, sunlight, lightning, insects and animals. It needs protections against these various external environmental influences, which vary by region. Therefore, research activities are required for each telecommunications operating entity to identify the causes of deteriorations and damages, and to find out their preventive measures such as to change materials, to

apply different designs and construction methods, to improve tools and equipment, to create new techniques and technology.

From this viewpoint, the research and development functions are to be improved. TOT should develop its own technology suitable for the Thai environment as the leading government enterprise in the telecommunications field of the country. Improvement of the test and development sector is necessary to be planned during the long-term period.

In executing these strategies to achieve the targets, continuous efforts and close cooperation among all the departments and sections in TOT are necessary.

9.3.3 Diversification of Services

The following priority criteria should be considered to introduce various telecommunications services:

- to satisfy customer needs,
- to promote customer benefits,
- to contribute revenue increase of the operating entity,
- to utilize network facilities efficiently.

1) Introduction of ISDN

Integrated Services Digital Network (ISDN) services will be developed in order to meet the demands in the Study Area during the long-term plan period. The introduction of new telecommunications services is to be carried out by taking the market survey results into consideration.

2) Introduction of CCS No. 7

Common Channel Signaling System No.7 (CCS No. 7) is indispensable to offer new services such as ISDN services and integrated network services. Introduction of CCS No. 7 is to be started from the Phase-1.

3) Introduction of SDH

Introduction of the Synchronous Digital Hierarchy system (SDH) will enhance not only the transmission links in the public network, but also routing and controlling facilities needed for broad band transmission.

SDH has the following features:
- simplified multiplexing / demultiplexing,
- direct access to lower speed tributaries without multiplexing / demultiplexing the entire high speed signals,
- easy growth to higher bit rates in step with the evolution of transmission technology,
- enhanced operation, administration and maintenance (OAM) capability.

Introduction of the SDH system will start in the Phase-1. Expansion of the SDH system is carried out from the Phase-2 to the Phase-3.

9.3.4   Improvement of Management

1)   Improvement of O&M System

TOT has carried out reorganization for the whole country in August 1991 except the BMA; however, the new organization structure should be verified in the viewpoint of both telecommunications service offerings and the cost performance of the operation and maintenance system.

The operation and maintenance system is required to be improved during the long-term plan period.

2)   Improvement of Human Resources Management

To manage the expanding telecommunications network facilities efficiently, an advanced telecommunications network management system must be developed; however, they will not work effectively without adequate staff. Thus, the human resources management plays greater roles for realizing successful telecommunications operations.

Efficient utilization of human resources is carried out during the long-term plan period.

3) Human Resource Development

When increasing new telecommunications service offerings such as ISDN services, a large number of engineers will be needed for operation and maintenance of the facilities. However, a shortage of engineers is expected from the Phase-1. Therefore, human resources development must be vigorously promoted during the long-term plan period.

9.4 Strategy and Target Execution

9.4.1 Countermeasure of Strategies and Targets

When the strategies are executed, how the targets are realized are shown in Figure 9.4.1. The figure shows the targets to be achieved in each phase of the long-term plan.

Objectives

1. Fulfillment of Telephone Demand

2. Upgrade of Services

3. Diversification of Services

4. Improvement of Management
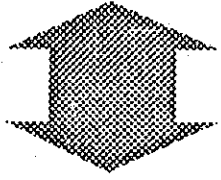
Present State of the Sector

1. Existing Socioeconomic Development Plan in the Area

2. Existing Government Telecommunications Development Plan

3. Existing Telecommunications Development Plan of the Sector

4. Present Situation of Telecommunications in the Country
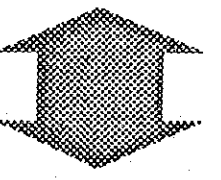
Environmental Condition

1. Socioeconomic Development

2. Technology Development Trend

3. Regional Development

4. Market Development

Strategies & Targets
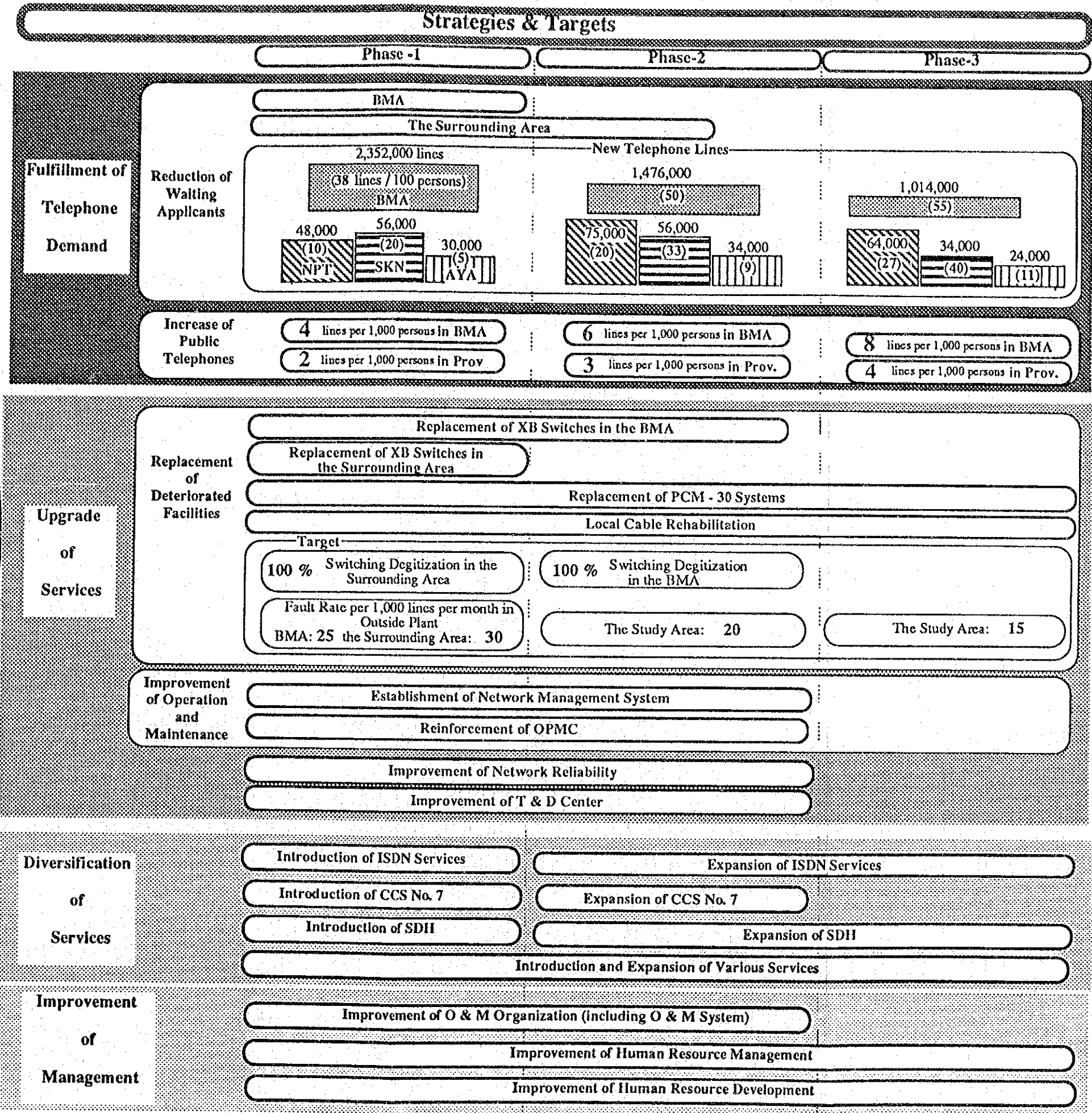
Beyond Universal Basic Service

	Phase -1	Phase-2	Phase-3

Fulfillment of Telephone Demand

Reduction of Waiting Applicants

BMA

The Surrounding Area

New Telephone Lines

Phase-1: 2,352,000 lines (38 lines / 100 persons) BMA
48,000 (10) NPT, 56,000 (20) SKN, 30,000 (5) AYA

Phase-2: 1,476,000 (50)
75,000 (20), 56,000 (33), 34,000 (9)

Phase-3: 1,014,000 (55)
64,000 (27), 34,000 (40), 24,000 (11)

Increase of Public Telephones

Phase-1: 4 lines per 1,000 persons in BMA / 2 lines per 1,000 persons in Prov

Phase-2: 6 lines per 1,000 persons in BMA / 3 lines per 1,000 persons in Prov.

Phase-3: 8 lines per 1,000 persons in BMA / 4 lines per 1,000 persons in Prov.

Upgrade of Services

Replacement of Deteriorated Facilities

Replacement of XB Switches in the BMA

Replacement of XB Switches in the Surrounding Area

Replacement of PCM - 30 Systems

Local Cable Rehabilitation

Target:
100 % Switching Degitization in the Surrounding Area

100 % Switching Degitization in the BMA

Fault Rate per 1,000 lines per month in Outside Plant BMA: 25 the Surrounding Area: 30

The Study Area: 20

The Study Area: 15

Improvement of Operation and Maintenance

Establishment of Network Management System

Reinforcement of OPMC

Improvement of Network Reliability

Improvement of T & D Center

Diversification of Services

Introduction of ISDN Services / Expansion of ISDN Services

Introduction of CCS No. 7 / Expansion of CCS No. 7

Introduction of SDH / Expansion of SDH

Introduction and Expansion of Various Services

Improvement of Management

Improvement of O & M Organization (including O & M System)

Improvement of Human Resource Management

Improvement of Human Resource Development

Figure 9.4.1   Strategies and Targets

9.4.2 Priority Order of the Strategic Target Areas in the Study Area

The study areas are ranked according to the following classification as a result of the regional development analysis made in Chapter 2. Figure 9.4.2 shows the area rank for each local exchange area in the BMA.

The Highest Priority Area (P-1 Area)   : Central Business Area
The Second Highest Priority Area (P-2 Area)   : Rapidly Growing Suburban Area
The Third Highest Priority Area (P-3 Area)   : Industrial Area
The Fourth Highest Priority Area (P-4 Area)   : Outer Area

Assignment of project priority and execution are decided by considering the targets and the area ranking. The project ranking is described in Chapter 15 in detail .

Legend

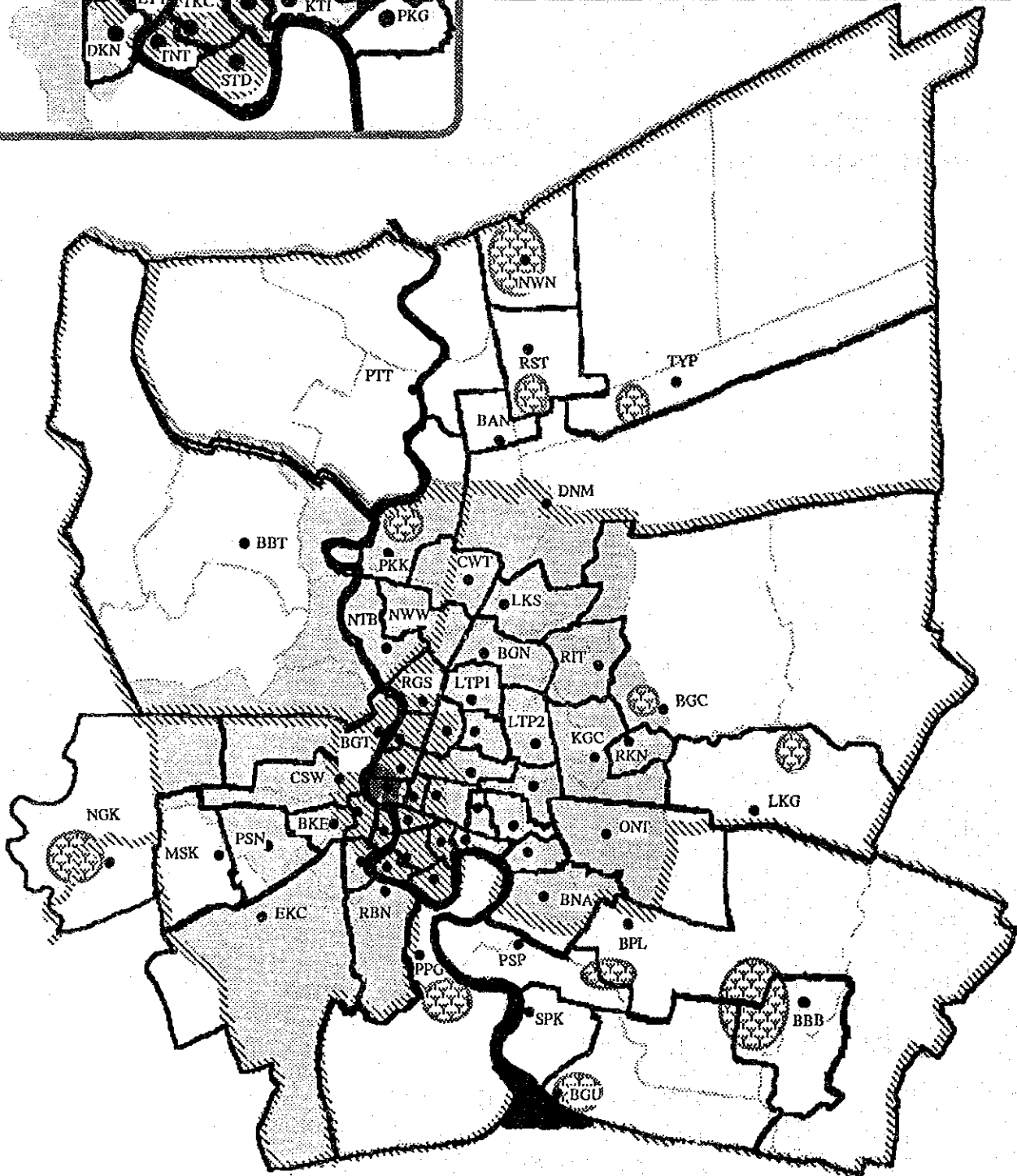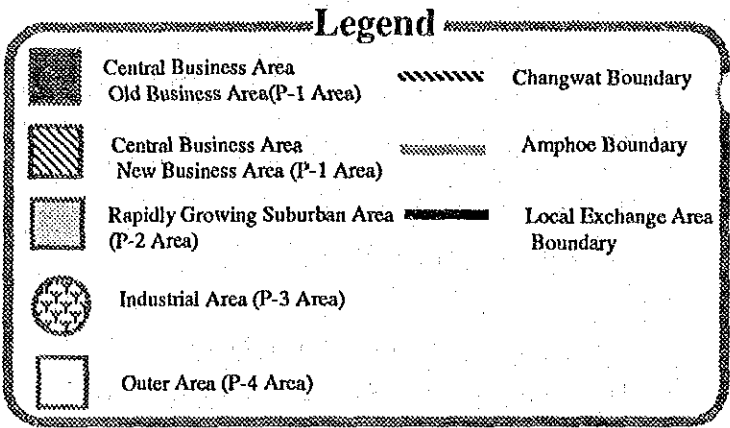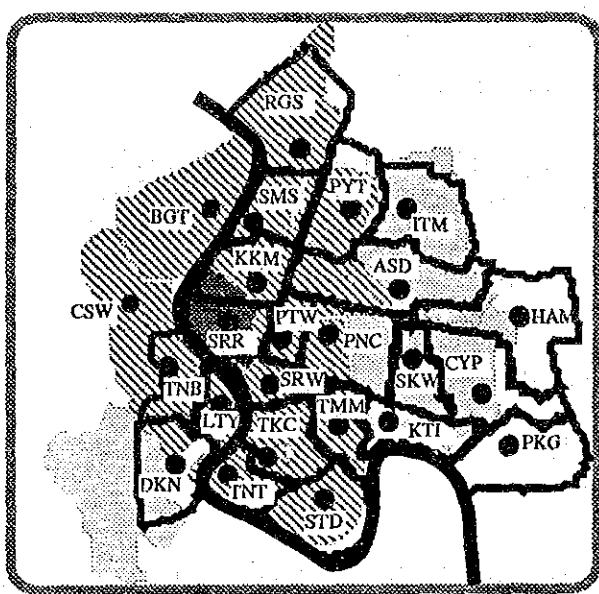|			
▓	Central Business Area Old Business Area(P-1 Area)	∿∿∿∿	Changwat Boundary
▨	Central Business Area New Business Area (P-1 Area)	∿∿∿∿	Amphoe Boundary
�	Rapidly Growing Suburban Area (P-2 Area)	▬▬▬	Local Exchange Area Boundary
◉	Industrial Area (P-3 Area)		
☐	Outer Area (P-4 Area)		

Figure 9.4.2-1   Strategic Target Areas of BMA

9 - 14

CHAPTER 10

TRAFFIC FORECAST

CHAPTER 10   TRAFFIC FORECAST

10.1   Methodology

In this study, future traffic demand will be forecasted by two steps. The first step is macro level forecast. This means forecast of the whole traffic volume of each message area (BMA, Nakhon Pathom, Samut Sakhon and Ayutthaya). The second step is micro level forecast. This means forecast of the traffic volume of each switch unit in the message areas.

10.1.1   Macro Forecast

Telephone traffic increase can be related to changes of many different variables such as increase of subscriber lines, telephone tariff, socio-economic activities. Table 10.1.1-1 shows the past traffic data of the whole country and each message area. From the table the local traffic per subscriber line is decreasing in accordance with the increase of subscriber lines, while the long distance and international traffic is increasing rather rapidly.

For forecasting the traffic growth in the study period, after making several regression analyses on the data we decided to adopt the following equations in this study.

1)   Local traffic

$$Y_t = a\, S_t^{\,b} \text{ -- (10.1)}$$

where
Y_t : Traffic growth index in year t (indexed by the base year 1987)
S_t : Subscriber growth index in year t (indexed by the base year 1987)
a,b   : Constant parameters

The formula can be rearranged in the following log-linear form.

$$\ln(Y_t) = A + b \ln(S_t) \text{ --- (10.2)}$$

2)   Long distance and international traffic

$$Y_t = c\, S_t + d \text{ --- (10.3)}$$

Table 10.1.1-1 Traffic Data in the Study Area

1. BMA

Year	MTS	Local	Trunk	Local/MTS	Trunk/MTS.
1978	218,820	495,565,577	N.A.	2,265	N.A.
1979	243,607	526,647,197	3,328,639	2,162	14
1980	269,534	535,484,774	3,743,778	1,987	14
1981	287,090	568,465,524	9,031,291	1,980	31
1982	312,062	628,705,764	12,189,558	2,015	39
1983	339,510	840,253,554	14,545,378	2,475	43
1984	361,924	904,847,007	16,523,748	2,500	46
1985	433,517	965,937,153	18,932,796	2,228	44
1986	548,080	1,172,389,978	22,719,118	2,139	41
1987	614,707	1,063,578,851	27,485,356	1,730	45
1988	686,151	1,218,947,565	35,081,957	1,777	51
1989	792,203	1,396,827,113	45,828,999	1,763	58

2. Nakhon Pathom

Year	MTS	Local	Trunk	Local/MTS	Trunk/MTS.
1978	2,758	2,978,960	213,194	1080	77
1979	2,773	3,102,850	214,294	1119	77
1980	2,791	2,835,422	255,750	1016	92
1981	2,794	3,056,976	687,300	1094	246
1982	2,804	3,187,845	869,662	1137	310
1983	2,817	3,620,328	1,097,093	1285	389
1984	5,535	5,113,232	1,141,114	924	206
1985	8,447	7,528,159	1,641,462	891	194
1986	8,768	11,436,709	2,211,036	1304	252
1987	8,946	7,396,395	2,438,850	827	273
1988	9,137	8,283,437	2,966,320	907	325
1989	11,394	9,253,046	3,644,884	812	320

3. Samut Sakhon

Year	MTS	Local	Trunk	Local/MTS	Trunk/MTS.
1978	819	868,740	58,872	1,061	72
1979	969	1,027,597	61,926	1,060	64
1980	989	1,083,324	76,706	1,095	78
1981	1,273	1,315,541	316,080	1,033	248
1982	1,969	2,225,355	467,628	1,130	237
1983	1,981	2,715,535	577,623	1,371	292
1984	3,343	3,789,574	831,345	1,134	249
1985	3,556	4,636,580	959,043	1,304	270
1986	3,577	8,009,311	1,293,118	2,239	362
1987	5,453	4,465,439	1,584,239	819	291
1988	6,348	6,081,349	2,241,868	958	353
1989	8,310	7,541,806	3,161,189	908	380

4. Ayatthaya

Year	MTS	Local	Trunk	Local/Sub.	Trunk/MTS
1978	1,217	1,175,882	114,981	966	94
1979	1,604	1,210,704	121,940	755	76
1980	1,882	1,298,755	169,034	690	90
1981	1,920	1,503,464	503,995	783	262
1982	2,004	1,776,909	644,215	887	321
1983	2,023	1,846,116	800,962	913	396
1984	2,027	2,060,746	811,222	1,017	400
1985	2,059	2,434,537	792,689	1,182	385
1986	4,536	5,576,498	1,215,444	1,229	268
1987	5,861	3,738,580	1,709,535	638	292
1988	6,498	4,509,478	2,230,638	694	343
1989	7,510	4,939,275	2,881,929	658	384

5. Whole Country

Year	MTS	Local	Trunk	International	Local/MTS	Trunk/MTS	Int/MTS
1978	295,634	620,029,617	10,611,242	N.A.	2,097	36	N.A.
1979	331,584	626,106,126	11,696,749	N.A.	1,888	35	N.A.
1980	365,894	651,252,865	13,916,551	N.A.	1,780	38	N.A.
1981	389,238	693,618,809	30,654,299	N.A.	1,782	79	N.A.
1982	425,679	771,650,125	41,406,365	N.A.	1,813	97	N.A.
1983	463,231	1,019,942,871	50,144,106	9.47	2,202	108	20
1984	519,491	1,116,255,030	56,598,000	10.62	2,149	109	20
1985	626,498	1,222,441,028	64,727,553	12.75	1,951	103	20
1986	798,912	1,569,560,922	75,610,023	19.44	1,965	95	24
1987	901,622	1,365,846,143	90,049,401	27.71	1,515	100	31
1988	1,005,872	1,573,659,510	113,456,427	42.45	1,564	113	42
1989	1,158,014	1,811,934,222	144,230,894	54.7	1,565	125	47

Note:

MTS	: Main Telephone Station
Local	: Local Service (Pulse)
Trunk	: Trunk Service (Call)
International	: International Service (Million Minutes)
Int/MTS	: International Service (Minute) /MTS
N.A.	: Data is not available

where

Y_t :Traffic growth index in year t (indexed by the base year 1987)

S_t :Subscriber growth index in year t (indexed by the base year 1987)

c,d :Constant parameters

The estimated parameters of the equations are shown in Table 10.1.1-2. The statistical test results of the calculation are compiled in APPENDIX.

Table 10.1.1-2   Values of Constant

1)   Local Traffic

$$\ln(Y_t) = A + b \ln(S_t)$$

	A	b
BMA	9.802	0.832
Nakhon Pathom	8.294	0.839
Samut Sakhon	7.260	0.971
Ayutthaya	7.849	0.860

2)   Long distant traffic

$$Y_t = c\, S_t + d$$

	c	d
BMA	1.523	-0.404
Nakhon Pathom	1.181	-0.165
Samut Sakhon	1.964	-0.192
Ayutthaya	1.301	-0.139

3) International traffic

$$Y_t = c\, S_t + d$$

	c	d
Whole Country	2.411	-1.126

After forecasting the values of macro traffic growth indexes in year t, the forecasted index values are transferred into the future traffic volume by using the base year traffic volume (thirty highest days traffic of a year = Fundamental Traffic) as follows:

Forecasted traffic volume in year t = (Forecasted traffic growth index in year t) x

(Base year traffic volume (Fundamental Traffic))

Base year traffic volume (Fundamental Traffic)

= 1.2 x (Measured traffic volume in the base year)

In addition, concerning traffic volume increase induced by new network services, the values in the Master Plan are applied as the basic telephone service traffic volume increase rate. These values are shown in Table 10.1.1-3.

Table 10.1.1-3   Increase Rate Induced by New Network Services to Basic Telephone Service

	1997	2002	2007
Increase Rate Induced by New Network Services	0.01	0.02	0.04

10.1.2   Micro Forecast

Figure 10.1.2 shows the originating calling rate of each switch unit in the BMA measured in 1990. The calling rates are distributed in the rage of 0.02 to 0.09. Basically, the calling rate of a switch unit varies according to the rate of residential subscribers to business subscribers accommodated to the switch because business telephones are used more often than residential telephones.
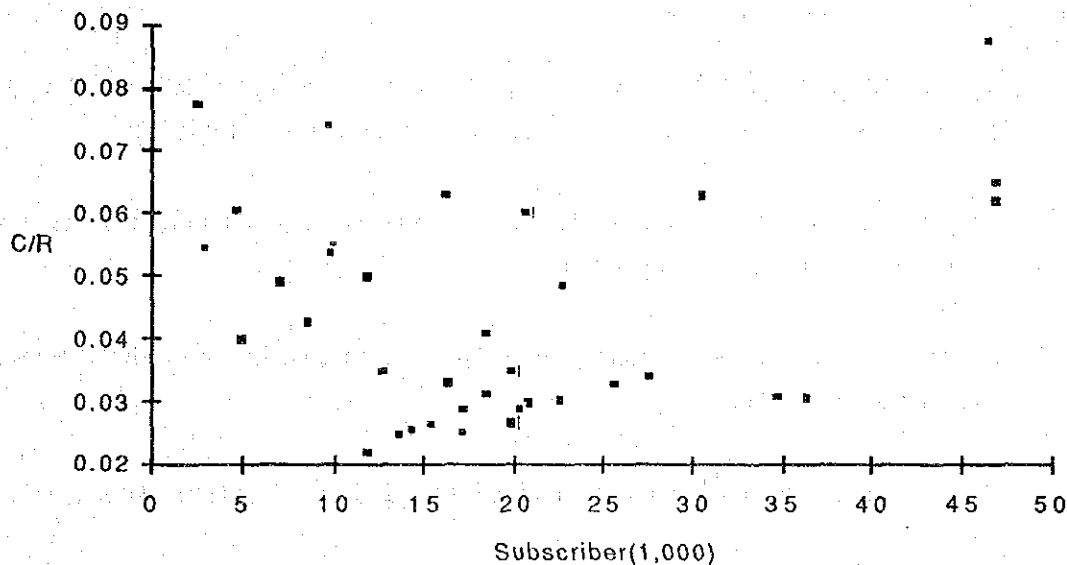
Figure 10.1.2   Distribution of Calling Rate in the BMA in 1990

Considering above mentioned situation, the future traffic volume in each switch unit is estimated based on the calling rate in 1987 of each switch unit and adjusted by the following formula with the macro traffic forecast.

$$Y_{it} = (C/R)_i\ 1987 \times S_{it} \times \frac{Y_t}{\displaystyle\sum_{i=1}^{n} \{(C/R)_i\ 1987 \times S_{it}\}} \quad \text{----------} \quad (9.4)$$

where

Y_{it}	Originating traffic volume of the ith switch unit in year t
$(C/R)_i\ 1987$	Calling rate of the ith switch unit in year 1987
S_{it}	The number of subscribers connected to the ith switch unit in year t
Y_t	Forecasted macro traffic volume of the message area in year t

10.1.3 Calculation of Terminating Traffic

The volume of terminating traffic to a switch unit is calculated by using the terminating to originating traffic volume ratio measured in year 1987.

10.1.4 Creation of Future Traffic Matrix

The forecasting procedure of traffic matrixes between switch units is illustrated in Figure 10.1.4. The future traffic matrixes will be forecasted by the following procedures:

1) Originating traffic volume for each switch unit (for both existing and added) is forecasted by using the subscription demand forecast,

2) Terminating traffic volume for each switch unit is forecasted by using the forecasted originating traffic volume,

3) The base year traffic matrix is expanded and rearranged to add the planned switch units,

4) The future traffic matrixes are forecasted by using the Kruithof's Algorithm with the forecasted originating and terminating traffic volume on the expanded traffic matrix,

5) The future traffic matrixes forecasted in 4) are further rearranged according to the XB switch replacement schedule. It is assumed that the subscriber lines connected to the XB switches which are going to be removed, will be accommodated to the existing TOT's SPC switches collocated in the same office.
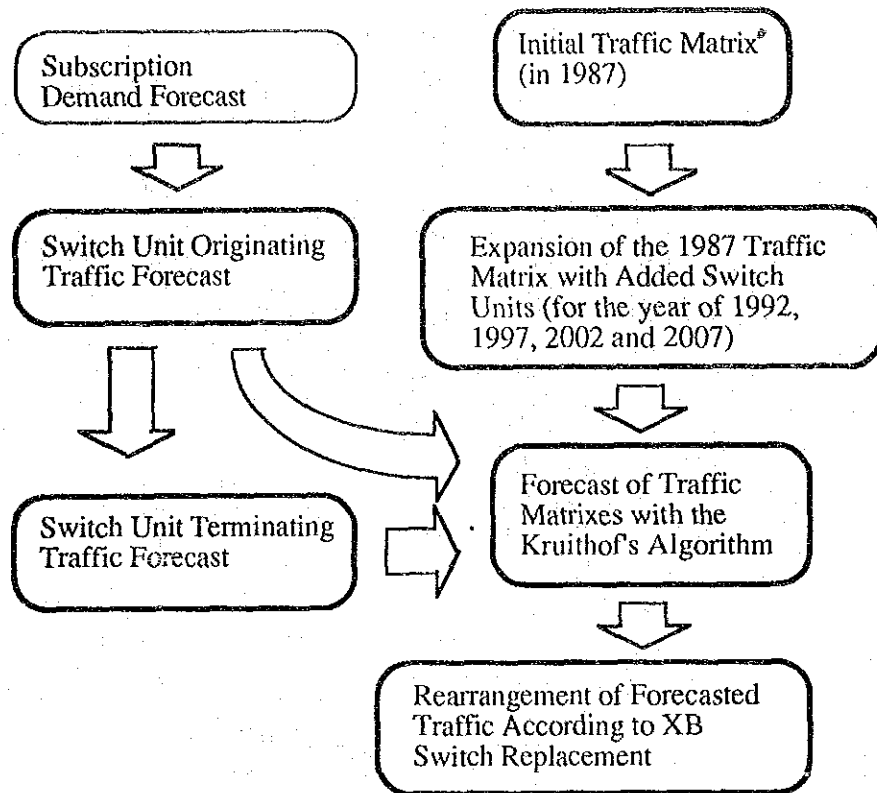
Figure 10.1.4 Traffic Matrix Forecast Procedure

10.2 Result of Traffic Forecast

10.2.1 Result of Macro Forecast

Results of the macro traffic forecast of the message areas are shown in Figure 10.2.1-1 to Figure 10.2.1-4.

Figure 10.2.1-1　Forecasted Result of Originating Traffic (BMA)

Figure 10.2.1-2　Forecasted Result of Originating Traffic (Nakhon Pathon)

Figure 10.2.1-3 Forecasted Result of Originating Traffic (Samut Sakhon)
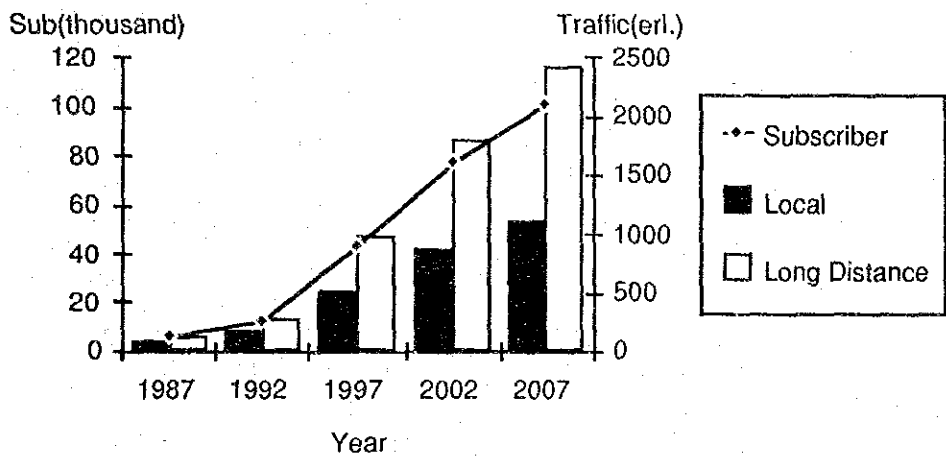
Figure 10.2.1-4 Forecasted Result of Originating Traffic (Ayutthaya)

10.2.2 Forecast of Traffic Matrix for the Planning Years

The results of forecast are shown in ANNEX.

CHAPTER 11

NEW SERVICE INTRODUCTION PLAN

CHAPTER 11   NEW SERVICE INTRODUCTION PLAN

11.1   Marketing Research on Telecommunications Services

11.1.1   Approach

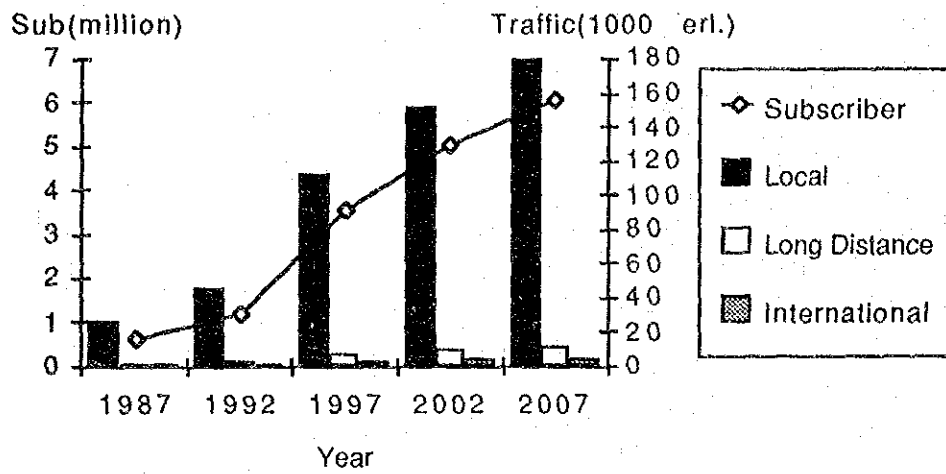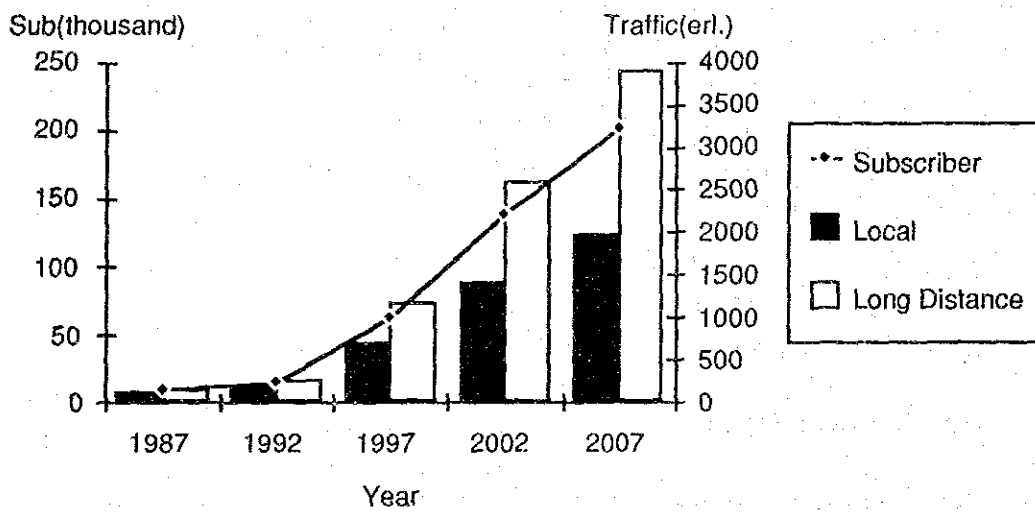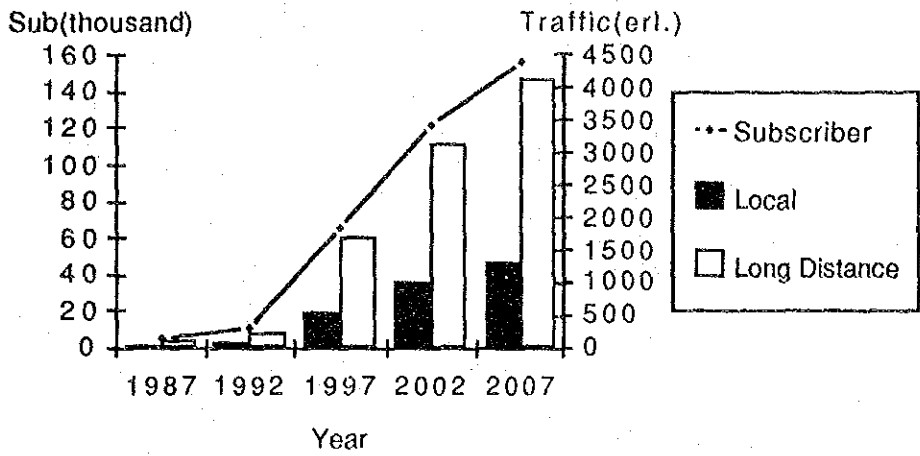In order to obtain the solid and quantified demand forecasts for the new services, a sampling survey was conducted in cooperation with Chulalongkorn University. Through questionnaires the demand structures and forecasts of the new services including the ISDN services were expected to be analyzed.

After a pretest with some establishments was conducted, most of the answers were found to be not satisfactory. This might be because the new services were still unclear to business enterprises. More importantly, the first part of the study, i.e., the questions on the existing telecommunications services seemed very detail. It thus needed not only to provide more time to understand the questions but also to provide more basic and advanced knowledge of the telecommunications market (hereafter called TCM).

With regard to these findings, it was, therefore, decided to give more basic knowledge to the parties involved which were mostly the business enterprises 5 meetings were held within 2 and a half days.

11.1.2   Survey Design

There was only a rough guideline on how many establishments would be involved in the BMA and the Surrounding Areas. Their distribution is shown as follows.

Industry	WHK	ABMA	5 Provinces
Mining and Quarrying	1,036	70	10
Manufacturing	53,622	24,089	5,374
Electricity, Gas and Water Supply	1,129	298	62
Construction	3,650	2,407	119
Wholesale, Retail Trade Restaurants and Hotels	67,088	28,530	2,664
Transport Storage and Communication	4,910	2,480	290
Finance, Insurance and Real Estate	7,001	4,087	241
Business and Public Services	23,959	8,178	1,584
Total	162,395	70,139	10,344

Note: WHK implies whole Kingdom of Thailand, ABMA implies Administrative Bangkok Metropolis Area, "5 Provinces" implies Nonthaburi, Samutprakan, Prathumthani, Samutsakorn, Nakorn Prathom excluding Ayutthaya in the study areas.
Source: Year Book of Labor Statistics, Department of Labor, Ministry of Interior Thailand.

Industry	BMA + 5 Provinces	
Mining and Quarrying	80	0.01%
Manufacturing	29,463	36.61%
Electricity, Gas and Water Supply	360	0.45%
Construction	2,526	3.14%
Wholesale, Retail Trade Restaurants and Hotels	31,194	38.85%
Transport Storage and Communication	2,770	3.44%
Finance, Insurance Real Estate	4,328	5.37%
Business and Public Services	9,762	12.13%
Total	80,483	100%

11.1.3   Achievement of Survey

1)   Summary of Meeting Attendance and Collected Samples

There were 228 representatives of companies and government officials attended the meetings. The classifications are as follows. The detailed data is in ANNEX.

Industry	No. Persons	No. Companies
Banking	38	15
Security	19	12
Insurance	11	8
Transportation & Communication	15	11
Hotel	8	6
Publishing	6	2
Agriculture	12	6
Construction & Property Development	26	13
Government Bureaus	32	18
Trading Firms	29	19
Other Manufacturing	32	21
Total	228	131

2) Summary of Collected Questionnaire

a) Service

Banking	20 companies
Security	20 companies
Insurance	8 companies
Transportation and Communication	14 companies
Hotel	8 companies
Trading Firm	36 companies
Government Organization and Enterprise	11 companies
Hospital	3 companies
Construction and Real Estate	22 companies
Other Service	3 companies
Sub Total	145 companies

b) Non-Services

i)   Agriculture   12 companies

ii)   Manufacturing

Printing and publishing	3 companies
Other Manufacturing	63 companies
Sub Total	66 companies
Grand Total	223 companies

11.1.4   Usage of Existing Telecommunications Services

1)   Ordinary Telephone

The detailed data is in ANNEX.

a)   Allocation of Calls by Calls Type of Destinations

More than 50 percent (approx. 60%) answered that their telephone calls were local compared with long distance (approx. 15-30%) and international calls (approx. 10-15%).

b)   Rank of Calling and Called Party

Most firms expressed that to make a call to and being called from their headquarters and other offices or firms ranked number one in all sectors except the retail sector for which calls were made to and from the wholesale sector.

c)   Purpose of Domestic Calls

The first main purpose of calls are "banking", "contact one's own company" and "make for purchase orders".

The second main purpose of calls are "banking", "sale of products and services", "contact one's own company", "personal and business contacts" and "send product's detail".

The frequency of calls for "sale of product and service" is approximately 114 times per day to Bangkok itself, to Chiangmai, and to Songkhla, the three most frequent destinations.

The frequency of calls for "company contact" is approximately 78 calls a day to Bangkok and Chiangmai.

The frequency of calls for "personal and other business contact" is 60 calls a day to Bangkok, Chonburi and Chachoengsao as the main destinations.

d) Purpose of International Calls

The first priority of calls are "banking procedure", "sale of product and services", "contact company" and "order for purchase".

The frequency of calls for "sale of product and service" is approximately 19 times per day to Japan, Hongkong and U.S.A.

The frequency of calls for "own company contact" is 10 calls a day to Hongkong, Japan and U.S.A.

2) Cellular Mobile Services

The calls made by cellular mobile telephones are generally local calls in both originating and terminating. Its international calls seem to be somewhat lower than ordinary phone calls.

The ranking of call purposes seems to be consistent with the general understanding. That is, calls to headquarters or other offices or firms still rank as the number one purpose.

Domestic calls are mainly for in "sale of products and service", "own company contact" and "order for purchase".

International calls are mainly for "sale of product and service", "own company contact", "order for purchase" and "confirmation of account".

The most frequent domestic use is approximately 21 calls per day to Bangkok, Chiangmai and Chonburi for the purpose of "sale of product and service". The second most frequent domestic use is approximately 17 times a day for the purpose of "own company contact" to Bangkok, Chonburi, Chaingmai and Phuket accordingly.

The international use is approximately 4-5 calls a day to Japan, Singapore, U.S.A., Hongkong and South Korea.

3) Facsimile Communications

Facsimile communications seem quite similar to other service usage patterns. For instance, the manufacturing sector has 58.15, 21.73 and 20.12 percent for domestic calls and 61.14, 20.69 and 18.17 percent for international calls, respectively.

Call destinations seem to be the same as other service usage patterns in general. The headquarters, other offices and firms are still the main destinations.

The main purpose of domestic use for the agriculture and mining sectors is "order for purchase". For the manufacturing sector, they are "sale of product and service", the utilities "contact own company and personal and business contact", the construction sector "sale of product and business and contact own company".

The "sale of product and service" has frequency of 35 calls a day to Bangkok, Chiangmai and Songkhla. The most frequent calls per day is 48 times to Bangkok, Phathum Thani, Chon Buri and Rayong for the purpose of "contact one's own company channel".

Most international calls are made for "sale of product and service", "contact company" and "order for purchase" etc. The most frequent international calls are 13 times per day to Japan, Hongkong and U.S.A.

4) Leased Circuit

The companies apply mostly a point to point method of leased circuit connections. The finance and real estate companies, however, has a point to multi point connections in 66 percent of the leased circuits. The sector which expresses high voice grade service applications is only the utilities. Other sectors show their demand in data transmission applications. The same is for the international leased circuits

"head quarters and other offices" are the number one destinations for every sector. The first priority of the manufacturing sector to use domestic leased circuit is to send "detail of product" while to connect with international circuit is for the purpose of "sale of product and service", "contact own company" and "order for purchase".

The frequency of domestic calls in the category of "banking procedure" is very high compared with other purposes such as "confirm of account", "send product detail" etc.

The frequency of international calls are much lower; however, it is quite impressively high in the case of "own company contact" to U.K., U.S.A and Hongkong.

11.1.5   Usage of Telecommunications Services as Part of Management's Strategies

1)   Average Expenditure of Telecommunications Service as of Total Expenditure

The telecommunications costs of firms in each sector are different. Companies pay 8-10 percent of the total expenditures in the manufacturing (9.11%), construction (10.50%), wholesale (8.0%) and retail trade (8.9%) and finance and real estate (10.08%) sectors. Companies in the agriculture and mining related sectors pay 1.5 percent, while the private and government service sectors pay 3.3 percent of the total expenditures, respectively.

2)   Effectiveness of Telecommunications Service in Enhancing Business Performance

In general, companies are partly convinced that the telecommunications services will enhance their business performances. The most promising areas are "development of new business chance", "enhancement of competition", "increase of sale", and "cost saving" where the telecommunications services will be able to render. The "enhancement of competition" seems to be the result among all other aspects.

3)   Frequency that Companies Contact Employee Working Outside
      (Ref. Table 4-(1) in ANNEX 11)

Companies in the agriculture and utility sectors contact their employees, working outside less than 10 times a day. Companies in the construction, wholesale, retail and restaurant and hotel sectors contact their employees working outside less than 20 times a day. Companies in the manufacturing sector contact 24.34 times a day, transport 24.45 times a day, finance 30.25 times a day and private service contact 25.88 times a day.

4)   Means and Ways of Contact
      (Ref. Table 4-(2) in ANNEX 11)

They contact mostly through the paging services.

5)   Familiarity with Telecommunications Management and Need
      (Ref. Table 5-(1), 5-(2) in ANNEX 11)

Most companies seem to be unaware of the telecommunications management services. The sectors which show significant (answer "yes" more than 50%) needs of the

telecommunications management services are utility, wholesale, restaurant and hotel, transport and finance and real estate sectors.

6) Fields that Telecommunications Manager can be Effective
(Ref. Table 5-(3), 5-(4) in ANNEX 11)

Companies respond that they need managers for establishing efficient engineering systems rather than minimizing expenditures or selecting suitable services or selecting hardwares. However, most of companies do not have telecommunications managers in their companies.

7) Usage of Computer
(Ref. Table 6-(1), (2) in ANNEX 11)

Usually computers help to carry out operations of companies in each sector on average 40-60 percent. Restaurants, hotels and finance companies seem to use computers for 68.3 and 70.6 percent of their operations. Tasks which are carried out by computers are mostly to make calculations and word processing.

8) Improving of Telecommunications Services
(Ref. Table 7-(1), (2) in ANNEX 11)

Most companies answer that they have moderate satisfaction on improvement of telecommunications services recently. Those who are "satisfied", however, point out the following improvement areas. "Telephone can be used at office anytime" is ranked as the number one by the manufacturing, construction and wholesale sectors. Those who would like to "call with one dialing attempt" are companies in the retail and finance sectors.

Those who are "moderately satisfied" and "dissatisfied" complain about "not enough telephones in office" are in the agriculture, finance and private services sectors, "long duration from application to beginning of service" by the manufacturing and utility sectors, "call with many dialing attempts" by the retails and restaurants and hotels and transportation sectors.

9) Local and Long Distance Charges
   (Ref. 7-(4a), (4b) in ANNEX 11)

   Most companies see the local and long distance charges as reasonable. It should be noted, however, that those who answer expensive (although in small percentage) are companies in the agriculture and construction and wholesale sectors.

10) Monthly Charge and Installation Fees
    (Ref. Table 7-(4c), (4d) in ANNEX 11)

    Most companies say that the monthly charge is reasonable. Those who see the installation fee "cheap" are companies in the agriculture, retail trade and restaurant and hotel sectors.

11) Local Call Area Size
    (Ref. Table 7-(e) in ANNEX 11)

    Most companies think that local call area size is reasonable. Some see it small.

12) Billing, Place of Payment
    (Ref. Table 4-(f), 4-(g) in ANNEX 11)

    Companies that see billing "accurate" are in most sectors except the restaurant and hotel sector. In addition, place of payment is more or less convenient, they say.

13) Price of Telephone Set, Facsimile, P(A)BX
    (Ref. Table 4-(h), (j), (k) in ANNEX 11)

    Those who think (although in small percentage) that telephone sets are expensive are companies in the utility, construction, private service and restaurant sectors.

    Companies that consider the facsimile sets "cheap" are in the restaurant and hotel sectors as well as the construction sector. Others consider them cheap or reasonable.

    The price of P(A)BX is considered to be cheap by companies in the retail trade and hotel and restaurant sectors.

14) Attitude on TOT's Service
   (Ref. Table 7-(5), (6) in ANNEX 11)

   Most companies have moderated satisfaction on the TOT services. Those who have strong dissatisfaction are in utility and agriculture sectors.

   Those who express "satisfaction" rank the "kind and polite reception" as their number one are companies in the manufacturing, utility, wholesale trade, finance and private services sectors. The agriculture sector sees that "quick response for repair work" as its number one, while the construction sector sees "applications are accepted at one visit", the restaurant and hotel sector sees that TOT's provision of consulting services is crucial.

   Those who express "moderate satisfaction" and "dissatisfaction" rank "unkind and impolite reception" as their problem are companies in the agriculture sector. The manufacturing and wholesale sectors see that "require several request in installation" as a crucial problem where the utility, restaurant and hotel, transport, private service and construction sectors see that "spontaneous response for repair work" is important. The retail trade sector sees that its complaints and questions are not handled carefully.

15) Discount Services
   (Ref. Table 8-(1), - (20) in ANNEX 11)

   Most companies do not seem to have any interest on "Charging only for services selected by the customer (combination with monthly charge and call charge on the customer's basis)".

   Most companies show partial interest in "Discount rate is raised according to call charge for large user". Companies in the retail trade sector show very high interest. Companies in the agriculture and manufacturing sectors show little interest.

   Most companies show partial interest in "different tariff system either by day or night or according to specified area". Construction and agriculture related companies show very minimal interest.

   Companies show some interest in "lower rates for frequently called numbers". Nonetheless, "call any place in Thailand with fixed charge during specified time" does not interest companies. In addition, quite a few are interested in "back up line being offered at lower charge in case of data transmission services through leased circuits".

With respect to the introduction of a free dial service, most of companies do not express any interest.

16) Special and New Services

Companies' opinions on "facsimile message store and forward service" as well as "virtual network services" are still carefully expressed.

Less than one-third of the companies are interested. It seems that many companies are interested in credit card calls to some extent.

The simple circuit resale or linking public telephone lines with leased circuits between headquarters and branch offices with lower cost also got high favorite responses.

The introduction of "detail charging bill services" and "consulting services" also interested companies in the agriculture, construction and restaurant and hotel sectors.

The introduction of "voice mail service" partially interested companies except in the manufacturing, utilities, construction, wholesale and retail sector.

The introduction of "one stop shopping services" seems to interest companies to small extent. The introduction of the "television and telephone conference service" do not strongly interest companies.

The introduction of "high speed more than 2 Mb/s leased circuit" interested companies in the utility sector.

Concerning the need for information providing services through telephone calls and facsimile, companies in restaurant and hotel and utilities sector show their needs stronger than others. Companies also express no interest in assigning business agency to collect telephone charge except the agriculture and mining sectors.

17) Demand for ISDN services

Most of the companies do not seem to have any interest on ISDN services. There seem three reasons for the responses.

The first reason is that the concept of ISDN services is difficult for ordinary customers to understand because the way digital telephone from an exchange office to a customer's

place is different from that of analog telephone. The second reason is that application services which have remarkable features in comparison with those of ordinary telephone have not been well developed yet.

The third reason is that the tariff system is not clear to customers; therefore, they can not evaluate properly its economic advantages.

11.2   Introduction Plan

11.2.1   Giving a Priority Ranking for Telecommunications Services Area

When considering an introduction plan of new telecommunication services, the exchange office areas must be ranked in order to carry out the construction effectively and to recover the investment cost as early as possible.

1) Data for Analysis

In order to grasp the exchange area characteristics, the analyses were made by using the collected data during the Work in Thailand-1.

a) Growth Rate

i) Revenue Per Line and Growth Ratio

Table 11.2.1-1 shows the revenue per line and the annual growth rates from 1989 to 1990 for the exchange offices. The detailed data is in ANNEX.

From the table, in the BMA, there are 21 exchange offices which made more than 10,000 Baht as the per line revenue in 1990. There are 22 exchange offices which have more than 25% growth rate of the per line revenue from 1989 to 1990.

Five exchange offices, AMARIN PLAZA, MAHBOONKRONG, BANG PHILI-BANG BO, PATHUM WAN and NAWA NAKHON, are in both groups. These exchange offices should be placed in the high priority group.

In the provincial areas, there are only a few profitable exchange offices. One such office is PHARA INTHARACHA. They should be placed in the high priority group as shown in Table 11.2.1-2.

Table 11.2.1 -1　Revenue per Line and Growth Rate in BMA

(Unit: Baht)

Area Code	Exchange Office	1989 Revenue/Line	1990 Revenue/Line	1990/1989 R.L/R/L	Area Code	Exchange Office	1989 Revenue/Line	1990 Revenue/Line	1990/1989 R.L/R/L
1	AMARIN PLAZA	18,707	30,742	1.64	4	INTHAMARA	9,398	9,752	1.70
2	THAI WA	16,371	18,775	1.15	1	AMARIN PLAZA	18,707	30,742	1.64
1	MAH BOONKRONG	13,773	18,632	1.35	1	PATHUM WAN	7,942	12,281	1.55
4	CENTRAL PLAZA	13,916	16,604	1.19	4	LAK SI	5,999	8,788	1.46
3	POM PHRACHOOL	13,150	16,095	1.23	2	PRAVET	6,526	8,863	1.36
2	BANG PHLI-BANG BO	11,373	15,246	1.34	2	NONG CHOK	6,549	8,886	1.36
1	SURAWONG	13,569	15,112	1.11	1	MAH BOONKRONG	13,773	18,632	1.35
2	BANG POO	13,490	14,754	1.09	2	BANG PHLI-BANG BO	11,373	15,246	1.34
1	PHLOEN CHIT	12,413	13,346	1.08	4	NAWA NAKHON	8,960	11,881	1.33
2	KHLONG TOEI	11,638	13,175	1.10	2	KLONG CHAN	6,132	7,244	1.30
1	C.P. Tower	N.A.	12,662	N.A.	4	CHAENG WATTANA	4,640	6,027	1.30
1	PATHUM WAN	10,706	12,281	1.55	3	PHUT THAMONTHON	6,633	8,587	1.29
4	PHAHONYOTHIN	10,114	12,024	1.19	3	EKKA CHAI	5,317	6,845	1.29
4	NAWA NAKHON	8,960	11,881	1.33	2	BANG CHAN	4,701	6,051	1.29
4	BANG BUA THONG	8,962	11,140	1.24	4	RAM INTHRA	4,905	6,256	1.28
1	KRUNG KASEM	11,085	11,104	1.00	4	BANG SU	5,601	7,135	1.27
1	SAMRAN RAT	10,152	11,054	1.09	2	HUA MAK	7,763	9,873	1.27
2	BANG PHLI	8,808	10,875	1.23	2	LAEM THONG	4,054	5,146	1.27
2	PU CHAO SAMINGPHRAI	9,323	10,748	1.15	3	CHARAN SANIT WONG	5,477	6,930	1.27
4	RANG SIT	10,655	10,659	1.00	3	PHRA PRA DAENG	7,740	9,667	1.25
1	SUKUMWIT	10,386	10,370	1.00	4	PAK KRET	4,478	5,592	1.25
					4	LAT PHRAO 2	5,314	6,635	1.25

Table 11.2.1 -2　Revenue per Line and Growth Rate in the Surrounding Area

(Unit: Baht)

Area Code	Exchange Office	1989 Revenue/Line	1990 Revenue/Line	1990/1989 R.L/R/L	Area Code	Exchange Office	1989 Revenue/Line	1990 Revenue/Line	1990/1989 R.L/R/L
35	PHBA IN THABACHA	21,271	21,727	1.02	35	SENA	8,936	10,981	1.23
35	THA RUA	13,568	13,209	0.97	35	BANG PA IN	9,988	11,909	1.19
35	BANG PA IN	9,988	11,909	1.19	35	PHA CHI	5,009	5,626	1.12
35	SENA	8,936	10,981	1.23	35	WANG NOI	8,503	9,375	1.10
35	WANG NOI	8,503	9,375	1.10	35	PHBA IN THABACHA	21,271	21,727	1.02
35	NAKHON LUANG		8,765	N.A	35	THA RUA	13,568	13,209	0.97
35	AYUT THAYA	10,142	8,399	0.83	35	AYUT THAYA	10,142	8,399	0.83
35	PHA CHI	5,009	5,626	1.12					
35	BANG SAI	N.A.	5,598	N.A					
35	BAN PHRAEK	5,450	5,554	N.A					
35	BANG BAN	N.A.	4,784	N.A					
35									
34	KRA THUM BAEN	11,569	11,654	1.01	34	KRA THUM BAEN	11,569	11,654	1.01
34	SAMUT SAKHON	10,147	10,562	1.04	34	SAMUT SAKHON	10,147	10,562	1.04
34	BAN PHAEO	8,509	4,086	0.48	34	BAN PHAEO	8,509	4,086	0.48
34	NAKHON PATHOM	8,591	8,072	0.94	34	NAKHON PATHOM	8,591	8,072	0.94
34	SAM PHRAN	10,852	9,969	0.92	34	SAM PHRAN	10,852	9,969	0.92
34	NAKHON CHASI	8,951	9,039	1.01	34	NAKHON CHASI	8,951	9,039	1.01
34	KAMPHAENG SAEM	8,777	10,234	1.17	34	KAMPHAENG SAEM	8,777	10,234	1.17

Note:　1) BANG SAI includes BANG SYE and LAT BUA LUANG.
　　　　2) BANG BAN includes PHAK HAI.
　　　　3) NAKHONLUANG includes UTHAI.
　　　　4) BAN PHRAEK includes BANG PAHAN and MAHA RAT.

ii)　Number of Subscribers

The growth rate of the subscribers should be seriously considered in judging the area ranking.

Although there have been many waiting applicants in the Study Area, the construction of the telephone lines have been limited by the project budgets. Hence, the past growth rates do not reflect the actual growth potentials. Therefore, this item was deleted in this study.

b) Leased Circuit

The number of leased circuits as of June, 1991 in each exchange office, which has more than 30 lines, is shown in Table 11.2.1-3. Although the data is by the contract basis of the leased circuits, its direction is unclear. However, the data reveals that the use of the least circuits are considered in the company headquarters.

From Table 11.2.1-3, the Metropolitan area 1 is the most company headquarters concentrated area. Their private networks expand from the Metropolitan 1 area to other Metropolitan areas and the provincial areas.

Table 11.2.1-3   Number of Leased Circuits Classified by Exchange Office Basis

AREA CODE	OFFICE NAME	No. of Lines	AREA CODE	OFFICE NAME	No. of Lines
1	PHLOEN CHIT	2,020	1	PHLOEN CHIT	2,020
1	SURAWONG	751	1	SURAWONG	751
1	KRUNG KASEM	615	1	KRUNG KASEM	615
4	PHAHONYOTHIN	471	1	SAMRAN RAT	446
1	SAMRAN RAT	446	1	ASOK DIN DAENG	217
4	LAT PHRAO 1	234	1	SUKUMWIT	83
1	ASOK DIN DAENG	217	1	SAMSEN	71
2	THUNG MAHAMEK	139	1	PATHUM WAN	43
1	SUKUMWIT	83	2	THUNG MAHAMEK	139
3	LAT YA	77	2	PHRA KHANONG	65
1	SAMSEN	71	2	CHAIYAPHRUK	64
2	PHRA KHANONG	65	2	HUA MAK	62
2	CHAIYAPHRUK	64	2	TROK CHAN	56
2	HUA MAK	62	2	THON BURI	45
2	TROK CHAN	56	2	SATHU PRADIT	37
4	BANG SU	46	3	LAT YA	77
2	THON BURI	45	3	PHRA PRA DAENG	32
1	PATHUM WAN	43	3	BANG PHLAD	31
4	LAK SI	43	4	PHAHONYOTHIN	471
2	SATHU PRADIT	37	4	LAT PHRAO 1	234
3	PHRA PRA DAENG	32	4	BANG SU	46
3	BANG PHLAD	31	4	LAK SI	43

Source: TOT Maintenance Report, Jun., 1991

c) Facsimile Service

The number of facsimile terminals can be taken as a parameter for classifying the telecommunication areas.

Table 11.2.1-4 indicates the number of facsimile terminal sets based on the 1989 telephone directory which was issued by AT&T in Thailand. The directory does not seem to cover all facsimile terminals in the BMA. However, in order to analyze the area characteristics, it seems sufficient.

Table 11.2.1-4   Number of Facsimile Terminal Sets in BMA

Area Code	Office Name	No.of FAX	Area Total No. of FAX	Area Code	Office Name	No.of FAX	Area Total No. of FAX
1	SURAWONG	1,024		3	EKKA CHAI	109	
1	PHLOEN CHIT	751		3	LAT YA	106	
1	SAMRAN RAT	644		3	BANG PHLAD	93	
1	SUKUMWIT	326		3	NONG KHAEM	86	
1	PATHUM WAN	198		3	PHRA PRA DAENG	80	
1	ASOK DIN DAENG	169		3	DAO KANONG	73	
1	KRUNG KASEM	168		3	RAT BURANA	69	
1	SAMSEN	33		3	PHASI CHAROEN	44	
1	AMARIN PLAZA	27	Area 1	3	BANG KHAE	40	
1	MAH BOONKRONG	3	3,343	3	CHARAN SANIT WONG	30	
2	CHAIYAPHRUK	283		3	MUBAN SETTHAKIT	28	
2	KHLONG TOEI	159		3	POM PHRACHOOL	16	Area 3
2	BANG NA	158		3	PHUT THAMONTHON	4	778
2	SATHU PRADIT	150		4	LAT PHRAO	167	
2	HUA MAK	142		4	PHAHONYOTHIN	162	
2	PU CHAO SAMINGPHRAI	139		4	INTHAMARA	74	
2	THUNG MAHAMEK	120		4	NAWA NAKHON	72	
2	TROK CHAN	119		4	LAK SI	60	
2	PHRA KHANONG	95		4	DON MUANG	56	
2	THANON TOK	76		4	BANG SU	55	
2	KLONG CHAN	69		4	BANG KHEN	53	
2	SAMUT PRAKAN	59		4	NGAM WONG NAN	38	
2	BANG PHLI	57		4	PATHUM THANI	24	
2	ON NUT	50		4	RAM INTHRA	20	
2	BANG POO	46		4	CHAENG WATTANA	19	
2	THON BURI	42		4	RANG SIT	18	
2	BANG CHAN	40		4	NON THABURI	13	
2	LAD KRABANG	40		4	SIKAN	11	
2	THAI WA	23		4	CENTRAL PLAZA	8	
2	BANG PHLI-BANG BO	17		4	THANYA BURI	3	
2	TROK CHAN	16		4	MUANG EK	2	Area
2	PRAVET	13		4	SIAM CEMENT	5	860
2	NONG CHOK	3			Total		6,901
2	PHRUK SACHAT	3	Area 2				
2	LAEM THONG	1	1,920				

d) Company Location

The company type seems to be one of the practical parameters for classifying the telecommunication areas. The number and the business categories of companies based on the telephone directory which will use the advanced telecommunication services such as the ISDN services are listed in Table 11.2.1-5.

Table 11.2.1-5 Number and Business Categories of Companies in the BMA

Area Code	Office Name	Insurance	Bank& Finance	Press	Hotel	Area Code	Office Name	Insurance	Bank& Finance	Press	Hotel
1	SURAWONG	138	103	27	16	3	RAT BURANA	2	1		
1	PHLOEN CHIT	55	104	11	18	2	SATHU PRADIT	2			
1	SAMRAN RAT	53	99	32	2	4	BANG KHEN	2	2	4	
3	PHAHONYOTHIN	14	14	13	2	4	BANG SU	2			
1	KRUNG KASEM	12	7	20	2	1	AMARIN PLAZA		2		
1	ASOK DIN DAENG	10	12	16	2	3	CHARAN SANIT WONG	1		1	
3	DAO KANONG	10		1		2	LAT KRABANG	1			
4	LAT PHRAO	9	2	12		3	NONG KHAEM	1		2	
3	BANG PHLAT	8	2	15		3	PHASI CHAROEN	1		1	
2	HUA MAK	6	9	5	2	2	PHRA KHANONG	1	2	1	
1	PATHUM WAN	6	12	6	1	2	THON BURI	1			
2	BANG NA	5	2	1		2	THUNG MAHAMEK	1	6	3	
3	LAT YA	5	2	4		3	BANG BUA THONG	1			
4	NON THABURI	5		3		4	CENTRAL PLAZA				1
1	CHAIYAPHRUK	4	4	7		3	DAO KANONG			1	
4	DON MUANG	4			1	3	EKKA CHAI			1	
4	INTHAMARA	4	1	1		4	LAK SI			3	
3	PHRA PRA DAENG	3	1	1		1	MAH BOONKRONG				
4	RAM INTHRA	3	1			4	MUANG EK			1	
2	SAMUT PRAKAN	3	2	1		3	MUBAN SETTHAKIT			1	
1	SUKHUMWIT	3	16	3	4	2	ON NUT		1	2	
4	PATHUM THANI	3		1		3	PHANURANGSI			1	
4	PAK KRET	3				1	SAMSEN		1	2	
4	BANG SU	3		2		2	THAI WA		2		
4	NGAM WONG NAN	3	2	3		2	THANON TOK			1	
3	BANG KHAE	2	3	2		2	TROK CHAN		3	2	
2	KHLONG TOEI	2	3	4		2	NONG CHOK		1		
2	KLONG CHAN	2	3	2		4	SIKAN		2		
2	PU CHAO SAMING PHI	2	2	1		4	THANYA BURI			1	

2) Giving a Priority Ranking to Exchange Offices

Scores to determine the priority ranking to introduce new telecommunication services were given to the exchange offices according to the following criterion in each category based on the data described in 10.2.1. The detailed data is in ANNEX 11.

a)   Revenue per Line

Criterion	Score
more than 15,000 Baht	10
1,200 to 15,000	8
9,000 to 11,999	6
5,000 to 8,999	4
less than 5,000	2

b)   Growth Rate of Revenue per Line

Criterion	Score
more than 1.5 Baht	10
1.25 to 1.5	8
1.1 to 1.24	6
1.00 to 1.09	4
less than 1.0	2

c)   Number of Leased Circuit

Criterion	Score
more than 11,000 lines	10
600 to 1000	9
400 to 599	8
200 to 399	6
100 to 199	4
less than 100	2

d)   Number of Facsimile Terminal Sets

Criterion	Score
more than 11,000 sets	10
500 to 1,000	8
300 to 499	6
100 to 299	4
less than 100	2

e)   Number of Companies

Criterion			Score
more than 150 companies			10
	100	to 150	8
	50	to 99	6
	30	to 49	4
	10	to 29	2
less than 100			1

3)   Result of Analysis

As a result of the analysis mentioned above, the exchange offices were classified by the scores according to each criterion. Table 11.2.1-6 lists the ranking of the exchange office areas to make an introduction plan for the new telecommunication services.

In addition, the locations of these exchange offices are shown in Figure 11.2.2. The figure also shows the locations of banks, hotels, department stores, broadcasting companies, high buildings, etc. Figure 11.2.1 shows the locations of the second highest priority exchange offices.

Table 11.2.1-6   Ranking of Exchange Offices

| Priority Order	Name of Exchange
Highest Priority Office Areas	SURAWONG, PHLOEN CHIT, SAMRAN RAT, PHAHOYOTIN, AMARIN PLAZA, ASOK DIN DAENG, CENTRAL PLAZA, KRUNG KASEM, PATHUM WAN, KHLONG TOEI, THAI WA
The second Highest Priority Office Areas	MAH BOONKRONG, SATHU PRADIT, BANG PLI-BANG BO, POM PHARACHOOL, PU CHAO SAMINGHARA, BANG PHLI, BANG POO, CHAIYA PHRUK, HUA MUK, LAT PHARAO 1, SUKUMWIT, THUNG MAHAMEK
The Third Highest Priority Office Areas	CHARAN SANIT WONG, EKA CHAI, TROK CHAN and other 17 Exchange Areas
The Fourth Priority Office Areas	BANGNA and other 25 exchange areas
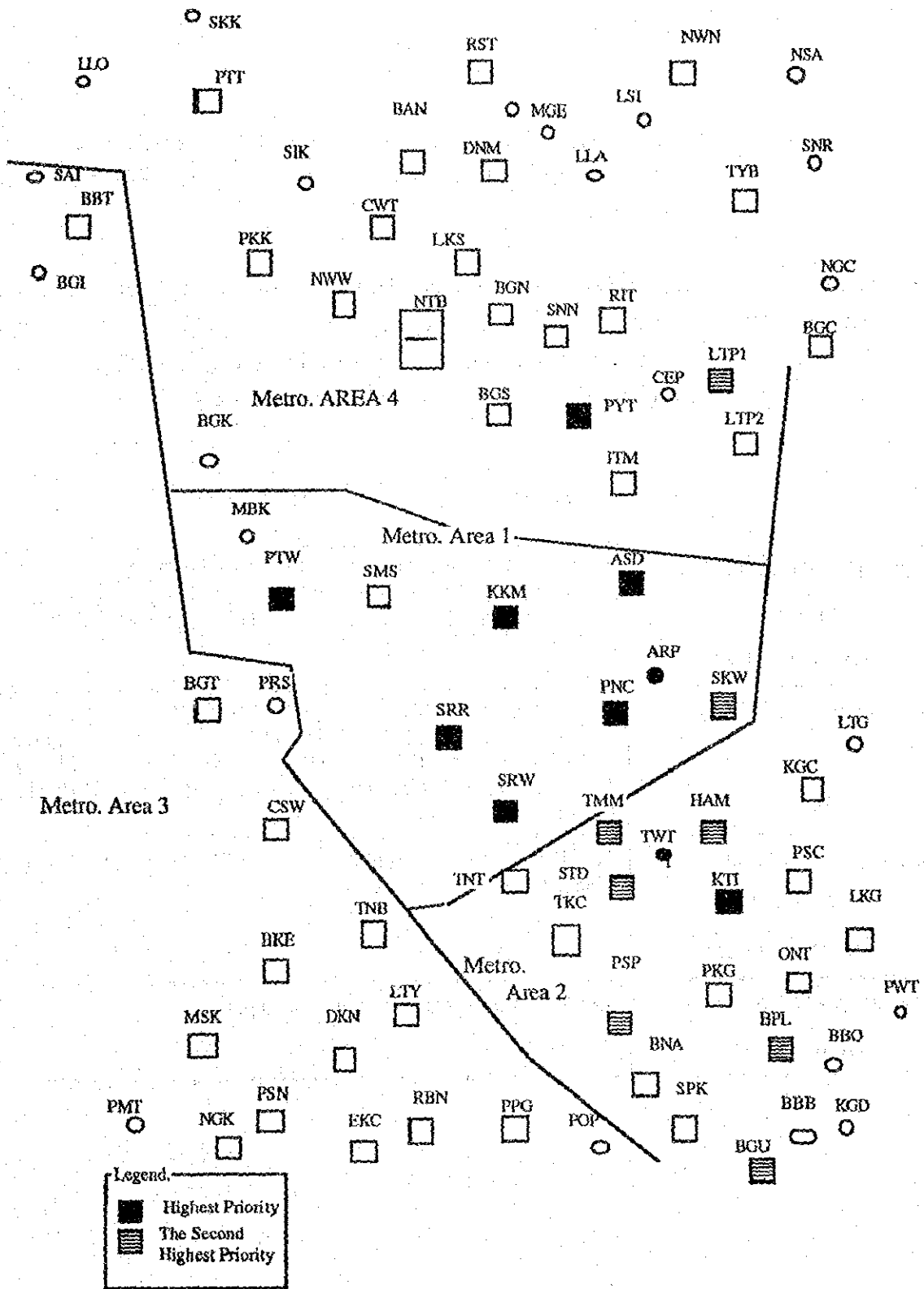
Figure 11.2.1   Locations of Highest and 2nd Highest Priority Exchange Offices

11.2.2 Introduction Plan

1) ISDN Services

The demand forecast is described in Chapter 8. Figure 11.2.2 shows the exchange offices where the ISDN services will be offered in the beginning of 1992. The ISDN services are introduced according to Table 11.2.2.

The lower and upper figures in the boxes are the number of financial companies and banks and the number of ISDN services in demand, respectively. The other financial business entities besides banks and financial companies should be considered; however, in this study the demand was forecasted for banks and financial companies.

Table 11.2.2   Ranking of Exchange Offices for Introduction of ISDN

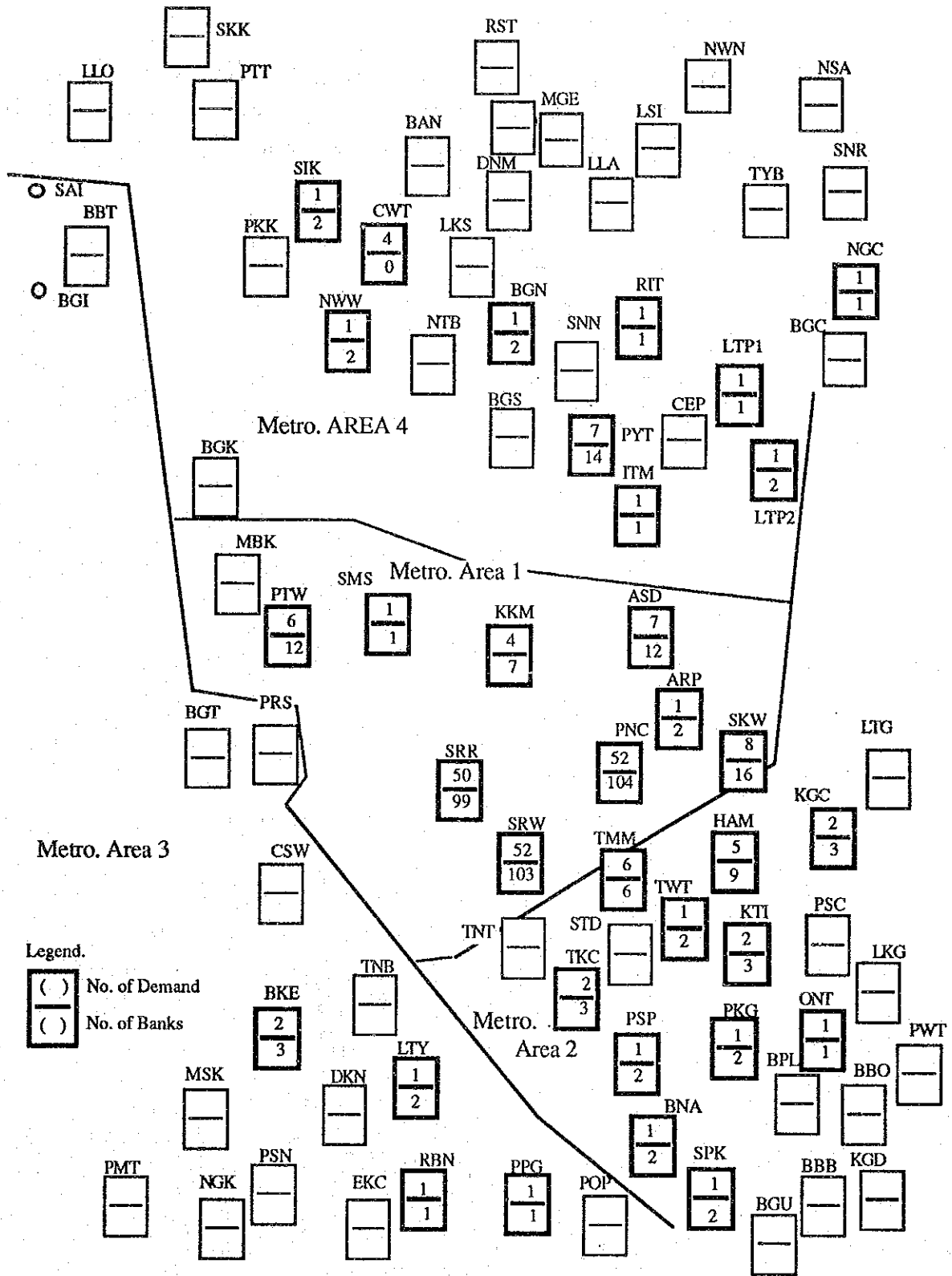| Higher Priority Office Areas Phase -1 (1993 ~ 1997)	SURAWONG, PHLOEN CHIT, SAMRAN RAT, PHAHOYOTIN, AMARIN PLAZA, ASOK DIN DAENG, CENTRAL PLAZA, KRUNG KASEM, PATHUM WAN, KHLONG TOEI, THAI WA
High Priority Office Areas Phase-2 (1998 ~ 2002)	MAH BOONKRONG, SATHU PRADIT, BANG PLI-BANG BO, POM PHARACHOOL, PU CHAO SAMINGHARA, BANG PHLI, BANG POO, CHAIYA PHRUK, HUA MUK, LAT PHARAO 1, SUKUMWIT, THUNG MAHAMEK
Ordinary Office Areas Phase-3 (2003 ~ 2007)	CHARAN SANIT WONG, EKA CHAI, TROK CHAN and other 17 Exchange Areas
Low priority Office Areas (After 2007)	BANA NA and other 25 exchange areas

Metro. AREA 4

Metro. Area 1

Metro. Area 3

Metro. Area 2

SKK
LLO
PTT
SAI
BBT
BGI

RST
NWN
NSA
MGE
BAN
LSI
DNM
LLA
SNR
TYB

SIK — 1/2
PKK
CWT — 4/0
LKS
BGN — 1/2
SNN
RIT — 1/1
NGC — 1/1
BGC

NWW — 1/2
NTB
BGS
PYT
CEP
LTP1 — 1/1
LTP2 — 1/2

BGK

ITM — 1/1

MBK
SMS
PTW — 6/12
KKM — 4/7
ASD — 7/12
SRR — 7/14

BGT
PRS
ARP — 1/2
SKW — 8/16
LTG

CSW
SRR — 50/99
PNC — 52/104
KGC — 2/3

Legend.
( ) No. of Demand
( ) No. of Banks

SRW — 52/103
TMM — 6/6
HAM — 5/9
STD
TWT — 1/2
KTI — 2/3
PSC

TNT
TKC — 2/3
LKG

BKE — 2/3
TNB
PSP — 1/2
PKG — 1/2
ONT — 1/1
BPL
BBO
PWT

MSK
DKN
LTY — 1/2
BNA — 1/2
SPK — 1/2

PMT
NGK
PSN
EKC
RBN — 1/1
PPG — 1/1
POP
BGU
BBB
KGD

Figure 11.2.2 ISDN Demand at an Initial Stage

11 - 21

2) Voice Message Service

This service can be provided by using the existing network facilities. The central
facility to store voice messages is needed. The central facility can be located in any
place; therefore, TOT can start offering the service anytime.