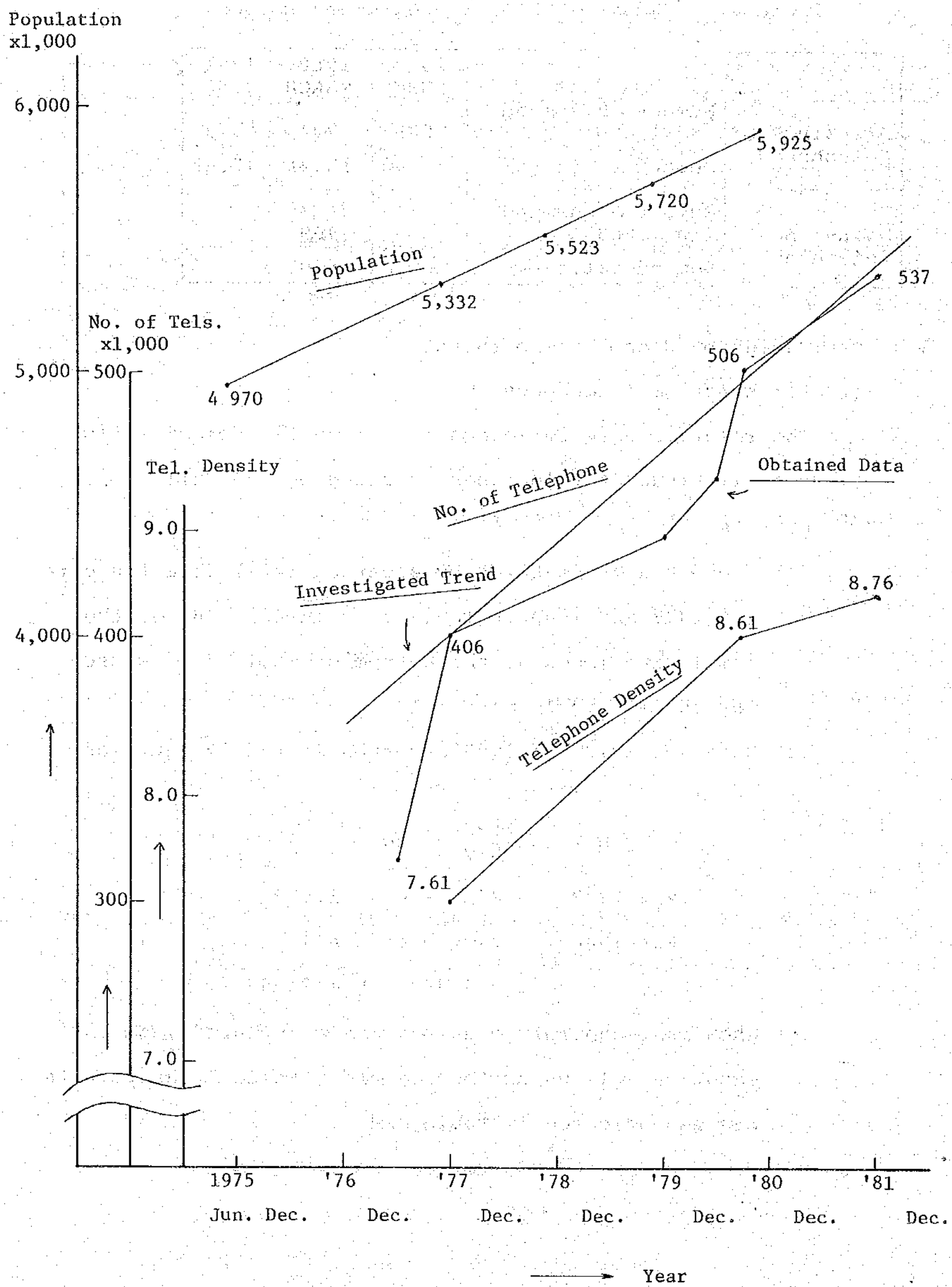

Fig. 4.1 Population and No. of Telephones, Telephone Density

Table 4.3 Number of Demand and Demand Ratios

Year		1977 JUNE	1980 MARCH	1981 JUNE
All kinds of telephones	Number of demand (in 1,000)	589	734	779
	Demand ratio (%)	11.03	12.48	12.69
Main-line telephones	Number of demand (in 1,000)		409	
	Demand ratio (%)		6.90	

4.3 Estimation by Economic Growth Rate

(1) All kinds of Telephones

The relation between income level and the demand ratio for all kinds of telephones is found by the following process.

(a) α and β are estimated by equation (4.2) from the data for 1977 and 1980 in Table 4.1 and 4.2. Here, the cumulative index at the bottom of Table 4.1 is used for the income level.

(b) Data for 1977 and 1980 are substituted in equation (4.2)

$$\alpha x - b = \log \frac{y}{K-y} = \log \frac{y}{0.75 - y}$$

For 1977 $\quad 0.852\alpha - b = -1.758$

For 1980 $\quad 1.0\alpha - b = -1.611$

$$\alpha = 0.993 \qquad b = 2.604$$

(c) When past and future values are calculated from equation 4.1, using these α and b values, the results are as indicated in Table 4.4.

Table 4.4 Logistic Estimation by Economic Growth (June Values)

		1977	1980	1981	1986	1990	2000
All kinds of telephones	Demand ratio (%)	11.03	12.48[1]	12.76	15.12	18.14	32.15
	Number of Demand (in 1000)	589	734	782	1,089	1,478	3,494
Main-line telephones	Demand ratio (%)		6.90	7.06	8.42	10.19	18.78
	Number of demand (in 1000)		409	433	607	830	2,041

1) As of March

2) As of May

(2) Main-Line Telephones

α and b cannot be estimated for main-line telephones as estimated for all kinds of telephones since there is only one set of data for main-line telephones. If, for the present, α obtained for all kinds of telephones is used for main-line telephones, be for main-line telephones can be obtained from 1980 data.

Similar to all kinds of telephones,

$$0.993 - b = -1.832 \text{ for } 1980$$

$$b = 2.825$$

Results of calculations for main-line telephones by α = 0.993 and b = 2.825 are also shown in Table 4.4.

4.4 Time Series Estimation Using Actual Data

(1) All Kinds of Telephones

If the last two digits of the year are used as a time unit, equation 4.2 using data from '77 and '80 is as indicated below and α and b can be calculated.

$$77\alpha - b = -1.758$$

$$80\alpha - b = -1.611$$

$\alpha = 0.049 \quad b = 5.531$

Data for '81 also can be used. So an estimation using three sets of data is statistically more correct but, in this case, the value of α clearly is smaller than 0.049. As described in the next paragraph, the pace of growth of α = 0.049 is considered to be too slow. Therefore, study in the direction of smaller values of α is, in practice, meaningless. Here the results of calculation by α = 0.049 and b = 5.531 are tentatively shown in Table 4.5.

Table 4.5 Logistic Estimation Using Actual Time Series

Year		1977	1980	1981	1986	1990	2000
All kinds of telephones	Demand ratio (%)	11.03	12.48	13.00	15.85	18.44	26.05
	Number of demand (in 1000)	589	734	797	1,142	1,502	2,831
Main-line telephones	Demand ratio		6.90	7.20	8.84	10.36	14.95
	Number of demand (in 1000)		409	441	640	844	1,625

(2) Main line Telephones

If b is calculated for main-line telephones from 1980 data, using α = 0.049 as in the above,

$3.92 - b = -1.832 \quad b = 5.752$

Estimated values by α = 0.047 and b = 5.752 are also shown in Table 4.5.

4.5 Time Series Estimation Using Analogy of Growth Rate

(1) Here, let us define the growth period as the period for 5% to 95% of the limit value. With the logistic curve for time:

$$\frac{K}{1+e^{-\alpha++b}}$$

$$y = \frac{K}{1+e^{-\alpha t+b}} \quad \ldots\ldots \quad (4.3)$$

corresponding α to a growth period of a year is

$\alpha = 5.8889$

Taking the ratio of this α (=5.889) to α (=0.049) in the preceding paragraph (4.4), the growth period becomes 120 years.

A growth period of 120 years is intuitively too long. In Japan, the growth period in this sense was, as a whole, about 30 years - though with considerable difference between business and residential telephones and with the impact of rapid economic growth.

The state of supply and demand in NCR may have something to do with how the small α with a growth period of 120 years was obtained. Also, there is a problem with the assumption that the ratio of pending applications in 1977 was the same as that in 1981.

(2) Supposing that the ratio of pending applications in 1977 was half compared with 1981, demand in 1977 was 497,000 and the demand ratio was 9.33%. If α is calculated under these conditions, the following is obtained:

For 1977 $77\alpha - b = -1.951$

For 1981 $81\alpha - b = 1.5913$

$\alpha = 0.0899 \quad b = 8.8732$

The growth period in this case is about 65 years.

The above growth period cannot be used, because it is not clear what the ratio of pending applications in 1977 was. However, it will serve to show the danger of using $\alpha = 0.049$.

We referred to the rapid growth of the economy as the background of the Japanese growth period of 30 years. During the period (1953-1972), the per-capita GNP growth rate was in excess of 8%. The future per-capita economic growth in the Philippines is expected to be about half this level (4.3%) during the period of 1980 to 2000. The Japanese growth period of about 30 years shown here is for all Japan and the growth period in Tokyo with the great importance of business telephones is somewhat longer.

(3) From the above point of view, about 70 years is believed to be reasonable as the growth period of telephones in NCR on the condition that hereafter efforts will be stepped up for the diffusion of telephones.

If the growth period is 70 years, $\alpha = 0.0841$. Using 1981 with a known ratio of pending applications as the standard, b for all kinds of telephones is:

$$81 \times 0.0841 - b = -1.5913 \quad b = 8.4034$$

For main-line telephones for which only 1980 data can be used,

$$80 \times 0.0841 - b = -1.832 \quad b = 8.560$$

Estimated values based on these results are shown in Table 4.6.

Table 4.6 Estimation Using Analogy of Growth Rate

Year		1977	1980	1981	1986	1990	2000
All kinds of telephones	Demand ratio (%)	9.53	11.83	12.69	17.75	22.70	37.62
	Number of demand (in 1,000)	508	701	778	1,279	1,849	4,089
Main-line telephones	Demand ratio (%)	5.53	6.90	7.42	10.48	13.54	23.13
	Number of demand (in 1,000)	295	409	455	755	1,103	2,514

In this method of estimating, actual data earlier than 1979 are not directly used. Rather, importance is attached to analogy with growth in foreign countries including Japan. This means that the basis of estimation is not, indeed, strong. Notwithstanding, estimated values by this method must, for the present, be used as forcast values for NCR since the estimates in Paragraphs 4.3 and 4.4 are considered to be too small.

5. Microscopic Forecasting for Cities/Municipalities

5.1 General

(1) In the macroscopic forecasting in Paragraphs 3 and 4, expressed demand was directly forecast. But in microscopic forecasting separately for cities and municipalities, the object of forecasting is not expressed demand but potential demand. In other words, the expressed demand expected when service of the prescribed level is provided, regardless of how service is actually provided, is the object of forecasting. Therefore, the value reached by adding microscopic potential demand in all areas naturally must exceed the national total figure for macroscopic demand. The difference between the total of microscopic values and the macroscopic value is large in proportion, since the difference between the prescribed service level, which is a condition of forecasting, and the real service is large. So, the difference between the total of microscopic values and the macroscopic value is large in proportion to the proximity of time intervals.

(2) The basic principle of the forecasting method was generally explained in Paragraph 1. First, basic demand used as potential demand is estimated and the future value is calculated by multiplying it by the magnifying power.

5.2 Basic Demand

The telephone penetration ratios in cities and municipalities in the rural areas of the Philippines are still fairly low. So, most of the present telephone demand in these areas is considered to be for business use. Under these circumstances, the social units for residential telephones can be ignored and only the social units for business telephones must be regarded as a proportional factor in telephone demand by city or municipality.

5.1.1 All Kinds of Telephones

(1) Regression Equation for Basic Demand

We calculated basic demand in 1981 for the following four divisions after studying statistics concerning the number of telephone subscriptions by cities and municipalities in Regions I~V.

Equation [A] $y_i = 2 \ S_i$ ..... (5.1)

Equation [B] $y_i = 1.5 \ S_i$ ..... (5.2)

Equation [C] $y_i = 0.135X_i - 0.078$ ..... (5.3)

Equation [D] $y_i = 0.27X_i - 0.156$ ..... (5.4)

$$y_i = \frac{\text{basic demand in city/municipality "i" (1981)}}{\text{population of city/municipality "i" (1981}} \times 100(\%)$$

$$x_i = \frac{\text{average number of workers in business establishments in city/municipality "i" (1975, basis: working place)}}{\text{population of city/municipality "i" (1981)}} \times 100\ (\%)$$

$$S_i = \frac{\text{number of existing telephones (1981) in city/municipality "i"}}{\text{population of city/municipality "i"}} \times 100\ (\%)$$

But the minimum value for all kinds of telephones is 13.

(2) Application of the equations

The application of each is according to the following:

(i) Equation [A] $y=2S$

a) City/municipality already provided with telephone service. Data are reliable in estimating demand and have been used for the analysis of regression equations. (See Table 5.1)

b) City/municipality already provided with telephone service. Not used for the analysis of regression equations but applying equation [A] is considered reasonable. (See Table 5.2)

(ii) Equation [B] $y=1.5S$

City/municipality already provided with telephone service. High per-worker penetration ratio (more than 0.2). (See Table 5.3)

(iii) Equation [C] $y=0.135X-0.078$

City/municipality already provided with telephone service. Low per-worker penetration ratio (less than 0.06). (See Table 5.4)

(iv) Equation [D] $y=0.27X-0.156$

a) City/municipality still without telephone service.

b) In city/municipality already provided with telephone service, number of existing telephones is practically very difficult to estimate separately for such reasons as extension service to several municipalities.

c) In city/municipality already provided with telephone service, number of subscribers either has not increased or has decreased during the past several years. (See Table 5.5)

d) In city/municipality for which telephone service has recently been started, telephone supply situation is not yet steady. (See Table 5.5)

5.1.2 Main Line Telephones

The number of main line telephones is calculated by dividing the number of all kinds of telephones for each city/municipality by the following ratio between all telephones and main-line telephones. The minimum value for main-line telephones is 10.

a) Baguio City, Angeles City 1.54
b) Other cities/municipalities 1.25

(Number of telephones in 1980)

	Total	NCR	6 Cities 3)	Other Area
All kinds of telephones 2)	695,162	506,128	68,002	121,032
Main-line telephones 1)	422,778	282,141	44,063	96,574
All telephones/ Main-line telephones	1.644	1.794	1.543	1.253

1) MOTC Guideline, as of May 1980

2) NTC statistics, as of June 1980

3) Baguio City, Iloilo City, Bacolod City, Cebu City, Davao City, Cagayan de Oro City.

5.1.3 Basis of Calculations for Regression Equation

(1) Analysis for Regression Factors

In examining regression equations, we studied the effects of the following factors in addition to the number of workers:

o Rate of population increase

- o Telephone service operating undertakings (PLDT, BUTEL, etc.)
- o Population of the city/municipality
- o Rank of the City/municipality

With the exception of certain large cities, these factors seemed unlikely to seriously affect the estimates of basic demand.

(a) Factors concerning incomes are not directly included in this analysis but, if the effects of income factors are great, they should be indirectly detected as something included in the effects of city ranking or city scale. (City ranks are decided paying much attention to income factors. Further, generally the income level is high in proportion to the size of cities.) In simultaneous analysis, including workers, city ranks, city scales and undertakings, no particularly significant effects appear.

(b) This does not, of course, mean that these factors have no effect. It merely indicates that the effects of establishment workers are particularly clear and that, because the number of workers is rather closely related to incomes and the scale of cities, in a multi-regression estimation where the number of workers is included among the explanatory factors, the accuracy of estimation will improve very little even if those factors are added to the explanatory variables.

(2) Equation [A] ... for city/municipality already provided with telephone service

No statistics have been recorded for pending applications in cities and municipalities in general. Nor is there any statistical data for estimating latent demand based on poor service. So, potential demand for cities and municipalities in general cannot be statistically determined. In consideration of demand trends in constructing or expanding Japanese telephone offices, we decide on equation [A] (y=2S).

(3) Equation [B] ... for city and municipality already provided with telephone service

Ordinary cities and municipalities are the main object of a equation [A].

Equation [A] cannot be applied to

(a) NCR and the six large cities (Baguio, Iloilo, Bacolod, Cebu, Davao and Cagayan de Oro)

(b) The large cities with a high s/x ratio to which PLDT has long since provided service

Table 5-3 shows these cities and municipalities for which special actions are taken.

For a number of reasons, service in these cities and municipalities is believed to be more substantial than in other cities and municipalities. It seems, therefore, that for these areas the present number of telephones plus pending applications and some latent demand is sufficient as potential demand.

Equation [B](y=1.5S) was employed for these areas by referring to the ratio of pending applications in NCR where service is particularly substantial.

(4) Equation [C] ... for city and municipality already

provided with telephone service

Equation [D] ... mainly for city and municipality still without telephone service

(a) In Regions I to V - excluding NCR - there are in 1981 about 120 areas with telephone service. But it is unwise to use for the estimation of regression equations data in areas with a particularly poor telephone supply situation, areas of which the statistical values concerning the number of telephones cannot be directly used due to the recent start of service or areas in which the conditions of service may greatly differ from those in other areas. Data for 45 areas were used for the estimation of regression equations after leaving out other areas that were ineligible due to this consideration. The names of the 45 areas are shown in Table 5-1.

(b) Equation [D] (y=0.135X-0.078) is calculated by the rectilinear regression between the number of all kinds of telephones in 1981 and the average number of establishment workers in 1975 at 45 exchanges as mentioned above. Fig. 5.1 shows the dispersion graph and the regression line.

In equation [C], which is based on the regression equation [D] obtained from the density of existing telephones, the potential demand ratio is regarded as double the density of existing telephones.

(c) In quite a few areas with telephone service, s/x extremely small. Regional characteristics seem,

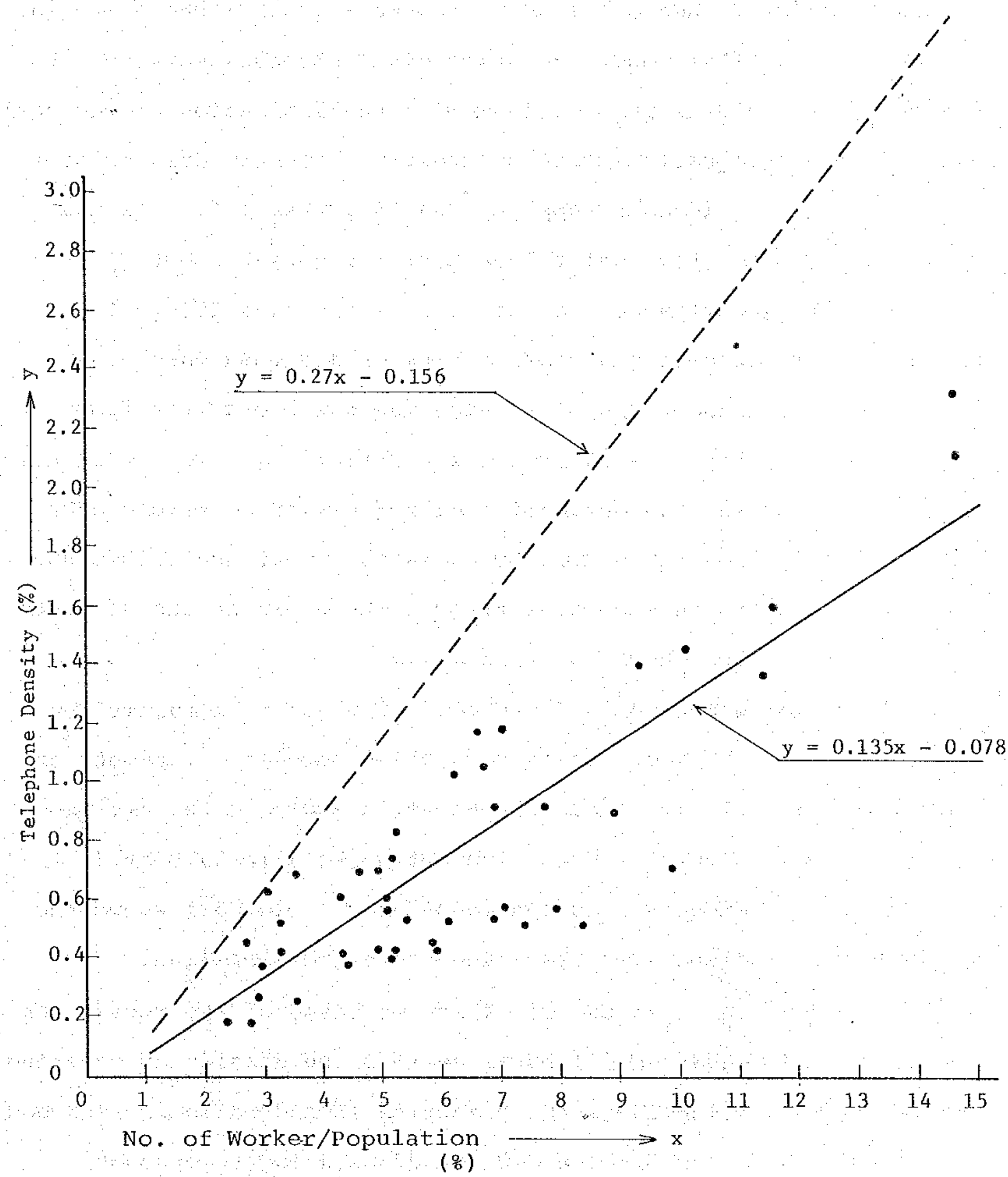

Fig. 5.1 Telephone Density and Worker Ratio

of course, to be accountable for a small s/x but that is not all. Problems concerning service - for example, the fact that service is now possible in only a small part of the entire area of a municipality - may also account for it. It is yet to be seen what factors are important and to what extent. (This may be ascertained by a field survey, etc.)

For these areas, simply using y=2S may well result in the under estimation of potential demand.

Meanwhile, considering the present small s/x ratio, applying the regression equation [D] seems likely to cause an overestimation.

So, as an immediate step, the regression equation [C] corresponding to half the equation [D] is used for the cities and municipalities in Table 5.5.

Table 5.1 Cities/municipalities used in analyzing regression equations

Applied equation ..... [A]

Region	City/Municipality	Number of Telephones (1981)	Number of Estab. Workers (1975)	Remarks
I	Agoo	195	2,261	
	Candon	151	1,658	
I	Laoag City	1,195	8,532	
	La Trinidad	255	1,604	
	Vigan	794	4,929	
II	Bayombon	324	1,656	
	Solano	204	2,464	
	Santiago	330	5,335	
	Tuguegarao	1,065	7,345	
III	Angat	110	826	
	Bacolor	97	1,209	
	Balagtas	227	1,234	
	Baliuag	373	4,738	
	Cabanatuan	1,264	9,486	
	Gapan	329	3,277	
	Iba	164	875	
	Limay	405	2,768	
	Macabebe	255	1,430	
	San Miguel	138	2,098	
	Sta Rosa	213	1,087	
	Guagua/Sta Rita	457	5,952	
	Malolos/Plaridel	822	7,320	
	Concepcion/Bamban/ Capas	408	4,410	
IV	Balayan	621	4,092	
	Batangas	1,472	8,781	
	Bauan	194	2,472	
	Binan	650	9,053	
	Boac	154	1,594	
	Cavite	1,261	7,021	
	Calapan	564	4,689	
	Lipa City	551	7,785	
	Mamburao	110	772	
	Puelto Princesa City	291	1,823	

Region	City/Municipality	Number of Tele-phones (1981)	Number of Estab. Workers (1975)	Remarks
	San Jose (Occ Min)	415	2,885	
	Tanauan	512	4,253	
	Bacoor/Kawit	439	5,424	
	Calamba/Cabuyao	1,467	14,487	
V	Daet	786	4,608	
	Iriga City	316	3,710	
	Legaspi City	626	8,558	
	Masbate	300	1,793	
	Nabua	125	1,696	
	Naga City	1,180	9,779	
	Sorsogon	462	2,909	
	Tabaco	392	5,624	

Table 5. 2 Cities/municipalities with telephone service. Not used for analysis of regression equations but applying equation [A] is logical.

Applied equation ..... [A]

Region	City/Municipality	Number of Tele-phones (1981)	Number of Estab. workers (1975)	Remarks
I	Bauang	43	1,624	
	Caba	42	365	
	Naguilian	44	1,332	
	Rosario	28	1,567	
	Sto Tomas	47	1,063	
	Tubao	26	520	
	San Juan/Bacnotom	158	2,246	
III	Angeles City	5,066	23,480	*
	Dinalupihan	225	1,296	
	Orani	265	1,404	
IV	San Pedro	614	5,226	
	Sta Cruz	621	3,877	
	Trece Martinez City	50	359	

* Exceptional application

Table 5.3 Cities/municipalities with telephone service.
High per-worker penetration ratio (more than 0.2)

Applied equation ..... [B]

Region	City/Municipality	Number of telephones(1981)	Number of Estab. Workers (1975)	Remarks
	Baguio City	5,817	16,138	
I		2,733	11,674	
	San Fernando	2,253	8,087	
	Balanga	657	3,042	
	Mabalacat	800	3,258	
III	Morong	101	183	
	Tarlac	2,234	9,918	
	San Fernando/ Sto Tomas	2,675	14,703	
	Imus	485	2,328	
	Lucena City	2,676	7,936	
IV	San Pablo City	3,116	12,470	
	Caintal Antipolo/ Taytay	5,488	22,919	
	Los Banos	1,977	6,318	
V	Daraga	577	2,021	

Table 5.4 Cities/municipalities with telephone service.
Low per-worker penetration ratio (less than 0.06)

Applied equation ..... [C]

Region	City/Municipality	Number of telephones(1981)	Number of Estab. Workers (1975)	Remarks
I	Alaminos	80	1,720	
	Urdaneta	186	4,450	
II	Aparri	158	4,402	
	Cauayan	169	3,341	
	Echague	58	1,974	
III	Bulacan	44	1,378	
	Camiling	171	3,094	
	Hagondy	109	2,284	
	Paniqui	132	2,533	
	San Jose City	160	3,001	
	Subic	117	2,268	
IV	Angono	200	3,615	
	Sta Rosa	170	3,969	
	Rosario/Novelta	233	5,268	
	Liliw/Nagcarlan	121	2,475	
	Paete/Pakil/Pangil	90	2,889	
V	Labo	56	1,689	

Table 5.5 Cities/municipalities for which estimating equation [D] is used.

c) City/municipality where number of subscribers either has not increased or has decreased during the past several years.

d) City/municipality for which telephone service has recently been started. The telephone supply situation is not yet steady.

Applied equation .... [D]

Region	City/Municipality	Number of Telephones(1981)	Number of Estab. Workers (1975)	Remarks
I	Aringay	21	2,591	c) item
	Bangued	176	1,981	"
	Bayombong	62	1,977	"
	Lingayen	117	3,524	"
	Rosales	160	1,706	"
	San Carlos City	80	3,487	"
II	Ilagan	153	3,354	c) item
III	Aparit	135	2,007	c) item
	Bocaue	301	2,717	"
	Marilao	161	9,209	"
	Mariveles	25	7,103	"
	Masantol	110	1,514	"
	Meycauyan	688	6,481	"
	Munoz	144	2,507	"
	Olongapo	1,438	26,080	"
	Pandi	81	924	d) item
	San Jose Del Monte	16	1,131	c) item
	Sta Maria	69	3,541	
IV	Binagonan	166	3,317	c) item
	Gumaca	83	1,545	"
	Ibaan	133	1,086	d) item
	Lemery	135	2,399	c) item
	Lucban	126	1,589	"
	Naic	40	2,036	"
	Nasugbu	64	4,067	"
	Sta Cruz	27	3,348	"
V	Buhi	56	1,385	d) item
	Bulan	216	1,594	"
	Virac	392	3,426	c) item

5.2 Demand Magnifying Power

(1) Forecasting Model

The demand magnifying power from 1981 to the forecasting time is found as the product of multiplication of the magnifying power by economic growth and the population magnifying power. That is, the following model is used for such as the number in demand in area i at time t:

$$\frac{Y_{it}}{Y_{io}} = \left(\frac{V_{it}}{V_{io}}\right)^{\alpha} \cdot \frac{N_{it}}{N_{io}} \quad \ldots\ldots \quad (5.5)$$

Y: number in demand, Yo=basic demand

V: economic level (income level)

N: population

α: constant (elasticity value)

In the (5.5) model, the absolute value of V is unnecessary and the magnifying power of V,

$$v_{it} = \left(\frac{V_{it}}{V_{io}}\right) \quad \ldots\ldots \quad (5.6)$$

is sufficient. The absolute value V considerably varies by area but the variation of the magnifying power v by areas is usually much smaller than the variation of V. So, for the convenience of estimation, calculations are uniformly made using the national average value vt, rather than using it as the function for the area i.

(2) Index of Economic Level

There is an opinion that during the early stage of telephone diffusion using local output or value added as an economic standard is desirable. This is because, at this stage, most telephone demand is believed to be for business purposes. However, it is indeed difficult to estimate future values of these. Usually, forecasting these is often more difficult than forecasting telephone demand. These factors cannot be used for the forecasting of telephone demand.

As the index of economic level, therefore, income level which is relatively easy to estimate is used.

(3) Elasticity Value α

(a) The elasticity value α must be smaller than 1.45 shown in the national demand increase model (3.5), because equation (3.5) is an increase model for expressed demand while equation (5.5) is an increase model for potential demand. The model for expressed demand shows the various effects of service improvement, including the start of telephone service in municipalities previously lacking service, more strongly than in the case of potential demand.

(b) Meanwhile, the income elasticity value of telephones usually exceeds 1 due to, among other things, the fact that the usefulness of telephones increases with their diffusion. Experience has shown that during the early stage of telephone penetration, this value exceeds 1.3. In the case of the Philippines, it is assumed as a condition of estimating potential demand in 1981 that the scope of areas served corresponds to the present service areas of existing telephone offices or something slightly larger than these in consideration of economic conditions. These service areas are at present considerably smaller than the areas of municipalities. Areas with telephone service tend to gradually expand for economic and social reasons as telephone spread progresses.

Taking this into consideration, the income elasticity value in the demand by municipalities in the Philippines should, for the time being, be considerably to be larger than 1 3.

Based on the above consideration, 1 4 is used as the income elasticity value in estimating the future demand in each city/municiparity.

(4) Demand Forecasting Equation

After all, equation (5.7) is used as the demand forecasting equation by city/municipality.

$$Y_{it}=Y_{io}\cdot\nu_t^{1.4}\cdot\frac{N_{io}}{N_{io}} \quad \ldots\ldots \quad (5.7)$$

The population magnifying power (N_{it}/N_{io}) takes a value that differs by area i but the effect of the income level factor is calculated as $\nu_t^{1.4}$ from the prescribed economic growth rate and population increase rate are shown in Table 5.6. (Values in Paragraph (2) were used for the economic growth rate and the population increase rate.)

Table 5.6 Demand Magnifying Power by Increase of Income Level ($\nu_t^{1.4}$)

Year	1981	1982	1983	1984	1985	1986	1990	1991
$\nu_t^{1.4}$	1.00	1.049	1.105	1.250	1.225	1.297	1.652	1.762
Year	1995	1996	2000	2001			2005	2006
$\nu_t^{1.4}$	2.275	2.427		3.155	3.371		4.403	4.709

6. Results of Forecasting

6.1 Demand for Cities/Municipalities

The results of forecasting by city/municipality in Regions III and IV are shown in the text.

6.2 National Macroscopic Demand and NCR/each Region Demand

The results of the national macroscopic forecasting (expressed demand) and the forecast values (potential demand) in all regions including NCR are shown in Table 6.1.

Here, the demand by rigion except NCR is estimated in order to check to see if the forecast value obtained for each city/municipality is resonable or not. This demand by region approximately equal to the total of the macroscopic forecast demands for the cities and the municipalities involved. The calculation procedure is as follows.

(a) Basic demand

Basic demand is first calculated by the following approximate equation:

$Yo = 0.24\ X$ X: average number of workers in business establishments in 1975

except for some large cities. And it is figured out by adding what is separately estimated for large cities ($Yo = 1.5\ So$ where, So: number as of 1981).

The cities for which separate estimation is made were the following 13: Baguio, Bacolod, Iloilo/Oton, Cebu, Cagayan de Oro, Davao, Angeles, San Fernando (La Union), San Fernando (Panpanga)/St. Tomas, Tarlac, Lucena, San Pablo, Mandave and Zamboanga.

(b) Future Demand

Forecast value of future demand is calculated by multipling the basic demand by the common magnification power on per capita income and the population magnification power by region.

The following study leads to conclusion that the microscopic forecasting method applied for demand by city/municipality is proven to be enough for practical use.

(a) The total of forecast values by region is about 14% larger than the national macroscopic forecast value (main-line telephones) because it includes latent demand. This means the national macroscopic forecast value (main-line telephones) because it includes latent demand. This means that 1.53, the ratio between 876,000, the total of potential demand by region in the base year, and 571,000, the expressed demand, falls to 1.14 by 2000, which is generally satisfactory as a trend of development of telephone service.

(b) The magnifying power for potential demand is larger in the NCR and Mindanao Area than in other regions. This is due largely to the effect of population increase. If the magnifying power of demand per 100 people (demand ratio) is used to eliminate the effect of population increase, the magnifying power for NCR is 2.90, which is smaller than 3.16 for other regions. This result is considered to be generally reasonable because the penetration ratio in NCR is considerably higher than for any other region.

(c) 421,000, the basic demand in the regions other than NCR, is more than three times the present number of subscribers in these regions. This reflects the present low level of service including the size of areas still without service and the lack of telephone supply. In the regions other than NCR, therefore, the magnifying power of expressed demand is indeed large because of the revelation of latent demand.

Table 6.1 Summary of Foecast Results (National and by Region)

Region	Basic demand, 1981		Projected demand, 2000		Growth power		Remarks
	All kinds of telephones (10^3)	Main-line telephones (10^3)	All kinds of telephones (10^3)	Main-line telephones (10^3)	Total	Annual average	
Region I	50	39	212	164	4.22	1.079	
" II	20	16	96	76	4.69	1.085	
" III	68	53	350	272	5.12	1.090	
" IV	76	60	336	268	4.40	1.081	
" V	30	24	129	103	4.31	1.080	Potential Demand
VISAYA	159	115	635	459	3.99	1.076	
MINDANAO	152	113	897	671	5.91	1.098	
SUB TOTAL	555	421	2,655	2,013	4.78	1.086	
NCR	778 2)	455 2)	4,089 2)	2,514 2)	5.53	1.094	
GRAND TOTAL	1,333	876	6,744	4,527	5.17	1.090	
NATIONAL MACRO ESTIMATION	938 3)	571 3)	6,147	3,966	6.95	1.102	Expressed Demand

1) Growth power for main-line telephones

2) As the oppressed demand in NCR is almost negrigible, this value means the potential demand.

3) Expressed demand as of 1980

II. FUNDAMENTAL FIGURES IN THE ECONOMIC EVALUATION

[illegible]

II. Fundamental Figures In the Economic Evaluation

The outline of the economic evaluation of the Central Luzon project is as described in the text. The details of the calculation of fundamental figures in the economic evaluation are as follows:

1. Revenues

The figures that are basic to the calculations of revenues are shown in Appended Table II.1.1 (Phase I) and Appended Table II.1.2 (Entire Project) and the specific method of calculating them is as follows:

1.1 Number of Telephones

The number of newly installed telephones was calculated per year according to the "IV. Telephone Installing Plan" of the text and Table IV·1·2, Installing Plan. The annual number of installed IPTS was calculated according to the pace of installing normal subscriber's stations.

1.2 Annual Traffic of Originating Telephone Calls

In accordance with "V Traffic Forecast", we used 0.04 erl as the busy hour subscriber line originating call rate for normal subscriber's stations and used double this rate for IPTS in consideration of the manners of its use. Of the total originating traffic, we estimated local calls at 70% (including 3% assumed as free-of-charge calls) and toll calls at 30%.

The busy hour concentration ratio is less than 15% in advanced nations with automatic direct distance dialing service. In Japan, it is 12% for toll calls and

8% for local calls. So, we used 10% for our calculation. Therefore, traffic calculated here includes an anticipated traffic increase accompanying service improvement, as stated in the text.

1.3 Forecast Number of Telegrams

We calculated the forecast number of telegrams for each year, using the forecast number of telegrams in 2001 in Table III. 2. 1. 1 in "III. Demand Forecast" of the text as the standard and using the annual increase rate of

$$8\% \left(15 \sqrt{\frac{\text{forecast number of telegrams in 2001}}{\text{forecast number of telegrams in 1986}}}\right).$$

However, since the entire equipment capacity of this project is in keeping with the demand of 15 years after the start of service, the same value for the forecast number of telegrams, which is basic to revenue calculations, was used for 2001 and subsequently for Phase I and 2004 and subsequently for Phase II.

1.4 Number of Telex Subscriptions as of the Fiscal Year End

We calculated the number of telex subscriptions as of the end of each fiscal year on the assumption that 48 units for Phase I and 374 units for Phase II would be evenly installed in six years after the start of service, as in the case of telephones, in accordance with Table VI.2.1.2 in "VI. Circuit Calculation" of the text.

2. Costs

Figures that are basic to cost calculations are indicated in Appended Table II.2.1 and the specific methods of calculating them are as follows:

2.1 Capital Investment

We first converted foreign funds into domestic funds separately by item of equipment in accordance with Table VIII 3 1 in "VIII. Construction Cost" of the text. The conversion rate used in this calculation was: 1 dollar = 215 yen, 1 dollar = 7.59 pesos as of May 1981. The amount of investment by year was calculated in consideration of Fig. IX.2.1 in "IX. Implementation Plan" of the text and the next terms of payment:

Machines	At time of contract	30%
	At time of shipment	50%
	Provisional acceptance	10%
	Final acceptance	10%
Civil work	At time of L/C opening	30%
	Piecework payment	70%
Local costs	At start of work	20%
	Piecework payment	80%

2.2 Maintenance Costs

The maintenance costs were calculated by the method described in the text. The results of calculation by item of facility were as shown in Appended Table II 2.1.

2.3 Leased Circuit Rentals

As stated in the text, we used 14.62 pesos as the rental fee per circuit per km by referring to the PLDT rate. We used the following rent sections in accordance with "XI. System Design and Amounts of work":

Section			Distance	Phase I	Phase I+Phase II
Manila	∿	Cabanatuan	120 km	94 cct	122 cct
SFP	∿	Cabanatuan	72	76	98
Manila	∿	Malolos	42	11	15
SFP	∿	Malolos	30	23	27
Cabanatuan	∿	Malolos	90	75	87
Manila	∿	Batangas	114	299	397
Manila	∿	Lucena	120	0	43
Batangas	∿	Lucena	75	14	18
Batangas	∿	San Pablo	54	22	24
Batangas	∿	Dasmarinas	78	14	14
SFU	∿	Cabanatuan	150	10	12

The distance is calculated by multiplying 1.2 for the direct distance, and the number of leased line depends on the "IV Telephone Installation Plan" in the text.

Appended Table II.1.1 Results of Calculation of Number of Subscriptions, Etc. (Phase I)

Year	Number of telephone subscriptions (subscription)					Annual telephone originating traffic (1000 minutes)							Forecast number of telegrams (1000 telegrams)	Number of telex sets at end of fiscal year	Remarks
	Number of new subscriptions		Number of subscriptions at end of fiscal year			Per subscription	Total		Pay local calls	Pay toll calls					
	General	IPTS	General	IPTS	Total		General	IPTS	General	General	IPTS	Total			
1982						(General) 0.04÷0.10x60 min x 365 days=8,760min (IPTS) 0.08÷0.10x60 min x 365 days=17,520 min									
83															
84															
85															
86	1,760	80	1,760	80	1,840		(*)8,944	(*)818	6,026	2,698	245	2,943	1,843	8	(*) Service is
87	1,760	80	3,520	160	3,680		30,835	2,803	20,659	9,251	841	10,092	1,871	16	started
88	1,760	80	5,280	240	5,520		46,253	4,205	30,990	13,876	1,202	15,138	1,899	24	Phase I: June 1986
89	810	80	6,090	320	6,410		53,348	5,606	35,743	16,004	1,682	17,686	1,927	32	
90	810	80	6,900	400	7,300		60,444	7,008	40,497	18,133	2,102	20,235	1,956	40	
91	910		7,810	"	8,210		68,416	"	45,839	20,525	"	22,627	1,985	48	
92			"	"	"		"	"	"	"	"	"	2,015	"	
93			"	"	"		"	"	"	"	"	"	2,045	"	
94			"	"	"		"	"	"	"	"	"	2,076	"	
95			"	"	"		"	"	"	"	"	"	2,107	"	
96			"	"	"		"	"	"	"	"	"	2,139	"	
97			"	"	"		"	"	"	"	"	"	2,171	"	
98			"	"	"		"	"	"	"	"	"	2,204	"	
99			"	"	"		"	"	"	"	"	"	2,237	"	
2000			"	"	"		"	"	"	"	"	"	2,271	"	
1			"	"	"		"	"	"	"	"	"	2,305	"	
2			"	"	"		"	"	"	"	"	"	"	"	
3			"	"	"		"	"	"	"	"	"	"	"	
4			"	"	"		"	"	"	"	"	"	"	"	
5			"	"	"		"	"	"	"	"	"	"	"	
6			"	"	"		"	"	"	"	"	"	"	"	
Total	7,810	400	-	-	-		1,294,530	132,568	867,339	388,362	39,764	428,126	44,576	-	

Appended Table II-1-2 Results of Calculation of Number of Subscriptions, Etc. (Entire Project)

Year	Number of telephone subscriptions (subscription)							Annual telephone originating traffic (1000 minutes)							Forecast number of telegrams (1000 telegrams)	Number of telex sets at end of fiscal year		Remarks
	Number of new subscriptions				Number of subscriptions at end of fiscal year			Per subscription	Total		Pay local calls	Pay toll calls						
	Phase I		Phase II													Phase I	Phase II	
	General	IPTS	General	IPTS	General	IPTS	Total		General	IPTS	General	General	IPTS	Total				
1982								(General) 0.04÷0.10x60 min x 365 days=8,760 min (IPTS) 0.08÷0.10 x 60 min x 365 days=17,520 min										
83																		
84																		
85																		
86	1,760	80			1,760	80	1,840		(*) 8,994	(*) 818	6,026	2,698	245	2,943	1,843	8		(*) Service is
87	1,760	80			3,520	160	3,680		30,835	2,803	20,657	9,251	841	10,072	1,871	16		started,
88	1,760	80			5,280	240	5,520		46,253	4,205	30,990	13,876	1,262	15,138	1,899	24		PhaseI:
89	810	80	260	770	6,350	1,090			(*) 54,677	(*) 13,475	36,634	16,403	4,043	20,446	1,927	32	60	June 1986
90	810	80	260	770	7,420	1,940	9,360		64,999	33,989	43,549	19,500	10,197	29,697	1,956	40	120	Phase II:
91	910		250	760	8,580	2,700	11,280		75,161	47,304	50,358	22,548	14,191	36,739	1,985	48	180	June 1989
92			210	650	8,790	3,350	12,140		77,000	58,692	51,590	23,100	17,608	40,708	2,015	"	240	
93			190	600	8,980	3,950	12,930		78,665	69,204	52,706	23,600	20,761	44,361	2,045	"	300	
94			220	570	7,200	4,520	13,720		80,592	79,190	53,997	24,178	23,757	47,935	2,076	"	374	
95					"	"	"		"	"	"	"	"	"	2,107	"	"	
96					"	"	"		"	"	"	"	"	"	2,139	"	"	
97					"	"	"		"	"	"	"	"	"	2,171	"	"	
98					"	"	"		"	"	"	"	"	"	2,204	"	"	
99					"	"	"		"	"	"	"	"	"	2,237	"	"	
2000					"	"	"		"	"	"	"	"	"	2,271	"	"	
1					"	"	"		"	"	"	"	"	"	2,305	"	"	
2					"	"	"		"	"	"	"	"	"	2,340	"	"	
3					"	"	"		"	"	"	"	"	"	2,375	"	"	
4					"	"	"		"	"	"	"	"	"	2,411	"	"	
5					"	"	"		"	"	"	"	"	"	"	"	"	
6					"	"	"		"	"	"	"	"	"	"	"	"	
Total	7,810	400	1,390	1,120	-	-	-		1,484,280	1,259,960	994,473	445,290	377,989	823,279	44,999	-	-	

Item	By Phase	Total project cost: Foreign funds: Foreign funds	Total project cost: Foreign funds: Conversion	Total project cost: Domestic funds	Total project cost: Total ①	Instalation service cost (foreign funds, included in total project cost)	Maintenance cost	Remarks
		(million yen)	(thousand pesos)	(thou-sand pesos)	(thou-sand pesos)	(thousand pesos)	(thousand pesos)	
Exchange	I	1,617	57,099	4,600	61,699	7,404	① x0.06x0.60	
	II	907	32,028	2,200	34,228	4,107	=2,221	
	Total	2,524	87,127	6,800	95,927	11,511	" =3,453	
Radio and transmission	I	2,270	80,157	10,000	90,157	20,735	① x0.10x0.60	
	II	3,000	105,935	13,400	119,335	27,447	=5,407	
	Total	5,270	186,092	23,400	209,492	48,182	" =12,570	
Telegraph	I	323	11,406	1,700	13,106	2,097	① x0.12x0.60	
	II	292	10,311	1,600	11,911	1,906	=944	
	Total	615	21,717	3,300	25,017	4,003	" =1,801	
Local cable and sub-scriber facilities	I	440	15,537	24,600	40,137	6,021	① x0.03x0.60	
	II	465	16,420	19,200	35,620	5,343	=722	
	Total	905	31,957	43,800	75,757	11,364	" =1,364	
Power Plant	I	941	33,228	1,900	35,128	8,079	① x0.06x0.60	
	II	1,333	47,070	4,500	51,570	11,861	=1,265	
	Total	2,274	80,298	6,400	86,698	19,940	" =3,121	
Buildings, access roads, towers, etc.	I	505	17,832	28,600	46,432	489*	① x0.05x0.60	*only steel towers
	II	618	21,823	19,900	41,723	306*	=1,393	
	Total	1,123	37,655	48,500	88,155	795*	" =2,645	
Land	I	0	0	4,100	7,100			
	II	0	0	9,200	9,200			
	Total	0	0	13,300	13,300			
Consultant cost	I	460	16,243	3,700	19,943			
	II	443	15,643	3,600	19,243			
	Total	903	31;886	7,300	39,186			
Grand total	I	6,556	231,503	79,200	310,703	44,825	11,954	
	II	7,058	249,229	73,600	322,829	50,970		
	Total	13,614	180,732	152,800	633,532	95,795	24,954	

Capital investment per year

Item			Total	1982	1983	1984	1985	1986	1987	1988	1989	Remarks
			(thou-sand pesos)									
Phase I	Foreign funds	Equipment cost	170,435		30% 51,130	50% 85,218	5% 8,522	15% 25,565				
		Instalation service cost	44,825		30% 13,448	4% 1,793	47% 21,068	19% 8,516				
		Consultant cost	16,243	100% 16,243								
		Total	231,503	16,243	64,578	87,011	29,590	34,081				
	Domestic funds	Land	4,100		100% 4,100							
		Roads, etc.	28,600		46 % 13,156	36% 10,296	18% 5,148					
		Others	42,800			20%+4% 10,272	54% 23,112	22% 9,416				
		Consultant cost	3,700	100% 3,700								
		Total	79,200	3,700	17,256	20,568	28,260	9,416				
	Grand Total		310,703	19,943	81,834	107,579	57,850	43,497				
Phase II	Foreign funds	Equipment cost	182,616					30% 54,785	50% 91,308	5% 9,131	15% 27,392	
		Instalation service cost	50,970					30% 15,291	4% 2,039	47% 23,956	19% 9,684	
		Consultant cost	15,643					100% 15,643				
		Total	249,229					85,719	93,347	33,087	37,076	
	Domestic funds	Land	9,200					100% 9,200				
		Roads, etc.	19,900					46% 9,154	36% 7,164	18% 3,582		
		Others	40,900						20%+4% 9,816	54% 22,086	22% 8,998	
		Consultant cost	3,600					100% 3,600				
		Total	73,600					21,954	16,980	25,668	8,998	
	Grand Total		322,819					107,673	110,327	58,755	46,074	