SECTION IV SULAWESI SELATAN

IV. SULAWESI SELATAN

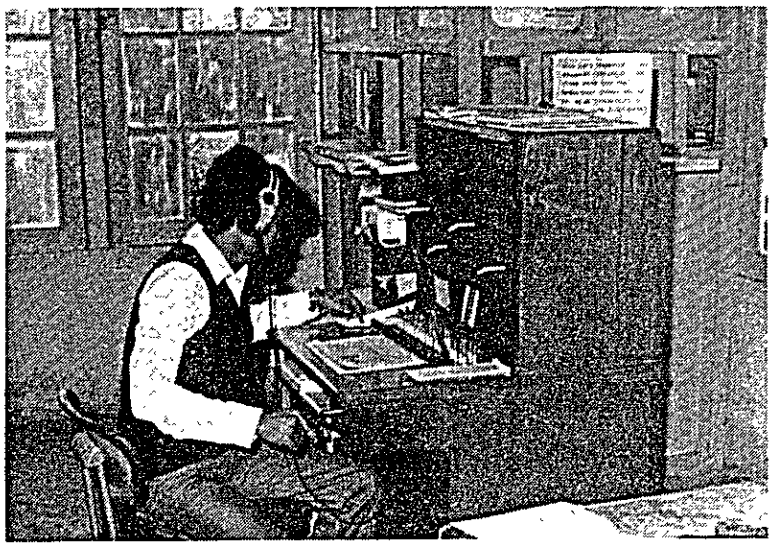
1. Demand and Traffic Forecast

In the case of the Sulawesi Selatan area, we have determined, through comparison of the two methods, the methods by GDP data to be employed for Sumatera Utara and the method by Gravity model, that the latter method is more suitable and matches the actual conditions as mentioned in detail in the APPENDIX. So that we have adopted the method using the gravity model.

The method by gravity model is to forecast demand through traffic forecast.

1-1 Demand Forecast

In order to forecast future demands, future traffic growth has been forecast by means of the gravity model by using the traffic flow record obtained under the current condition, as stated earlier.



A manual telephone exchange operator of Berastagi telephone exchange

1-1-1 Gravity Model

(1) Equation of traffic forecast between two offices

It is generally known that the magnitude of traffic between two exchange offices can be expressed by a function of the populations of the two exchange areas and the distance between the two offices, as follows.

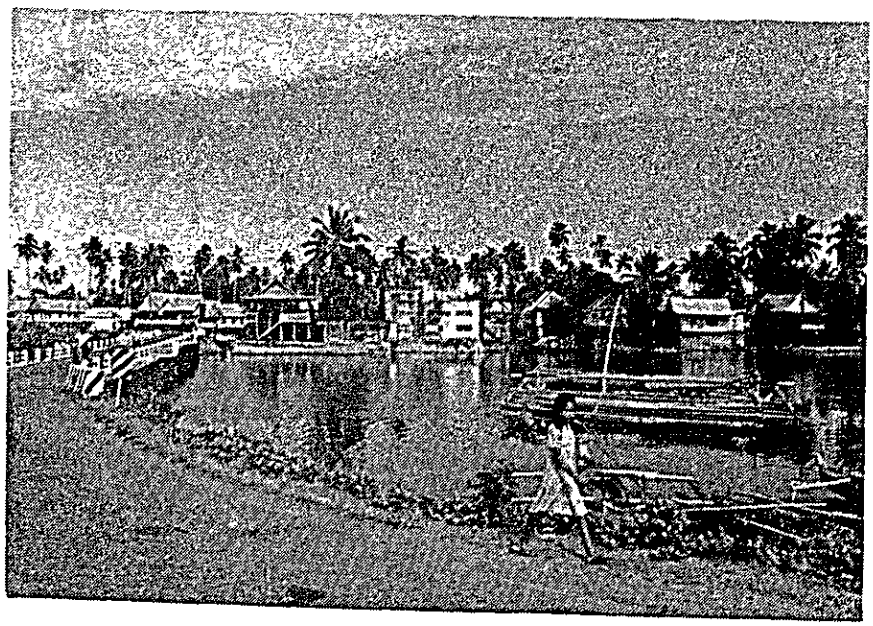
$$T_{ij} = a.\frac{Ni^b \, Nj^c}{D^d} \qquad (1)$$

where T_{ij}: Traffic from office i to office j

N_i and N_j: populations of exchange areas of offices i and j

D: Economic distance (road distance) between offices i and j

a, b, c and d: Coefficients



The countryside of east part of South Sulawesi

(2) Calculation of traffic

By using the traffic flow record between existing offices (manual switchboard offices) in Sulawesi Selatan (measured in the period of May 20 ~ June 19, 1980), the above-mentioned coefficients have been obtained approximately as follows.

$a = e^{-15.8}$

$b = 1.02$

$c = 1.06$

$d = -0.73$

Hence, Equation (1) can be expressed as follows.

$$\ln T_{ij} = -15.8 + 1.02 \ln N_i + 1.06 \ln Nj - 0.73 \ln D \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The traffic flow record employed for obtaining the above-mentioned coefficients is expressed by the numbers of telephone calls made for individual destinations for one month, so that T_{ij} obtainable from Equation (2) is expressed also by the numbers of telephone calls for individual destinations for one month. In order to obtain the busy hour traffic of a day, the following assumptions have been made.

1) The number of actual working days of a month is assumed to be 25.

2) The busy hour concentration ratio of a day is assumed to be 1/6. (This is from current consumption record of Ujung Pandang-I exchange.)

3) The average duration of interlocal calls is supposed to be 8 minutes. (From the statistical data of Ujung Pandang-I exchange.)

The annual population increases of individual Kabupaten and Kecamatan are estimated to be 1% from the past time series data of populations of individual Kabupaten. Distances from individual Kacamatan to the Kabupaten and population as of 1978 are shown in Attached DWG. IV. 1.2-1.

1-1-2 Conversion to Demand Forecast

Calculation by the gravity model has been made for the current conditions, as stated earlier. That is,

1) all exchanges are of manual switchboard type.
2) the traffic flow record employed contains only data measured under the condition that the number of subscribers was 45% of the total demands, that is, (the number of subscribers + the number of waiting applicants)
3) the traffic flow record contains data on inter-local calls but not data on local calls.

The team visited Mayor of Bulukumba

Accordingly, the annual number of demands can be obtained by effecting correction in consideration of items 2) and 3) above* to the result of calculation made by using the gravity model, and then dividing the value thus obtained through correction by the average subscriber's originating calling rate for a manual switchboard (0.01 erlang).

* Correction for item 2) is made by dividing the result of calculation obtained by 0.45.

  Correction for item 3) may be considered as follows.
  According to the result of our survey, the average calling rate of interlocal calls to local calls of the existing offices is (82:18), and the average duration of local calls is supposed to be 3 minutes. Accordingly, it is necessary to increase the traffic by this rate. That is, it is necessary to increase the traffic by approx. 1% in erlang.

A summary of demand forecast for Sulawesi Selatan is given in Table IV.1.1-1. For demand forecast for individual Kecamatan, see Attached Table IV.1.1-1.

Table IV. 1.1-1 Demand Forecast (Sulawesi Selatan)

Name of Kabupaten	1980	1985	1995	2005
GOWA	1569	1856	2599	3663
TAKALAR	73	79	98	121
JENEPONTO	612	709	957	1296
BANTAENG	254	294	394	531
BULUKUMBA	616	710	947	1281
SINJAI	276	320	424	567
SELAYAR	26	34	41	49
MAROS	715	841	1168	1626
PANGKEP	570	664	926	1228
BARRU	72	101	119	178
PINRANG	334	396	487	593
SIDRAP	246	300	368	450
SOPPENG	338	346	428	560
BONE	1030	1191	1588	2139
WAJO	455	500	560	645
POLMAS	237	310	381	450
LUWU	322	396	445	507
MAJENE	67	76	88	107
MAMUJU	15	15	20	24
ENREKANG	74	101	120	169
TANA TORAJA	874	1070	1448	2012
TOTAL	8775	10309	13606	18196

Note: For demand forecast for Ujung Pandang Kotamadya and Pare Pare Kotamadya, see SECTION V, paragraph 5-2.

Year	Estimated Population (Hundred)	Demand Density (per Hundred Inhabitants)
1985	53,922	0.19
1995	58,962	0.23
2005	64,001	0.28

1-2 Traffic Forecast

In the trafic forecast made for achieving demand forecast as stated in the preceding paragraph, the average subscriber's originating calling rate has been assumed to be 0.01 erlang in consideration of subscribers corrected by means of manual switchboard. In this project, change from manual switching to automatic switching is to be introduced to the great majority of subscribers except those subscribers to be connected by manual switchboards to be set up newly. By assuming the traffic increase rate of 2.5 for the change from manual to automatic switching, we have the subscriber's originating calling rate of 0.025 erlang.
By multiplying the subscriber's originating calling rate by the number of subscribers, the total traffic of originating calls of individual Kabupaten and Kecamatan can be obtained. The numbers of subscribers of which demands are to be fulfilled in individual Kabupaten in different years are given in Attached Table IV.1.1-1.

High usage routes are to be set up when a traffic exceeding 3 erlangs is estimated by traffic distribution made depending on the number of calls given in the current traffic record.
Attached DWG. V.1.2-2 shows traffic forecast for the different years.
Since the present study is intended for the improvement and development of rural communication, study on Kotamadya Ujung Pandang and Pare Pare are described in SECTION V, paragraph 5-2.

2. Telephone Facility Plan

2-1 Demand Fulfilment Plan

In the case of Sulawesi Selatan, the major purposes of the telecommunication network development are as follows.

1) Development and expansion of toll transmission network

2) Measures for non-telephone Kecamatan

3) Automatization of switching

Of these items, item 1) is an important, basic objective for the development of communication, so that the initial provision is to be made to meet the traffic to be reached in 1995 (10 years hence after commencement) in conside ration of expansibility to the ultimate capacity to be reached in 2005.
Items 2) and 3) are described in detail below.

2-1-1 Measures for Non-Telephone Kecamatan

For non-telephone Kecamatan, the period of 20 years to 2005 is divided from the standpoint of facilities into the following two stages.

First stage (1985 ~ 1995):

Telephone facilities are to be installed at important Kecamatan in consideration of the degrees of importance of individual Kecamatan. The priority order given among Kecamatan is as follows.

1) Ibukota Kabupaten, important sight-seeing places, airports, harbors, and other important areas having comparatively heavy traffic and expected to see rapid dvelopment in future.

2) Towns having shops, small business offices, etc., and having been developed similarly as the above-mentioned Ibkota Kabupaten.

3) Other, underdeveloped towns having less shops and small business offices.

Second stage (1995 ~ 2005):

Telephone facilities are to be installed in such Ibkota Kecamatan for which measures have not been taken in the first stage and expansion of facilities having been installed in the first stage is to be accomplished.

A building of Bonteng telephone exchange

For the demand fulfilment of the first stage:

-For towns of item 1), automatic switching system is to be installed to meet demands by 100%.
-For towns of item 2), manual switchboard is to be installed to meet demands by 100%.
-For towns of item 3), one MAS system is to be installed for, in principle, every Kabupaten and its maximum capacity (96 subscribers) is to be distributed to Ibkota Kecamatan as much as possible.

The quantities of facilities to be implemented in the first stage to range from 1985 to 1995 are given in Tables IV.2.1-1
The distribution of MAS subscriber's terminals to individual Kecamatan and the demand fulfilment of automatic switching system are shown in Attached Table IV.1.1-1.

2-1-2 Automatization of Switching

Manual switchboards by which service is currently given in Ibukota Kabupaten, important sight-seeing places, etc., are to be replaced with automatic switching systems. For these offices to be automazied demand fulfilment is to be achieved by 100%, and initial provision is to be made to meet demands to be reached 10 years hence.

2-2 Network Configuration

2-2-1 Telephone Network

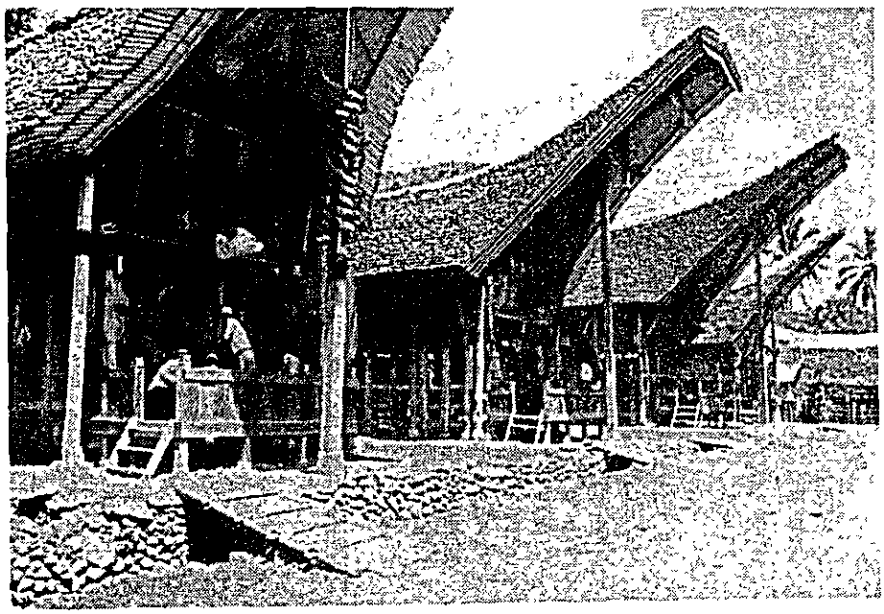
In designing the telephone network, the following items have been considered.

(1) Star network is to be employed in principle. High usage route may be used depending on the

traffic between offices.

(2) In the network configuration, exchange hierarchy, numbering plan, etc., having been dicided in PERUMTEL, consideration is not given to increase in the number of automatic switching offices to be acheived by the implementation of this project. Accordingly, we have reviewed the network configuration in consideration of the demand forecast, transmission network plan, automatization plan, topographical conditions, etc. The current exchange hierarchy and numbering plan are shown in Attached Table IV.2.2-1. A recommendable network configuration is shown in Fig. IV.2.2-1.

3) We have planned to install telephone facilities in consideration of future digitalization of the telephone network as well as positive introduction of network automatization. Accordingly, toll transmission equipment and exchagnes to be installed are to be of digital type.



Village scape of Traja area, central part of South Sulawesi

4) In principle, ordinary interlocal calls within the Propinsi are to be connected automatically and calls which require to be handled by operator, for instance, special service calls and interlocal calls to other Propinsi, are to be concentrated to the direct upper secondary exchange or primary exchange to be handled by the operator thereof.

The telephone network recommended for Sulawesi Selatan in consideration of all above conditions is shown in Fig. IV.2.2-1.

2-2-2 Telegraph Network

At present telegraph is used rather extensively because of less promptness of the current network, as stated in SECTION V, paragraph 2. However, with the spread

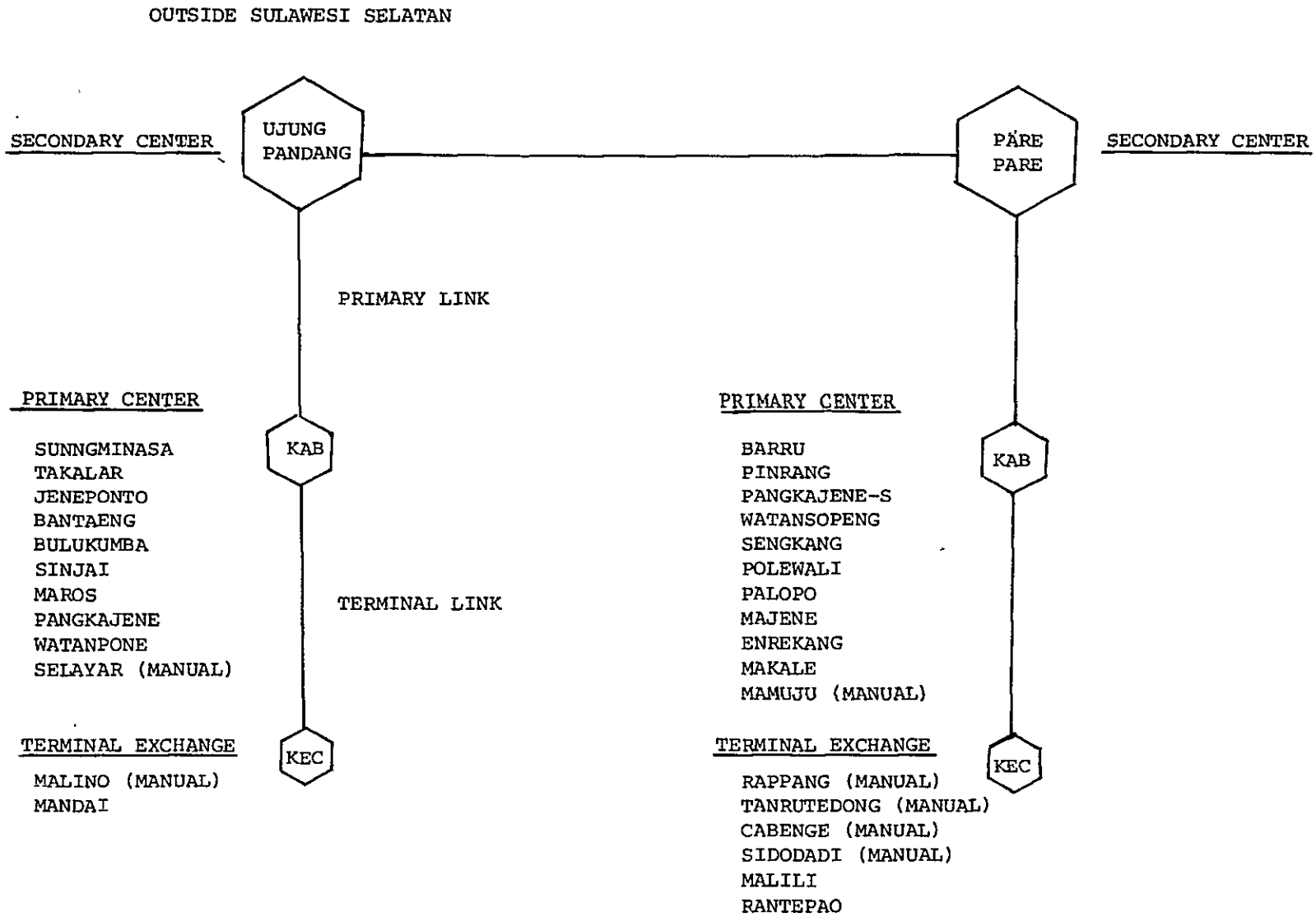


Fig. IV.2.2-1 Telephone Network (Plan) - Surawesi Selatan

of automatic telephone and TELEX, telgraph demands will decrease.
Accordingly, equipment investment to the telegraph network is not considered and the current service by telegram and facsimile is to be continued without any additional installation or expansion of telegraph network.

2-3 Local Facilities (Exchange and subscriber's facilities)

Although the ideal facility plan may be to fulfil demands by 100%, it can not be helped, in consideration of the economy and financial efficiency of the project, excluding such facilities and demands out of the plan that may disturb economic balance. In order to have IRR = 9.2 %, it is necessary to limit the quantities of facilities to such as shown in Tables IV.2.3-1 and IV.2.3-2, as will be stated later in the paragraph on economic analysis.

2-3-1 Measures for Non-Telephone Kecamatan

(1) System outline

a) Setup of manual switchboard

Manual switchboard office is to be set up in towns developing as in Kabupaten cities, towns with comparatively heavy traffic, and sight-seeing places. (4 Kecamatan)

b) MAS

MAS system is to be installed in towns having

Table IV.2.1-1 Quantities of Facilities to Be Installed by This Project

Facility	Method	1980	1985	1995
Automatic Exchanges (Automatized: 21 exchanges) (Newly installed: 1 exchange)	Local cable		4,222	5,429
	MAS		1,327	1,344
	Open wire		9	9
	Subtotal		5,558	6,782
Manual switchboards (Newly installed: 4 exchanges) (Existing: 3 exchanges)	Newly Installed switchboard local cable		114	139
	Existing switchboard local cable	2,687	197	261
	Subtotal		311	400
Total		2,687	5,869	7,182

Table IV.2.1-2 Measures for Non-Telephone Kecamatan

No.	Name of Kabupaten (Kotamadya)	Number of Kecamatan	Number of Kecamatan with Telephone	Number of Kecamatan without Telephone	Number of Kecamatan where Measures Are to Be Taken			Number of Telephone Office to Exist by 1985			
					Number of Telephone Offices to Be Installed Newly	MAS System	Open Wire	Number of Automatic Exchanges to Be Installed Newly	Number of Exchanges to Be Automa-tized	Number of Manual Switchboards to Be Installed Newly	Number of Existing Manual Switchboards
1	(Ujung Pandang)*	(11)									*
2	Gowa	8	2	6		5			1		
3	Takalar	6	1	5		5			1		
4	Jeneponto	5	1	4		4			1		
5	Bantaeng	3	1	3		2			1		
6	Bulukumba	7	1	6		6			1		
7	Sinjai	5	1	4					1		
8	Selayar	5	0	5	1					1	
9	(Pare-Pare)*	(3)									*
10	Maros	4	2	2					2		
11	Pankajene	9	1	8		4			1		
12	Barru	5	1	4			3		1		
13	Pinrang	7	1	6		5			1		
14	Pankajene-S	7	2	5	1	4			1	1	1
15	Watansoppeng	5	2	3		3			1		1
16	Bone	21	1	20		12			1		
17	Wajo	10	1	9		7			1		

(Continued)

No.	Number of Kabupaten (Kotamadya)	Number of Kecamatan	Number of Kecamatan with Telephone	Number of Kecamatan without Telephone	Number of Kecamatan where Measures Are to Be Taken			Number of Telephone Office To Exost bu 1985			
					Number of Telephone Offices to Be Installed Newly	MAS System	Open Wire	Number of Automatic Exchanges to Be Installed Newly	Number of Exchanges to Be Automa-tized	Number of Manual Switchboards to Be Installed Newly	Number of Existing Manual Switchboards
18	Polewali	8	1	7	1				1		1
19	Luwu	16	1 + (1)**	14	1	10		1	1		(1)**
20	Majene	4	1	3					1		
21	Mamuju	6	0	6	1					1	
22	Enrekang	5	1	4					1		
23	Tana Toraja	9	2	7					2		
	Total	(14)			5	67	3	1	21	3	4+(1)**
		155	24 + (1)**	130	75			29 + (1)**			

* Measures are not to be taken by this project.

** Soroako

scales next to those of towns mentioned in item a) above. MAS base station is to be set up in principle at the automatic exchange office in the Ibukota Kabupaten to serve important subscribers in the Ibukota Kecamatan. However, when it is necessary to set up the base station at other place than the automatic exchange of the Ibukota Kabupaten in consideration of radio propagation, the base station is to be set up at a radio repeater station.

Note: Installation of MAS base station at a place other than the above-mentioned places requires the construction of office building, power supply facilities, tower, trunk line from the base station to the automatic exchange in the Ibukota Kabupaten, which would be very costy and would worsen the balance of the entire project. Accordingly, setup of MAS base station at places other than automatic exchange or radio repeater station is to be minimized (only at one station in Luwa Kabupaten). Fig. IV.2.3-1 shows the MAS and telephone office setup plan.

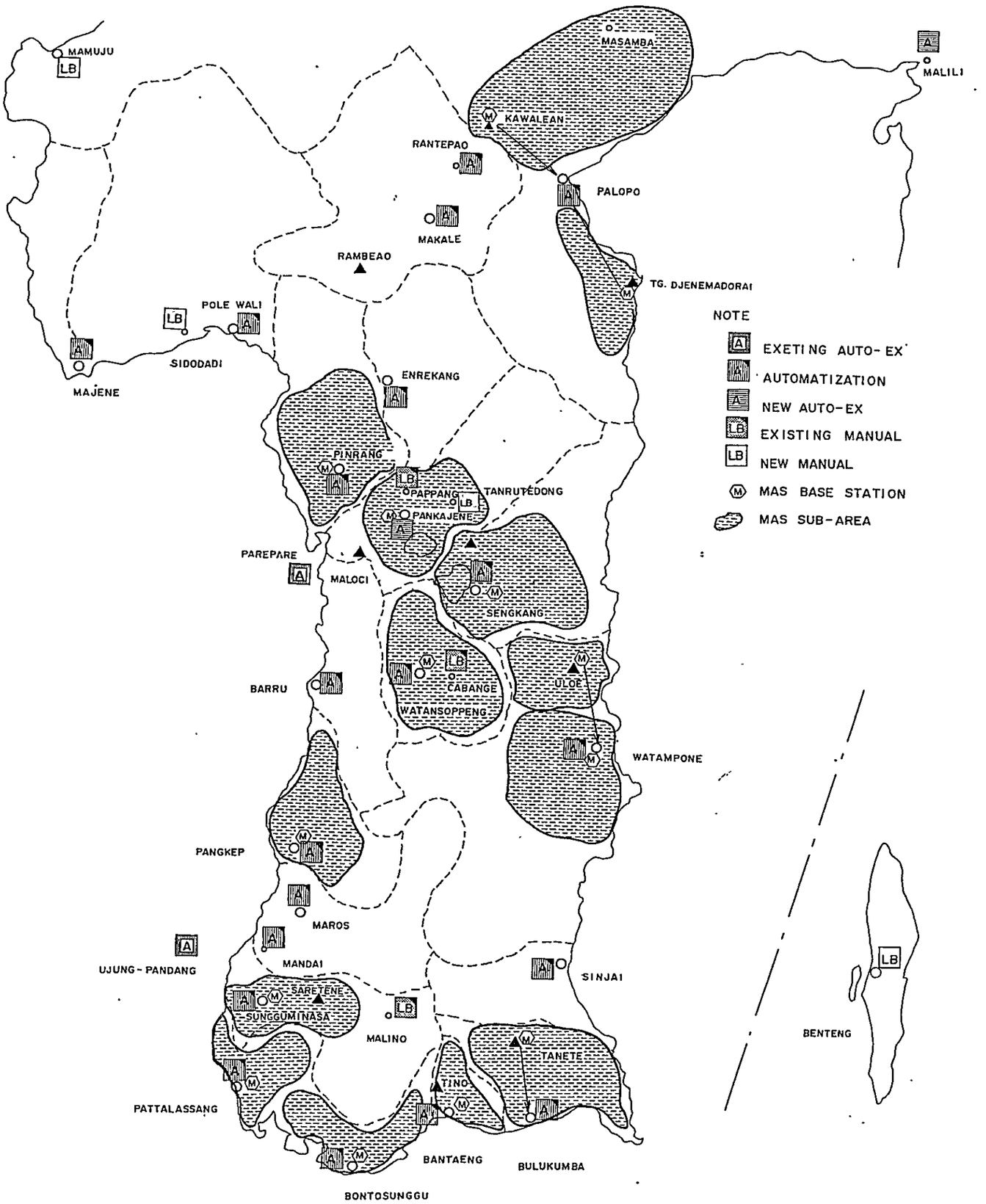
c) Open wire

Important subscribers in some Ibukota Kecamatan are to be served by using open wire available after the improvement and arrangement of interlocal trunks between Ibukota Kabupaten. (3 Kecamatan)

FIG. IV 2-3-1

SULAWESI SELATN

TELEPHONE EXCHANGE & MAS



(2) Capacity

The capacity of the MAS system is to be determined in proportion with the number of demands of the Kecamatan.

For the time being, one MAS system is to be set up in each Kabupaten. One MAS system is to serve subscribers in 2 ~ 8 Kecamatan. The maximum capacity of one MAS system is 96 subscribers. MAS system distribution ot individual Kecamatan is shown in Table IV.1.1-1. Although it is desirable to sell the full capacity of MAS terminals to be distributed to each Kecamatan for the purpose of recovering initial investiment, the initial subscribers may be at least as follows:

a) For Kantor Camat: 1 subscriber's line unit
b) For police: 1 subscriber's line unit
c) For public telephone (including telegram): 1 subscriber's line unit

The total number of subscriber's line units to be served by MAS is to be as follows.

1985: 1327 subscriber's line units
1995: 1344 subscriber's line units

When using open wire, 3 telephone sets are to be used per channel.

(3) Standard provision of facilities

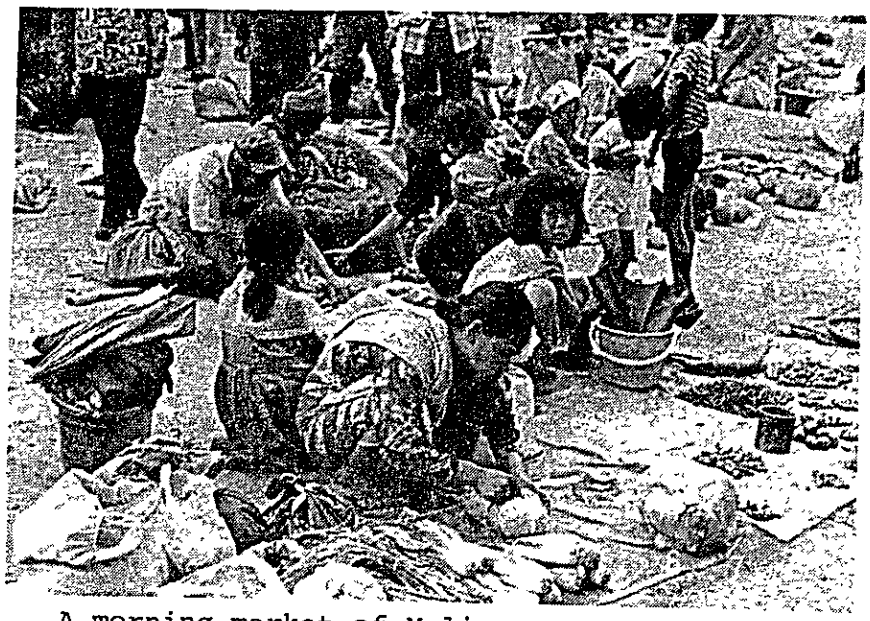
The average traffic per subscriber is to be 0.025 erl. and the grade of service between the telephone office and telephone sets is to be 1/100.

In the case of open wire system, a maximum of 3 telephone sets is to be used per channel.

2-3-2 Automatization Plan

(1) Switching system

Time division electronic switching system is to be employed.
The maximum ultimate capacity is to be 2000 terminals.
The number of terminals to be installed at the initial stage is to be minimum 200 and expansion to 400, 600, 800, 1000, 1500, and 2000 terminals is to be achievable.



A morning market of Malino, a summer resort in east side of Ujung Pandang

In the case of Sulawesi Selatan, almost no such commercial power source that allows power feeding for 24 hours a day is available and sufficient batteries and dual engine generators are to be provided in principle for feeding power to the exchange or radio transmission equipment. Since a telephone directory and toll board is to be provided at each Ibukota Kabupaten office, office building for accommodating

the telephone directory and toll board is to be required. Accordingly, the exchange to be introduced is not of container type but exchange type.

(2) Capacity

Table IV.2.3-1 gives the names of exchanges and the number of terminals to be provided. The number of terminals to be provided at the first stage is to meet the demands of 1995.

Table IV.2.3-1 List of Offices to Be Automatized
(Suwelasi Selatan)

Exchange Name	Number of Initial Subscribers*	Terminals to Be Provided	
		1995	2005
Sungguminasa	546	800	2000
Takalar	79	200	200
Jeneponto	356	600	1000
Bantaeng	243	400	600
Bulukunba	357	600	1000
Sinjai	157	400	600
Mandai	201	400	400
Maros	396	600	1500
Pangkajene	357	600	600
Pinrang	318	400	600
Pangkajene-S	249	400	400
Barru	71	200	200
Watansoppen	283	400	600
Watanpone	582	800	2000
Sengkang	321	400	600
Polewali	156	200	400
Majene	37	200	200
Palopo	341	400	400
Malili	23	200	200
Makale	281	400	1500
Rantepao	70	200	200
Enrekang	56	200	200
Total	5480	200 x 7	
		400 x 9	
		600 x 4	
		700 x 2	

* Including MAS subscriber's terminals

Accordingly, expansion of the number of terminals to meet the demands of 2005 is to be accomplished by 1995.

(3) Standard provision of facilities

The standard for automatization is to be as follows.

Automatization is to be introduced in the following types of areas having existing manual switchboards.

1) Ibukota Kabupaten
2) Major sight-seeing places or towns with dense traffic where telephone demands are to increase.

Local cables are to be laid newly in principle. Aerial cables are to be laid since the number of subscriber's line units per cable may be less than 300.

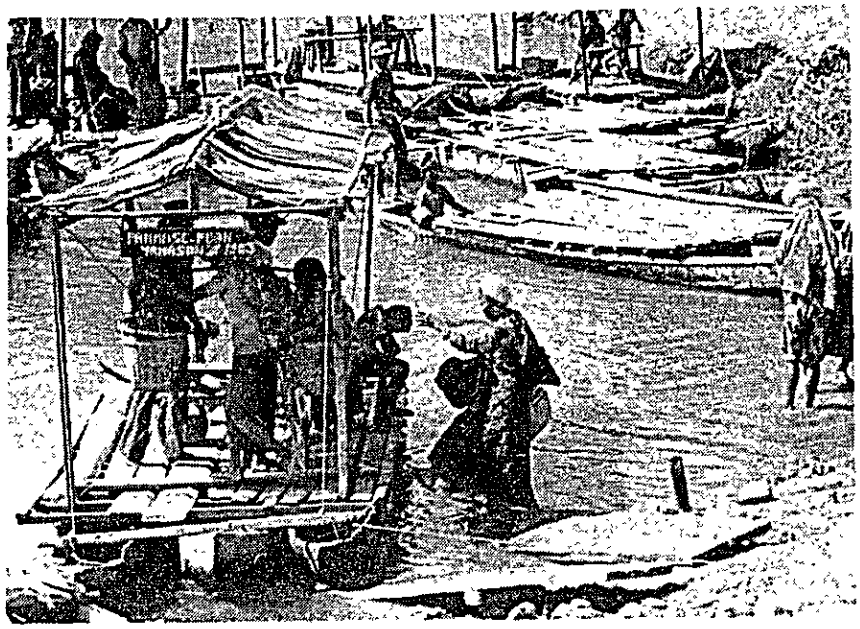
2-4 Transmission Line

The improvement and development of toll transmission lines is most important and should be given the first priority in this project. Figs. IV.2.4-1 ~ 3 shows the toll transmission line development plan to be implemented by this project.

In preparing the toll transmission line development plan, the following basic points were taken into account.

(1) Scope

Toll transmission lines between Ujung Pandang



A ferry of Malaso River, North-west of South Sulawesi

and individual Ibukota Kabupaten and between Pare Pare and individual Ibukota Kabupaten are to be improved and developed.

(2) System

In consideration of recent technical trends and ease of change to future digitalization, a digital system is to be employed, in principle, for the transmission lines to be set up newly.

(3) Utilization of existing transmission lines

For transmission between Ujung Pandang and Pare Pare and between Ujung Pandang or Pare Pare and Ibukota Kabupaten located on the way between Ujung Pandang and Pare Pare, the existing coaxial system (CIT-COX) is to be utilized and required number of channels are to be provided. For transmission between Ujung Pandang and Bantaeng, the existing microwave system is to be utilized and necessary channels are to be provided.

(4) Shortwave radio and open wire channels

Until the above-mentioned toll transmission lines are established, the existing shortwave radio and open wire channels are to be utilized.
No shortwave radio channel nor open wire channel is to be set up newly. Such shortwave transceivers that are to become unnecessary any more are to be reused at remote places in islands or mountainous places. Such open wires that are to become unnecessary are to be reused as transmission lines between Ibukota Kabupaten and Ibukota Kecamatan.

(5) Satellite communication

Prior to this project, a plan for establishing satellite communication earth stations in six Ibukota Kabupaten in Slawesi Selatan has been made. The satellite communication established newly is to be used for extra-Propinsi communication such as with Jakarta and for emergency use. Accordingly, terestrial circuits are to be set up in these Ibukota Kabupaten in principle for intra-Propinsi communication.

(6) Relationship with extra-Propinsi backborn transmission network

The backbone transmission network to connect Ujung Pandang via Pare Pare to major cities outside the Propinsi, such as Manado, Kendari, will be necessary in near future.
Accordingly, the route, system, and capacity of the 6GHz radio to interconnect Senkang, Pare Pare and Palopo (Kawalean) have been determined so that the 6GHz radio link can be used as it is to form part of the above-mentioned backborn transmission network in future.

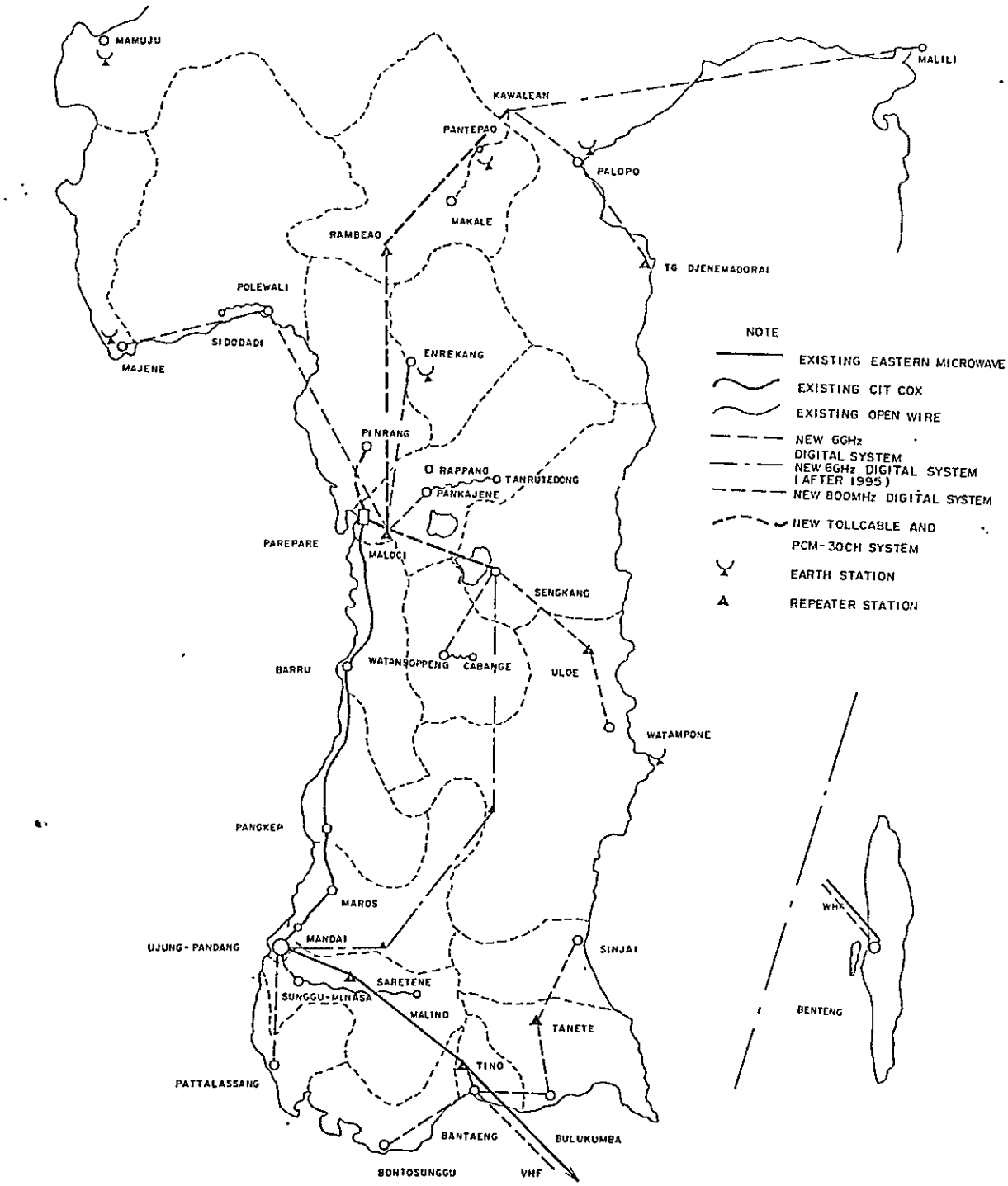
The system outlines and work volume of the major transmission lines to be introduced by this project are as follows.
The configurations of these transmission network are shown in Figs. IV.2.4-1 ~ 3.

(1) 6GHz radio system — 2 sections, 3 systems
Digital system — Channel capacity: 960 channels/system

FIG IV 2-4-1

SULAWESI SELATAN

Network Plan of Trunk circuit



NOTE : ○ 2M PCM CODEC
○ Analog · Multiplex

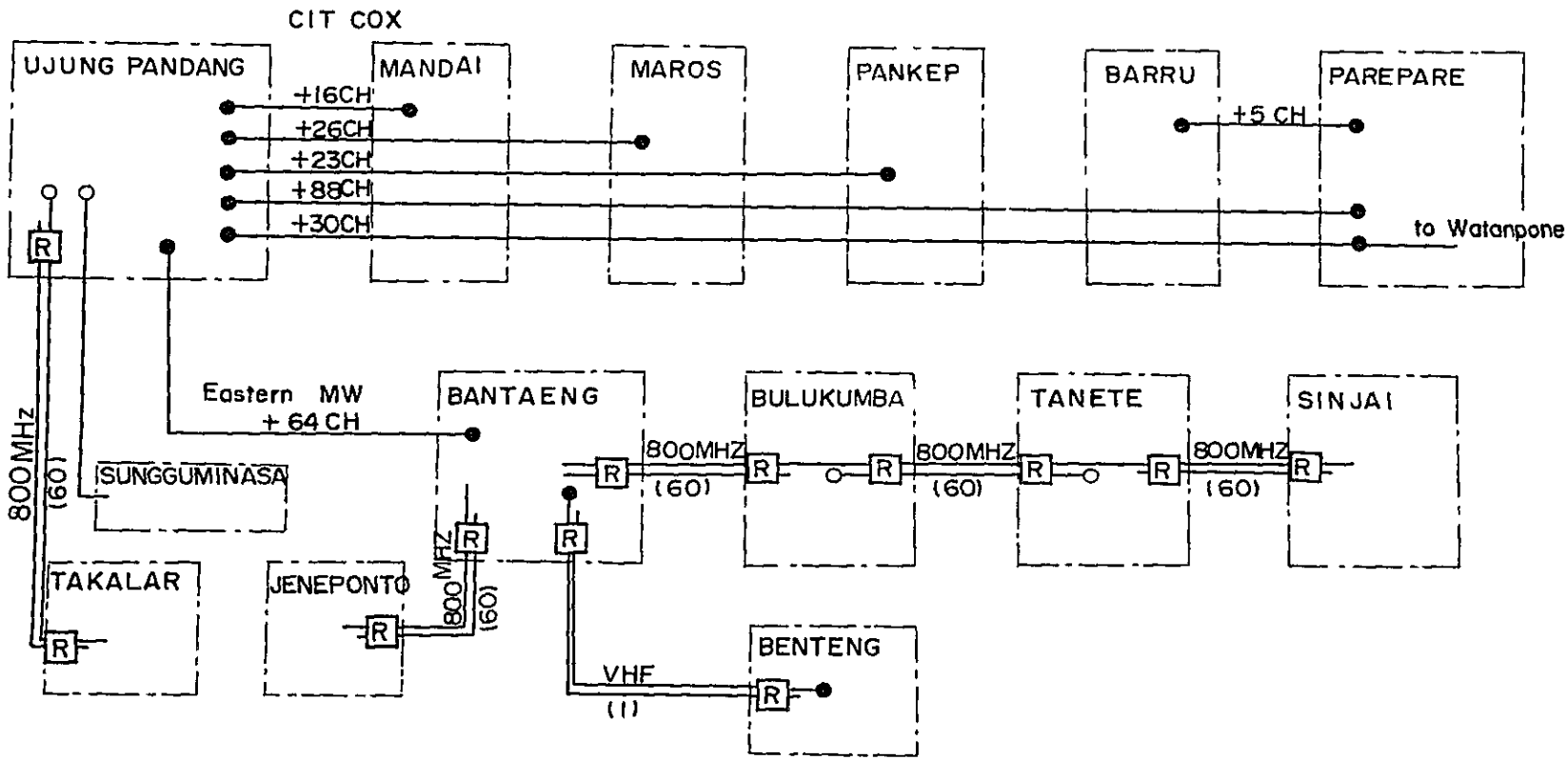


FIG. Ⅳ·2·4-2 MULTIPLEX CONFIGURATION (UJUNG PANDANG AREA)

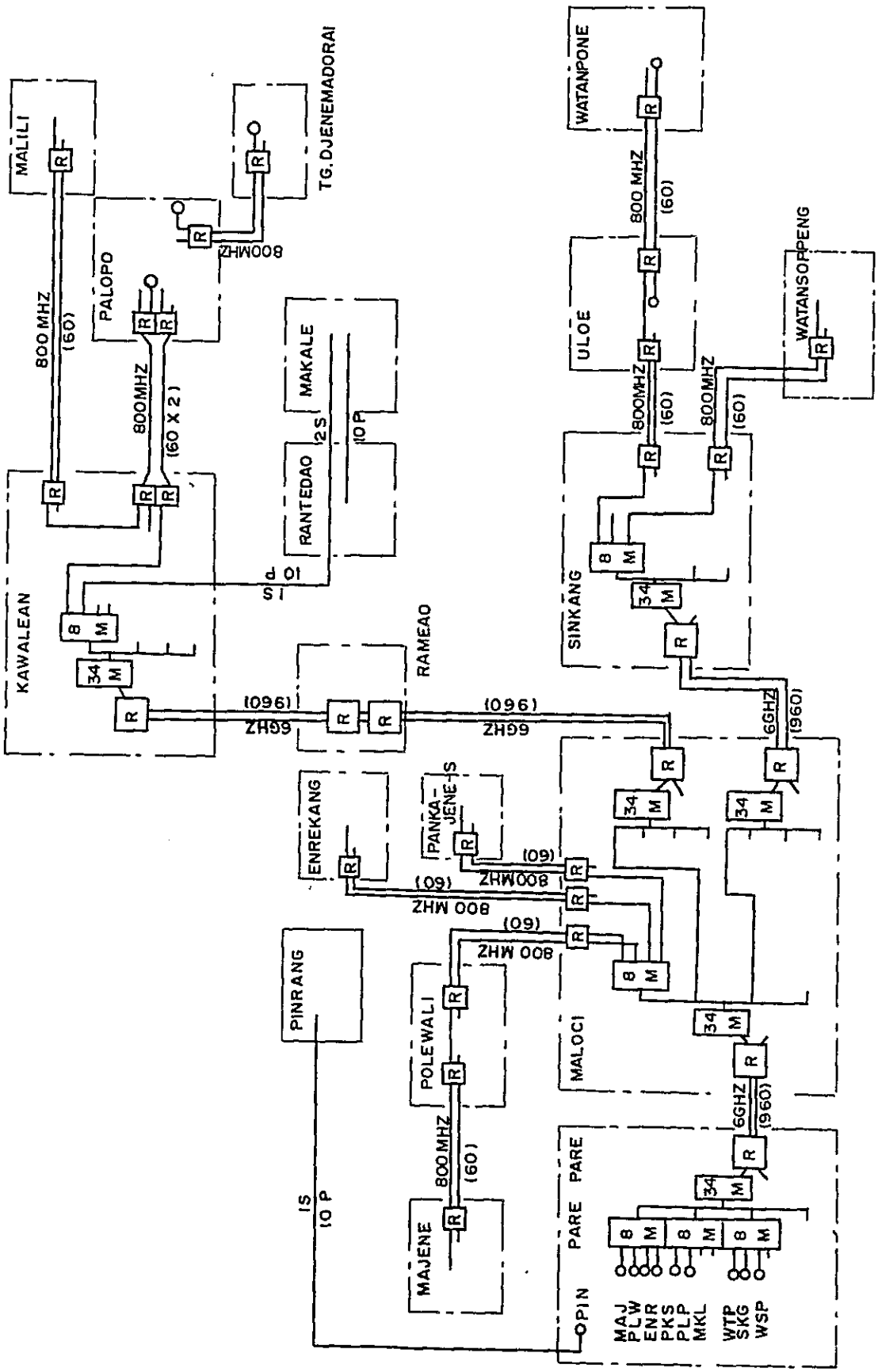


FIG. IV 2.4-3 MULTIPLEX CONFIGURATION (PARE^2 AREA)

(2)	800MHz radio system Digital system	15 sections, 16 systems Channel capacity: 60 channels/system
(3)	Cable carrier system Digital system	5 sections, 5 systems Channel capacity: 30 channels/system
(4)	VHF radio link Analog system	1 section, 1 system Channel capacity: 3 channels/system

Expansion of the existing transmission lines is to be made as follows.

(1)	CIT-coaxial cable system	5 section, 188 channels
(2)	Microwave system	1 section, 64 channels

2-5 Buildings and Power Supply Equipment

The expenses for the construction of buildings and power supply equipment is expected to amount to a considerable part of all expenses of the project (approx. 1/4 of all expenses). Accordingly, it is important to design the project so as to minimize the expenses for buildings and power supply equipment. For this purpose, it is necessary

(1) to employ compact, low-power consumption type communication equipment as much as possible and

(2) to minimize the floor space of the building except the space for communication equipment.

It is possible to classify and standardize the buildings and power supply equipment depending on the purpose of use as shown in Table IV.2.5-1. An outline of standardized building and power supply equipment is shown in Attached DWG. IV.2.5-1.

In this project it is necessary to construct buildings and power supply equipment newly at a total of 26 offices/ stations, that is, 21 automatic exchanges and 5 radio repeater stations.

Table IV.2.5-1 Standard Buildings and Power Supply Equipment

Model	Applicable Place
B-1 Building	Building for telephone office to be set up in Ibukota Kabupaten
B-2 Building	Building for telephone office to be set up in Ibukota Kecamatan
B-3 Building	Station building for unattended repeater station
D-1 Power Supply	Power supply equipment to be installed at B-1 building
D-2 Power Supply	Power supply equipment to be installed at B-2 building
D-3 Power Supply	Power supply equipment to be installed at B-3 building

2-6 Maintenance and Operation

2-6-1 Local Facilities

(1) Maintenance of exchange and power supply equipment

In principle, centralized maintenance is to be effected for automatic exchanges and power supply equipment. Sulawesi Selatan is to have the following six maintenance centers to be engaged in centralized maintenance.

Ujung Pandang district
- Ujung Pandang
- Bantaeng
- Watanpone

Pare Pare district
- Pare Pare
- Sengkang
- Polewali

Offices and repeater stations located more than 50 km distant from the adjacent maintenance center are to be attended by resident maintenance personnel (technician). Each maintanence center is to be provided with an engineer or engineers to be engaged in the maintenance of unattended offices and repeater stations. One director is to be assigned to each of Ujung Pandang and Pare Pare Kotamadya to control exchange maintenance activities in Slawesi Selatan.

Maintenance personnel organization for the manual switchboards are to be as it is in

principle.
By this, the number of personnel to be assigned to maitenance of exchanges and power supply equipment are as follows.

2 directors
10 directors
40 directors

Details are specified in Attached DWG. IV.2.6-1.

A telephone line patrol-man of Senkang telephone exchange

(2) Operation of exchange

A telephone directory and a toll board are to be installed at Ibukota Kabupaten Offices.
The existing operators are to be assigned to such boards.
For four manual switchboards to be set up newly, 16 operators are to be employed newly.

(3) Maintenance of local cable and MAS system

Maintenance personnel of local cable and MAS system are to be assigned also to the exchange maintenance centers. Complaints from subscribers are to be accepted by manual switchboards at offices in Ibukota Kabupaten.
The maintenance works of MAS system include the maintenance of subscriber's units and subscriber's power supplies (mostly batteries).
Accordingly, the following personnel are to be required for the maintenance of MAS systems.

2 enginners

47 technicians

2-6-2 Transmission Line Facilities

Maintenance of transmission line facilities is to be centralized in principle. Six maintenance centers are to be set up for the maintenance of transmission line facilities in Sulawesi Selatan as in the case of the maintenance of exchanges. One maintenance center is to have a maintenance area to cover 2 ~ 6 Kabupaten. Radio terminal stations located less than 50 km apart from the adjacent maintenance center are to be unattended and radio terminal stations more than 50 km distant from the adjacent maintenance center are to be attended by more than two resident maintenance personnel (technicians). All intermediate repeater stations are to be unattended. Every maintenance centers are to be attended by more than one engineers. One director is to be assigned to each of Ujung Pandang and Pare Pare Kotamadya to control the maintenance activities of the transmission network in Sulawesi Selatan.

Measuring instruments and spare panels are to be provided concentratively at maintenance centers although a minimum quantity of measuring instruments to be required upon occurrence of trouble is to be provided at radio terminal stations with resident maintenance personnel.
The following personnel are to be necessary for the maintenance of transmission line facilities.
(See Attached DWG. IV.2.6-2.)

2 directors
8 engineers
43 technicians

2-7 Project Implementation Schedule

Same as the project implementation schedule for Sumatera Utara (III 2-7).

2-8 Construction Expenses

Table IV.2.8-1 gives the breakdown of expenses for the construction of the telecommunication network in Sulawesi Selatan. Expenses given in the table are initial investment, that is, the sum of investment for facilities necessary for meeting the demands of subscribers for a period of 10 years from 1985. The foreign currency expenses for individual items include expenses for training to be performed during the construction of telecommunication network. The total sum of expenses of this project is about 19.4 billion rupiahs (nineteen billion four hundred million rupiahs) and the percentages of the foreign and domestic currencies are respectively 66% and 34%.

The expense for the maintenance and operation and the operating capital have been obtained by the same analysis employed for Sumatera Utara.

Table IV.2.8-1 Summary of Expenses for Construction of Telecommunication Network (Unit: Million Rp.)

Item	Quantity	Expense			Remarks
		Foreign Currency	Domestic Currency	Total	
1. Telephone Exchange					
(1) Automatic exchange	22 offices	3,642	429	4,071	
(2) Manual switchboard	23 sets	0	150	150	Manual office: 4 Automatic office toll boards: 19
Subtotal		3,642	579	4,221	
2. Subscriber's Facilities					
(3) Subscriber's line	29 offices	0	1,959	1,959	
(4) MAS	14 systems	3,432	402	3,834	
(5) Subscriber;s carrier system	-	0	0	0	
Subtotal		3,432	2,361	5,793	
3. Transmission Facilities					
(6) Radio system	20 systems	1,446	510	1,956	6GHz system: 3 800MHz system: 16 VHF: 1
(7) Wired carrier system	5 systems	228	36	264	
(8) Expansion of existing channels	252 channels	213	24	237	
(9) Access roads	3 sections	0	669	669	
Subtotal		1,887	1,239	3,126	
4. Building					
(10) Building	26 offices	0	1,815	1,815	
(11) Power supply equipment	26 offices	3,150	369	3,519	
Subtotal		3,150	2,184	5,334	
Total		12,111	6,363	18,474	
5. Consultant's Fee and Reserve Funds		606	318	924	
Ground Total		12,717 (4,239)	6,681 (2,227)	19,398 (6,466)	

( ): In Japanese Million Yen

2-9 Revenue (Sulawesi Selatan)

The method of estimating the revenue of this project for Sulawesi Selatan is the same as that for Sumatera Utara. For Sulawesi Selatan, the average percentage of effective calls in this area is estimated to be 80% in consideration of the regeonal characteristics of Sulawesi Selatan. This means that in installing telephone sets, priority is given to governmental organizations and public telephone.
As a result, the average annual telephone traffic per subscriber is estimated to be 576 and the call charge earning per subscriber is estimated to be Rp. 310,000 even if the decrease in the call complete rate due to increase in traffic (from 72.25% to 70.00%) is considered.

This project includes the expansion of some existing manual switchboard offices. According to PURUMTEL's data, the call charge earning of these manual switchboard offices is estimated to be Rp.71,000 per year and this figure is used herein.
The monthly rental charge of these manual switchboard offices is Rp.18,000 per year.
The number of telephone demands to be made in 1985 which is the reference year for the estimation of revenue in this project is estimated to be 10.39 and average number of telephone sets to be installed after that is estimated to be 399 per year.
The annual fund statement of the project for Sulawesi Selatan is shown in Table IV.2-1.

3. Financial and Economic Analyses (Sulawesi Selatan)

3-1 Financial Analysis

(1) Premises for financial analysis

Earnings and expenditure used in the financial analysis are based on the estimated figures mentioned in paragraphs 2-8 and 2-9 of this section.

Costs and earnings for Sulawesi Selatan are classified in the same way as for Sumatera Utara and various premises used for financial analysis are the same as those used for Sumatera Utara.

Manual telephone exchange boards of Ujung Pandang telephone office

(2) Analysis of the ratio of profit to gross investment

The estimated cost and revenue of individual items in individual years during the system life of this project are given in Table IV.3-1.

The estimated internal rate of return obtained from these values is 6.37% for this project.

Since the IRR is less than the interest rate of the Indonesian Government to PERUMTEL (12%), this project can not be determined profitable for PERUMTEL with this project alone.

However, since this project does not include the telephone facility expansion plan of Ujung Pandang and Pare Pare in the Propinsi, the earning rate of this project will be developed if the earning increments of these two Kotamadya are added to the earnings of this project.

The call charge earning per subscriber in this project is estimated by a similar way of the Sumatera Utara project. However, in non-telephone areas stress is given to the installation of governmental organizations, police, and public call telephone and the utilization efficiency of telephone service will become considerably high. Accordingly, suppose the call charge earning per subscriber exceeds 10%, the IRR will become about 9.2%.
With this IRR, the project will be able to be profitable depending on the method of operation.

To summarize, it may be concluded that this project may become feasible by making efforts for the development of earnings in operating the system.

(3) Analysis of the rate of profit to local portion

The estimated rate of profit to the local portion on the assumption that the loan in Japanese yen credit is offered under the same premises as in the Sumatera Utara project is 14.37% in this project, which exceeds the loan rate of 12% of the Government to PERUMTEL. Accordingly, it can be determined that this project will be profitable for PERUMTEL on the assumption that a low-interest long-range loan can be introduced. Although funds necessary for renewal by the expiration of the system life may not be able to be reserved as in the Sumatera Utara project, the fund position

standard of more than about 30% of the total amount of investment, which is the target of the World Bank, will be sufficiently met.
Accordingly, this project can be determined to be feasible from the financial standpoint on the assumption of a low-interest long-range loan.

Table IV.3-1 Cash Flow Statement (Sulawesi Selatan)

(Unit: Thousand Rp.)

Item / Year No.	Income	Loan from Foreign Government	Total Revenue	Invest-ment	Working Capital	Mainte-nance and Operation Costs	Repayment of Loan and Interest	Total Expenditure	Balance between Revenue and Expenditure	Accumula-tion of Balance
1	0	6362444	6362444	8698850	0	0	0	9698850	-3336406	-3336406
2	0	6362444	6362444	9698850	0	0	222686	9921536	-3559092	-6895498
3	2640998	0	2640998	0	792299	930543	445371	2168213	472785	-6422713
4	2639698	0	2539698	0	-30390	917171	445371	1332152	1207546	-5215167
5	2591672	0	2591672	0	15592	924032	445371	1384995	1206677	-4008490
6	2643646	0	2643646	0	15592	930892	445371	1391855	1251791	-2756699
7	2695620	0	2695620	0	15592	937753	445371	1398716	1296904	-1459795
8	2747595	0	2747595	0	15592	944613	445371	1405576	1342019	-117776
9	2799569	0	2799569	0	15592	951474	445371	1412437	1382019	1269356
10	2851543	0	2851543	0	15592	958335	445371	1419298	1432245	2701601
11	2903517	0	2903517	0	15592	965195	445371	1426158	1477359	4178960
12	2955492	0	2555492	0	15592	972056	445371	1433019	1522473	5701433
13	2952217	0	2952217	0	-982	971624	1081615	2052257	899960	6601393
14	2952217	0	2952217	0	0	971624	1059379	2031003	921214	7522607
15	2952217	0	2952217	0	0	971624	1037089	2008713	943504	8466111
16	2952217	0	2952217	0	0	971624	1014853	1986477	965740	9431851
17	2952217	0	2952217	0	0	971624	992563	1964187	988030	10419881
18	2952217	0	2952217	0	0	971624	970273	1941897	1010320	11430201
19	2952217	0	2952217	0	0	971624	948037	1919661	1032556	12462757
20	2952217	0	2952217	0	0	971624	925746	1897370	1054847	13517604
21	2952217	0	2952217	0	0	971624	903510	1875134	1077083	14594687
22	2952217	0	3837882	0	-885665	971624	881220	967179	1985038	16579716

The fund position of this project on the premise of the loan in Japanese yen credit is shown in Table IV.3-1. The estimated present value of this project for the social discount rate of 12% is Rp.20.75 billion and the estimated cost-to-earning ratio for the same condition is 0.96.

3-2 Economic Analysis

(1) Premises for economic analysis

The method and premises for the estimation of costs and benefits used in the economic analysis of this project are the same as those employed in the Sumatera Utara project mentioned in SECTION III.

(2) Economic analysis

Costs and benefits in different economic sectors in individual years of this project are given in Table IV.3-2.

It may be concluded, from these values, that the implementation of this project is desirable from the standpoint of national economy. However, since the estimated earning rate of this project alone is not what PERUMTEL initially required in financial standpoint and some subsidiary from other telephone project for urban areas with higher earning rates is necessary. For Sulawesi Selatan, such subsidiary from Ujung Pandang and Pare Pare Kotamadya is desirable. Furthermore, in consideration of the social effect of this project and its effect to the national economy, it may be more desirable to collect low-rate funds upon raising local funds in Indonesia also.

The estimated employment opportunities to be provided in the applicable area by the implementation of this project are about 5,400 man-years for engineers and technicians and about 1,600 man-years for unskilled laborers. This means that

Table IV.3-2 Cost and Benefit Table (Sulawesi Selatan)

PV = 20754573

	1	2	3	4	5	6	7	8	9	10
PB1	0	0	2640998	2539698	2591672	2643646	2695620	2747595	2799569	2851543
PB2	0	0	0	0	0	0	0	0	0	0
MB	0	0	0	0	0	0	0	0	0	0
SB1	2669121	2669121	0	0	0	0	0	0	0	0
SB2	0	0	323554	323554	323554	323554	323554	323554	323554	323554
SB3	0	0	237690	228573	233250	237928	242606	247283	251961	256639
LSB1	333640	333640	0	0	0	0	0	0	0	0
LSB2	0	0	258377	258377	258377	258377	258377	258377	258377	258377
LSB3	0	0	110922	106667	108850	111033	113216	115399	117582	119765
LUB	333640	333640	0	0	0	0	0	0	0	0
EB	0	0	0	0	0	0	0	0	0	0
GB	0	0	0	0	0	0	0	0	0	0
CB1	0	0	5414043	5206378	5312925	5419472	5526018	5632567	5739114	5845660
CB2	0	0	0	0	0	0	0	0	0	0
TOTAL	3336402	3336402	8985584	8663247	8828629	8994010	9159391	9324775	9490157	9655537
PC1	3336406	3336406	0	0	0	0	0	0	0	0
PC2	0	0	0	0	0	0	0	0	0	0
PC3	0	222686	445371	445371	445371	445371	445371	445371	445371	445371
PC4	0	0	792299	-30390	15592	15592	15592	15592	15592	15592
PC5	0	0	930543	917171	924032	930892	937753	944613	951474	958335
PC6	0	0	0	0	0	0	0	0	0	0
MC	0	0	0	0	0	0	0	0	0	0
SC1	2301849	2301849	0	0	0	0	0	0	0	0
SC2	0	0	279033	279033	279033	279033	279033	279033	279033	279033
SC3	0	0	204984	197121	201155	205189	209223	213257	217291	221325
LSC1	300276	300276	0	0	0	0	0	0	0	0
LSC2	0	0	232540	232540	232540	232540	232540	232540	232540	232540
LSC3	0	0	99830	96001	97965	99930	101894	103859	105824	107788
LUC	196848	196848	0	0	0	0	0	0	0	0
EC	0	0	0	0	0	0	0	0	0	0
GC	0	0	0	0	0	0	0	0	0	0
CC1	0	0	2588177	2488903	2539838	2590772	2641707	2692642	2743577	2794512
TOTAL	6135379	6358065	5572775	4625749	4735525	4799318	4863113	4926906	4990701	5054496

(Continued)

	11	12	13	14	15	16	17	18	19	20
PB1	2903517	2955492	2952217	2952217	2952217	2952217	2952217	2952217	2952217	2952217
PB2	0	0	0	0	0	0	0	0	0	0
MB	0	0	0	0	0	0	0	0	0	0
SB1	0	0	0	0	0	0	0	0	0	0
SB2	323554	323554	323554	323554	323554	323554	323554	323554	323554	323554
SB3	261316	265994	265699	265699	265699	265699	265699	265699	265699	265699
LSB1	0	0	0	0	0	0	0	0	0	0
LSB2	258377	258377	258377	258377	258377	258377	258377	258377	258377	258377
LSB3	121948	124131	123993	123993	123993	123993	123993	123993	123993	123993
LUB	0	0	0	0	0	0	0	0	0	0
EB	0	0	0	0	0	0	0	0	0	0
GB	0	0	0	0	0	0	0	0	0	0
CB1	5952207	6058756	6052042	6052042	6052042	6052042	6052042	6052042	6052042	6052042
CB2	0	0	0	0	554703	554703	554703	554703	554703	554703
TOTAL	9820919	9986304	9975882	9975882	10530585	10530585	10530585	10530585	10530585	10530585
PC1	0	0	0	0	0	0	0	0	0	0
PC2	0	0	0	0	0	0	0	0	0	0
PC3	445371	445371	1081615	1059379	1037089	1014853	992563	970273	948037	925746
PC4	15592	15592	-982	0	0	0	0	0	0	0
PC5	965195	972056	971624	971624	971624	971624	971624	971624	971624	971624
PC6	0	0	0	0	0	0	0	0	0	0
MC	0	0	0	0	0	0	0	0	0	0
SC1	0	0	0	0	0	0	0	0	0	0
SC2	279033	279033	279033	279033	279033	279033	279033	279033	279033	279033
SC3	225359	229393	229139	229139	229139	229139	229139	229139	229139	229139
LSC1	0	0	0	0	0	0	0	0	0	0
LSC2	232540	232540	232540	232540	232540	232540	232540	232540	232540	232540
LSC3	109753	111718	111594	111594	111594	111594	111594	111594	111594	111594
LUC	0	0	0	0	0	0	0	0	0	0
EC	0	0	0	0	0	0	0	0	0	0
GC	0	0	0	0	0	0	0	0	0	0
CC1	2845446	2896382	2893172	2893172	2893172	2893172	2893172	2893172	2893172	2893172
TOTAL	5118288	5182084	5797734	5776480	5754190	5731954	5709664	5687374	5665138	5642847

(Continued)

	21	22
PB1	2952217	2952217
PB2	0	885665
MB	0	0
SB1	0	0
SB2	323554	323554
SB3	265699	265699
LSB1	0	0
LSB2	258377	258377
LSB3	123993	123993
LUB	0	0
EB	0	0
GB	0	0
CB1	6052042	6052042
CB2	554703	554703
TOTAL	10530585	11416250
PC1	0	0
PC2	0	0
PC3	903510	881220
PC4	0	0
PC5	971624	971624
PC6	0	0
MC	0	0
SC1	0	0
SC2	279033	279033
SC3	229139	229139
LSC1	0	0
LSC2	232540	232540
LSC3	111594	111594
LUC	0	0
EC	0	0
GC	0	0
CC1	2893172	2893172
TOTAL	5620611	5598321

Legend:

PB1	:	PERUMTEL 1
PB2	:	PERUMTEL 2
SB1	:	Local supplyers 1
SB2	:	Local supplyers 2
SB3	:	Local supplyers 3
LSB1	:	Skilled laborer 1
LSB2	:	Skilled laborer 2
LSB3	:	Skilled laborer 3
LUB	:	Unskilled laborer
CB1	:	Subscribers 1
CB2	:	Subscribers 2
PC1	:	PERUMTEL 1
PC2	:	PERUMTEL 2
PC3	:	PERUMTEL 3
PC4	:	PERUMTEL 4
PC5	:	PERUMTEL 5
PC6	:	PERUMTEL 6
SC1	:	Local supplyers 1
SC2	:	Local supplyers 2
SC3	:	Local supplyers 3
LSC1	:	Skilled laborers 1
LSC2	:	Skilled laborers 2
LSC3	:	Skilled laborers 3
LUC	:	Unskilled laborers
CC1	:	Subscribers

annual employment opportunities of 320 persons are to be provided by this project.
The estimated effect to local industries in this area, as calculated in the same way with the Sumatera Utara project, amounts to a total demand sum of Rp.16,563 million, from which employment opportunities of annually 380 persons are to be provided.

4. Evaluation

The Sulawesi Selatan area is one of those areas in Indonesia that have been less industrialized in the country and people in this area are making economic activities by agriculture mainly by producing rice crop. Infrastructure necessary for modern economic activities have not been developed except in Ujung Pandang and the Underdvelopment has been a great distriction to the economic and social dvelopment of the area.

Since telecommnication service, like other infrastructure such as electric power and water supply services, is available in limited urban areas only, most people in the area can not enjoy the service. Accordingly, economic and social activities are subject to strong restrictions particularly in rural areas, causing economic activities in the areas to be behind those in other those areas and the population to be flowed out of the areas.

Under these circumstances, telephone service in rural areas, particularly telephone service for individual Ibukota Kecamatan which are the political, economic and social centers of rural areas, is expected to make a pioneer's contribution to the economic and social development of the areas and thus the improvement and development of telephone service is strongly desired. In the Sulawesi Selatan area, however, the Trans-Sulawesi Selatan Communication Network has been completed but only partially and for the improvement and development of telephone service in this area it is necessary to arrange and complete the network as well.

Accordingly, the feasibility of the Sulawesi Selatan project can not help but being lower than that of the Sumatera Utara project. On the other hand, the elimination of non-telephone Kecamatan is a strong social and political desire as in the Sumatera Utara area. However, since the revenue rate will be considerably low because of the increase in costs rising from the incompleteness of the Trans-Sulawesi Selatan Network and less demands caused by low economic activity level and it is necessary to realize the elimination of non-telephone Kecamatan step by step.

The Sulawesi Selatan project should also be such a project that can cope with future telecommunication demands as in the case of the Sumatera Utara project. This requires a careful examination not only from technical standpoint but also from financial and economic standpoints.

The project discussed herein is supposed to be the most suitable, practicable one from both technical and economic standpoints in consideration of the above-mentioned various points.

From the financial standpoint, however, the IRR (6.37%) is less than the interest rate of the Government to PERUMTEL (12%) and this project can not necessarily be said feasible. However, in consideration of the importance of telecommunication service in this area, it is desirable to implement this project by the introduction of a long-range, low-rate loan. Suppose such a loan of an interest rate of 3.5%, a repayment period of 20 years, and a grace period of 10 years is offered for the foreign currency portion (about 65.6%) of the

Total investment to be raised in this project, the estimated interval rate of return to be collected by PERUMTEL becomes 14.37% and thus the project will become feasible. Furthermore, since the telephone development projects for Ujung Pandang and Pare Pare areas expected to provide the higher return rates are excluded from the project, sufficient feasibility can be secured if this project is included as a part of the project for the whole Sulawesi Selatan area.

To conclude, in consideration of the fund rasing capability of the present PERUMTEL, such an economic cooperation as the introduction of a loan in roreign country at least for the foreign currency portion of all funds is desirable as in the case of the Sumatera Utara project.

SECTION V. APPENDIX

V. APPENDIX

1. Supplementary Explanation on Telephone Demand Forecast

1-1 Telephone Demand Density and GDP per Capita

GDP per capita and telephone densities (the number of main telephone stations in population per 100 inhabitants) of various countries in the world are shown in Table V.1.1-1 (1) ~ (3). Fig. V.1.1-1 shows the plotted data of Table V.1.1-1 (1) ~ (3) by giving the GDP per capita on the abscissa and the telephone density on the ordinate. The straight line in the figure is the regression line for the plotted points and can be expressed by

$$\log Y = -7.1643 + 1.3968 \log X$$

where

Y: telephone density per 100 inhabitants
X: GDP per capita (in Rp.)

It appears, from the figure, that Indonesia provides a suitable average level of telephone service for her economic activities.

The data and equation (expressed in US $) are those reported in "JAKARTA CITY TELEPHONE PLANNING JTP '79."

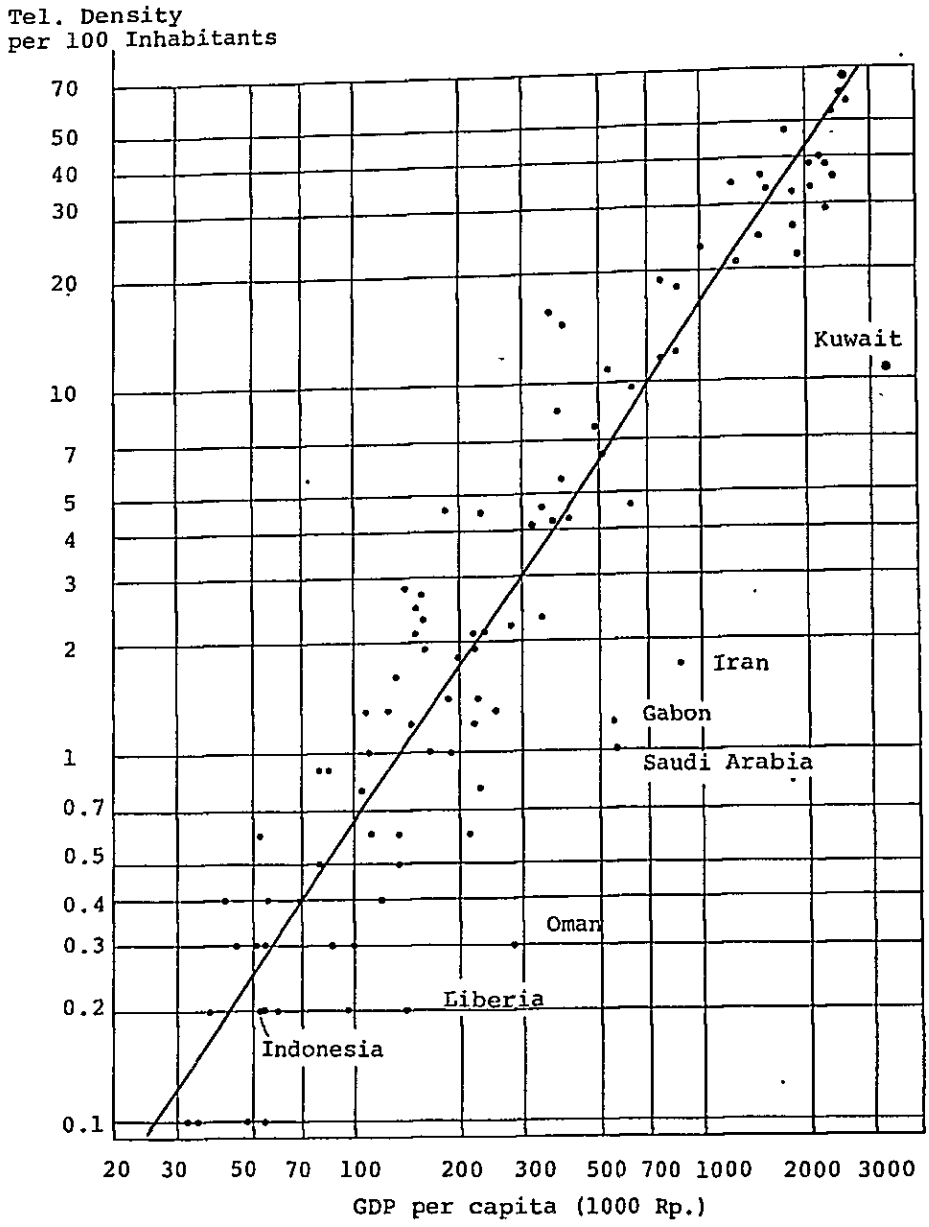


Fig. V.1.1-1 Telephone Density and GDP per capita in 1973

Table V.1.1-1 (1) GDP per Capita and Telephone Density per 100 Inhabitants in 1973

Name of Country	GDP in 1973 Million (*Billion)	Exchange Rate per US $	National Currency	Population in 1973 (Million)	GDP per Capita (US$)	Telephone Density per 100 Inhabitants
Algeria	* 29.7	4.185	Dinar	15.77	450	1.4
Australia	* 50.7	0.672	Dollar	13.13	5,746	35.5
Austria	* 533.3	19.85	Schilling	7.53	3,568	24.6
Bangladesh	* 69.1	8.165	Taka	73.21	116	0.1
Barbados	425.9	2.07	Dollar	0.24	857	15.6
Belgium	* 1,774.0	41.32	Franc	9.74	4,408	25.7
Benin	* 73.6	235.4	Franc	2.95	106	0.3
Bolivia	21,459.0	20.0	Peso	5.33	201	0.9
Botswana	* 192.1	0.6712	Pula	0.65	440	0.9
Brazil	* 477.2	6.22	Cruzeiro	100.56	763	2.3
Burma	11,735.0	4.862	Kyat	29.04	83	0.1
Canada	* 124.5	0.9958	Dollar	22.13	5,650	52.8
Colombia	* 243.2	24.89	Peso	22.27	439	4.6
Costa Rica	10,162.0	6.65	Colon	1.87	818	4.6
Cyprus	335.7	0.361	Pound	0.62	1,500	9.7
Denmark	164.9	6.29	Krone	5.02	5,222	40.0
Dominica Republic	2,345.0	1.00	Peso	4.43	529	1.9
Ecuador	* 64.6	25.0	Sucre	6.73	384	1.9
Egypt	3,663.0	0.3913	Pound	35.62	263	1.3
El Salvador	3,332.0	2.5	Colon	3.77	354	1.2
Ethiopia	5,005.0	2.09	Birr	26.55	90	0.2
Fiji	338.3	0.8092	Dollar	0.55	760	4.1
Finland	* 66.7	3.85	Markka	4.67	3,710	32.9
France	* 1,114.2	4.708	Franc	52.18	4,535	21.7
Gabon	* 161.1	235.4	Franc	0.52	1,316	1.2
German	* 918.6	2.703	D. Mark	61.97	5,484	28.7
Ghana	3,501.0	1.15	Cadi	9.36	325	0.6
Greece	* 484.0	29.7	Drachma	8.93	1,825	18,7
Guatemala	2,569.0	1.00	Quetzal	5.74	448	1,0
Guyana	643.4	2.24	Dollar	0.76	378	2.3
Haiti	3,129.0	5.00	Gourde	4.44	141	0.2
Honduras	1,814.0	2.0	Lempira	2.78	326	0.5
Iceland	* 95.4	83.81	Krone	0.21	5,420	38.1
India	* 576.8	8.13	Rupee	574.42	124	0.3

Table V.1.1-1 (2) GDP per Capita and Telephone Density per 100 Inhabitants in 1973

Name of Country	GDP in 1973 Million (*Billion)	Exchange Rate per US $	National Currency	Population in 1973 (Million)	GDP per Capita (US$)	Telephone Density per 100 Inhabitants
Indonesia	* 6,753.0	415.0	Rupiah	129.15	126	0.2
Iran	* 1,861.0	67.63	Rial	31.3	879	1.7
Iraq	1,626.0	0.2961	Dinar	10.41	528	1.2
Ireland	2,689.0	0.4305	Pound	3.05	2,048	12.0
Israel	41,875.0	4.2	Pound	3.21	3,106	20.8
Italy	* 82,143.0	607.92	Lira	54.91	2,461	22.9
Ivory Coast	* 556.2	235.4	Franc	4.65	508	0.6
Jamaica	1,752.0	0.9091	Dollar	1.98	973	4.3
Japan	*111,061.0	280.0	Yen	108.70	3,649	35.7
Jordan	268.5	0.3289	Dinar	2.54	321	1.6
Kenya	829.0	0.345	Pound	112.48	193	0.9
Korea Republic	* 4,939.0	398.0	Won	34.10	364	2.5
Kuwait	2,111.0	0.2967	Dinar	0.89	7,994	10.7
Lesotho	84.1	0.6712	Rand	0.99	127	0.3
Liberia	544.9	1.0	Dollar	1.63	334	0.2
Libyan Arab Jamahiriya	2,246.0	0.2961	Dinar	2.25	3,371	2.8
Luxembourg	* 72.7	41.32	Franc	0.35	5,027	38.2
Madagascar	* 297.6	235.4	Franc	7.57	167	0.4
Malawi	400.0	0.8475	Kwacha	4.79	99	0.4
Malaysia	14,401.0	2.45	Ringitt	11.31	520	2.1
Malta	115.7	0.3867	Pound	0.32	935	14.4
Mauritius	1,852.0	5.739	Rupee	0.86	375	2.7
Mexico	* 619.6	12.5	Peso	56.16	883	4.2
Morocco	* 21.3	4.29	Dirham	16.31	304	1.3
Nepal	9,969.0	10.56	Rupee	12.07	78	0.1
Netherlands	* 168.1	2.824	Ghilder	13.44	4,429	32.0
New Zealand	8,767.0	0.7001	Dollar	2.95	4,245	47.5
Nicaragua	7,655.0	7,026	Cordoba	2.01	542	0.8
Nigeria	9,001.0	0.6579	Naira	59.66	229	0.2
Norway	* 111.8	5.73	Krone	3.96	4,927	32.9
Omen	169.4	0.3454	Rialamani	0.72	681	0.3
Pakistan	* 86.2	9.931	Rupee	66.23	131	0.3

Table V.1.1-1 (3) GDP per Capita and Telephone Density per 100 Inhabitants in 1973

Name of Country	GDP in 1973 Million (*Billion)	Exchange Rate per US $	National Currency	Population in 1973 (Million)	GDP per Capita (US$)	Telephone Density per 100 Inhabitants
Panama	1,472.0	1.0	Balbou	1.57	938	5.5
Papua New Ginea	1,040.6	0.672	Kina	2.56	605	1.3
Paraguay	* 125.4	126.0	Guarani	2.50	398	1.0
Peru	* 381.9	38.7	Sol	14.71	671	2.2
Phillippines	* 71.8	6.74	Peos	40.12	266	1.0
Portugal	* 281.1	25.85	Escudo	8.56	1,270	10.9
Saudi Arabia	* 40.6	3.55	Riyal	8.45	1,353	1.0
Senegal	* 230.6	235.4	Franc	3.87	253	0.8
Seychelles	168.0	5.739	Rupee	0.06	488	4.5
Sierra Leone	478.0	0.8609	Leone	2.67	208	0.3
Singapore	10,205.0	2.49	Dollar	2.19	1,871	11.4
South Africa	19,074.0	0.6712	Rand	24.31	1,169	7.5
Spain	* 4,129.0	56.85	Peseta	34.86	2,083	18.1
Sri Lanka	17,053.0	6.748	Rupee	13.25	191	0.5
Sudan	1,246.0	0.3482	Pound	15.0	239	0.3
Sweden	* 220.2	4.588	Krone	8.14	5,896	59.4
Switzerland	* 130.1	3.244	Franc	6.43	6,237	56.0
Syrian Arab Republic	9,413.0	3.8	Pound	6.89	360	2.1
Thailand	* 216.5	20.38	Baht	39.69	268	0.6
Trinidad & Tobago	2,689.0	2.07	Dollar	1.06	1,226	6.3
Tunisia	1,163.0	0.445	Dinar	5.44	480	1.8
Turkey	* 296.0	14.15	Lira	37.36	560	2.1
United Kingdom	* 72.0	0.4304	Pound	55.93	2,991	34.0
United Republic of Cameroon	* 416.0	235.4	Franc	6.17	286	0.4
Tanzania	13,103?0	6.9	Shilling	14.37	132	0.4
U.S.A.	* 1,302.0	1.0	Dollar	210.41	6,188	65.7
Uruguay	* 2,537.5	937.0	Peso	2.99	906	8.3
Venezuela	* 72.5	4.28	Bolivar	11.28	1,502	4.6
Yemen	3,710.0	4.575	Rial	6.29	129	0.1
Yemen Democratic	68.0	0.3454	Dinar	1.56	126	0.6
Zaire	1,501.8	0.5	Zaire	23.56	127	0.2
Zambia	1,616.0	0.6435	Kwacha	4.64	541	1.4

Quotation of 1973
1 US$ = 415 Rp.

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1-2 Forecast of GDP per Capita

Sumatera Utara's GDP per capita in individual years at 1971 constant prices are given in Table V.1.2-1.

Table V.1.2-1 GDP per capita of Smatera Utara at 1971 Constant Prices

Year	GDP per capita*(in Rp.)
1971	46347
1972	51159
1973	55429
1974	60454
1975	60938
1976	65986
1977	67593
1978	72474

* From P16, Table 2.5, S-32 (see Table V-7-1-1)

The relation between the GDP per capita at 1971 constant prices and respective years has been obtained by the least square method, as follows.

$$y = 72500(1 + 0.06)^{n}$$

where

y: GDP per capita at 1971 constant prices (in Rp.)
n: the number of years counted from the reference year (for 1978, n = 0).

From the above equation, we have 6% for the average annual economic growth rate and Rp. 72,500 for the GDP per capita of the reference year (1978) at 1971 constant prices.

The trend of GDP per capita and its regression line are shown in Fig. V.1.2-1. Since the economic growth tends to somehow slow down, regression lines for the economic growth rates of 4.5% and 3% are also shown in the figure. GDP per capita in individual years at 1971 constant prices for the economic growth rates of 6%, 4.5%, and 3% are given in Table V.1.2-2.

Table V.1.2-2 GDP per capita of Sumatera Utara for Different Economic Growth Rates (at 1971 Constant Prices)

Economic Growth Rate	GDP per capita (in Rp.)		
	1985	1995	2005
6%	109,000	195,000	349,000
4.5%	99,000	153,000	238,000
3%	89,000	120,000	161,000

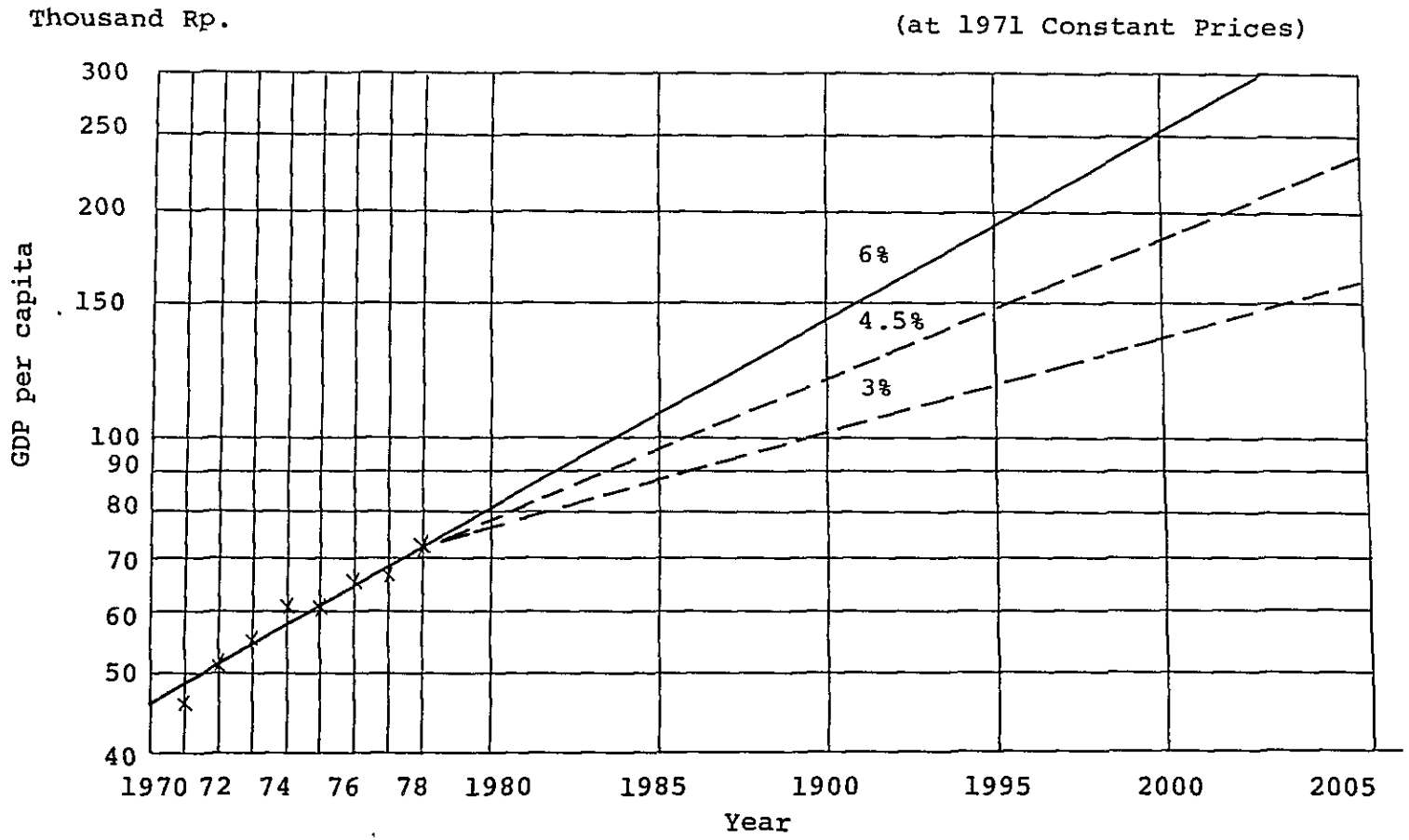

Fig. V.1.2-1 GDP per capita of Sumatera Utara at 1971 Constant Prices

1-3 Effects of Telecommunication to other Industrial Fields

The effects of telecommunication to other industrial fields have been cleared in the "Roles of Telecommunications in Developing Countries" (by Naoe, et al). According to this document, the effects of the telecommunication to the service productivities and service prices of 66 industrial fields among those listed in the "Indonesian Industrial Fields as of 1971" are obtained by calculation and the results of calculation are given in Table V.1.3-1 (1) ~ (3). The effects of the telecommunication field to the major 15 industrial fields having experienced large increase in productivity are given in Table V.1.3-2 and those to the major 15 industrial fields having experienced less increase in productivity are given in Table V.1.3-3. Also, fifteen major industrial fields to which the impact of the service price of the communication field is large are given in Table V.1.3-4 and fifteen major industrial fields to which the impact thereof is small are given in Table V.1.3-5.

It is known from Table V.1.3-2 that considerable productivity increase has been experienced, on account of increase in the service productivity of the telecommunication field, in the fields of trading, petroleum refining, social and community services, restaurants and hotels, inland transportation, and construction most of which are in the tertiary industry. On the other hand, those industrial fields having experienced less productivity increase, on account of the service productivity increase of the telecommunication field, are concentrated in the primary industry (Table V.1.3-3). Considerably large impact of the service price of the

telecommunication field has been given to prices in industrial fields mostly in the secondary industry (Table V.1.3-4) and less impact thereof is given to prices in industrial fields in the primary industry (Table V.1.3-5).

We have determined, from these trends, that a greater telephone demand increase is experienced in the secondary and tertiary industries and that demand distribution by non-agricultural labor population is a practical method for the first approximation for the distribuiton of the microscopic demand forecast to individual areas.

Table V.1.3-1 (1) Effects of Telecommunication to Other Industrial Fields given in the "List of Indonesian Industrials"

Code	Classification	Price Increase	Productivity Increase
1	Paddy	0.001115	0.002871
2	Handpounding of rice	002001	002002
3	Maize	001071	000322
4	Root crops	002917	001302
5	Vegetables & fruits	000835	002343
6	Other farm food crops	001312	000624
7	Rubber	007702	001208
8	Sugar cane & brown sugar	008032	001080
9	Coconut	001196	001680
10	Coconut & palm oil	005776	002212
11	Tobacco leaves & tobacco processed	009058	000524
12	Roasted coffee	005288	000498
13	Tea leaves & farm processed tea	009133	000179
14	Cloves	001078	000519
15	Nutmeg	002396	000021
16	Other spices	001052	000064
17	Other crops	002272	002036
18	Livestock	001272	001015
19	Slaughtering	004010	001681
20	Poultry & products	000620	003355
21	Logging & sawmilling	006530	005718
22	Other forest products	001124	001206
23	Fisheries	003669	005602
24	Coal & metal ore mining	007737	001827
25	Petroleum & natural gas mining	001260	023074
26	Other quarrying	002801	002001
27	Processing & preserving of foods	008794	000983
28	Oil & fats	009861	002568
29	Rice milling, cleaning & polishing	002699	001358
30	Wheat flour & products	009112	000986
31	Sugar refining	010900	000281
32	Foods products, not elsewhere classified	007449	002129

Table V.1.3-1 (2) Effects of Telecommunication to Other Industrial Fields given in the "List of Indonesian Industrials"

Code	Classification	Price Increase	Productivity Increase
33	Beverage industries	012025	001836
34	Cigarettes	009161	001395
35	Spinning industries	013299	005407
36	Textile, leather & wearing apparel	036819	027702
37	Wood & wood products	013823	002777
38	Paper & paper products & printing	027027	024983
39	Fertilizer & pesticides	009144	000298
40	Chemical industries	010378	008254
41	Petroleum refining	032302	043664
42	Rubber products	013894	002765
43	Non-metalic mineral products	009920	002814
44	Cement	013992	001862
45	Iron & steel basic industries	016883	006234
46	Non-ferrous basic metal industries	005880	002650
47	Prefabricated metal products	016150	007164
48	Machinery, electrical appliances, apparatus and accessories	016129	013549
49	Manufacture & repair of transport equipment	030253	035210
50	Other manufacturing industries, not elsewhere classified	011777	001305
51	Electricity, gas & water supplies	015762	006546
52	Construction	047187	038110
53	Trade	041394	067035
54	Restaurants & hotels	044515	039520
55	Railways	021694	002280
56	Road transport	038287	038759
57	Water transport	012537	002036
58	Air transport	043295	033143
59	Services allied to transport	005745	002558
60	Financial services	011172	008194
61	Real estate & business services	010068	006129
62	Public administration and defence	000000	000000

Table V.1.3-1 (3) Effects of Telecommunication to Other Industrial Fields given in the "List of Indonesian Industrials"

Code	Classification	Price Increase	Priductivity Increase
63	Social and community services	048533	043018
64	Recrationalcultural, personnel & houshold services	012920	009874
65	Unspecified & provisional sector	018542	004546

Table V.1.3-2 Fifteen (15) Major Industrial Fields Having Experienced Higher Productivity Increase

Order	Classification	Productivity Increase Rate
1	53 Trade	0.067035
2	41 Petroleum refining	043664
3	63 Social and community service	043018
4	54 Restaurants & hotels	039520
5	56 Road transport	038759
6	52 Construction	038110
7	49 Manufacture & repair of transport equipment	035210
8	58 Air transport	033143
9	36 Textile, leather & wearing apparel	027702
10	38 Wood & wood products	024983
11	25 Petroleum & natural gas	023074
12	48 Machinery, electrical appliances, apparatus and accessories	013549
13	64 Recrational cultural, personnel & houshold services	009874
14	40 Chemical industries	008254
15	60 Financial services	008194

Table V.1.3-3 Fifteen (15) Major Industrial Fields Having Experienced Less Productivity Increase

Order	Classification	Productivity Increase Rate
1	15 Nutmeg	0.000021
2	16 Other spices	000064
3	13 Tea leaves & farm processed tea	000179
4	31 Sugar refining	000281
5	39 Fertilizer & pesticides	000298
6	3 Maize	000322
7	12 Roasted coffee	000498
8	14 Cloves	000519
9	11 Tobacco leaves & tobacco processed	000524
10	6 Other farm food crops	000624
11	27 Processing & preserving of foods	000983
12	30 Wheat flour & products	000986
13	18 Livestock	001015
14	8 Sugar cane & brown sugar	001080
15	22 Other forest products	001206

Table V.1.3-4 Fifteen (15) Major Industrial Fields Having Experienced Higher Price Increase

Order	Classification	Price Increase Rate
1	63 Social and community services	0.048533
2	52 Construction	047487
3	54 Restaurants & hotels	044515
4	58 Air transport	043295
5	53 Trade	041394
6	56 Road transport	038287
7	36 Textile, leather & wearing apparel	036819
8	41 Petroleum refining	032302
9	49 Manufacture & repair of transport equipment	030253
10	38 Paper & paper products & printing	027027
11	55 Railways	021694
12	44 Cement	018922
13	45 Iron & steel basic Industries	016883
14	47 Prefabricated metal products	016150
15	48 Machinery, electrical appliances, apparatus and accesssories	016129

Table V.1.3-5 Fifteen (15) Major Industrial Fields Having Experienced Less Price Increase

Order	Classification	Price Increase Rate
1	20 Poultry & products	0.000620
2	5 Vegetables & fruits	000835
3	16 Other spices	001052
4	3 Maize	001071
5	14 Cloves	001078
6	1 Paddy	001115
7	22 Other forest products	001124
8	9 Coconut	001196
9	25 Petroleum & natural gas mining	001260
10	18 Livestock	001272
11	6 Other farm feed crops	001312
12	2 Handpounding of rice	002001
13	17 Other crops	002272
14	15 Nutmeg	002396
15	29 Rice milling, cleaning & polishing	002699

1-4 Allotment of Estimated Demand Obtained by First Approximation to Areas

This paragraph describes the method of calculation for the allotment of the total estimated demand obtained by the first approximation to areas by nonagricultural population ratio. The following were set forth as premises upon calculation.

(1) Since the data of nonagricultural population ratio of individual Kotamadya and Kabupaten in individual years were not available, the data of the labor populations of different types of industries given in the 1971 Census (Table V.1.4-1) is used as the basic data for the nonagricultural population ratio. This ratio is supposed to be constant in the future also.

(2) After the 1971 Census, Kotamadya Medan and Tebing Tinggi have spread their areas and their populations have changed. Since different areas have different population increase ratios, the nonagricultural populations of Kotamadya and Kabupaten have been obtained by multiplying the populations in the applicable year, which have been obtained in item (2), by the nonagricultural population coefficient obtained in item (1), as follows.

$$y_i = K_i \cdot Y$$

where

y_i: demand of Kotamadya or Kabupaten

Y: macroscopic forecast demand

K_i: allotment coefficient

$$K_i = \frac{w_i N_i}{\sum_i w_i N_i}$$

where $w_i N_i$: nonagricultural population of Kotamadya or Kabupaten

$\sum_i w_i N_i$: nonagricultural population of Sumatera Utara

w_i: nonagriculatural population coefficient

N_i: population in the applicable year

$$w_i \equiv \frac{N_{is} - A_{is}}{N_{is}}$$

where N_{is}: total labor population given in Table V.1.4-1

A_{is}: agricultral population given in Table V.1.4-1.

The results of calculation of the nonagricultural population coefficient and the estimated demand values obtained by the first approximation and alloted to individual Kotamadya and Kabupaten (1980) are given in Table V.1.4-2. It appears, from Table V.1.4-2, that the estimated demand values for individual Kotamadya can be determined nearly proper when compared with the current number of main telephone stations in operation but some discrepancies exist between estimated and actual values for individual Kabupaten.

Table V.1.4-1 Economically Active Population by Kabupaten/Kotamadya and Industry

Urban + Rural

Kabupaten/ Kotamadya	Industry										Total
	Agri-culture, Hunting, etc.	Mining and Quarry-ing	Manufac-turing	Elec-tricity Gas and Water	Construc-tion	Trade, Restau-rant and hotels	Trans-port Storage and Communi-cation	Financing Insurance, etc.	Community Service, etc.	Activities not Adequately Defined	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Deli Serdang	322402	511	18389	817	8536	36257	23026	972	47170	32726	490806
Langkat	125157	2440	7568	106	1164	5604	2903	53	13356	5579	163930
Karo	73299	0	891	17	316	2795	1011	1	4974	2572	85876
Simalungun	171046	6	9461	52	3021	5514	1374	54	15880	29384	235792
Asahan	192627	57	5934	237	3896	11686	3735	44	10648	3414	232278
Labuhan Ratu	116098	130	3801	75	585	4148	1340	66	6081	5415	137739
Tapanuli Tengan	50795	21	651	0	105	1263	275	0	1633	820	55563
Tapanuli Selatan	185005	1	2680	62	814	9077	2402	220	10641	19673	230575
Tapanuli Utara	208386	5	2850	56	913	5364	1433	0	13410	11639	244056
Nias	159741	0	519	0	417	1235	1214	82	7089	4441	174738
Dairi	76373	0	192	0	113	870	341	17	3596	603	82105
KOD. Medan	3747	627	12672	637	8939	41056	18218	2522	47483	17986	153887
Ko. Pem. Siantar	1358	21	4222	295	1287	7224	2908	312	8639	4795	31062
Ko. Tanjung Balai	1782	6	571	30	246	2560	1063	49	1864	1434	9605
KOD. Binjai	1826	72	1104	78	590	3978	1048	69	5325	977	15067
KO. Tebing Tinggi	215	8	751	73	280	2539	920	18	2504	290	7598
KOD. Sibolga	1820	20	693	29	515	2355	1158	179	3184	772	10725
Total	1691677	3925	72949	2564	31737	143525	64369	4659	203477	142520	2361402

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Table V.1.4-2 Estimated Demand for Different Areas (by First Approximation)

	w_i	N_i (x1000)	$w_i N_i$ (x1000)	K_i	Estimated Demand y_i (1980)	Telephone Stations in Operation (May, 1980)
Medan	0.86	1205	1036	0.438	17494	16860
Binjai	0.80	78	62	0.026	1038	261
T. Tinggi	0.93	82	76	0.032	1278	523
Tg Balai	0.67	44	30	0.013	519	460
P. Siantar	0.80	145	116	0.049	1957	3000
Deli Serdang	0.28	1217	341	0.144	5752	239
Langkat	0.19	664	126	0.053	2117	254
Asahan	0.17	713	121	0.051	2037	459
Karo	0.11	214	24	0.011	439	408
Simalungun	0.15	780	117	0.049	1957	222
Others*	0.10	3180	318	0.134	5352	?
Total			2366	1	39941	

* Sibolga, Labuhan Batu, Tapanuli Tengah, Tapanuli Selatan, Tapanuli Utara, Nias and Dairi.

1-5 Estimated Demand and Demand Ratio

By obtaining the 1980's estimated demand values of individual Kecamatan where communication service is being given, we have compared the values with the number of main telephone stations in operation at the time of our survey (August, 1980). The current demand values for individual Kecamatan have been obtained by allotting the current estimated demand of each Kabupaten by

population ratio. The results are given in Table V.1.5-1. Fig. V.1.5-1 shows the plotted data of Table V.1.5-1 by giving the area on the abscissa and giving the ratio of the current number of main telephone stations in operation to the estimated demand on the ordinate. The figure shows that the demand ratio (that is, the ratio of the number of main telephone stations in operation to the estimated demand) decreases in proportion with the area of the Kecamatan and that areas can be classified into two types, that is, areas with high telephone demand such as Ibukota Kabapaten (Kisaran and Kabanjahe), sightseeing area (such as S. Bolon) and industrial areas (such as Air Putih and Babalan) and other areas. For general areas the demand ratio curve shown by the solid line in the figure may be applied in consideration of increase in demand on account of change from manual to automatic switching. The demand ratio is 1 ($S \leq 100$ km^2) or $\frac{100}{S}$ ($S > 100$ km^2).

The areas, populations, overall demand (first approximation of demand), and estimated ultimate demand (obtained through correction of the overall demand by the demand ratio) are given in Table V.1.5-2 (1) ~ (3).

Table V.1.5-1 Estimated Demand Values for Individual Kecamatan

Kecamaten	Area S(km^2)	Number of Main Telephone Stations in Operation A (L.U.)	Estimated Demand B (L.U.)	Demand Ratio A/B
(Deli Serdang)				
Galang	310	38	276	0.14
Lubuk Pakam	310	169	581	0.29
Sei Rampah	334	32	426	0.08
(Langkat)				
P.K. Susu	316	18	95	0.19
Babalan	480	115	256	0.45
Tg Pura	154	97	140	0.69
Kuala	206	24	110	0.22
(Asahan)				
Kisaran	329	330	344	0.96
Talawi	81	25	98	0.26
Air Putih	382	104	161	0.65
(Karo)				
Kabanjahe	68	395	102	3.87
Tiga Binanga	157	13	31	0.42
(Simalungun)				
S. Bolon	77	87	25	3.43
D.B. Nyanggir	217	43	155	0.28
Bandar	422	92	337	0.27

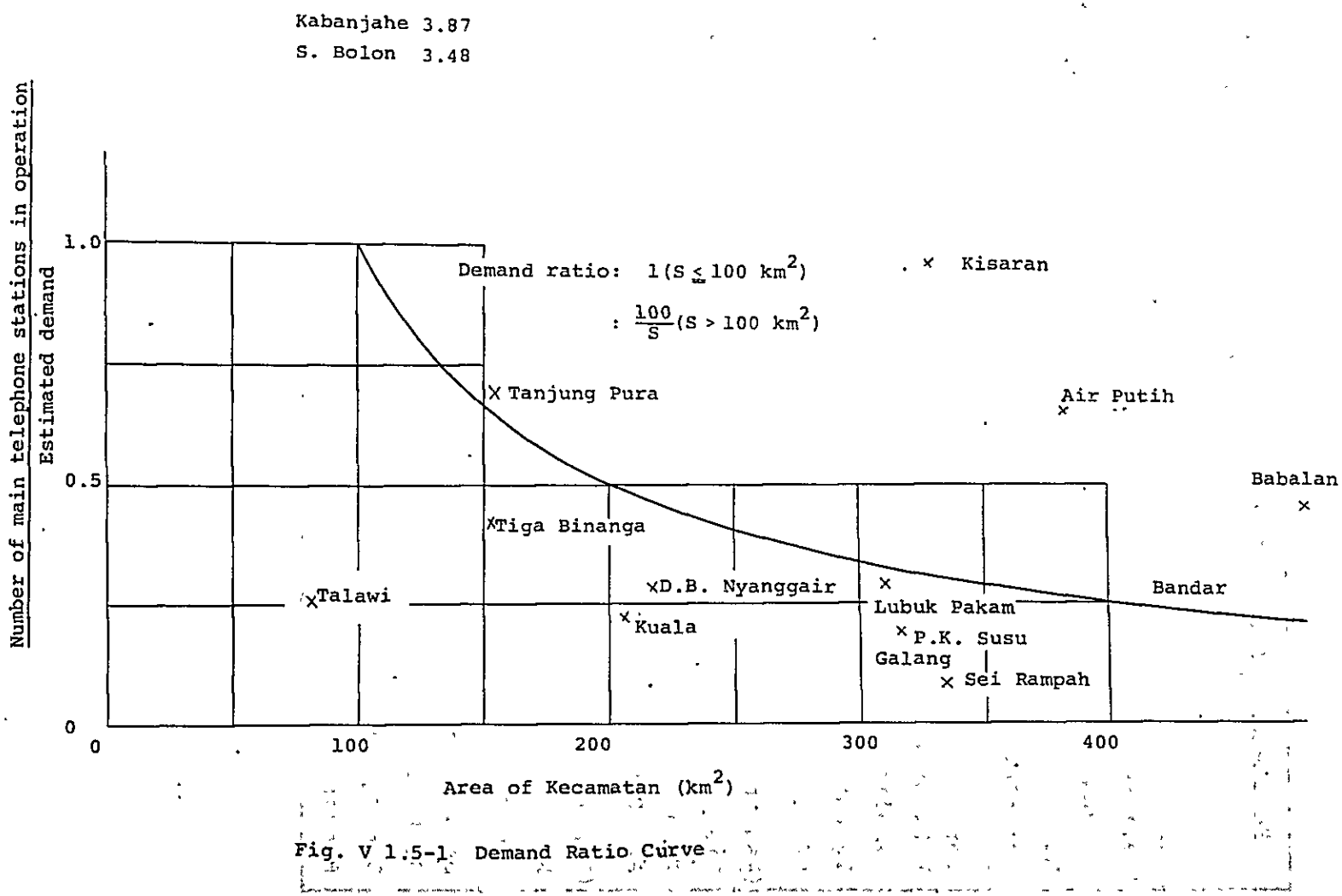


Fig. V 1.5-1 Demand Ratio Curve

Table V.1.5-2.(1) Estimated Telephone Demands

Item / Kecamatan	Area (km^2)	Population Ratio (%)	1985		1995		2005		Remarks
			Overall Demand	Estimated Demand	Overall Demand	Estimated Demand	Overall Demand	Estimated Demand	
(Deli Serdang)									
1 Hamparan Perak	381	7.5	625	165	1436	377	3282	861	
2 Labuhan Deli	214	1.6	134	63	306	143	700	327	
3 Sunggal	220	5.9	495	225	1130	514	2582	1174	
4 Delitua	30	1.5	126	126	287	287	656	656	
5 Patumbak	78	1.8	151	151	345	345	788	788	
6 Percut Sei Tuan	159	6.8	571	359	1302	819	2975	1871	
7 Biru-Biru	320	1.6	134	42	306	96	700	219	
8 Kuta Limbaru	350	1.7	143	41	326	93	744	213	
9 Namorambai	120	1.0	84	70	192	160	438	365	
10 Pancur Batu	300	2.8	235	78	536	179	1225	408	
11 Sibolangit	300	1.2	101	34	230	77	525	175	
12 Galang	310	4.8	403	130	919	296	2100	677	
13 Batang Kuwis	42	1.6	134	134	306	306	700	700	
14 Pantai Cermin	150	2.0	168	112	383	255	875	583	
15 Tanjung Merawa	300	5.4	453	151	1034	345	2363	788	
16 Lubuk Padam	310	10.1	847	273	1934	624	4419	1425	
17 Perbaungan	350	6.9	579	165	1321	377	3019	863	
18 Gunung Meriah	180	0.2	17	9	38	21	88	49	
19 Kota Rih	150	1.3	109	73	249	166	569	379	
20 Bangun Purba	370	2.0	168	45	383	104	875	236	
21 Senembah Tanjung Mude Hilir	470	1.5	126	27	287	61	656	140	
22 Senembah Tanjung Muda Hulu	380	0.5	42	11	96	25	219	58	
23 Dolok Merawan	93	1.5	126	126	287	287	656	656	
24 Bandar Khalifah	116	1.8	151	130	345	297	788	679	
25 Sipispis	220	2.6	218	99	498	226	1138	517	
26 Tebing Tinggi	315	9.3	780	248	1781	565	4069	1292	
27 Sei Rempah	334	7.4	621	186	1417	424	3238	969	
28 Tanjung Beringin	63	1.9	159	150	364	364	831	831	
29 Dolok Masihul	300	3.7	310	103	709	236	1619	540	
30 Teluk Mengkudu	910	2.1	176	19	402	44	919	101	
Total	1163041	100	8390	3545	19152	8113	43756	18540	

Table V.1.5-2 (2) Estimated Telephone Demands

Item / Kecamatan	Area (km^2)	Population Ratio (%)	1985 Overall Demand	1985 Estimated Demand	1995 Overall Demand	1995 Estimated Demand	2005 Overall Demand	2005 Estimated Demand	Remarks
(Karo)									
1 Kabanjahe	68	23.3	624	624	1324	1324	3068	3068	*
2 Payung	140	10.2	68	49	145	104	336	240	
3 Simpang Empat	207	11.1	74	36	158	76	365	176	
4 Barus Jahe	120	6.5	45	37	96	80	224	187	
5 Tiga Panah	359	13.1	88	25	186	52	431	120	
6 Tiga Binanga	157	7.1	47	30	101	64	234	149	
7 Mardinding	582	9.7	65	11	138	24	319	55	
8 Munte	123	7.3	49	40	104	85	240	195	
9 Juhar	204	6.9	46	23	98	48	227	111	
10 Kota Buluh	167	4.4	29	17	62	37	145	87	
Total	2147	100	1135	892	2412	1894	5589	4388	
(Simalungun)									
1 Siantar	342	16.8	511	149	1168	342	2543	744	
2 Jarlang Hataran	55	2.0	61	61	139	139	303	303	
3 Sidamanik	129	5.7	173	134	396	307	863	669	
4 Dolok Pardamean	227	1.4	43	19	97	43	212	93	
5 Raya	315	3.4	103	33	236	75	515	163	
6 Panei	135	4.7	143	106	327	242	711	527	
7 Silina Kuta	168	1.9	58	35	132	79	288	171	
8 Dolok Silau	203	1.1	33	16	76	37	166	82	
9 Purba	188	2.5	76	40	174	93	378	201	
10 Simpangan Bolon	77	1.3	123	123	223	223	400	400	*
11 Bosar Maligas	526	11.3	344	65	786	149	1710	325	
12 Dolok Panribuan	134	2.8	85	63	195	146	424	316	
13 Tanah Jawa	613	16.1	489	160	1119	366	2437	798	*
14 Raya Kahean	218	1.8	55	25	125	57	272	125	
15 Silau Kahean	245	1.9	58	24	132	54	288	118	
16 Dolok Batu Nyanggar	217	7.9	240	111	549	253	1196	551	
17 Bandar	422	17.2	523	124	1196	283	2603	617	
Total	4215	100	3123	1288	7085	2888	15337	6201	

* with special compensation correction

Table V.1.5-2 (3) Estimated Telephone Demands

(Langkat/Asahan)

Item / Kecamatan	Area (km^2)	Population Ratio (%)	1985		1995		2005		Remarks
			Overall Demand	Estimated Demand	Overall Demand	Estimated Demand	Overall Demand	Estimated Demand	
L-1 Gebang	152	4.1	132	87	302	199	688	453	
2 Besitang	690	3.8	122	18	280	41	638	92	
3 Pangkalan Susu	316	4.5	145	46	332	105	755	239	
4 Babalan	480	12.1	390	174	893	400	2030	920	*
5 Stabat	239	11.4	367	154	841	352	1913	800	
6 Padang Tualang	1678	9.8	316	19	723	43	1644	98	
7 Hinai	94	4.2	135	135	310	310	705	705	
8 Sicanggang	218	7.3	235	108	539	247	1225	562	
9 Tanjung Pura	154	6.6	213	138	487	316	1107	719	
10 Sei Bingei	333	5.0	161	48	369	111	839	252	
11 Binjai	105	9.1	293	279	671	639	1527	1454	
12 Salapian	476	6.1	197	41	450	95	1023	215	
13 Kuala	206	5.2	168	82	384	186	872	423	
14 Selesai	192	6.3	203	106	465	242	1057	551	
15 Bohorok	988	4.5	145	15	332	34	755	76	
Total	6320	100	3222	1450	7377	3320	16778	7559	
A-1 Sungai Kepayang	499	4.8	125	25	286	51	647	130	
2 Air Joman	165	5.0	131	79	298	181	674	408	
3 Simpang Empat	250	3.7	97	39	220	88	499	200	
4 Kisaran	329	16.9	442	442	1007	1007	2280	2280	
5 Air Batu	184	7.5	196	101	447	230	1012	522	
6 Buntu Pane	436	6.4	167	38	381	87	863	198	
7 Pulau Rakyat	452	7.1	186	41	423	94	958	212	
8 Bandar Pulau	737	4.4	115	16	262	36	594	81	
9 Bandar Pasir Mandoge	651	0.8	21	3	48	7	108	17	
10 Talawi	81	4.8	125	125	286	286	647	647	
11 Lima Puluh	263	9.6	251	95	572	217	1295	492	
12 Tanjung Tiran	284	9.3	243	86	554	195	1254	442	
13 Air Putih	382	7.9	207	207	471	471	1066	1066	*
14 Medang Deras	77	3.9	102	102	232	232	526	526	
15 Tanjung Balai	134	7.8	204	152	465	347	1052	785	
Total		100	2614	1551	5958	3535	13489	8006	

* with special compensation

1-6 Telephone Demand Forecast by GDP for Sulawesi Selatan

Although the gravity model method has been employed for telephone demand forecast in the text, telephone demand forecast by a more general method as employed in demand forecast for Sumatera Utara --- the method by using GDP data --- is employed here to achieve demand forecast for the sake of comparison.

1-6-1 Telephone Demand in Sulawesi Selatan

A. GDP per capita of Sulawesi Selatan

According to GDP data for Sulawesi Selatan, which we could get after site survey, the GDP per capita of Sulawesi Selatan can be estimated to be 70% of that of the whole country of Indonesia. (Table V.1.6-1 shows the GDP data for different years)

That is, from the GDP per capita of Rp. 67750 (US$163 at 1971 constant price) for the whole country as of the reference year 1978, the GDP per capita of Sulawesi Selatan can be estimated to be Rp. 47,425 (US$114.3) at 1971 constant prices.

Table 1-6-1 GDP data for Sulawesi Selatan

GDP per Capita	1974	1975	1976	1977	1978
1. Current Market Prices					
- Whole country	83,918	96,803	115,682	138,230	
- Sulawesi-S	45,926	62,115	71,702	89,133	108,507
2. Constant Prices at 1975					
- Whole country (A)	94,378	96,803	101,113	106,232	
- Sulawesi-S (B)	53,160	62,115	62,682	72,093	80,281
Ratio (B/A)	56.3%	64.2%	62.0%	67.9%	

G.D.P (S-Sulawesi) = G.D.P (Whole Indonesia) x 70%

B. Telephone Demand Density Forecast

The GDP per capita and telephone demand density to be achieved in different years can be estimated for the real economic growth rates of 6%, 4.5% and 3%, as given in Table V.1.6-2.

C. Population Forecast

From the statistical data of Sulawesi Selatan as of 1978, we have estimated the population growth rate of the Propinsi as follows. For the estimated population i years hence, we have

$$N_i = N_0(1 + 0.01 \times i)$$

where i: the number of years from the reference year (1978)

N_0: Population in the reference year (5,723,000 in 1978)

N_i: Population i years hence

The estimated population of Selawesi Selatan for different years are given in Table IV.1.6-3. The results of telephone demands of Sulawesi Selatan for different years, which have been obtained by using Tables. V.1.6-2 and V.1.6-3, are given in Table V.1.6-4.

Table V.1.6-2 GDP per Capita and Telephone Demand Density

Economic Growth Rate	Year			
	1978	1985	1955	2005
6%	0.23	0.41	0.93	2.09
	114	171	307	550
4.5%	0.23	0.36	0.66	1.22
	114	155	241	374
3%	0.23	0.31	0.47	0.71
	114	140	189	253

Note Upper: Telephone demand density (in line units/100 inhabitants)

Lower: GDP per capita (in US dollars)
(1 US$ = Rp. 415)

Table V.1.6-3 Population Forecast (Unit: Thousand)

Year	Forecast Population
1978	5,723
1985	6,124
1995	6,696
2005	7,268

Table V.1.6-4 Total Telephone Demand Forecast of Sulawesi Selatan

Year	Number of Demand		
	6%	4.5%	3%
1979	13,163	13,163	13,163
1985	25,108	22,046	18,984
1995	62,273	44,194	31,471
2005	151,901	88,670	51,603

D. Telephone Demand in Areas to Be Served by the Project (excluding Ujung Pandang and Pare Pare Kotamadya)

In order to forecast demands in areas to be served by this project, the total number of demands has been distributed to the two Kotamadya of Ujung Pandang and Pare Pare and to other, Kabupaten.
Since data of these Kotamadya were not obtained, the data of the ratio of the incoming of these two Kotamadya in 1978 to the total incoming of other Kabupaten in 1978 (78:22), which has been obtained from the 1978 Sulawesi Selatan statistic data, has been used for estimation.
As the result, demands to be distributed to the area to be served by this project are given in Table V.1.6-5.

Table V.1.6-5 Demand Forecast in the Area to Be Served by This Project

Year	Demands		
	6%	4.5%	3%
1985	5,524	4,850	4,176
1995	13,700	9,723	6,924
2005	33,418	19,507	11,353

Demand Density per 100 Inhabitants
(excluding Ujung Pandang and Pare Pare)

Year	Demand Density per 100 Inhabitants		
	6%	4.5%	3%
1985	0.10	0.10	0.10
1995	0.23	0.17	0.12
2005	0.52	0.30	0.17

On the other hand, Reference Data 7.2-2 shows that the number of telephone subscribers in Sulawesi Selatan in the period of 1975 to 1978 increased by an annual rate of 8%. Since the number of waiting applicants was none during this period, it can be determined that demands were fulfilled naturally with sufficient facilities. That is, by assuming that the number of waiting applicants has increased since 1978 because of the unbalance between facilities and demands, it can be determined that the telephone increase rate of Selawesi Selatan is annualy 8% which is nearly equal to the average value of the entire land of Indonesia and which is not greatly different from the increase rate at the economical growth rate of 4.5%. Accordingly, we have determined to use the economic growth rate of 4.5% for the first approximation of demand forecast in Sulawesi Selaten.

1-6-2 Distribution to Individual Kabupaten

Distribution of demands to individual Kabupaten is achievable by distribution to individual Kabupaten by the non-agricultural labor population ratio obtained from the labor population data for different industries, as in the case of Sumatera Utara.

1-6-3 Evaluation of These Telephone Demand Forecast Methods

Let us compare the result of the method using the gravity model which is described in the text and the result of the forecast method using GDP which is described herein.

A. Values Obtained by These Forecast Methods

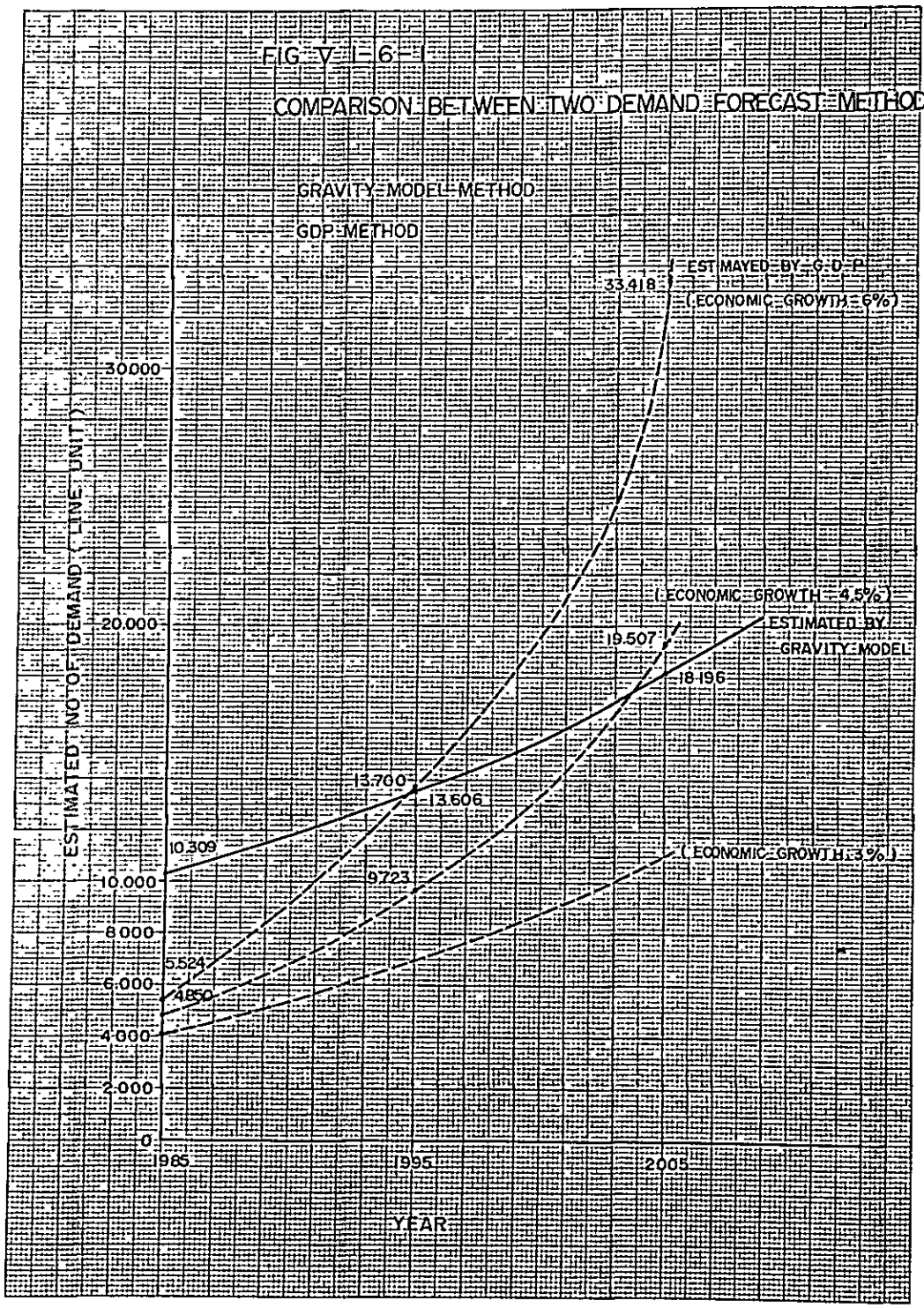
The number of demands forecast by the gravity model increases almost linearly with the number of years on the assumption that the number of demands increases with the increase in population. On the other hand, the number of demands forecast by using GDP data increases exponentially with the number of years as indicated by the equation. The results obtained by these two methods are given in Fig. V.1.6-1.

The number of facilities to be provided by this project is to meet demands to be made in 1995.

As is clear from the figure, the number of demands forecast for 1995 by the gravity model falls between the forecast values corresponding to the economic growth rates of 6% and 4.5% in the forecast method using GDP data. Now, let us consider the number of demands to be reached in 2005 for determining the ultimate capacity of telephone facilities. The number of demands forecast for the year 2005 by the gravity model comes less than those obtained for the above-mentioned two economical growth rates in the method using GDP data. Assuming that there is no such conspicuous data that supports the forecast of rapid economical progress for the time being in Sulawesi Selatan and that it is more desirable to prevent excessive investment for future, we recommended the method using the gravity model in this report.

FIG V I-6-1

COMPARISON BETWEEN TWO DEMAND FORECAST METHODS



B. Applicable Ranges of the two Forecast Methods

The forecast method using GDP data is the method often employed for demand forecast on a national scale as stated in SECTION III "SUMATERA UTARA." The GDP of Sulawesi Selatan alone is estimated to be 70% of the national average value, so that it is rather difficult to take Sulawesi Selatan substantially a selfsupporting country. Accordingly, the method of using GDP data can not necessarily be determined to be proper.

The method of using the gravity model is generally used rather for forecasting traffic from demand forecast. However, when sufficient GDP data is not available or for under developing area, this latter method of forecast is one of the effective methods available.

C. Selection of the Most Suitable Forecast Method

The forecast method using the gravity model has been employed for demand forecast in Sulawesi Selatan for the reasons mentioned in items A and B above.