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FUNDAMENTAL STUDY
ON
RURAL TELECOMMUNICATIONS NETWORK

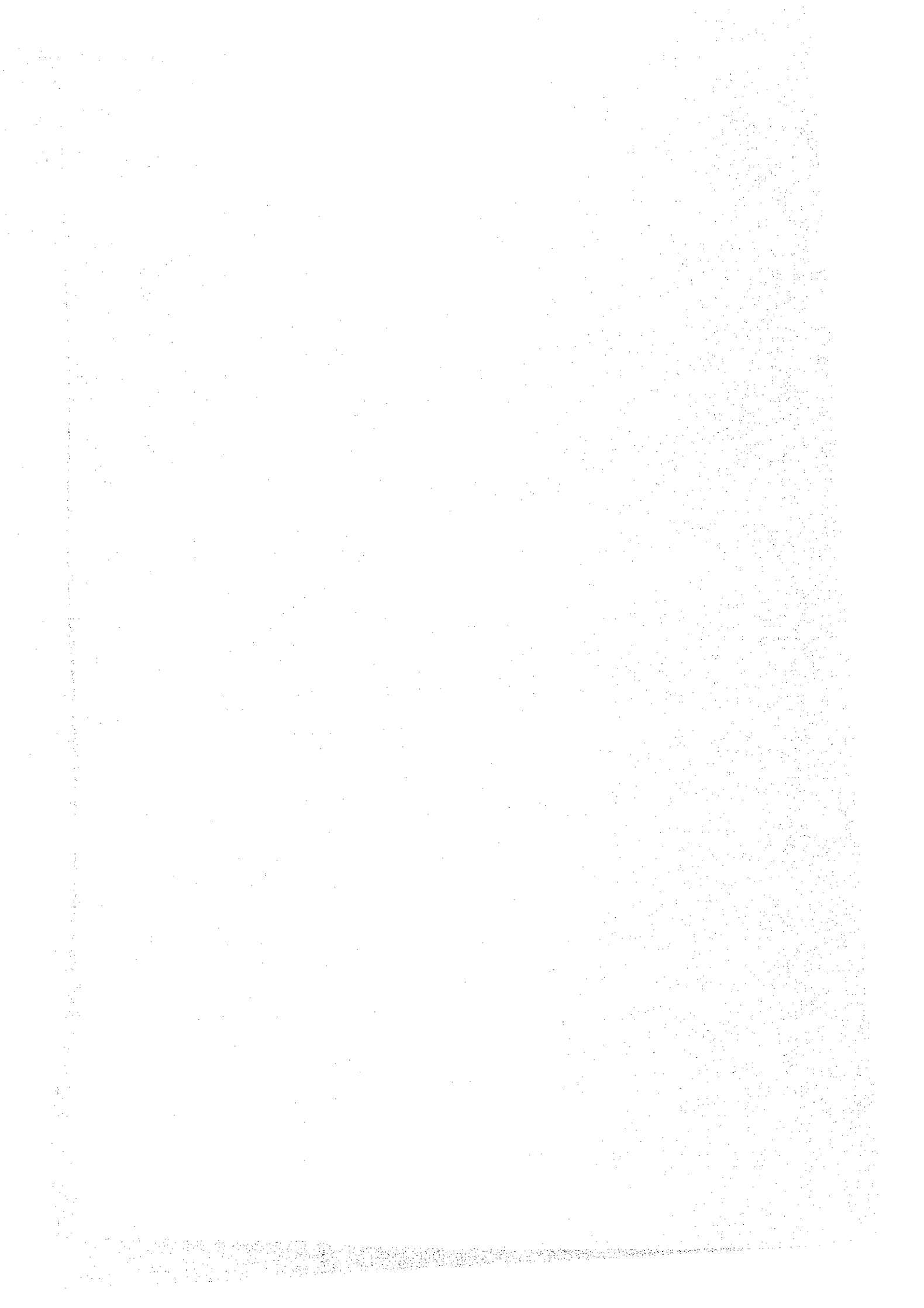
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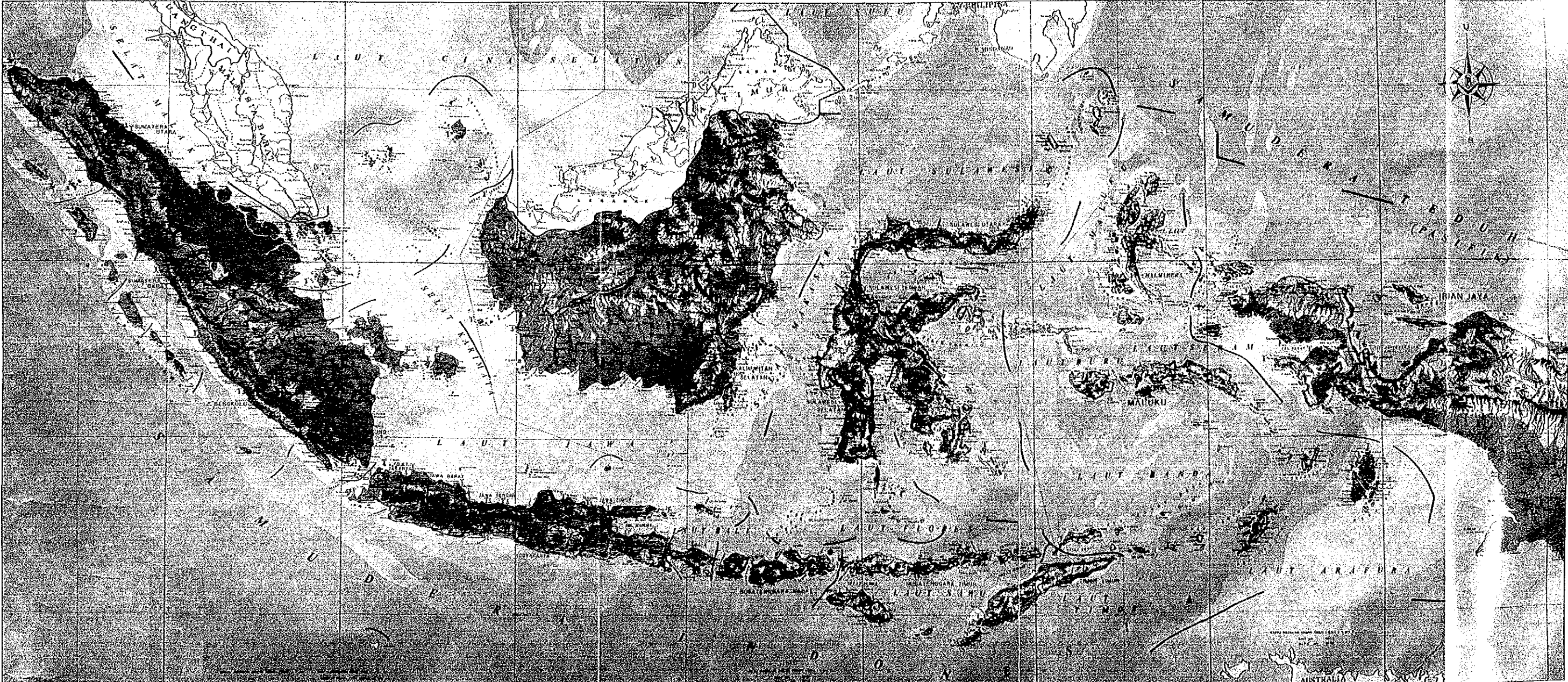
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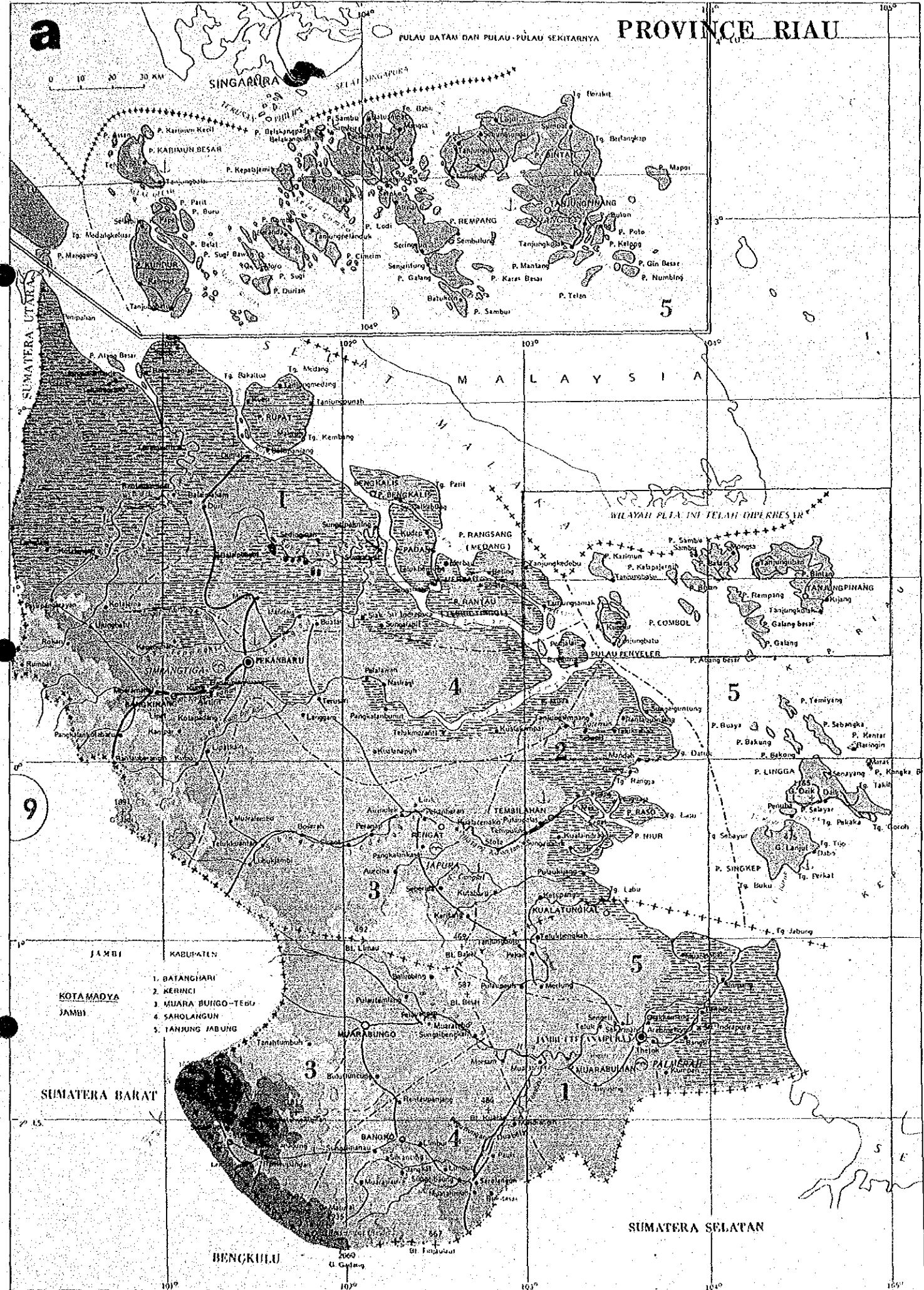
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PROVINCE RIAU

PULAU DATARAN DAN PULAU-PULAU SEKITARNYA

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3. MUARA BUNGO-TEBU
4. SAHOLANGUN
5. IANJUNG JABUNG

KOTA MADYA
JAMBI

SUMATERA BARAT

BENGKULU

SUMATERA SELATAN

SUMATERA UTARA

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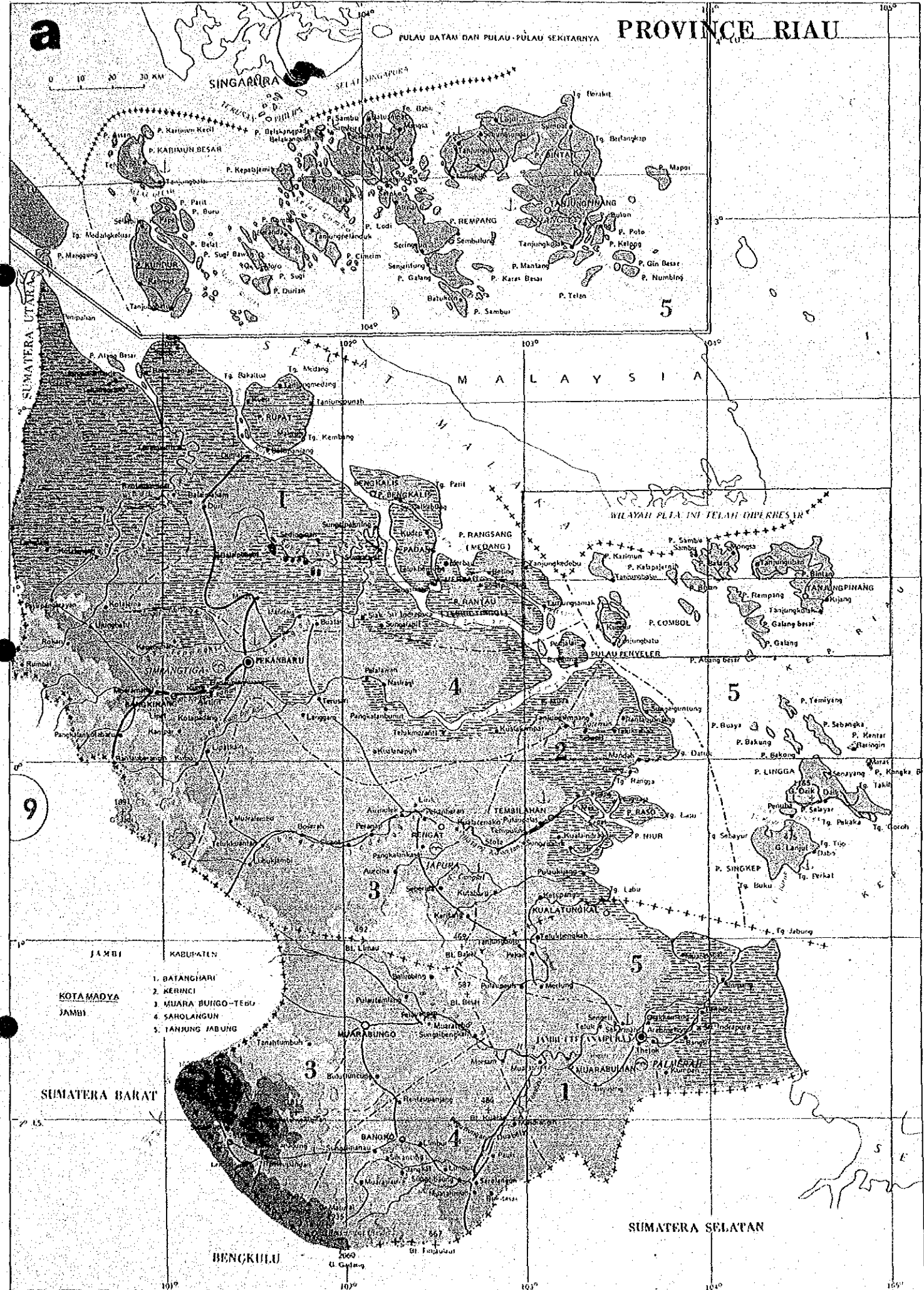
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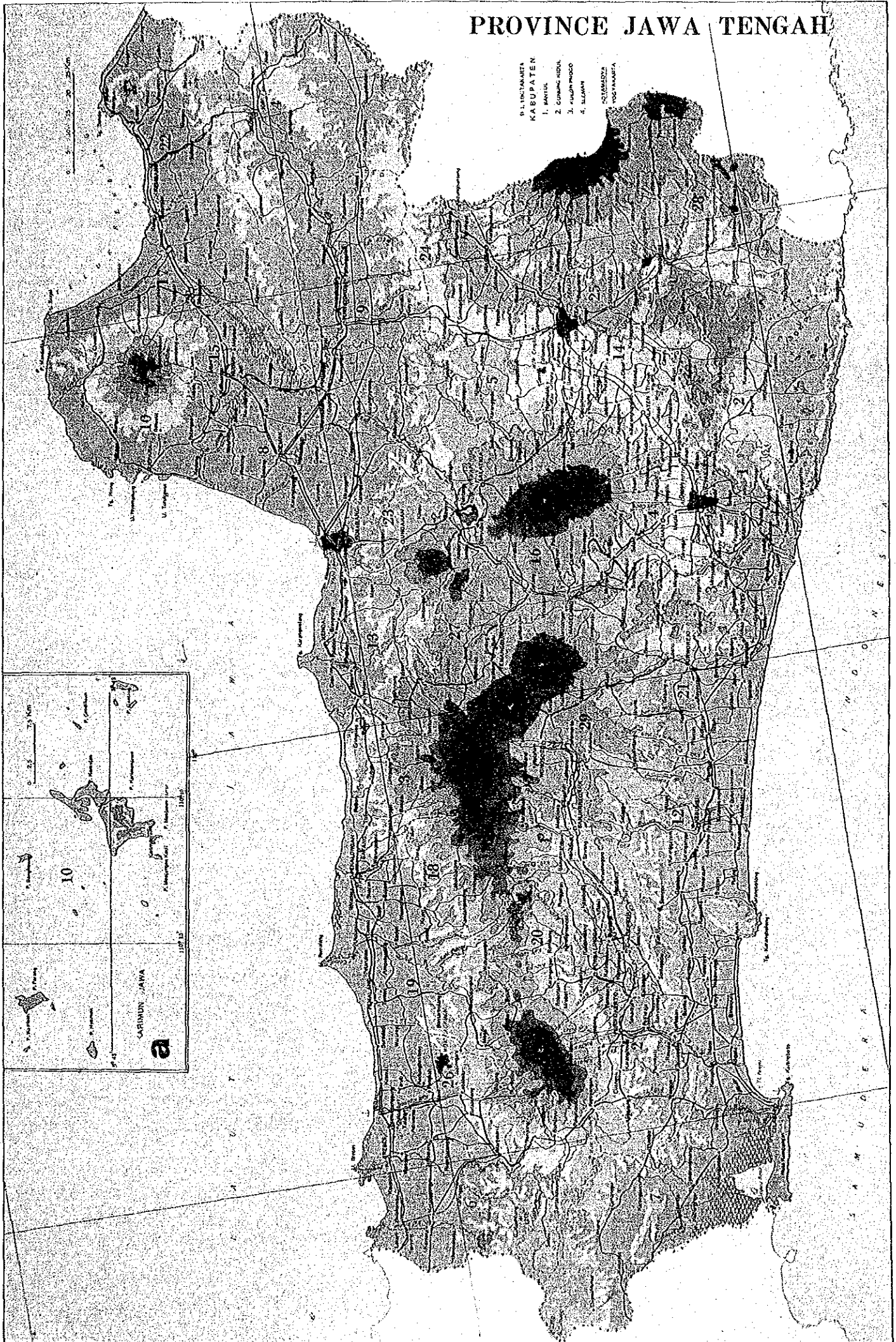
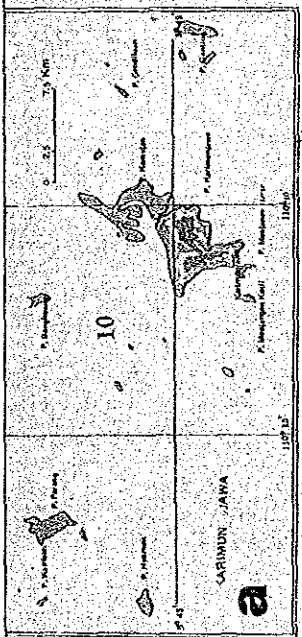
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PROVINCE JAWA TENGAH

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- 3. KAMPUNG WISDO
- 4. SLEMAN
- 5. KARANGANYAR
- 6. SUKOHARJO
- 7. WONOGIRI
- 8. BOYALINGGIR
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PREFACE

In response to the request of the Government of the Republic of Indonesia, the Japanese Government decided to conduct a Fundamental Study on the Rural Telecommunications Network Project and entrusted the study to the Japan International Cooperation Agency (JICA).

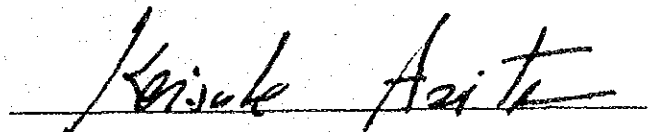
The JICA sent to Indonesia a survey team and JICA Advisory Committee, Chairman Mr. Masami KATO, Special Advisor for International Cooperation, Ministry of Posts & Telecommunications, for the First Stage from June 11 to July 20, 1984 and for the Second Stage of the survey from September 26 to December 24, 1984.

The team had discussions on the Project for the Rural Telecommunications Network with the officials concerned of the Government of the Republic of Indonesia, and conducted a field survey in Jawa, Sumatera, Kalimantan, Sulawesi and Maluku areas. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

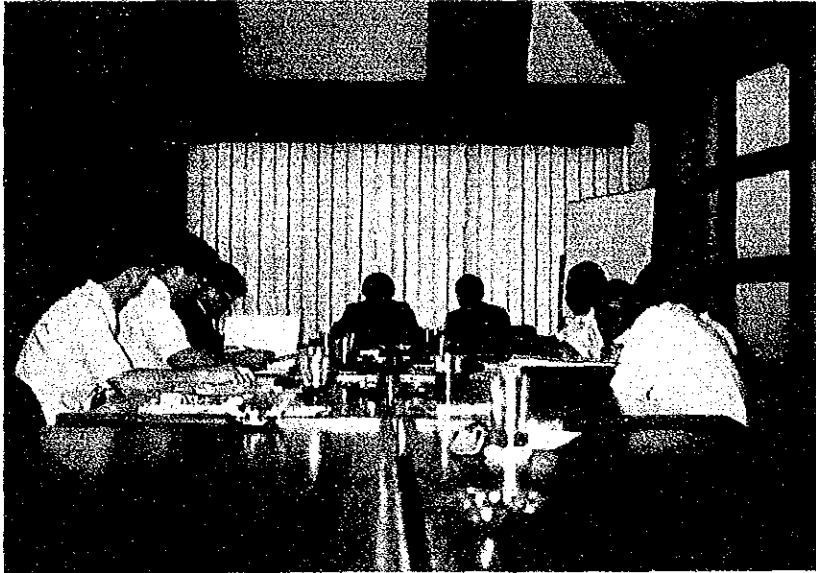
October 1985

A handwritten signature in black ink, reading "Keisuke Arita", is written over a horizontal line.

Keisuke ARITA

President

Japan International Cooperation Agency



JICA team members explaining the draft final report
(August 1985, at DITJEN POSTEL, Jakarta)

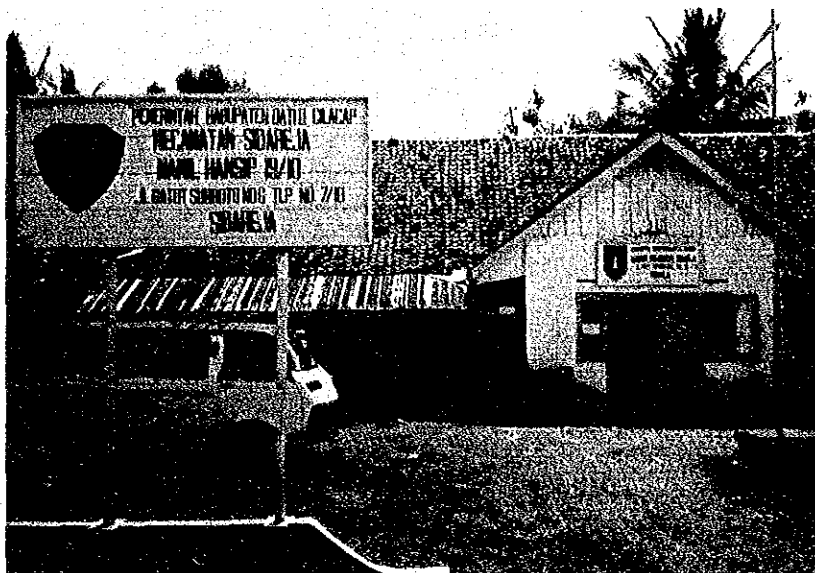


Completing the draft final report
(August 1985, at DITJEN POSTEL, Jakarta)



JICA team members reporting and discussing the study results
(August 1985, at PERUMTEL, Bandung)





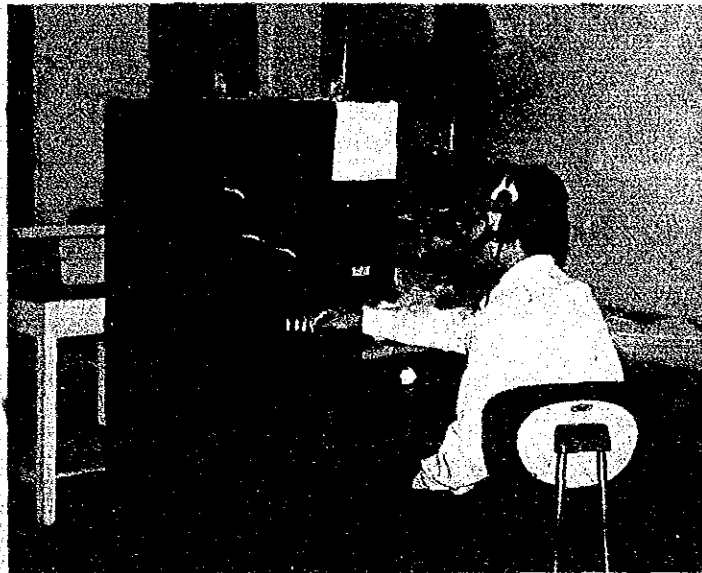
Survey at Kecamatan office
(Kabupaten Cilacap, Jawa Tengah)



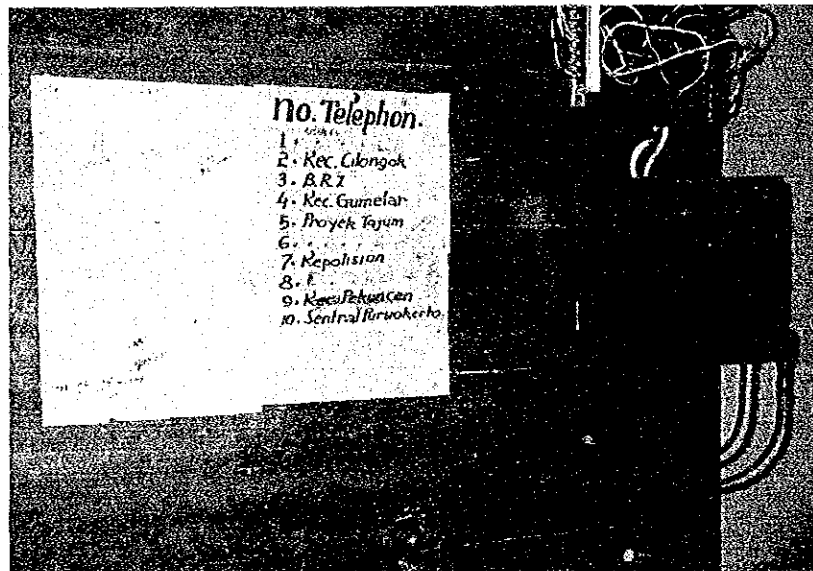
Survey at Desa office
(Kabupaten Cilacap, Jawa Tengah)



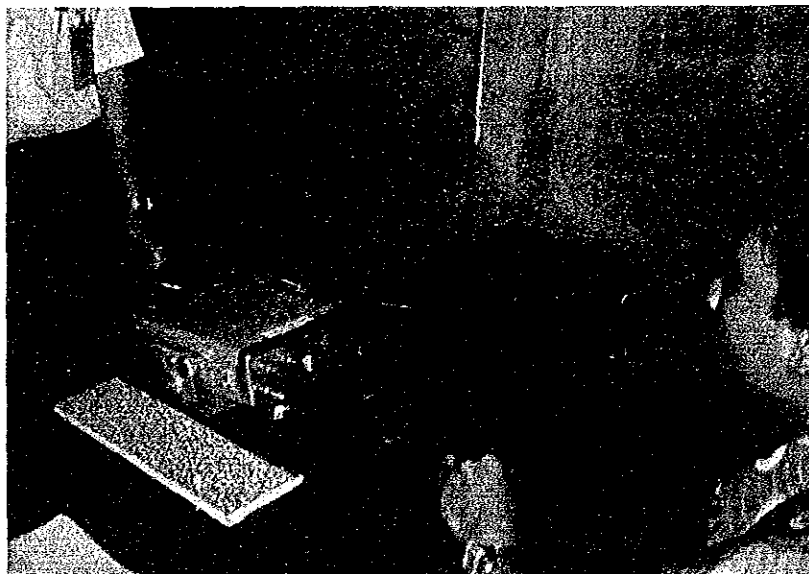
Scenery of rural town
(Jawa Tengah)



Typical manual telephone exchange
(Jawa Tengah)



Typical manual telephone exchange
(Jawa Tengah)



Communication medium in rural area —H.F. Radio—
(Riau)

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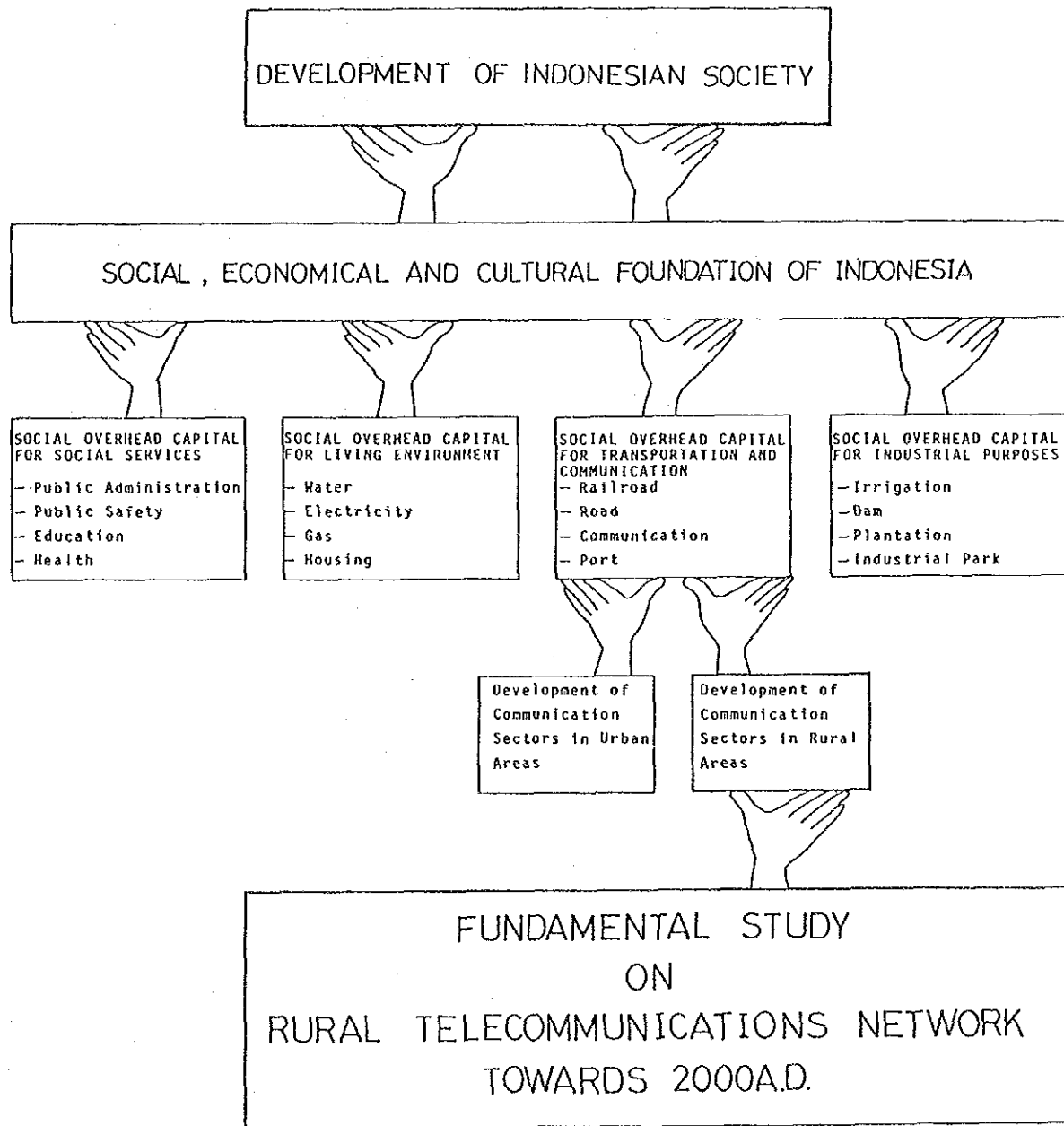
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Abbreviation

AUTO	Automatic or Automatic Telephone Exchange
BHT	Busy Hour Traffic
CR	Calling Rate
CRE	Corrected Reference Equivalent
erl. (Erl.)	Erlang
FDMA	Frequency Division Multiple Access
GDP	Gross Domestic Product
GNP	Gross National Product
GRDP	Gross Regional Domestic Product
ha	Hectare
l	Liter
L.U	Line Unit
PCM	Pulse Code Modulation
PCO	Public Call Office
PLS	Pulse
PTC	Primary Trunk Center
PSK	Phase Shift Keying
RCRE	Receiving Corrected Reference Equivalent
RLC	Remote Line Concentrator
RSU	Remote Switching Unit
SBB	Large Type Satellite Earth Station
SBK	Small Type Satellite Earth Station
SBS	Medium Type Satellite Earth Station
SCPC	Single Channel Per Carrier
SCRE	Sending Corrected Reference Equivalent
SKSD	Domestic Satellite Communication System
SLDD	Subscriber Long Distance Dialling

SSB	Single Sideband Transmission System
STC	Secondary Trunk Center
SUB	Subscriber
TDMA	Time Division Multiple Access
TDMA-RCS	TDMA-Radio Concentrator System
TE	Terminal Exchange
TTC	Tertiary Trunk Center
WITEL	Bureau of Telecommunication

SUMMARY



1. CURRENT STATUS OF RURAL AREAS AND NECESSITY OF TELE-
COMMUNICATIONS NETWORK

1-1 Significance of Rural Telecommunications Network Project

In order to achieve development and modernization in the Republic of Indonesia, it is essential that properly balanced improvement of the infrastructure be carried out as an official policy of national development.

Telecommunications is a particularly important element in the infrastructure in that it affects all social, economic and cultural aspects of the nation. For this reason, the building of a telecommunications network is of extremely vital importance to national development.

In Indonesia, telecommunications facilities in Rural Areas lag behind those available in the cities, and the need to correct this imbalance is a topic of utmost importance. This **Fundamental Study** offers long-range proposals through the year 2000 which may be taken under consideration as the basis for official decisions and implementation plans relating to the building of **Rural Telecommunications Network**.

The building of **Rural Telecommunications Network** is of vital significance to national development in the following ways:

- 1) In achieving social and economic development and promoting national stability
- 2) In improving and supporting social services
- 3) In raising the efficiency of administrative services offered to the nation's citizens.

1-2 Telephone Services in Indonesia

(1) Comparison of Social Development Indexes

Figure 1 shows a comparison by island of various indexes of social development in Indonesia. The national averages derived from this data is as follows:

a. Motorcycle ownership	24.3/1,000 persons
b. Television ownership	19.0/1,000 persons
c. Automobile ownership	10.2/1,000 persons
d. Telephone ownership (Main Telephone)	3.3/1,000 persons

(Statistics for 1982)

From this table it is clear that the rate of telephone density is considerably lower than density rates of the other items listed.

In view of the fact that motorcycle and television ownership is between 10 and 20 units per 1,000 persons on all islands, it can be expected that there is ample purchasing power for telephones. And as the latent demand for telephones is therefore high, it is deemed desirable that this demand be met.

In order to carry out a national development policy which is well balanced socially, economically and culturally, it is thus necessary to undertake active development of a telecommunications network.

Figure 2 shows a comparison by island of various indexes concerning population, GRDP and telephone service as of 1983.

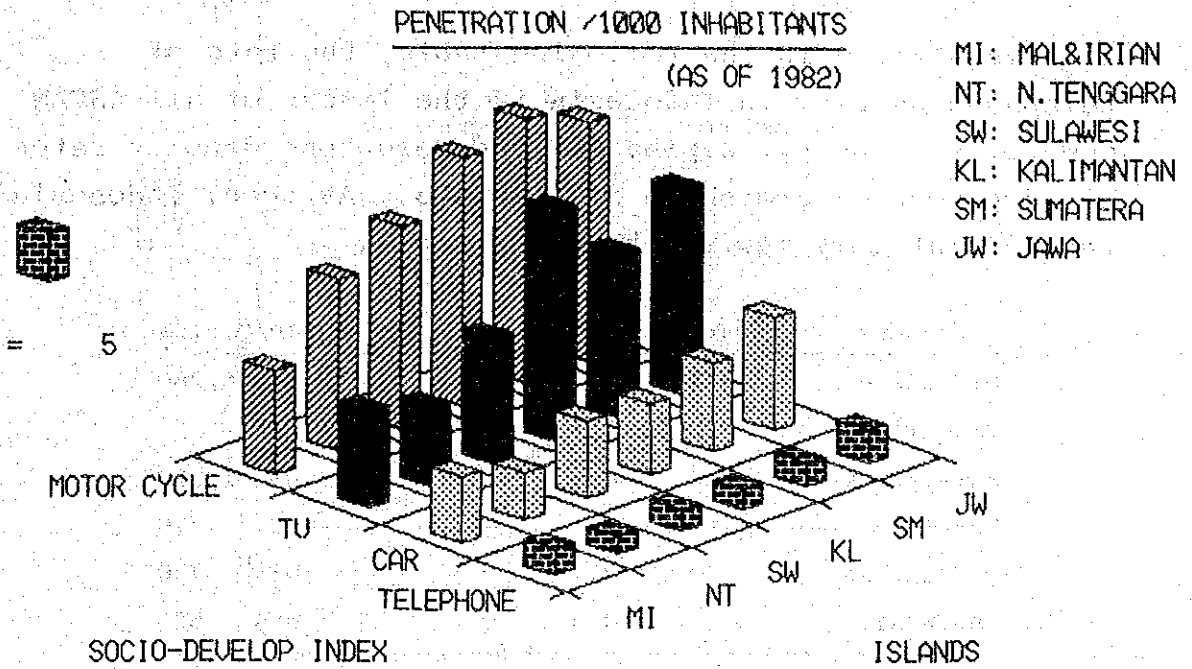


Figure 1 Social Development Indexes in Indonesia

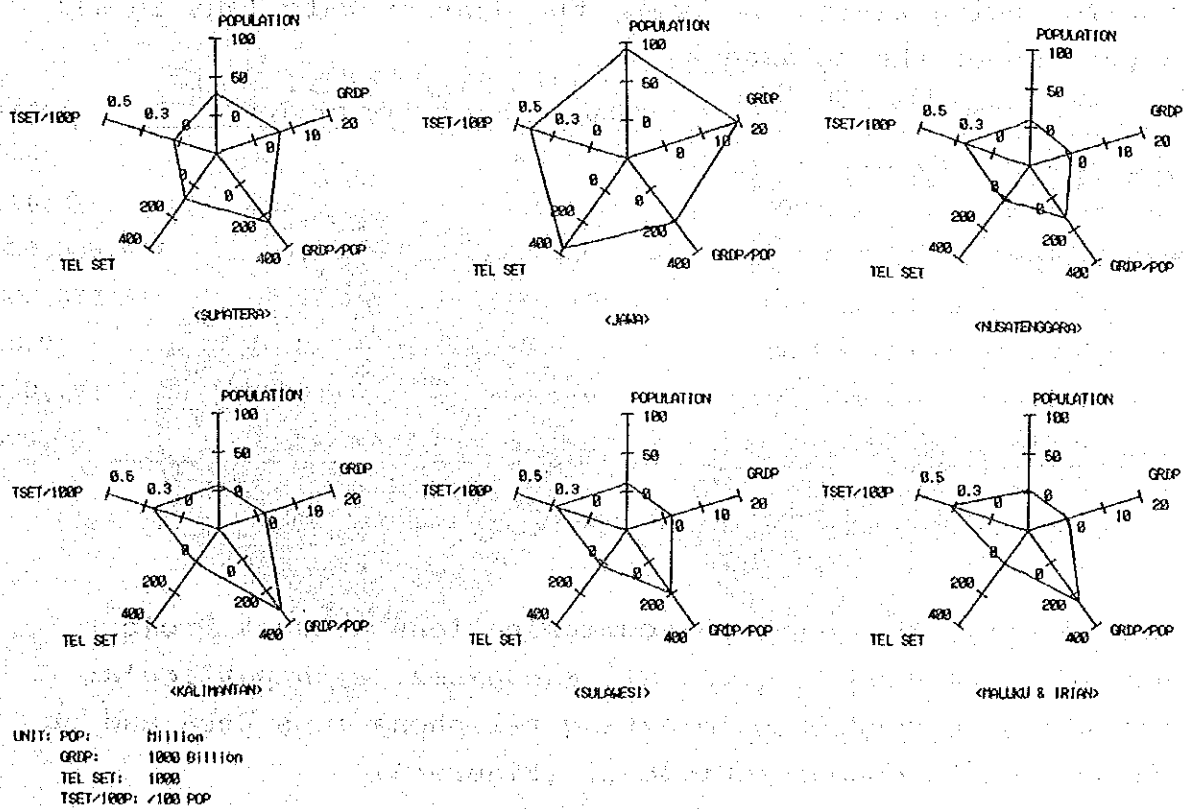


Figure 2 Population, GRDP and Telephones in Indonesia

(2) International Comparisons

As demonstrated in the following table, the rate of telephone density in Indonesia is the lowest of all ASEAN countries. The per capita GDP and telephone density rates of each country are shown in Figure 3. As seen, Indonesia ranks relatively low on the world scale.

Country	Telephone Density	GDP/Capita
Singapore	22.4	US\$ 5,280
Brunei	7.3	US\$
Malaysia	4.3	US\$ 1,910
Thailand	0.8	US\$ 770
Philippines	0.7	US\$ 780
Indonesia	0.3	US\$ 560

Sources: World Bank and ATT World Telephone (As of 1981)

(3) Domestic Situation

The telephone density rates within Indonesia are shown in the following table. As seen, the density rate lags in all areas except the Kotamadya.

Item	Kabupaten	Kotamadya	Total
No. of Kab. & Kota.	246	54	300
No. of Kecamatan (in 1980)	3,212	208	3,420
Population	145,000,000	12,800,000	157,800,000
No. of Current Subscribers	131,000	385,000	516,000
Telephones/100 Inhabitants	0.09	3.01	0.33
Line Units of Automatic Ex.	91,000	486,000	577,000
Line Units of Manual Ex.	87,000	2,000	89,000

Sources: Central Bureau of Statistics and PERUMTEL (As of 1983)

Accordingly, the Rural Telecommunications Network Project should be planned to cover all Kabupaten, with particular attention focused on eliminating telephone-less Desa and on automating telephone equipment. (Figure 4)

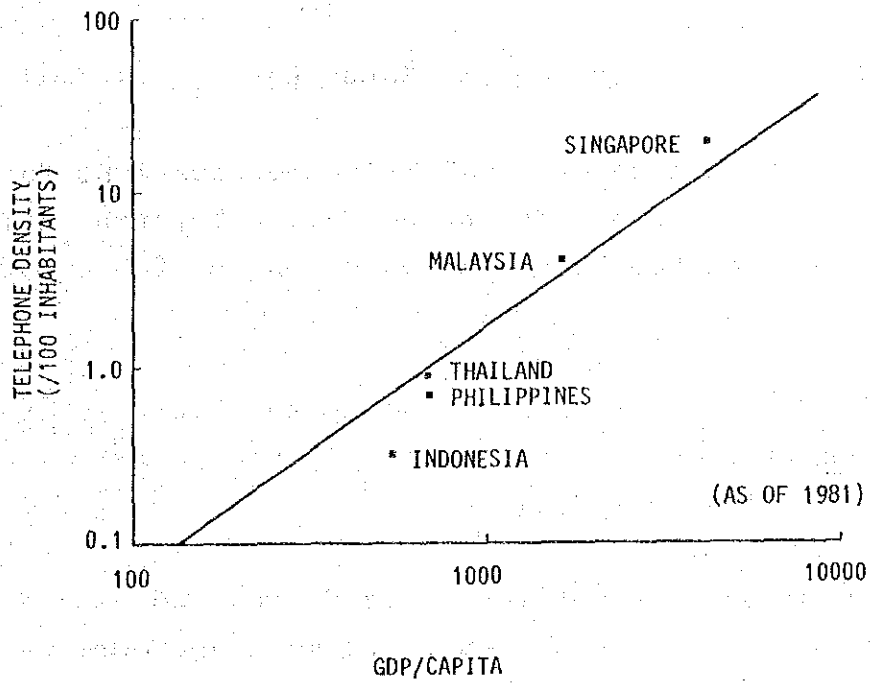


Figure 3 GDP/Capita and Telephone Density

TEL FACILITIES ON KEC LEVEL

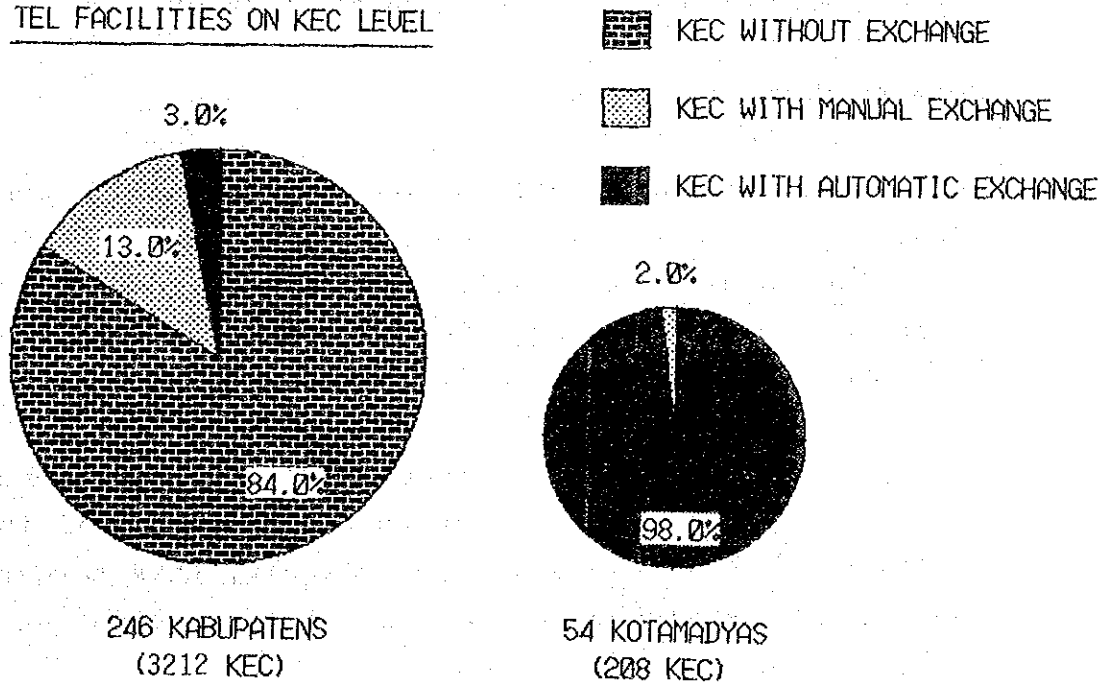


Figure 4 Telephone Facilities in Kabupaten and Kotamadya

1-3 Objective Area of Project and Development Goals

(1) Objective Area Covering All Kabupaten

The objective area of Rural Telecommunications Network Project has been set to include all Kabupaten in Indonesia. This decision has been made based on the following three points:

- 1) 56% of the nation's 246 Kabupaten capitals are to be supplied only with manual telephone service at the end of PELITA-IV (1988).
- 2) From the perspectives of land area and demand scale, a Kabupaten unit is seen to be most appropriate for the network structure.
- 3) The network of Kabupaten units can be gradually broadened to include all Kabupaten capital, Kecamatan capitals and Desa.

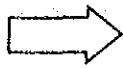
The outline for development of a rural telecommunications network under this Project is shown in Figure 5.

(2) Network Covering All Desa

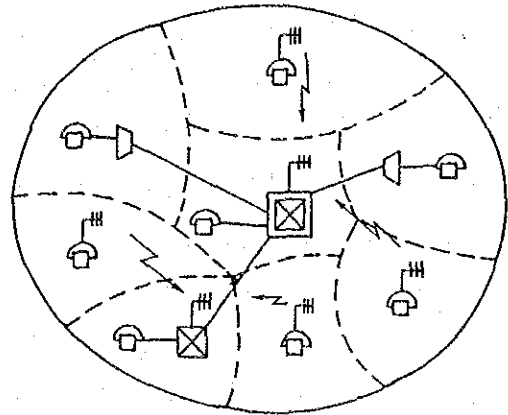
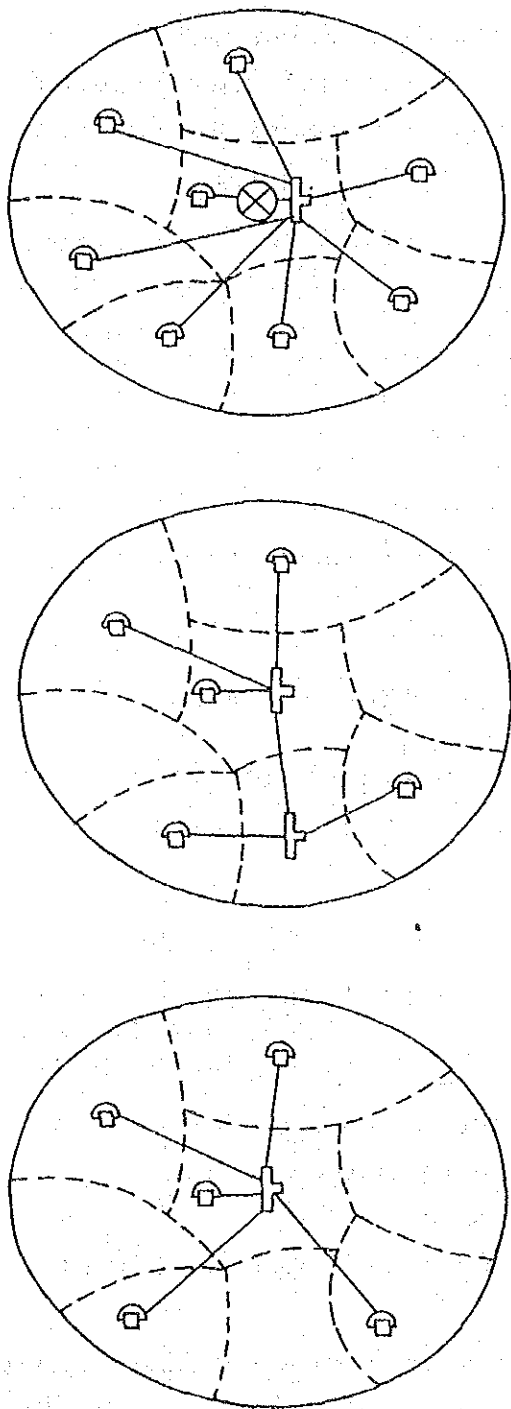
In the Kuala Lumpur Declaration made at the ITU Seminar in 1983, the following was given as one of the targets of improving rural communication networks: "to provide telecommunication services to all persons within a walking distance not exceeding 3km by the year 2000."

In the majority of Desa in Indonesia's rural regions, the distance from the Desa center to the residents living most remotely is less than 3km. Accordingly, this target can be reached by installing at least one telephone set at the center of these Desa.

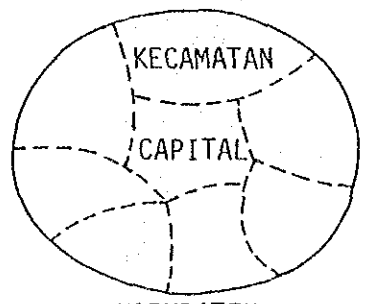
PRESENT TYPICAL NETWORK
AT THE YEAR 1985



FUTURE TYPICAL NETWORK
AT THE YEAR 2000



LEGEND



- KABUPATEN
- ☒ DIGITAL EXCHANGE (PC + LE)
- ☒ RSU
- ▷ RLC
- ☒# TDMA-RCS
- 🏠 SUBSCRIBER
- ⌋ MANUAL EXCHANGE
- ⊗ ANALOG EXCHANGE

Figure 5 Development of Rural Telecommunications Network

1-4 Subscriber Demand and Level of Improvement

(1) Nationwide Subscriber Demand

Figure 6 shows the estimated subscriber demand nationwide in Indonesia through the year 2000. By year 2000, approximately 4,900,000 telephones (7.4 times the current capacity) will be required, with demand in Kabupaten accounting for 27.8% (1,360,000 telephones) of that figure. Accordingly, the targets for telephone equipment improvement by the year 2000 are as shown in the following table.

Area	Existing 1983	Demand 2000	Improvement 1984-2000	Density/100 1983	Inhabitants 2000
Kabupaten	178,000	1,364,000	1,273,000 (1)	0.13 (3)	0.68
Kotamadya	488,000	3,534,000	3,048,000 (2)	3.81 (3)	15.19
Total(nationwide)	666,000	4,898,000	4,321,000	0.42 (3)	2.20

- Note 1: Includes automatization of 87,000 LU from existing manual.
 Note 2: Includes automatization of 2,000 LU from existing manual.
 Note 3: Shows existing telephone capacity per 100 inhabitants.

(2) Subscriber Demand in 246 Kabupaten in Objective Area

Subscriber demand for the year 2000 in the objective area is 1,364,000 units, divided administratively as follows:

<u>Administrative Division</u>	<u>Typical Demand</u>	<u>Average Demand</u>
Kabupaten	2,000	5,500(=1,364,000/ 246)
Kecamatan	250	420(=1,364,000/ 3,212)
Desa	3	20(=1,364,000/65,000)

The nationwide subscriber demand in the year 2000 according to island is distributed as shown in Figure 7. The following analytical points can be made:

- 1) Jawa accounts for the highest demand, including 60% of the national total.
- 2) Sumatera ranks second in demand with a 22% national share.
- 3) Demand on other islands is low on a nationwide basis, accounting for only 3-6%.
- 4) Concentration of demand in the Kabupaten Capital is highest on Jawa, where it is 46%.

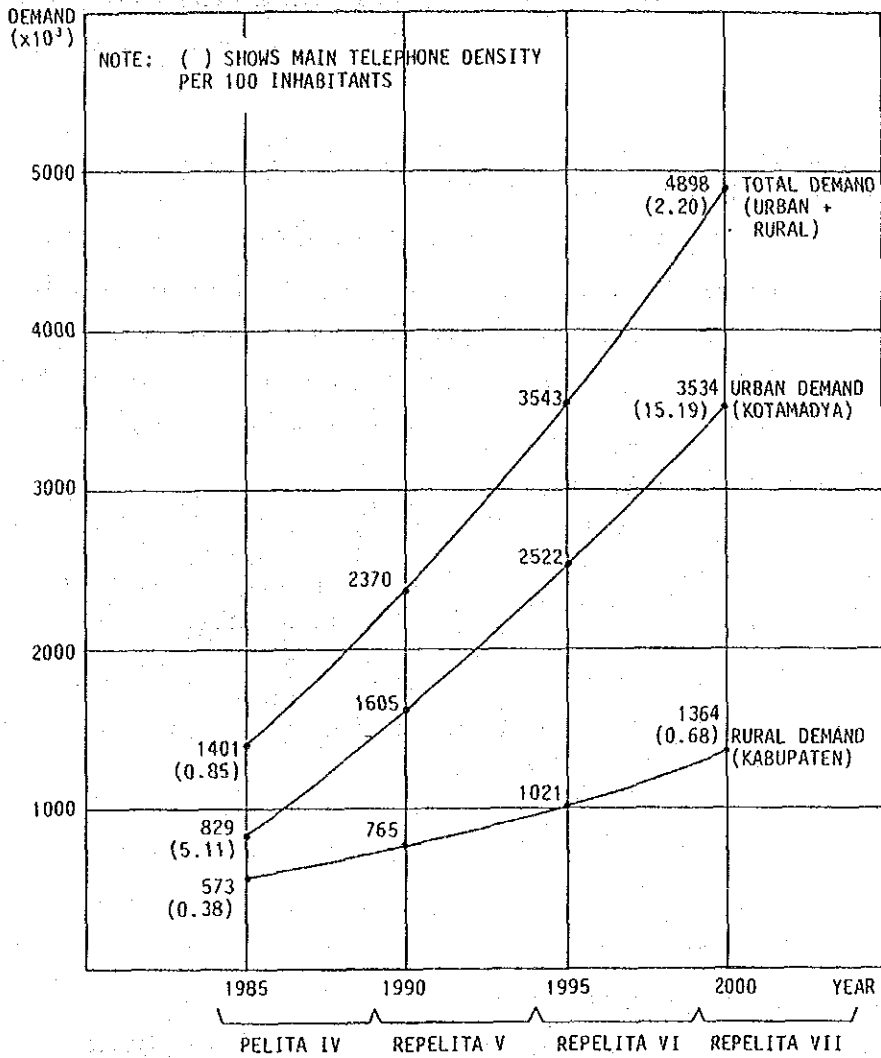


Figure 6 Telephone Demand in Indonesia

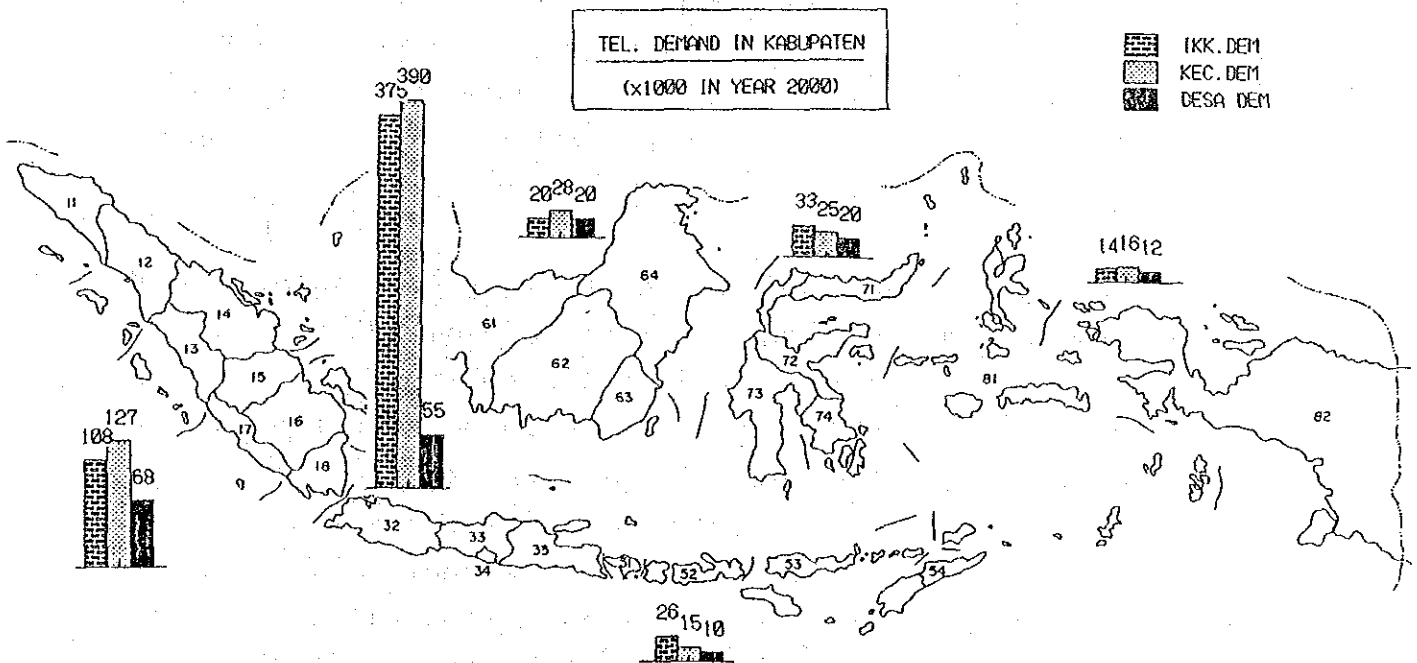


Figure 7 Telephone Demand in Kabupaten

2. ECONOMIC STUDY OF RURAL TELECOMMUNICATIONS NETWORK PROJECT

2-1 Initial Costs

(1) Total Costs of Plan through 2000

In order to satisfy 100% of the nationwide demand for **4,900,000 telephones** in the year 2000, beginning with REPELITA-V a total of **12 trillion Rp.** is required in construction costs (including power and building cost). A budget proposal for each term within the long-range plan is outlined in the following table and in Figure 8.

(Unit: Billion Rp.)

Project	PELITA-IV 1984-1988	REPELITA-V 1989-1993	REPELITA-VI 1994-1998	REPELITA-VII(2/5) 1999-2000	Total 1989-2000
Kabupaten		1,682	2,467	1,494*	5,643
Kotamadya	3,092	1,427	1,821	862*	4,110
Trunk Link		878	975	215*	2,068
Total	3,092	3,987	5,263	2,571*	11,821

(Exchange rate: US\$ = Rp. 1100)

(Note: * refers to 2-year sum.)

(2) Initial Cost in Objective Area

The number of automatic telephones for the objective area (246 Kabupaten) through the end of PELITA-IV (1988) is slated at 237,000 LU. The initial cost for the additional **1,127,000 LU** to be provided beginning with REPELITA-V and through the year 2000 is estimated to be **5.6 trillion Rp.**, as seen in the table above. Figure 9 shows the estimated initial cost for each area within the total network coverage area.

- 1) Using only 13% of the total cost, it is possible to meet demand in Kabupaten capital representing 42% of the total number of telephone installations.
- 2) Although 57% of the total cost would be required in order to extend the network coverage area to the Kecamatan level, this would raise the percentage of telephone installations to 86% of demand.
- 3) The investment efficiency rate resulting, if the network coverage area were extended to the Desa level, is extremely low compared with that for the Kecamatan level.

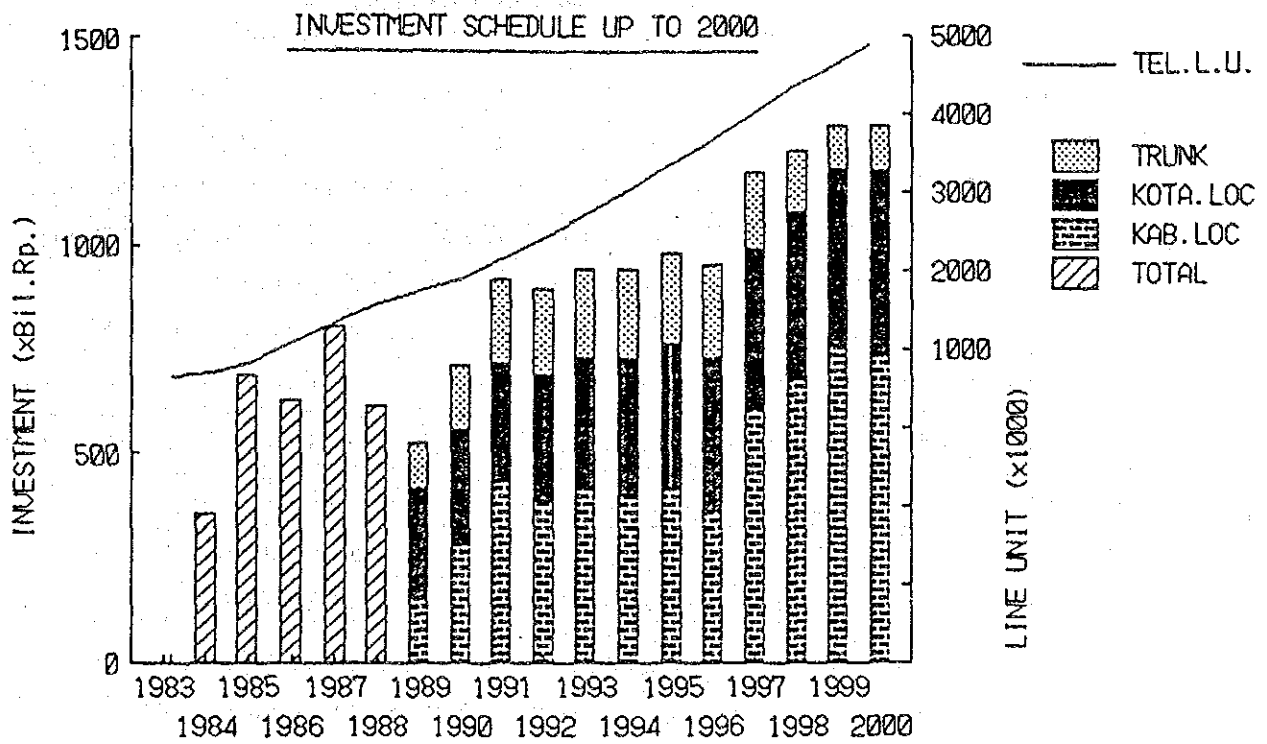


Figure 8 Investment Schedule up to 2000

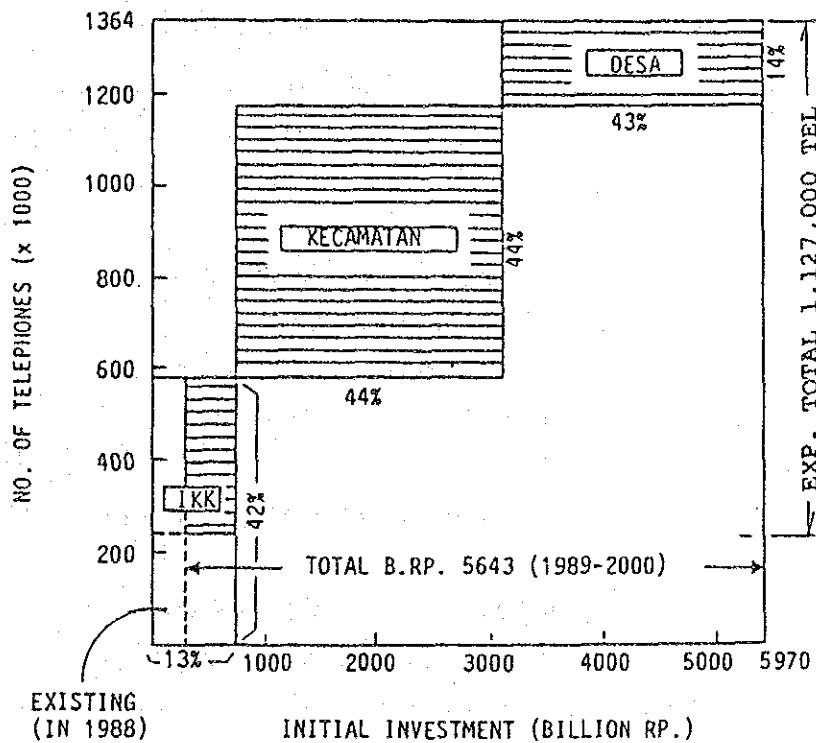


Figure 9 Initial Investment and Network Coverage

2-2 General Outline of Project Implementation

(1) Network Coverage (Network Expansion Method)

A comparison of three network expansion methods (Figure 10) is shown in the table which follows. On a nationwide basis, no major differences were recognizable in the results of the three methods. In terms of FIRR, Jawa showed a large number of Kabupaten with high FIRR under the third method; Kalimantan and Maluku/Irian Jaya, a large number under the first method.

Expansion Method	Initial Cost	Construction	Inter-Kabupaten Balance	FIRR
Method #1	1.0	Simple	Unbalanced	6.1%
Method #2	1.1	Somewhat complex	Somewhat unbalanced	7.1%
Method #3	1.2	Complex	Balanced	6.0%

In summary, although **method #2 is recommended**, the optimum expansion method should be selected for each Kabupaten following re-evaluation at the time of actual implementation.

(2) Regional Priority

The following points may be considered as parameters for determining the relative regional priority for implementing the Project:

1) From viewpoint of regional development:

- Areas forming national boundary
- Areas having poor transportation networks
- Areas under development for industries which require telephone service
- Areas having high regional potential (population density)

2) From viewpoint of social and economic effects:

- Areas having high consumer surplus
- Areas in which one telephone set can cover a great number of persons

3) From viewpoint of financial return:

- Areas having high FIRR

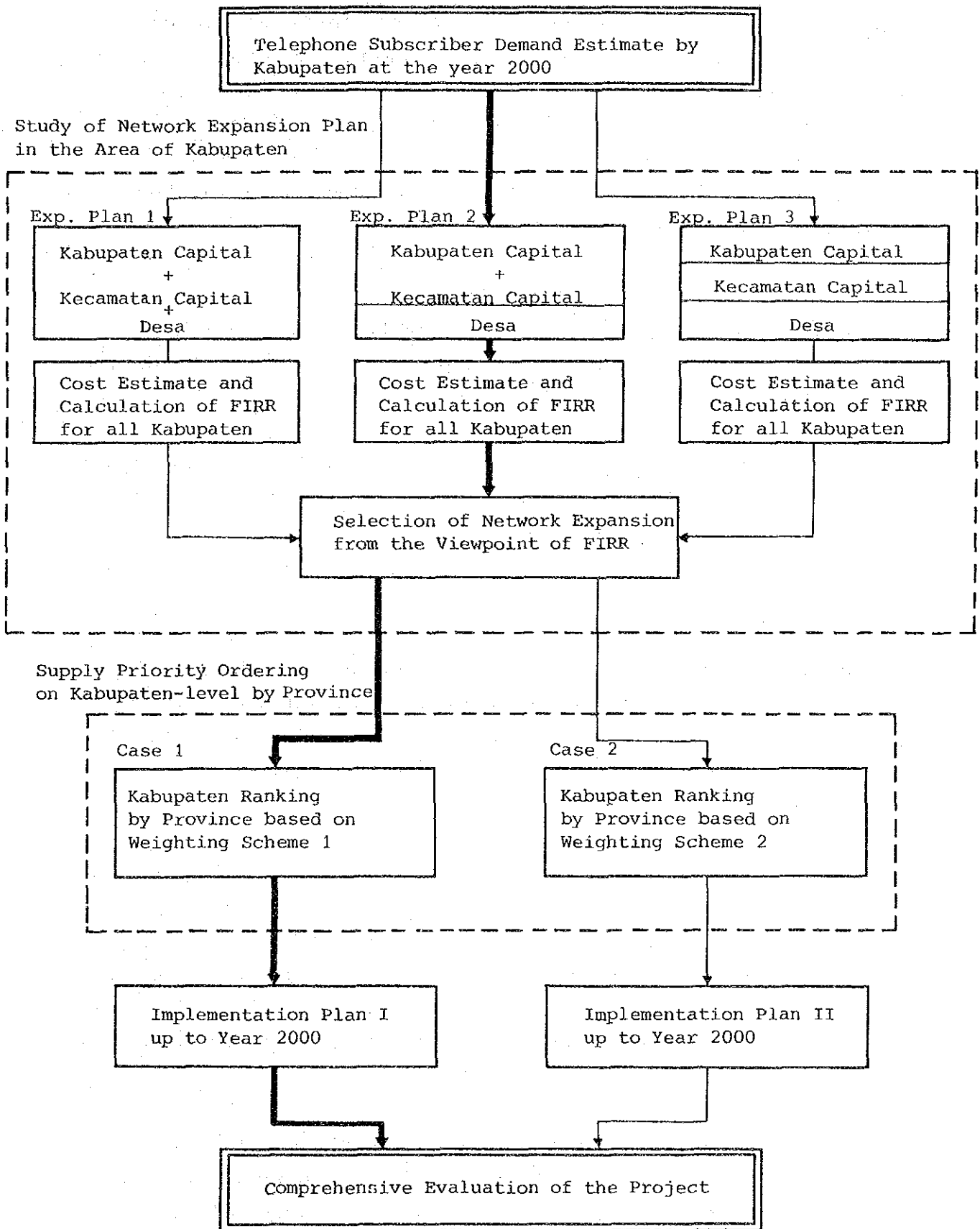


Figure 10 Planning Flow of Project Implementation

In order to expand the Project through internal capital assistance, it is necessary to implement the Project in Jawa where financial return is high. However, in consideration of Indonesia's regional development policy, "equality", in order to achieve a proper balance overall it is most desirable to implement the Project without creating any gaps in priority between Propinsi.

Within the Propinsi, two points of emphasis were established based on the following three perspectives and the construction implementation priority was determined for the Kabupaten according to two proposals.

<u>Evaluation Category</u>	<u>Emphasis #1</u>	<u>Emphasis #2</u>
1) Regional development	25%	30%
2) Social & economic development	15%	40%
3) Financial return	60%	30%

Changes in the rate of sufficiency for the Project Implementation Plan Proposal #1 prepared according to this policy are described in Figure 11. Although the rate of sufficiency differs to some extent in Jawa compared to other islands, there is no major recognizable variance among all islands overall.

Figure 12 describes changes in the coverage population per telephone set arising from implementation of the Rural Telecommunications Network Project. While a large gap can be seen in accessibility to telephones among rural residents during the initial phase of the Project depending on their island of residence, the gap gradually narrows to result in a well-balanced nationwide plan.

A financial evaluation of these two proposals revealed nearly identical FIRR figures: 6.8% for proposal #1 and 6.7% for proposal #2. No difference was seen, also, in supply speed depending on the island. As a result, there is no difference resulting from the two points of emphasis, and the priority can be decided according to development policy.