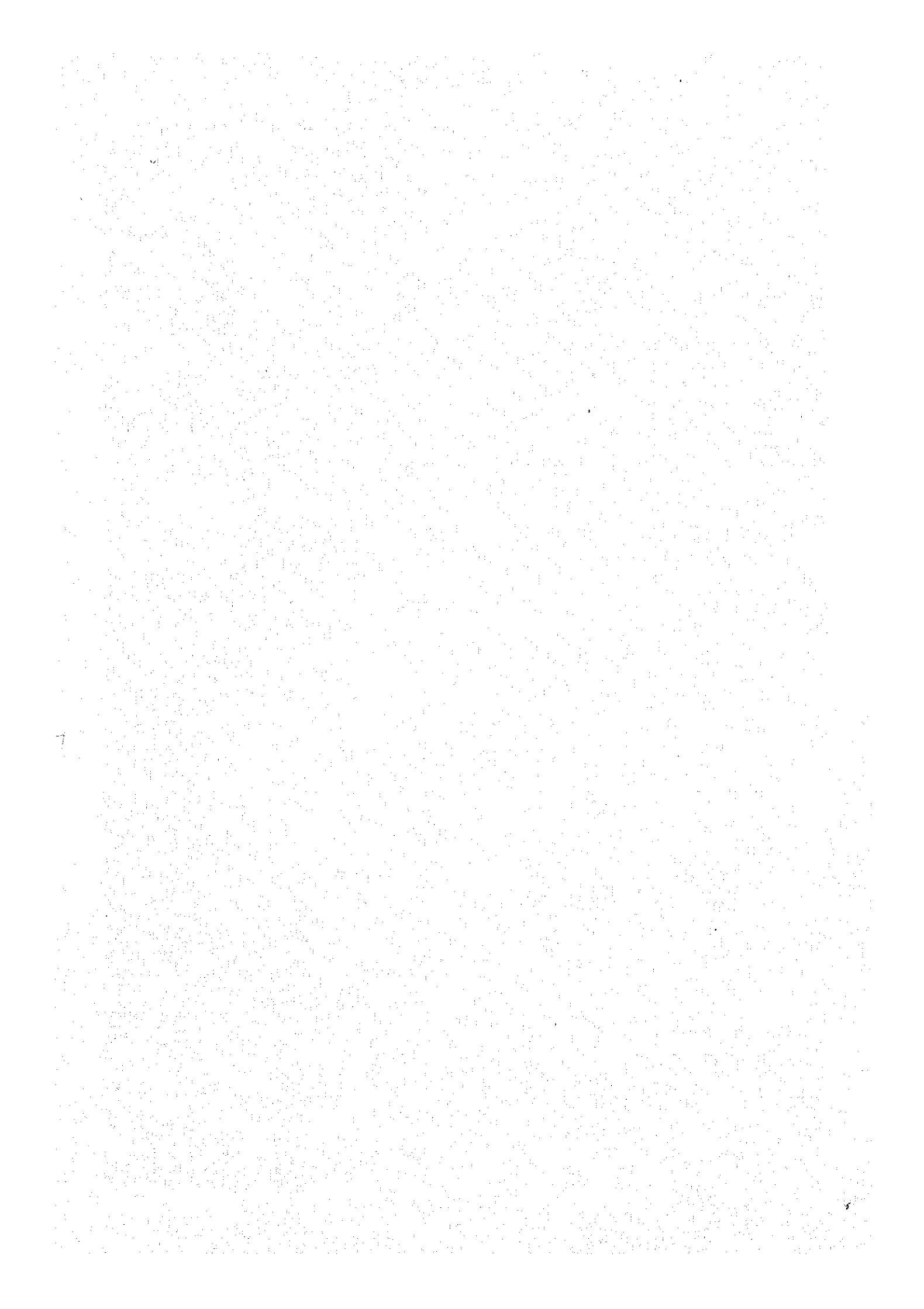


THE KINGDOM OF NEPAL  
DISABILITY STUDY REPORT  
ON  
THE RURAL SELF-EMPLOYMENT  
NETWORK PROJECT

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NETWORK PROJECT

OCTOBER 1983

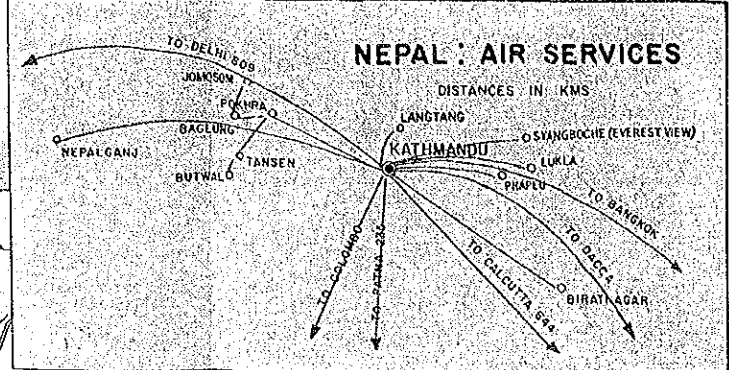
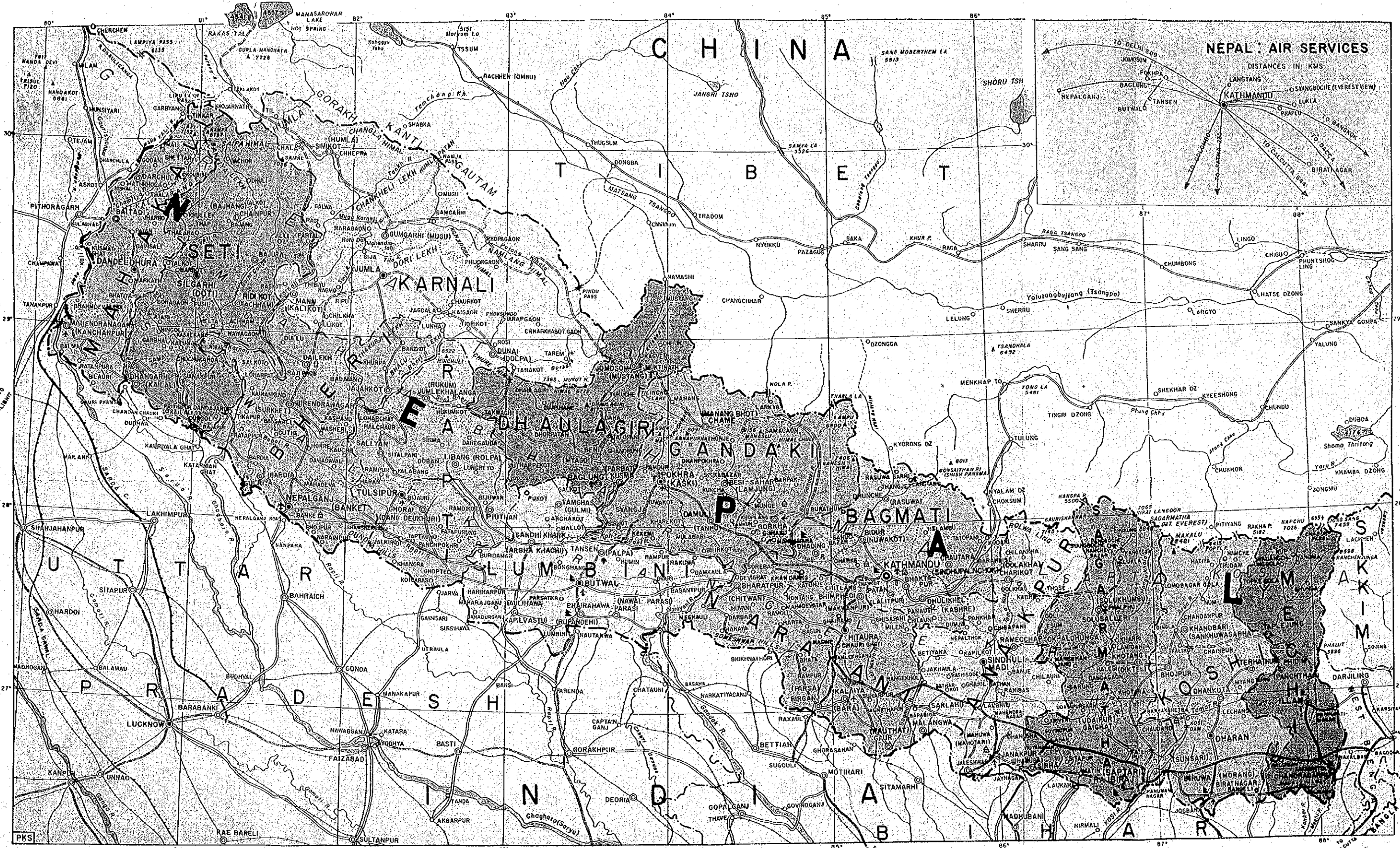
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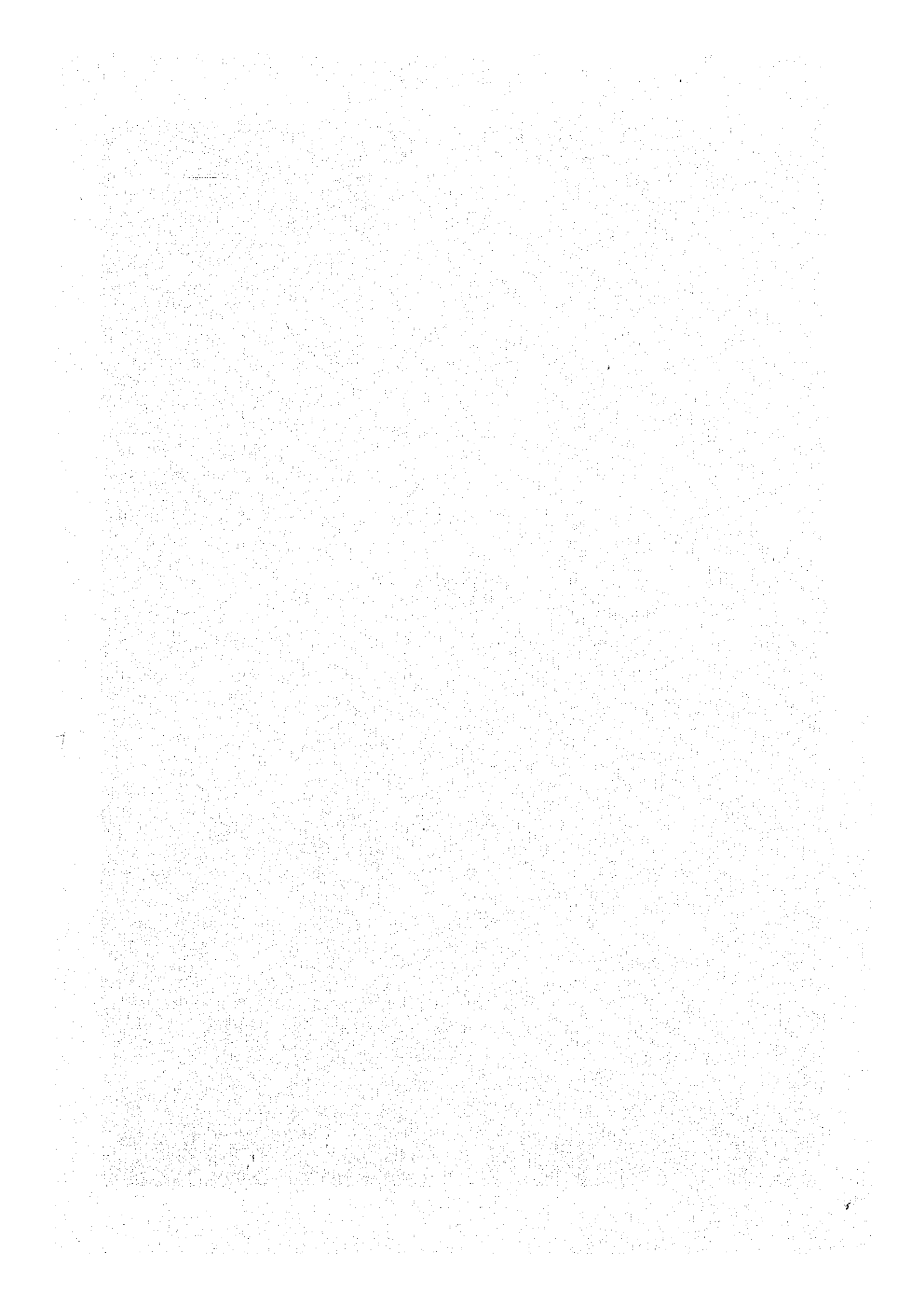
# NEPAL



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PKS





## PREFACE

In response to the request of His Majesty's Government of Nepal, the Government of Japan decided to conduct a feasibility study on the Rural Telecommunications Network Project in the Kingdom of Nepal and entrusted the study to the Japan International Cooperation Agency (JICA).

The JICA sent to Nepal a survey team headed by Mr. Fukushi Kitahara, Special Advisor for International Cooperation, Minister's Secretariat, Ministry of Posts and Telecommunications, from December 9, 1982 to February 26, 1983.

The team had discussions on the Project with the officials concerned of the Government of Nepal and the Nepal Telecommunications Corporation (NTC), and conducted a field survey in the rural areas involved. 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 His Majesty's Government of Nepal and the Nepal Telecommunications Corporation for their close cooperation extended to the team.

October 1983



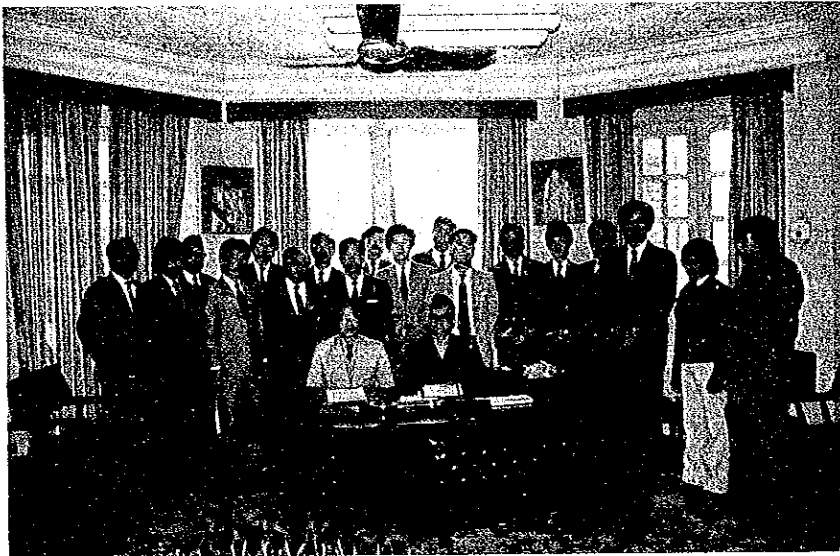
Keisuke Arita  
President

Japan International Cooperation Agency





Signing the Scope of Work and Minutes

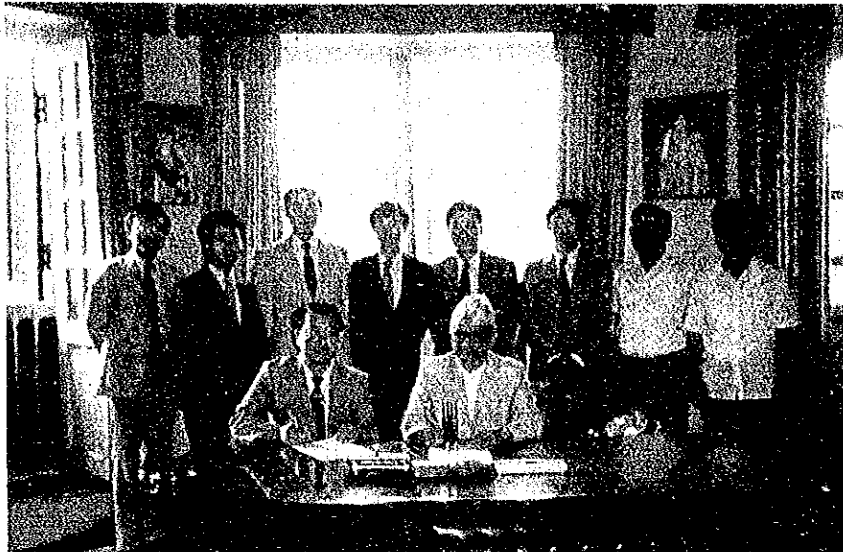


Key Personnel of NTC and Survey Team Members



Signing the Interim Report and Minutes





Signing the Minutes after Explanation on Draft Final Report



Technical Discussion with NTC Staff

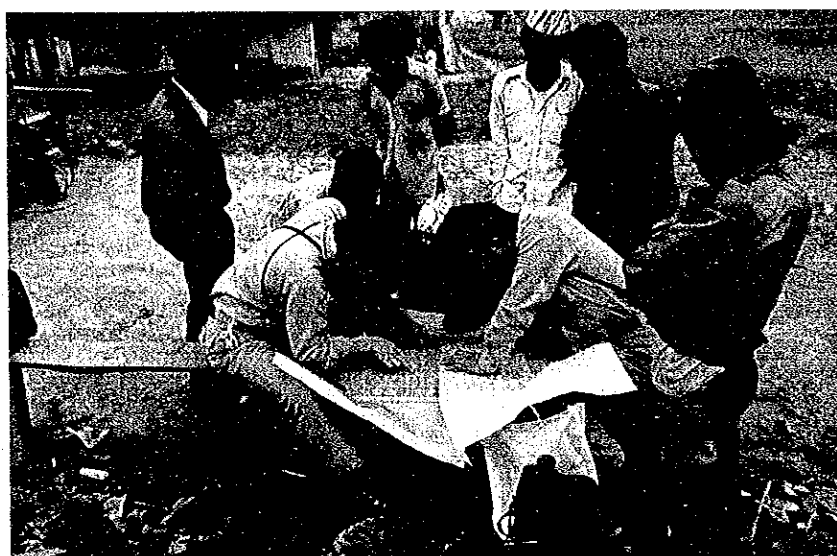


Field Survey (1)





Field Survey (2)

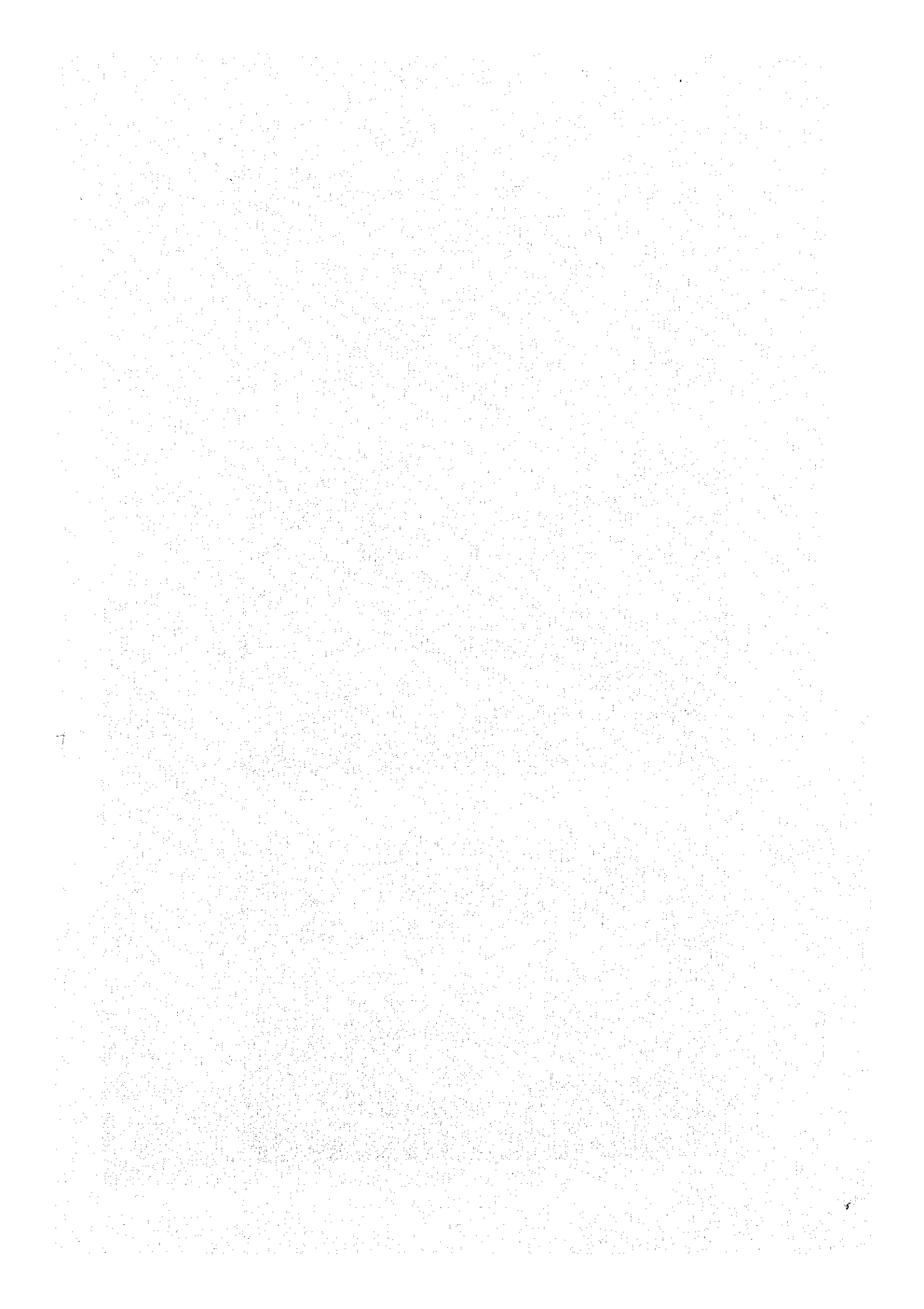


Field Survey (3)



Field Survey (4)





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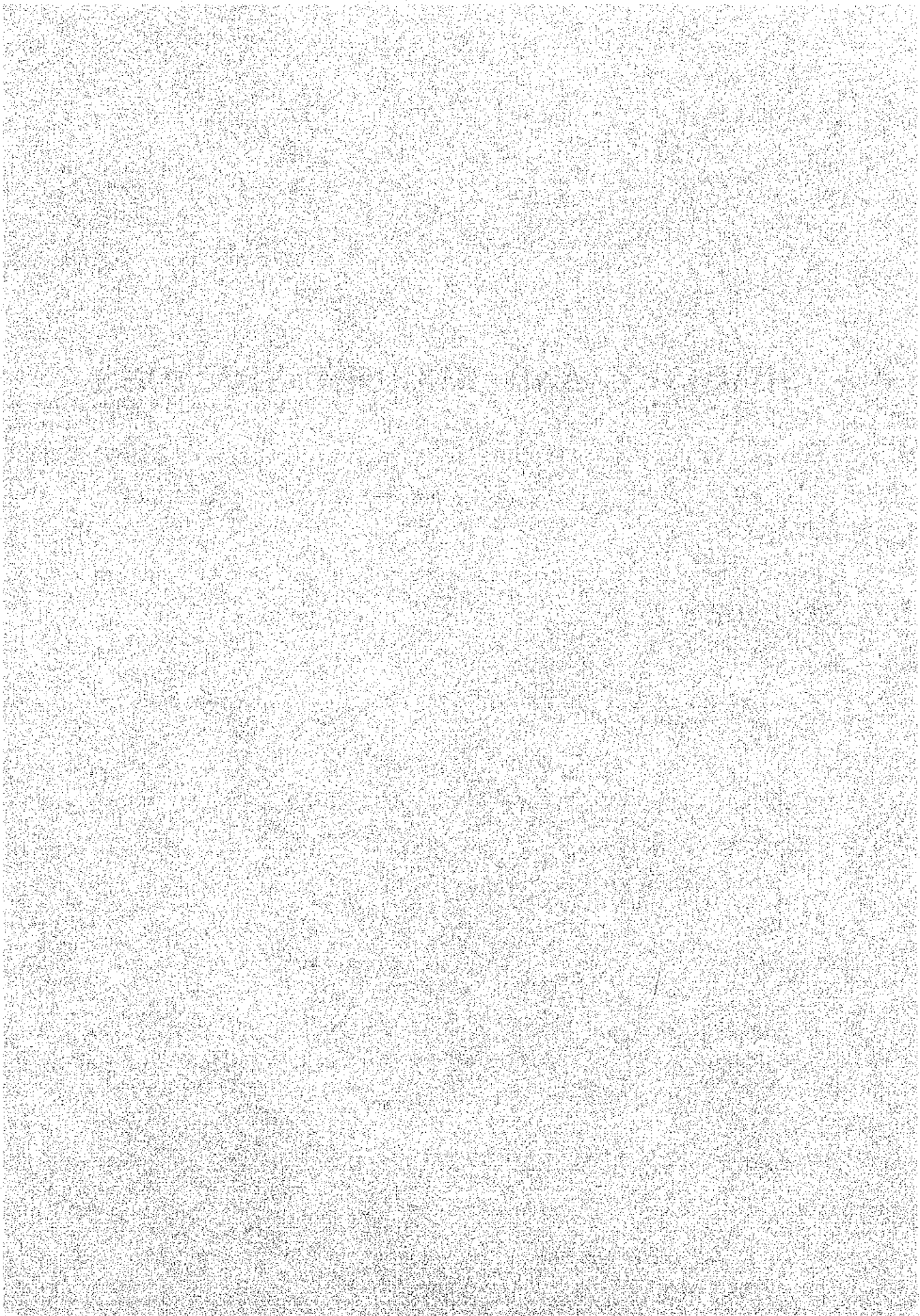
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## SUMMARY AND RECOMMENDATIONS





## SUMMARY AND RECOMMENDATIONS

### I. SUMMARY

#### 1. Objective of Study

This feasibility study is to determine the technical and economic feasibilities of the Project to improve the Rural Telecommunications Network extending all over the Kingdom of Nepal. The study is made from the long term viewpoint up to the year 2000.

#### 2. Basic Principles and Preconditions

The objective areas of this feasibility study are the areas where the social foundation has not yet been fully developed and the telephone service is still in the initiatory stage. Therefore, for the purpose of providing telecommunications services in the necessary minimum, i.e., services mainly to such key establishments as government and public organizations in the objective areas, the network improvement plan is to be established by the basic principles identified below:

- (1) To construct the toll public call offices (hereafter referred to as public call offices) in the administrative centers and the correspondingly important agricultural and commercial/industrial centers in the objective areas, and to administer public toll telephone service plus telegraph service.
- (2) To provide subscriber toll telephone service to such important subscribers as government and public organizations in each public call office service area.

- (3) To construct the telephone exchange offices (hereafter referred to as independent exchanges) exceptionally in Tulsipur, Ghorahi and S. Doti, the development bases in the mid-western and far-western development regions.
- (4) To have the switching of originating/terminating toll telephone traffic from/to the public call offices, as well as the call metering, carried out area by area by the existing telephone exchanges or those to be constructed by the Nepal Telecommunications Corporation (hereafter referred to as NTC) separately from the current plan. (These telephone exchanges are hereafter referred to as parent exchanges.)

Preconditions to the formulation of network improvement plan are as under.

- (1) The areas that can be easily covered by the existing transmission network and the areas located in the Trans-Himalayan region where maintenance and operation would be difficult at present state of development be excluded from the objective areas. (The administrative centers in the former category of areas number five and in the latter, three.)
- (2) The public call offices be constructed at 48 administrative centers and 15 correspondingly important locations, and the independent exchanges at the aforementioned three sites. (Transmission facilities for Kalaiya independent exchange to be constructed by NTC separately from the current plan are to be prepared in the current plan.) The parent exchanges be established at 11 locations (nine primary switching centers plus Bhadrapur and Hitauda).

- (3) Transmission facilities and switching facilities to be introduced by the current plan be of the digital system. The transmission route be composed of the digital line-of-sight radio system.
- (4) The network improvement plan be formulated in accordance with NTC's Basic Plan for the Telephone Network, in principle.

### 3. Demand Forecast and Facilities Capacity

#### 3-1 Demand Forecast

##### (1) Telephone Subscribers

The telephone subscriber demand forecast is to be made, using the model formula of correlation between GDP per capita and the number of main telephones in 54 countries. The model formula follows:

$$Y = 0.0003854 X^{1.2395}$$

where

Y: Number of main telephones per population of 100

X: GDP per capita (in U.S. dollars)

In the demand forecast by the above model formula, the assumption is used that the population of Nepal will increase by an annual average of 2.25% and GDP per capita will grow by 0.225% in annual average.

The forecast consists of the estimate number of subscribers at each objective site as of 1985, 1990, 1995 and 2000. For this estimate, the number of main telephones in the whole of Nepal obtained by the above model formula is to be distributed to each objective site according to its population ratio.

The result is that the number of subscribers as of the year 2000, i.e., the final year of the plan, averages 118 at each public call office while the number of subscribers at the independent exchanges comprises 168 at Tulsipur, 216 at Ghorahi and 376 at S. Doti.

(2) Non-Voice Communication Service

For non-voice communication service, the telegraph and document transmission service is taken up for study, based on NTC's service policy.

Sufficient data whereby to forecast the trend of demand for telegraph service and document transmission service are not available. Therefore, the assumption is made, using the demand trend among the developing countries, that both services in Nepal will grow by 10% annually. Thus the estimate number of copies in both services as of the year 2000 averages 178 per day per public call office.

3-2 Facilities Capacity

As previously stated, the current plan is intended to provide the necessary minimum telecommunications service in the objective areas, instead of satisfying the telephone demand completely. Therefore, the demand forecast made in the preceding paragraph is to be used for reference only in selecting the system to be introduced and in determining the capacity of facilities required.

The basic capacity of facilities thus determined is as under.

(1) Public Call Office

- a) The number of telephones to be installed at the initial stage consists of one for public toll calls, one for telegram message service and four for important subscribers. Exceptions are eight subscribers to be installed at Bidur and 15 at Simra.
- b) For transmission facilities, capacity for 30 circuits is to be established, in principle, so as to meet with the increase of important subscribers in the future. However, at eight sites where the estimate number of main telephones in the final year of the plan exceeds 200 each, capacity for 60 circuits is to be established.

(2) Independent Exchange

- a) Capacities of facilities at initial and final stages are to be as under

	<u>Initial stage</u>	<u>Final Stage</u>
Tulsipur	250	500
Ghorahi	250	500
S. Doti	350	500

- b) Capacity of transmission facilities is to be for 60 circuits. One facsimile terminal is to be installed at the initial stage.

(3) Parent Exchange

- a) All facilities other than switching facilities and power facilities (except rectifiers and batteries of Janakpur and Birganj) are to be established under this plan.

- b) At the initial stage, four facsimile terminals are to be installed at Kathmandu and two at each other parent exchange.
- c) A radio repeater station is to be temporarily installed at Dangadhi before it begins to perform as a parent exchange with switching facilities introduced by NTC.

#### 4. Installation Plan

##### 4-1 Transmission Facilities

###### (1) Transmission Route Selection

The transmission route is to be constituted as an independent network centering upon each parent exchange. In the transmission route selection, radio propagation characteristics on the route concerned are to be considered, with emphasis placed on the ease of construction and maintenance work also.

###### (2) System Selection

For the transmission system, the digital line-of-sight radio system is to be introduced. The frequency band of the system is to be 2 GHz.

###### (3) Basic Design

- a) Transmission performance objective is to be established, based on CCIR Rep. 930.
- b) The transmission system is to be composed of the cold stand-by system. This is to reduce the power consumption by equipment to the possible minimum and thereby save the construction cost of power supply system.

- c) The remote supervisory and control system is to be introduced so as to keep unattended all other sites than parent exchange sites and to reduce the maintenance manpower requirement to the necessary minimum.
- d) For antenna, the grid type parabolic antenna is to be adopted. For tower, either the steel tubular pole or the triangle tower or the guyed tower is to be chosen in consideration of the required tower height and the number of antennas to be mounted.

#### 4-2 Telephone Switching Facilities

The telephone switching facilities are to be designed so as to perform in conformity with the operational philosophy of the digital telephone network presently being planned by NTC. At the same time, the facilities are to be the type of simple construction and moderate cost.

At the independent exchanges, the air-conditioning system is to be introduced.

#### 4-3 Cable and Outside Plant Facilities

##### (1) Introduction Plan and Installation Capacity

For cable and outside plant facilities, the introduction plan and installation capacity are to be as under.

- a) Outside plant to connect important subscribers in public call office service area and the public call office be established in the capacity commensurate with the initial stage number of subscribers.



- b) Outside plant for ordinary subscribers of each independent exchange be established in the capacity commensurate with the initial stage number of line units of the switching equipment.
- c) For the parent exchanges whose transmission facilities and switching facilities are to be installed in separate buildings -- the number of these parent exchanges is five, inter-office tie cable be installed between both buildings in the capacity commensurate with the final stage capacity of transmission facilities.

(2) Basic Design

The basic design of outside plant is to satisfy the undermentioned requirements.

- a) Subscriber line loss distribution: 8 dB, standard
- b) D.C. loop resistance:
  - Subscriber line 1,500 ohms
  - Inter-office tie cable 1,200 ohms
- c) To install cable mainly by the self-supporting type aerial system. Also, to adopt the fixed line distribution method.
- d) To take necessary measure for protecting outside plant from lightning.

4-4 Power Supply Facilities

(1) Installation Location

Power supply facilities for all other sites than the parent exchanges and Nagarkot public call office, are to be installed by the current plan.

(2) System Selection

a) At 13 sites where commercial power supply is available, the battery full-floating system is to be adopted, with diesel engine generator as a stand-by unit.

b) At the sites where commercial power supply is not available, the stand-alone power supply system is to be adopted as under.

- Independent exchange:

Diesel engine driven dual prime mover system

- Public call office:

Solar photovoltaic cell system

For D.C. current supply to the equipment, the battery floating system is to be adopted.

4-5 Terminal Facilities

(1) Telephone Set

All telephone sets are to be the push button dialling type. The initial stage installation is as under.

	<u>With Call Meter</u>	<u>For Call Only</u>	<u>For Ordinary Subscriber</u>	<u>For Telegram Service</u>
Public call offices	63	63	267	63
Independent exchanges	3	3	850	-
Total	66	66	1,117	63

(2) Facsimile Terminal

Facsimile terminal is to be the CCITT G-II type. The initial stage installation is as under.

Independent exchanges	3
Parent exchanges other than Kathmandu	20
Kathmandu	4
Total	27

#### 4-6 Building Facilities

Building facilities are to be the transportable type in which case the construction is easy and the construction work period can be reduced. At the same time, buildings are to be as small-sized as possible and to be the type that can be assembled at site. Furthermore, to reduce the cost of construction, batteries and engines are to be accommodated separately from the main equipment in the ad hoc simple buildings.

Parent exchange buildings are to be provided by NTC. Hence outside of the scope of work of the current plan.

#### 5. Maintenance and Operation

Proposals concerning maintenance and operation of the rural telecommunications network to be introduced by the current plan are as under.

- (1) To make the 10 parent exchanges (excluding Hitauda) the maintenance centers responsible for the maintenance and upkeep of unattended site facilities in the areas under their respective controls. Also, to establish the central maintenance center in Kathmandu to assume responsibility for maintenance and operation of the rural telecommunications network as a whole.

- (2) To procure necessary personnel for maintenance and operation (maintenance personnel: 123; operation personnel: 198), and to administer training and education of those personnel, especially the maintenance personnel.

## 6. Implementation Plan and Cost Estimate

### (1) Implementation Plan

The construction work is to be divided into four phases and to be implemented phase after phase.

The number of sites to be constructed in each phase is as under.

	<u>Phase I</u>	<u>Phase II</u>	<u>Phase III</u>	<u>Phase IV</u>
Public call offices	*14	12	21	17
Independent exchanges	-	2	1	-
Radio repeaters	**10	9	16	21

Note: \* include temporarily established S. Doti.  
 \*\* include temporarily established Dangadhi, and Kaliya

### (2) Project Cost

The project cost estimate is as under. From Phase I to Phase III, the cost estimate is on Contractor's turn-key base, and for Phase IV, by NTC's direct management.

(in million Japanese yen)

<u>Phase I</u>	<u>Phase II</u>	<u>Phase III</u>	<u>Phase IV</u>
2,376	2,295	2,929	1,840

## 7. Economic Evaluation

When the current project implementation is completely financed with the fund on hand, the financial internal rate of return turns out to be 0.46%. Thus, financially, the current project cannot be considered as being feasible.

Nevertheless, in view of the great contribution of the current project to social and economic development of rural areas of the Kingdom of Nepal, the implementation worthiness of the current project can be fully recognized.

## 8. Overall Project Evaluation and Proposal

Direct economic benefits that NTC, the responsible party for the current project, can derive from project implementation are relatively few. Nevertheless, the project contributes a great deal to the promotion of integral rural development that takes top place on the keynote policy planks of His Majesty's Government of Nepal. Especially when the contributions to the improvement of administrative and financial organizations of the country and to the elevation of the standard of national life through the promotion of economic and industrial development and the diffusion of culture are considered, the project can be recognized as being worthwhile to implement.

However, from the economic viewpoint, the financial requirement for system construction, as well as system maintenance and operation, must be reduced to the necessary minimum. The proposal for this purpose is as under.

- (1) To curtail service hours;
- (2) To reduce the storage battery holding time of solar cell system

(3) To retrench the project size.

(4) To change independent exchange introduction timing.

## II. RECOMMENDATIONS

### 1. Site Confirmation and Land Acquisition

To confirm by field survey the public call office sites, independent exchange sites and radio repeater sites selected by the feasibility study, this time, and to make necessary prior arrangements for land acquisition, ground levelling and land formation, and access road construction. Also, to select substitute sites to be used in case the land acquisition is impossible at the primarily selected sites or those sites prove to be disqualified.

The field survey of sites is indispensable for smooth progress of construction work and its completion without delay. Furthermore, in view of the underdeveloped road condition and the lack of traffic convenience in the objective areas of the current plan, the field survey should be started at the earliest possible opportunity.

### 2. Procurement and Training of Personnel

To procure the necessary maintenance and operation manpower from among NTC's staff personnel or by means of new employment, and to train such manpower in advance about the basic requirements at the training center.

### 3. Improvement/Expansion of Related Facilities

To improve and expand the facilities related to the current plan. Those facilities are as under.

- a) Installation floor space for transmission facilities at the parent exchanges, as well as power supply facilities and antenna towers.
- b) Switching facilities at parent exchanges and Kalaiya independent exchange.
- c) Main transmission route network.

4. The tariff system must be reviewed and properly revised so that it will comply with the principle of beneficiaries to share the cost.
5. So as to implement the project and facilitate the future maintenance and operation of the system, supply of the necessary initial costs of the project and running costs of the system is required to the NTC in the form of Government capital contribution and/or subsidies.



