

HIS MAJESTY'S GOVERNMENT OF NEPAL
MINISTRY OF PANCHAYAT AND LOCAL DEVELOPMENT

THE MASTER PLAN STUDY
ON
THE INTEGRATED RURAL DEVELOPMENT PROJECT
IN
THE LUMBINI ZONE

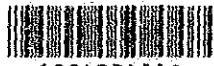
GULMI, ARGHAKHANCHI, KAPILVASTU DISTRICTS
AND MARCHAWAR AREA OF RUPANDEHI DISTRICT

MAIN REPORT

JANUARY, 1990

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PREFACE

In response to a request from His Majesty's Government of Nepal, the Government of Japan decided to conduct a Master Plan Study on the Integrated Rural Development Project in the Lumbini Zone and has entrusted the study to Japan International Cooperation Agency (JICA).

JICA sent to Nepal a survey team headed by Mr. Kensaku Takeda, Nippon Koei Co., Ltd. twice from September, 1988 to October, 1989.

The team held discussions with the officials concerned of His Majesty's Government of Nepal and conducted a field survey. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement 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 for their close cooperation extended to the team.

January, 1990



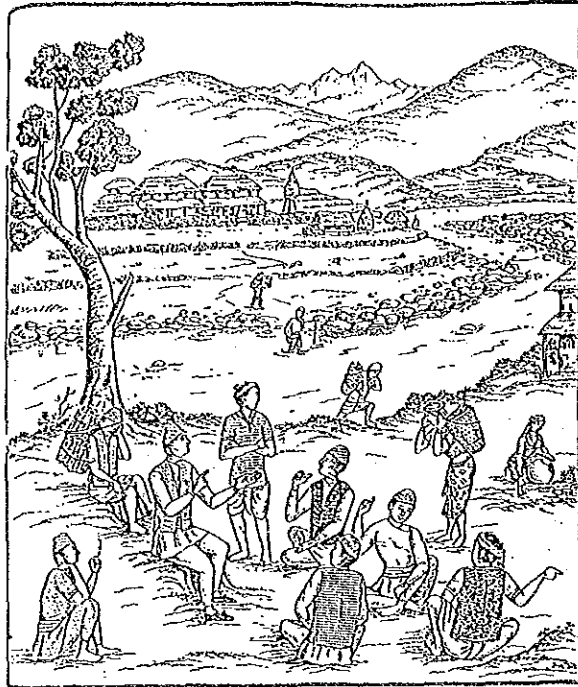
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President

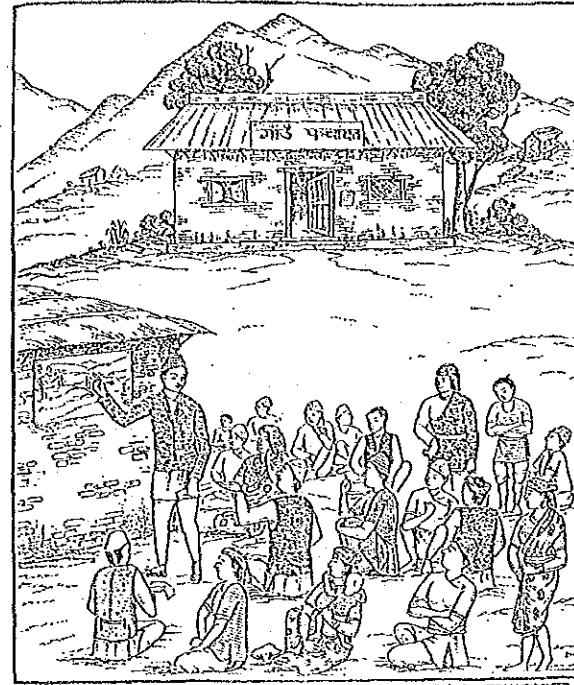
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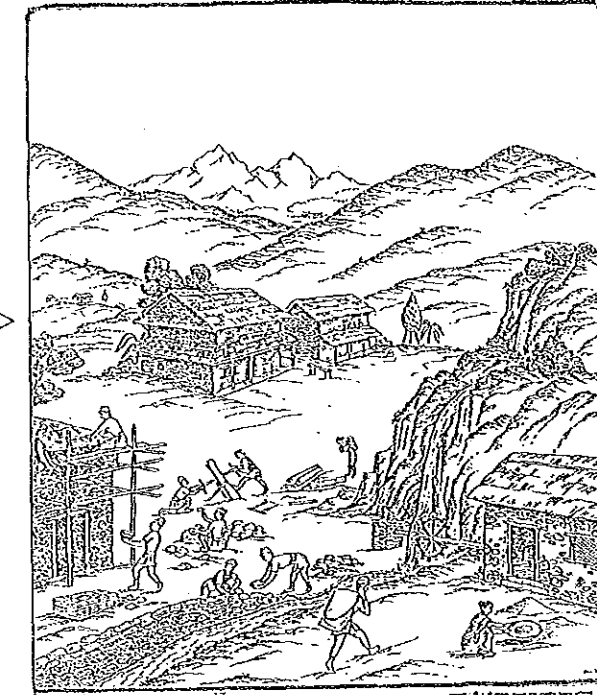
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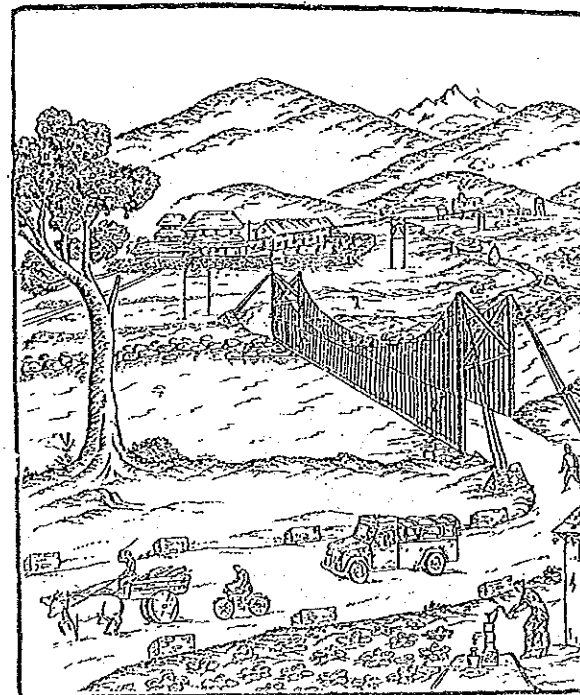
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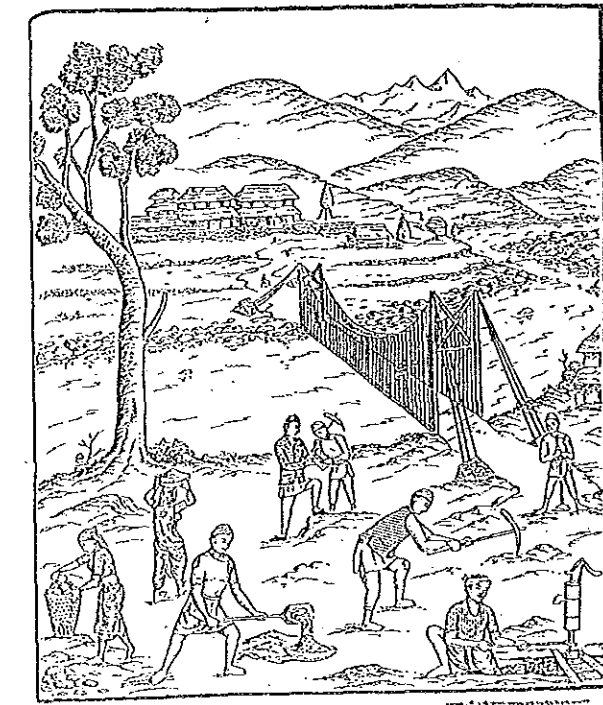
गाउँ बनाउन गाउँकै स्रोत ठीक छ
काठ, ढुङ्गा, माटो, श्रम, पानी अनि सीप छ



मिलीजुली विकास गरे गाउँ बन्द, हाम्रो
विकेन्द्रीकरणको भीठो फल पाउने हौं र हाम्रो



अस्को भर अब नपरो
गाउँ-घरको विकास आफै गरौं



1. Decentralization policy has come for the rural development. Good opportunity has come to work out own benefit.
2. Let us prepare our development plans by ourselves. Let us implement our development plans by ourselves.
3. Utilize local resources for rural development. Wood, stone, soil, labour, water and skills also.
4. Let us not depend on others now. Let us develop rural areas by ourselves.
5. Our village can be developed by our effort. Decentralization program's sweet fruit can be achieved.

DECENTRALIZATION AND PEOPLE'S PARTICIPATION IN RURAL DEVELOPMENT

SUMMARY

1. (The report)

This report deals with the master plan for the Integrated Rural Development Project (IRDP) in the Lumbini Zone. The results of pre-feasibility study on the development priority projects of the master plan are also included. The master plan covers a period of 15 years from 1990/91 to 2004/2005.

2. (History)

Following the project formulation study by the UNDP in 1985, HMG/N requested the Government of Japan to conduct the master plan study for the Lumbini IRDP. In response to the request, the Japanese Government carried out the study from the end of September 1988 to the middle of November 1989 through Japan International Cooperation Agency (JICA).

3. (Methodology)

In order to formulate the master plan for the Lumbini IRDP, the following activities were carried out.

- Review and examination of existing data and information,
- Interviews with officials of the central and local agencies concerned of HMG/N,
- Field surveys by the experts, and
- Sample surveys of about 10% of the total village panchayats in the study area.

4. (National plan)

HMG/N has carried out five year development plans since 1956, and is now operating the Seventh five year plan (1985-1990). The growth rate of GDP during the Sixth Plan period was 4%. GDP per capita in 1985/86 was estimated at about Rs. 2,900 (US\$160).

5. (Agriculture in national economy)

Nepal is a predominantly agricultural country. The agricultural sector accounts for about 60% of GDP, 90% of employment and 75% of exports. The agricultural sector has been growing slower than the population, and agricultural activities in the project area are still at subsistence level.

6. (IRDP)

In Nepal, the Integrated Rural Development Projects (IRDP) were started in the early 1970s. At present, nine IRDP projects, excluding the Lumbini IRDP, are under implementation through the joint efforts of HMG and several donor organizations.

7. (Project area)

The Lumbini IRDP area is located in the Western Development Region of Nepal, and covers Gulmi, Arghakhanchi, Kapilvastu and Marchawar area of Rupandehi district of the Lumbini Zone.

Gulmi and Arghakhanchi districts are located in the hill area, and Kapilvastu and Rupandehi districts extend over the Terai area. The total project area is about 4,200 km², of which 55% is hill area, and 45% is Terai. In the project area, there are 221 village panchayats and one town panchayat. The population in the project area was 820,000 at 1987.

8. (Topography)

The hill area has a mountainous topography characterized by high altitude and steep slopes. From this hill area, it rises in successive waves of ridges to Dhaulagiri Himal to the north. By contrast, the Terai area is a flat alluvial plain with low altitude and forms the northern fringe of the Gangetic plain. The hill area rises abruptly from the Terai plain.

9. (Land use)

Cultivated land in the Terai accounts for 51% of the total, and most of the cultivated land is paddy field. On the other hand, the cultivated land in the hill area is 20%, and mainly consists of upland fields. However, according to the land capability assessment there is no available land to expand the cultivation area in the project area.

10. (Land resources)

Environmental degradation in the project area is a very serious problem just as in other parts of Nepal. From this point of view, the land resources for development are very limited, and there is no scope for expansion of cultivated land.

11. (Meteorology and Hydrology)

The project area as well as elsewhere in Nepal has two distinct seasons, namely a rainy season (June - September) and a dry season (October - May). Over 90% of the annual rainfall occurs in the rainy season. The mean annual precipitation is about

2,000 mm. Rivers generally originate in and around the hill ranges and flow out onto the Gangetic plain of India through the Terai.

12. (Hydrogeology)

The Western Terai, of which the ground water development of the project area forms a part, is underlain by a sequence of alluvial deposits which were carried by river water running from the Siwaliks.

However, the beds of the alluvial deposits which form good aquifers are thin and poor in their continuity compared with those in other parts of the Terai. The area of higher potential has a 40-50 lit./sec yield from one deep tubewell.

13. (Population)

The total population of the four districts in 1987 was estimated at 1,203,800 and will increase to 1,751,000 in 2005. Out of the total households in the four districts, farm-households account for 83.8% and, in the project area is estimated at 92%. Migration from the hill area to the Terai is a common phenomenon in the project area as well as elsewhere in Nepal.

14. (Agriculture)

The main crops in the hill area are food grains such as maize, paddy and wheat. Some cash crops such as mustard, coffee, ginger and mandarin orange are also cultivated.

Livestock plays an important role in agricultural production and rural life. Cattle, buffaloes, goats and sheep are raised throughout the project area. Poor animal health and feeding are major constraints in livestock farming.

15. (Income)

The average gross income of farm-household at present is about NRs. 17,500 in the hill area and NRs. 19,100 in the Terai. Per capita gross income of the farm-household is about NRs. 2,500 in the hill area and NRs. 2,729 in the Terai. These correspond to only 55 to 60% of the per capita GDP of Nepal as a whole.

16. (Irrigation)

The average proportion of cultivated land with irrigation facilities is 26% for the Terai and 9% for the hill area as compared to the national average of 21% for the Terai and 11% for the hill area.

17. (Rural road)

The district headquarters of the hill area has no motorable roads which link with the highway all the year round, and travel in the hill area is very difficult. In the Terai, the road network is rather better than that in the hill area, but there are trafficability problems in the rainy seasons.

Social solidarity, agricultural extension activities and other rural development efforts suffer from such access constraints.

18. (Water supply)

The coverage rate of water supply in the four districts of the project ranges from 9% to 35%, the average rate being 22% in 1988/89. In the hill area, small streams and springs are the most usual water sources, and in the Terai area, it is groundwater. In the hill area, fetching water from remote water sources is very hard daily work for the people especially for women and children.

19. (Development needs)

HMG/N has embarked on the basic needs fulfillment approach in the national development plan. As mentioned previously, the average per capita income of the project area is lower than the national average, and the necessary basic physical and social infrastructures are at a very low level. The final goal of the IRDP is the alleviation of poverty through the increase of incomes and raising of living standards.

20. (Development potential)

There is no land left for new reclamation in the project area. Increasing agricultural production must be achieved by increasing land productivity, taking into consideration reconciliation of development and conservation.

A considerable amount of precipitation is expected every year. But it is not easy to utilize the water resources of the area due to occurrence of the dry season and the severe topographic conditions especially in the hill.

Despite its relatively poorly endowment of natural resources, the area has rich human resources. Encouragement of the people in the area is one of the most important factors for development.

21. (Development strategy)

In order to meet the needs of development, the following inter-related areas of strategy have been identified:

- promotion of agricultural production,
- improvement of the living environment,
- consolidation of basic infrastructures,
- strengthening of plan implementation capacity through reinforcement of human resources,
- generation of financial resources.

22. (Development approach)

An integrated approach by administrative level and by stage will be required in order to attain the objectives of the IRDP. Timely inputs of development resources such as man power and funds will be required through appropriate channels.

23. (Promotion of agricultural production)

Agricultural production will be increased through the following measures.

- increase of cropping intensity,
- increase of unit yield,
- introduction and expansion of cash crops,
- raising of livestock productivity and improvement of husbandry,
- promotion of fish culture and apiculture,
- strengthening of agricultural extension and livestock services.

24. (Farmer's economy with the project)

The average total farm income with the IRDP, will increase to about NRs. 35,000 compared with the present value NRs. 18,000 and average per capita gross income is estimated at NRs. 5,000. These figures are about twice their present levels.

25. (Irrigation)

In order to achieve an early return of benefits and absorptive capacity of implementation, 157 projects have been identified with 18,770 ha of benefited area including central and district level projects.

In the hill area maximized development including rehabilitation of existing facilities and new development projects would be planned. In the Terai area, rehabilitation

projects have been identified. The irrigation ratio with the project will be increased to 15% in the hill area and 47% in the Terai.

26. (Rural road)
Consolidation of the road network to be motorable all year round is most essential for development of the area. Eleven projects with 427 km of rural road were planned.
27. (Water supply)
The target for the water supply sector was planned at 80% of water supply coverage by the end of the master plan period. Water sources to be developed will be small streams and springs in the hill area and groundwater in the Terai. The population to be supplied additionally will be 551,900, and the quantity of water to be developed will be about 44,000 cu.m/day.
28. (Agricultural marketing and processing)
Agricultural production will be increased according to the progress of the project development. In order to meet the production increase, consolidation of input supply system and marketing system, and increase of processing capacity have been planned.
29. (Living environment improvement)
This sub-project provides for improvement of living related facilities, construction of facilities on education and health services, and women's development. Most of these projects will be implemented at the lower level of the district system, such as at village or even at community level.
30. (Strengthening of plan implementation capacity)
The Decentralization Act gives authority and power for rural development to the district, but capability for planning and implementation at the district level is not so high at present. In order to overcome this problem, recruiting and training of staff have been planned to strengthen capacity at district level.
31. (Project cost)
The project cost for the IRDP master plan was estimated at about NRs.4,000 million for construction excluding the costs of operation and maintenance and the recurrent costs for agriculture. A breakdown of the cost by sectors is summarized in the table.

32. (Project evaluation)

Primary evaluation was made in each sector according to the sector criteria. After that an integrated cross-sector evaluation was made at a trial level taking into account various aspects of the project impacts.

33. (Implementation program)

The implementation schedule for the master plan was prepared on the assumption of simultaneous progress on the main components and formation of intersectoral linkages.

The Lumbini Integrated Rural Development Project (IRDP) does not provide for establishment of any separate organization for project implementation. The project works will be carried out through the existing project implementation system and organization structures in line with the rules and regulations of the Decentralization Act and its byelaws.

In order to maintain the integrated approach to implementation, coordination between the line agencies concerned as well as between the concerned districts will be very important. The coordination work would be undertaken by NPC/IRDB through the MPLD.

34. (Priority projects)

Several priority projects have been identified as the essential projects for successive development works. These includes construction of basic infrastructures and strengthening of plan implementation capacity at the local level.

35. (Conclusion and Recommendation)

The final goal of the Lumbini Integrated Rural Development Project is to create a home land of which the people will be proud through alleviation of poverty by fulfilling the basic needs of the people through increasing income by promotion of production and raising of living standards by improvement of the living environment.

During the initial stages of the project, construction of the infrastructures will be implemented by the central level agencies, while the plan implementation capacity at the district level will be reinforced to carry out the projects which concern directly the rural life of the people. In this connection, it is recommended that a feasibility study on the Plan Implementation Capacity Reinforcement Project should be carried out at the earliest possible stage.

For promotion and effective management of the Lumbini IRDP, it is recommended that reinforcement of the overall project management organization should be carried out along with the regulations and the development system in Nepal. It is essential to establish a system of monitoring and evaluation on the Lumbini IRDP, and to adjust project implementation depending on future circumstances. In this connection it is recommended that a benchmark survey be carried out at an early stage to facilitate monitoring and evaluation.

SUMMARY OF THE MASTER PLAN

				<u>Cost</u> (Million NRs.)
1. <u>Construction Cost</u>				
1)	<u>Irrigation</u>	Central Level : 23 projects	8,890 ha	1,335.0
		District Level : 134 projects	9,880 ha	194.0
		Total	18,770 ha	<u>1,529.0</u>
2)	<u>Rural Road</u>	Central Level : 9 projects	387 km	1,300.0
		District Level : 2 projects	40 km	140.0
		Total	427 km	<u>1,440.0</u>
3)	<u>Water Supply</u>	Additional population to be served : 551,900		
		Development quantity : 44,280 cu.m/day		<u>595.0</u>
4)	<u>Agriculture</u>	- Extension Services		134.4
		- Livestock Services		78.1
		- Fisheries		5.2
		- Apiculture		0.6
		Total		<u>218.3</u>
5)	<u>Marketing and Processing</u>			<u>305.8</u>
	<u>Grand Total</u>			<u>4,088.1</u>
2. <u>Operation and Maintenance Cost (per year)</u>				
1)	<u>Irrigation</u>			6.9
2)	<u>Rural Road</u>			4.9
3)	<u>Water Supply</u>			31.7
4)	<u>Agriculture</u>			10.9
3.	<u>Recurrent Cost for Agriculture (per year)</u>			32.8
4.	<u>Initial Operation Fund of Marketing Organizations</u>			30.9
5.	<u>Cost for Improvement of Living Environment (per year)</u>			
1)	<u>Confidence Building (first three years)</u>			36.0
2)	<u>Living Environment Improvement (fourth year and thereafter)</u>			36.0

SUMMARY OF THE PRIORITY PROJECTS

<u>Sector</u>	<u>Description</u>	<u>Cost</u> (Million NRs.)
1. <u>Irrigation</u>	Rajikuduwa: 2,400 ha	Rehabilitation <u>281.4</u>
2. <u>Rural Road</u>	1) Tansen - Tamghas: 75 km	Improvement 237.0
	2) MRM - Sandhikharkha: 69 km	- ditto - 288.2
	Total 144 km	<u>525.2</u>
3. <u>Water Supply</u>	1) Banganga & Gajida	New project 40.8
	2) Material Supply for 2 districts of hill area	6.7
	Total	<u>47.5</u>
4. <u>Agriculture</u>	1) Extension Services	New project <u>134.4</u>
	- District level 3 locations (office, service center, etc.)	
	- Ilaka level 22 locations	
	2) Livestock Services	New project <u>78.1</u>
	- Central level (1 office)	20.4
- District level 3 locations	57.7	
- Ilaka level 27 locations		
<u>Grand Total</u>		<u>1,066.6</u>
5. <u>Strengthening of Plan Implementation Capacity</u>		
	1) Standardization of the plan implementation process	
	2) Human resources development	
	3) Local finance resources mobilization	

THE MASTER PLAN STUDY
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NOTATIONS

AADO.....	Assistant ADO	JICA	Japan International Cooperation Agency
ADB.....	Asian Development Bank	JT	Junior Technician
ADB/N	Agriculture Development Bank of Nepal	JTA	Junior Technical Assistant
ADO	Agricultural Development Officer	LRMP.....	Land Resources Mapping Project
AIC.....	Agricultural Input Corporation	LDO	Local Development officer
ARPP.....	Agricultural Research and Production Programme	MPLD.....	Ministry of Panchayat and Local Development
BNP	Basic Needs Program	NFC	National Food Corporation
CBS	Central Bureau of Statistics	NPC	National Planning Commission
CDO	Chief District Officer	PLAA	Panchayat Level Agricultural Assistant
CIDA	Canadian International Development Agency	PPRTC	Pokhara Panchayat Regional Training Center
CIMMYT.....	Centro Internacional de Mejoramiento de Maiz y Trigo	RD	Rural Development
DDP.....	District Development Plan	RSC	Rural Service Centre
DLAH	Department of Livestock and Animal Husbandry	SATA	Swiss Association for Technical Assistance
DOA	Department of Agriculture	SFDP.....	Small Farmer Development Project
DOI.....	Department of Irrigation	SMS	Subject Matter Specialist
DOR	Department of Road	STA.....	Senior Technical Advisor
DWSS.....	Department of Water Supply and Sewerage, Ministry of Housing and Physical Planning	UNCDF	United Nations Capital Development Fund
EEC	European Economic Community	UNDP	United Nations Development Program
FAO.....	Food and Agriculture Organization	UNICEF ...	United Nations Children's Fund
GDP.....	Gross Domestic Products	USAID.....	United States Agency for International Development
GTZ.....	German Technical Cooperation	WFP.....	World Food programme
HMG/N	His Majesty's Government of Nepal	WSSC.....	Water Supply and Sewage Corporation, Ministry of Housing and Physical Planning
Helvetas	Swiss Association for Development and Cooperation		
IBRD	The International Bank for Reconstruction and Development (World Bank)		
IMF	International Monetary Fund		
IFAD	International Fund for Agricultural Development		
IRDB	Integrated Rural Development Board		
IRDP.....	Integrated Rural Development Project		

ABBREVIATIONS OF MEASUREMENTS

Length

mm	=	millimeter	
cm	=	centimetre	
	=	0.39 in.	
m	=	meter	= 1.09 yd
	=	3.28 ft.	
km	=	kilometre	= 0.62 ml
in.	=	inch	= 2.54 cm
ft.	=	foot	= 30.48 cm
yd.	=	yard	= 91.44 cm
ml.	=	mile	= 1.61 km

Area

cm ²	=	square centimetre	
m ²	=	square meter	
km ²	=	square kilometre	
	=	100 ha	
ha	=	hectare	= 0.01 km ²
	=	2.5 ac	
ac	=	acre	= 0.41 ha
	=	4,050 m ²	
ft ²	=	square feet	
	=	0.09 m ²	
mile ²	=	square mile	= 2.59 km ²

Electrical Measures

kW	=	kilowatt	= 1,000 watt
MW	=	megawatt	= 1,000 KW
GW	=	gigawatt	= 1,000 MW
kV	=	kilovolt	= 1,000 volt

Other Measures

%	=	percent
°	=	degree
'	=	minute
"	=	second
°C	=	degree in Celsius
lakh	=	10 ⁵
crore	=	10 ⁷

Volume

lit.	=	litter
cm ³	=	cubic centimetre
m ³	=	cubic meter
	=	1,000 lit.
MCM	=	million m ³
	=	1x10 ³ m ³
ft ³	=	cubic feet = 0.028 m ³
	=	28.32 lit.
ac-in.	=	acre inch = 88.05 m ³
ac-ft.	=	acre feet = 1,234 m ³

Weight

g	=	gram
kg	=	kilogram
t	=	metric ton = 1,000 kg
lb	=	pound = 375 g

Time

sec	=	second
min	=	minute = 60 seconds
hr	=	hour = 60 minuits
	=	3,600 seconds
day	=	24 hrs = 1,440 minutes
	=	86,400 seconds
yr	=	year

Derived Measures

m ³ /sec	=	cubic meter per second (Cumecc)
ft ³ /sec	=	cubic foot per second (Cusec)

Monetary

US\$	=	US dollar
¥	=	Japanese yen
Rs	=	Nepalese rupee

MEASUREMENT UNIT

Land Measurement

1 Bigha	= 20 Katha	= 0.677 ha	
	= 1.676 Acre	= 13.31 Ropani	
1 Katha	= 20 Dhur	= 339 m ²	
1 Dhur	= 182 sq. feet	= 16.9 m ²	
1 hectare	= 2.47 acre	= 1,477 Bigha	
	= 29.5 Katha	= 19.6 Ropani	
1 mile ²	= 640 Acre	= 259 ha	
	= 2.59 km ²		
1 Acre	= 0.4047 hectare	= 43,563 ft ²	
	= 0.5966 Bigha		

Volume

1 litre	= Mana 3 Chauthai	= 1.0567 US quart	
	= 1.76 Pint	= 1,000 millilitre	
	= 0.881 Imperial quart		
1 Mana	= 598 millilitre	= 33.264 cubic inch	
1 cup	= 16 Tablespoon	= 240 c.c.	
	= 8 ounces		
1 fluid ounce	= 2 Tablespoon		
1 gallon	= 3.785 millilitre	= 3.785 litres	
	= 16 cups	= 128 fluid ounces	
	= 227.42 cubic inches		
1 standard table spoon	= 1.5 general table spoon		
1 Tea spoon	= 5 c.c		
3 Table spoon	= 6 tea spoons		
1 Kerosene oil tin	= 20 litres	= 5 gallons	
1 Muri	= 90.910 litres		
3 Pathi	= 4.546 litres		
1 quarter or chouthai	= 124 millilitre		
2 Mana	= 1 Kurua		
4 Kurua	= 1 Pathi		
20 Pathi	= 1 Muri		
1 Hectolitre	= 22.01 gallons		
1 gallon	= 4,564 litres		

Weight

1 Kg	= 2.2046 pounds	= 86 tolas	
	= 5 pau		
	= 1 seer	= 1 chhatank	= 1 tola
	= 0.42 Dharni		
1 gram	= 15.43 grains	= 0.035 ounce	
100 kg	= 1 quintal	= 231 pounds	
	= 2 mounds	= 27 seers	= 14 tolas
40 kg	= 1 Mound	= 2 seers	= 14 tolas
	= 1 Mound	(Prevalent now a days)	
1 Pound	= 16 ounces	= 454 grams	
1 mound	= 37.32 kg		
1 seer	= 933 grams		
1 Chhatank	= 58 grams		
1 Tola	= 11.66 grams		

Hills

12 Masa	= 1 Tola		
18 Tola (Nepali)	= 1 pau		
17.1 Tola (Indian)	= 1 Pau		
12 Pau	= 1 Dharni		
1 Pau	= 200 grams		
5 Pau	= 1 kilogram		
1 Dharni	= 2,270 kilogram		
	= 5 Pounds		

Terai

5 Tola	= 1 Chhatank		
16 Chhatank	= 1 Seer		
	= 2.057 Pounds		
	= 0.933 Kilogram		
	= 933 grams		
40 Seer	= 1 Maund		
	= 82.28 Pounds		
	= 37.325 Kilogram		
4 Chhatank	= 1 Pau		
4 Pau	= 1 Seer		
5 Seer	= 1 Panseri		
8 Panseri	= 1 maund		
1 Tola	= 180 grain	= 0.4114 ounce	
	= 11.66 gram		
1 Chhatank	= 5 Tola	= 0.1286 Pound	= 0.583 kg
1 Seer	= 16 Chhatank	= 2,057 Pound	= 0.933 kg
1 Mound	= 40 Seer	= 82.28 Pounds	= 37,325 kg
1 Quintal	= 2,679 Maunds	= 107,169 Seers	
1 Md/B	= 54.9 kg/H		
1 Ton/ha	= 18 maunds/Bigha		
1 kg/ha	= 1.12 Pound/Acre	= 0.677277 kg/Bigha	
	= 0.33863 kg/Katha	= 0.90874 kg/Ropani	

CONVERSION FACTORS

GRAIN VOLUME

1 muri = 20 pathi = 160 mana = standard

1 local muri = 16 local pathi
= 64 standard mana - Jumla
(Source farne information)

Muri to Kg.

	kg
Paddy (rice)	48.768
Wheat/maize	68.048
Barley/oat	45.360
Buckwheat	54.432
Fingermillet	65.776
Common millet	72.663
Crams	65.696
Bean	71.809
Pigeon pea	70.799
Soyabean	63.500
Mustard	56.700
Mung/black gram/lentil/horsebean	72.580
Chick pea	68.050
Sesame	54.415

Source: Department of Mint, Weight Measures

	kg
Peanut	38.200
Potato/sweet potato	83.667
Ginger	54.533
Linseed	58.560
Cow pea	68.800
Coriander	25.760

Source: Measured on Farm

Note: 1 gun = 16 mani
1 mani = 16 sai
5 mani = 1 muri
40 rajiya = 1 muri

Source: Information from Farmers

WEIGHT CONVERSION

Unit	kg
1 Md = 40 seers = 8 paseri =	40
1 Quintal =	100

Source: Common usage

COMPOST

Unit	kg
1 Doka	25
1 Case	1,000
1 Tractor	3,000

Source: Field estimation

AREA CONVERSION

Nepali Unit	Hectare
1 Bigha = 20 Katha = 400 Dhurs	0.677276
1 Ropani = 16 Aana = 64 Paisa	0.0508735
1 Muri land	0.0127183

Source: Department of Mint, Weight Measures

CHAPTER 1 HISTORY AND BACKGROUND OF THE PROJECT

1.1 Authority

This Report is prepared in accordance with the "Scope of Work" for the Master Plan Study on the Integrated Rural Development Project in the Lumbini Zone (the Study) as agreed upon between His Majesty's Government of Nepal (HMG/N) through the Ministry of Panchayat and Local Development (MPLD) and the Japan International Cooperation Agency (JICA) on June 13, 1988.

This report deals with the results of the Study on the Master Plan for the Integrated Rural Development in the Lumbini Zone, and the results of the Pre-Feasibility Study on the development priority projects.

This master plan covers the 15 years period from 1990/91 to 2004/05 in consonance with the periodic National Plan of HMG/N.

1.2 History of the Project

HMG/N requested the United Nations Development Programme (UNDP) to carry out a project identification in the context of the Integrated Rural Development in the Lumbini Zone. The project identification mission was dispatched from May 13 to June 5, 1985 and followed by a Project Formulation Mission which was dispatched from November 25 to December 21, 1985 by UNDP.

Following the above, in February 1986, HMG/N requested the Government of Japan for the implementation of the Master Plan Study for the Integrated Rural Development Project in the Lumbini Zone (hereinafter referred to as the Study). In response to the request, the Government of Japan decided to implement the Study, sent a Contact Mission in May 1987, and a Preliminary Survey Team in June 1988, through JICA. The Preliminary Survey Team and HMG/N signed the Scope of Work with regard to the Study.

In accordance with the Scope of Work, JICA dispatched a study team on the Master Plan for the Integrated Rural Development Project in the Lumbini Zone (the Study Team).

The work of the Study was broadly divided into two phases, namely Phase I and Phase II. The work of Phase I was composed of field work in Nepal and home office work in Japan. The field work of Phase I was carried out from September 28, 1988 to January 6, 1989, and the home office work was conducted from January 7 to February 18, 1989. The Phase II work was also composed of field work in Nepal and home office work in Japan. The field work for Phase II began on August 18, 1989 and completed on October 1, 1989. The home office work was conducted successively to the field work and completed on November 15, 1989.

1.3 Background of the Project

1.3.1 Country and National Economy

(1) Land and Population

Nepal is located on the southern slopes and foot of the Himalayas between India and China, covers an area of about 147,000 km². It is about 885 km east to west and 145 to 241 km north to south. Nepal is bounded on the north by Tibet region of China, on the east by Sikkim and West Bengal of India and on the south and the west by Bihar and Uttar Pradesh of India. The country has a wide range of elevation and rough terrain. More than 25% of the land surface is about 3,000 m and then 20% is lower than 300 m. Nepal has three ecological zones running east-west: the Terai Plain, an extension of the Gangetic Plain of India; the Hills, actually the foothills of the Himalayas, ranging from 500 m to 4,000 m in elevation; and the Himalayan Mountains at the north. These three zones account for 17%, 68%, and 15% of the total area of about 147,000 km², respectively. It is constituted by 27% or 4.01 million ha of cultivated land, 38% or 5.61 million ha of forest and 12% or 1.70 million ha of pasture.

Rivers and streams, running north-south, cut the Hills into isolated areas and varying microclimatic conditions provide a range of environments for plant growth, depending on elevation, aspect, cloud cover, slope, etc.

Nepal's population in 1986 is estimated at 17.1 million, overall population density is about 119/km², with the highest concentration in the Terai region. The population growth rate has accelerated from 2.2% in the 1960s to 2.7% in the 1980s, according to census figures, and it is expected to reach 23.7 million by 2,000 and 33.0 million by 2,020. Life expectancy at birth rose from 42 years in 1971 to 46 years in 1981. Demographic distribution has changed steadily over the past 30 years as a result of the pressure of population on arable

land in the mountain/hill zones, and resettlement in the Terai, which was infested with malaria until the 1950s.

(2) National Economy

Table 1.3.1 shows the growth rate of GDP and population of Nepal between 1970/71 and 1984/85. This shows that the growth rate of GDP per capita has been minimal during this 15-year period. GDP per capita in 1985/86 was about Rs.2,916 (US\$159 at the exchange rate of US\$1 = Rs.18.33). This shows that a significantly higher rate of GDP growth has been achieved during the Sixth Plan period compared to the previous plan periods, although yearly fluctuations of the figure are seen, namely a substantial drop of GDP growth rate in 1982/83 due to drought.

The agricultural sector accounts for about 60% of GDP, 90% of employment and 75% of exports, thus this sector has primary importance for the Nepalese economy. The agricultural sector showed a lower growth rate than population, despite the high achievement of the Sixth Plan period, which means that a nationwide food shortage has been occurring. The foodgrain production growth rate was 1.89% per annum between 1970/71 and 1984/85, whereas the land area for foodgrain expanded 2.73% per annum during the same period. Thus production increase was mainly achieved by the extension of the cultivation area, meanwhile land productivity showed a decline over the same time. This implies that cultivation has been extended to marginal lands.

There are wide differences in the agricultural practices of the hill and Terai areas. In the hill area, people cultivate mainly upland crops such as wheat, maize, barley, etc., whereas the Terai area is dominated by paddy. The hill area has historically experienced food deficits and this situation is worsening due to the high population growth and limited land availability. Thus, substantial numbers of the population were forced to migrate down to the Terai area.

Agricultural activities have been carried out mainly at the subsistence level, especially in the hill area, using traditional tools and methods under rainfed condition. Less than 15% of the cultivated land in Nepal has irrigation facilities. Although the potential for increase production exists, a combination of disadvantageous conditions, such as lack of advanced technology, shortage of fund, inadequate participation of farmers, insufficient administrative support, etc., made it difficult to take place.

Livestock is also an important element of the agricultural system. It provides not only proteinful food such as meat and dairy products, but also manure for fertilizer or fuel, draught power, skins, etc. Nevertheless, its production has been decreasing over the time due to disease, poor breeding, and shortage of fodder due to deterioration of pasture and forest areas.

The industrial sector accounts for only 4.6% of GDP, 1% of employment in 1983/84. Industrial growth is limited by the small domestic market and lack of export market due to the landlocked condition. The existence of India, as a powerful supplier of industrial products, is also a serious disadvantage to the growth of infant industries in Nepal. Serious efforts to try to find out industrial areas which have comparative advantage is needed, as well as general infrastructural support to secure the formation of industries by the Government, such as water, energy, transportation, etc.

1.3.2 National Development Plan

(1) Main Principles of National Development Plan

Nepal has had the 5-year development plans since 1956/57, 5 years after its restoration, and has continued to adopt the system for more than three decades. At present, it is in the last year of the Seventh Plan in 1989, and the Eighth Plan is under preparation.

Throughout the past 5-year plans, especially from the Fourth Plan onward, some recurrent themes are observed. These are: increasing agricultural production, development of cottage industries and increasing industrial productivity, strengthening the Government in planning and implementation, and the provision of social services. Meanwhile, some shift of emphasis is found. The Fourth Plan, and previous Plans also, put the priority on building the necessary infrastructure for economic development. In the Fifth Plan, productive sectors were emphasized together with infrastructure building. Social services also started to receive attention. Regional development concept started to emerge in the Plan. In the Sixth Plan, productive sectors and social services continued to receive high priority, while strong emphasis was put on rural development programs to meet the people's basic needs.

The Seventh National Development Plan, which covers the period from July 1985 to July 1990, has three major objectives:

- 1) to increase production at a higher rate;
- 2) to increase opportunities for productive employment; and

- 3) to fulfil the minimum basic needs of the people.

The basic needs of the people include:

- i) foodgrains,
- ii) clothing,
- iii) fuelwood,
- iv) drinking water,
- v) primary health care and sanitation,
- vi) primary and skill oriented education, and
- vii) minimum rural transport facilities.

The Seventh Plan adopts two principles in order to achieve the above objectives.

Those are:

- 1) to help fully utilize the infrastructures already created and to concentrate investment on programs of a kind that are likely to boost production within a short span of time, and
- 2) to strengthen the foundation of the economy and to increase the level of investment.

Along with the above fundamental investment policy, the following basic development strategies are defined:

- 1) to put overall priority on development of agricultural sector,
- 2) to put stress on forest resources and soil conservation,
- 3) to put emphasis on development of water resources,
- 4) to put emphasis on development of industries,
- 5) to put emphasis on promotion of export trade,
- 6) to put emphasis on tourism development,
- 7) to curb population growth rate,
- 8) to consolidate national economic integration (balanced regional growth and the economic integration of remote areas),
- 9) to decentralize financial management and to invest the economy with greater capability and competence (decentralization and people's participation), and

- 10) to strengthen and consolidate development administration.

In order to achieve effective implementation of the Seventh Plan importance is attached to on building up an environment which will allow the efficient mobilization of internal resources, and on creating conditions to motivate government employees to dedicate themselves to the service of nation building.

- (2) Decentralization Policy

- 1) Panchayat System

The panchayat system was introduced in Nepal together with the new Constitution in 1962. It is a partyless political democratic system, which has constitutes a three-tier structure, i.e. village-town panchayats, district panchayats, and Rashtriya Panchayat. A village usually consists of 9 wards, each of which more or less corresponds to a natural community, containing several hundreds of population. A district consists of 9 areas (illakas) each of which includes several village Panchayats, and a zone consists of 4 - 8 districts. There are 4,023 village panchayats and 29 town panchayats forming 75 districts, 14 zones, and 5 development regions in 1987.

One of the main policies for reinforcing the panchayat system is to encourage decentralization of planning and administrative power and responsibility through the people's participation. In the Sixth Plan, plan formulation mechanism from the bottom up was further expanded and project ideas were collected from village and town panchayat in order to formulate district development plans which were finally integrated into the National Plan.

Integrated rural development (IRD) programmes have been launched in collaboration with various donors since the early 1970s. These were mainly oriented towards eradicating rural poverty. Nevertheless, according to various evaluations, the investment in these projects has not been geared in that direction.

- 2) New Direction of Decentralization

A new dimension has been added for local development planning with the Decentralization Act (1982) and the its bylaws(1984), which provided the firm

basic principles for formulating district level plans. The main conditions for decentralized development process are stated as follows:

- (i) It is essential to enhance the capacity of local units for effective plan formulation, implementation, and evaluation.
- (ii) Power and responsibilities have to be decentralized even within the governmental organizations.
- (iii) Financial, policy-related, technical and other necessary support will be provided from the central level.

This method was practiced in the formulation of the Seventh Plan and achieved advancement in popularizing the decentralization process. Nevertheless, the result seemed to be still away from the desirable situation, mainly due to the lack of local people's experience and technical skills in planning and preparation of development projects.

Thus, during the Eighth Plan formulation process, it is expected to let local people understand more the policy and means of decentralization, meanwhile district level administrative reform, such as strengthening the service centers function at illaka level, is recommended.

1.3.3 Integrated Rural Development

(1) Integrated Rural Development Projects

The integrated rural development approach was emerged to accelerate the pace of development by "coordinate and integrate programs by different agencies of the government designed to solve the inter-related problems confronting the rural populace".

Integrated rural development projects (IRDPs) were started in the early 1970s, but were intentionally incorporated in the national plan during the Sixth Plan (1980-85). Nine IRDP projects, excluding Lumbini IRDP, are now under implementation through the joint efforts of HMG and different donor organizations. There are wide varieties among these projects in their subject coverage, strategies, priorities, organization and operational systems.

(2) Lumbini IRDP

In 1985, the Guidelines and Directives on the development of the Western Region were issued by His Majesty the King, which stressed the need to undertake development activities to fulfill the basic needs of the people and in such areas as transportation, irrigation, food production, etc.

The average per capita income of the Lumbini Zone is substantially lower than the national average both in the Hill and Terai areas. Meanwhile, the necessary basic physical infrastructures, such as road, irrigation, electricity, and the social infrastructure such as education, health, etc. are at a low level. Thus, there is a need to accelerate development activities in the Lumbini Zone with a target to bring the level of living to that of the national average.

According to the study result and the preliminary discussions with HMG agencies concerned, priorities should be given to the following sectors in order to achieve the dual objectives of promoting the region's agricultural production and improving the living environment of the rural area:

- 1) Irrigation development,
- 2) Road improvement,
- 3) Promotion of agricultural production, and
- 4) Rural water supply provision

In addition to the above, stress should be put on the importance of the women's status in the rural socio-economic sector.

The key considerations in planning and formulating IRDP in the Lumbini Zone are provided from the past IRDP experience in the other parts of Nepal. They are as follows:

- 1) Planning and project formulation must be based on local people's development priorities, and the details of projects should be determined with the participation of local people.
- 2) Projects should consist of inputs in a balanced manner, such as capital assistance accompanied by proper technical assistance, equipment, with experts and training, appropriate local institutions with proper staffing.

- 3) Assistance should be directed particularly towards strengthening local capabilities and institutions to sustain rural development implementation.
- 4) Emphasis should be placed on utilizing existing organizations by strengthening them as necessary.

CHAPTER 2 . PROJECT AREA AND ITS PROBLEM

2.1 Location

The project area consists of Gulmi, Arghakhanchi, Kapilvastu districts and Marchawar area of Rupandehi district of the Lumbini Zone in the Western Development Region.

Kapilvastu and Marchawar area of the Rupandehi districts extend over the Terai area with low altitudes between 100 m to 150 m above the mean sea level. These two districts are border with India in the south. Marchawar area is isolated near the Indian border.

The total project area is about 4,200 km² consisting of 55% of hill area and 45% of Terai area as detailed below:

District	Area	Proportional Extent
Hill	Gulmi	1,079 km ² (25.6%)
	Arghakhanchi	1,233 km ² (29.3%)
	Sub-total	2,312 km ² (54.9%)
Terai	Kapilvastu	1,757 km ² (41.7%)
	Rupandehi (Marchawar)	144 km ² (3.4%)
	Sub-total	1,901 km ² (45.1%)
Total	4,213 km ²	(100.0%)

In the project area, there are 221 village panchayats and 1 town panchayat as shown below.

District	Village	Town	Total
Gulmi	79	-	79
Arghakhanchi	41	-	41
Kapilvastu	78	1	79
Rupandehi (Marchawar)	23	-	23
Total in the project area	221	1	222

The nearest urban center for the project area is Bhairahawa (Rupandehi district), and the distance from Bhairahawa to Kathmandu and Pokhara (regional center) are about

300 km and 180 km respectively. The schematic road network for the area and the urban centers is shown on Fig. 2.1.1.

2.2 Natural Conditions

2.2.1 Topography and Geology

Nepal shares common frontiers with China in the north and India in the south, east and west. The Himalayas forms the northern fringe and the Terai forms the southern fringe of the country. The Terai is the Gangetic Plain within Nepal.

Physiographically, Nepal can be classified arbitrarily into the following subdivisions, stretching parallel to the Himalayas from the eastern to the western corner of the country.

South to North	Width (km)	Elevation (m)
		Maximum, in the order of
Terai	Average 30 (30 - 50)	130
Siwalik	Average 20 (20 - 30)	1,200
Middle Mountains	Average 50 (40 - 60)	3,000
High Mountains	Average 30 (50 - 30)	4,800
High Himal	Average 40 (10 - 90)	8,000

Of the project area, Gulmi and Arghakhanchi districts belong to the Siwalik-Middle Mountains, and Kapilvastu and Rupandehi (Marchawar) districts belong to the Terai. The former two is called as the hill area, and the latter two as the Terai area in this report.

The hill area shows a mountainous topographic condition characterized by high altitude and steep slopes. On the other hand, the Terai area is a flat alluvial plain with low altitude. The hill area (the Siwaliks foothills) rises abruptly from the Terai plain, therefore the boundary of the hill area and the Terai area is very clear.

The Middle Mountains mainly consist of sedimentary rocks older than Tertiary. The Siwaliks comprise the Siwalik formations which is molasse derived from the rising Himalayas and consist of sedimentary rocks of Miocene to Pleistocene age. The Siwalik formations form a basement of the Terai area. The Terai area is an alluvial plain which is

composed of debris flow deposits (alluvial deposits) carried by river water running from the Siwaliks.

2.2.2 Land Resources

(1) Land Use

On the basis of the Land Resource Mapping Project (LRMP) conducted in 1980 to 1985, the present land use is estimated as follows;

(Unit : ha)

District	Net cultivated land	Grazing land	Forestry land	Other ^{/1} land	Total land
Hill area	45,600 (20%)	21,800 (9%)	113,900 (49%)	49,900 (22%)	231,200 (100%)
Terai area ^{/2}	97,500 (51%)	900 (1%)	77,800 (41%)	13,900 (7%)	190,100 (100%)
Project area	143,100 (34%)	22,700 (5%)	191,700 (46%)	63,800 (15%)	421,300 (100%)

^{/1} : Other land includes small segment of noncultivated land, bare land, ponds, urban area, land slides, etc.

^{/2} : Rupandehi district includes only Marchawar area.

The net cultivated area in the Terai area accounts for 51% of the total land, and most of the cultivated land is paddy field. The cultivated land in the hill area is 20%, mainly consisting of upland field. Accordingly, the net cultivated area is 34% of the project area. The details of land use in the project area is provided on Table 2.2.1, and the land use map in the four districts is shown in Fig. 2.2.1.

(2) Land Capability

According to LRMP, the land is classified into seven classes in terms of land capability. Classes I and II are suitable for agricultural use. Class III is marginal land for cropping because of steeper slopes (5° - 30°), and the unit yields of the crops planted in this class is considered to be lower than those in the Classes I and II. Classes IV to VII are not suitable owing to steep slopes and shallow soil depth.

In addition to the land capability classification, LRMP conducted the suitability classification for irrigation on class-I and -II lands. The I/1, I/2 and II/2 classes are suitable to moderately suitable for upland crops, the I/1R and II/2R classes suitable to moderately

suitable for paddy and the I/5 and II/5 classes are not suitable for irrigated farming because of inundation or flood risk in the rainy season.

The area and proportional extent of each land capability class are shown in Table 2.2.2, and the land capability map is illustrated in Fig. 2.2.2.

About 138,700 ha or 33% of the project area belong to the classes suitable to moderately suitable for crop production (classes I/1, I/2, II/2, I/1R, I/2R), but 93% of these classes extend over the Terai area. A summary of the land capability of the project area is given below.

(Unit : ha)

District	Suitable (I/1, I/2, II/2, I/1R, I/2R)	Marginal (III)	Not Suitable (I/5, II/5, IV, V, VI, others)	Total
Hill area	9,800 (4%)	73,200 (32%)	148,200 (64%)	231,200 (100%)
Terai area ¹	128,900 (68%)	1,700 (1%)	59,300 (31%)	190,100 (100%)
Project area	138,700 (33%)	74,900 (18%)	207,700 (49%)	421,300 (100%)

¹ : Rupandehi district includes only Marchawar area.

Compared with the land use and the land capability, the following facts are found on the land resources.

1) Hill Area

Although about 45,600 ha are cultivated, only about 9,800 ha are suitable for crop production and the remaining 35,800 ha are considered to be cultivated in marginal land. It is estimated that the forest reserves and 21,800 ha of grazing land extend over the marginal land, and there is no area available for cultivation expansion.

2) Terai Area

Land classes I, II and III occupy 130,600 ha and the net cultivated area is 97,500 ha, and the remaining 33,100 ha seems to be cultivated. However, the forest reserves extend widely in the suitable and marginal lands, and these

reserves are legally prohibited to be used for cultivation. This indicates that there is no more lands to expand the cultivation area.

2.2.3 Meteorology, Hydrology and Surface Water Resources

(1) Meteorology

The project area of the Lumbini Integrated Rural Development Project (IRDP) is comprised of four administrative districts i.e. Gulmi, Arghakhanchi, Kapilvastu and Marchawar area in Rupandehi district. The area lies between 27°20' to 27°55' north latitude and 82°42' to 83°25' east longitude. The climate of the project area as well as Nepal is strongly affected by the southeast monsoon during the rainy season and the northwest monsoon during the dry season. These monsoons distinctly divide the climate into two seasons. The rainy season generally lasts from June to September, while the dry season is from November to April. May and October are transition period of these seasons. In general, it is humid and hot in the rainy season or summer, while it is dry and cool in the dry season or winter. More than 90% of annual rainfall occurs in the rainy season. This is due to the influence of the said southeast monsoon.

In terms of altitude, the climate in Nepal is generally divided into five climatic zones, i.e. Arctic, Alpine, Cool Temperature, Warm Temperature and Sub-tropical. The altitude in Gulmi and Arghakhanchi districts, so called hill area, varies from about 600 m to more than 2,000 m. The climate in the two districts is classified into Warm Temperature and Cool Temperature. Those in Kapilvastu and Rupandehi districts, so called Terai area, is from 90 m to 150 m. Climate in these districts is classified into Sub-tropical. From November to February, the weather is cool with a mean temperature of 15°C; March to October is the warm or hot season, having a mean temperature of 28°C as shown in the following table. The annual rainfall is recorded from 1,600 mm to 2,000 mm.

According to the "Climatological Records of Nepal", there are 11 major meteorological stations in the project area. Out of these temperature, relative humidity, rainfall, etc. are observed at the following six stations:

List of Meteorological Stations

Name of Station	District	Altitude (m)	Mean Temperature (°C)	Mean Humidity (%)	Rainfall (mm)
703 Butwal	Rupandehi	205	25.1	66	2,194
705 Bhairahawa Airport	Rupandehi	110	24.8	67	1,732
707 Bhairahawa (Agri)	Rupandehi	120	24.5	75	1,793
715 Khanchikot	Arghakhanchi	1,760	15.9	74	2,042
716 Taulihawa	Kapilvastu	94	24.6	71	1,613
725 Tamghas	Gulmi	1,530	17.1	80	1,978

At the remained four stations, only rainfall is observed:

List of Rain Gauges

Name of Station	District	Altitude (m)	Rainfall (mm)
701 Ridi Bazar	Gulmi	442	1,527
721 Patharkot West	Kapilvastu	1,200	2,240
722 Musikot	Gulmi	1,280	2,120
723 Bhagwanpur	Kapilvastu	80	1,786
727 Lumbini	Rupandehi	95	1,938

The meteorological data at each stations are summarized in Table 2.2.3

(2) Hydrology

Nepal is a landlocked country. Rivers generally originate in and around the hill ranges and flow out India through Terai Plain. Rivers generally flow in north-south direction in the Terai plain.

The rivers and streams were identified in the water use inventory study of Gulmi, Arghakhanchi, Kapilvastu and Rupandehi districts conducted by the Water and Energy Commission in 1987/88, 1988/89, 1986/87 and 1984/85 respectively. According to the said study, 69, 77, 55 and 29 rivers were identified in the respective districts. In the same study, the mean monthly flows of major rivers and streams were analyzed in the form of predicted hydrograph as shown in Table 2.2.4.

The large ones are: the Kali Gandaki, the Badi Gad and Ridi Khola in Gulmi, the Rapti and Jhimruk in Arghakhanchi, the Banganga and the Kothi in Kapilvastu, and the Tinau and Dano in Rupandehi. Of these, the Badi Gad and Ridi Khola are tributaries of the Kali Gandaki which forms the eastern boundary of Gulmi. The Jhimruk is a tributary of the Rapti which forms the western boundary of the Gulmi and Arghakhanchi. After joining with the Badi Gad and Ridi Khola, the Kali Gandaki flows out from the Gulmi district to the east and never flows into the project area again. The Rapti river does not flow into the project area after joining with the Jhimruk.

(3) Surface Water Resources

Conceivable water resources in the hill area i.e. Gulmi and Arghakhanchi districts are: a) river and stream flow particularly in the rainy season; and b) springs most of which are perennial but have small flow, and those in the plain of Terai area i.e. Kapilvastu and Rupandehi districts are: c) river and stream flow particularly in the rainy season; d) groundwater to be tapped from dug wells and tubewells; and e) water in the reservoirs and ponds to be filled in the rainy season.

Most of the rivers in the project area have small catchments and very small flow even in the rainy season and nearly dry up in the dry season. The rivers which have comparatively large flows are limited to the following:

Gulmi district	:	Kali Gandaki, Badi Gad, Chhaldi Khola, Ridi Khola
Arghakhanchi district	:	Rapti, Jhimruk, Sisne
Kapilvastu district	:	Banganga, Murthi, Kothi, Arra Nala
Rupandehi district	:	Tinau, Dano

The above rivers and other major rivers have already been utilized as water sources for irrigation particularly in the rainy season, except the Kali Gandaki, the Ridi Khola, and the Rapti rivers. Because these three rivers are very large and form deep gorges in the project area, several comprehensive water resources development plans must be studied in the first place and considerably large amount of investment will be required for their implementation.

In general, as mentioned in the following sections, water utilization is not yet systematically organized in the project area in spite of limited resources. In this project, development of surface water resources has to be mainly in re-development of existing water

resources rather than new water resources development in the Terai area and utilization of rivulets and springs in the hill area.

2.2.4 Hydrogeology (Groundwater)

(1) General

The Terai is the northernmost part of the Gangetic Plain within Nepal. Most of Terai forms the narrow and southern fringe of the country from 20 to 45 km wide, and shows a gentle depositional slope of alluvium which consists of clastics derived from the Himalayas. The Terai amounting to about 1,900 km² in the project area is included in the Lumbini Zone of the Western Terai from the hydrogeological viewpoint. The Terai area is an alluvial plain which is bordered by Siwalik ranges (Siwalkis) to the north and by India to the south. The elevation ranges from 90 to 130 m, however it is almost flat in general though the tail areas of the Siwaliks have moderate slope.

The Siwaliks are formed by mountains of about 1,000 m high running east to west. They comprise the Siwalik formations (Si) which is the molasse derived from the Himalayas and consists of sedimentary rocks of Miocene to Pleistocene age. The Siwalik formations form a basement of the alluvial deposits in the Terai area. The Terai area is composed of debris flow deposits (alluvial deposits) which were carried by river water running from the Siwaliks. Groundwater in the Terai area is recharged mainly by the river water.

(2) Groundwater Development Area

There are two main perennial rivers, namely the Banganga and the Tinau, in the groundwater development area, i.e., Kapilvastu District and Marchawar Area of Rupandehi District in the project area. Those two rivers, however, have their origins in the mid-Siwaliks or Middle Mountains and they are categorized in minor rivers in Nepal comparing with other major rivers which have their origins in the High Mountains or High Himal and run across the Terai. Other small rivers in the groundwater development area have their origins on the southern slope, facing to the Terai area, of the Siwaliks and are almost dry up in the dry seasons.

The alluvial deposits in the Terai area are divided into two, namely the older alluvial deposits (Oa) and the young ones (Ya) as seen in Fig. 2.2.3. The former's distribution area forms the upland which nearly corresponds to the forest area. The latter is

formed by erosion of the former, and is being deposited on it. The large part of the latter's distribution area corresponds to the flood area seen in the monsoon season. The latter forms fans typically at the entrance point where the Banganga and the Tinau flow into the Terai area from the Siwaliks.

The above-said alluvial deposits consist of a large amount of coarse-grained materials such as boulders, cobbles and pebbles forming good aquifers in the north, and fine materials such as sand, silt and clay in the south. However, each bed of the alluvial deposits in the Terai area is thin, its continuity is poor and its geological log is extremely variable. According to the existing data, the beds of coarse-grained materials which form good aquifers in this Terai area are especially thin and poor in continuity compared with those in other Terai areas. It is probably because that there is no large rivers in this Terai area.

(3) Unconfined Aquifer and Confined Aquifer

The unconfined aquifers is distributed throughout the Terai area. As for the limits of the aquifer, it is presumed to be up to 30 m below the ground surface. The aquifer consists of alternating beds of clay, silt, fine sand and thin stringers of gravel. Generally, permeability of the aquifer is low. The unconfined aquifer has been tapped by many dugwells to supply water for domestic use and the irrigation of vegetable gardens.

The confined aquifer is widely known in the Terai. The depth of the aquifer is presumed to be 40 m and more below the ground surface. On the other hand, in the layers below 200 m, suitable aquifers seem to be little. The major artesian aquifers exist in the layers 40 - 60 m deep and 150 - 160 m deep. The former is dominant in the northern highland, and the latter in the southern lowland. The aquifer consists of coarse sand and gravel beds intercalated by thick layers.

(4) Water Quality

According to the results of unconfined water quality analysis, the values of pH show that water is slightly alkaline, and the higher values of total hardness and total ammonia indicate that water is moderately hard and is polluted slightly. Furthermore, the values of total solids are higher. On the other hand, as for confined water quality, the values of pH and the higher values of total hardness indicate that water is slightly-moderately alkaline and moderately hard.

Although water quality both of unconfined and confined water is not excellent, the latter will be favorable for water source, because it is difficult to be polluted and will supply stable quantity.

(5) Expected Quantity of Groundwater

To study the possibility of groundwater exploitation in the area, the following data were mainly utilized:

- 1) Data of wells installed by HMG/N for Kapilvastu Tubewell Project.
- 2) Data of wells installed by JICA, February 1989.

In this course, three kind of potential areas of High Potential Area, Moderate Potential Area and Low Potential Area were selected as shown in Fig. 2.2.3 and studied in detail. Definition of "potential area" and "well" is as follows:

Definition of Potential Area

- High potential area: Transmissivity is in the range of 10^{-2} m²/sec
- Moderate potential area: Transmissivity is in the range of 10^{-3} m²/sec
- Low potential area: Transmissivity is in the range of 10^{-4} m²/sec

Definition of Well

- Deep tubewell: 70 - 200 m in depth.
Studies were conducted at 200 m in depth and eight inches in diameter.
According to the existing data, in the layers below 200 m suitable aquifers seem to be little.
- Shallow tubewell: 30 - 70 m in depth.
Studies were conducted at 70 m in depth and eight inches in diameter.
- Hand pump well: Up to 30 m in depth.
Studies were conducted at 30 m in depth and four inches in diameter.

Pumping hours, drawdown and radius of influence were calculated using 'Theis' formula in each case of the defined wells in each defined potential area. The results of the

study are shown in Tables 2.2.5 and 2.2.6. It is expected that water of 40 - 50 lit/sec will be obtainable from one deep well by pumping-up, in the High/Moderate Potential Areas.

2.3 Socio-economy

2.3.1 Population

According to estimation by the National Population Committee, the total population of the four districts in 1987 was 1,203,800 which represented about 7% of the whole country. The population of 53% of male and 47% of female as shown in Table 2.3.1. The population and related indicators in each district are shown below:

		Population		Annual growth rate 1981-87 (%)	Population density 1987 (persons/km ²)
		1981/1 (persons)	1987/2 (persons)		
<u>Hill area</u>	Gulmi	238,100	250,600	0.9	218
	Arghakhanchi	157,300	171,000	1.4	144
	Total	395,400	421,600	1.1	180
<u>Terai area</u>	Kapilvastu	270,000	309,900	2.3	177
	Rupandehi	379,100	472,300	3.7	348
	(Marchawar)	(69,390)	(86,300) ³	(3.7)	(599)
	Total	649,100	782,200	3.2	252
<u>Grand Total</u>	4 districts	1,044,500	1,203,800	2.4	221
	Project Area	734,790	817,800	1.9	194

Source: 1 : National Population Census, 1981.

2 : Estimation by National Population Committee.

3 : Estimated by applying the growth rate.

The above table shows that the annual population growth rate in the Terai area is much higher than that in the hill area. This indicates that people in the hill area have migrated to the Terai area.

The population in years 1995, 2000 and 2005 is projected by applying high, medium and low population growth rates as follows:

(Unit: 1,000 persons)

District	Assumption ^{/1}	Growth Rate ^{/2} (%)	Year		
			1995	2000	2005
Gulmi	Low	0.6	258.1	261.2	264.7
	Medium	0.9	266.0	275.0	284.1
	High	1.9	291.8	321.3	353.7
Arghakhanchi	Low	0.9	179.2	182.7	186.2
	Medium	1.4	187.6	197.4	207.7
	High	2.9	215.7	249.7	288.9
Kapilvastu	Low	1.4	337.3	352.1	367.5
	Medium	2.3	364.0	399.3	438.0
	High	2.7	384.1	439.6	503.0
Rupandehi	Low	2.2	539.2	576.7	616.7
	Medium	3.7	610.7	708.3	821.4
	High	4.3	663.1	820.5	1,015.3
Total	Low	-	1,313.8	1,372.7	1,435.1
	Medium	-	1,428.3	1,580.0	1,751.2
	High	-	1,554.7	1,831.1	2,160.9

^{/1} Low, High : Estimation from "Population Projection of Nepal", CBS, 1986.
Medium : Annual growth rate during 1981-87 (CBS).

^{/2} Applied for 1987 - 1990. Annual population growth rates are changed after 1991.
Refer to ANNEX A.

The medium assumption shows that the total population of the 4 districts will increase to approximately 1,580,000 in 2000 and 1,751,200 in 2005, which will be 1.3 times and 1.5 times of the population in 1987, respectively. As for high and low assumption, the total population in 2005 are projected to be about 1.8 times and 1.2 times of the population in 1987, respectively.

2.3.2 Households

The number of household and farm household in each district is as follows.

Item	(Unit: Nos.)					
	Gulmi	Arghakhanchi	Kapilvastu	Rupandehi	(Marchawar)	Total
Household	42,050	27,540	46,420	61,240	(11,176)	177,250
Farm Household	33,866	21,747	39,535	53,444	(9,757) ^{/1}	148,592
(%)	(80.5)	(79.0)	(85.2)	(87.3)	(87.3) ^{/1}	(83.8)

Source: National Population Census, 1981,
National Sample Census of Agriculture (1981/82).

^{/1}: Estimated by applying the same percentage of Rupandehi.

Out of the total households, farm household account for 83.8% in the four districts, while in the project area, There are estimated at about 92% according to the results of the rural socio-economic survey over the sample panchayats conducted in this study.

The average family size in the project area is estimated to be 6 persons based on the Population Census in 1981, whereas that in 1987 was estimated to be 7 persons from the socio-economic survey. The number of households in one panchayat ranged from 400 to 2,600, and averages 900.

2.3.3 Migration

Migration from the hill area to the Terai is a common phenomenon in Nepal. The main causes of the migration are fewer working opportunities and scarcity of food in the hill area. In the project area, many families have migrated from Gulmi and Arghakhanchi districts to Kapilvastu and Rupandehi districts. About 5% of the native-born population in the hill districts has emigrated, and about 10% of population in the Terai districts has immigrated from hill or mountain area.

A part from migration, most families in the hill area send at least one member to other districts during the off-farm season, in order to look for a job and then make remittances to their family. Families living near Indian borders also send one or two of their members to India during off-farm season. On the other hand, a number of Indian people come to the Terai area for seasonal work or permanent settlement.

According to Study's rural socio-economic survey of the sample panchayats, about 4.2% of the total households has immigrated to the sample panchayats in Kapilvastu during the last 5 years. In the hill area, Gulmi and Arghakhanchi district, households have decreased by 2.7% and 0.9%, respectively during the same period, although some panchayats in the districts show some increase.

2.3.4 Ethnic Groups

In the project area, there are many ethnic groups with different cultures, languages and religions. The prevailing ethnic groups in the hill area are Brahmin and Chhetri (high-class in cast), and those in the Terai are Taru (agricultural cast in the Terai), Kami, Chamer, etc. (job cast). Muslims constitute 14% and 13% of the total population in the Kapilvastu and Rupandehi districts respectively.

(Unit: %)

District	Group A	Group B	Group C	Group D	Group E
Gulmi	87	3	15	18	-
Arghakhanchi	48	5	18	25	4
Kapilvastu	17	31	9	29	14
Rupandehi (Marchawar)	5	26	-	56	13

Source : Rural Socio-economic Survey on IRDP in Lumbini Zone, 1988

Note : Group A - Brahmin, Chhetri, Thakur, Rajput,
 Group B - Newar, Kayastha, Gupta, Das, Yadav, Tharu, Chaudhari,
 Group C - Gurung, Magar, Rai, Limbu, Tamang, Lama,
 Group D - Kami, Kahar, Chamar, Mallah, Rajbhar, Dussad,
 Group E - Muslim.

2.3.5 Land Tenure Structure

The average farm size per farm household is estimated at 0.78 ha in the hill area and 1.52 ha in the Terai as shown below:

	Cultivated Area (ha)	Estimated Population in 1989	No. of Total ¹ Households (Nos.)	No. of Farm ² Households (Nos.)	Average Farm Size per Household (ha)
Hill area	45,600	431,000	61,570	58,490	0.78
Terai area ³	171,900	832,200	118,890	112,950	1.52

¹ : Average family size is 7.0 persons/household.² : Farm households are estimated at 95%³ : Kapilvastu and Rupandehi district.

Farm sizes in the hill area is about half those in the Terai due to the limited cultivable land. Tables 2.3.2 show distribution of the land holding size in the four districts. It shows that more than 90% of the total farm households in the hill area have less than 1.0 ha, and they occupy about 75% of the land. This indicates that the majority of the farmers in the hill area are small farmers. By contrast in the Terai area, about 70% of the farm households own less than 2.0 ha of land are, but there are about 30% of middle and large farmers who occupy about 75% and 58% of the total farm lands in Kapilvatsu and Rupandehi districts, respectively.

Land ownership in the project area is shown in Table 2.3.3. The rural socio-economic survey shows that most farmers in the hill area are owner operators whereas about 12% of farm land are cultivated by tenants.

2.3.6 Employment

The following table shows the distribution of the economically active population (EAP) in the project area in comparison with the national average and Lumbini Zone average in 1981. According to this table, Gulmi, Arghakhanchi, and Kapilvastu show much higher percentage of Agriculture, Forestry and Fishery employment than the national average. Meanwhile, Rupandehi's primary sector figure was far lower than the average, and accordingly, manufacturing and services sector figures were notably high. Thus, the project area of Lumbini IRDP is confirmed to be predominantly primary sector in terms of employment.

Major Industry Group of EAP by District

	National level	Lumbini zone	Gulmi	Argha-khanchi	Kapil-vastu	Rupandehi
Agriculture, Forestry Forestry & Fishery	91.1	93.0	95.7	96.4	95.0	85.5
Mining & Manufacturing	0.5	0.3	0.1	0.2	0.1	0.9
Services	6.5	4.7	2.4	2.1	2.7	11.8
N.A.	1.9	2.0	1.7	1.3	2.2	1.7
Total Economically Active Population	100	100	100	100	100	100

(Unit: %)

Source: Population Census (1981)

Employment distribution by occupation shows a similar situation in the project area. Much higher figures were seen in farm/fishery occupation in the area except for Rupandehi District. Instead, Rupandehi showed higher percentage figures in sales and production/labour occupations.

It is also notable that Gulmi and Rupandehi show higher distribution in professional/technical occupation than the average.

Major Occupation Group of EAP by District

(Unit: %)

	National level	Lumbini zone	Gulmi	Argha-khanchi	Kapil-vastu	Rupandehi
Professional/Technical	0.9	0.9	1.3	0.9	0.4	1.0
Administrative	0.1	0.1	-	-	-	0.2
Clerical	0.7	0.4	0.3	0.2	0.1	1.3
Sales	1.2	1.1	0.5	0.3	0.6	3.2
Service	0.2	0.2	0.21	0.1	0.1	0.7
Farm/Fishery	91.4	93.1	95.7	96.0	95.0	85.7
Production/Labour	3.1	2.5	0.5	.8	2.7	5.0
N.A.	2.3	1.7	1.5	1.0	1.1	2.9
Total	100	100	100	100	100	100

Source: Population Census (1981)

The following table shows one remarkable employment characteristics of the project area. It clearly shows that hill districts are sending out a significantly higher percentage of working male population to foreign countries as service men. In other words, those districts are highly dependent upon remittance from abroad for their income.

Absent Population

(Unit: %)

	National level	Lumbini zone	Gulmi	Argha khanchi	Kapil-vastu	Rupandehi
Absent Pop./EAP+Absent Pop.	5.5	10.1	23.4	21.8	1.1	3.3
Service Pop./EAP+Absent Pop.	3.6	7.3	16.8	17.0	0.6	2.0
15 ~ 44 yr Service Pop./ Same age EAP+Absent Pop.	7.0	13.8	34.0	28.9	1.3	3.0

Source: Population Census (1981)

2.3.7 Living Standard of People in the Project Area

The indicators for living standards of people in the project area are given in Table 2.3.4. Living activities of the people are strongly tied to agricultural activities in the area.

In the hill area, the cultivated area per farm household is especially small and, it is impossible to maintain family living allowances only by agricultural production and significantly many workers are sent to find jobs abroad and in the Terai for gaining remittance for their families at home.

In the project area, high population pressure has caused inappropriate agricultural activities such as crop cultivation on un-suitable land, badly managed grazing for livestock,

and increased fuelwood demand. These phenomena have been causing degradation of the ecosystem such as deforestation and soil erosion, thus resulting in shortage of fuelwood for daily life, shortage and contamination of drinking water resources, etc.

Under the above circumstances, the living standards of the people are very low due to their low income levels together with poor ideas of health and sanitation. The main examples are as follow:

- Shortage of food (especially in the hill area), and unbalanced nutrition (shortage of animal protein),
- Unhygienic housing and daily life facilities such as toilets, drinking water, sewerage, smoky kitchen range, etc.
- Poor and dangerous road conditions, rivers without bridges, and lack of main roads in most area to provide all year round vehicle transportation. Especially in the hill area this causes shortage of basic needs of the people such as food, kerosene for light, salt, social services, medical care, etc.
- Poor opportunities for getting education especially for women in the Terai area, and shortage of school teachers especially for sciences,
- Poor hygienic ideas and shortage of training for sanitation mainly due to shortage and low level knowledge of health workers and health posts.

2.4 Agriculture

2.4.1 Agricultural Land Use

As mentioned in section 2.2.2, the cultivated area has been expanded upto the maximum limit of the land resource in both Terai and hill areas. Furthermore, forests in the hill area have been shrinking and deteriorating due to shifting cultivation, collection of firewood and overgrazing obey cattle. Agricultural land use in the project area may be summarized as follows;

(unit : ha)

Area	Paddy field			Upland field	Grazing Land	Total
	Irrigated	Rainfed	Subtotal			
Hill area ¹	4,100 (6%)	4,000 (6%)	8,100 (12%)	37,500 (56%)	21,800 (32%)	67,400 (100%)
Terai area ²	25,400 (26%)	61,000 (62%)	86,400 (88%)	11,100 (11%)	900 (10%)	98,400 (100%)
Project area Total	29,500 (18%)	65,000 (39%)	94,500 (57%)	48,600 (29%)	22,700 (14%)	165,800 (100%)

¹ : Gulmi and Arghakhanchi districts.

² : Kapilvastu district and Marchawar area.

Upland fields are cultivated under rainfed conditions. Irrigation is practiced mainly in parts of the paddy field, and more than a half of the paddy field area is under rainfed condition. Accordingly, about 80% of the cultivated land in the project area is cultivated under rainfed conditions.

2.4.2 Cropped Area

Cultivated areas fluctuate from year to year depending on climatic condition, preference of farmers and commodity prices. Therefore, the present cropped areas are estimated on the basis of the above agricultural land use and statistics, as shown below.

(Unit : ton)

Hill area	Paddy field		Upland field	Total
	Irrigated	Rainfed		
Cereals				
Paddy	4,900	4,000	-	8,900
Wheat	4,100	2,830	-	6,930
Maize	-	-	34,990	34,990
Millet	-	-	4,960	4,960
Other cereals	-	-	690	690
Other crops				
Pulses	-	-	2,440	2,440
Sweet potatoes	-	-	1,890	1,890
Oil seeds	-	-	700	700
Orchard ¹	-	-	620	620
Others ²	120	-	130	250
Total	9,120	6,830	46,420	62,370
Cultivated area	4,100	4,000	37,500	45,600
Cropping intensity	224%	171%	124%	137%

¹ : Orchard is mainly citrus, coffee and tropical and temperate fruits.

² : Others include vegetables and spicy crops.

Terai area				(Unit : ton)
Crops	Paddy field		Upland field	Total
	Irrigated	Rainfed		
Cereals				
Paddy	25,400	61,000	-	86,400
Wheat	24,580	-	-	24,580
Maize	-	-	1,170	1,170
Other crops				
Pulses	-	1,600	7,100	8,700
Oil seeds	2,200	-	-	2,200
Sugar cane	-	-	1,700	1,700
Orchard ¹	-	-	2,300	2,300
Others ²	440	190	-	630
Total	52,620	62,740	12,270	127,680
Cultivated area	25,400	61,000	11,160	97,500
Cropping intensity	207%	103%	111%	131%

¹: Orchard is mainly tropical fruits.

²: Others include vegetables and spicy crops.

The main crops in the hill area are food grains such as maize, followed by paddy, wheat, millet and other cereals. Oil seeds (mainly mustard), coffee, ginger, mandarin orange, vegetables are cash crops. Although coffee and ginger are sent to Terai, their production is not so much. Almost all of other crops are for home consumption.

Promising cash crops in the hill districts are coffee and citrus (mainly mandarin orange). The cropped area of coffee has been gradually increasing though it occupies less than 120 ha at present. Mandarin orange is just being introduced now under planning to crop.

Major crops in the Terai districts are paddy and wheat which account for about 68% and 19% of the cropped area respectively, and pulses such as pigeon peas follow. Oil seeds and maize are cropped in small areas. Some vegetables and spices are also cultivated in small areas. These crops are not only for home consumption but also for sales at local markets. Sugarcane is also planted in small areas, and the production is sold to sugar mills.

2.4.3 Cropping Patterns

The main crops in the rainy season are paddy in the Terai area and maize in the hill area. Paddy is transplanted at the beginning of the rainy season, generally from June to July, and is harvested in October to November. In small areas of the hill area, double cropping of paddy is carried out under irrigation condition. Maize is planted from April to May and is

harvested from September to October. Millet and sweet potatoes are also planted in the hill area at the same time as maize or after maize.

Wheat, mustard and pulses are the main crops in the dry season. Wheat is usually planted after harvesting paddy in November to December, and is harvested in March to April. Mustard and pulses are planted after maize in the hill area and after paddy in the Terai area.

Sugarcane and fruits such as mango and banana, and pigeon peas are planted as perennial crops in the Terai area. Sugarcane is harvested after December. Besides citrus as the main fruits, coffee has been introduced to part of the hill area. Coffee is harvested during December to February.

The main cropping pattern in the project area is shown Fig, 2.4.1, and may be summarized as follows.

	Monsoon season	Dry season
<u>Hill area</u>		
Paddy field	Paddy	Wheat
Upland field	Maize, millet, and sweet potatoes	Pulses, oil seed, and barley
Perennial;	Coffee, citrus, etc.	
<u>Terai area</u>		
Paddy field	Paddy	Wheat, oil seeds and pulses
Upland field	Maize	Pulses
Perennial	Sugar cane, pigeon pea, mango, banana, etc.	

2.4.4 Farming Practices

Farming works are carried out generally by manual labour and draft animals in a traditional way using local implements. Land preparation and threshing of cereals are done by a pair of bullocks or buffaloes but other practices are done manually.

Generally, farmers use seeds multiplied locally by farmers themselves or improved variety supplied by the Agricultural Input Corporation. The coverage of improved variety varies depending on crops and districts. According to the socio-economic survey on sample panchayats, the coverage of improved variety of main crops is as shown below. Unit yields of improved variety are higher than local varieties.

Area	Paddy	Wheat	Maize
Hill	22%	72%	60%
Terai	57%	97%	-

The main fertilizer is farm yard manure which is applied for paddy in the Terai area, and is applied for maize in the hill area. Chemical fertilizers are utilized in limited areas, and are mainly applied to irrigated crops. The average dosage of fertilizers is estimated at 9 kg/ha in the hill area and 57 kg/ha in the Terai according to the cultivated area and amount supplied.

Agro-chemicals are applied mainly to irrigated crops in the rainy season, but are not common for rainfed crops and winter crops. According to the socio-economic survey, agro-chemicals (mainly pesticides) are applied to 22% of the paddy area in the hill area and to 57% in the Terai area.

2.4.5 Crop Production

The cultivated area, production and unit yield of crops during the period from 1971/72 to 1988/89 are shown in Annex A. These figures have fluctuated yearly mainly due to irregularity of climatic conditions. The average cropped area, and production of the main cereals (paddy, maize, millet, wheat and barley) in 1972/73 to 1974/75 are compared with those in 1986/87 to 1988/89 as follows.

Area		Average in 1972/73-74/75	Average in 1986/87-88/89	Increase
Hill	Cropped area	29,050 ha	54,030 ha	186%
	Production	53,760 ton	67,090 ton	126%
Terai ^{1/}	Cropped area	166,350 ha	186,430 ha	112%
	Production	284,910 ton	332,840 ton	117%

Source : Department of Food and Agricultural Marketing Services.

^{1/} : Kapilvastu and Rupandehi districts

The production of cereals in both hill and Terai areas has been increasing, however, the increased rate of production in the hill area was much lower than that of the cropped area. This indicates that the unit yields have decreased severely by expanding the cropped area into the lower capability lands.

The crop yields and production under present conditions are estimated on the basis of statistics and the Study's socio-economic survey as shown in Table 2.4.1.

The unit yield of paddy varies from 2.05 to 1.21 ton/ha depending on irrigation condition and dosage of farm inputs such as improved seeds and fertilizers. In most crops, unit yields are lower than the national average.

The total production of cereals in the project area is estimated at 70,000 ton in the hill districts and 201,000 tons in the Terai districts as summarized below.

Crops	Hill Area	Terai Area	(unit : ton)
			Project Area Total
Cereals			
Paddy	16,200	164,700	180,900
Wheat	7,100	34,200	41,300
Maize	41,600	2,100	43,700
Millet	4,500	-	4,500
Other cereal	600	-	600
Other crops			
Pulses	1,300	5,200	6,500
Sweet potatoes	8,500	-	8,500
Oil seeds	400	1,300	1,700
Sugar cane	-	46,900	46,900

2.4.6 Livestock

Livestock plays an important role in agricultural production and rural life. Cattle and buffaloes provide the draft power and farm yard manure for farm operation. Horses are the main transportation mean in the hill area. Livestock products are the essential foods for the villagers, and marketable surplus is their important income source.

On the basis of the Sample Census of Agriculture conducted in 1981/82, the holding status of livestock is estimated as shown in Table 2.4.2. 60% to 70% of the farm households raised cattle in both of the hill and Terai areas; moreover, 80% of households in the hill and 30% in the Terai own buffaloes. Average number of livestock per farm household are shown in the following table.

District	Cattle	Buffaloes	Goats	Sheep	Pigs	Poultry
<u>Hill</u>						
Gulmi	4.7	3.5	3.4	2.3	6.6	7.6
Arghakhanchi	4.4	2.8	4.0	1.0	6.3	7.3
Average	4.6	3.2	3.7	2.2	6.5	7.5
<u>Terai</u>						
Kapilvastu	4.7	3.4	3.4	8.8	8.5	11.0
Rupandehi	4.0	3.4	3.1	2.1	6.9	10.5
Average	4.3	3.4	3.2	5.6	7.9	10.6

Source: National Sample Census of Agriculture, 1981/82. (Refer to Table 2.4.3)

In the hill districts, cattle and buffaloes are usually raised in the community forest or pasture, and feeds in the winter season is very short.

The productivity of livestock is low in the project area. Milk production of local varieties is as low as 160-180 liters per lactation of cattle and 350-450 liters of buffalo. Therefore improved varieties of cattle and buffaloes are being introduced from India, and popularized in the country by means of cross-breeding with dominant local varieties.

Poor animal health is one of the major constraints in livestock farming. This is the result of poor nutrition and limited animal health services (veterinary services).

2.4.7 Fish Culture

Fishery has been carried out traditionally in some irrigation ponds and rivers in the project area, and fishery constitutes one of the sources of protein and cash income. In Terai districts, fish farming has expanded recently through the efforts of the Bhairahawa Fisheries Development Center located in Rupandehi district, and superintended by the National Agricultural Research Center.

The main activities of the Development Center are research, multiplication of fingerlings, supply of fingerlings to fishery farmers and technical extension service. Multiplication is made by natural breeding for common carp and artificial breeding for other varieties. In recent, the center has produced fingerlings as follows.

Fish	1985/86	1986/87	1987/88
Common carp	940,100	750,000	913,900
Silver carp	350,200	410,200	686,400
Grass carp	240,900	274,000	231,000
Big head carp	36,300	192,400	324,500
Rohy (Roho)	452,500	512,700	184,500
Nainy	38,300	105,900	84,100
Bhakur	293,000	-	-
Total	2,351,300	2,245,200	2,424,900

Fishery farmers purchase fingerlings from the center, and keep them in nursery ponds for 1 to 2 months. After that, fish are shifted to production ponds. After their weight reaches to 1 to 1.5 kg, fish are harvested. Owing to the small production, fish produced are marketed in the local market in Kapilvastu and Rupandehi without passing processing facility and cold storage system.

According to the Department of Food and Agricultural Marketing Services, the number of fishery ponds and production are as shown below.

	Kapilvastu	Rupandehi	Total
Number of ponds	381	406	787
Area of ponds (ha)	148.2	155.7	303.9
Area per pond (ha)	0.389	0.383	0.386
Annual production (ton)	175	208	383
Unit yield (ton/ha)	1.18	1.33	1.26

For promoting fish culture, the Agricultural Development Officer of the Rupandehi district has also one subject matter specialist (SMS), several Junior Technicians (JT) and Junior Technical Assistants (JTA).

2.4.8 Apiculture

According to the rural socio-economic survey, about 300 farm households engage in bee keeping for cash income in hill districts of Gulmi and Arghakhanchi.

Farmers keep several beehives, the pollen and nectar coming mainly from mustard flowers and orchards. In one beehive, 4 to 6 kg of honey can be collected a year.

The cottage industry office in Arghakhanchi had made some trials to introduce improved beekeeping to farmers. By expanding the cropped acreage of mustard, citrus and

other crops as blossom sources, and with improved beekeeping techniques, it is expected that the productivity will increase.

2.4.9 Farm Household Income

The present income level of the average farm household in the project area is estimated at NRs.17,500 in the hill districts and NRs.19,100 in the Terai districts. In the hill districts about 23% of the income come from off-farm labour.

Per capita gross income of farm household is about NRs.2,500 (US\$89) in the hill districts and NRs.2,730 (US\$98) in the Terai area. These correspond to only 56 to 61% of the per capita GDP of whole of Nepal (NRs.4,980 or US\$160, 1987/88).

On the other hand, out of national GDP per capita, national level farm income per capita is estimated at about NRs.2,700 (US\$95), 1987/88. That in the hill and the Terai districts is about NRs.1,930 (US\$69), NRs.2,690 (US\$96), respectively, as seen below:

	(Unit: NRs)	
	Hill Area	Terai Area
<u>Per Household</u>		
Total Gross Income	17,500	19,100
Farm Income	13,500	18,800
Off-farm Income	4,000	300
<u>Per Capita</u>		
Total Gross Income	2,500 (56%)	2,730 (61%)
Farm Gross Income	1,930 (71%)	2,690 (79%)

Source : Estimated based on the household survey conducted by the study team.

Note : Figures in bracket show percentage compared with the national level.

The income level of farmers in the Terai district is almost at the same level of the national average, while that in the hill district is about 70% of the national level.

2.5 Agricultural Support System

2.5.1 Agricultural Extension

Agricultural extension services are provided by the Division of Agricultural Training and Extension under the Department of Agriculture, through the channel of the regional directorates and district agricultural development offices. Each district development office is headed by the agricultural development officer (ADO). Under the ADO, extension

workers are ranked in descending order as Junior Technicians (JTs), Junior Technical Assistants (JTAs) and Panchayat Level Agricultural Assistants (PLAAs). PLAAs are selected among farmers and are trained for one month by JTs, JTAs Subject Matter Specialists (SMSs). Pre-service training of JTs (and partly of JTAs) is given by the Institute of Agriculture and Animal Science of Tribhuvan University at Rampur, while JTAs and lower level workers are mostly trained at research stations.

In-service training of JTs and JTAs is carried out by the Division of Extension and Training. The curriculum tends to depend more on the specialities of trainers available than on the needs of trainees. Staff is well motivated but their effectiveness is hampered by a number of problems: (i) lack of trainers (SMSs) and training facilities in the field; (ii) limited feedback between research and field programmes.

A training and visit system (T&V) was implemented in Kapilvastu and Rupandehi districts under IDA financing of intensified and reorganized extension services.

In the project area, agricultural extension services have been rendered by JT, JTA and PLAAs under the supervision by ADO appointed as the Chief of the District Agricultural Development Office.

The Agricultural Development Office is establishing service centers in Illakas under the decentralization policy, constituting nine Illakas in one district. The service centers have been established in Kapilvastu and Rupandehi districts, and will be provided in Gulmi and Arghakhanchi districts by 1989/90.

The number of the present service centers and staff for extension services in the four districts are as follows:

	Gulmi	Arghakhanchi	Kapilvastu	Rupandehi
No. of service center	7	5	9	9
Technical Staff				
ADO	1	1	1	1
AADO ¹	1	1	1	1
SMS ²	-	-	2	5
JT	10	10	12	16
JTA	29	15	22	30
PLAA	70	41	79	70

¹: Assistant ADO

²: Subject Matter Specialist

Although the extension services in the four districts are being strengthened, the number of extension workers, facilities, demonstration farms are not yet sufficient. According to the sample panchayat survey, farmers receiving extension services are estimated at 20% to 30% in the hill districts and 15% to 20% in the Terai districts at present.

2.5.2 Agricultural Research

In Nepal, agricultural research is carried out at 7 research stations, 6 agricultural, 8 livestock and 6 fish farms under the direction of the National Agricultural Research Center. Some agricultural research stations function as national crop development centers (for paddy, maize, jute, and wheat).

Research tends to be focused particularly on food-grain improvement programmes, with assistance from USAID, UNDP and CIMMYT. Applied research (crop trials and irrigation/cultivation practices), which would help the farmers most, is limited. Graduate agriculturalists are generally trained outside the country.

In the project area, the Siddarthanagar Research Station is located at Bhairhawa in Rupandehi district. The station has mainly provided research and training on wheat and other crops. The four experimental farm plots, under the Agricultural Research and Production Programmes (ARPP), exist in Gulmi district, of which main activity is varietal trails and experiment of triple cropping system.

In the Bairahawa Lumbini Groundwater Irrigation Project, Agricultural Division provides the demonstration and trial programmes under irrigated condition. These programmes include trials of cropping pattern of new crops and varieties, farming practices newly introduced, dosage and application of farm inputs.

2.5.3 Agricultural Credit Service

The Agricultural Development Bank of Nepal (ADB/N) is the main source of institutional credit in agriculture, and extends short, medium and long-term loans to individual farmers, groups of farmers, cooperative societies and village-committees. In recent years, overall lending covers more than 25% of total agricultural credit needs. ADB/N's financial position is sound, and loan recovery has been satisfactory under the circumstances.

Repayment performance of cooperative societies, however, has been poor and a number of government programmes are underway to improve the functioning of these

important groups. Loans are extended by ADB/N for a wide variety of purposes, including irrigation, ware-housing and marketing. Interest rates vary with loan purpose between 6 to 15 percent.

ADB/N is making efforts to reach more small farmers directly and application procedures for institutional credit from private lenders. About two-thirds of the short-term production credit is disbursed by ADB/N through the Sajha cooperatives.

Coordination of credit with agricultural extension needs to be improved. Promotion activities are very limited, the result being that most farmers are not fully aware of credit facilities available to them.

In the project area. ADB/N zonal office is located at Bhairahawa. Under the zonal office, there are 3 branch offices in the Terai area and 2 sub-branch offices in the hill area. These branches and sub-branches provide credit in two kind of mode, i.e. direct lending and indirect lending.

Loan disbursement and repayment collection by ADBN in 1986/87 are as follows:

District	Loan Disbursement		Repayment Collection	
	Target	Achievement	Target	Achievement
Rupandehi	10,233	13,602	8,688	10,790
Kapilvastu	7,449	5,423	3,178	2,368
Arghakhanchi*	1,796	2,322	1,428	1,875
Gulmi	5,377	5,956	4,264	4,051

*: Data in 1985/86

The following SFDP's are implemented by ADB/N:

Branch office	Existing	Under process
Gulmi		
Tamghas	-	3 projects
Arghakhanchi		
Sandhikharkha	-	3 projects
Kapilvastu		
Krishnanagar	1 project	-
Taulihawa	4 projects	1 project
Rupandehi		
Sidharthanagar	2 projects	1 project
Butwal	5 projects	-

2.5.4 Agricultural Input Supply

The procurement, storage and distribution of basic inputs for agricultural production is carried out by the Agricultural Input Corporation. AIC is required to ensure that fair priced fertilizer, seeds, chemicals and implements are available at strategic locations in the production areas to the farming communities. The main distribution channel for the farmer is through the regional office and branch offices of ADB/N through the direct cooperative union and the Panchayat Sajhas.

Mainly fertilizers and seed of improved varieties are handled in this way, whereas chemicals are also traded through private retail outlets. In a few cases private dealers are appointed to distribute seed inputs. Fertilizer sales are subsidized and cost the same at each district storage. Transportation costs from there to the Sajha and farmer are borne by the farmer.

Use of modern agricultural inputs in the project area is very limited. Some of the sub-areas are not accessible by road and supplies must be brought in by portorage. Consequently delays between the decision to use the inputs and their arrival on the farm are often considerable. Another reason, which adds to the delay, is the fact that almost all the inputs used by farmers are subject to credit arrangements which must be made before ordering the materials.

Furthermore, due to the limitations of the extension service, benefits of the use of inputs are not well known to many farmers. Other constraints, which cause additional shortages and late delivery of inputs, lay in Nepal's landlocked situation, managerial deficiencies of all involved organizations and limited AIC resources. In addition, due to inadequate storage facilities, Sajhas cannot maintain stocks ahead of need for emergency situation.

In the meantime, the zonal office of AIC in Lumbini Zone is located at Shiddharthanagar in Bhairahawa, and has 4 branch offices as below:

Location	Office	Staff	Facility
Shiddharthanagar (Bhairahawa)	Zonal office	33	Storage of 6,000 tons Seed processing plant
Taulihawa (Kapilvastu)	Branch office	12	Storage of 1,250 tons
Krishnanagar (Kapilvastu)	Branch office	8	Storage of 500 tons
Tamghas (Gulmi)	Branch office	6	Storage of 290 tons
Sandhikharka (Arghakhanchi)	Branch office	9	Storage of 150 tons

The number of cooperative and private dealers, distributing agricultural inputs under each office, are as below.

District	Co-operative dealer	Private dealer
Rupandehi	26	13
Kapilvastu	Taulihawa	9
	Krishnanagar	13
Gulmi	4	19
Arghakhanchi	6	2

According to the zonal office, distribution of agricultural inputs to dealers in 1987/88 and targets in 1988/89 were as summarized as below:

District	Ferti- lizer (ton)	Vegetable seed (kg)	Cereal seed (ton)	Pesticide		Trans- potation Cost (Rs.)
				Liquid (litre)	Powder (ton)	
Rupandehi						
1987/88	7,370	147	88	227	12	40,000
1988/89	11,130	1,000	211	100	15	60,000
Kapilvastu						
1987/88	5,200	147	42	182	4	8,470
1988/89	7,780	750	82	120	7	30,000
Gulmi						
1987/88	482	283	25	79	4.4	17,850
1988/89	331	250	52	30	2	12,000
Arghakhanchi						
1987/88	665	168	15	50	2.2	3,400
1988/89	423	250	78	30	2	3,000

2.5.5 Sajhas Cooperatives

Sajha have developed as farmers' cooperatives to provide credits and marketing channel to individual farmers. Farmers purchase farm inputs and consumer goods, and sell their products mainly wheat and rice through Sajha cooperatives. The following cooperatives exists in the project area.

District	Number of Societies	Membership
Gulmi	6	N.A.
Arghakhanchi	4	8,592
Kapilvastu	19	53,887
Rupandehi	26	47,740
(Marchawar)	(5)	10,704

The district cooperative office in each district is headed by a board of directors, who are elected by the cooperative members, and one cooperative officer is appointed from the government. In each cooperative, main staff consist of a cooperative manager, accountant, salesmen. The cooperative manager gets periodical training by the government.

2.6 Marketing and Processing

2.6.1 Processing Facilities

There are many small scale mills for cereals and oil seeds in the project area. About 30% of the mills in the hill are driven by water turbines. Other mills in hill area and all the mills in the Terai area are driven by diesel engines. The recovery rate of these mills is about 60% for paddy/rice.

According to the field interview and the socio-economic survey, the average capacity of the mills is about 0.2 ton/hr for water turbine mills and 0.25 ton/hr for diesel engine mills in the hill districts, and 0.5 ton/hr in the Terai area. On the basis on these mill capacities, the total milling capacity is estimated as follows.

District	Number of mills	Processing capacity (ton/hr/unit)	Total Capacity (ton/month)
Gulmi			
Water turbine	30	0.2	1,050
Diesel	96	0.25	4,200
Argkhanchi			
Water turbine	43	0.2	1,510
Diesel	77	0.25	3,370
Total in hill	246		10,130
Kapilvastu	461	0.5	40,340
Rupandehi¹	861	0.5	75,340
(Marchawar)	(24)	(0.5)	(2,100)
Total in Terai	1,322		115,680

¹ : Rupandehi includes Marchawar area.

The total processing capacity for cereals in the project area is estimated at 10,130 ton/month in the hilly districts and 115,680 ton/month in the Terai districts. As mentioned in the section 2.4.5, the annual cereal production in the project area is estimated at 70,000 tons in the hill area and 201,000 ton in the Terai area. The milling capacity in the Terai districts is enough to process all the cereals within 2 months. However, it takes more than 7 months to process all the cereals. This indicates that the farmers process their products manually in their houses by the family members.

The coffee processing factory of the Nepal Coffee Company is located at Manigram near Bairahawa. This factory consists of one unit of huller, one roaster machine and one grinder, and has the capacity to process 400 kg of coffee cherry per shift. The production of coffee cherry is low at present, and procurement is not enough for the factory. The processed amount of this factory is estimated at about 30 ton in 1987/88.

The Ministry of Agriculture established a small coffee processing plant at Ampchaur village in Gulmi district in 1982 for demonstration of processing. This plant includes one pulper (40 kg per hour), one huller (20 kg per hour), one roaster (15 kg per hour) and one grinder (1 kg per hour). Presently, this plant is not utilized by farmers because of insufficient technical guidance.

Regarding sugar cane, the Mahendra Sugar Mill has been operated in Bhairahawa. The sugar mill is a private company and produces sugar and liquor. Although the installed capacity is 50 tons/day of sugar with the recovery rate of 85% and 6 klit./day of liquor, the production of sugar is less than 70% of capacity owing to the shortage of supply of sugarcane, which is brought in from the Rupandehi, Kapilvastu and Nawalparasi. In

1986/87, this factory employed about 800 persons, produced 5,400 tons of sugar and 259,000 lit. of alcohol.

2.6.2 Marketing of Agricultural Products

Marketing of agricultural products is dependent on geographical conditions. In the hill area, production of food grains is not sufficient, and supplemental food grains have to be transported from the Terai districts in large quantities to sustain the population. On the other hand, farmers in the Terai have a marketable surplus in food grain production, and the surplus is conveyed to market in the hill area and outside of the area such as Kathmandu, Pokhara and India.

Marketing channels of agricultural products may be broadly divided into two categories, private and government. Co-operative societies also market agricultural products in small amounts, but this channel is involved in the above two channels.

The National Food Corporation (NFC) is the government organization to market food cereals. NFC functions to stabilize the price of foods through purchasing at the minimum support prices, which are set after every harvest season.

In the Lumbini Zone, NFC zonal office is located at Bhairahawa in Rupandehi District. Under the zonal office, there are one branch office at Tansen in Palpa district, one sub-branch at Tamghas in Gulmi district, and one sub-branch at Sandhikharka in Arghakhanchi district. Two depots are located at Majuwa and Chaurasi Phant for distributing foods in Gulmi district.

NFC procures food grains through the Sajha cooperatives in Rupandehi, Kapilvastu and Nawalparasi districts in Terai area, and conveys them to Palpa, Gulmi and Arghakhanchi Districts in the hill area. The amounts procured by the zonal office and transported to Gulmi and Arghakhanchi District are as follows :

Fiscal year	Procured amount (ton)	Transported amount (ton)	Destination
1984/85	2,200	380 690	Gulmi Arghakhanchi
1985/86	3,660	830 930	Gulmi Arghakhanchi
1986/87	120	380 900	Gulmi Arghakhanchi
1987/88	2,960	470 540	Gulmi Arghakhanchi
1988/89	470	60 170	Gulmi Arghakhanchi

According to the interview survey in the zonal office of NFC, it is difficult to achieve the target to procure food grains in the Terai mainly due to low level of the minimum support prices compared with the private dealers.

Private dealers such as mill owners, transporters and middlemen are the main marketing channels for both food grains and cash crops. No record is available on food grains and cash crops marketed by the private sector in the project area, but it is estimated that a large proportion of the food grains and cash crops are sold on the domestic market and the rest being marketed on the export market by the private sector.

The marketable surplus of food grains in the Terai districts is estimated on the basis of present production and per capita consumption, and summarized as follows.

District	Production	Seed and Waste	Consumption in the Area	Marketable Surplus
Kapilvastu	162,600	21,100	55,200	86,300
Rupandehi	172,400	22,400	84,000	66,000
Total	335,000	43,500	139,000	152,300

2.6.3 Storage Facilities

According to the Department of Food and Agricultural Marketing Services, Nepal Food Corporation (NFC) and Agricultural Input Corporation (AIC), these are some of the storage facilities in the project as listed below.

District	Organization	Number	Total Capacity (ton)
Gulmi	NEC	1	250
	AIC	2	290
	Sajha	0	0
Arghakhanchi	NFC	1	250
	AIC	1	150
	Sajha	1	100
Kapilvastu	NFC	1	1,000
	AIC	2	2,750
	Sajha	5	500
Rupandehi	NFC	3	3,000
	AIC	-	6,000
	Sajha	15	2,550

AIC has large storage facilities in Bairahawa, Taulihawa and Krishnanagar to store and handle inputs such as seeds, chemical fertilizers and agro-chemicals. Storages in Gulmi and Arghakhanchi are for distribution of the inputs. In Taulihawa and Krishnanagar, some private storages are hired by AIC to store inputs owing to the short capacity of the storages. Sajha cooperatives have small storages to distribute farm inputs.

NFC has large storages in the Terai districts to procure food grains. The storages in the hilly districts are mainly for distribution of food grains.

2.6.4 Constraints for Development

- 1) The capacities of grain mills and oil expellers are inadequate in the hill districts and their recovery rates are low. At present, most farmers process the grains and expel oil seeds manually in their homes. It is necessary to install small scale mills to cover the villages sporadically located in the hills.
- 2) As for marketing of food grains in the Terai area, farmers usually sell their products at low prices at harvest time. It is necessary to enhance the function of the Sajha cooperatives to improve marketing opportunities for farmers through the construction of small storages.
- 3) In terms of supply of the food grains to the hilly districts, only small storages of NFC are available for distribution. From these storages, food grains are carried

by horses or by foot. To stabilize the supply amount and the price, it is required to establish small storages in the village level.

- 4) Present dealing amount of NFC is estimated at less than 5% of the marketing surplus in the Terai districts. This amount is small to control and stabilize the price. It is required to increase the dealing amount of NFC.
- 5) In both of the hill and Terai districts, supply of farm input is limited at present. However, it is essential to expand supply of farm inputs to increase agricultural production. In this regard, it is necessary to develop the distribution system in the project area through the establishment of storages in the Sajha cooperatives level with proper management.
- 6) Coffee in the hill area seems to be the most promising cash crop in the future. However, production is still small and fluctuates year by year. Also, availability of processing facilities and transportation is limited, and the quality of the products should be improved. To obtain a stable market for coffee in Nepal and foreign countries, it is necessary to promote improved coffee cultivation and to introduce new technology for processing.

2.7 Irrigation

2.7.1 Irrigation Area

The present area of cultivated lands under irrigation in the four objective districts is as follows:

District	(1) Cultivated Land (ha) ¹	(2) Land under Irrigation (ha) ²	(2)/(1) Irrigation Percentage (%)
Kapilvastu	84,730	25,320	29.9
Rupandehi	87,210	31,540	36.2
Gulmi	25,600	1,840	7.2
Arghakhanchi	19,960	2,260	11.3

¹ : The Land Resources Mapping Project (LRMP) in 1986.

² : The figures are estimates of irrigation-command areas where supplemental water is provided for at least the rainy season paddy. Area where year-round irrigation is practiced is much smaller than the figures.

As shown in the above table, there is a great difference in the irrigated area between the first two districts in the hill and the other two districts in the Terai, with far larger area under irrigation in the Terai.

The national averages for the cultivated area with irrigation facilities as percentage are: 21% for the Terai and 11% for the hill. Comparing the figure of the four districts with the national averages, the irrigated lands in the two districts in the hill area are less than or equal to the national average, but on the contrary, those in the two districts in the Terai are higher than the national average.

The higher irrigation percentage in the Rupandehi is contributed by both two national irrigation projects comprising Bhairahawa-Lumbini Groundwater Project and Tubewell Water Use and Distribution Project and 10 nos. of farmers' irrigation schemes, including Sorah - Chatti's Mahja Kulo Scheme, Panch Majha - Aath Majha Kulo Scheme, Mahau Irrigation Scheme, etc. Likewise, the high percentage in the Kapilvastu is the result from both three national projects consisting of Banganga Irrigation Project, Surai Irrigation Project and Jamai Irrigation Project and 132 nos. of farmers' irrigation schemes such as Bhutaha Bandh Scheme, Murthi Nala Scheme, Pattharkot Bandh Scheme, etc.

On the other hand, the low irrigation percentages in Gulmi and Arghakhanchi districts are attributed to both limited water resources and complicated topography in the hill areas, though 121 nos. and 179 nos. of farmers' irrigation scheme exist respectively.

In general, irrigation in the farmers' schemes is confined only to paddy cultivation only in the rainy season.

2.7.2 Existing Irrigation Projects and Schemes

There are a great number of existing irrigation projects and schemes constructed by HMG/N and the farmers' communities in the four objective districts in the Lumbini Zone. The numbers of such projects and schemes can be summarized as follows:

Numbers of Existing Project and Scheme

District	HMG/N's Project	Farmers' Scheme
Kapilvastu	3 (3)	132 (10)
Rupandehi	4 (4)	10 (4)
Gulmi	2 (2) ^{/1}	121 (1) ^{/1}
Arghakhanchi	0	179 (3)

Source : The Water Use or Resources Inventory Study of Gulmi, Arghakhanchi, Kapilvastu and Rupandehi Districts conducted by the Water and Energy Commission from 1984/85 to 1988/89.

^{/1} : The bracketed figures show the number of the projects and schemes which have permanent irrigation systems.

However most of the existing projects and schemes use irrigation for the rainy season paddy only since their water sources have sharply decreased or dried up in the dry season. List of the existing projects are shown in Table 2.7.1. Location of the project completed and under construction are shown in Fig. 2.7.1.

The HMG/N's projects are generally comprised of diversion weir, intake, irrigation canals, etc. Diversion weir is generally of overflow weir type with under sluice equipped with gate. Intake structure are also equipped with gate. However, some of these gates do not function well due to deterioration. The irrigation canals are generally of earthen canal having trapezoidal section. In some projects, main canal losses the original flow capacity due to sedimentation and weed. Water measuring devices are not installed in almost all the projects.

In the farmer's scheme, diversion structure is generally run-of-river type and made of earth, stones and woods. No gate is equipped. Irrigation canals are generally of earthen trapezoidal type.

2.7.3 Current Situation and Problems

More than 90% of the rainfall occurs in the rainy season from June to September. In the dry season, irrigation is indispensable for intensive agriculture particularly from March to May. In the rainy season, drought days often continue in more than one week so supplemental irrigation is required.

Most of the existing projects depend on the irrigation water resources of the rivers. Those rivers generally has very small catchment area so its flow is small and unstable even in the rainy season. In the dry season, most of the rivers are dry up. Irrigation is quite limited or unable in the dry season. Rivers also carry so much sediment in the rainy season. The sediment directly flow into the intake and canals and accumulate resulting in decreasing their original function.

Several projects does not function well due to damage, breakage, sediment, erosion and scouring of weirs, intakes, canals and the related structures mainly by flood and embankment sliding. Those are Surai and Jamai in Kapilvastu, and Siyari, Sorah - Chattis Mahia Kulo and Panch Majiha - Aath Majha Kulo projects in Rupandehi. In Banganga Project in Kapilvastu, weed grows very thick in the canals due to the slow velocity of water. Weeding work is done by the villagers participation but such work is a heavy burden for villagers. Because few water control facilities such as gates and measuring devices are constructed in the canals, effective use and even distribution of water is hardly done in the many projects.

So many temporary diversion structures are constructed by village panchayats in the rivers. Although the river water is very limited, villagers usually take water at their convenience so that water is not available at the intake located downstream even though during the rainy season. Several villages frequently dispute each other. In order to solve such dispute and realize the effective use and even distribution of water, adjustment and integration of the existing water right has to be made; however, it may take an extremely long period of time.

Several barrages or diversion works on the rivers are constructed in India near the border. The back water of these barrages frequently cause inundation in the rainy season. Some flood protection works such as construction of dikes and short cut of river channel is indispensable to protect farm lands from the inundation.

2.8 Roads and Traffic

2.8.1 Present Situation

(1) General

Major means of transportation at present is mainly roads linking the four districts in the project area and Kathmandu, the capital of Nepal, Pokhara, a center of the Western Development Region and principal cities. The major roads are illustrated in Fig. 2.8.1.

In the project area, roads working almost thoroughly are only the East-West Highway, the Siddharta Highway, the Taulihawa-Lumbini and the Chandranta-Krishnanagar. There are great difference between Hill Districts and Terai Districts in regards to roads' status in the project area. The present situation is as follows:

1) Hill Districts

The percentage of road coverage per km² is inferior to the national average. Roads are not paved with gravel or asphalt. Some roads are not passable in rainy seasons due to shortage of drainage facilities and retaining walls. Some others have been partly constructed and can not be passed through. Other roads linking villages are only small-scale foot paths and suspension bridges.

2) Terai Districts

The Siddharta Highway and the East-West Highway are two arterial roads. Besides, there are also asphalt or gravel paved roads on a few route. The percentage of completed roads is more than the national average. The roads running from east to west have the traffic problems in the rainy seasons, because of no bridge over the Banganga River and the Kothi River, and the shortage of structures to cross rivers. Access roads and foot paths linking main roads and villages, have also the traffic problems in the rainy seasons because of shortage of consolidation on the roads' surface, heights of roads, and drainage facilities.

(2) Situation of Existing Roads

The condition of existing roads is referred to Fig 2.8.1 and Annex E Tables E.1.1 to E.1.3. Benefited areas and benefited population of the roads are given in Annex E Fig. E.1.3.

1) National Highway

a) East-West Highway (Mahendra Raj Marg: MRM)

This highway links the Eastern Development Region, the Central Development Region involving Kathmandu, and the Mid-Western Development Region. It runs north side of Rupandehi District and Kapilvastu District from east to west. The distance in the two districts is about 106 km. Asphalt pavement carriage way is about 6 m, while the total width of the road is about 10 m.

b) Siddharta Highway

This highway links Pokhara, Headquarters of the Western Development Region, and Bhairahawa, the capital of Rupandehi District and extends to the Indian Border. The span between Butwal, the capital of Lumbini Zone, and Paklihawa on the Indian Border is 34 km, and asphalt pavement carriage way is 6 m, while the total width of the road is 11 m.

2) Feeder Roads

The Feeder Road is defined as the road linking the capital of the Zone or major towns. There are five Feeder Roads in the project area.

3) District Roads

The definition of the District Road is the road between major towns and major villages or between villages. There are five district roads in Gulmi District, seven in Arghakhanchi District, four in Kapilvastu and three in Rupandehi District.

4) Village Roads

This is the path that inhabitants could carry daily necessities on foot or by livestock.

(3) Road Density

The comparison of the roads in Terai Districts and Hill Districts in Lumbini Zone with those of the whole Hill Districts and the whole Terai Districts in Nepal is as below: (For detail, see Annex E Table E.1.4).

Road Density

District	Asphalt Paved (km)	Gravel Paved (km)	Fair Weather Type (km)	Total (km)	Road Density	
					km per 1,000 People	km per km ²
Hill area in project area	-	-	90	90	0.21	0.039
Hill area in whole Nepal	1,330	565	1,186	3,081	0.38	0.052
Terai area in project area	204	114	68	386	0.49	0.122
Terai area in whole Nepal	1,507	756	1,162	3,425	0.42	0.101

From the above table followings can be given:

- 1) Road length per 1,000 people in the Hill Districts of the project area is only 0.21 km, equivalent to about 50% of that of the whole hill area in Nepal.
- 2) Road length per area in the Hill Districts of the project area, that is road density, is also low at 0.039 km/km²: about 80% of the whole Nepal.
- 3) In the national level, even in hill districts asphalt or gravel paved roads are more than 50%. But there is no paved roads in the Hill Districts in the project area.
- 4) On the other hand, road length per 1,000 people and road density in the Terai Districts of the project area are more than the whole Terai in Nepal by about 20%. As far as roads concerned, this area is not considered less-developing.
- 5) There are two arterial roads: the East-West Highway and the Siddharta Highway; and some district roads in the two districts in Terai. They are passable in the rainy seasons, though not completely enough.
- 6) Length of roads being passable by vehicles in the two Districts of the Hill area is 90 km. It is very short, comparing 386 km in the two districts in the Terai; and there is no roads passable throughout year.

- 7) Smallest length of roads per 1,000 people in the project area is for Gulmi District, and smallest length per area is for Arghakhanchi District.

(4) Areas and Population Benefited by Roads

Benefited areas and benefited population of roads in the project area are shown in Annex E Fig. E.1.3. Some of them, having large benefited area/cultivated land/population are referred to Table 2.8.1.

(5) Traffic Volume

Traffic volume data and the growth rate of the traffic volume of highways in the vicinity of Butwal on MRM in the project area are referred to Table 2.8.2.

Present situation of traffic volume in the feeder roads of Tansen-Tamghas and MRM-Sandhikharka is shown in Table 2.8.3, and that of bus utilization in Table 2.8.4.

In the Table 2.8.2, the growth rate of traffic volume have increased by 13.2% per annum. That of Lamosangu-Jili Road by SATA have also increased by 10-15% per annum. This route works as a feeder road linking the national highway with district roads. Besides, in the future, it will formulate a ring road connecting Siddharta Highway, Tansen-Tamghas and Sandhikharka-MRM, and will work as traffic network in the whole Lumbini Zone. The traffic volume will be increased necessarily.

(6) Maintenance

DOR maintains roads every year, but as shown in Table 2.8.5, numbers of machinery for maintenance is short in the Western Development Region, and roads damaged by landslides and floods have not been repaired rapidly. As shown in Table 2.8.6, roads require maintenance cost every year.

2.8.2 Needs for Development

In the project area, improvement of road network is indispensable to attain the following purposes:

- 1) To satisfy the transportation condition not only for farming input/products but also materials necessary for daily life such as food, kerosene, drug, etc..

- 2) To facilitate human movement derivable from economic and social activities.
- 3) To activate communication derivable from human movement, postal services and others.
- 4) To promote smoothly various projects other than this road projects.

Details on improvement plan of roads are as mentioned below.

(1) Hill Districts

1) Ensuring Year-Round Access by Road

- Width enlargement:
Width enlargement work for ensuring side drainage and road shoulder which is mainly occupied by excavation.
- Pavement:
Pavement work utilizing pebbles and/or asphalt protecting muddying in the monsoon season, dust in the dry season and erosion by rainfall.
- Slope protection:
Protection work for damages of slope which might occur in the monsoon seasons.

2) Improving Rural Roads Connecting to Villages

- Crossing small stream:
Ensuring traffic in the monsoon seasons.
- Improving slope:
Ensuring traffic in the monsoon seasons.
- Slope protection:
Control work for damage which might occur mainly in the monsoon seasons.
- Installation of suspension bridges:
Ensuring traffic in the monsoon seasons, and shortening traffic distance.

(2) Terai Districts

1) Ensuring Year-Round Access of Trunk Roads

- **Asphalt pavement and maintenance of paved road:**
Asphalt pavement and the maintenance work should be positively carried out in view of the necessity for transporting materials and the high speed traffic for the commercial trade with India.
- **Bridge:**
Construction of bridges for ensuring traffic in the monsoon seasons and shortening traffic distance.
- **Drainage:**
Ensuring transportation in the monsoon seasons.

2) Improvement of Roads Connecting to Villages

- **Crossing of small streams:**
Ensuring transportation in the monsoon seasons.
- **Improvement of road surface:**
Ensuring traffic in the monsoon seasons.

2.9 Drinking Water Supply

2.9.1 Present Situation

(1) Water Supply Coverage

The rate of the water supply coverage in the four districts of the project area ranges 35% - 9%, 22% on the average, in 1988/89.

Water Supply Coverage in the Project Area
(Year: 1988/89)

District	Total Population	Population Served	Rate of Coverage (%)
a) Gulmi	267,877	94,812	35
b) Arghakhanchi	176,967	62,261	35
c) Kapilvastu	379,839	34,900	9
Sub-total	824,683	191,973	23
d) Rupandehi	543,487	114,169	21
Total	1,368,170	306,142	22

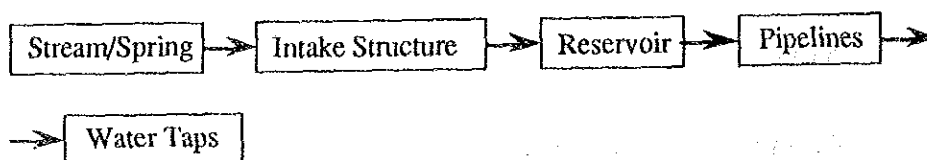
(2) Water Source and Water Quality

Water sources currently used are classified into two categories. In the hill area (Gulmi and Arghakhanchi), small streams and springs are common water sources, and in the Terai area (Kapilvastu and Rupandehi), it is groundwater.

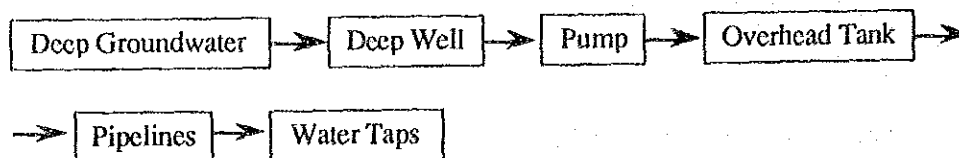
Regarding water quality, small streams and spring water in the hill area are usually drinkable. In the case of shallow groundwater, though drilled tube wells with handpumps have little chances to be contaminated, dug wells (usually 1.5 m in diameter) are likely to be polluted since the wells are not protected by covers and located nearby houses. On the other hand, deep wells' water is considered safe in quality.

(3) Supply System

Hill Area (Gulmi and Arghakhanchi)



Terai Area (Kapilvastu)



(4) Water Charge and Maintenance

Currently water is supplied to consumers free of charge, in the project area, excepting the case of private house connections. In almost all cases, water is taken from public stand taps without charge. Private taps are charged Rs.13 per tap monthly.

As for facilities of pipelines in the hill area and handpumps in the Terai area, village people organize "Users Committee" to maintain and to repair their facilities to some extent, but repair or rehabilitation requiring considerable technology and cost is dependent on the local governments or public contributors.

(5) Administration and Organization for Water Supply

In Nepal, administration for public water supply sector is carried out by the three agencies.

They are:

- 1) WSSC: Water Supply and Sewerage Corporation,
Ministry of Housing and Physical Planning.
- 2) DWSS: Department of Water Supply and Sewerage,
Ministry of Housing and Physical Planning.
- 3) MPLD: Ministry of Panchayat and Local Development.

Among the above, DWSS normally assumes the responsibility for the implementation of water supply and sanitation projects in communities having a population greater than 1,500. The basic policy is to turn over these schemes to the local operator trained for this purpose. For various reason, however, this policy is frequently not followed, but will be given further emphasis under the provisions of the Decentralization Act (1982) and the Decentralization Rules (1984).

2.9.2 Necessity of Improvement of Water Supply System

Naturally, water for domestic purpose is essential for human daily life. The public water supply system has two major functions. The first one is for human health and the second for convenience on daily life. The Government of Nepal recognizes that water supply is one of basic human needs and plans that the public water supply systems cover all over the

country by the year 2000. At present, leaving urban area out of the question, public water supply systems in the rural area covers a comparatively low rate of 30%-40% of rural population. It seems relatively hard to develop the water supply systems all over the country completely in a short period; however, it is necessary to strive for further development of the public water supply systems step by step and steadily.

In the project area, a rate of water supply coverage at Kapilvastu District is very low at 9% in 1989, therefore, further development of public water supply systems is urgently required. This area has groundwater and the water source is deep groundwater to be taken from deep wells; and it is to be pumped up to overhead tanks by submersible pumps. In hill areas of Gulmi District and Arghakhanchi District, the water source is spring water or small stream that is hardly polluted with inhabitants and livestock. In the master plan, development of the above systems will be programmed in areas where the systems have not been existing.

Note: The Marchawar Area of Rupandehi District will be excluded from water supply planning of the project, since drinking water in the area has been handled by the Nepal Red Cross Society with satisfactory construction of numerous tube wells in the area; and plans for activities to be continued in the future.

2.10 Other Social Infrastructure

2.10.1 Rural Electrification

In the project area there exist a transmission line and seven distribution lines as listed below:

Description	Connection	Capacity (kVA)
Transmission	Butwal-Shivapur (to Nepalganj, Trans Nepal line)	132
Distribution	Butwal-Tansen	33
	Butwal-Bhairahawa (2 lines) (One from India)	33
	Krishnanagar-Taulihawa-Bhairahawa (From India)	33/11
	Krishnanagar-Shivapur (From India)	33
	Butwal-Lumbini	11
	Bhairahawa-B/L Groundwater Project (Constructed by B/L-G Project)	11
	Bhairahawa-Marchawa Pump Station (Under construction by Marchawar Lift Irrigation Project)	11

In addition, there is an extension plan to connect Tansen-Tamghas-Sandhikharka-Pyuthan, which will be undertaken by Nepal Electric Authority (NEA) in 1990/91. Those routes are shown in Fig. 2.10.1.

Apart from the NEA projects, there are small scale-private projects as follows:

- (1) Tamghas micro - hydro. (24 kw);
- (2) Butwal small - hydro. (1,000 kw);
- (3) Bhairahawa diesel generation (500 kw);
- (4) Krishnanagar micro - hydro. (112 kw); and
- (5) Krishnanagar diesel generation (25 kw), etc.

More lines of electric distribution will therefore be required for villagers in the project area and for the groundwater development and the lift irrigation development to be planned, particularly in the Terai area in future.

2.10.2 Communication

The communication facilities including telephones, telegraph, postal services in the four districts are tabulated as follows.

	Gulmi	Algha-khanchi	Kapilvastu	Rupandehi
Telephone	(a few)	(a few)	50	1,000
Telegraph station	1	1	2	2
Postal service				
- District post office	1	1	1	1
- Sub-post office	11	6	8	6
- Support office	17	18	22	18

Source : Statistical Profile, Development Atlas of Nepal, Aug. 1988.

In the hill area of Gulmi and Arghakhanchi, the micro wave telephone lines were constructed at Tamghas and Sandhikharkha in 1987 by the Japanese grant aid, but only a few telephones in the district offices and officials are connected with line.

In the four district, there is only one airport located at Bairahawa. Flight is connected with Kathmandu, Pokhala, Nepalganji and other places, and about 20,000 passengers are utilizing annually.

2.10.3 Education

The education system in Nepal consists of five years of the primary level from age six through eleven, two years of the lower secondary level and three years of the secondary level. Although the primary level is compulsory and free of charge in principle, the enrollment ratio in national level was 73% in 1983 mainly because of shortage of school facilities and teachers.

Number of schools and enrollment of students in 1976/77, 1980/81 and 1986/87 in each districts are shown on Table 2.10.1, and those in 1986/87 are summarized as below.

District	Primary		Lower secondary		Secondary	
	school	students	school	students	school	students
Gulmi	237	38,112	61	5,178	26	4,632
Arghakhanchi	177	26,793	45	3,344	24	3,258
Kapilvastu	151	30,038	40	3,267	17	2,954
Rupandehi	166	33,820	60	7,872	33	14,314
(Marchawar)	(22)	(6,129)	(4)	(1,271)	(2)	(956)

Source : Statistical Profile, Development Atlas of Nepal, 1988.

It is estimated that the enrollment rate of the primary level in 1987 was more than 90% in the hill districts, but 45% to 60% in the Terai districts. Out of the total number of the students in the primary level, about 30% was girls students except Kapilvastu district, where only 18% was girl students.

Number of teachers in 1976/77, 1980/81 and 1986/87 is shown in Table 2.10.2, and number in 1986/87 is summarized as below.

District	Primary		Lower secondary		Secondary	
	Total	Trained	Total	Trained	Total	Trained
Gulmi	1,057	286	183	66	126	64
Arghakhanchi	697	167	134	38	110	35
Kapilvastu	717	207	121	38	96	39
Rupandehi	940	359	192	101	211	134

Teachers per school and students per teacher in both hill and Terai districts are almost same level as the national level. On the other hand, population per school in the hill districts was lower than the national level, however, that in the Terai was higher than the

national average. This means that the density of school in the hill area is higher than the national level, but that in the Terai area is lower than the national level, as shown below.

Population per school

District	Primary school	Lower secondary school	Secondary school
Gulmi	1,060	4,110	9,640
Arghakhanchi	970	3,800	7,130
Kapilvastu	2,050	7,750	18,230
Rupandehi	2,850	7,870	14,310
Whole country	1,440	4,710	12,440

Students per school

District	Primary school	Lower secondary school	Secondary school
Gulmi	161	85	178
Arghakhanchi	151	74	136
Kapilvastu	199	82	174
Rupandehi	204	100	188
Whole country	152	73	191

Students per teacher

District	Primary school	Lower secondary school	Secondary school
Gulmi	36.1	28.3	36.7
Arghakhanchi	38.3	24.9	29.7
Kapilvastu	41.9	27.1	30.8
Rupandehi	36.0	31.3	29.4
Whole country	34.8	21.6	29.0

There are 6 higher educational institutions (campuses) in the four districts, i.e., one campus in Gulmi district, 1 campus in Kapilvastu district, and four campuses in Rupandehi district as shown in Table 2.10.3. These campuses have the faculties of humanities, social science, management, science, education and agriculture with 2,051 students in total.

According to the field interview in each district, short of physical facilities (buildings including roofing, library, water supply, toilets, equipments, etc.) and trained teachers, irregularly enrollment of students in the class are the main problem in the 4 districts in general. Especially, in the Marchawar area enrollment rate is low due to poor family income.

In Rupandehi district, the female educational programme is assisted by UNICEF, adult educational programme and science education development are under preparation. The main educational development programmes in Arghakhanchi are to allocate 1 education inspection in each Illaka, free charge education in primary level and 30 students in one class.

2.10.4 Health

The public health office in each district supervises hospitals, health posts, health workers and promotes projects and programmes such as family planning and maternity child health project, immunization programme, leprocy and T.B. control, malaria eradication, sanitation, etc. The health facilities, staff and projects in the 4 districts are listed in Table 2.10.4. There are 1 hospital in Gulmi district, 2 hospitals in Kapilvastu district and 3 hospitals in Rupandehi district. In Arghakhanchi district, 1 hospital has already constructed, but no doctor is assigned.

In the Marchawar area, there are 2 health posts but no hospital. When the habitants need to go to the hospital, they will go to the Indian hospital near the border because of hard access to the hospitals in Bairahawa.

According to the field interviews in each district, medical facilities, health posts and their staff are not enough in general.

2.11 Local Development System

2.11.1 Local Development System and Institutions in Nepal

Ministry of Panchayat and Local Development is the lead agency for local and rural development. It was created in 1980 with stress on the integrated district level planning, and on supervision and evaluation. The present organizational structures for local development is as shown in Fig. 2.11.1.

The Integrated Rural Development Board(IRDB) created in 1983 is responsible for all IRD programmes in Nepal, and is chaired by the Minister of MPLD, with representatives from the line ministries and National Planning Commission (NPC). The Board is responsible for determining policies required to achieve the objectives of integrated rural development as well as having some staffing, financing, monitoring, evaluating and planning functions.

Decentralization Act and by-laws have provided for an integrated shape of the district development administration by integrating the District Panchayat, LDO, and the district development agencies of HMG/N. This integrated structure is to facilitate planning and implementation of the development project by the districts. District panchayat is required to formulate periodic and annual district development plans. These plans are then submitted to the District Assembly for final approval. After the approval of District Assembly, these plans are to be incorporated in the national plan.

Budget ceiling and planning guidelines are to be provided to the district by the NPC as well as by the concerned line ministries, and by the district to the Town and Village Panchayats.

District Panchayat is required to constitute different sectoral plan formulation committees in the district to assist the District Panchayat to formulate sectoral plans. The plan formulation committees are as follows:

- Irrigation and Agricultural Committee
- Construction and Maintenance Committee
- Industry, Forest and Soil Conservation Committee
- Health and population Committee
- Education Committee

The plans prepared by the respective plan formulation committees are examined in the Joint Meeting for formulation of the district development plan by making further integration and coordination of all the sectoral plans.

The district development plans are necessary to be formulated with focusing on the following priorities:

- The project which provides direct benefit to the general public and fulfils the minimum requirement.
- The project which assists in increasing the agricultural output.
- The project which may be conducted with local techniques and means.
- The project which help in increasing the productivity and employment.
- The project for which priority is given in the National Plan.

The Act makes provision for the establishment of service centers in each Ilaka to provide an integrated package of support and services to village panchayats and users committees in the area of planning, implementation and review.

2.11.2 Local Administrative Organization

The lowest organization unit of the people is Ward and 9 Wards compose 1 Village. A Ward Chairman and four members are elected by the people of the particular ward.

The Village Assembly is the elective body of a village. The Village Assembly comprises of 47 elected members: 9 wards x 5 elected members plus 1 Pradhan Panch (Village Panchayat Chairman) and 1 Upa Pradhan Panch (Vice Village Panchayat Chairman) plus 6 ex-officious members of local class organizations.

The Village Panchayat is the executive body of the Village Assembly, consisting of 11 elected members (9 representatives of wards, plus 1 Pradhan Panch and 1 Upa Pradhan Panch), and 6 ex-officio members of local class organizations.

The Village Panchayat is responsible for the implementation of the decisions of the Village Assembly and for carrying out certain directives of the District Panchayat.

Each district is divided into 9 Ilakas consisting of 5 - 9 Village Panchayats (see Annex H), and is represented in the District Panchayat by 1 member. The member is elected among the members of the Village Assemblies of the respective Ilaka.

The District Assembly consists of Pradhan Panchas and Upa Pradhan Panchas of all Village Panchayats plus all members of the District Panchayat.

The District Panchayat is the executive body of the District Assembly. The District Panchayat consists of 11 elected members: one each from 9 Ilakas plus Sabbapati and Upa Sabbapati (Chairman and Vice Chairman of the District Panchayat elected by all members of Village Assemblies of the District), and 8 ex-officio members (one each from 6 class organizations and 2 members representing the District at the Rastriya Panchayat).

Generally, there are formed following 6 Class Organizations at Village and District Panchayat levels as a part of the panchayat system:

- Youth organization
- Elders' organization
- Women's organization
- Ex-military men organization