

REPORT
ON
MASTER PLAN STUDY
FOR
HAJJAH PROVINCE INTEGRATED RURAL DEVELOPMENT
IN
THE YEMEN ARAB REPUBLIC

VOLUME ONE — MAIN REPORT

MARCH 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

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國際協力事業団	
受入 期日 55.8.13 84.8.27	3160
登録No. 08165	8/93
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Preface

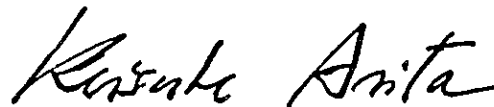
The Government of Yemen Arab Republic requested the cooperation of the Government of Japan in 1976 to conduct a survey on the agricultural development in Hajjah province.

The Japan International Cooperation Agency, JICA, entrusted by the Japanese Government dispatched to Yemen Arab Republic a preliminary survey in March 1977 and in January 1978 dispatched a survey on a topographical map of Hajjah province area 8,000 km² reduced scale a one-to-fifty-thousand. In December 1978, JICA dispatched a master plan study team on Hajjah province integrated rural development headed by Mr. Shizen Inoue of the Agricultural Development Consultants Association for the survey of the whole areas of Hajjah province. And in June 1979 JICA dispatched again a master plan study team continued from the previous survey.

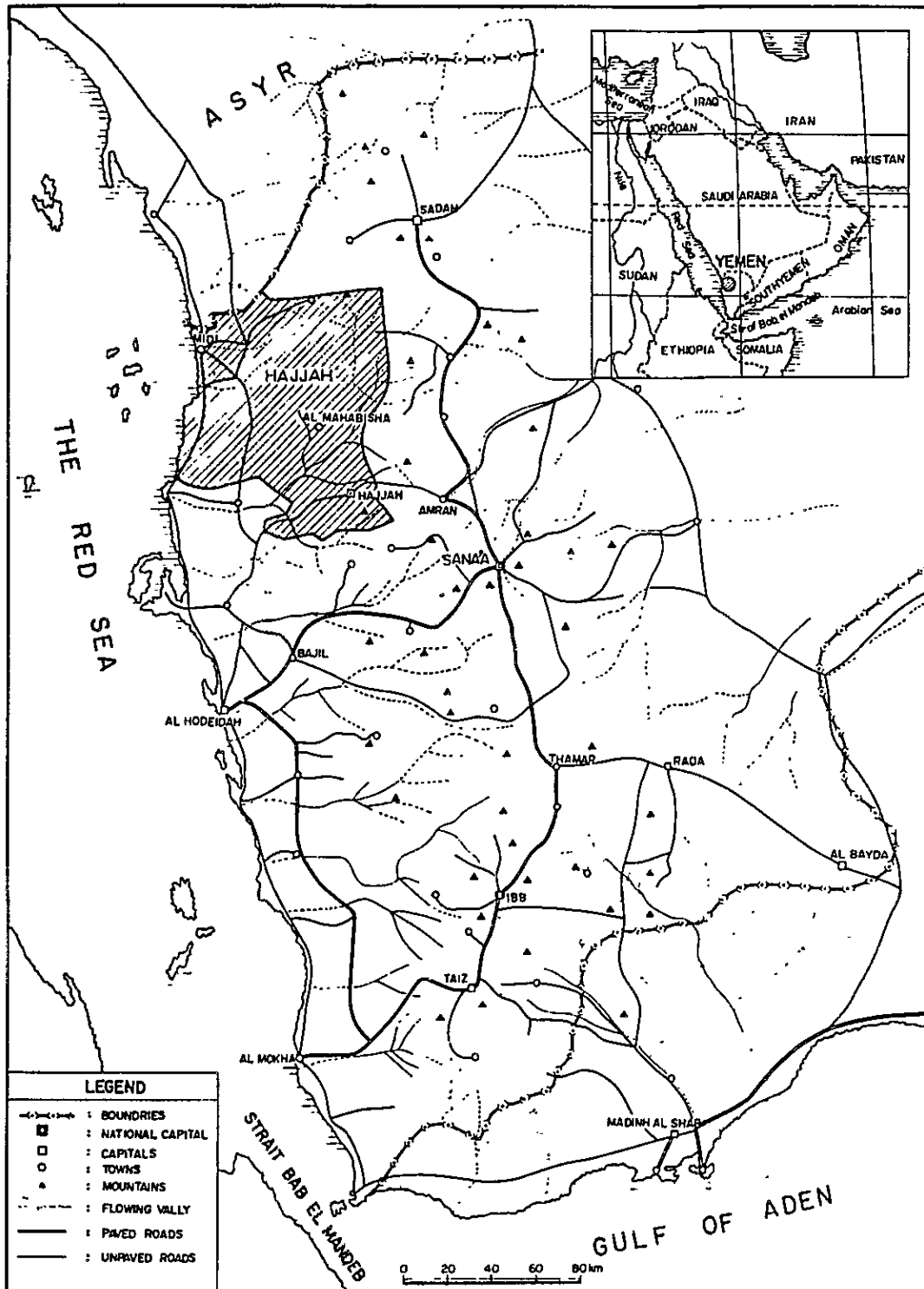
The present report incorporates the results of the master plan study on Hajjah province integrated rural development.

I hope the report will be useful for the Hajjah province development. I wish to express my heartfelt appreciation to the Yemen authorities concerned for their close cooperation extended to the survey team.

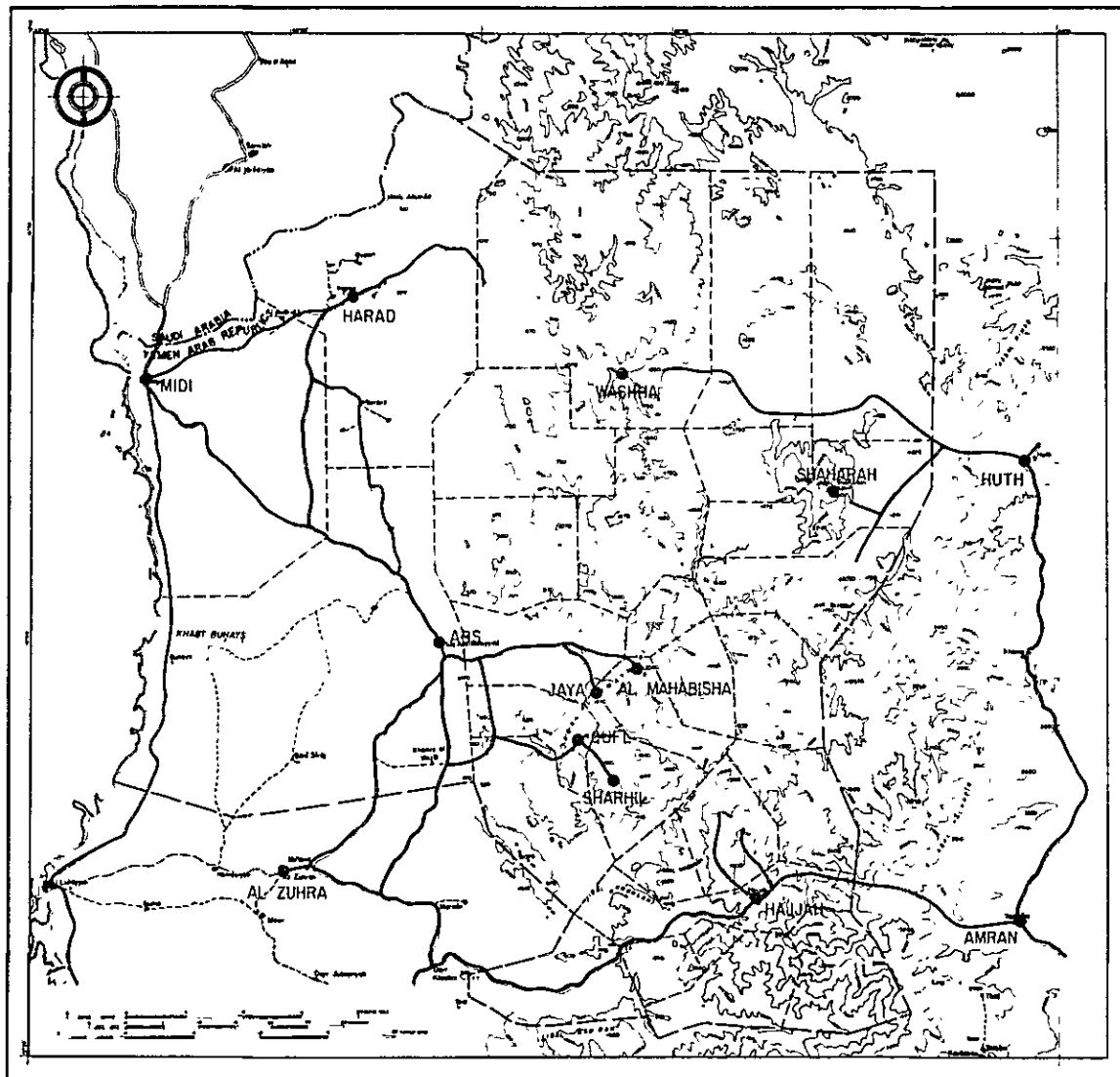
March 1980, Tokyo



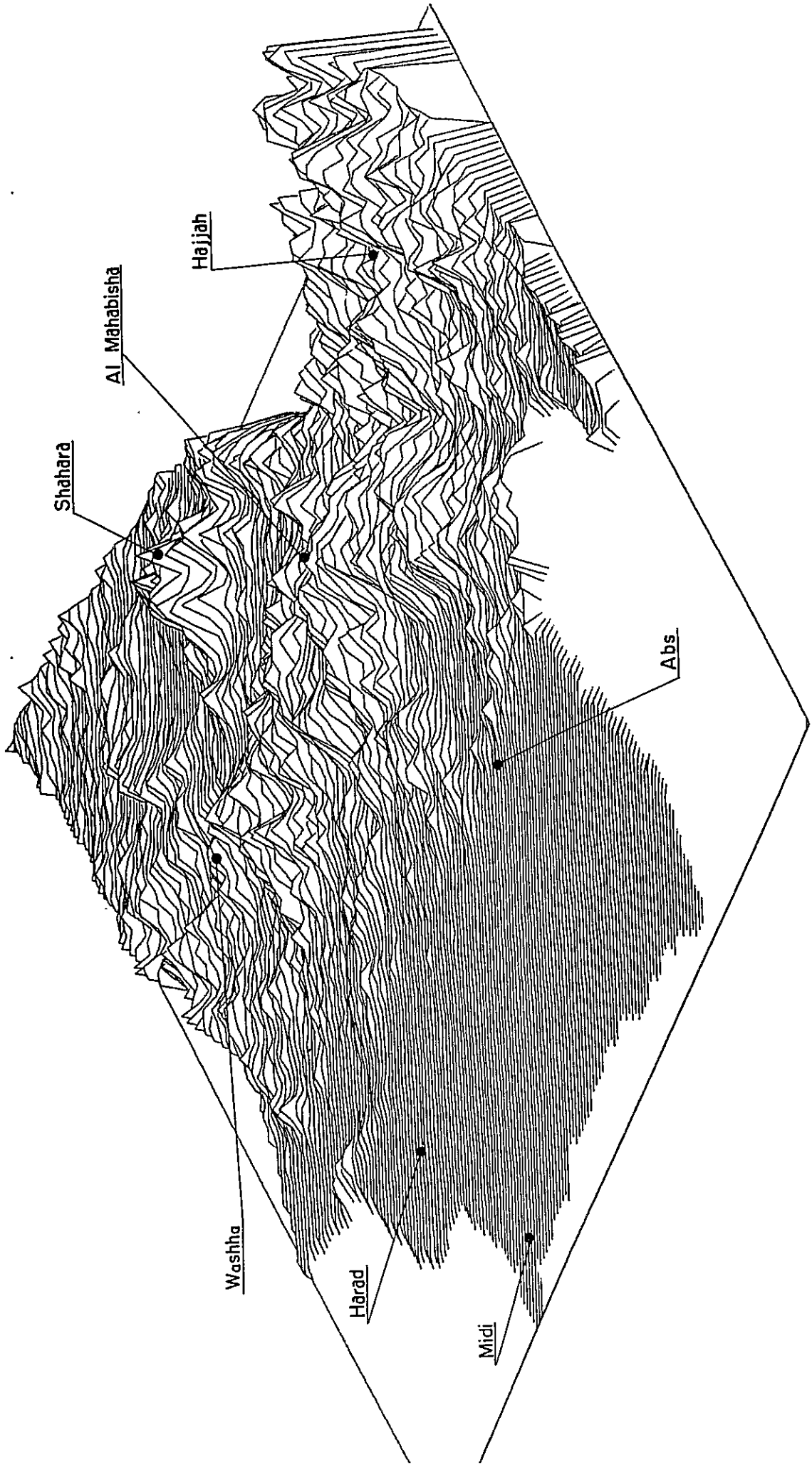
Keisuke Arita
President
Japan International
Cooperation Agency



THE YEMEN ARAB REPUBLIC



HAJJAH PROVINCE



BASIC DATA

AREA	:	200,000 sq.km
POPULATION	:	6.5 million (1976)
rate of growth		2 % (from 1970 to 1976)
density		28 per sq.km
birth rate		46 (per 1,000)
death rate		27 (per 1,000)
GROSS NATIONAL PRODUCT (GNP)	:	US\$1,630 million (1975/76)
per capita		US\$390 (1976/77)
CURRENCY UNIT	:	Yemen Rial (YR) YR 1.00 = 100 Fils
CURRENCY EQUIVALENTS	:	YR 1.00 = US\$0.22 ≅ ¥50 US\$1.00 = YR4.50 ≅ ¥230
FISCAL YEAR	:	July 1 to June 30

WEIGHTS AND MEASURES

(Metric System)

1 millimeter (mm)	=	0.039 inches
1 meter (m)	=	3.28 feet
1 square meter (m ²)	=	10.76 square feet
1 cubic meter (m ³)	=	1.31 cubic yards
1 cubic meter per second (m ³ /sec)	=	35.31 cubic feet per second
1 liter per second (l/sec)	=	0.035 cubic feet per second
1 kilometer (km)	=	0.62 miles
1 square kilometer (km ²)	=	0.386 square miles
1 hectare (ha)	=	2.47 acres
1 kilogram (kg)	=	2.205 pounds
1 metric ton (ton)	=	2,205 pounds

ABBREVIATIONS

YAR	=	Yemen Arab Republic
ACB	=	Agricultural Credit Bank
ACF	=	Agricultural Credit Fund
CARS	=	Central Agricultural Research Station, Taiz
CPO	=	Central Planning Organization
CYDA	=	Confederation of Yemen Development Authorities
LDA/LDB	=	Local Development Authority/Board
SURDP	=	Southern Uplands Rural Development Project
SURDU	=	Southern Uplands Rural Development Unit
TDA	=	Tihama Development Authority
UNDP	=	United Nations Development Programme
JICA	=	Japan International Cooperation Agency
GNP	=	Gross National Product
GDP	=	Gross Domestic Product



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SUMMARY AND CONCLUSIONS

Background

i. Agriculture is the most important production sector in the Yemen Arab Republic (YAR), contributing 50 to 60 % of GDP and employing 70 to 80 % of labour force. However, very limited agricultural resources, especially land and water, are available and the productivity is generally low, resulting in low income level of the farmers. Living condition in the rural areas is also at low level, lacking most of social infrastructures like clean drinking water, electricity, rural access roads, health facilities and elementary education. On the other hand, urban inhabitants are enjoying relatively high incomes, receiving better social services. This disparity between rural and urban areas is the major cause for the recent massive migration of rural labour force into urban areas.

ii. The migration of labour force from rural areas has recently been accelerated by the higher labour wages offered by the neighbouring oil-producing countries. These shifts have resulted in the desolation of the terraced lands in the mountain areas as well as millions of the abandoned farmlands in the Tihama coastal plain, posing the serious problem of weakening the most important economic sector in the country.

iii. Aiming at breaking seclusion of rural regions and stopping outmigration from the rural areas, the Five-Year Development Plan (1975/76-1980/81) which is the first attempt at a comprehensive national development planning in YAR, envisages several integrated rural development projects, major components of which are developing agriculture, making roads, supplying hygienic water and spreading education and health facilities for providing the rural inhabitants with

higher incomes and better living conditions. The integrated rural development in the Hajjah Province is one of the projects thus envisaged in the Five-Year Development Plan. The development of the Hajjah Province, however, has been delayed due to many difficulties involved in planning and implementation which are generally attributable to lack of basic field data and information.

Present Condition of Hajjah Province

iv. The Hajjah Province is located on the north-western part of Yemen, being surrounded by Sadah Province and Saudi Arabia in the north, Sana'a Province in the east. Hodeidah and Al Mahwit Provinces in the south and the Red Sea in the west. The total land area is 9,590 km². The total population is about 397,000. More than 70 % of economically active population are engaged in agricultural sector, and a few percent are nomadic herdsmen. Major towns in the mountain areas are Hajjah, Mabyan, Al Mahabisha and Shahara, and those in the Tihama lowland area are Abs, Harad and Midi. About 4 % of population are living in these towns. The rest (96 %) lives in small settlement of less than 1,000 inhabitants. The population density is 41 persons per km². Average size of household is 5.1 persons.

v. The Hajjah Province is not richly endowed with agricultural resources. Definite limits to the agricultural development are set by the low and erratic rainfall and limited arable lands. In areas where rainfall and irrigation water are adequate for crop production, available arable land is already in full use. In areas where unused arable land exists, additional water resources are hardly available for development.

vi. Out of a total land area of 9,590 km², only 840 km² are regularly cultivated. An additional 570 km² of marginal

cropland is cultivated only during high rainfall years. Woody vegetation or shrub growth covers 1,480 km². About 6,700 km² are rocky mountains and semi-arid range lands with sparse vegetation. About 88 % (1,250 km²) of the croplands depends solely on low and erratic rainfall, 9 % (120 km²) is supplied with spate irrigation by seasonal flood flow, and only 3 % (40 km²) is put under regular irrigation by wells.

vii. The main rainfed crops are sorghum and millet in the lowland, and wheat, barley and sorghum in the mountains. Maize, cotton and tobacco are grown on the irrigated land in the lowland; coffee and qut are main crops of relatively high rainfall areas in the mountains. Vegetables and fruits trees are cultivated on a limited scale in the irrigated land. Farming method is still very primitive. Seeds are provided locally and is of inferior quality. Fertilizers are used only in the irrigated land. No pest and insect control measures are applied. Consequently, the productivity in agriculture remains at low level, falling behind the national average.

viii. There is no extension service in the Province. No agricultural office is established. Agricultural research programme has not been initiated yet. A branch office of the Agricultural Credit Bank was opened at Abs only in March 1979 and has made very little achievement. There is no institutional support to the farmers for farm input supply. Cereal grains are stored in the villages and are subject to damage by rodents and insects. Surplus grains and other marketable products are transported by donkey or camel to the nearest local market.

ix. Apart from the main secondary roads linking Hajjah Province with Basil, Amran and Hajjah (under construction), the road network is very poor. Many villages have no

connection to the main roads and the existing roads are rough and hazardous. The farmers in the Hajjah Province are generally isolated from big markets like Sana'a and Hodeidah due to the lack of adequate road network. Safe drinking water is very scarce in the Province and only a few major towns have piped water. People get their drinking water from open wells and cisterns which are filled during the rainy season. Water quality is poor and incidence of water-borne diseases are high. Women and children are daily engaged in transportation of water from wells or cisterns to their home. It is very laborious.

x. The Hajjah Province is generally far behind the modernization. Communication network is very poor. Only local radio stations have recently been established on Hajjah and Al Mahabisha. No telecommunication services exist in the Province. School facilities are generally poor and number of pupils enrolled in the primary schools is quite limited. Health conditions are also still very poor. This is indicated by the high death rate of some 30 per thousand inhabitants and the high infant mortality which is reported around 20 percent. The extreme shortage of modern health care is one of the main reasons for the low standard of public health in the Province. No electricity services are available in most of the villages. There are very limited number of public administration offices and places for public use.

Basic Concept for Development

xi. The development of the Hajjah Province should be centering around the development of agriculture on the following grounds. First, the large majority of the rural inhabitants in the Hajjah Province has long been engaged in agriculture and they have acquired certain level of farming techniques to exploit their farmland and, therefore,

possess grounds for further development of agriculture. Secondly, it is quite difficult to find the industry with higher development potential than agriculture in the Province. The prospect of the development of the Province will heavily rely on the agricultural development which will encompass crop and livestock production, irrigation, afforestation, fishery and agro-based industries as integrated components.

xii. The agricultural development in the Province should be promoted on the basis of i) crop diversification, ii) use of better farm inputs, iii) improvement of irrigation practices, iv) agricultural mechanization and v) better marketing arrangement. In other words, the present subsistence agriculture should be replaced with the modern agriculture which would realize higher productivity and guarantee the higher income to the farmers.

xiii. The Province is in no sense well equipped with rural infrastructures and social services. Although considerable progress has been made in some of these areas, especially in securing food supplies and reducing underemployment, the Province is still far from a satisfactory situation. Elementary education, health facilities, clean drinking water, electricity and rural access roads have yet to be provided to the bulk of the population. The rural inhabitants have more serious concerns for the immediate improvement of their living environment than the long-range agricultural development. In fact, the weakness of such "rural infrastructures and social services" itself has become to some extent an obstacle to the effective agricultural development.

xiv. Considering all these, the ultimate objectives of integrated rural development will be:

- a. to increase agricultural production and stimulate economic growth, and
- b. to improve the condition of rural life.

Identification of Possible Projects

xv. The possible projects, which have been identified on the basis of the studies on each sector, are listed as follows:

- a. Rural water supplies: Installation of 25 villages water supply system
- b. Rural road network:
 - i) Construction and up-grading of 255 km of secondary roads
 - ii) Construction of a bridge over the Wadi Mawr
 - iii) Construction and up-grading of 1,700 km of feeder roads.
- c. Agricultural development
 - i) Agricultural research for promotion of midland agriculture through establishment of a comprehensive agricultural research station.
 - ii) Promotion of water-saving irrigation techniques and farm mechanization in lowland through establishment of a research and training center for irrigation and mechanization.
 - iii) Agricultural census and statistics
 - iv) Detailed physical resources survey
 - v) Collection of meteorological and hydrological records through establishment of observation network

- vi) Institutional services for agricultural extension and farm inputs supply
 - vii) Agricultural credit services
 - viii) Multiplication and distribution of pure-line seeds of recommendable varieties
 - ix) Demonstration of small scale pump irrigation and horticulture techniques
 - x) Promotion of livestock improvement through veterinary services, improvement of animal feeds and breeding
- d. Irrigation improvement
- i) Hydrological observation of wadi-flow
 - ii) Field trials on crop-water requirement and irrigation method for making the best possible use of the limited water
 - iii) Construction of irrigation facilities covering a total area of 10,000 ha; 8,500 ha in lowland, 500 ha at Al Mahabisha and 1,000 ha along wadi courses.
- e. Afforestation:
- i) Multiplication and distribution of seedlings of recommendable tree species through operation of a forest nursery and extension services
 - ii. Pilot afforestation schemes for effective demonstration
- f. Improvement of other rural infrastructures and social services:
- i) Expansion of educational facilities
 - ii) Improvement of public health facilities

- iii) Electricity supplies in combination of pump operation for rural water supplies
- iv) Construction of telecommunication network connecting in between major towns.

Stagewise Development

xvi. Immediate execution of all these possible projects would be very difficult due to lack of basic data for project planning and implementation, underdeveloped organization coupled with shortage of skilled manpower and limited availability of investment funds. However, early implementation would be of rather serious requirement, even in part, in order to stop the continuous decline in economic growth of the Hajjah Province. Considering all these, it is proposed that a small scale integrated project be established initially, which will be gradually expanded as more trials become known, and more experience is obtained through implementation of the initial integrated project.

xvii. It is also proposed that the initial integrated project be formulated in a particular area where physical and economic environment is relatively favourable compared with other areas of the Province and all the development efforts be concentrated to this priority area. Development of other areas will be made progress successively on the basis of the achievement and results of the development carried out in the priority area.

Organization and Management

xviii. The integrated rural development of the Hajjah Province will essentially involve almost all of the sectors which are closely connected each other. Each sector will have to give the greatest contribution to the overall

development of the Hajjah Province; paying due attention to the inter-relationship among relevant sectors. Since all the sectors should be integrated in the development of the Hajjah Province, a comprehensive implementation body will have to be newly established within the Province. The comprehensive implementation body will have to carry out all the necessary tasks for integrated rural development, including physical resources survey, planning and design, project preparation, construction, research, extension services and likes.

Priority Area and Development Plan

xix. The proposed priority area is located within the catchment area of the Wadi Qur, occupying a total area of about 62,000 ha. The major towns in the proposed priority area are Abs and Al Mahabisha. This area has most of typical environments identified within the whole Province in physical-economic-social context. The development of this area will, therefore, be a model project to be taken for a pattern of development in the Province.

xx. The top priority projects which would be integrated and implemented in the priority area, would comprise:

- a. Rural water supplies: Installation of 4 village water supply systems
- b. Rural road network:
 - i) Construction and up-grading of secondary roads; Abs - Al Mahabisha (35 km) and Al Mahabisha - Hajjah (45 km)
 - ii) Construction of a bridge over the Wadi Mawr
 - iii) Construction and up-grading of 290 km of feeder roads

- c. Agricultural development:
 - i) Collection of meteorological and hydrological records through establishment of observation network
 - ii) Establishment of agricultural research station
 - iii) Establishment of research and training center for irrigation and mechanization
- d. Irrigation improvement: Construction of pilot irrigation projects; Abs area (1,300 ha), Jaya area (300 ha), Sharhil area (100 ha) and Tahannen area (100 ha)
- e. Afforestation
 - i) Establishment of a forest nursery
 - ii) Pilot afforestation schemes for demonstration
- f. Improvement of other rural infrastructures and social services:
 - i) Improvement of health facilities; construction and up-grading of 3 branch hospitals (Abs, Sharhil, Al Mahabisha) as well as main hospital at Hajjah, and new construction of primary health care units.
 - ii) Electricity supplies in combination of pump operation for rural water supplies
- g. Organization and management:
 - i) Establishment of a comprehensive implementation body (Project Office)
 - ii) Recruitment and training of local staff
 - iii) Expatriate expert services and training of counterpart staff

xxi. The total costs required for implementation of these priority projects are estimated around YR 252 million. It

should be noted that the cost estimates as well as the development plan itself are of very preliminary nature and be modified on the basis of further field investigation and studies. It is proposed that the Project Office should be established as early as possible for making necessary arrangement for further actions.

I INTRODUCTION

1.01 In response to the request from the Yemen Government, the Government of Japan despatched a preliminary survey team in March, 1977 for agricultural development in the Yemen Arab Republic. During the period of preliminary survey, the team was requested in the meeting with the Ministry of Agriculture to study the development possibilities of the Hajjah Province. After preliminary investigation, the team pointed out:

- a. the Province might have high potential for agricultural development, especially in the Tihama region,
- b. airphoto interpretation and remote sensing techniques would have to be fully utilized for the study because of the present poor accessibility in the Province, and
- c. topographic maps would be indispensable for the further study.

1.02 In January, 1978, the Government of Japan despatched another survey team by request from the Yemen Government for the preparation of the topographic maps scaled 1/50,000 for whole area of the Hajjah Province. The topographic maps were submitted to the Central Planning Organization in April, 1978.

1.03 Following these activities, the Yemen Government requested again the Government of Japan to supply the experts concerning the formulation of a master plan for the integrated rural development in the Hajjah Province. The Government of Japan despatched the scope of works mission in August, 1978, and the "Scope of Works" for the Hajjah Province integrated rural development master plan study was prepared in agreement with the Yemen Government (refer to Annex I,

"SCOPE OF WORKS ON MASTER PLAN STUDY FOR HAJJAH PROVINCE INTEGRATED RURAL DEVELOPMENT").

1.04 The master plan study comprises two different stages. The main objectives of each stage of the study are:

a. First Stage (Dec. 1978 - Mar. 1979)

- Preliminary discussion with government officials at different level concerning the development strategy and master plan study
- Data collection and preliminary investigation, especially on socio-economic situations of the Province
- Preliminary aerial photo interpretation and assessment of applicability of remote sensing techniques
- Establishment of basic framework for the master plan
- Preparation of general guideline for second stage study.

b. Second Stage (Apr. 1979 - Mar. 1980)

- Detailed investigation and study in accordance with the results of first stage studies
- Assessment of capable resources and study on limiting factors for development
- Study on development strategies and identification of possible projects
- Selection and delineation of priority areas for stagewise development
- Preparation of stagewise investment programme
- Formulation of an integrated rural development master plan

1.05 In December, 1978, the first master plan study team was despatched by the Government of Japan through the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation programme of the Government, to carry out the first stage investigation and study. The team comprising 5 members as listed in Annex II stayed in Yemen for the period of 41 days from Dec. 20, 1978 to Jan. 29, 1979. The results of the first stage investigation were summarized in the field note prepared by the first master plan study team and submitted to the Ministry of Agriculture on January 27, 1979.

1.06 The second master plan study team was despatched by the Government of Japan through JICA for the execution of second and final field investigation. The team comprised 13 engineers and experts as also listed in Annex II and stayed in Yemen for the period of 48 days from June 13 to July 30, 1979.

1.07 The Yemen Government provided the team with the following government officers as the counterpart personnel:

<u>Central Planning Organization</u>	Mr. Yahya Al Bruk, Coordinator
	Mr. Abdel Wahab Hyder, Regional Economist
<u>Ministry of Agriculture</u>	Mr. Mohamed Sharaf, Agronomist
	Mr. Mutahar Al-Shamy, Irrigation Engineer
	Mr. Hussein Al-Safargal, Agricultural Economist
<u>Ministry of Public Works</u>	Mr. Abdellah Abdel Malek, Hydrogeologist
<u>Yemen Mineral and Petroleum Corporation</u>	Mr. Abdallah Al-Thari, Survey Engineer

1.08 The physical conditions of the Hajjah Province were examined mainly through photo interpretation and Landsat remote sensing analysis. An extensive field visit to the Hajjah Province was also made with the assistance of counterpart personnel and additional hydrological, geological, topographical and soil data were obtained to make more accurate analysis on physical resources.

1.09 The basic data for the socio-economic study were mainly derived from the government publications and the various reports of on-going projects. These documents the team collected, however, are far from adequate for the requirement of master plan study. There is no agricultural census which gives a dependable base to formulate development plans. The team carried out, therefore, the farm economy survey in the sampled areas of Mabyan, Abs and Al Mahabisha. About 150 farmers were interviewed.

1.10 The field data of various on-going projects concerning the integrated rural development were provided by FAO/World Bank officers and verbal explications were also given to the team. These are very valuable and highly appreciated. The team was also given very valuable information and suggestions from the Chinese research farm near Huth (El-Bahana), USAID Horticultural Project and German research farm at Sana'a.

1.11 In order to make clear the government policy for rural development in the Hajjah Province and to prepare the development plans acceptable to the Yemeni people, the team had repeated discussions with Government officials and their expatriate advisors in the ministries and organizations concerned with the study. The discussions were always successful and fruitful. The officers and/or advisors interviewed by the team are listed in Annex III.

1.12 This report is compiled on the basis of the results of these field activities. The aim of the report is to provide the basis for an understanding of physical resources, development potential and constraints and to indicate the necessary, possible projects for further actions as a reference work for government agencies and institutions concerned with development of the Hajjah Province. The report is in three (3) parts; the Main Report (Volume I), the Study Report (Volume II) and Arabic translation of the Main Report (Volume III). The Main Report contains the results of field investigations and the principal conclusions of studies. The Main Report is translated into Arabic as given in Volume III. Detailed analyses are presented in the Study Report.

II BACKGROUND

(1) Physical Condition

2.01 The Yemen Arab Republic (YAR) lies between latitudes 12°40' and 17°26' north, and longitudes 42°30' and 46°31' east, and located in the southwestern corner of the Arabian Peninsula. The country is bordered by Saudi Arabia in the north, the Peoples' Democratic Republic of Yemen in the south and southeast, and the Red Sea in the west. East of the Yemen is the great Arabian desert, the Yemen quarter of Rub-al Khali.

2.02 Covering an area of approximately 200,000 km², Yemen is conveniently divided into four (4) geographic regions based on the particular physiographic structure; Tihama coastal lowlands, foothills and middle heights of the western slopes, central highlands and eastern semi-desert plateau.

- a. Tihama coastal lowlands: This 20,000 km² region is a 30 to 60 km wide area paralleling the Red Sea and the foothills of the central mountain range. The elevation ranges from sea level to 200 m at the foothills. The annual rainfall ranges between 50 mm to 300 mm, with adequate rainfall for millet and other drought resistant crops. The region has 70,000 ha under spate irrigation and 25,000 ha under well irrigation. The area is thought to have at least 200,000 ha of land that is potentially irrigable from improved diversion of wadi flows and also through further exploitation of groundwater. The region is intersected by seven (7) major wide shallow wadis, which are from north to south, Wadi Mawr, Wadi Sordud, Wadi Siham, Wadi Rima, Wadi Zabid, Wadi Risyan and Wadi Mawza. The mean monthly

temperature does not vary considerably. The relative humidity is high and dew formation along the coastal strip is common. Winds generally blow from southwest and northwest with high velocities and causes sand-movement in the coastal belt or soil erosion in the cultivated fields of inner lands.

- b. Foothills and middle heights: This 55,000 km² region lies between the Tihama and central highlands within the elevation range of 200 m to 1,500 m above sea level. The topography is very rugged, cut by deep wadis running through narrow gorges with steep slopes. Most of these wadis drain to the west on the Tihama, while the wadis to the south and east of Taiz drain to the south into the Gulf of Aden. All the cultivated land on the slopes is terraced. The rainfall is over 400 mm and concentrated around August and September. The amount of rainfall increases as the elevation increases up to an average annual of 800 mm at an elevation of about 2,300 m. The temperature is moderate all the year round. The relative humidity is lower in winter and higher in the rainy months of spring and summer.
- c. Central highlands: This 35,000 km² region includes the central mountain range exceeding 1,500 m elevation above sea level which extends from Ibb in the south into Saudi Arabia in the north. The area of the highest land is found between Ibb and Sana'a where mountain peaks frequently exceed 3,000 m. The highest of them is Nabi Shnayb (3,760 m). The topography to the west is very rugged. The eastern slopes are gentle and terminate at the high plateau area above 2,000 m

elevation. Annual rainfall is said to be over 1,000 mm on the rain-exposed slopes of the most southern end (Ibb district). It decreases at first rapidly then gradually to the north. The mean annual rainfall is about 300 mm in Sana'a and 200 mm near Saudi Arabian border in the north. The temperature is moderate in summer, but frequently becomes around freezing point during winter. The relative humidity is low.

- d. Eastern semi-desert plateau: The land comprising 90,000 km² slopes gently eastward and forms rolling country dropping to an elevation of 1,000 m where it borders the Empty Quarter Rub-al Khali. The plateau is the largest region but poorest in agricultural potential. Temperatures are high and rainfall is only about 100 mm to 200 mm which form desert conditions in the area.

2.03 Yemen is located in the northern stretches of the tropical climatic zone with two rainfall seasons, one in April-May, the other in July-September, and a long dry, almost rainless period, of four to five months during the late autumn and winter. Rain bearing winds blow from south-east and southwest. Amount of annual rainfall depends mainly on altitude. The rainfall steadily decreases from the south to north.

(2) General Economic Situations

Economic structure and its growth

2.04 The Gross Domestic Products (GDP) has recorded steady growth during 1969/70-1975/76 period with an average annual growth rate of 8.5 % in real terms. The GDP attained YR5,181 million in 1975/76 fiscal year at current prices. The GDP per capita, however, remained as low as some YR1,150

(US\$256), indicating low productivity per worker in the country.

2.05 Agricultural sector is dominating in the national economy. The value added of this sector recorded YR2,305 million in the 1975/76 fiscal year, contributing some 44 % of the GDP. Trade sector takes second place with YR1,220 million or 23.5 % of the total GDP. Services sector follows with YR835 million or 16.1 % of GDP. The GDP at current prices during the period of 1969/70-1975/76 is as shown in Table 2.1.

2.06 The significance of the agricultural sector has, however, been weakening gradually in these years. Its share in GDP dropped from 53 % in the 1969/70 fiscal year to 44 % in the 1975/76 fiscal year. The average growth rate during this period was 7.8 % in real terms. Trade sector and services sectors grew at an average annual growth rate of 8.0 % and 8.3 % respectively during this period, which were higher than that of the agricultural sector. In terms of the number of workers employed, about 73 % were in agricultural sector in 1975, being followed by trade sector employing some 7 % of the total labour force. Though the number has been decreasing, the large majority of the people in YAR are still engaged in agriculture.

Government revenues and expenditures

2.07 Until the 1975/76 fiscal year, the Government was unable to cover its annual expenditures from domestic revenue due mainly to the narrow tax base. However, the Government has made strenuous efforts to improve this budgetary situation by raising additional revenue and keeping a strict control over annual expenditure. As a result, it succeeded gradually in eliminating the current deficit in achieving significant current surpluses as shown below:

(Unit: ×10 ⁶ YRs)			
<u>Description</u>	<u>1970/71</u>	<u>1975/76</u>	<u>1976/77</u>
a. Current Revenues	97	565	1,293
Import Duties	(53)	(393)	(929)
Others	(44)	(172)	(364)
b. Current Expenditures	170	604	841
c. Current Deficit/Surplus	-73	-39	+452
d. Development Expenditures	83	340	463
e. Foreign Assistance, Net	119	609	606

2.08 The structure of the government revenue is dominated by import duties which in the 1976/77 fiscal year accounted for some 72 % of total revenue. Other indirect taxes contributed 8 % and direct taxes on incomes and profits represented only 3 % of the total. During the past years, generous foreign aid has helped the Government to finance the development projects and programme. Although substantial foreign aid is likely to continue in the foreseeable future, it is highly desirable to raise sufficient domestic revenue by improving the collection of existing taxes.

Foreign trade

2.09 Total exports amounted to about YR50.5 million in the 1976/77 fiscal year. Agricultural commodities played the leading role, accounting for some 97 % of the total. Most of the commodities were exported as raw materials. The major agricultural raw materials for export consist of cotton, coffee and hides and skins. The total exports doubled during the 1971/72 fiscal year through the 1976/77 in current prices with an average annual growth rate of 14.9 %. However, the figure is much lower than that for imports. Commodity composition of recorded exports during the period of 1971/72-1976/77 is as shown in Table 2.2.

2.10 Total imports have been increasing steadily and very sharply. It recorded YR3,087.5 million in the 1976/77 fiscal year with an average annual growth rate of 50 % or some 650 % increase compared with the 1971/72 fiscal year. The major thrust of this upsurge is attributable to the growing domestic demand for consumption goods due mainly to the increasing private remittances from abroad and to the strong demand for capital formation goods. Major import components are foodstuffs, machinery and equipment and manufactured consumer goods, out of which foodstuffs are dominating, accounting for more than 40 % of the total. Commodity composition of private imports during the period of 1971/72-1976/77 is as shown in Table 2.3

2.11 Due to the striking imbalance between exports and imports, a deficit in the trade balance has always recorded. The discrepancy has further been widening with sharp increase in imports and relatively slow increase in exports.

Private remittances from abroad

2.12 Historically, some Yemeni workers went abroad, earned wages and sent some portion of their earnings back home. In recent years, from 1974 onwards in particular, the number of Yemeni labour force working abroad has risen sharply, more than 90 % of which are employed in the neighbouring Arab oil-producing countries, mostly in Saudi Arabia. Though no reliable data are available for the number of these migrant workers, it is estimated that the number lies in the range of 1.2 to 1.5 million.

2.13 Total amount of the remittances sent from abroad by these Yemeni workers recorded sharp increase in recent years. It grew about eight times attaining more than

YR4,900 million^{/1} in the 1977/78 fiscal year from YR504 million^{/1} in the 1973/74 fiscal year. Accordingly, its ratio to GDP has risen sharply from 15.5 % in the 1973/74 fiscal year to more than 50 % in the 1977/78 fiscal year. Put another way, private remittance was as big as YR800 on a per capita basis in the 1976/77 fiscal year. It makes up for a huge trade balance deficit and thus plays a key role for the improvement of the balance of payments of YAR.

(3) Institutional Background

2.14 The country is administratively divided into ten (10) provinces, namely Sana'a, Hodeidah, Taiz, Ibb, Sadah, Hajjah, Dhamar, Al Beidha, Al Mahwit and Marib. Each province is further subdivided into Quada's, Nahiya's, Ozlah's and villages.

2.15 Modern administration in YAR has a relatively short history of less than 20 years, beginning in 1962 with Revolution which established the Republic. Following the Revolution, much efforts has been made to strengthen the governmental administration. However, the public administration including collection of tax, mediation of the troubles between villages and among villagers and execution of public works can actually be operative through the support of the traditional tribal system continuing from the Imam era.

Central government

2.16 The Prime Minister of the Government is responsible for the public administration of the country under the President, the Chief of the State. Under him, 14 ministries

^{/1} These figures are underestimated, if these remittances which are not officially registered are taken into consideration.

are organized for engaging in practical administrative affairs, including Ministry of Agriculture, Ministry of Public Works, Ministry of Communication, Ministry of Education and Ministry of Health, as shown in Fig. 2.1. For efficient and effective execution of development planning, Central Planning Organization (CPO) was established in 1972. CPO is vested an important power of authorizing the disbursement of funds on individual projects, playing the leading role in the national development planning.

2.17 With short history of development, the public administration remains rather inoperative at present and much needs to be done in order to strengthen the absorptive capacity of the public administration. The major problems are as follows:

- a. Critical shortage of qualified and trained personnel with 20 % of the total number of approved positions remaining vacant and as much as one-half of the approved positions remaining vacant in the technical departments.
- b. Ambiguities of the definition of the responsibilities and authorities of the departments created in a short period of time.

Local administrative organization

2.18 The history of the local administration is rather short and it has not fully filled its function. There exists ambiguities in the relationships between the central and local administration. In particular, there is no clear definition for the responsibilities and authorities of the provincial governor. Though the governor is held responsible for the police or traffic control, for instance, he has no administrative supervision over these departments. His financial responsibilities are also ill-defined. At the

Quada and Nahiya level, administrative officers and a judge are despatched from the Central Government.

Agricultural institutions

2.19 Almost all the institutions to serve agriculture are just at their early stages. Although noteworthy progress has been under way to strengthen the institutions, much remains to be done before all of the agriculture is adequately reached by essential services. The branch offices and the operations of the institutions are limited in only a part of the country. Only one agricultural engineer is, for example, available for nearly 20,000 rural households and one extension worker for 6,000 households. Branch offices of Agricultural Credit Bank (ACB) are not yet established in most of the provinces.

Local Development Association (LDA) and Confederation of Yemeni Development Associations (CYDA)

2.20 LDAs were established according to a law issued in 1963, i.e., one year after the Revolution, principal objective of which is to encourage local self-help based on the strong family and tribal ties rather than relying on initiatives and programme launched by the Central Government. As of 1977, some 150 LDAs are in operation, most of them concentrating in the provinces of Sana'a, Taiz, Ibb and Hajjah.

2.21 Each LDA is managed by an administrative committee which is democratically elected by the association members. At the province level, Coordinating Councils have been established. Although Governor presides over the Council, his position is rather honorary and administrative responsibilities are delegated to the secretary general of the Council. At the national level, the LDAs are supervised by the Ministry of Social Affairs and supported by CYDA which was established in 1973 for efficient coordination between

LDAs and the governmental institutions, operating under the direct supervision of the President of the Republic.

2.22 The scope of the activities undertaken by LDAs includes the construction of rural access roads, water supply systems, schools, health facilities and electrification schemes. Individual projects identified by the individual LDAs are submitted to the Coordinating Council for consultation. They will then be sent to the Central Government for approval. After examination by the CPO, the Ministry of Social Affairs and other relevant government agencies, the approved project will be implemented by the LDA concerned. Upon completion of the project, the LDA concerned usually takes responsibility for maintenance of the facilities.

2.23 These projects undertaken by the LDAs are usually financed from three (3) major sources: The Central Government, the LDA concerned and voluntary contributions of the association members. The Central Government earmarks 2.5 percent of custom duties for these projects. These finances together with special budget allocations and some foreign aid are channeled through CYDA. Three quarters of the zaqat tax is allocated for the LDAs which provides the major financial resources of the LDAs. LDA members often make contributions to these projects mostly in kind, often in the form of labour.

2.24 Since the establishment in 1963, the LDAs has attained remarkable achievements in the rural development, with estimated accomplishments of over 5,000 km of rural access roads, some 850 water supply projects and nearly 600 schools. LDAs are facing, however, serious constraints on which the success of the implementation of ongoing and future development projects of LDAs depends. Major factors of them are as follows:

- a. Severe shortage of qualified personnel for planning, administration and supervision of implementation.
- b. Inadequacy of financial resources to cover the costs of rapidly expanding development projects.
- c. Insufficient coordination between LDAs, CYDA and various relevant government institutions.

2.25 Despite these constraints, in the longer run, they could play a crucial role in agricultural development and in strengthening the economic viability of rural area through the following activities:

- a. to set up agricultural cooperations.
- b. to disseminate modern production techniques.
- c. to improve marketing organization and arrangements.
- d. to establish local credit associations with a view to collecting savings in the rural communities and making funds available for farmers.

(4) Present Condition of Rural Areas

Socio-economic situations

2.26 The country has a total resident population of some 4.5 million. The population of the town and villages with more than 2,000 inhabitants occupies about 11 % of the total resident population. The rest or some 90 % of the total is living in the rural areas. Agriculture plays dominant role in the economy of the rural area, employing some 80 % of the resident labour force. Other economic activities in rural areas, which include local crafts, stone quarrying and trading, are still primitive.

2.27 Present conditions of the rural areas are characterized by a) low income level and b) low standards of living,

with poor infrastructural facilities as well as meager social services. Although no precise records are obtainable, incomes of the rural inhabitants are much lower than those of the people living in the urban areas. This is attributable to the low productivity of the agricultural sector which is the mainstay of the rural economy. The rural areas have also been left behind in the modernization of living conditions, lacking safe drinking water, rural road access, health facilities, etc.

2.28 The outmigration of the labour from rural areas has recently been accelerated by the higher earning opportunities both in the urban areas and the neighbouring oil-producing countries. The resultant imbalance in supply-demand condition of labour in rural areas has brought about sharp increase in rural wages. The most immediate effects of the emigration of labour from rural areas and the resulting wage increases have been as in the following:

- a. higher production costs leading to a reduction in area planted for low-value crops, mainly, cereals, and rapid abandonment of marginal lands
- b. intensification of land use, where water resources are available, and substitution of high-value crops for low-value crops
- c. partial mechanization, mainly for labourious ploughing
- d. pressures on the landowners to alter crop sharing arrangements in favour of the tenants
- e. greater use of women and children in farm operations
- f. higher real incomes in rural areas and greater consumption of expensive commodities

- g. cost escalation of development projects requiring the employment of rural labour.

Present agriculture

2.29 The country is not richly endowed in agricultural resources. Out of a total land area of 20 million ha, only 1.5 million ha are regularly cultivated. In addition, 2 million ha of marginal agricultural land is cropped only during high rainfall years. Woody vegetation or shrub area covers 1.6 million ha. Mountainous and semi-arid to arid range lands account for the rest of about 15 million ha. Land use of the country during the 1976/77 fiscal year is shown in Table 2.4.

2.30 Even with the limited resources at their disposal, especially water, the farmers have achieved a noteworthy degree of agricultural efficiency within the confines of traditional techniques. Agriculture in midlands and highlands are characterized by the terraced farm lands. Millions of terraces have been constructed on the mountain slopes to provide a level area and to collect runoff water through the centuries, which now produce much of the food-grain products of the country. Irrigation also has a long history. Smaller dams are being used in wadi agriculture to divert flood flows into farm lands. Shallow wells, perennial springs and diverted perennial stream flows are other traditional forms of irrigation in the country. Agriculture, however, is still largely dependent on rainfall. About 84 % of the total cultivated land or 1.3 million ha are solely dependent on rainfall, 8 % or 120,000 ha is supplied with irrigation water by spate flood flow, and only 8 % or 110,000 ha is supplied with regular irrigation either by perennial stream, spring flows or wells. Cultivation area classified by type of irrigation and by province is as shown in Table 2.5.

2.31 Crops represent about 75 % of the production value of agriculture, about 20 % is from livestock, 4 % from forestry and 1 % from fisheries. Foodgrains consisting of sorghum, millet, wheat and barley account for the major portion of the crop production. Historically, about 95 % of all crop acreage was planted to these cereals. In recent years, diversification of cropping has been encouraged and this acreage has been reduced to about 90 % of all planted land.

2.32 Despite this predominance of grain crops, the varied ecological zones of the country permit the growing of a wide range of crops. In the highland regions, potatoes, grapes, deciduous fruits and various legumes are successfully grown. In the southern middle heights, sorghum, millet, maize and barley are the major crops. In the Tihama plain, millet and sorghum are the principal crops. Cotton, tobacco and sesame can also be planted with irrigation. Melons, edible beans, tomatoes and onions are also suitable crops in the plain. In the highlands, qut growing has expanded rapidly in recent years, reflecting a strong consumer demand, high prices and relatively low production cost. It is extremely profitable to farmers and thereby has been replacing competing crops, especially coffee.

2.33 Notwithstanding the efficient use of agricultural resources through traditional production techniques, absolute level of productivity remains very low. For instance, cereal grain yields of 0.8 to 1.1 ton per ha, cotton yields of about 1.0 ton per ha are low even compared with the countries with similar physical conditions. Cultivation areas, yields and production of major crops are shown in Table 2.6.

2.34 Livestock, consisting of sheep, goats, cattle, camels and donkeys, is fed all over the country. The domestic

animals are used mainly for the production of meat and milk. They also serve as beasts of draft and of burden. Current husbandry practices are primitive and feed supplies are meager. There is also general lack of modern veterinary care. These all together cause heavy losses and keep productivity at a very low level.

2.35 The forestry resources are sparse and being depleted gradually. They are mainly used for poles and fuel. Farmers are increasingly planting trees because of high market prices for woods. This trend of afforestation would have other beneficial effects including soil conservation and watershed protection.

2.36 The present stage of fishery is too primitive. Although fish resources are considerable, local fish demand is not big enough for further development.

(5) Five-Year Plan and On-going Integrated Rural Development Projects

Five-Year Plan (1975/76 - 1980/81)

2.37 The Five-Year Development Plan (1975/76 - 1980/81) is the first attempt at comprehensive national development planning in YAR, in continuation of The Third-Year Plan (1973/74 - 1975/76), with due consideration for overall investment and manpower requirements. The Plan contemplates to further develop the human and natural resources; to reinforce the physical infrastructure; to improve the productivity of the commodity producing sectors; and to raise the standard of living of the people, giving due attention to their basic needs for food, water supply, inland transport, health services, education and other social infrastructures.

2.38 During the Plan period, YR15,971 million (1975/76 prices) will be invested for fixed capital formation. The biggest portion will be defrayed in the transport and communication sector followed by industry, mining and power sector. Their shares in the total investments are 31 % and 25 %, respectively. In the agricultural development, YR2,276 million or some 14 % of the total will be invested.

2.39 During the five years of the Plan, GDP is planned to grow to YR7,671 million in the 1980/81 fiscal year, the last year of the Plan, from YR5,181 million in the 1975/76 fiscal year, base year of the Plan, with the average annual growth rate of 8.2 % in real terms. The industrial sector including construction is envisaged to grow at the highest growth rate of 12.9 % per annum, being followed by the distribution sector which is planned to grow with the average annual growth rate of 10.1 %. The planned growth rate of the agricultural sector is the lowest, 5.5 % per annum. Agricultural sector, however, still is to have the biggest share in GDP with some 39 % of the total, being followed by the distribution sector.

2.40 Out of the total investments of YR15,971 million, some 59 % will be from domestic funds. The dependency on the foreign financing will be about 41 %. The details of the investment envisaged in the Five-Year Plan is shown in Table 2.7.

On-going integrated rural development projects

2.41 Aiming at breaking seclusion of regions and stopping internal migration from rural areas to towns and cities, the Five-Year Development Plan envisages integrated rural development projects, major components of which are developing agriculture, making roads, supplying hygienic water and spreading education and health services for

providing higher incomes and better conditions of living. Brief description of planned and on-going projects are given below:

- a. Southern Uplands Rural Development Project (on-going); This is the first integrated rural development project ever executed in YAR. This project started in the beginning of 1976 and will go on for a period of six (6) years. The project covers an area of 50,000 ha in the provinces of Taiz and Ibb. The principal aims of the project are to increase productivity of crops and to improve the living condition of the area. Main components of the project are:
 - i. establishing 60 agricultural extension offices
 - ii. establishing a branch of the Agricultural Credit Fund
 - iii. establishing two (2) veterinary units
 - iv. constructing and repairing of 180 km of rural roads
 - v. implementation of 90 drinking water projects
 - vi. providing necessary administration requirements and helping the establishment of co-operative societies for farmers
 - vii. planting 350 ha with trees and protecting 20 km of river courses

- b. Integrated Rural Development in Rada Area (under study or negotiation); The major components of the project are:
 - i. establishing a center for agricultural development
 - ii. raising land productivity, water and manpower in the area

- iii. development of livestock production
 - iv. securing drinking water
 - v. constructing 270 km of feeder roads
- c. Integrated Rural Development Project in the Al Mahwit Province (under study or negotiation); The project covers an area of approximately 5,000 ha of agricultural land in the province, including the following major activities:
- i. establishing an agricultural research center and extension service offices
 - ii. securing a network of roads in the province
 - iii. securing clean water in the provincial capital in the first phase and in all the villages of the province in the ultimate phase
- d. Integrated Rural Development Project in Eastern Areas of Khawlan and Beni Hushaish (under study or negotiation); The project aims at achieving integrated rural development for these areas which require strongly the services of integrated rural development and the development of crop and livestock production. The components of the project will be determined after the study undertaken by the Arab Organization for Agricultural Development is completed.
- e. Integrated Rural Development Project for Northern Areas of Sana'a and Sada'h (under study or negotiation); The project basically aims at expanding private activities through the development of agricultural production in these areas by enhancing agricultural extension services, establishing service and research stations and rationalizing water use. The details of the project are to be determined later.

III NECESSITY OF INTEGRATED RURAL DEVELOPMENT

3.01 About 90 percent of the total population of Yemen Arab Republic are living in the rural areas. Although recently urbanization is in progress, especially in the areas of the three (3) big cities; Sana'a, Hodeidah and Taiz, majority of the people will remain in the rural areas at least in the foreseeable future.

3.02 About 80 percent of the people in the rural areas are engaged in agriculture. However, very limited agricultural resources, especially land and water, are available and the productivity is generally low, resulting in low income level of the farmers. Living condition in the rural areas is also at low level, lacking adequate hygienic drinking water, road access, electricity, health facilities, education and the like. On the other hand, residents in the urban areas are enjoying relatively high income receiving better social services. This disparity between rural and urban areas is the major cause for the massive migration of the rural inhabitants into urban areas.

3.03 The outmigration of the rural inhabitants is accelerated by the higher labour wages offered by neighbouring oil-producing countries which have been experiencing spectacular economic growth in recent years. In consequence, a large number of the rural inhabitants who should carry the task of agricultural development have left their villages. The result is the desolation of the terrace lands in the mountainous region as well as millions of the abandoned farmlands in the Tihama coastal plain, posing the serious problem of the weakening of the key economic sector in the rural areas.

3.04 From the viewpoint of national economy, agriculture is the country's principal economic sector, contributing

50 to 60 percent of GDP and employing 70 to 80 percent of labour force. In 1976, agricultural products with cotton, coffee, hides and skins as major components, accounted for 94 percent of the total export value. Food import, nearly half of which were cereals, accounted for 47 percent of the total import value. Although, at the present moment the country is enjoying her favourable foreign reserve position, it is anticipated that balance of payment will be deteriorated drastically, if urgent measures will not be taken, due to the rapid expansion of imports of capital formation goods as well as consumption commodities. With this in view, it is highly desirable to expand the agricultural production for the export promotion as well as import substitution.

3.05 Progressive reduction in the number of the workers abroad is anticipated due to the following reasons:

- a. The wage level in YAR has recently become nearly equal to those in the neighbouring oil-producing countries.
- b. It is very likely that in the medium and long run, the building and construction works in the neighbouring countries would be slowed down.
- c. Growing labour demand is in existence in YAR herself, particularly in building and construction sectors.

3.06 The agriculture should be the largest absorptive sector for the anticipated returning workers, though some portion would be employed in other sectors, considering that most of them were once engaged in farming.

3.07 Furthermore, if the present population growth is considered, new problem of population pressure will be brought up in the near future. The agriculture, again,

should play the key role in coping with this new problem, paying due attention to its comparative advantage over other economic sectors.

3.08 Improvement of infrastructures and social services is another sine qua non for the effective development of rural areas. It would raise the standard of living and eventually improve the productivity of the rural economy and thereby make a substantial contribution to preventing massive out-migration of rural manpower.

3.09 Considering all these, the rural development which is founded on agricultural development, accompanied with improvement of rural living conditions, is of vital importance for the well-being of the rural inhabitants as well as the overall development of the Yemeni economy.

IV PRESENT CONDITION OF HAJJAH PROVINCE

(1) General

4.01 The Hajjah Province has a total area of 9,590 km² with a population of some 397,000 (as of 1975). Population density is estimated at about 41.4 persons per km². Total number of household is 76,900. Average size of household is about 5.1 persons. More than 70 % of the population are engaged in agriculture and a few percents of the population are nomadic herdsmen. Administratively, the Hajjah Province consists of five quadas, 29 nahiyas and 1,929 villages. The capital of the Province is the town of Hajjah located at the south-east corner in the Province. The administrative division of the Hajjah Province is as shown in Fig. 4.1.

4.02 The town of Hajjah has the biggest population of some 5,800. Hajjah, Mabyan, Al Mahabisha and Shahara are the major towns in the mountainous area, and Abs, Midi and Harad are the principal ones in the Tihama lowland. About 4 % of the whole population are living in these towns. The rest are living in small settlements with the population of 1,000 or less. The population of the Quadas and Nahiyas of the Province as of 1975 are as shown in Table 4.1.

4.03 The Hajjah Province is located in the north-western part of YAR, being surrounded by Sadah Province and Saudi Arabia in the north, Sana'a Province in the east, Hodeidah and Al-Mahwit Provinces in the south and the Red Sea in the west. Although Hajjah Province enjoys favourable location, being close to Sana'a, the capital of the Republic, and to Hodeidah, the biggest and actually the only foreign trade port in YAR, its development has long been hindered principally because of the lack of adequate road network due to mountainous topography and the strong tribal system over which the administration of the central government is not

always effective. Socio-economic environment of the Province lags far behind the advanced provinces and the Province is facing the serious problem of massive outmigration of the inhabitants. The overall development of the Hajjah Province, exploiting its physical and human resources, is urgent and of vital importance.

(2) Physical Resources

Physiographical regions

4.04 As mentioned in Chapter II, the Yemen Arab Republic could conveniently be divided into four (4) physiographic regions, each having its distinct climatic and vegetational characteristics; i.e., a) Tihama lowland, b) foothills and middle heights, c) central highlands and d) eastern semi-desert plateau. The physiographic features of the Hajjah Province are well conformable to this country-wide stratification and the first three physiographic regions are recognized in the Province (refer to Fig. 4.2).

4.05 The general features of each physiographic region are briefed as follows:

- a. The Coastal Lowland forms a 40 km-wide belt along the Red Sea. The lowland occupies an area of 4,690 km² or 48.9 % of the total. The elevation ranges from sea level to about 500 m. It is level or slightly undulating and intersected by shallow-wide wadis draining from the eastern mountains towards the Red Sea. The region generally receives less than 400 mm rainfall annually. The mean monthly temperature is over 22°C all the year round. The relative humidity is high. Strong winds generally blow from the southwest to northeast causing coastal sand dune movement and inland soil erosion. Drifting sands and sand dunes alternate with

cultivated fields. Salt-impregnated flats are common along the coast.

- b. The Midland region ranges from 500 to 1,500 m in elevation between the Coastal lowland and the Highland. The area of the midland is 4,090 km², corresponding to 42.6 % of the total area. The landscape is generally rugged, cut by deep wadis through narrow gorges which drain to the Coastal lowlands in the west. Average annual rainfall varies with altitude to between 500 and 900 mm. This region has various types of mountain scarpments or cliffs which are a major orographic obstacle to southwest monsoons and also to dust blown from the Coastal Lowlands. Water erosion is vigorous. Precambrian and metasedimentary rocks are common in the south and southwest. Metavolcanic rocks predominate in the northeastern part. Jurassic limestone mantles the central part with some marl and shale.
- c. The Highland region comprises higher mountain areas exceeding 1,500 m in elevation. The highland extends over 810 km² or 8.5 % of the total land area. The topography is generally very rugged. The annual rainfall is over 900 mm. In general, the rainfall decreases eastward and northward. The temperature differences between day and night are considerable. This region, with its rugged and complex topography and stream valleys 600 to 1,500 m in depth, reflects the degree of dissection and wide varieties of rock types exposed in the area. Volcanics of Tertiary age covers most of the highlands in the north. Precambrian rocks, mainly granite and gneiss, are common in the southern highlands.

Topography

4.06 The topographic conditions of the Hajjah Province have been studied using topographic maps scaled 1 to 50,000, in conjunction with aerial-photo interpretation and ground surveys. The topographic data were computerized for land slope analysis. The results are given in Fig. 4.3. Areas of each slope class are summarized below:

<u>Region</u>	<u>Slope Class (%)</u>						<u>Total (km²)</u>
	<u>0-2</u>	<u>2-6</u>	<u>6-13</u>	<u>13-25</u>	<u>25-55</u>	<u>55-</u>	
Lowland (0 - 500 m)	2,950	840	530	300	70	0	4,690
Midland (500 - 1,500 m)	50	510	890	1,340	1,290	10	4,090
Highland (over 1,500 m)	0	20	60	160	540	30	810
<u>Total (km²)</u>	<u>3,000</u>	<u>1,370</u>	<u>1,480</u>	<u>1,800</u>	<u>1,900</u>	<u>40</u>	<u>9,590</u>

4.07 The lowland is mostly level to gently undulating. The rolling to hilly topography dominates in the midland region. The highland region is generally steeply dissected. The general view of the Hajjah Province is drawn by computerized autoplotter as shown in Fig. 4.4.

4.08 Most of the lowland consist of alluvial fans, low dunes and sand sheets. The region is intersected by five (5) wide-shallow wadis, which are from north to south, Wadi Harad, Wadi Hayran, Wadi Bawhal, Wadi Qur and Wadi Bani Nashir. In the rainy season, the wadi floods wash the wadi delta plains and disappear in a few days. The wadi flood courses are generally capricious. The wadi water seldom reaches the Red Sea.

4.09 The midland region is subdivided into three topographic units, i.e., piedmont (foothills), upland and plateau. The piedmont area forms talus and colluvial slopes. This unit is widely distributed along the foothills mainly in the northeastern part of the Province. The upland is generally dissected with gentle slopes less than 13 %, and occupy a large area extending on left side of the Wadi Mawr. The mountain plateau area is generally rugged with steep slope. The plateau with steepest slope is dominant on the mountains composed of limestone and green shale. The plateau developed on Yemen Volcanics has rather gentle slopes. Rugged topography is common on the plateau of granite and gneiss.

4.10 The highland region extends around Al Mahabisha, Shahara and Hajjah. A chain of highest land is found around southern areas of Hajjah town where mountain peaks exceed 2,500 m, including highest mountain, Almahdad (3,360 m). The highland region is subdivided into three units on the basis of geological composition, i.e., inter-mountain plain, mountains on Yemen Volcanics and mountains on granite and gneiss. The inter-mountain plain is developed on limestone and shale with slightly undulating topography. It is seated around Al Mahabisha and Hajjah. The mountains on Yemen Volcanics form convex surface and very steep slopes, extending around the town of Shahara. The mountains developed on granite and gneiss have generally moderate slopes and occupy the areas around Bani Mawzaf and Al Mahadad in the southern part of the Hajjah Province.

Geology

4.11 The geological conditions of the Hajjah Province have been studied mainly on the basis of the geological map prepared by the U.S. Geological Survey. The information was also obtained through interpretation of Landsat Imagery and aerial photographs and was partly supported by field

investigation. The said geological map was elaborated on the basis of these additional information as shown in Fig. 4.5.

4.12 The geological features of each physiographic region are generally as follows:

- a. Lowland: This region consists of terrace desposits and alluvial deposits. These deposits are composed of mud, sand and gravel transported by wadis. As the reflection of geologic conditions in the upper reaches of wadis, sand and gravel are little in the northern part, and comparatively much in southern part. In the rainy season, gravels are transported by wadis and are irregularly distributed along wadis.
- b. Midland: The region consists of Pre-Cambrian basement rocks and Jurassic sediments. Pre-Cambrian basement rocks are distributed in hillsides and mountain slopes, and consist mainly of crystal-line schists, slate and conglomerate in the northern part and of granites in the southern part. Jurassic sediments consisting mainly of dark grey hard shale (Kohlan series) and yellowish grey limestone (Amran series) are distributed near the mountain top covering over basement rocks with unconformity. In the distribution area of inclined Jurassic sediments, Cuesta can be observed, and in gentle slope of inclined side, the terraced croplands are developed, but in steep slope of opposite side, land collapse and falling stones are remarkable.
- c. Highland: The region consists of great amount of lavas and pyroclastic materials (Yemen trap series) erupted in the depressed basin. Steep mountains

ranging from 1,500 m to 2,500 m in elevation, are formed by the later volcanic activities. These pyroclastic materials are fairly subjected to thermal metamorphism, and become fragile in part.

Meteorology

4.13 No long term meteorological data are available in the Hajjah Province. Systematic observation has been carried out only at the Chinese Farm in El-Bahana since 1976. The Chinese Farm is located northeast of Shahara where the elevation is around 1,200 meters above the sea level. The observation data represent the midland climate. No meteorological stations exist in the coastal lowland and the highland. The climate conditions in the coastal lowland and the highland were estimated from the observation data at the adjacent meteorological stations, i.e., Al Zuhra and Sana'a, respectively. The representative patterns of rainfall and temperature in each physiographical region are given in Fig. 4.6.

4.14 The coastal lowland has a tropical arid climate. The mean monthly temperatures range from 26°C in December to 34°C in June. The mean monthly minimum temperatures range from 19°C to 29°C and mean monthly maximum temperatures range from 32°C to 40°C. The area generally receives less than 300 mm annual rainfall which concentrates in the periods between May and October. The average relative humidity is 60 to 80 percent and is generally high in the morning. Strong winds blow frequently from the southwest to northeast causing sand dune movement.

4.15 The midland has subtropical climate. The mean monthly temperatures range from 21°C in January to 29°C in June. The mean monthly minimum temperatures range from 6°C to 15°C and mean monthly maximum temperatures range from 23°C

to 30°C. The annual rainfall is over 300 mm in the foothills and it increases by altitude reaching 600 mm with two peaks in April/May and July/August. Annual rainfall decreases from southwest to northeast ranging 950 mm at At Tur to 520 mm at El Bahana near Shahara. Main wind direction is east in winter and spring, and west in summer and autumn.

4.16 The climatic conditions of the highland region are similar to those of the midland. The annual mean temperature goes down by altitude as illustrated in Fig. 4.7. The annual rainfall reaches to 800 mm in Al Mahabisha and decreases towards the northeast. The temperature fluctuation in a day is considerable. The sunshine intensities are very much affected by the slope directions as illustrated in Fig. 4.8.

4.17 In and around the Province, a total of 17 rain gauge stations are located as shown in Fig. 4.9. The altitude of the rain gauge stations and periods of observations are shown in Table 4.2. The observation periods are insufficient for hydrological analysis and all the rain gauge stations in the Hajjah Province are located in the catchment area of Wadi Mawr. Several new stations will be required in the coastal lowland and the midland in the west of the ridge. The monthly mean rainfall records at 17 stations are given in Table 4.3. In illustration of the local distribution of annual rainfall, an isohyetal map is shown in Fig. 4.10. The rainfall distribution makes a cone with the center at At Tur, where the average annual rainfall is 950 mm, and it gradually decreases toward northeast.

Hydrology

4.18 Wadi Mawr, the largest of Tihama wadis, has a catchment area of about 7,900 sq.km and most of the catchment area lie in the Hajjah Province. It flows away into the

Tihama area which is entirely outside the Hajjah Province. The Hajjah Province, in terms of river basins, could be roughly divided into two regions by the ridge which is running from north to south in the central part of the Hajjah Province. The one is the Wadi Mawr basin which covers most of mountainous area in the east of the ridge and the other is the basin composed of coastal lowland and midland in the west of the ridge, as shown in Fig. 4.11.

4.19 The discharge records of Wadi Mawr are only available runoff data. The observation has been carried out by the Tihama Development Authority especially for the development of Wadi Mawr since 1975. The monthly mean specific discharges range from 1.2 mm in February to 3.8 mm in August. The annual runoff coefficient is 5.4 percent. The relation between average rainfall and specific discharge is illustrated on Fig. 4.12.

4.20 The sediment runoff data of Wadi Mawr are available. Due to the high intensity of rainfall and the steep slope of the river course, Wadi Mawr is swift running stream, and a considerable amount of sediment is carried by the surface runoff. Most of the sediment is supplied from erosion of uncultivated hillslope through the tributaries. The average silt concentration of wadi water is estimated around 5,700 ppm.

4.21 The subsurface of the Tihama coastal plain, which is composed of alluvial deposits, constitutes groundwater aquifer. The seepage from the wadis and the infiltration of rainfall from land surface replenish the groundwater. Unconfined groundwater table can be found in most of the Tihama coastal land. The depth from the land surface to the water surface ranges from less than 5 m to 30 m. Shallow hand-dug wells for domestic use are found near the

villages everywhere in the Tihama coastal land. These wells have insufficient in yield capacity, some of which dry out during dry season. Deep drilled wells were perforated into semi-confined aquifer and confined aquifer in Harad and Abs for the purpose of potable water and irrigation water. The groundwater development can be expected in the vicinity of wadis, though the further comprehensive study is required.

4.22 The result of water quality analysis for well, wadi and spring are given in Table 4.4. The water quality does not vary much in different water-sources. The specific electric conductivity is below 1,000 micromhos/cm and pH values range from 7.7 to 8.2, which will be acceptable for both irrigation and drinking purposes. The values of sodium absorption ratio (SAR) range from 1.3 to 2.1 and the water can be applied without any restriction to almost all the types of soils and crops.

4.23 The water rights for streams are administrated under Islamic Law 'al ala falala', whereby the higher lands have priority to the lower land. The priority of a main canal is related to the point of diversion on the wadi, and that of the secondary canal, on the main canal. The field nearest to the canal head has highest priority.

Soils

4.24 There is very limited information available on the soils of the Yemen Arab Republic. Whatever information is available, it is usually the form of generalized reports. Even if detailed information is available, it represents a few specific areas. In Hajjah Province, no systematic soil studies have been made so far and the soil information is quite limited. The soil study was, therefore, roughly made on the basis of the findings derived from the interpretation of Landsat imagery and was supported by limited

field investigation and background information available from earlier broad soil studies.

4.25 The first step using Landsat imagery was to demarcate easily distinguishable physiographic units, taking these physiographic characteristics into consideration. A subsequent physiographic analysis of Landsat imagery recognizes 23 terrain units on the basis of differences in some image characteristics (shape, size, tone, color, texture, etc.) exhibited by various physiographic segments. In delineating these segments or terrain units, the soil-forming factors, particularly parent materials, topography, climate and vegetation, are taken into consideration.

4.26 These 23 units were keyed to the information provided by the FAO/UNESCO Soil Map of the World. The soils were classified in terms of soil associations, which are terrain units, occurring in a defined physiographic pattern with defined proportion. The soil associations corresponding to each terrain unit consist of the dominant soil unit covering more than 50 % of the surface; associated soil unit occupying an area that varies between 20 and 50 %; and the most important inclusions which do not cover more than 20 % of the surface. The terrain units and their soil associations are thus identified and shown in Fig. 4.13. The map legend is repeated in Table 4.5 and the key to soil symbols used is given in Table 4.6.

Land Classification

4.27 The land classification was undertaken to evaluate the land resources in the Hajjah Province. The land classes were tentatively defined using basically the system of the U.S. Bureau of Reclamation and specifications were modified to fit the purpose of the master plan study. The land classification was not made to each soil group but to each

terranean unit composed of several soil units. The terranean units were then classified into three classes of arable land, Class 1, 2 and 3, Class 4, limited arable land and Class 6, nonarable land.

4.28 Soil texture, soil depth, salinity and topography are important in determining land classification, and each of these factors should be favourable for Class 1 land. Any one factor considered unfavourable would result in changing the land class to a lower class. Nonarable class was given to the lands which do not meet the minimum requirement for other land classes and are not suitable for crop production. In classifying the lands, availability of water for irrigation was not considered as a limiting factor.

4.29 The results of the classification of lands are shown in Fig. 4.14. Terrain units in each land class are given in Table 5.3. The total land area of the Hajjah Province is 9,590 km², out of which arable lands (Class 1, 2 and 3) are estimated around 3,810 km² or 39.7 % as summarized below:

<u>Land Class</u>	<u>Lowland</u> (km ²)	<u>Midland</u> (km ²)	<u>Highland</u> (km ²)	<u>Total</u> (km ²)	
Class 1	1,070	-	50	1,120	(11.7%)
Class 2	250	-	360	610	(6.4%)
Class 3	1,370	710	-	2,080	(21.6%)
Sub-total	2,690	710	410	3,810	(39.7%)
Class 4	1,480	1,310	170	2,960	(30.9%)
Class 6	520	2,070	230	2,820	(29.4%)
Total	4,690	4,090	810	9,590	(100.0%)

4.30 Most of the arable lands (57 %) extend on the lowland area, the soils of which have no serious problems. Limited water availability is only the problem for use. These lands are generally suitable for large scale mechanized production

of cereals, cotton and tropical fruits. Small scale vegetable production is also recommendable on the lands where irrigation water is available.

4.31 The class 3 arable lands in the midland area are very scattered and most of them are presently cultivated under rainfed condition. The lands are mostly terraced and subject to serious erosion. The soils of these lands include gravelly phase in general and not very fertile due to continuous cultivation for centuries without replenishment of plant nutrients.

(3) Land Use

4.32 Present land use in the Hajjah Province is generally characterized by topographical and geographical features of the terrain units, and is extremely influenced by meteorohydrologic features. To make the land use map of the Province, Landsat remote sensing has been utilized, in connection with aerial photo interpretation and intensive field investigation.

4.33 Fig. 4.15 shows land cover map, which explains the condition of the ground's surface at the time of remote sensing. It has been compiled from digital multispectral data taken by the Landsat satellite on October 13, 1972. The multispectral data were classified into 14 land cover patterns, based on the spectral characteristics in a digital image analysis system. These land cover patterns are shown in 14 different colours in Fig. 4.15. The land use map has been prepared on the basis of these land cover patterns (refer to Fig. 4.16). The areas of the land use categories thus identified are tabulated as follows:

<u>Land use category</u>	<u>Land use subdivision</u>	<u>Area</u> (km ²)	<u>Proportional extent</u> (%)
A. Irrigated cropland	A1 Intensively cultivated under irrigation/pumping and diverted stream flow/sorghum vegetables and fruits	40	0.4
	A2 Intensively cultivated under regular spate irrigation/mainly sorghum	120	1.3
(Sub-total)		(160)	1.7
B. Rainfed cropland/ Annual cultivation	B1 Densely cultivated/irregular spate irrigation/mainly sorghum	190	2.0
	B2 Densely cultivated/sorghum and millet	260	2.6
	B3 Wadi lands/vegetables and sub-tropical fruits		
	B4 Gently sloping lands receiving hill-slope runoff/sorghum and maize	150	1.6
(Sub-total)		(750)	7.8
C. Rainfed cropland/Opportunistic cultivation/mainly millet		120	1.3
D. Rainfed cropland/ Terraced	D1 Densely cultivated/sorghum, wheat, barley and gut	130	1.3
	D2 Sparsely cultivated/sorghum, millet, wheat and barley	150	1.6
(Sub-total)		(280)	2.9
E. Rainfed cropland/Rangeland, Opportunistic cultivation, otherwise dwarf shrub grass land/mainly millet		100	1.0
Total Cropland (A + B + C + D + E)		1,410	14.7
F. Rangeland		7,680	80.1
G. Unused land		300	3.1
H. Settlement areas		200	2.1
Total		9,590	100.0

4.34 Irrigated croplands are found along major wadi courses in the Tihama plain. The irrigation is mainly made by diverting high stream flow during the rainy season by small earthen dams and leading it by means of simple channels on to the fields located along the wadi courses. Some of these spate irrigation lands are supplementally irrigated by pumps or other means during the dry season. These lands are intensively cultivated for growing mainly sorghum; and sorghum, vegetables and tropical fruits are grown under supplemental irrigation. Irrigated lands are also found in the bottoms of some valleys which have perennial springs; over abundant ground water in these valleys is exploited by wells with pumps or traditional lifting methods. These areas are, however, categorized as a part of the annually cultivated, rainfed cropland because of their limited extent.

4.35 The rainfed croplands under annual cultivation, which occupy major part of the farmland, are found in the east Tihama plain as well as in intermountain valley bottoms. The Tihama rainfed croplands are generally located slightly off the wadi courses or downstream of the wadis. At the hill front of the Tihama plain, however, more reliable rainfall and runoff from hill slopes permit the annual planting of sorghum and millet in these areas. There is a greater availability of water in the lands in the bottoms of valleys from perennial springs, shallow wells, hill slope runoff, etc. Thus, much of the areas are annually cultivated, and even perennially cultivated lands are found in this area.

4.36 There is a transition zone between rangeland and annually cultivated cropland that is used for opportunistic planting. These areas are usually spot-planted to millet and sorghum in response to favourable rainfall. Similar opportunistic croplands also exist at the heads of the

fans of major wadis, where the great floods occasionally inundate the land. These croplands are usually left uncultivated and become dwarf shrub grassland. Main crop is millet.

4.37 Intensively terraced agricultural lands can be found on the rain-exposed slopes in the highland area. These areas are the most appropriate for agriculture. In areas of sufficient precipitation, the main crops are sorghum, wheat, barley and gut. In areas of less rainfall or drier soils, the more resistant millet can be found. The terraced croplands have been prepared so as to catch all available runoff from surrounding areas.

4.38 Rangelands, which are not normally cultivated, are used as a feed base for grazing and also as watershed to catch runoff discharges for neighbouring croplands. Rangelands in the coastal Tihama plain are only sparsely vegetated and most of them are of unused. On rangelands in wadi depressions and banks as well as in areas closer to mountains with high precipitation, some vegetation cover which is used for grazing livestock, is found.

(4) Socio-economic Regions

4.39 The Province could be further sub-divided into five (5) socio-economic zones which are exactly conformable to existing quadas, i.e., Al Mahabisha quada, Hajjah quada, Washhah quada, Shahara quada and Midi quada. Midi quada almost represents the Tihama lowland area and the other four quadas represent the mountainous areas.

4.40 Al Mahabisha quada is located at the central part of the Province, being adjacent to Hodeidah Province in the south and the Tihama plain in the west. The quada is developed with the town of Al Mahabisha as its core. It

has an area of 1,120 km² or 11.7 % of the total area of the Province. The total cultivated area is 10,300 ha. It has a population of some 92,000, accounting for some 23 % of the total population of the Province. The population density is estimated at as high as 82 persons per km², the second highest among the five quadas next to Hajjah quada. The net annual crop production value amounts to about YR768 million or 68.5 % of the total net crop production value of the Province. The net annual crop production value per farm household is estimated at about YR59,000, more than six times as large as these for the other quadas (see Table 4.10). Al Mahabisha quada is characterized as the most economically advanced zone in the Province, being most densely populated and earning the highest income among the quadas.

4.41 Hajjah quada is located at southeasternmost part of the Province, neighbouring on Sana'a Province in the south and east. Hajjah and Mabyan are the major towns of the quada. The town of Hajjah is Capital of the Province and the center of the administrative system of the Province. The quada has an area of 1,560 km² or 16.3 % of the total area of the Province. It has the biggest population among the quadas with 134,000 inhabitants or about one third of the total population of the Province. The population density is estimated at as high as 86 persons per km², the highest among the quadas. The total cultivated area is 18,600 ha. The net annual crop production value amounts to about YR161 million or 14.4 % of the total of the Province. Although the figure is the second largest among the quadas, it is only about one fifth of that for Al Mahabisha quada. The net annual crop production value per farm household is estimated at about YR 8,700. Although this figure is about equal to these for Midi quada and Washha quada and higher than that for Shahara quada, it

falls far behind that for Al Mahabisha quada.

4.42 Washhah quada is located at the northernmost part of the Province, being adjacent to the northern province of Sadah. The quada has an area of 1,710 km² or 17.8 % of the total area of the Province. It has a population of some 47,000 or 11.9 % of the total population of the Province. The population density is estimated at about 28 persons per km². The total cultivated area is 5,600 ha. The net annual crop production value amounts to about YR57 million. The net annual crop production value per household is estimated at YR8,500, about equal to these for Mid quada and Hajjah quada.

4.43 Shahara quada is located at the northeasternmost part of the Province, neighbouring on Sana'a Province and Sadah Province. The quada has an area of 1,840 km² or 19.2 % of the total area of the Province. It has a population of some 49,000 or 12.3 % of the total population of the Province. The population density is estimated at about 27 persons per km². The total cultivated area is 5,900 ha as of 1979. The net annual crop production value amounts to only YR44 million or only about 4 % of the total value for the Province, being the lowest among the quadas. The net annual crop production value per household is estimated at mere YR6,500, also being the lowest among the quadas. The quada is rather characterized by economic backwardness. There also exists a strong tendency toward local autonomy against central administration.

4.44 Midi quada is located in the Tihama plain, neighbouring on Saudi Arabia in the north, the mountainous area in the east, Hodeidah Province in the south and the Red Sea in the west. The quada is developed around the three

major towns, i.e., Abs, Midi and Harad. Abs and Harad are connected with Hodeidah via Bajil, a major economic center and the principal international trade port of YAR, by a north-south road running in the Tihama plain. Abs is also linked with Al Mahabisha, a key economic center of the Province, by road transport. Midi quada has an area of 3,360 km² or 18.9 % of the total area of the Province. It has a population of some 75,000, accounting for some 19 % of the total population of the Province. The population is rather dispersedly located with the density of some 22 persons per km², the lowest among the quada. The total cultivated area is 43,500 ha. The net annual crop production value amounts to about YR91 million. Although the cultivated land per farm household is the highest among the quadas with 4.3 ha, the net annual crop production value per farm household is estimated at only about YR8,900, being ranked second with Hajjah quada and Washhah quada but far behind Al Mahabisha quada. A large majority of the people in the quada are tenants and peasants. Few landowners are mostly the residents of the mountainous area.

(5) Present Agriculture

Agricultural land use

4.45 Out of a total land area of 9,590 km², woody vegetation or shrub growth covers 1,480 km². About 6,700 km² are rocky mountains and semi-arid range lands with sparse vegetation. The croplands are only 1,410 km² (15 %) out of which only 840 km² are regularly cultivated and an additional 570 km² of marginal cropland is cultivated only during high rainfall years. About 88 % (1,250 km²) of the croplands depends solely on low and erratic rainfall, 9 % (120 km²) is supplied with spate irrigation by seasonal flood flow, and 3 % (40 km²) is put under regular irrigation by wells.

Labour force

4.46 According to the latest population census in 1975, the resident labour force of the Hajjah Province was estimated at about 100,300 or 25.3 % of a total population of 396,600, and 73,200 or 73 % resident labour force was engaged in agriculture. The population census also gives a figure of 76,900 as a total number of household. Since about 55,400 or 72 % of a total number of household is considered as farm households, an average farm labour per farm household would be 1.3 persons, which is extremely low. This figure results from limited participation of women in agriculture and serious outmigration of inhabitants to urban areas. The available labour force by quada is given in Table 4.8.

Crop production

4.47 In the Hajjah Province, crop production is heavily concentrated on foodgrains, namely, sorghum and millet. More than 80 % of all cropped area are planted to these crops as follows:

<u>Crops</u>	<u>Cultivated Area</u> (ha)	<u>Production</u> (ton)	<u>Unit Yield</u> (ton/ha)
Sorghum/Millet	70,000	56,000	0.8
Wheat	500	400	0.8
Barley	400	400	1.0
Maize	500	750	1.5
Legumes	1,000	800	0.8
Qut	6,800	15×10 ⁶ bundles	2,200 bundles
Coffee	1,000	400	0.4
Grapes	1,000	4,800	4.8
Fruits	1,800	14,400	8.0
Potatoes	200	1,600	8.0
Sesame	100	50	0.5
Tobacco	100	120	1.2
Cotton	100	60	0.6
Total	83,900		

4.48 The main rainfed crops are sorghum and bulrush millet in the lowland, and wheat, barley and sorghum in the midland and highland. Irrigated agriculture is limited due to the scarcity of water resources. Groundwater, very small perennial flow and seasonal floods coming down the wadi courses are generally the water sources for irrigation. Irrigation practices are still very limited in the mountain regions. Spate irrigation is common in the areas along the wadi courses mainly in the lowland. Groundwater irrigation (shallow wells) by pumps is practised in some areas in the lowland, but the commandable areas are generally very small. Maize, cotton and tobacco are grown on the irrigated lands in the lowland; coffee and gut are the main crops of the high rainfall areas in the mountain regions. Vegetables are cultivated on the irrigated sites on a limited scale.

4.49 Farming method is still very primitive. Seeds are provided locally and is of inferior quality. Fertilizer is used only in the irrigated fields. No pest and insect control measures are applied. Crop yields are generally low. For example, sorghum and millet yields of 800 kg per ha, wheat yield of 800 kg per ha, barley yield of 1,000 kg per ha, maize yield of 1,500 kg per ha are among the lowest in the country.

4.50 The most important cash crop in the Hajjah Province and also the most controversial, is gut, a mildly narcotic plant which is widely consumed by the population. Although there are no statistics estimating the acreage planted to gut, the farm inputs used and the value of annual production, there is ample evidence suggesting that gut growing has expanded rapidly in recent years and that agricultural resources are increasingly diverted to this crop. Gut owes its popularity among farmers to a strong consumer demand,

high prices and relatively low production cost. Qut is more drought resistant and requires less care than most competing crops, especially coffee. As a result, qut is extremely profitable to farmers and its returns generally exceed those of competing crops by a wide margin. The area under qut cultivation is estimated at about 6,800 ha or only 8 % of the total cropped areas. The production value from qut, however, occupies approximately 80 % of the total crop production values of the Hajjah Province as shown in Tables 4.8 and 4.9.

Livestock production

4.51 It is estimated that over 360,000 sheep and goats, 42,000 donkeys and 88,000 cattle exist in the Province. There are also considerable numbers of camels. Semi-nomadic husbandry is common. Animal diseases are widespread owing to the lack of veterinary facilities. Among the livestock products, hides and skins occupy an important place in the local economy. Meager and uncertain feed supplies together with lack of modern veterinary care create heavy losses and keep production rates at very low level. Annual animal production in the Province is roughly estimated and given in Table 4.10.

4.52 There is no extension services in the Province. Agricultural research programme has not been initiated yet. A branch office of the Agricultural Credit Bank was opened only in March 1979 and has made very little achievement. There is no institutional support to the farmers for farm inputs supply. Harvested crops are stored in the villages and are subject to damages by rodents and insects. Surplus grains and other marketable products are transported by donkey or camel to the nearest market.

Prevailing farming pattern

4.53 The farming patterns prevailing in each physiographical zone are as follows:

<u>Agricultural Zone</u>	<u>Dominant Farming Pattern</u>	<u>Major Crops</u>
Lowland (0 - 500m)	- Large scale rainfed cereal (millet, sorghum) production	Sorghum Millet Maize Sesame
	- Semi-nomadic rough grazing (cattle, camel, goats, sheep)	Tobacco Legumes
	- Small scale irrigated cereal and cash crops production by diverted stream flow	Vegetables Tropical fruits
Midland (500 - 1,500m)	- Rough grazing on perennial low vegetation (sheep, goats)	Sorghum Maize
	- Small scale irrigated cereal and vegetables production (by diverted and sheet flow) on the wadi lands	Vegetables Legumes Qut Sub-tropical fruits
	- Small scale rainfed cereal production on the terraced lands	
	- Qut production	
Highland (1,500-2,500m)	- Intensive cereal production under rainfed condition	Sorghum Qut Coffee
	- Grazing (goats, sheep, cattle)	Grapes
	- Intensive qut production on the gentle-slope lands complementally irrigated by hill-slope runoff	
	- Intensive coffee production	

Agricultural income

4.54 The estimated agricultural production, production value and production costs are given in Tables 4.9 (crop) and 4.10 (livestock) and are summarized as follows:

(Unit: 10³ YRS)

<u>Description</u>	<u>Crop</u>	<u>Livestock</u>	<u>Total</u>
Gross production value	1,348	71	1,419
Production cost	227	22	249
Net production value	1,121	49	1,170
No. of farm household			55,400
Net production value per farm household		YRS	21,120

Major problems

4.55 About 96 % of the whole population of the Province are living in the rural areas and more than 70 % of them are engaged in agriculture. The Province, however, is by no means richly endowed with agricultural resources with small and erratic rainfall and limited area of cultivable land. Moreover, the traditional production techniques are still prevalent without the use of high yielding varieties, fertilizer and pesticides. The total area of irrigated farm land is also quite limited. Consequently, the productivity in agriculture remains low, falling behind the national average.

4.56 About 70 % of the total cultivable land in the Province is owned by tribal leaders and merchants. About 20 % is the property of religious institutions. A large majority of the farmers are engaged in agriculture as tenants under crop sharing arrangements. About 50 % to 80 % of the total proceeds is usually taken by the landowners as farm rent. The rest, or only 20 % is left for the tenants.

Moreover the 10 % zaqat tax is frequently borne by the tenants. There are also considerable number of peasants. Their land holding size is quite limited, just sufficient for maintaining their subsistence, taking into account the current low cropping intensity and low productivity. The agriculture in the Province is thus characterized by a large number of tenants and small independent farmers whose incomes are quite low.

4.57 The low income level of the large majority of the rural people coupled with the insufficient infrastructure facilities and social services has caused the massive out-migration of the rural inhabitants of the Province, especially among able-bodied male workers. The outflow is more prevalent in the Tihama area. In Abs Nahiya, for instance, it is reported that about 50 % to 65 % of the total male population are working elsewhere outside the Nahiya. They either head for the neighbouring Arab countries or the urban areas where they can earn higher wages and enjoy better living conditions. The massive outflow of the rural inhabitants has drained the agriculture of its labour force. In consequence, extensive area of the terraced lands has been desolated in the mountainous area and millions of farm lands have been abandoned in the Tihama plain, posing serious problem of the weakening of the key industry in the rural areas.

(6) Rural Infrastructural Facilities and Social Services

Rural water supply

4.58 Safe drinking water is very scarce in the Province and only a few major towns have piped water. In the mountainous area, rainy water, which stored in cisterns, is generally used for domestic use. However, the absolute quantity is not sufficient and the shortage is made up for by carrying water from wadis and springs usually

located away from the villages. In the Tihama area, several villages possess their own wells and ground water which is drawn either by manpower, animal drought or pumps is utilized for domestic use. Women and children usually engage in the transport of the water. A great portion of daytime is consumed for this laborious work due to a long distance between the houses and the water sources. The shortage of domestic water accompanied by its poor quality has caused various water-borne diseases, resulting in the poor health condition of the rural population.

Rural roads

4.59 All the roads running in the Province are primitive tracks, suitable only for four-wheel drive vehicles and animal transport. Most of them have no wadi crossings. Wadis themselves are frequently used for inland transport in many places in the Province. During the rainy season, almost all the roads are closed. Under these conditions, most of the villages and towns are socially and culturally isolated from each other and marketing areas are usually confined within wadis flood basins and sub-range of mountains. Although the Highway Authority contemplates to construct new trunk roads to connect the major towns in the Province, only the Amran-Hajjah route is underway. Lack of adequate road network is one of the major restrictions on the social, cultural and economic development of the Province.

Education

4.60 Although the number of primary schools can be considered sufficient, their quality is far from adequate. They suffer from an acute shortage of qualified teaching staffs as well as a lack of instruction materials. Only a limited number of schools offer the full range of six grades, a large majority having only three grades or less.

Very few school children finish the primary education because schools are usually located away from their villages and the school attendance is not practicable due to their responsibility for daily water fetching. Lower and higher secondary schools are insufficient in number and school enrollments are very low. Adult education has also hardly been conducted in the Province. Under these conditions, illiteracy is prevalent in the Province with a rate of 91.3 %.

Health facilities

4.61 Of the diseases spreading throughout the country, diarrhoeal diseases and schistosomiasis are the most prevailing in the Hajjah Province. Diarrhoeal diseases largely caused by contaminated water are the major causes for the high infant mortality (about 20 %) in the Province. The estimated prevalence of schistosomiasis in the Province is the highest in the country with 255 patients per 1,000 inhabitants. The extreme shortage of modern health care is one of the main reasons for the low standard of public health in the Province. There is only one hospital in the town of Hajjah. Although small dispensaries were recently constructed in Kahlam, Midi, Al Mahabisha, Harad and Abs, these have not yet effectively been operating due to the lack of required medical service facilities and medical personnel. Even if they were well equipped, they would be in no sense sufficient for the whole population of some 400,000 of the Province. At present, the beds are always fully occupied and most of the patients stay in their villages without receiving any medical treatment.

Electric power supply

4.62 Electric power is used mainly for lighting in the Province. The town of Hajjah has a power station, and the

electricity is supplied to houses. In the other areas, small portable generators with a capacity of three to five kilowatts are used. However, total number of households enjoying the benefit of power supply is quite limited at present. The Government has been making efforts to increase power supply in the Province. The Ras Kateriv Power Station Project is one of such projects. It aims to generate the power of 150,000 kW in the target year of 1982. After the implementation of this project, the power supply capacity in the Province might be possibly increased to about ten times of the present one. However, it is not clear at this moment whether or not the power to be generated at this station will be supplied to the Hajjah Province.

Telecommunication

4.63 Telecommunication networks are hardly available in the Province except telephone service between Hajjah and Sana'a for which the test operation is now underway. It is planned to connect Hajjah and Al Mahabisha by telecommunication system in 1979. However, the communication capacity, as a whole, is still very poor. Therefore, information and action lags occur in the Province especially in the economic sector, which shows the backwardness of this Province.

(7) Local Development Associations (LDA)

4.64 The Local Development Associations (LDAs) are remarkably active in the Hajjah Province. Out of some 150 LDAs established in 10 provinces of the country, 32 LDAs exist in the Hajjah Province as of 1979. They have strong influence over the National LDA Assembly Committee which comprises the heads of the Provincial LDA Administrative Committees.

4.65 Similar to the LDAs in other provinces, LDAs in the Province have concentrated their activities in the project categories of rural access road, water supply, school and health facilities. They have been working quite successfully, constructing most of the existing rural access roads and water supply systems in the Province.

4.66 The LDAs in the Hajjah Province, however, share common problems and constraints with these in other provinces as follows:

- a. acute shortage of all kinds of skills including shortage of qualified staffs for planning, administration and supervision.
- b. acute shortage of financial resources to cover the costs of rapidly growing number of development projects.
- c. insufficient coordination between the development organizations and associations.

V BASIC CONCEPT FOR DEVELOPMENT

5.01 The development of the Hajjah Province should be centering around the development of agriculture on the following grounds. First, the large majority of the rural inhabitants in the Hajjah Province has long been engaged in agriculture. Although their farming method remains traditional, they have acquired certain level of farming techniques to exploit their farmland and, therefore, possess grounds for further development of agriculture. Secondly, judging from the data and information available at present, it is quite difficult to find the industry with higher development potential than agriculture in the Province. The prospect of the development of the Province will heavily rely on the agricultural development which will encompass crop and livestock production, irrigation, afforestation, fishery and agro-based industries as integrated components.

5.02 The physical and economic environment in the Province, however, is in no sense favourable for agricultural development. The major components of the agricultural resources endowment are generally poor as mentioned in Chapter IV.

5.03 Out of the total area of about 9,590 km², only 840 km² are regularly cultivated and of which 40 km² is under perennial irrigation. Average annual rainfall is about 600 mm in the mountainous area and about 150 mm in the Tihama plain. Most of the rainfall is concentrated during two rainy seasons, April through May and July through August. Only 5.4 percent of the rainfall is available as surface water, most of which is in the form of flood discharge. The total maximum ground water which is normally rechargeable is estimated at only 20 million m³ per annum. The water resources available in the Province are quite limited and are unevenly distributed both in time and space.

5.04 In the Hajjah Province, manpower resources are still under-developed. The literacy rate is as low as 9 percent, which is far below the national average of 18 percent. The manpower situation is characterized by an overall scarcity of qualified labour, as a result of the fact that basic facilities for development, such as education and training are lacking.

5.05 Under these circumstances, the productivity in agriculture remains low, resulting in the low income level of the farmers. The low income brings about the out-migration of the able-bodied farmers into urban areas as well as abroad where they can find better opportunities to earn higher incomes. The outflow of the able-bodied farmers brings about the weakening and deterioration of the human resources base of the agricultural production, which in turn causes the lower productivity and lower income in agricultural sector.

5.06 In the long run, the agricultural development in the Province should be promoted on the basis of i) crop diversification, ii) use of better farm inputs, iii) improvement of irrigation practices, iv) agricultural mechanization and v) better marketing arrangement. In other words, the present subsistence agriculture should be replaced with the modern agriculture which would realize higher productivity and guarantee the higher income to the farmers.

To achieve this objective, rapid expansion of the agricultural support services will be highly required, because nearly all the institutions to serve agricultural development including research, extension service, farm inputs, supply services, veterinary service, credit service etc. are lacking in the Province. Although these services are prerequisites for agricultural development, it would be difficult to consolidate these services at once under the present

low level of manpower resource in the Province. Agricultural development should therefore be considered on the long term basis.

5.07 The Province is in no sense well equipped with rural infrastructures and social services. Although considerable progress has been made in some of these areas, especially in securing food supplies and reducing underemployment, the Province is still far from a satisfactory situation. Elementary education, health facilities, clean drinking water, electricity and rural access roads have yet to be provided to the bulk of the population. The rural inhabitants have more serious concerns for the immediate improvement of their living environment than the long-range agricultural development.

5.08 In fact, the weakness of such "rural infrastructures and social services" itself has become to some extent an obstacle to the effective agricultural development.

5.09 Considering all these, the ultimate objectives of integrated rural development will be:

- a. to increase agricultural production and stimulate economic growth, and
- b. to improve the condition of rural life.

5.10 It would be neither practical nor efficient, however, to start the implementation of all the development projects immediately over the Province mainly due to lack of basic data for project planning and implementation, underdeveloped development organizations coupled with shortage of skilled manpower and limited availability of investment funds. In order to attain the effective and efficient execution of overall rural development of the Province, a stagewise

development policy will, therefore, have to be adopted under these situations.

5.11 It is proposed that a small scale integrated project be established initially and be gradually expanded as more trials become known and more experience is obtained together with building of skilled manpower resources. The initial project will have to be carefully determined in accordance with priority of each development project which will be identified through the studies on each development sector.

5.12 The small scale initial project which will comprise the priority projects of each sector, will have to be integrated into a comprehensive one, and if possible, be implemented in a particular area where physical and economic environment is relatively favourable in comparison with other areas of the Province. It is proposed that in the first place, all the development efforts be concentrated to this "priority area" and the development of other areas be made successively on the basis of the achievement and results of the initial integrated project to be carried out in the priority area.

5.13 In due consideration of the present environment for development and also of the basic concept for integrated development, the following three categories of development project will be given the highest priority:

- a. basic projects for agricultural development
- b. rural water supplies
- c. construction and upgrading of rural road network

5.14 These sectors are in no sense adequate at present and are essential to the maintenance of healthy and stable society and the cohesion of the regions in socio-cultural -

political - economic context and hence long aspired by the whole population of the province.

5.15 Agriculture should play the leading role in the restoration and further development of the rural areas of the Province. Under the present development environment, however, much remains to be done before the full agricultural development is materialized. Necessary measures should be taken in order to enhance and make better use of the meager agricultural resources. Afforestation and restoring of vegetation cover, which would have beneficial effects of soil conservation and fostering of water resources, should be accelerated. With a view to procuring a proper understanding of the water resources in the Province, a meteorological and hydrological observation network should be set up. In advance of the full introduction of the modern agriculture into the Province, basic research activities as well as training of qualified personnel to serve agricultural institutions are required.

5.16 The direct benefit which would be derived from the hygienic water supply would be magnificent and manifold. It will improve the public health, save time of the women and children by relieving them from labourious work of fetching water and improve the animal health. Together with the improvement of health and education services and provision of training courses in sewing and husbandry for women, village water supply would yield the indirect benefit of the increased productivity and improved living standard together would provide large incentive for village people to settle themselves into rural society.

5.17 The construction of new roads and the upgrading of the existing road network will be the prerequisite for solidarity between the regions which are socially and

culturally isolated from each other. It will also give great contribution toward better availability of consumer goods at lower prices. The road construction would be the strong stimulant for the agricultural development. Accurate and quick market information could be reached. Farm inputs and farm outputs as well could be transported whenever needed and throughout the year at reduced transportation cost. Extension service required for advanced farming techniques could be extended to whomever and whenever needed.

5.18 The provision of village water supplies and the reinforcement of the transportation infrastructure are, therefore the precondition for the full agricultural development in the Province and should be materialized at the earliest opportunity possible.

5.19 Taking a long-sighted view, due attention should also be given to the improvement of the social infrastructures which encompasses education and health facilities, rural electrification, telecommunication and communal facilities. It would provide better living conditions and increase the volition of the rural inhabitants for working. Further, in the long run, it would bring on the enhancement of the labour productivity and higher skill level of labour force.

5.20 The overall development of the Hajjah Province should essentially involve almost all of the sectors comprising agriculture, animal husbandry, afforestation, fishery, transportation, communication, water supply, electrification, education, health and the like. They are closely connected with each other and interdependent. The Development Master Plan will be so formulated that each sector will give the greatest contribution to the overall development of Hajjah Province, paying due attention to the inter-relationship among the relevant sectors.

5.21 Since all the sectors should be integrated in the development of the Hajjah Province, a new, comprehensive implementation body will have to be established within the Province, and regular contacts will have to be maintained with the representatives of: i) Ministry of Agriculture, ii) Ministry of Public Works, iii) Agricultural Credit Bank, iv) Tihama Development Authority, v) Wadi Mawr Development Office, vi) Surdud Government Farm, vii) Wadi Zabid Development Office, viii) Southern Upland Rural Development Project in Ibb/Taiz, ix) Central Agricultural Research Station in Taiz, and other institutions relevant to the required activities. The comprehensive implementation body will have all the necessary functions including physical resources survey, planning and design, construction supervision, research, extension service and others. It is also required that the development units will have to be closely connected with the Confederation of Yemeni Development Associations (CYDA) and the Local Development Associations in the Province.

VI DEVELOPMENT PLANS

(1) Rural Water Supplies

General

6.01 At present, very few people can afford hygienic water supply in the Province. A large majority of the people generally get their drinking water either from cisterns or from wadi streams, which are usually insanitary causing serious health problem. Women and children carry the laborious work of fetching water from water sources which are usually located far away from their dwellings spending most of the daytime. Supplying the population with hygienic drinking water has long been a strong wish of the whole population of the Province.

General development plan

6.02 Water supplies would be provided to twenty-five (25) towns and villages, as marked and numbered on Fig. 6.1, with population totalling 132,000 inhabitants and containing about 32 percent of the total population of the Province. It is difficult to increase the number of the beneficiaries at the present stage, because most of the settlements are very scattered and generally too small in size. Capacity of each water supply unit to be installed, however, will have enough room for future expansion when needs arise, and will be able to supply the piped water to about half of the population at the ultimate stage.

6.03 The first stage of the rural water supplies will comprise twenty-five (25) water supply schemes, and will cover almost all of the large settlements with the population more than 1,000. The second stage will therefore be rather small scale, especially for the small settlements with the population less than 1,000. The present plan deals with

only the first stage schemes. The town and villages which will be included in the first stage schemes are listed in Table 6.1.

6.04 Water supply installation would consist of intake boxes or tube wells as the intake facilities, pumps, storage tanks, pipes and public hydrants as shown on Fig. 6.2. The designs are planned to provide eighty litres per day per person, which is considered to be sufficient to cover all domestic uses including village livestock. Water sources are surface water, ground water and springs.

6.05 The water will be pumped up from intake facilities to the storage tanks which will be built on the high places from where water will be conveyed by gravity to the public hydrants in villages. Intake facilities will be the intake boxes or tube wells. If the water table is too low at the intake site, a cut-off structure will be constructed to dam up the underground wadi flow.

6.06 The pumps will be multistage volute type with very high-head capacity, and will be operated for eight hours daily. There are two ways of operating the pumps; i.e., diesel driven and electric driven.

- a. Diesel driven pumps: The initial cost is comparatively low. However, pump operations are rather complicated and may be difficult to master for the local inhabitants.
- b. Electric driven pumps: A power generating station will be required, resulting in higher initial costs. The pump operations are rather easy.

Although the initial cost is higher, the electric driven pump units are recommendable for their easier operation. The electric power can also be used for lighting and other domestic uses.

6.07 As far as pipes are concerned, ductile cast iron pipe, steel pipe and hard vinyl chloride pipe will be used. The storage tank structures will be made of reinforced concrete and the capacity has been designed to meet the daily consumption.

Operation and maintenance

6.08 It is proposed that the pumps and pipes with same specifications should be used at every water supply schemes sites for easier arrangement of spare parts and operators. It is also proposed that the pumps should be operated by salaried pump operators recruited from the local community, and that these operators should receive a basic training in advance.

(2) Rural Road Network

General

6.09 In the Hajjah Province, modern road network is non-existent at present. The only available land transport means are primitive tracks suitable only for four-wheel drive vehicles and animal transport, which are usually closed during rainy season. General lack of transport facilities has been a major cause of social and cultural isolation between the regions in the Province and of confinement of marketing areas within wadi flood basins and sub-range of mountains.

6.10 The road network in the Hajjah Province is shown in Fig. 6.3. There are two principal roads. One is running through the Tihama lowland from Al Zahra to Harad in the north-south direction. The other is Amran-Khashm road which is traversing the mountainous area and Tihama lowland in the east-west direction. No paved roads run in the Hajjah Province. The Amran-Hajjah road which is now under construction is planned to be paved by the cooperation of the People's Republic of China.

Proposed road Network

6.11 Three (3) secondary roads have been planned to be improved or newly constructed so as to form a rectangular shape together with Sana'a-Sadah main road which is running through the mountainous area in the east of the Hajjah Province. The first one is existing Harad-Al Zuhra road, which is running through the Tihama lowland in the north-south direction. The second one is Amran-Hajjah-Al Zuhra road, traversing the mountainous area. The third one is Huth-Washha-Harad road in east-west direction.

6.12 Besides these three secondary roads, a Hajjah-Al Mahabisha-Abs secondary road has also been planned to be improved so that the political and economic centers in the Province could be connected. The road must run across the Wadi Mawr between Hajjah and Al Mahabisha. A bridgework with a total length of about 200 m will be required at the wadi crossing to secure passage of traffic during the flood season.

6.13 It is anticipated that these four secondaries will form main arteries of the economy of the Province and these arteries would fulfill their functions to a maximum extent possible, giving due consideration for the growth trend of the economy. The proposed secondary roads are as follows:

<u>Route</u>	<u>Length (km)</u>	<u>Remarks</u>
Amran - Hajjah	50	under construction
Hajjah - Khashim - Al Zuhra	60	improvement
Al Zuhra - Abs	45	improvement
Abs - Al Mahabisha	35	improvement
Al Mahabisha - Hajjah	45	under construction
Abs - Harad	70	improvement
Harad - Washha - Huth	125	under planning
<u>Total</u>	<u>430</u>	

6.14 Feeder roads are so planned as to link all the principal towns and villages in the area, making best possible use of the existing roads. Special attention has been paid to the connection of feeder roads with secondary roads or other feeder roads in order to avoid the simple side-track roads.

6.13 The proposed road network of secondary and feeder roads is shown in Fig. 6.4. The total length of the feeder roads reaches to 1,700 km in the area, and together with the secondary roads, the road density in the area becomes 220 m/ km².

6.16 The secondary roads would have two lanes in principle with double bituminous surface treatment, and the feeder roads one lane with gravel pavement.

(3) Agricultural Development

Development potential

6.17 The economy of the Hajjah Province has been centering around agriculture, which employs more than 70 % of the labour force of the Province. The Hajjah Province, however, is by no means richly endowed with agricultural resources. Definite limits to the agricultural development are set by the limited arable land and water resources. In areas where rainfall and irrigation water are adequate for crop production, available arable land is already in full use. In areas where unused arable land exists, additional water resources are not available for development (Tables 6.2 and 6.3, to be referred).

6.18 The absolute limit of the physical resources means that the prospect for expansion of agricultural production lies in better utilization of land and water for the highest

return crops under proper farm management. The present low level of agricultural productivity suggests considerable potential for development. Even under the limiting conditions of low and erratic rainfall, crop yields could be increased through the improvement of cultivation techniques including use of high yielding seeds, fertilizers and agrochemicals. Better animal husbandry and health care together with improvement of animal feeds can increase weight gains and improve eggs and milk production.

6.19 A large body of good crop research has been carried out by on-going research projects on the country basis. The fertilizer research results indicate a very substantial potential for increasing crop yields in high rainfall regions. In areas where rainfall is less than 400 mm per annum, the farmers may not be willing to take the financial risk of applying fertilizers. These low rainfall areas occupy about 59 % of total arable lands. In such low rainfall areas, crops do not respond well to fertilizers. The present meteorological study indicates that about 12 % of the total arable land is in areas with annual rainfall of over 600 mm. While these high rainfall areas already have the highest and most stable crop yields within the confines of traditional techniques, they also have the highest potential for still higher yields. The areas receiving marginal rainfall of 400-600 mm per annum, extend mainly on midland, occupying about 29 % of the total arable land. These marginal rainfall areas have also some potential.

6.20 A further potential exists in crop diversification, a shift to higher-return crops. After centuries of subsistence farming, farmers are now faced with drastic social changes including labour shortage, high wages, relatively easy access of Sana'a and changing consumer

tastes. These changes offer new opportunities for the shift to market-oriented agriculture. A trend in this direction is already apparent. Many farmers have already started planting new-high-value crops like vegetables and fruits. With rising urban incomes, dietary habits are changing. The urban population increasingly consume a wide variety of vegetables and fruits. The Province has now very easy access to Sana'a by the completion of road between Hajjah and Amran. Continued increase in demand for vegetables and fruits will support the agricultural development in the Hajjah Province.

6.21 Livestock also has the potential for a greater contribution to the rural economy. The demand for livestock products is also increasing and the Province will have better position as the supplier because of its favourable location. However, this will require an improvement of rangelands, use of crop by-products and growing of fodder crops in rotation with other crops. In addition to these improvement of animal feeds, better veterinary care would be essential for livestock development. Dairy farming and poultry production would have some potential in the Hajjah-Mabyan area.

Development constraints

6.22 The agricultural development plan will have to aim at increasing crop and livestock production and raising farm incomes of the rural inhabitants. To achieve an increase in production, a number of constraints have to be eliminated. The major constraints involved in the exploitation of agricultural potential are summarized as follows:

a. Human Factors

- i. Most of the farmers are not knowledgeable or experienced in modern farming practices. They

are unlikely to take financial risks of adopting new practices.

- ii. A large number of the rural inhabitants who should carry out the task of agricultural development have left their villages due to higher wages offered by the neighbouring oil-producing countries. This brought about serious labour shortage problem in rural area and pushed the rural wages up to relatively high level (rural wages have risen about 20-25 times since 1972 compared with 3.6 times for the general price index).
 - iii. The large cash remittances sent to rural villages by the migrant workers are reducing the incentives to continue cultivating the marginal agricultural lands.
 - iv. Higher costs of production due to higher labour wages led to a reduction in area planted in low-value crops, mainly cereals and abandonment of marginal lands, and have jointly resulted in an overall decline in food grain outputs.
- b. Institutional Factors
- i. Nearly all the institutions to serve agricultural development have not been put operation in the Province.
 - ii. Most farms are tenant-operated. The traditional 50/50 sharing system does not give the share-cropper an incentive or the means to adopt more costly farm practices, especially use of fertilizers and insecticides.
 - iii. The share-cropper cultivates the lands under a verbal agreement with the landowner on the

terms and conditions that are determined by tradition. Even if both owners and tenants have an interest in long-range farm improvement like irrigation work, soil erosion protection measures, land reclamation, etc., the cooperation between the two can hardly be expected on such a year-to-year verbal understanding.

- iv. There is an extreme shortage of professional staff and technician required for new agricultural institutions and services.

c. Physical Factors

- i. The expansion of agricultural production is definitely limited by the all-important factor "water" as already mentioned.
- ii. Secondary and feeder roads connecting the farming areas have not been developed. Many villages are not accessible by motorized transport. Construction of infrastructural facilities, institutional agricultural services and marketing activities are largely constrained by the lack of motorized rural roads.
- iii. Many of the rural inhabitants are living in a harsh environment where the people's basic needs are not yet satisfied, especially in social services like clean drinking water, health facilities, elementary education and electricity. The rural inhabitants have more serious concerns for the immediate improvement of their living environment than the long-range on-farm improvement.

Proposed measures for improvement of agricultural production

6.23 Although the exploitation of agricultural potential is presently constrained by a number of human, institutional and physical factors, the development prospects of the Province will heavily rely on the agricultural sector. In the long run, the agricultural development will have to be promoted, in spite of the limits set by a number of constraints, on the basis of a) crop diversification, b) use of better farm inputs, c) improvement of irrigation practices (to make the best possible use of limited irrigation water available), d) agricultural mechanization, and e) better marketing arrangement. In other words, the present subsistence agriculture should be replaced with the market-oriented one which would realize higher productivity and guarantee the higher incomes to the farmers.

6.24 A constant flow of field-tested knowledge relevant to crop and livestock production will be a pre-condition for the success of such prospective agricultural development. Many of the rural inhabitants are living in a harsh environment where investment will produce very little extra income until technical discoveries create reliable new opportunity. In this view, it is proposed that the following specific schemes be established within the Hajjah Province.

- a. agricultural research station for development of midland agriculture
- b. research and training center for mechanization and irrigation, particularly for development of lowland.

6.25 Introduction of institutional agricultural services, on the basis of the results to be obtained from the proposed research institutions, will also become very necessary,

because nearly all the institutions to serve the agricultural development, including extension services, credit facilities, farm input supply services, research, etc., are lacking in the Province. Although these institutional services are considered as prerequisites for agricultural development, it would be very difficult to consolidate all the needed institutions and services at once under the present low level of manpower resources in the Province. The agricultural development should therefore be considered on the long term basis.

6.26 In implementing agricultural development, opinions may differ as regards the scale, phasing and the requirements of various other sectors. In due consideration of the constraints involved in the agricultural development, it is proposed that, among others, small scale development schemes be established initially, which will be gradually expanded as more trial results become known and more experience is obtained together with building of skilled manpower.

6.27 Considering all these, the basis for the promotion of agricultural development will be a comprehensive implementation body, which will carry out all the tasks necessary for the rural development. The proposed set-up of this comprehensive implementation body will be discussed in Chapter VIII, "ORGANIZATION AND MANAGEMENT." The activities to be carried out under the proposed set-up will be comprehensive and directed towards overall improvement of the rural incomes and welfare.

Agricultural research station

6.28 The midland region occupies 42.6 % of the total land area or 4,090 km² in the Hajjah Province. Although its soil condition is not very favourable, the midland region will continue to be important for crop and livestock

production, receiving relatively high rainfall of about 400-600 mm per annum. However, there is no research institution to serve the development of midland agriculture in this country, while a large body of agricultural research for both lowland and highland zones has been carried out by the existing research institutions.

6.29 The proposed agricultural research station will be established around Al Mahabisha where irrigation water is available. The agricultural research station will carry out, in close coordination with the Central Agricultural Research Station (CARS) in Taiz, various field trials and basic meteorological observation necessary for agricultural development of midland region. The technical information to be obtained through the field trials will have to form an integral part of the extension services. The research station will also serve the advanced training of extension workers who will be recruited from the local community and offered a basic training in the existing training facilities. In the light of special importance of afforestation in the mountain regions, a forest nursery will be included in the proposed research station.

6.30 The agricultural research to be carried out will mainly be confined to:

- a. field trials of crop varieties selected elsewhere in the country for their adaptability to the local condition,
- b. field trials of fodder crops and trees for improvement of animal feeds,
- c. veterinary studies for cattle, domestic fowls, sheep and goats,
- d. demonstration and research for irrigation method and crop water requirement by using small pumps,

- e. farm economy survey and study on farm management.

6.31 The proposed size of the agricultural research station will be 10 ha including the sites for offices and laboratories. The proposed site is located on the Jaya area, about 3 km southeast of Al Mahabisha.

6.32 The agricultural research station will be gradually expanded and at the stage which all the activities will get on the right track, the following branch stations will be established:

- a. stock seed farms for keeping pure-line seeds of recommendable varieties
- b. seed multiplication fields to be managed by the progressive farmers under the contract with the agricultural research station
- c. veterinary service station to be attached to each branch office (refer to Chapter VIII)
- d. demonstration fields for small scale pump irrigation and new horticulture technique
- e. pilot afforestation schemes

6.33 The agricultural research station will have the following sections in its organizational set-up:

- a. crop research
- b. livestock
- c. irrigation improvement
- d. farm management
- e. afforestation
- f. information and administration

The organizational set-up will be discussed in Chapter VIII, "ORGANIZATION AND MANAGEMENT."

Research and training center for irrigation and mechanization

6.34 The lowland agriculture is characterized by relatively large farm holding, cereal-single-cropping, rainfed cultivation under tropical climate with scant rainfall, extreme labour shortage and relatively low agricultural incomes. According to the soil studies, there exist 2,690 km² of arable land in the lowland, out of which only 790 km² are presently under cultivation. Expansion of cropland will be the essential basis for promotion of agricultural development in the lowland. The labour shortage and the limited availability of water will be the limiting factors for the expansion of cropland.

6.35 In order to make the best possible use of water available, crop water requirement will have to be re-studied. If the water consumption could be saved, more areas of arable lands would be put under irrigation, resulting in the increase of total output. Water losses in the water conveyance system should be kept as low as possible. Irrigation structures and land levelling have to be improved in view of an efficient water distribution and it will have to be studied which irrigation methods can best be applied.

6.36 The labour constraint can only partly be removed by a greater emphasis on mechanization. Quick land preparation by mechanization will make the timely sowing of crop possible. Mechanization will also be effective for catching seasonal flood water under spate irrigation. However, mechanization will have to be carefully introduced. The gradual introduction of intermediate technology will be a valuable solution in a situation in which skilled manpower, maintenance facilities and capital resources are lacking.

6.37 With this in view, it is proposed to establish a research and training center for irrigation and mechanization. The proposed site will be within the Abs area where about 1,300 ha of the spate-irrigated land will possibly be improved by constructing headworks on the Wadi Qur and canal system. The size of the proposed center will be 20 ha.

6.38 The major activities to be carried out will be as follows:

- a. meteorological observation and analysis through the establishment of observation network
- b. trial cultivation of crop varieties selected by the Tihama Development Authority for their adaptability to the local condition
- c. experiment on crop water requirement and irrigation method
- d. testing of mechanized cultivation using various equipment and attachments
- e. training of machine operators and mechanics.

6.39 The trainee of the center will have to be recruited from the local community and will have to gain an insight into the way in which to make use of machinery in the lowland. The center will then serve to the rural community as a supply unit. The technical information to be obtained from the field trials will be promptly transferred to extension services.

6.40 The proposed organizational set-up will comprise three (3) departments, i.e., irrigation, machinery and administration, and it will be discussed again in more detail in Chapter VIII, "ORGANIZATION AND MANAGEMENT."

Selection of suitable crops

6.41 The crops to be grown in the Hajjah Province should be highly profitable, and also have good marketability. The crops should also be of water-saving type and be suited to the local condition. Selection of suitable crops will have to be made on the basis of the results of studies on water saving crops and farming practices, marketability relative to crop varieties and quality, profitability of crops in terms of profit and loss, and adaptability to local condition. All these factors for selecting the suitable crops have not been, however, clarified yet.

6.42 Selection of suitable crops were therefore studied within the confines of limited information obtained from the farm economic survey and research results published by the government research institutions. The studies were made for different agricultural zones, i.e., lowland, midland and highland, in terms of four factors; water-saving characteristics, marketability, profitability and technical adaptability. The water saving characteristics are graded by crop-water requirement. Marketability is evaluated by using the expected net production value and profitability by output-inputs ratio. Technical adaptability is assessed from agronomic viewpoint on the zone-by-zone basis. Results are given in Table 6.4.

Proposed farming pattern

6.43 The proposed farming patterns for each agricultural zone have been studied on the basis of the selected crops and prospective agricultural development in each zone. They are shown in the following table. These farming patterns and crops to be adapted will have to be re-studied in the proposed research institutions.

<u>Agricultural Zone/Quada</u>	<u>Proposed Farming Pattern</u>	<u>Major Crops</u>
Lowland (0 - 500m) Quada: Midi	<ul style="list-style-type: none"> - Large scale mechanized cereal (sorghum, millet) production under rainfed condition - Small scale vegetable and tropical fruits production under irrigated condition - Large scale mechanized sorghum and cotton production under spate irrigated condition - Large scale rainfed sunflower production - Grazing (cattle, sheep, goats) on perennial low vegetation 	<ul style="list-style-type: none"> Sorghum Millet Cotton Sunflower Tomatoes Okra Pepper Papaya Banana
Midland (500 - 1,500m) Quada: Hajjah Shahara Washha	<ul style="list-style-type: none"> - Small scale cereal and vegetables production on the irrigated wadi lands - Small scale rainfed maize and potatoes production on terraced lands - Small scale soybean and groundnuts production under rainfed condition - Grazing (sheep, goats) 	<ul style="list-style-type: none"> Maize Potatoes Onion Cucumber Soybean Groundnuts
Highland (1,500-2,500m) Quada: Al Mahabisha	<ul style="list-style-type: none"> - Intensive cereal (wheat, barley) production under rainfed condition - Intensive coffee and grapes production on gentle slope lands complementary irrigated by hill-slope runoff - Vegetables and fruits production under irrigated condition - Cattle raising with fodder crop production - Commercial poultry 	<ul style="list-style-type: none"> Wheat Barley Grapes Coffee Vegetables Fruits Fodder crops

Future agricultural production

6.44 There exist about 1,410 km² of cropland in the Hajjah Province, out of which only 840 km² are regularly cultivated mainly due to labour shortage caused by

outmigration as described before. Although the Province has 3,810 km² of arable land, most of unused arable lands extend on the lowland area with annual rainfall of less than 400 mm and cultivation on such low rainfall lands will not be very profitable. Such being the situation, expansion of croplands will not be feasible. The basis for improvement of agricultural production will, therefore, be full use of existing cropland and improvement of land productivity. Labour constraint can be only partly removed by a greater emphasis on mechanization.

6.45 Prospective cropping patterns have been prepared for each quada on the basis of suitable crops, proposed farming patterns and areas of existing croplands. These are shown in Fig. 6.5. The cropping intensity will be possibly increased from present level of 60 % to 139 % at the full development stage.

6.46 The future agricultural production has been calculated and shown in Table 6.5. The future net production value will be YR 2,131 million compared with YR 1,121 million of present production value, as summarized below:

	<u>Total Crop Production</u> (×10 ³ YRs)	<u>Per Household</u> (YRs)
a. Present	1,121	20,240
b. Future	2,131	38,470
c. Increment	1,010	18,230

In this estimate, production values of livestock products are excluded due to lack of dependable base for estimation. However, the increased production of crops would produce a lot of by-products which could be fed to animals and would contribute to the increase of livestock production in future.

(4) Irrigation Improvement

General

6.47 In the Hajjah Province, irrigated agriculture is limited due to the scarcity of water resources. The water resources for irrigation are ground water, very small perennial flow and seasonal floods coming down the wadi courses. Blessed with higher rainfall, the rainfed farming prevails in the mid and high-lands. Spate irrigation is common in the areas along wadis mainly in the coastal lowland. Ground water irrigation (shallow wells) by pumps is also practised in some areas in the lowland, but the commandable areas are generally very small. The irrigation area totals only 16,000 ha, corresponding to about 11 % of the total cropland.

6.48 Irrigation possibility in the Province is not promising. Expansion of irrigation area is generally difficult because strictly limited additional water is available. The areas where irrigation is technically applicable, irrespective of economic feasibility, are as follows:

- a. wadi-delta plains in Tihama area by a combination of small dams and wells
- b. swampy lands around Al Mahabisha by pumps
- c. gentle-slopes along the wadi courses by a combination of small dams and pumps

In each case, the commandable area is small and very high economic return will not be expected.

Irrigation plan

6.49 Wadi-delta plains in lowland: In the Tihama lowland, spate irrigation has been practised for centuries. The area under spate irrigation is about 12,000 ha, most of which extend along the wadi courses. The wadi water seems

to be already fully utilized for irrigation and other uses. Several dikes have been constructed across the wadi courses in order to divert the wadi spate water and keep the water in the fields for longer period. The dikes are of temporary nature and sometimes reconstructed by the farmers themselves using bulldozers. The extent of the spate irrigation area depends on the flood courses and discharges, and therefore the irrigation area fluctuates largely year by year.

6.50 Since the additional water resources are quite limited, the basis for irrigation development will be improvement of irrigation water use. This includes improvement of irrigation water distribution, through construction of semi-permanent intake structures and canals and also land levelling, and re-use of seepaged water by shallow wells and pumps. In the lowland, about 8,500 ha of the existing irrigated cropland will be possibly improved by constructing diversion works, supply canals and additional tube-wells. The irrigated areas to be thus improved extend along the wadis as shown in Fig. 6.6.

6.51 Swampy lands around Al Mahabisha: There are three (3) scattered inter-mountain plains around the town of Al Mahabisha, totalling about 500 ha in area. They are:

- a. Jaya area : 300 ha
- b. Tahannen area : 100 ha
- c. Sharhil area : 100 ha

In these areas, spring water is available and has partially been exploited for irrigation. The farmers grow rice under swampy condition. The soils of these lands are graded as Land Class 1, arable, being medium textured deep soils. If the irrigation water is effectively applied, crop production will be largely improved. In these areas, water is sufficient for irrigating all the arable lands of 500 ha.

The areas are among others considered economically justifiable under present economic circumstances.

6.52 The irrigation plan includes full use of spring water and further exploitation of shallow groundwater. About 10 shallow wells will be made at the rate of one unit per 50 ha. The irrigation facilities will consist of 30 m shallow well, diesel driven pumps and pipes with 300 mm diameter. The irrigation plan will be discussed in Chapter IX, "PRIORITY AREAS AND DEVELOPMENT PLAN."

6.53 Gentle-slopes along wadi courses: There exist scattered narrow strips along the wadis. Although these lands have not been clearly identified yet, they occupy considerable areas. The estimated total area of these wadi lands is approximately 15,000 ha. These wadi lands include somewhat wide strips of about 50 - 100 m width. Irrigation will be feasible on these gently sloping wide wadi lands. The total area of such land is estimated at about 1,000 ha. Most of narrow strips are subject to seasonal flood damages and not suitable for modern irrigation practices.

6.54 Irrigation water will be taken directly from the wadis, by using diesel-driven pumps, and will be distributed to the field through pipe network. The commandable area will be generally small. Irrigation unit commanded by each intake facility will be about 10 - 30 ha.

Field trial on irrigation practices

6.55 The present irrigation practices show a remarkable degree of efficiency within the confines of traditional techniques. However, the water requirement will have to be re-studied through field experiment. If the water consumption could be saved, more areas of arable lands would be

put under irrigation, resulting in the increase of total output. The water saving farm practices, including water application methods and field mulching, will also be studied for making the best possible use of the limited water.

6.56 The irrigation improvement plan will have to be modified after examination of these field trials and will require more accurate data on meteorology and hydrology. It is strongly recommended that observation gauge network be established within the Province as early as possible.

(5) Afforestation

Basic concept for afforestation

6.57 The forestry resources of the Hajjah Province are sparse and being depleted rapidly. Not much effort, however, has been done for afforestation in the Province. The present denudation and depletion of woodlands, which resulted from the quest for quick return and lack of integrated development strategies, have brought about very serious repercussions. For instance, dangerous floods and torrents (and ironically shortage of water), soil erosion, exposure of soils to dry climate and desertification, shortage of essential wood products and soaring prices are giving many hardship to rural inhabitants.

6.58 The benefits of afforestation are manifold, and the rural inhabitants will have to rely on woodlands for various essential requirements. Fuel wood may be the only available source of energy in the rural areas. Wood products like pole lumbers and sawnwood are also needed for housing, furniture, handles of agricultural tools, etc. Wood lands are also a source of fodder for livestock. The green belts and windbreaks close to settlements and shade trees along roads and in between and within houses, will

enhance the quality of rural life through improvement of climate protection and provision of recreational outlets. Windbreaks around croplands also protect crops against adverse climatic conditions and induce higher productivity. Forestry benefits to rural inhabitants also take the form of soil and water conservation.

6.59 The steady decline of forestry is so serious at present and cannot be reversed except over the very long run. Factors which impede afforestation in the rural development include uncontrolled over-grazing, indiscriminate cutting for fire wood and lack of tree protection and replacement. Individual farmers pay little attention to overall resources limitation. Another problems in this connection are lack of sufficient fund for afforestation and shortage of trained forestry manpower coupled with lack of institutional support. This situation is further accentuated by the difficult question of land tenure. As most of the lands are privately owned, suitable afforestation sites for community use are difficult to select in the Province.

6.60 The forestry work for rural development will have to be carried out by the rural inhabitants who will also receive most of benefits. This must be the principle of forestry development in the rural area. Considering all these, it is proposed that the rural inhabitants be given a demonstration to show forest or trees on their lands are beneficial. In order to strengthen the demonstration work, agricultural extension should also cover forestry work and forest nursery be established at a suitable site for propagation of technical know-how coupled with distribution of tree seedlings.

Development plan

6.61 The development plan will cover the four (4) typical areas as shown below:

- a. Tihama lowland
- b. range lands on rocky slopes
- c. marginal terraced lands
- d. gullied areas and severe erosion sites

6.62 Tihama lowland: The urgent requirements of the inhabitants in this region are (a) protection of cropland from sand dune encroachment, (b) fodder for their livestock, and (c) fuel woods and building poles. Some indigenous species like *Suaeda monica*, *Tamarix vlovica* and *Panicum Turgidum* can be utilized in fixing sand dune movement. However, *Acacia albida*, *Cassia stritii* and *Prosopis chilensis* may be more effective in this area. These tree species have important characteristics of resisting drought and their vegetable parts or pods can be fed to animals. The extensive flats in the Tihama lowland have a good potential for industrial plantation of timber trees. For accomplishment of these development targets, the rural inhabitants will have to be convinced to include promising tree species among their cash crops. This can be led by demonstration.

6.63 At least two (2) demonstration sites will be needed to lead this type of work in extensive area of the Tihama lowland. The areas selected for demonstration will be located around Abs and Harad. The sites will cover about 10 ha each and be provided with irrigation facilities. The demonstration work will, however, necessitate research on species trials and watering regimes. Such trials would require several years to identify the most suitable trees for different ecological zones in the Tihama lowland. Such research work will not be included in the development

plan. The research activities will be continued by the Tihama Development Authority. The demonstration work will, therefore, have to be delayed until the research work will progress into final stage.

6.64 Range land on rocky slopes: These lands are being cased for grazing. The total land area is about 622,000 ha or 65 % of the Hajjah Province. The area is mainly dwarf grassland with sparse scrub. The natural vegetation is very poor. Existing woody lands are continuously dwindling because of over grazing and uncontrolled cutting for fire woods and building poles without protection and replacement. This area will have to need the care of perennial vegetation preferably fodder trees, through which watershed protection and soil conservation will be achieved. The rural inhabitants could be led by demonstration to promote the afforestation in this area.

6.65 The demonstration will be carried out in two (2) areas. One will be located in the 300-500 mm rainfall area and the other in the over 500 mm rainfall area. One of the sites selected is located around Shahara representing for less rainfall area and the other is located around Al Mahabisha for higher rainfall area. The size of demonstration afforestation site will be 200 ha each under rainfed conditions. The recommendable fodder tree species are *Acacia mellifera*, *Ziziphus spina*, *Prosopis chilensis*, etc. Many other species are being studied by on-going forest nurseries in Sana'a and Ibb. Seedlings of promising tree species will be obtainable from these nurseries.

6.66 Marginal terraced lands: In these lands on which tree plantation is rather urgent as described before, it is recommended that tree species suitable for building poles and timber for agricultural implements be planted. The

seedlings of promising species like *Eucalyptus camaldulensis*, *Casuarina equisetifolia*, etc. are readily obtainable from the said on-going forest nurseries. The demonstration work will be difficult for these areas because most of lands are privately owned. Extension services will, therefore, be highly required for this type of work. The serious areas where marginal lands are continuously abandoned, are Hajjah, Mabyan and Shahara. The extension services and provision of tree seedlings will first be concentrated to these areas.

6.67 Gullied areas and severe erosion sites: These lands can also be reclaimed by planting tree species like *Acacia farnesiana*, *Leucaena glauca* and *Cassia auriculata* which will be able to grow quickly and to generate themselves even under severe conditions. It is very important to involve the rural inhabitants in this type of works and to demonstrate that the lack of vegetation cover resulted in gullies and advanced soil erosion sites. The lands that require soil and water conservation, extend over the Province. The demonstration or pilot afforestation on such lands will gradually be carried out after some progress will be observed on the range land on rocky slopes and the marginal terraced land.

(6) Fishery Development

6.68 The present stage of fishery in the Province is too primitive. Although fish resources are considerable, local fish demand is not big enough for further development. Investment on fishery development may not be feasible at present. The magnification of domestic fish demands will be pre-condition for further development.

6.69 Hodeidah and Kamran, famous fishery ports, are located near to the Hajjah Province. Several projects concerning industrial fishery are planned and some of them have been

executed in these areas. Even if fish consumption increases in the Hajjah Province, most of fresh fish will come from these areas where all necessary facilities are already installed and a large quantity of fresh fish can be supplied to the markets. With this in view, the Hajjah coast would have only supplementary function for fresh fish supply. A large scale fishery development will not be feasible under present economic circumstances.

6.70 It is expected that on-going fishery projects will exploit the latent domestic demand for fish and gradual changes in fish consumption will extend over the country as well as the Hajjah Province. There are good opportunities to develop the domestic markets, as farm interview conducted by the present team has indicated that fresh fish, if in good state of preservation, is readily accepted by the rural inhabitants and also that the demand increases when good quality of fish is offered at reasonable prices.

6.71 The fishery development along the Hajjah coast is not promising as stated before. Although drastic investment is not feasible, gradual improvement will have to be continued for better profits from fishery operations. Among others, small landing facilities, ice-making plant and cold storage will be essential needs for improvement of present fishery. Investment will have to be made gradually within the amounts the rural inhabitants can share. It is recommended that these investments be supported by credit facilities.

6.72 Considering all these, the fishery development is not of urgent nature. For effective use of limited fund, the fishery development will have to be delayed until other sectors will be started along right lines. In the master plan, any fishery development will not be taken into consideration.