

JAPAN INTERNATIONAL COOPERATION AGENCY

AGRICULTURE DEPARTMENT
PROVINCE OF THE PUNJAB
THE ISLAMIC REPUBLIC OF PAKISTAN

BASIC DESIGN STUDY REPORT
ON
LAND RESOURCES DEVELOPMENT PROJECT
FOR THE UPLIFT OF FARMING COMMUNITY
IN THE PROVINCE OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN

OCTOBER 1992

CONSTRUCTION PROJECT CONSULTANTS, INC.

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CONSTRUCTION PROJECT CONSULTANTS, INC.

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PREFACE

In response to a request from the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct a basic design study on Land Resources Development Project for the Uplift of Farming Community in the Province of the Punjab and entrusted the study to the Japan International Cooperation Agency (JICA).

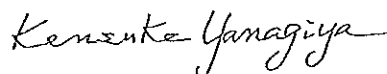
JICA sent a study team to Pakistan, headed by Mr. Yoshikatsu Nakamura, Director, 1st Basic Design Study Division, Grant Aid Study & Design Department, JICA, and constituted by members of the Construction Project Consultants, Inc., from July 3 to August 1, 1992.

The team held discussions with the officials concerned of the Government of Pakistan, and conducted a field study at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Islamic Republic of Pakistan for the close cooperation extended to the team.

October 1992



Kensuke Yanagiya
President
Japan International Cooperation Agency

October 1992

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

We are pleased to submit herein the basic design study report on Land Resources Development Project for the Uplift of Farming Community in the Province of the Punjab in the Islamic Republic of Pakistan.

This study has been prepared by Construction Project Consultants, Inc., based on a contract with JICA, from June 25th to October 30th, 1992. Throughout the study, we have taken full consideration of the present situation in the Islamic Republic of Pakistan, and have planned the most appropriate project under the scheme of Japan's grant aid.

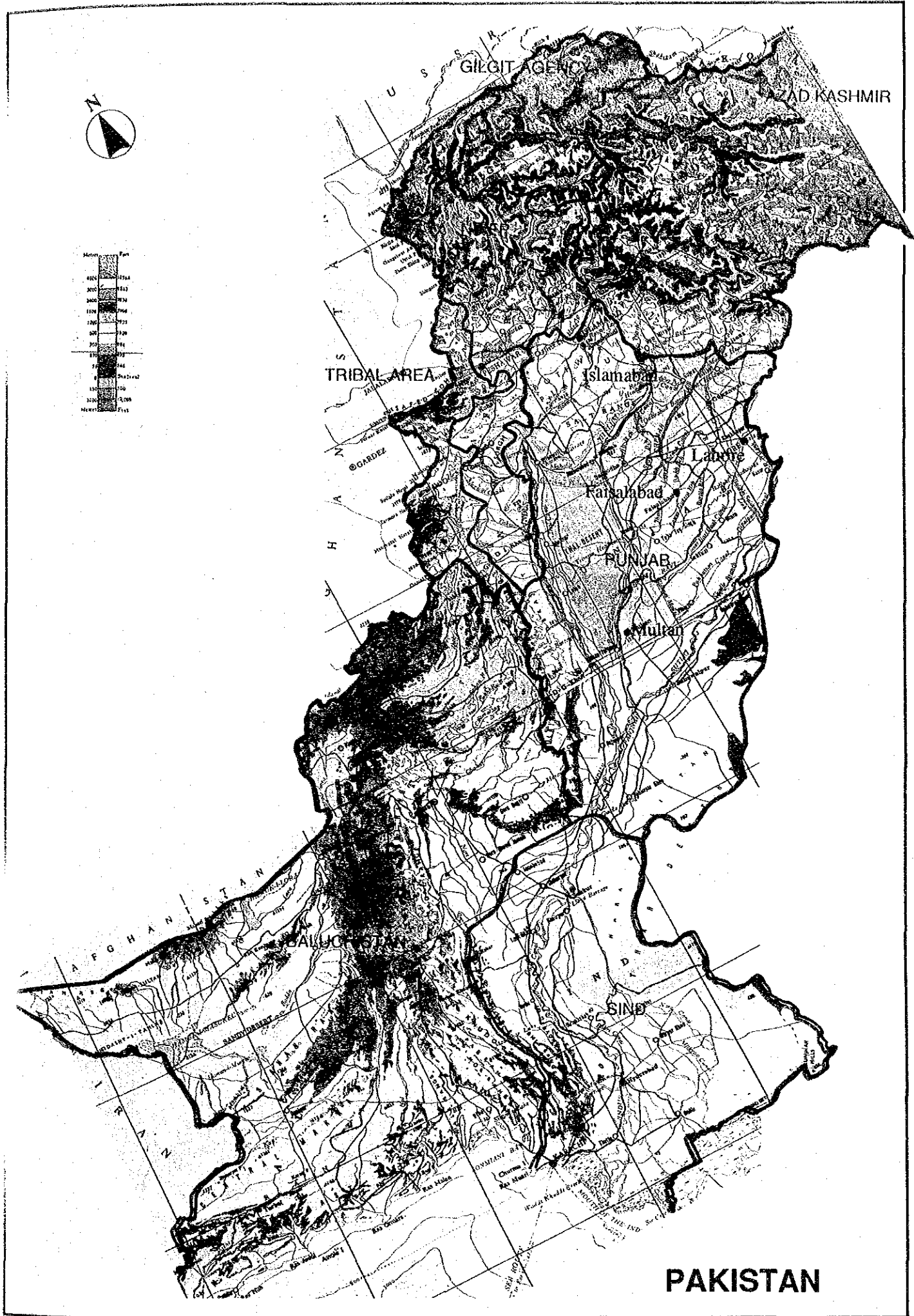
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs and Ministry of Agriculture, Forestry and Fisheries. We also wish to express our deep gratitude to the officials concerned of the Ministry of Finance and Economic Affairs, the Agriculture Department, Government of the Punjab, the JICA Pakistan Office and the Embassy of Japan in Pakistan for their close cooperation and assistance during our study.

Lastly, we hope that this report will be effectively used for the promotion of the project.

Very truly yours,

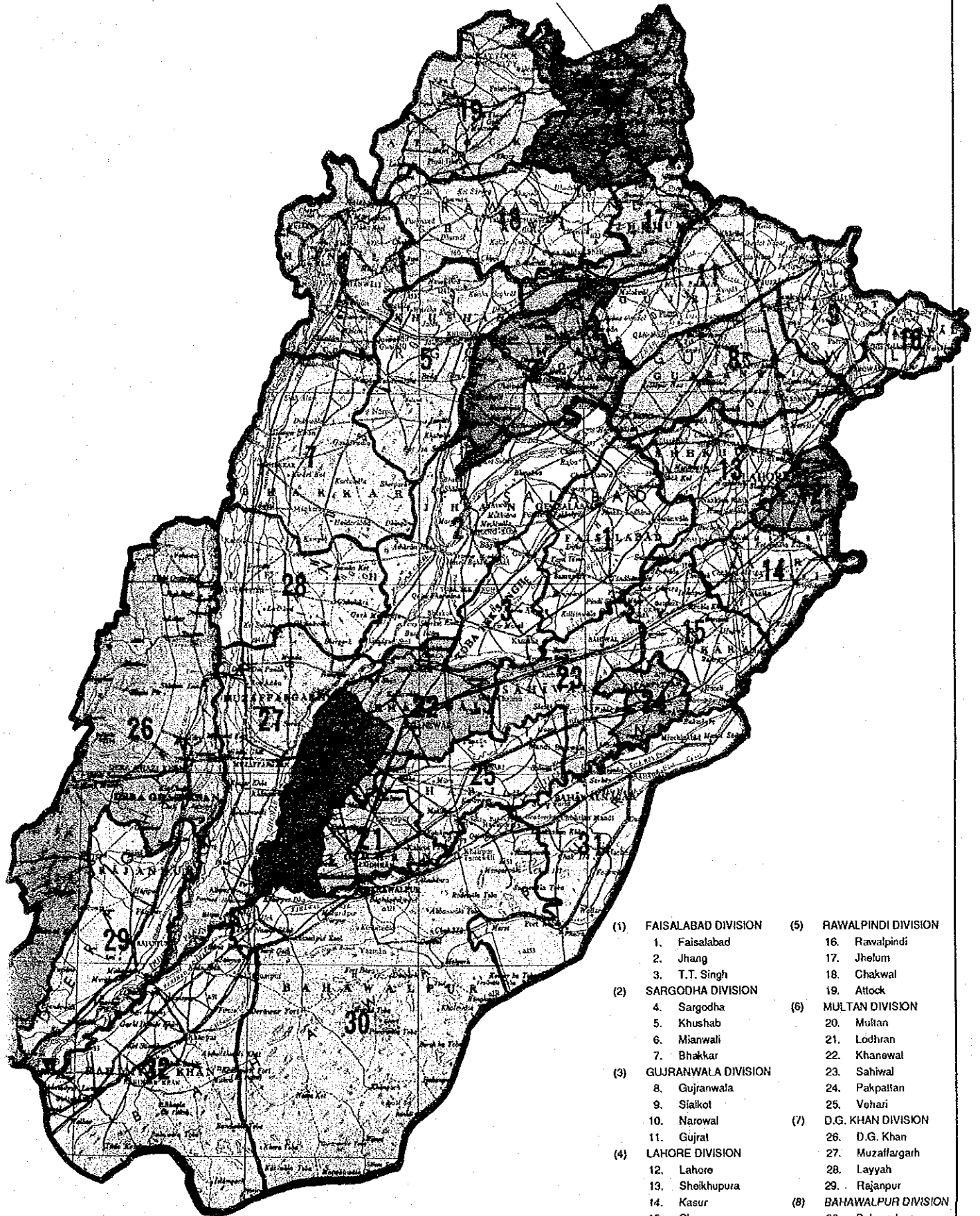


Daisaku Inaba
Team Leader,
Basic Design Study Team on
Land Resources Development Project
for the Uplift of Farming Community
in the Province of the Punjab
Construction Project Consultants, Inc.



PAKISTAN

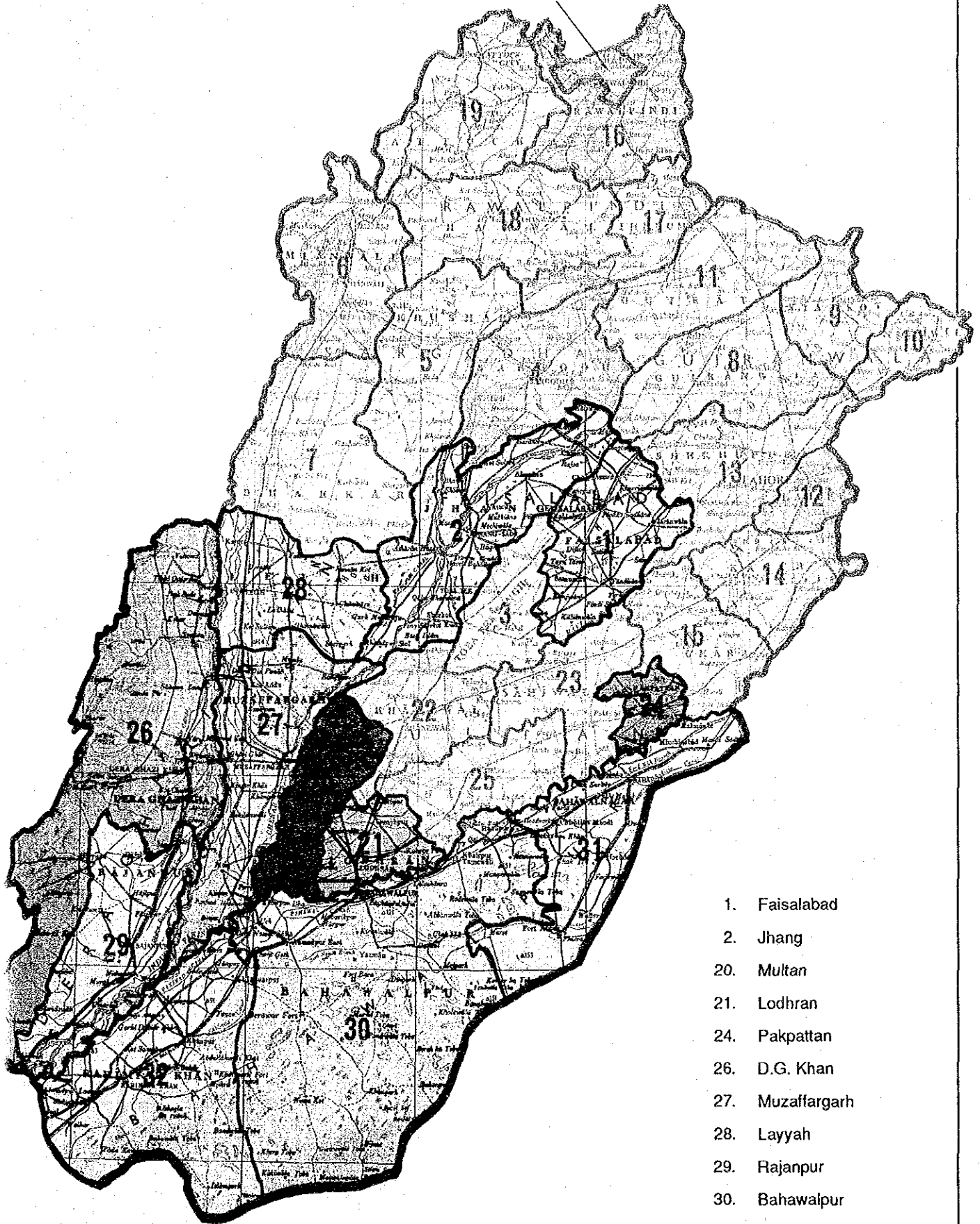
ISLAMABAD



- | | |
|-------------------------|-------------------------|
| (1) FAISALABAD DIVISION | (5) RAWALPINDI DIVISION |
| 1. Faisalabad | 16. Rawalpindi |
| 2. Jhang | 17. Jhelum |
| 3. T.T. Singh | 18. Chakwal |
| (2) SARGODHA DIVISION | 19. Attock |
| 4. Sargodha | (6) MULTAN DIVISION |
| 5. Khushab | 20. Multan |
| 6. Mianwali | 21. Lodhran |
| 7. Bhakkar | 22. Khanewal |
| (3) GUJRANWALA DIVISION | 23. Sahiwal |
| 8. Gujranwala | 24. Pakpattan |
| 9. Sialkot | 25. Vehari |
| 10. Narowal | (7) D.G. KHAN DIVISION |
| 11. Gujrat | 26. D.G. Khan |
| (4) LAHORE DIVISION | 27. Muzaffargarh |
| 12. Lahore | 28. Layyah |
| 13. Sheikhupura | 29. Rajanpur |
| 14. Kasur | (8) BAHAWALPUR DIVISION |
| 15. Okara | 30. Bahawalpur |
| | 31. Bahawalnagar |
| | 32. R.Y. Khan |

DISTRICT MAP PUNJAB

ISLAMABAD



1. Faisalabad
2. Jhang
20. Multan
21. Lodhran
24. Pakpattan
26. D.G. Khan
27. Muzaffargarh
28. Layyah
29. Rajanpur
30. Bahawalpur
31. Bahawalnagar
32. R.Y. Khan

PROJECT AREA

SUMMARY

SUMMARY

The Government of Islamic Republic of Pakistan has established a long term development plan for 15 years of 1988~2003 (2nd Perspective Plan), with the primary objective of achieving economic independence. The main thrusts will be placed on the stabilization of fiscal revenue, achievement of self-sufficiency in foodstuff, reduction of trade deficit and acquisition of specific technologies through human resources development.

The Seventh Five-Year Plan (1988/89~1992/93) positioned as the initial phase of the Perspective Plan aims at the vitalization of the private sectors and increase of employment opportunities and emphasizes the improvement of rural infrastructure and improvement of public services in the localities.

The population of Pakistan is estimated at 113,000,000, of which Punjab Province accounts for 53%. The Punjab has a wheat cultivating area of 5,580,000 hectare (ha), or 70% of Pakistan's total and produces 10,520,000 tons of wheat, accounting for 74% of Pakistan's total production. The Punjab also contributes to 46% of Pakistan's total rice production and 87% of the production of cotton, of which export, including cotton products, accounts for 50% of the total export.

Producing also sugar cane, gram, Punjab Province can truly be called the granary of Pakistan, and the production zone of principal export agricultural produces.

The Department of Agriculture of Punjab Province has decided to increase the agricultural production by extending the farming area, in parallel with raising the yields, and to promote with the assistance of the Federal Government, the project of developing of 1,800,000 ha of undeveloped arable wastelands owned by farmers of the Province.

The Department of Agriculture of Punjab Province, the implementing agency of the Project, procured 440 units of bulldozer with the Aid for Increased Food Production of the Japanese Government (KR-II) in 1985~1990 and assisted farmers to develop their agricultural lands. These bulldozers have contributed to the development of 470,000 ha of agricultural land since 1985 and thereby to the increases in staple foods: 350,000 tons per year of wheat, 110,000 tons per year of rice.

Based on the result of agricultural land development with the bulldozers procured under the KR-II, the Government of Punjab Province has established a plan of developing 200,000 ha of agricultural land during 5 years (1992/93~1996/97) and has requested to the Government of Japan to provide an aid for procuring 300 units of bulldozer required for executing the plan. For the purpose of confirming the content of the request, and of

establishing the appropriate contents including auxiliary equipment, it was decided to conduct a Basic Design Study for the Project. Then JICA sent a study team from July 3rd to August 1st 1992. The Team held discussions with the officials concerned of the Federal Government of Pakistan, and of the Government of Punjab Province, and conducted a survey of the project area and relative facilities, and collected data. As a result, the following two points have been confirmed.

- (1) The content of the request for the Project to be executed in all 32 districts of Punjab Province is justifiable and urgently viable.
- (2) The Project is initially aimed at all 32 districts to start at the same time but each district has its own priority ranking in the execution of the Project, and the districts divided into some groups by the order of such priority.

The Study Team has hence selected 12 districts in the southern regions. The selection has been made according to the following criteria.

- (1) High productivity of land
- (2) Climate adapted to agricultural production
- (3) Well established agricultural infrastructure (Irrigation and drainage canals, processing facilities for agricultural products)
- (4) Availability of sufficient area for the land development
- (5) Well functioning implementing agency, assuring good operation, maintenance and management of equipment

The content of the aid has been decided as follows:

	Content of the request made by the Pakistani part		Content proposed by the Japanese part		Remarks
1st phase	Medium size bulldozer	100 units	Medium size bulldozer	71 units	The equipment are limited to those which are to be assigned to 12 districts with the highest priority.
	Small size bulldozer	50 units	Small size bulldozer	42 units	
	Spare parts for the above	20% (of the value of equipment)	Spare parts for the above	for the initial 2 years of operation of equipment	
	Transporting vehicle	5 units	Transporting vehicle	2 units	
	Spare parts for the above	10% (of the value of equipment)	Spare parts for the above	for the initial 2 years of operation of equipment	
2nd phase	Medium size bulldozer	100 units			
	Small size bulldozer	50 units			
	Spare parts for the above	20% (of the value of equipment)			
	Transporting vehicle	5 units			
	Spare parts for the above	10% (of the value of equipment)			

The efficient use of the bulldozers to be procured under the Project will be able to develop 95,000 ha of agricultural land in five years of 1992~1997. This will result in the increased production of staple food crops, wheat and rice, and contribute thereby to the food self-sufficiency for the population increasing 3.1% annually. It will also contribute to the increase of cotton production; raw cotton and cotton products account for 50% of Pakistan's total export. Thus the Project will lead to the assistance for achieving the economic independence aimed at by Pakistan in its long term plan.

The extension of agricultural land will lead to an increase in employment opportunities in regional society and will have the effect of alleviating social insecurity due to the concentration of surplus labour force in urban area.

As discussed above, the Project is expected to produce a substantial effect and to improve widely the standard of living of inhabitants of the Project area. Therefore it is recommended to execute the Project with a grant aid from the Government of Japan. It is considered that the recipient country has a sufficient staff and experience for the operation and management of the Project.

CONTENTS

		Page
CHAPTER 1.	GENERAL.....	1-1
1.1	Background for the Dispatching of Study Team.....	1-1
1.2	Content of the Basic Design Study	1-2
CHAPTER 2.	BACKGROUND OF THE PROJECT.....	2-1
2.1	Agriculture in Pakistan.....	2-1
2.1.1	Outline of Agriculture	2-1
2.1.2	Condition of Agricultural Land	2-5
2.1.3	Irrigation and Drainage.....	2-6
2.2	The Seventh Five-Year Plan.....	2-10
2.2.1	Outline	2-10
2.2.2	Development of Agricultural Sector.....	2-11
2.3	Background and Content of the Request.....	2-16
CHAPTER 3.	OUTLINE OF PUNJAB PROVINCE.....	3-1
3.1	General.....	3-1
3.2	Condition of the Agricultural Production.....	3-3
3.3	The Land Resource Development Project and Increase in Agricultural Production.....	3-4
3.3.1	Implementing Agency of the Land Resource Development Project	3-4
3.3.2	The Land Resource Development Project and the Leasing of Land Development Equipment.....	3-6
3.3.3	Evolution of the Land Resource Development	3-9
3.3.4	History of the Procurement of the Equipment for Agricultural Land Development.....	3-12
3.4	Condition of the Agricultural Land Development Equipment	3-16
3.4.1	Condition of Equipment in Possession	3-16
3.4.2	Situation of the Maintenance and Management of Equipment.....	3-18
CHAPTER 4.	THE PROJECT.....	4-1
4.1	Objective of the Project	4-1
4.2	Review of the Content of the Project.....	4-4
4.2.1	Rationality and Necessity of the Project	4-4
4.2.2	Implementation and Operation Programme.....	4-33

4.2.3	Similar Projects and Relations with other Assisting Countries and International Organizations.....	4-35
4.2.4	Study of the Requested Equipment.....	4-35
4.2.5	Necessity of Technical Cooperation.....	4-37
4.2.6	Basic Policy on Cooperation.....	4-37
4.3	Outline of the Project.....	4-38
4.3.1	Implementing Agency and Operation System.....	4-38
4.3.2	Project Plan.....	4-38
4.3.3	Outline of Equipment.....	4-38
4.3.4	Maintenance and Management Plan.....	4-39
CHAPTER 5.	BASIC DESIGN	5-1
5.1	Design Policy	5-1
5.1.1	Natural Condition.....	5-1
5.1.2	Specification of Bulldozer.....	5-1
5.1.3	Spare Parts for Bulldozer.....	5-1
5.1.4	Transport Vehicle.....	5-1
5.1.5	Procurement from the Third Countries.....	5-1
5.1.6	Implementation Schedule.....	5-1
5.2	Basic Design	5-2
5.2.1	The Project Equipment and Deployment.....	5-2
5.2.2	Maintenance and Management Plant of Equipment.....	5-2
5.3	Procurement Plan.....	5-5
5.3.1	Basic Policy	5-5
5.3.2	Procurement Supervising Plan.....	5-5
5.3.3	Implementation Schedule.....	5-5
CHAPTER 6.	EFFECT OF PROJECT AND CONCLUSION IN FIVE YEARS (1992/93~1996/97)	6-1

APPENDICES

APPENDIX-1	Members of the Basic Design Study Team.....	A-1
APPENDIX-2	Schedule of Basic Design Study Team.....	A-2
APPENDIX-3	List of Personnel Interviewed.....	A-3
APPENDIX-4	Minutes of Discussions.....	A-4
APPENDIX-5	Request Letter for Technical Cooperation.....	A-5
APPENDIX-6	Table of Existing Bulldozers.....	A-6
APPENDIX-7	Details of Land Holding and Work Done with Bulldozers.....	A-7
APPENDIX-8	Photos.....	A-8



CHAPTER 1. GENERAL

CHAPTER 1. GENERAL

1.1 Background for the Dispatching of Study Team

The government of Punjab Province plans to promote the development of land resources with the assistance of the Federal Government as one of the most effective measures for improving the degree of food self-sufficiency, for increasing the export of agricultural processes and for generating employment opportunities, which are the principal objectives of the Current Perspective Plan, and of the Seventh Five-Year Plan. Punjab province has 180,000 hectare (ha) of undeveloped arable land of private ownership. And the Department of Agriculture of Punjab Province plans to develop culturable wasteland by leasing to farmers the bulldozers required for land development.

For realization of this project of extreme urgency, the Government of Pakistan requested to the Government of Japan for a grant aid for the procurement of bulldozer that has been implemented so far mainly with KR-II (Aid for Increased Food Production).

The Government of Japan decided to conduct a basic design study for this project, and JICA sent a study team headed by Mr. Yoshikatsu Nakamura from July 3, 1992 to August 1, 1992.

1.2 Content of the Basic Design Study

The Basic Design Study Team conducted a study on the following items.

- (1) Background of the project and confirmation of the content of the request
- (2) Investigation of content of the request
- (3) Investigation of equipment maintenance programme and management system
- (4) Confirmation of the extent of undertaking by the recipient country

The present report has been prepared on the basis of the result of project area surveys and survey data analyses.

The members of the Study Team, study schedule and the minutes of discussions are shown in Appendices 1 to 4.

CHAPTER 2. BACKGROUND OF THE PROJECT

CHAPTER 2. BACKGROUND OF THE PROJECT

2.1 Agriculture in Pakistan

2.1.1 Outline of Agriculture

Agriculture is Pakistan's key industry, and occupies 70% of the total population (estimated at 113 million in 1991) and 50% of the active population.

Table 2-1 Agricultural Population

(Unit: 1,000)

Year	Total Population (a)	Economic Active Population (b)	Agricultural Active Population (c)	Percentage of Agricultural Active Population (c/b-%)
1980	82,581	25,415	13,883	54.6
1985	96,180	30,330	15,825	52.2
1989	107,000	34,400	17,265	50.2
1991	113,000	-	-	-

Source: Population - Pakistan's annual statistics 1989
Active population - FAO Annual Report 1989

The total land area of Pakistan is 79,610,000 ha (2.1 times of Japan's land area) excluding the territory at issue. According to the land use survey conducted on 57,860,000 ha of area in 1988/89, 20,730,000 ha is registered as cultivated land and 9,260,000 ha as culturable wasteland. Therefore about half of the total land area is estimated to be agricultural land. (See table 2-6)

The agricultural sector's share of the GDP is becoming smaller compared with manufacture and commerce sub-sectors, but still accounted for 26% of the GDP in 1988/89 1989/1990, and stands as a principal industry of Pakistan. (See Table 2-2)

Table 2-2 Gross Domestic Product (1980/81~1989/90)

(Unit: %)

	1980/81	1985/86	1986/87	1987/88	1988/89	1989/90 ^a
Agriculture	27.2	27.3	26.6	25.7	26.3	26.0
Manufacturing	15.1	16.7	17.0	17.5	17.4	17.8
Commerce	15.1	16.2	16.2	16.6	16.7	16.6
Transport	9.7	10.0	10.2	10.2	9.7	9.6
Government Services, Defence	7.8	7.4	7.3	7.2	7.3	7.2
Others ^b	25.1	22.4	22.7	22.8	22.6	22.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Note: a. Provisional
b. Mining, quarries, construction, electricity, gas, ownership of dwelling and other services

Source: Department of Finance
Economic survey 1989/1990

As shown in Table 2-3 below, 60% of export (1988/1989) was occupied by the agricultural produce and agricultural processed products.

Table 2-3 Major Exports

(Unit: million Rupees)

	1985/86	1986/87	1987/88	1988/89 (percent)
Raw cotton	8,291	7,676	10,759	18,032 (20.0)
Rice	5,527	5,139	6,404	5,967 (6.6)
Cotton fabrics	5,083	5,931	8,540	8,947 (9.9)
Cotton yarn	4,511	8,709	9,530	11,645 (12.9)
Synthetic textile	802	2,698	3,478	2,240 (2.5)
Garments Hosieries	4,214	7,757	8,521	9,692 (10.7)
Sub-total	28,428	37,910	47,232	56,523 (62.6)
Carpet, rug	2,693	3,439	4,445	4,451 (4.9)
Leather	2,900	4,079	5,042	4,702 (5.2)
Fishing and its products	1,335	1,930	2,186	2,092 (2.3)
Others	14,236	15,995	19,540	22,415 (24.9)
Total	49,592	63,353	78,445	90,183(100.0)

Note : FOB Value

Source : Department of Finance, Economic Survey 1989/90

Pakistan's principal agricultural products are food crops such as wheat, rice, maize, gram and sugar cane, and cotton. Table 2-4 illustrates the evolution of the production of wheat, rice and cotton on the whole land of Pakistan in 1960/61 ~ 1989/1990, and shows that each crop has marked a quite high growth rate.

However the production of wheat, raw material of nann and chapati has been declining, and its growth rate fell down from 5.9% in 1980/1981 to 1.2% in 1988/1989 and to the negative in the following year 1989/1990. The reason is that the yield per hectare has substantially decreased since 1980/1981 under the influence of drought, pest and disease, flood etc., although the planted area of wheat has regularly extended.

Similarly, growth rate of rice production fell down from 7.9% in the 1970s to 3.1% in 1988/1989 and remained at the same level in the following year 1989/1990. The rate of self-sufficiency also reflects this tendency as Table 2-5 shows. The wheat production reached the complete self-sufficiency in 1986/87, but became short of 12% in 1988/1989. Similarly, the rate of self-sufficiency in rice, that reached 182.1% in 1985/1986, has declined constantly down to the level of 130% in 1989/1990 (30% of surplus produce may be directed to export).

In the case of cotton, the most important export item, the planted area increased by 2.4% on average in the 30 years, 1960/61~1989/1990, and by 3% on average in 1985/86~1989/90 and started showing a sign of declining in 1989/90. Nevertheless the production maintains a high growth rate, 5.6% per year on average since 1970/71. The fluctuation of growth rate is attributed to a large variation of external conditions like climate and the decreasing yield.

As there seems a limit to increasing the yield, the development of agricultural land becomes relatively crucial to the future production increase together with the essential irrigation facilities for the developed land.

Table 2-4 Production of Main Crops (1960/61~1989/1990)

	1960/61	1970/71	1980/81	1985/86	1988/89	1989/90	Average Annual Growth Rate 1960/61~1989/90
Wheat:							
Planted area (1,000 ha) (comparison with the preceding year)	4,639	5,977 (+2.6%)	6,984 (+1.6%)	7,403 (+1.2%)	7,730 (+1.5%)	7,845 (+1.5%)	1.9 (%)
Yield (ton/ha) (comparison with the preceding year)	0.82	1.08 (+2.8%)	1.64 (+4.3%)	1.88 (+2.7%)	1.87 (-0.2%)	1.83 (-2.2%)	2.8 (%)
Production (1,000 ton) (comparison with the preceding year)	3,814	6,476 (+5.4%)	11,474 (+5.9%)	13,923 (+3.9%)	14,419 (+1.2%)	14,316 (-0.7%)	4.7 (%)
Rice:							
Planted area (1,000 ha) (comparison with the preceding year)	1,181	1,503 (+2.4%)	1,933 (+2.5%)	1,863 (-0.7%)	2,042 (+3.1%)	2,017 (+3.2%)	2.0 (%)
Yield (ton/ha) (comparison with the preceding year)	0.87	1.46 (+5.5%)	1.62 (+1.1%)	1.5 (-0.6%)	1.57 (+0.0%)	1.53 (-2.6%)	2.0 (%)
Production (1,000 ton) (comparison with the preceding year)	1,030	2,200 (+7.9%)	3,123 (+3.6%)	2,919 (-1.3%)	3,200 (+3.1%)	3,220 (+0.6%)	4.0 (%)
Cotton:							
Planted area (1,000 ha) (comparison with the preceding year)	1,293	1,733 (+3.0%)	2,108 (+2.0%)	2,364 (+2.3%)	2,619 (+3.5%)	2,599 (-0.8%)	2.4 (%)
Yield (ton/ha) (comparison with the preceding year)	0.23	0.13 (+3.1%)	0.634 (+0.8%)	0.51 (+8.8%)	0.54 (+2.2%)	0.56 (+2.9%)	3.1 (%)
Production (1,000 ton) (comparison with the preceding year)	301	542 (+6.1%)	715 (+2.8%)	1,208 (+11.1%)	1,426 (+5.7%)	1,456 (+2.1%)	5.6 (%)

Source: Department of Finance, Economic survey 1990/91

Table 2-5 Ratio of Self-Sufficiency in Main Food Crops

Year	(Unit: %)				
	1985/86	1986/87	1987/88	1988/89	1989/90
Wheat	88.2	100.0	100.0	87.8	90.0
Rice	182.1	155.2	159.6	136.4	130.0
Bean	91.5	88.1	88.4	79.5	92.6
Edible oil	29.1	32.0	25.8	27.6	26.0

Source: Department of Agriculture of the Government of Pakistan 1991/92

2.1.2 Condition of Agricultural Land

In 1988/89, Pakistan had 20,730,000 ha of agricultural land, of which the planted area is 14,970,000 ha or 72% of the total agricultural land and the remaining 5,760,000 ha is in fallow. The area other than agricultural land comprises 3,500,000 ha of forest, 24,370,000 ha of unexploited mountains, desert and other devastated land. But there still remains 9,260,000 ha of unexploited culturable wasteland.

Table 2-6 Land Use Situation (1988/89)
(Agricultural lands and others)

(Unit: million ha)	
Total area	79.61
Surveyed area	57.86
Cultivated area	20.73
• Planted area	14.97
• Fallow	5.76
Uncultivated area	37.13
• Undeveloped culturable waste	9.26
• Forests	3.50
• Area not available for cultivation (Mountains, deserts etc)	24.37

Source: Economic statistics 1990/91

Of 20,730,000 ha of agricultural land, 15,680,000 ha or 76%, belongs to the semi-arid zone (steppe) and arid zone (desert) with an annual rainfall under 400 mm, where the irrigated agriculture is being practiced.

Table 2-7 Irrigated Area by Sources

Water source	(Unit: million ha)		
	1969/70	1979/80	1989/90 (percent)
River	9.26	10.74	11.23 (71.6)
Barrage	0.01	0.05	0.06 (0.4)
Shallow well	0.84	0.34	0.23 (1.5)
Deep well	1.11	2.74	3.97 (25.3)
Other	1.27	0.87	0.19 (1.2)
Total	12.49	14.74	15.68 (100.0)

Source: Economic statistics 1990/91

Fig. 2-7 shows the irrigated areas classified by water source in the whole country. Large scale irrigated agriculture using river water is dominant in the basins of the Indus and other large rivers, especially in the rich alluvial plains of a part of Punjab and Sind Provinces, and its area accounts for 71.6% of the total irrigated area. The rich arable land on hills and at the feet of mountains, equal to 27.2% of the total irrigated area, is irrigated by medium and small scale irrigation system, such as deep well, tubewell, pond etc.

The rainfed agriculture (barani agriculture) is conducted in relatively rainy zone of the northern part of Punjab Province, the North-West Frontier Province, and a part of the Bultistan Province, of which the total area is 5,050,000 ha, or 24% of the total agricultural land.

The rainfed agriculture is more unstable than irrigated agriculture in securing water, and the yield is low.

2.1.3 Irrigation and Drainage

The origin of irrigation and drainage in Pakistan is old. The remains of ancient Mohenjo-Daro and Harapp have been found giving evidence of the practice of irrigation in 4000 - 3000 B.C. using the water diverted from rivers and wells.

In 14th~15th century, in the Indus Basin of Pakistani-Indo subcontinent, submerged irrigation using flood water diverted into farming land was conducted. It was in 1854, while a British colony, that a department in charge of irrigation was set up in Punjab district, with the objective of applying modern irrigation techniques. Large scale irrigation involving the construction of water intake facilities comprising barrages and water canals was started.

In other areas than those benefitting from irrigation facilities as well as those in remote parts of the beneficiary area where water cannot be supplied in sufficient quantity, water supply is assured by small and medium size barrages constructed locally or by wells constructed for pump irrigation. In the area at the feet of the western mountains the flood water was brought in, though in insufficient quantity, for watering agricultural land for cultivation.

Heavy accumulation of sands and soil is decreasing the storage capacity of existing dams year by year. There is an urgent need to rehabilitate the irrigation facilities that have deteriorated or are not functioning satisfactorily, and there are project plans for raising dam height and for constructing large capacity dams.

Drainage work is an indispensable part of the development of irrigation. In order to cope with the accumulation of salt in soil resulting from irrigation in dry areas and the waterlogging resulting from insufficient drainage, there have been installed tubewells, tile drain and drainage channel ways, with the assistance of the World Bank group, mainly in Punjab Province and in the region along the middle and lower stream of the Indus river. The ground water drawn from tubewell is used for the irrigation of neighboring areas after having been diluted with water.

Water management in Pakistan is undertaken by the WAPDA (Water and Power Development Authority), who controls large canals and the quantity of the water each province can take from the Indus.

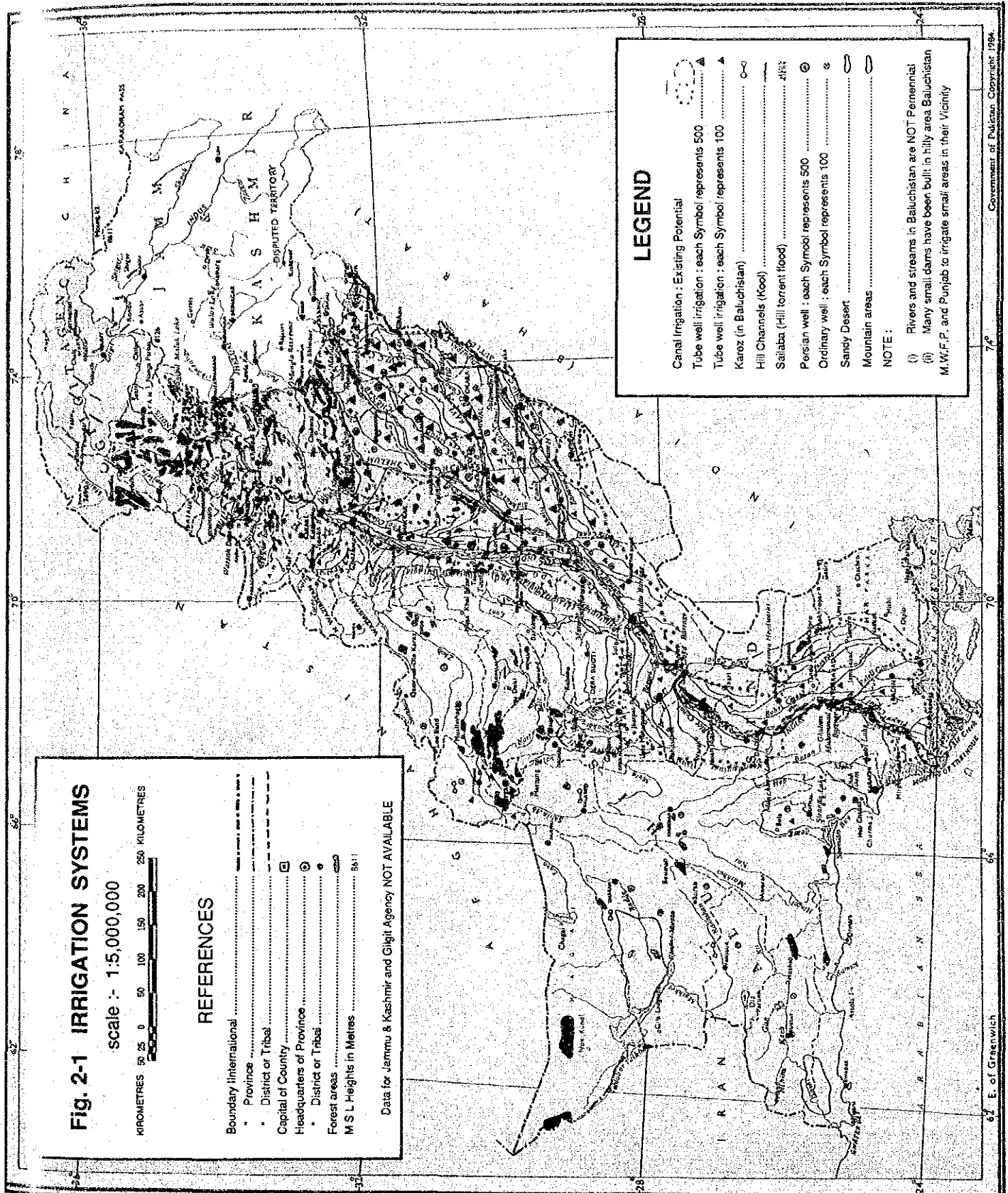


Fig. 2-1 IRRIGATION SYSTEMS

scale :- 1:5,000,000

KILOMETRES 50 25 0 50 100 150 200 250 KILOMETRES

REFERENCES

- Boundary International
- Province
- District or Tribal
- Capital of Country
- Headquarters of Province
- District or Tribal
- Forest areas
- M.S.L. Heights in Metres

Data for Jammu & Kashmir and Gilgit Agency NOT AVAILABLE

LEGEND

- Canal Irrigation : Existing Potential
- Tube well irrigation : each Symbol represents 500
- Tube well irrigation : each Symbol represents 100
- Karez (in Baluchistan)
- Hill Channels (Kool)
- Sailaba (Hill torrent flood)
- Persian well : each Symbol represents 500
- Ordinary well : each Symbol represents 100
- Sandy Desert
- Mountain areas

NOTE :

- (i) Rivers and streams in Baluchistan are NOT Perennial
- (ii) Many small dams have been built in hilly area Baluchistan M.W.F.P. and Punjab to irrigate small areas in their vicinity

Table 2-8 Classification of Canals by Flow Volumes and Managers

Description	Flow Volume (cubic ft./sec)	Manager
Main canal	500<	Provincial Department of Irrigation
Branch canal	50~500	"
Distributary	15~50	"
Minor	5~15	"
Sub-minor	<5	"
Water course	0~4	Provincial Department of Agriculture

In the past, agricultural land development was made mainly in Punjab Province. In the case of Tahl project, the operation started in the rainfed zone of the northern Punjab but is extending recently, with the construction of large dams, to the irrigated agricultural zone in the south with lighter rainfall. Now, it would not be exaggerated to say that new development of agricultural land is concentrated in the zone of irrigated agriculture using river water or partly ground water.

Therefore, irrigation water now becomes an important matter. Problems will be rather small in the case of relatively small projects, like the present project of developing 200,000 ha out of 1,800,000 ha of culturable wasteland in 5 years. But, if the expansion of agricultural land continue extensively, the problem of irrigation water needs to be studied carefully. As there is a limit to the capacity of river water irrigation, the Department of Agriculture of Punjab Province must discuss with the Department of Irrigation of Punjab Province whether the developed area can be supplied with a large quantity of irrigation water and should make necessary adjustments between them. There is also a need to study seriously the possibility of ground water irrigation, in place of river water irrigation, through a comprehensive study of ground water resource development.

Similarly, a thorough study should be made on the possibility of parallel practice of rainfed and irrigated agricultures.

Therefore it is recommended that the Government of Punjab Province conducts a comprehensive study and make necessary adjustment between the departments concerned.

2.2 The Seventh Five-Year Plan

2.2.1 Outline

The Seventh Five-Year Plan (1988/89~1992/93) is positioned as the 1st period of the Long Term Development Plan (1988~2003), which was simultaneously established. The Long Term Development Plan aims at, in priority, the achievement of economic independence of Pakistan through the increased proportion of domestic fund procurement, stabilization of fiscal revenue, achievement of food self-sufficiency, expansion of the export of agricultural products, diversification in the production of capital goods and acquisition of specific technology through human resources development. Above all, a particular emphasis is placed on the achievement of food self-sufficiency. In view of the population growth of 3.1% per year, the target of production growth of the staple foods such as wheat, rice, maize etc. is set at 3.6% per year (15 years of 1988~2003) and a surplus to consumption is to be directed to export. The production of food crops is projected to increase from 18,300,000 tons in 1988 to 31,000,000 tons in 2003.

The Seventh Five-Year Plan emphasizes the vitalization of the private sector and the increase of employment opportunities, and aims at the improvement of rural infrastructure, betterment of public services (education, health etc.), generation of employment opportunities and aid to the handicapped. Targeted growth rate of each economic sector is 4.7% per year for agricultural sector, 8% for mining, 8.1% for industry and 6.5% average of all sectors. The agricultural sector will form about 21% of the GDP in the last year 1992/1993 of the Seventh Five-Year Plan.

Table 2-9 The Gross Domestic Product by Sectoral Origins
 - Seventh Five-Year Plan -
 (1987/88 price)

(Unit: million Rupees)

	1982/83	1988/89	1992/93	Annual Growth Rate (%)	
				Sixth Plan	Seventh Plan
Agricultural (including fisheries and forestry)	119,193	143,917	181,350	3.8	4.7
Mining, Puarries	8,596	14,767	21,698	11.4	8.0
Manufacturing	74,492	108,060	159,558	7.7	8.1
Construction	25,849	39,242	57,659	8.7	8.0
Electricity, gas	9,147	13,974	21,012	8.8	8.5
Transport and communication	33,419	48,504	67,396	7.7	6.8
Commerce	71,227	98,611	136,379	6.7	6.7
Banking, Insurance	12,279	17,476	22,840	7.3	5.5
Housing	15,592	22,997	29,772	8.1	5.3
Government, Defence	41,458	58,565	77,637	7.2	5.8
Service	37,727	51,923	71,474	6.6	6.6
Total	448,979	618,036	846,775	6.6	6.5

Source: Seventh Five-Year Plan Vol. 1

2.2.2 Development of Agricultural Sector

The Seventh Five-Year Plan sets the target of annual growth rate of the agricultural sector at 4.7%, which is higher than the average growth rate target of the Long Term Development Plan (1988~2003), 3.6%. The growth rates of food crops - wheat, rice, maize - and of other agricultural products, targeted in the Plan are 4.0% and 5.5% respectively. The targeted production volumes of cereal, cotton and vegetable are shown in Table 2-11.

Table 2-10 Growth Rate of Agricultural Sector (including fishery and forestry)
- Seventh Five-Year Plan -

(% per year)

	Result (1949~82)	Sixth Plan (1983/84~1987/88)		Seventh Plan (1988/89~ 1992/93)
		Target	Result	Target
Food grains	3.4	3.6	2.3	4.0
Other agricultural produces	3.1	7.0	3.6	5.5
Livestock farming	2.4	5.9	6.2	5.3
Fishery	4.1	7.5	4.5	4.9
Forestry	2.2	5.0	10.8	2.6
Total	5.1	4.9	3.8	4.7

Source: Seventh Five-Year Plan Vol. 1

Tale 2-11 Production Target by Produces of the Agricultural Sector
- Seventh Five-Year Plan -

(Unit: 1,000 ton)

	1982/83 (Result)	Seventh Five-Year Plan		
		1987/88 (First Year)	1992/93 (Last Year)	Annual Growth Rate (%)
Rice	3,445	3,300	4,220	5.0
Basmati	1,010	904	1,290	7.3
Others	2,435	2,396	2,930	4.1
Wheat	12,415	12,926	16,380	4.9
Baley	185	124	156	4.7
Millet	222	187	273	7.9
Barn grass	220	136	271	14.8
Maize	1,005	1,156	1,470	4.9
Gram	491	367	650	12.1
Mustard	246	213	340	9.8
Sesame	11	11	14	4.9
Tobacco	65	69	93	6.1
Sugar cane	32,534	31,239	40,320	5.2
Cotton	823	1,513	1,649	1.7
Beans	203	241	250	0.7
Potato	518	620	750	3.9
Onion	475	550	750	6.4
Fruits	3,170	3,785	5,000	5.7
Vegetable	1,907	2,458	3,175	5.3
Peanut	84	95	110	3.0
Rapeseed	12	60	321	39.9

Source: Seventh Five-Year Plan Vol. 1

Table 2-12 shows the production target for export products, separately for agricultural produces such as rice, cotton, cotton goods and for other produces.

Among the food crops taken up as the object of self-sufficiency in the Long Term Plan (1988~2003) only rice is listed as export product in the Seventh Five-Year Plan. The export volume of rice, surplus to consumption, increased from 1,250,000 tons in 1987/88 to 1,420,000 tons in 1992/93 at an annual rate of 2.6%. In 1992/93 the export of rice is expected to form 7.3% of the total production, and the production of cotton, principal export product, is expected of growth rate 2.4% per year.

Table 2-12 Production Volume and Amount of Main Agricultural Exports
- Seventh Five-Year Plan -

	1987~ 88	1988~ 89	1989~ 90	1990~ 91	1991~ 92	1992~ 93	Growth Rate (% per annum)
Cotton							
Volume (million tons)	0.561	0.578	0.594	0.611	0.611	0.627	2.4
Amount (million dollars)	765.0	799.0	834.6	871.7	910.5	951.0	4.4
Rice (Total)							
Volume (million tons)	1,250.0	1,282.5	1,315.9	1,350.1	1,385.2	1,421.2	2.6
Amount (million dollars)	341.3	358.5	376.7	395.7	415.8	436.8	5.1
Basmati							
Volume (million tons)	250.0	257.5	265.2	273.2	281.4	289.8	3.0
Amount (million dollars)	181.3	190.4	200.1	210.2	220.8	232.0	5.1
Others							
Volume (million tons)	1,000.0	1,025.0	1,050.6	1,076.9	1,103.8	1,131.4	2.5
Amount (million dollars)	160.0	168.1	176.6	185.6	194.9	204.8	5.1
Cotton yarn							
Volume (million tons)	260.0	273.0	286.7	301.0	316.0	331.8	5.0
Amount (million dollars)	501.8	548.0	598.4	653.4	713.5	779.2	9.2
Cotton fabrics							
Volume (million tons)	780.0	822.9	868.2	915.9	966.3	1,019.4	5.5
Amount (million dollars)	413.4	457.9	507.3	561.9	622.5	689.6	10.8
Sub-total	2,362.8	2,521.9	2,693.7	2,878.5	3,078.0	3,293.4	5.1
Others							
Amount (million dollars)	1,985.9	2,669.9	3,125.4	3,645.2	4,237.7	4,913.1	19.9
Total (million dollars)	4,348.7	5,191.8	5,819.1	6,523.7	7,315.7	8,206.5	13.5

Note: (1) Quantity of cotton: Bale converted into ton at 1 bale = 0.165 ton

(2) Above figures indicate the production volume of export products (not FOB or CIF value)

Source: Seventh Five-Year Plan Vol. 1

The Seventh Five-Year Plan emphasizes the following strategies for achieving the objectives of agricultural development.

- (1) Improvement of productivity by the application of fertilizer, improvement of soil, introduction of water management technology, production and distribution of superior varieties, rational cultivation technology, economical comprehensive crops protection.
- (2) Promotion of the research on high yielding varieties and disease resistant varieties
- (3) Improvement of research facilities, elevation of research level, financial back-up and diffusion of the result of research.
- (4) Amelioration in audio-visual facilities for the solution of the shortage in staff and for the effective education and training
- (5) Increased production of edible oil
- (6) Expansion and development of crops planting at ecologically adapted area
- (7) Achievement of the production target of major crops, in particular rice and vegetable.
- (8) Securing of farming lands and water source, and management of forest, rivers and grassland
- (9) Development of dryness resistant high yielding varieties for rainfed agricultural area
- (10) Assistance for private farms

As regards the securing of agricultural land, the planting area extension plan, i.e. new development plan of agricultural land, corresponding to the production increase programme for each crop has been set as Table 2-13. According to this plan, 910,000 ha of agricultural land is planned to be newly developed in whole Pakistan: 590,000 ha for cereals, wheat, rice, maize; 50,000 ha for cotton, principal export product; 287,000 ha for rapeseed that was imported in 1987/88 for the amount of 300,000 dollars, as against 700,000 dollars of total import, as raw material of edible oil.

Table 2-13 Planted Area by Crops and Projected Development Areas
- Seventh Five-Year Plan -

Crops	Percentage of the total planted area (%)		Projected Development Area (1,000 ha)
	1987/88 Standard	1992/93 Target	
Wheat	36.8	35.4	240
Rice	9.9	10.1	195
Maize	4.1	4.2	85
Other food grain	4.6	4.6	70
Sub-total	55.4	54.3	590
Cotton	12.4	11.8	50
Rapeseed	2.8	0.4	287
Bean	7.1	6.9	60
Vegetable, spices, fruits	4.0	7.9	145
Sugar cane	4.3	4.4	100
Grass	13.8	14.1	268
Tobacco	0.2	0.2	-
Sub-total	44.6	45.7	910
Total	100.0	100.0	1,500

Source: National Agriculture Committee Report 1986

2.3 Background and Content of the Request

The agricultural sector weighs heavily in Pakistan's economy and contributes to 26% of the GDP. Of the total population of 113 million, 70% live in agricultural area, and the agricultural population occupies 50% of the active population. With a population increasing at a high rate of 3.1% per year a higher growth in agricultural production is needed. Nevertheless, agricultural productivity is actually low and needs to be raised. From this point of view, in the Seventh Five-Year Plan (1988/89~1992/93) the Government of Pakistan emphasizes the improvement of food self-sufficiency rate through the production increase and has made efforts in extending the cultivating area by new development of agricultural land and in increasing the yield.

Punjab Province has 20.53 million ha of land area, 26% of Pakistan's total, and 11.83 million ha of cultivated land. Producing 67% of the country's total food crops, even 73% in wheat, the Province can be truly called the granary of the country. However there still remains 1.8 million ha of culturable wasteland.

DGAF consists of 8 Divisional Offices and 32 District Offices. Upon the request from farmers, each District Office leases out bulldozers in its possession together with drivers, and 1.84 million ha of agricultural land has been developed in 1953~1992.

For the execution of the above project of agricultural land development, the Japanese government supplied 440 units of bulldozer to Punjab Province with KR-II in three times during 1985/86~1989/90.

The first 106 units of bulldozers supplied by the Government of Japan have already reached the end of their economic life, and the second 194 units are considered to terminate their economic life before long.

It is therefore feared that the execution of the agricultural land development project will be disrupted because of shortage of equipment, and a request has been made for the supply of 300 units of bulldozer for supplementing these bulldozers. The bulldozers will be used for the development and improvement of 200,000 ha of agricultural land for the irrigated agriculture. For the execution of this project of extreme urgency, the Government of Pakistan has requested to the Government of Japan for a grant aid.

Contents of the request

Supply of the equipment for agricultural land development

Bulldozer (110~130 HP) 200 units

Bulldozer (80~90 HP) 100 units

Spare parts (equivalent to 20% of the value of equipment)

Vehicle 10 units

Spare parts (equivalent to 10% of the value of equipment)

CHAPTER 3. OUTLINE OF PUNJAB PROVINCE

CHAPTER 3. OUTLINE OF PUNJAB PROVINCE

3.1 General

Punjab Province has an area of 20.53 million ha, equal to 26% of Pakistan's total area. The population of Punjab Province stood at 59.42 million accounting for 53% of the total population, and the population density is the second highest after Islamabad, capital area.

Table 3-1 Population in City (1981)

No.	City	Province	Population (million)
1	Karachi	Sindh	5.10
2	Lahore	Punjab	2.92
3	Faisalabad	Punjab	1.09
4	Rawalpindi	Punjab	0.90
5	Hyderabad	Sindh	0.80

Source: Economic Statistic 1988

As shown in Table 3-2, 71% of the agricultural population are small landholders with farming areas of less than 5 ha or landless farmers, and their standard of living is low. The major part of the agricultural land is held by small farmers holding less than 5 ha of area, which accounts for 33% of the total agricultural land. The illiteracy rate in rural area exceeds 50%, which is larger than the rate in urban area, 30%. (See Table 3-1).

Table 3-2 Number and Area of Farms in the Punjab

	Farms		Farm Area	
	Number	Percent (%)	Total (ha)	Percent (%)
Under 5 ha	1,800,325	71	4,027,298	33
5 ha to under 10 ha	493,594	19	3,229,965	27
10 ha to under 20 ha	183,960	7	2,343,891	19
20 ha and above	66,534	3	2,498,519	21
Total	2,544,413	100	12,099,673	100

Source: Dept. of Agriculture, Punjab 1991

The topography of Punjab Province is characterized by mountains and hills in the northern region and vast flat land in the central and southern region. The Province falls within the arid and semi-arid zones, except for the relatively rainy northern region. The highland in the extreme north stands at an altitude of 2,500 m, and forms steep land covered with dense natural forest of pine and other trees; Potwar Plateau of 500~600 m above sea level (a.s.l.) extends from the feet of mountains with scattered shrubs. Punjab Province consists mostly of rich alluvial plain formed by the flooding of the Indus River and its tributaries at the altitudes of 100~300 m a.s.l., which comprises a zone of irrigated agriculture using abundant water of the Indus River.

There are two main seasons in a year; summer (Kharif: April~October) and winter (Rabi: October~April). In winter, the temperature falls below -10°C in the northern mountains, and there is snowfall. On the contrary, in flat lands including Potwar Plateau of 500 m a.s.l., the temperature never falls below zero even in winter. In summer, temperature rises above 40°C on the average and exceeds even 50°C in the southern desert area.

The average annual rainfall is 100 mm in the southern desert area, more than 1,500 mm in the northern mountains and 200~600 mm in the plain area, active agricultural area. The rainfall concentrates in summer (July~September) except for the northern hills and mountains.

3.2 Condition of the Agricultural Production

The cultivated land in Punjab Province is 11.83 million ha, which represents 58% of the total area of the Province and 15% of Pakistan total area.

Main crops in Punjab Province are wheat, rice, cotton, sugar cane and maize as shown in Table 3-3. The production by crops shows that the greater part of Pakistan's crops is produced in Punjab Province. Punjab Province has 5.6 million ha of wheat cultivation area and produces 10.52 million tons of wheat, which accounts for 73% of Pakistan's total production. (See Table 3-3) It produces 1.48 million tons of rice or 46% of the country's total, on 1.17 million ha of land. It also produces 1.23 million tons of cotton or 87% of the country's total. As these examples show, Punjab Province is the most influential area of agricultural production.

Table 3-3 Production of Main Crops in the Punjab

(Unit: 1,000 ton)

Crop	1989/90		
	Pakistan	Punjab	Punjab/ Pakistan (%)
Wheat	14,316	10,518	73.47
Cotton	1,412	1,230	87.08
Sugar Cane	35,494	18,683	52.64
Rice	3,220	1,482	46.02
Basmati	1,216	1,160	95.39
Others	2,004	322	16.07
Maize	1,179	455	38.59
Gram	562	397	70.64
Oil Seeds	233	147	63.09

Source: Statistical Book, Punjab 1990

3.3 The Land Resource Development Project and Increase in Agricultural Production

3.3.1 Implementing Agency of the Land Resource Development Project

The Department of Agriculture of Punjab Province has the organization as shown in Fig. 3-1. It comprises the Secretariat, Purchase Cell, and 5 Directorates General Agriculture as follows:

Directorate General Agriculture (Extension)

- Agricultural production
- Establishment agricultural policy
- Extension and guidance
- Research and development
- Distribution of fertilizer
- Processing of cotton yarn
- Collection and distribution of agricultural products

Directorate General Agriculture (Research)

- Research and development
- Mechanization of agriculture
- Soil protection

Directorate General Agriculture (Field)

- Land resource development
- Well digging
- Equipment leasing

Directorate General Agriculture (Water Management)

- Irrigation and drainage

Rice Research Institute

- Production and distribution of seeds

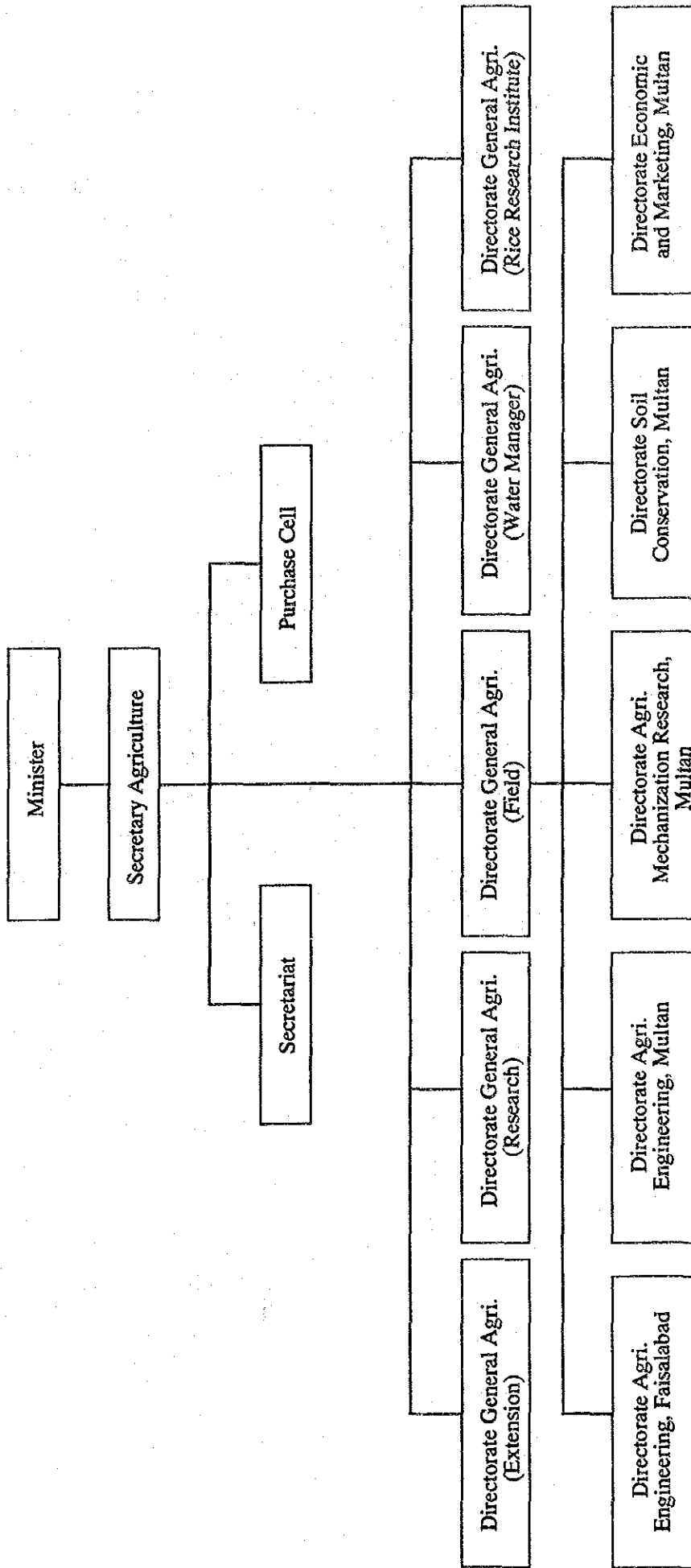


Fig 3 - 1 Organization Chart of Department of Agriculture, Punjab

The department in charge of implementation of the land resource development project is the Directorate General Agriculture, Field (DGAF). (See Fig. 3-1) The DGAF executes the project in the territory of the province divided into 8 Divisions including 32 Districts, through the two Directorates installed at Faisalabad and Multan; Directorate No.1 (Faisalabad) has under its control 5 divisional offices, and Directorate No.2 (Multan) 3 divisional offices. Fig. 3-2 indicates the strength of staff belonging to the divisional and district offices under the control of the Directorate No.1 (Faisalabad) and the Directorate No.2 (Multan) respectively.

3.3.2 The Land Resource Development Project and the Leasing of Land Development Equipment

The DGAF of Punjab Province has a function to assist the farmers' work by leasing to them, with charge, the construction equipment and operator for the development of their agricultural lands and the management of cultivated land - prevention of soil efflux, elimination of salinity, leveling of farming land, preservation of agricultural water, construction of small feeder roads etc. The DGAF has distributed the existing bulldozers to the district offices, and manages and operates them through respective office. The leasing of equipment is subsidized by the provincial budget, therefore, the operation, repair and maintenance of equipment are directly performed by the DGAF. The DGAF subsidizes through its budget as much as 25 to 40% of the standard operation cost. (See Table 3-5) The lease charge collected from farmers occupying almost half of the revenue of DGAF is deposited and is appropriated for the cost of operation and maintenance of equipment. (See Table 3-4)

Table 3-4 Revenue & Expenditure of DGAF

(Unit: Million Rupees)

Year	Allocation	Expenditure	Revenue
1988/89	218.2	219.7	154.6
1989/90	210.3	208.2	147.8
1990/91	233.4	273.3	154.4

Directorate General Agriculture (Field)

Dy Director (Mech) 1 AD (Admn) 1 EADA (E&M) 1
 Liaison Officer 1 AD (Agri) 1

Directorate of Agri. Engineering Faisalabad	Directorate of Agri. Engineering Multan	Directorate of Soil Conservation Rawalpindi	Directorate Agri. Mech. Research Institute Multan	Directorate Agri. (E&M) Lahore, Punjab
Director 1 Technical Officer 1 AD (Planning) 1 Admn. Officer 1 Progress Officer 1 AAO 1 Technical P.A. 7	Director 1 Technical Officer 1 AD (Planning) 1 Progress Officer 1 AAO 1 7	Director 1 Agri. Engineers 2 Progress Engineer 1 Agronomist 1 Forest Officer 1 Range Specialist 1 Soil Specialist 1 Asst. S.S. 3 11	Director 1 Agri. Engineers 3 Agronomist 1 AD (Ind. Ext. & Publication) 1 Asst. Economist 1 Admn. Officer 1 Junior Statistician 1 9	Director 1 Dy. Directors (E&M) 2 Econ. Investigators 1 EADA 1 Agri. Officers 2 4 10
Field Staff 5 Division (19 Districts) Agri. Engineers 5 AAE (Stores) 5 AAE (W/S) 6 AAE (S.V.) 5 Admn. Officers 4 AAE (Training) 3 AAE (Field) 18 AAE (W/D) 13 AAE (Rigs) 1 60	Field Staff 3 Division (13 Districts) Proj. Director (KAZ) 1 Agri. Engineers 3 Project Officer 3 AAE (W/S) 4 AAE (S.V.) 3 Admn. Officer 3 AAE (Training) 2 AD (Stores) 1 AAE (Field) 9 AAE (W/D) 8 AAE (KAZ) 1 60	Field Staff Agri. Engineers 2 Dy. Directors (S.C.) 2 AAE (Stores) 2 AAE (W/S) 2 AAE (S.V.) 2 Admn. Officers 3 AAE (Field) 5 AAE (Training) 1 AD (S.C.) 15 SCO 32 Agronomy Officer 1 Soil Survey Officer 4 S.C. Pub. Officer 1 Teshildar 1 Cartographer 1 74	Field Staff Agri Engineer 1 Asst. Res. Officers 3 Asst. Agri. Econ. 1 AAE (W/S) 1 AAE (Design) 1 AAE (Research) 2 AAE (T&E) 2 AAE (Fabrication) 1 13	Field Staff EADA (E&M) at each district 32 Agri. Officers at each district 32 64

Abbreviations: AD = Assistant Director
 AAO = Assistant Accounts Officer
 W/S = Workshop

AAE = Assistant Agri. Engineer
 SV = Store Verifier
 W/D = Well Drilling

KAZ = Karkhana Allat-e-Zari (Special Project)
 S.C. = Soil Conservation
 EADA = Extra A.D. of Agriculture (E&M) = Economic & Marketing

Fig. 3-2 Organization Chart of Directorate General Agriculture (Field)

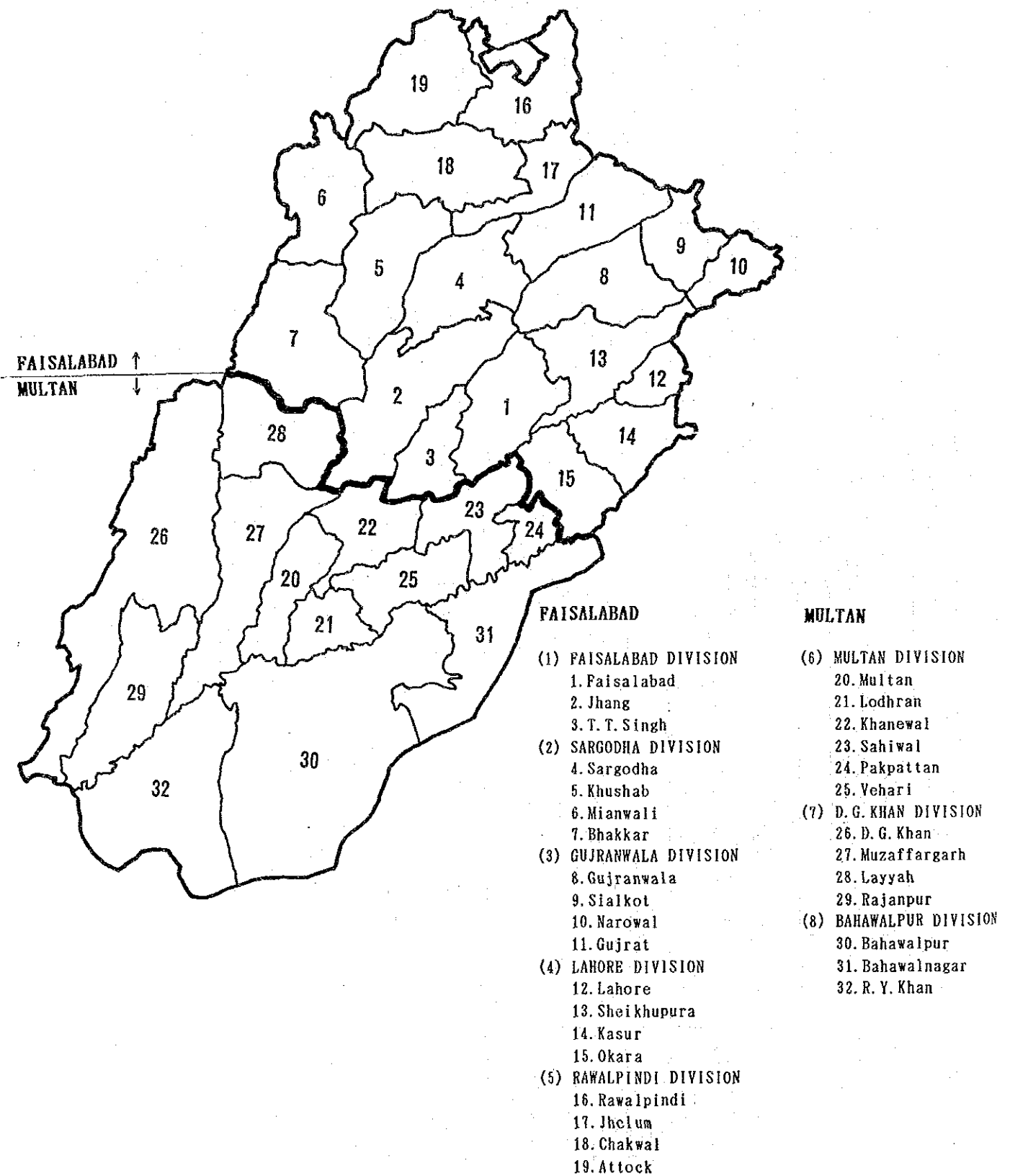


Fig 3-3 BORDER LINE OF ENGINEERING OFFICE

Hourly lease charge is calculated based on the hourly operation cost (estimated) consisting of spare parts/repairs, petro/oil/lubricants, wages of operator, etc.

Lease charge is set separately for irrigated areas and rainfed areas as follows.

Table 3-5 Lease Charge of Bulldozers

(Unit: Rupees per Hour)

	Medium Size Bulldozer	Small Size Bulldozer
Operation Cost (estimated)	(226)	(190)
Subsidized Rates for Canal Communication Areas (Percent)	169 (25%)	149 (25%)
Special Subsidized Rates for Barani Areas (Percent)	132 (40%)	117 (40%)

Furthermore, small farmers with holdings of less than 5 ha can benefit from a bank finance for the lease charge and some 40,000 farmers are applying to the leasing of the equipment for their agricultural land development.

The farmers desiring to hire bulldozers should submit to DGAF district offices the duration of bulldozer engagement required for the planned work, and pay a deposit corresponding to estimated total lease charge. At present, the number of operable bulldozers is not large enough to satisfy the demand, and the applicants must wait, before receiving the requested equipment, 6 months to one year after the request for assistance in land development and payment of deposit, particularly in the southern districts of Punjab Province.

3.3.3 Evolution of the Land Resource Development

The first land resources development project was the Tahl Project executed in 1953 in Punjab Province by Tahl Development Corporation (under the Federal Government).

The project was aimed at the development of Tahl hills near Rawalpindi for the settlement of farmers. The bulldozers used for land reclamation was very effective, and the farmers of the Tahl region sent constantly requests for the leasing of bulldozer to the Department of Agriculture of Punjab Province. In order to assist

farmers in their project of agricultural land development, the Department of Agriculture of Punjab Province procured, for the first time in 1957/58, a small quantity of bulldozers through the Federal Government and leased them for the agricultural development works.

With view to increasing the food production to meet the demand of the increasing rural population, the development of agricultural land of private ownership continued mostly in Punjab Province. The Department of Agriculture of Punjab Province established the Directorate General Agriculture, Field (DGAF) and purchased bulldozers through this department, and leased them out to farmers for assisting their land development operations. The total area developed thereby reached 1.84 million ha in 35 years by May 1992. All development areas are either the holding of owner farmers or that of owner-cum-tenant farmers. The average annual development area that was 55,000 ha during 1980~85, increased to 70,000~80,000 ha after 1985. This increase is considered to reflect the introduction of the land development equipment through the KR-II of the Japanese Government in 1985/86, 1986/87 and 1989/90.

Table 3-7 shows the evolution of the planted areas of major crops and the achievements of agricultural land development. In the case of wheat, 224,000 ha of planting area was developed in the same period, and the annual production is estimated to have increased by 415,000 tons at a rate of 1.85 tons per ha of yield. As for rice, of which 30% of the total product is exported, 117,000 ha of planting area has been newly developed, and 134,000 tons per year of production increase is estimated to have been achieved.

The total area developed during the same period for the cultivation of staple crops including maize reached 547,000 ha, and the annual crops is estimated to have increased by 551,000 tons. This is considered to reflect the effect of the input of the equipment procured with the KR-II of the Japanese government.

The production of cotton, principal export product, has also increased by 124,000 tons per year owing to the development of 200,000 ha of land.

Table 3-6 Area Developed by Bulldozers in the Punjab

(Unit: 1,000 ha)

No.	District	1957/65	65/70	70/75	75/80	80/85	85/90	90/92	Total
1	Faisalabad	3.76	28.17	11.70	8.52	7.55	6.21	2.59	68.50
2	Jhang	4.97	15.16	7.79	12.82	11.66	11.34	1.51	65.25
3	T.T. Singh	-	-	-	-	3.01	2.60	3.13	8.74
4	Sargodha	2.15	14.09	6.71	8.83	8.31	9.81	3.05	52.95
5	Khushab	-	-	-	-	1.05	2.31	3.81	7.17
6	Mianwali	86.68	30.21	13.91	10.16	9.64	9.16	3.20	162.96
7	Bhakkar	-	-	-	1.19	10.49	11.96	3.58	27.22
8	Gujranwala	2.90	15.23	11.40	9.14	6.69	3.74	0.78	49.88
9	Sialkot/Narowal	0.05	4.75	4.27	7.04	6.72	4.01	1.18	28.02
10	Gujrat	0.07	5.37	3.00	7.14	6.35	4.95	3.81	30.69
11	Lahore	2.75	18.03	11.34	6.75	4.13	5.57	1.55	50.12
12	Sheikhupura	3.16	13.94	11.17	10.27	9.02	6.62	1.35	55.53
13	Kasur	-	-	-	4.74	4.73	5.17	1.71	16.35
14	Okara	-	-	-	-	1.38	2.19	1.06	4.63
15	Rawalpindi	0.30	7.16	5.23	4.74	17.48	13.09	11.65	59.65
16	Jhelum	1.57	14.59	5.89	5.32	38.51	26.99	7.92	100.79
17	Chakwal	-	-	-	-	-	16.31	12.80	29.11
18	Attock	0.56	14.53	7.44	8.27	39.18	34.48	14.77	119.23
19	Multan/Lodhran	5.01	37.39	19.40	18.78	26.77	13.46	4.76	125.57
20	Khanewal	-	-	-	-	-	6.41	6.67	13.08
21	Sahiwal/Pakpattan	9.25	24.97	11.03	12.97	10.00	11.52	4.28	84.02
22	Vehari	-	-	-	4.14	14.52	11.13	4.57	34.36
23	D.G. Khan	0.27	14.37	9.25	11.36	12.91	11.85	4.68	64.69
24	Muzaffargarh	167.16	25.23	20.36	17.39	20.15	18.66	6.08	275.03
25	Layyah	-	-	-	-	5.99	5.62	5.84	17.45
26	Rajanpur	-	-	-	-	3.02	4.52	3.60	11.14
27	Bahawalpur	4.51	8.91	6.74	14.46	20.19	25.28	11.64	91.73
28	Bahawalnagar	4.04	8.65	6.34	12.16	15.57	7.22	6.15	60.13
29	R.Y. Khan	13.16	21.91	8.07	20.42	26.07	25.80	12.89	128.32
Total		312.32	322.66	181.04	216.61	341.09	317.98	150.61	1,842.31
Average per year		39.04	64.53	36.21	41.32	68.22	63.47	78.58	52.92

Source: Dept. of Agriculture, Punjab 1992

Table 3-7 Cultivated Area of Main Crops and Area Development in the Punjab

	85/86	86/87	87/88	88/89	89/90	85/86~ 89/90 Area Devel- oped (1000 ha)	90/92 (May) Area Devel- oped (1000 ha)	85/86~ 90/92 (May) Area Devel- oped (1000 ha)	Annual Grow- th	89/90 Yield (Ton/ ha)	85/86 ~ 90/92 (May) Production Increase (1000 ton)
Wheat (A) Cultivated Area (1000ha)	5,343	5,574	5,344	5,589	5,668	325/ 128.7	61.7	190.4		1.85	352.2
(P) Production (1000ton)	9,200	9,200	9,204	10,517	10,518				+2.7%		
(Y) Yield (ton/ha)	1.72	1.65	1.72	1.88	1.85						
Cotton (A)	1,745	1,863	1,936	2,054	2,036	291/ 115.2	55.2	170.4		0.62	105.6
(P)	941	1,064	1,197	1,200	1,230				+5.5%		
(Y)	0.56	0.59	0.64	0.60	0.62						
Rice (A)	1,113	1,175	1,085	1,282	1,282	169/ 66.9	32.1	99.0		1.15	113.9
(P)	1,478	1,064	1,352	1,482	1,482				+0.0%		
(Y)	1.32	0.59	1.24	1.15	1.15						
Gram (A)	821	860	642	763	816	-5/ -4.0	-1.9	-5.9		0.48	-
(P)	440	430	246	294	397				-2.0%		
(Y)	0.53	0.50	0.38	0.38	0.48						
Sugar Cane (A)	511	487	535	530	501	-10/ -7.9	-3.8	-11.7		37.29	-
(P)	16,755	18,478	19,406	19,494	18,683				+2.2%		
(Y)	32.79	37.94	36.27	36.78	37.29						
Maize (A)	339	346	337	346	345	6/ 2.4	1.1	3.5		1.31	4.6
(P)	415	453	405	455	455				+1.9%		
(Y)	1.22	1.30	1.20	1.31	1.31						
Baira (A)	282	266	255	303	296	14/ 5.5	2.7	8.2		0.42	3.4
(P)	154	149	117	126	127				-3.8%		
(Y)	0.54	0.56	0.45	0.41	0.42						
Jowar (AP)	211	237	184	254	239	28/ 11.1	5.3	16.4		0.53	8.7
(P)	120	135	95	129	128				+1.3%		
(Y)	0.56	0.57	0.51	0.50	0.53						
Others (A)						0/ 0.08	-1.79	-1.71		-	-
Area Developed						317.98	150.61	468.59			470.7
Production of Main Crops				12,455							

Source: Statistical Data, Punjab 1990

3.3.4 History of the Procurement of the Equipment for Agricultural Land Development

As mentioned in the preceding section, it was in 1953 for Tahl project that the bulldozer was introduced for the first time in Punjab Province for agricultural land development. Then, in 1957/58 a small quantity of equipment were purchased by the Federal Government, and further in 1964/65 some Italian bulldozers were procured. They were all supplied to Punjab Province and then leased to the small farmers for their own land development.

It was in 1973/1974 that Punjab Province planned for the first time to procure bulldozers by themselves. Punjab Province claimed to the Federal Government for the procurement of 600 units of bulldozer during the period of 1973/74~1976/77: 1973/74, 100 units, 1974/75, 200 units, 1975/76, 150 units and 1976/77, 150 units. But, it could procure only 203 units of small bulldozer (80 HP) in 1975/76 with a loan of the Italian Government.

Then, in 1979/80 Punjab Province procured the 397 units in short with the Japanese Yen Credit: 247 units of small bulldozers (90 HP) and 150 units of medium bulldozers (120 HP).

These 600 units of small and medium size bulldozers were distributed by DGAF to all 29 districts in Punjab Province (Now 32 districts) and leased to the farmers for the agricultural land development.

As the project of private land development using leased equipment had proved to be very efficient, the Government of Punjab Province decided to continue the project and made a plan of procuring 300 units in three years (1982/83~1984/85). The Federal Government requested to the Japanese Government for the Aid for increased food production (KR-II), and Punjab Province could procure, 106 units of medium size bulldozer (120 HP) in 1985/86.

Successively, in 1986/87 the Government of Punjab Province procured 194 units of bulldozer with the KR-II of the Japanese Government: 150 units of small bulldozer (90 HP) and 44 units of medium bulldozer (120 HP).

In 1987/88, Punjab Province applied further to the Federal Government for the procurement of another 150 units because 203 units introduced in 1975/76 reached the end of their economic life and 397 units procured in 1979/80 are nearing the replacement time. Punjab Province claimed to the Federal Government and obtained 140 units of medium size bulldozer (120 HP) in 1989/90.

Table 3-8 shows Punjab Province's plan, approved by the Federal Government, for the procurement of agricultural land development equipment as well as actual procurements. According to the table the total number of bulldozer procured by Punjab Province since 1985/86 with the KR-II of the Japanese Government counts 440.

The cultivating area developed with bulldozer in Punjab Province since 1953, the first year of introduction of bulldozer, till the end of May 1992 has reached 192,000 ha (See Table 3-6), of which the area developed with the bulldozers procured with the KR-II of the Japanese Government in three phases since 1985/86 is estimated at 550,000 ha, or 30% of the total developed area in Punjab Province.

Table 3-8 Procurement Record of Land Development Equipment

Year	Approval by Federal Govt.	Nos. as per PC-I	Actual Purchase
1973/74	600	100	-
1974/75	-	200	-
1975/76	-	150	203
1976/77	-	150	-
1977/78	-	-	-
1978/79	-	-	-
1979/80	-	-	397
1980/81	-	-	-
1981/82	-	-	-
1982/83	300	100	-
1983/84	-	100	-
1984/85	-	100	-
1985/86	-	-	106 *
1986/87	-	-	194 *
1987/88	150	150	-
1988/89	-	-	-
1989/90	-	-	140 *
1990/91	300	-	-
1991/92	-	150	-
1992/93	-	150	-

Note: (*) Financed under KR-II
 Source: Dept. of Agriculture, Punjab 1992

3.4 Condition of the Agricultural Land Development Equipment

3.4.1 Condition of Equipment in Possession

Out of 1,040 units of bulldozer introduced into Punjab Province, 600 units have reached the end of their economic life: 203 units of small size Italian bulldozer (80 HP) procured in 1975/76, 247 units of small size bulldozer (90 HP) and 150 units of medium size bulldozer (120 HP) of both Japanese make, procured in 1979/80 with the Yen Credit. They are all now classified as substantially unserviceable, except for 2 units of medium size bulldozer (120 HP) of Japanese make.

The distribution by district of the 440 units of bulldozer procured with the KR-II of the Japanese Government is shown in Table 3-10. The condition of those bulldozers at the end of June 1992 is shown in Table 3-9. It shows that 185 units representing 42% of the total are operable, 150 units or 34% of the total are under repair or overhaul and the remaining 105 units or 24% unserviceable (for auction).

Table 3-9 Present Condition of Bulldozers

Year Procured		Size	Condition			Total
			Operable	Under repair	Unserviceable	
1	1985/86	Medium	4	15	87	106
2	1986/87	Medium	4	24	16	44
		Small	51	97	2	150
3	1989/90	Medium	126	14	0	140
Total (Ratio)			185 (42%)	150 (34%)	105 (24%)	440 (100%)

Source: Dept. of Agriculture, Punjab 1992

Table 3-10 District-wise Distribution of Bulldozers under KR-II

	District	Year Procured			Total
		1985/86	1986/87	1989/90	
1	Faisalabad	-	6	3	9
2	Jhang	-	8	-	8
3	T.T. Singh	-	6	5	11
4	Sargodha	-	6	4	10
5	Khushab	-	-	3	3
6	Mianwali	-	6	4	10
7	Bhakkar	-	8	4	12
8	Gujranwala	-	5	-	5
9	Sialkot	-	-	2	2
10	Narowall	-	-	1	1
11	Gujrat	-	-	5	5
12	Lahore	-	8	2	10
13	Sheikhupura	-	6	3	9
14	Kasur	-	-	2	2
15	Okara	-	6	2	8
16	Rawalpindi	11	20	18	49
17	Jhelum	9	-	2	11
18	Chakwal	10	-	2	12
19	Attock	1	44	18	63
20	Multan	-	3	3	6
21	Lodhran	-	3	3	6
22	Khanewal	10	-	6	16
23	Sahiwal	-	9	4	13
24	Pakpattan	-	3	2	5
25	Vehari	-	12	7	19
26	D.G. Khan	5	5	7	17
27	Muzaffargarh	13	5	3	21
28	Layyah	8	5	5	18
29	Rajanpur	-	5	5	10
30	Bahawalpur	17	5	5	27
31	Bahawalnagar	8	6	5	19
32	R.Y. Khan	14	4	5	23
Total		106	194	140	440

Source: Dept. of Agriculture, Punjab 1991

During the period of the Basic Design Study, the study team surveyed 12 units of bulldozers at land reclamation work (in field) and 21 units of bulldozers under repair at base workshops or divisional workshops, both procured with the KR-II of the Japanese Government.

The bulldozers apply mainly to two types of work.

- (1) Development of culturable wasteland
- (2) Excavation of cultivated and fallow land (for introduction of irrigation water)

Generally medium size bulldozers are used for the first type of works and small size bulldozers for the second type.

As most of the operating bulldozers are engaged in light works consisting mainly of earth dozing, they did not suffer heavy damages, except for the undercarriages, even in the part liable to heavy wear like blade. The repairing of undercarriage parts is sometimes difficult as machines cannot be stopped for periodical maintenance and lose timing for repair because of a strong demand for machines from the farmers. The most wearing components are engines, which show wear in proportion to the duration of use even in dusty area.

The bulldozers in present service are over-worked and are not stopped even for periodical maintenance, which leading to shortening of their service lives. Under such conditions, the number of bulldozer in operable condition is estimated at maximum of 150.

3.4.2 Situation of the Maintenance and Management of Equipment

The bulldozers procured with the KR-II of the Japanese Government (440 units) were delivered to 8 Divisions including 32 Districts, and have been used for the agricultural land development under the control of the Agricultural Engineers of Divisional Offices and Assistant Agricultural Engineers of District Offices.

The DGAF has under its control 23 workshops which are classified into three groups - Base Workshop, Divisional Workshop and District Workshop -, according to the capacity of maintenance machine tools thereof. (See Fig. 3-4)