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Agricultural Development in the Mondego Valley, Portugal

Antonio Jose C.C. Sousa Dias

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Thesis submitted to the University of Durham,
England, for the Degree of Master of Science

Department of Geography

December 1988



11 MAY 1990

Agricultural Development in the Mondego Valley,
Portugal

- A Case Study of Rural Change

Abstract

The various projects of the PIDRBM (Rural development of the Lower Mondego) are the most complete programme of rural development ever carried out in Portugal.

For many years there have been numerous proposals for the development of the region, before the actual agricultural project was initiated by DGHEA in 1978 with the technical and financial support of the Federal Republic of Germany.

The development of the agricultural project of the lower Mondego valley from Coimbra to Figueira da Foz is the most relevant factor for the success of the entire programme and therefore in this thesis special attention is given to the increase of agricultural production, which is essential to the economic development of the region. The project is described in some detail and also socio-economic factors are considered. Additionally, other potential resources are mentioned such as fishery, industry, tourism, i.e. those considered relevant for the development of the region (see Chapter 9.2.2).

Acknowledgements

During the preparation of this work I had to face many difficulties, specially those concerned with the collection of data and information.

I should record here my special gratitude to my immediate supervisor, Professor H. Bowen-Jones, for having accepted me as a post-graduate student at Durham, for the interest shown in this thesis, his advice and for the innumerable suggestions which have been very valuable for the progress in my studies.

My special gratitude is also for Dr. Heinrich Speetzen for all the facilities granted, for his comments and suggestions and mostly for his advice and influence on my decision to join Durham University. This gratitude is also extended to his wife, Mrs. Elsie Susan Speetzen for helping me to overcome language problems.

My thanks go particularly to Eng.º Santos Veloso, Director of the co-ordinator's office of the PIDRBM for his enthusiasm and his willingness to explain the larger implications of the development efforts in the region.

Eng.º Flavio Santos Ferreira, Director of the Mondego Project, deserves thanks for the facilities permitted in using sources and reports available in the Project.

To Eng.º Antonio Santos Trindade, responsible for the management of the research station of "Quinta do Canal" I also owe my gratitude for his help.

For the elucidation of irrigation and drainage maps and for his general professional support my thanks goes Eng.° Westerveld, of GTZ. I am also indebt to Dr. R. Barsch, consultant of the GTZ in Portugal, for his interest and suggestions.

My special gratitude for the final preparation and typing of this thesis to Miss Catherine Reed.

For my fiancée, A.A. Borega, I reserve special praise for her help in typing numerous drafts of this thesis.

To all those people who were interviewed and contacted, and cannot be mentioned here, I owe great debt.

CONTENTS

	<u>Page</u>
<u>Abstract</u>	i
<u>Acknowledgements</u>	ii
<u>List of Contents</u>	iv
<u>List of Tables</u>	viii
<u>List of Figures</u>	ix
<u>List of Abbreviations</u>	xi
<u>Chapter 1 - Introduction</u>	1
1.1 History and Reasons for the Mondego Project	1
1.2 Agriculture and Regional Development	5
1.3 Summary of the Socio-Economic Characteristics of Beira-Litoral	8
1.4 The Basis for Investigation	9
References	12
<u>Chapter 2 - Physical Resource Potential</u>	13
2.1 Climate	13
2.2 Topography	16
2.3 Soils	18
2.4 Hydrology and Water Resources	19
References	21
<u>Chapter 3 - Human Potential</u>	22
3.1 Introduction	22
3.2 Population Structure	22

	<u>Page</u>
3.3 Education	25
3.4 Health and Health Services	25
3.5 The Farmers	26
3.6 Farm Incomes	28
3.7 Employment	30
3.8 General Attitude Towards the Project	30
References	33
<u>Chapter 4 - The Assessment of the Present and Plans for</u>	
<u>the Future</u>	34
4.1 Present Land Use; Traditional Methods	34
4.2 Land Holdings, Marketing and Economics	43
References	48
<u>Chapter 5 - The Project; Technical Aspects of Production ...</u>	49
5.1 Land Reallocation	49
5.2 Irrigation and Drainage	50
5.3 Soil Conservation	55
5.4 Road Network	56
5.5 The Research Station of "Quinta do Canal"	56
5.6 Agricultural Production Crops and Cropping Patterns	57
5.7 Innovations and Plans for Future: General Principles	68
References	73

	<u>Page</u>
<u>Chapter 6 - Special Agricultural Production Sectors and</u>	
<u>Associated Non-Farming Activities</u>	74
6.1 Vegetables	75
6.2 Cereals	76
6.3 Fodder and Animal Production	77
6.4 Poplars and Match-Industry	78
6.5 Machinery-Hire	79
References	81
<u>Chapter 7 - Socio-Economic Aspects of Rural Development</u>	82
7.1 The Training of Producers; Extension Services ..	82
7.2 Cooperation Between Farmers	84
7.3 Prices, Markets and Organization of Marketing of Agricultural Products	92
7.4 Agricultural Financing	93
7.5 Transportation and the Communication Infrastructure	95
References	97
<u>Chapter 8 - General Administration</u>	98
8.1 Regional Development Planning and the PIDRBM ...	98
8.2 The Mondego Project - the Agricultural Sector ..	100
8.3 Regional Directorate of Agriculture of Beira Litoral - DRABL	101
8.4 Water Distribution and Administration - EDP (MIE)	102

	<u>Page</u>
8.5 The Creation and Functioning of the Water	
Association	103
References	107
<u>Chapter 9 - Analysis of Requirements; Strategy for</u>	
<u>Development and Conclusion</u>	108
9.1 Analysis of requirements	108
9.2 The General Context and PIDRBM	110
9.3 Agriculture - The Mondego Project and	
Conclusion	114
References	118
<u>Further Reading</u> (selected works only)	119

List of Tables

	<u>Page</u>
Table 1.1 Project organization : Responsibilities and Planning	7
1.2 Sectoral employment by district : 1970	10
Table 2.1 Temperature : Mean monthly, mean monthly maximum and minimum (°C) - 1941-1970	14
2.2 Average annual rainfall	15
2.3 Potential evapotranspiration (Penman, mm) ..	17
Table 3.1 Age structure of the population (1970)	23
3.2 Age of farmers (%)	24
3.3 Farm income evolution goals (Before project = 100)	29
Table 4.1 Cropping systems and types of farming (%) ..	36
4.2 Use of machinery (1981)	38
4.3 Estimated number of livestock in the Mondego valley (1980)	41
4.4 Farm size and plot distribution in the Mondego valley	44
Table 5.1 Peak water requirements (mm/day) and volume of water (m ³ /ha/year)	52
5.2 Research station of "Quinta do Canal"; Average yields (tonnes/ha)	62
Table 7.1 Agricultural cooperatives in the Mondego valley (1983)	87
7.2 Employment in Lacticoop processing plants ..	91
7.3 Milk production (1,000 litres)	91

List of Figures

	<u>after page</u>
Figure 1.1 Schematic map of the project area and its location within Portugal	1
1.2 Hydrological works in the Mondego watershed	3
1.3 Blocks incorporated in the agricultural development of the main valley of the Mondego river	4
Figure 2.1 Climatic Diagram, Mondego project area, Portugal	15
2.2 Soil type map of the Mondego valley	17
Figure 3.1 Selected population trends, 1950-1981 (Base 1950 = 100)	21
Figure 5.1 Irrigation and Drainage system of the main valley	52
5.2 Lay-out of two irrigation/drainage units (Basin irrigation)	53
5.3 Crop areas in the Mondego valley	56
5.4 Evapotranspiration (Fodder crop, wheat, maize) according to Penman	66
Figure 7.1 Marketing system of agricultural products .	92
7.2 Marketing structure of rice in Portugal (1984/1986)	93
7.3 Marketing structure of maize in Portugal (1984/1986)	93
7.4 Meat market system (Beef, lamb and pork) ..	93

Figure 8.1	General administration and hierarchic structures	98
8.2	The Mondego Agricultural Project organization	101
8.3	Functioning of a water association according to German model	102
8.4	Water supply for agriculture, industries and towns	104

List of Abbreviations

- AJAP - Association of Portuguese young farmers
- CCEPHA - Hydro-agricultural project co-ordinator board
- CCG - General co-ordinator
- DGHEA - General directorate of hydraulics and agriculture engineering
- DGP - General directorate of harbours
- DGRN - General directorate of the natural resources
- DRABL - Regional directorate of agriculture of Beira Litoral
- EDP - Electricity of Portugal
- EEC - Economic European Community
- EPAC - Public enterprise of cereal supply
- GTZ - German agency for technical cooperation
- IFADAP - Financing institute for development of Portuguese agriculture
- IGEF - Institute for land administration and reallocation
- INIA - National institute for agricultural research
- MAP - Ministry of agriculture and fishery
- MHOP - Ministry of hydraulics and public works
- MIE - Ministry of industry and energy
- MOP - Ministry of public works
- PIDRBM - Regional development programme of lower Mondego valley
- SIFAP - Integrated system for financing of Portuguese agriculture
- PDABM - Agricultural development project of lower Mondego
- PM - Mondego project
- ZA - Agrarian zone

Chapter 1

INTRODUCTION

1. History of and Reasons For the Mondego Project

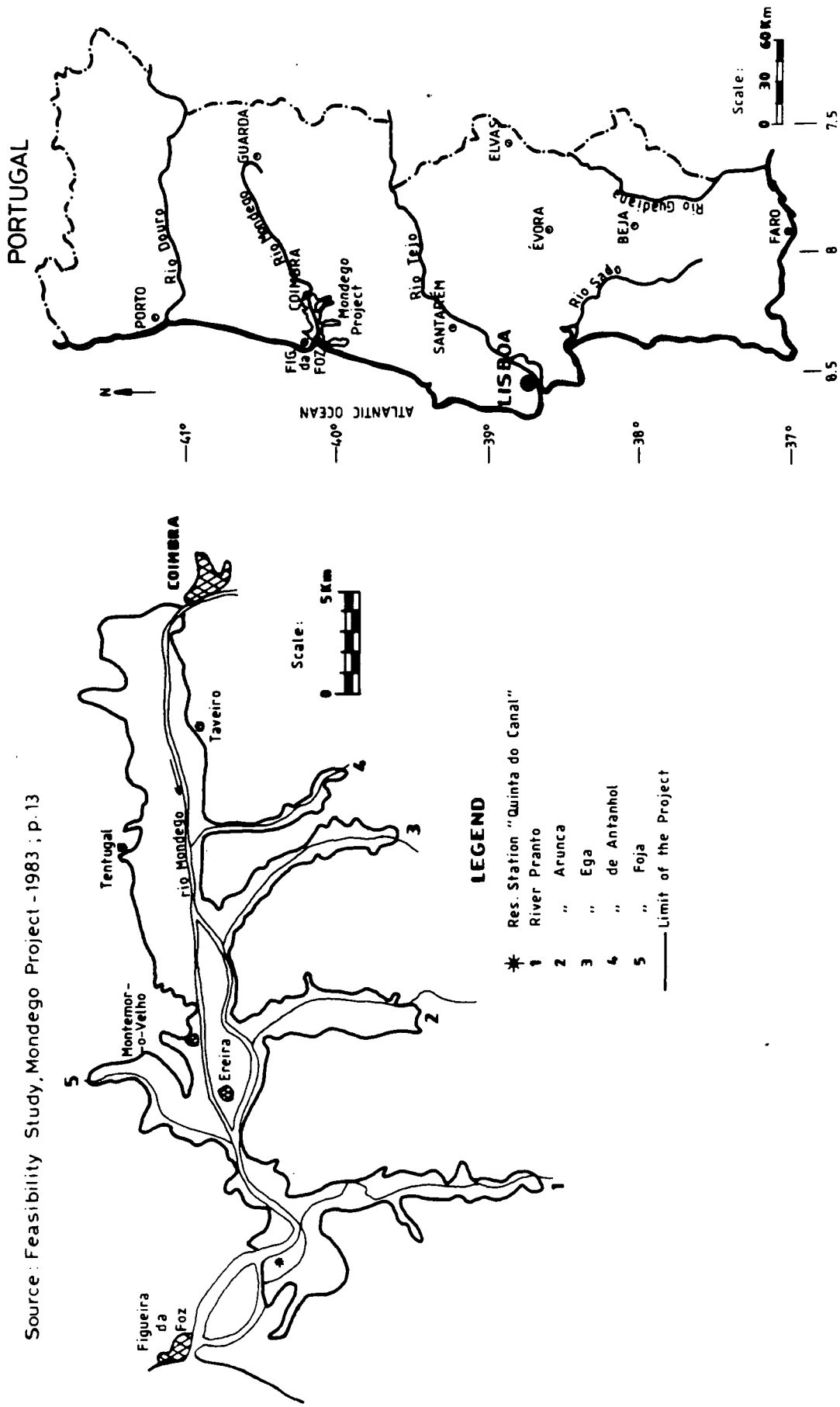
The Mondego project area considered here lies in the alluvial plain of the lower 40 km of the river Mondego, between Coimbra and Figueira da Foz. This alluvial floodplain is commonly called "Campos do Mondego" and is made up of a series of terraces resulting from the erosional and depositional phases of river action over the years (see Fig. 1.1).

The project zone covers an area of about 15,000 hectares divided into about 35,000 small fields owned by 7,000 individual farmers. About 100,000 people live in this area (see Ch. 3).¹

The flow of the Mondego for centuries was irregular with frequent floods. It is believed that the settlement of people on the riverine lands above Coimbra expanded particularly during the 13th century.² Forests were cut down on the river banks to enable cultivation of the land, this causing both localized erosion and deposition of solid materials and, together with increased runoff, resulted in a violently fluctuating river regime. For example, in 1285 the monastery of Sant'Ana and later that of Santa Clara-a-Velha, in Coimbra, were abandoned due to the occurrence of frequent floods.³

Fig 1.1-SCHEMATIC MAP OF THE PROJECT AREA AND ITS LOCATION WITHIN PORTUGAL

Source : Feasibility Study, Mondego Project -1983 ; p.13



Attempts to find a solution to this problem date back hundreds of years. In 1461, a letter from the King of Portugal, Dom Afonso V prohibited burning of the forest on the river banks upstream from Coimbra. Dom Joao II and Dom Manuel maintained that policy. The latter initiated a regional administration of the river in order to carry out maintenance and engineering works for the prevention of floods.⁴

Dom Joao III in 1538 ordered the building of a river bank wall within the city of Coimbra to prevent the river from meandering and leaving its bed. Later, Cardinal Dom Henrique ordered a study for the canalization of the river and the associated construction of eight cross-stream barrages (1565). This project was completed and carried out in 1964. In 1791 a canal and other water control and supply structures were built by the priest Estevao Cabral. Two straight, narrow sections of the new river channel were built from Coimbra to Montemor-o-Velho. It was supposed that by building straight, narrow, canalized sections, the velocity of flow would increase in such a way that the silt load would be carried to the sea, without there being alternation of deposition and erosion.⁵

A Directorate of Public Works of the Mondego river and Coimbra was created in 1841. A few years later (1850) a Commission presented a project for the regulation of the Mondego river. In 1919 a Junta (Board) for the Mondego river was created in Coimbra. Its task was to develop a plan to regulate the river and control flooding. A plan was presented in 1936 to control most floods up to a flow of about 520 m³ per second. Four years later (1940) the Autonomous Junta for Hydraulic Agricultural Works presented a plan for the

Hydro-agricultural and Hydro-electrical use of the Mondego basin.⁶
A later overall plan was produced by a MHOP team with a design completed in 1962.⁷

In 1973, the Ministry of Hydraulics and Public Works (MHOP) commissioned a consultant to carry out a further study on the canalization, drainage and irrigation of the lower Mondego river, i.e. from Coimbra downstream.⁸

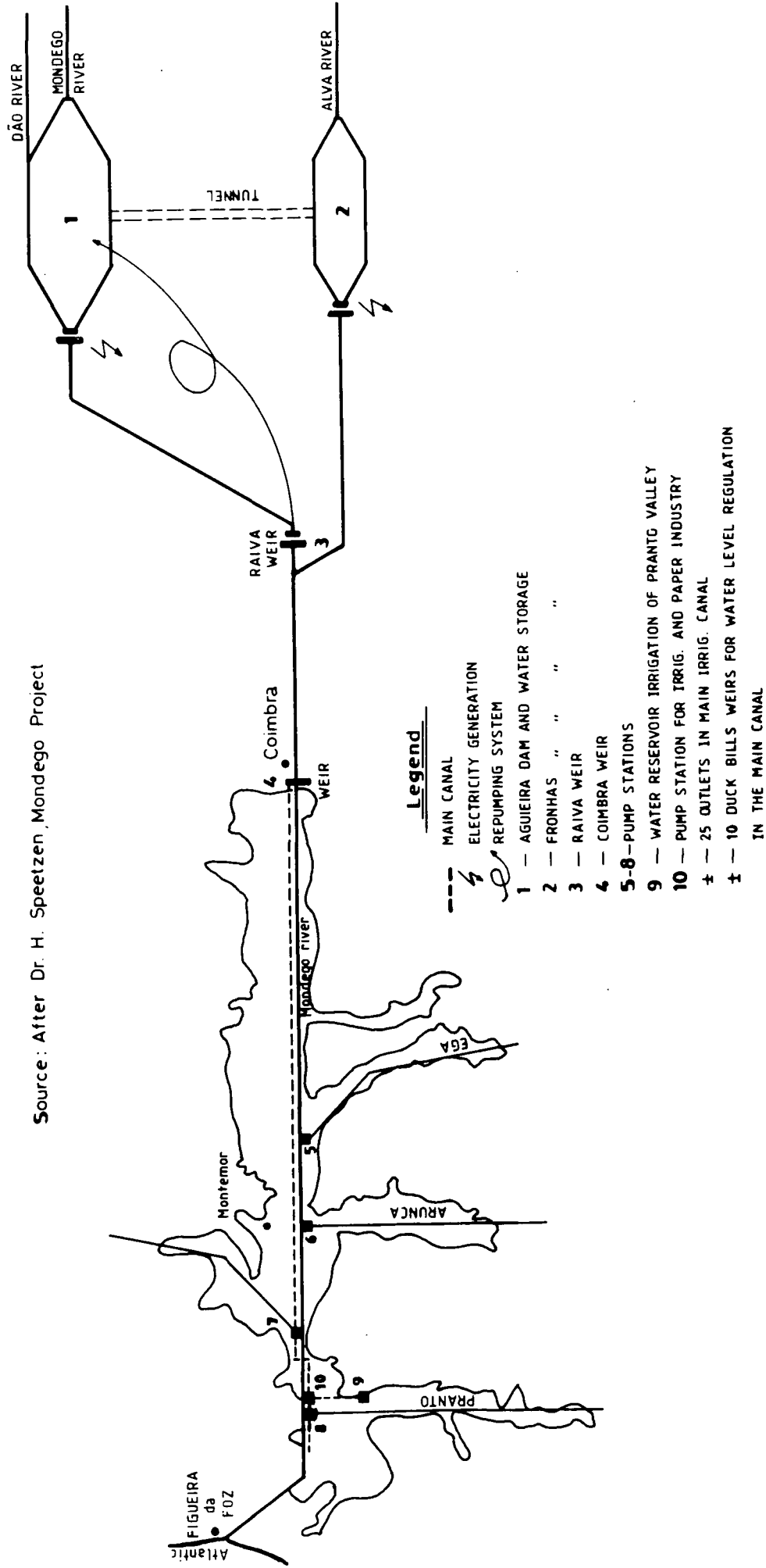
In 1975, a Luso-German Governmental Commission for Economic Matters met to agree on financing of a project for flood control and irrigation of the lower Mondego valley, as presented by the MHOP. The finance contract between the two governments was signed in March 1978; an agreement on technical cooperation was also signed in November of the same year.⁹

The plan comprises the following¹⁰ (see Fig. 1.2):

- The whole hydrological programme, covering 76 per cent of the Mondego basin North-East of Coimbra, is based on 4 systems of dams: Asse-Asse, Girabolhos, Ervedal and Aguieira. The latter is part of a system formed by the Raiva and Fronhas dams. The Aguieira project was carried out in the first phase (1980) since it was essential for the prevention of floods and implementation of the agricultural project of the lower Mondego valley. This system, Aguieira, Raiva and Fronhas, allows the reduction of peak floods in Coimbra, from about 4,000 m³ per second to 1,200 m³ per second (water flow) and 7.5 l per second to 1.5 l per second (solid flow).

Fig. 1.2 - HYDROLOGICAL WORKS IN THE MONDEGO WATERSHED

Source: After Dr. H. Speetzen, Mondego Project



- A reafforestation programme in the upper watershed area.
- Regularization of the Mondego river-bed and its main tributaries (Ega, Arunca and Foja), extending from Coimbra to Figueira da Foz, covering about 36 kms. The main objective is to ensure that only major floods which occur with a probable frequency of once every 100 years could inundate the fields. Essentially, a new river channel has been constructed with river-bank dikes constructed to protect the floodplain from winter flooding.
- The irrigation of cultivable land in the plains of the Mondego river and its tributaries downstream of Coimbra. Part of this irrigation supply will be drawn from a main irrigation canal fed by a diversion weir on the Mondego at Coimbra. This canal runs along the northern bank of the new Mondego channel some two-thirds of the distance to the sea and then crosses over to the south bank (Fig. 1.3) (see also Ch. 2.4).
- Two collector canals designed to prevent excess water entering the Mondego plain from the highlands to the north and south are to be constructed. These will run along the upper plain edge contours, following the lie of land, and are an essential part of the drainage system (see also Ch. 2.4).
- A road network (already constructed) of about 27.5 kms including 10 bridges, provides a link between the dams and between Santa Comba Dao and Coimbra via Penacova.

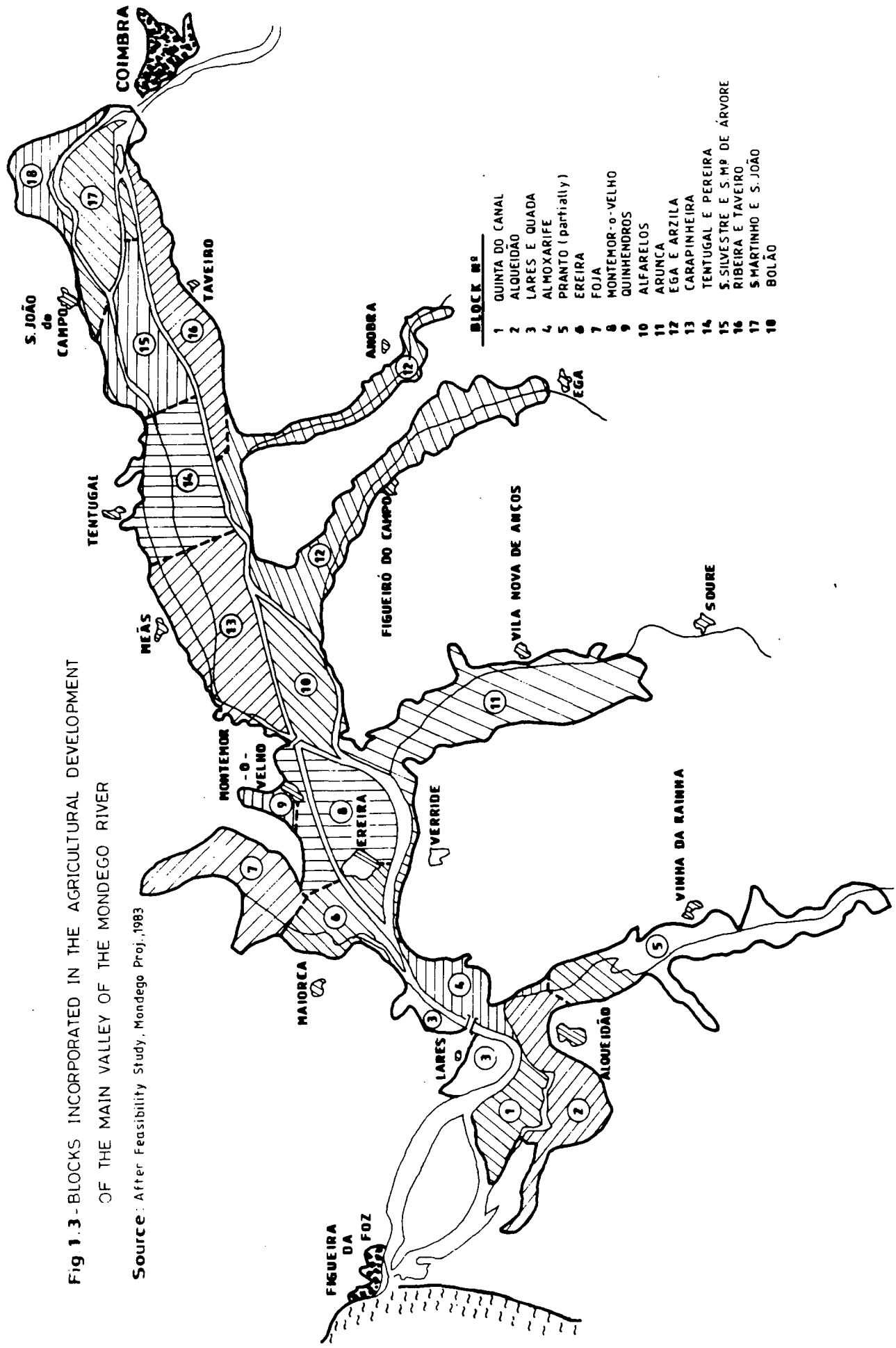


Fig 1.3 - BLOCKS INCORPORATED IN THE AGRICULTURAL DEVELOPMENT OF THE MAIN VALLEY OF THE MONDEGO RIVER

Source : After Feasibility Study, Mondego Proj., 1983

The plan also includes the construction of a road system in the lower Mondego valley as well as a project of field roads for access to the farms. New bridges in Montemor-o-Velho, Formoselha, Verride, Casais and Ameal have been built as well as 5 fords over the left peripheral canal and 5 over the right one.

These engineering works, based on the need to control the flow of the Mondego river and its associated tributaries are also designed to greatly increase the irrigation potential of these rivers.

2. Agriculture and Regional Development (and see Ch. 9)

The irrigation potential thus created has made it possible to consider regional economic development in the whole Mondego valley region based on the increased productivity of improved irrigation agriculture. This has meant that many aspects of agriculture and its relationships with economy and society have had to be considered. The starting point was one of a low ecological, economic and social base associated with a number of particular problems.

In order to solve these problems, some technical and socio-economic drawbacks are being removed, such as bad drainage conditions, inadequate irrigation network, unsatisfactory or non-existent field roads, high salinity of the ground water and the salinization hazard to soils, lack of irrigation water, fragmentation of the regional agrarian structure and the predominance of a very restricted range of crops and of livestock husbandry.

In 1978 a technical team was established to execute the so-called "Projecto de Desenvolvimento Agrícola do Baixo Mondego". It is this lower Mondego valley agricultural development, generally referred to as the Mondego project, which is the subject of this thesis. The project has been supported by technical consultants from the German Agency for Development (GTZ). Enquiries, studies and field research have been carried out by the Mondego project team in order to find an appropriate solution for the existing problems (see Table 1.1).

The Mondego team has already initiated the execution of project works with regard to irrigation and drainage of the valley and a rural road network, and a start has also been made with the land reallocation process.

These investments are being followed by the provision of professional training courses, extension service and financial and technical support to farmers and their organizations. This implies social engineering as distinct from physical engineering.

Table 1.1 Project Organization : Responsibilities and Planning

	MOP	MAP	GTZ
STRUCTURES/ACTIVITIES			
<u>PRIMARY STRUCTURES</u>			
Dams	X		
Roads	X	X	X
Bridges	X		X
River	X	X	X
Irrigation	X	X	X
Drainage (1)		X	X
Field Research		X	X
Process Training		X	X
Ext. Service		X	X
Soil Laboratory		X	X
Marketing		X	X
Financing	X	X	X
Land Reallocation		X	X

(1) The old river will be used as primary drainage.

3. Summary of the Socio-Economic Characteristics of Beira-Litoral

The region of the lower Mondego valley includes the districts of Coimbra, Figueira da Foz, Soure, Montemor-o-Velho and Condeixa. Within these districts, Coimbra and Figueira da Foz are the main urban centres. The latter includes an important manufacturing area, with 43 per cent of the capacity of the national paper industry,¹¹ and one of the two seaports of the central coastal region. Agriculture, fishing, industry, commerce and tourism are also important for the economy of the region.

In 1981, 260,590 persons lived in the area, concentrated mostly in the districts of Coimbra and Figueira da Foz, with 53.3 and 22.5 per cent of the population respectively. In the remaining districts, corresponding to 48.5 per cent of the area, lived only 24.2 per cent of the population.¹²

The regional distribution of the active (employed) population related to the main sectors mentioned above is equally differentiated. In fact, whilst 82 per cent of the total labour force works in the commercial and industrial sectors, in Condeixa, Montemor-o-Velho and Soure employment in the primary sector, almost wholly in agriculture, is higher than the regional average (32 per cent), 31, 38.5 and 35.9 per cent respectively whereas in Figueira da Foz and Coimbra it falls much lower, 24.3 and 3.9 per cent.¹³

There is and has been for some years in the rural areas a move out of agriculture, migrants trying to find alternative employment in the main urban centres. However, even with the generally low level

of income in farming, the balance between population increase and migration is changing only slowly; 32 per cent of workers were still in farming in 1981 (Table 1.2)¹⁴ (compare with the 1970 situation). Rural development therefore must include programmes for stabilizing population movement, increasing employment prospects as a whole in the region and raising agricultural incomes.

Agriculture, nationally and regionally, is marked by low labour productivity, on average only 40 per cent of that in non-agricultural sectors as measured by GDP per capita.¹⁵ This reflects low level of investment in agriculture, inadequate technology, the move out of farming especially by the young and enterprising, poor training and many other negative factors.

In this study, the emphasis is placed in examining the opportunities for and the constraints on the creation of wealth by improving the agricultural sector. In Chapters 2 to 7 the requirements for progress from the pre-project situation to a dynamic future in farming are considered in their various aspects. In chapters 8 to 9, the thesis progresses from an examination of the strategy for agricultural growth to the wider regional context.

4. The Basis For Investigation

The candidate was employed as an agronomist in the project between 1979 and 1986 and as such has been able to call on a great deal of project data. Since 1985/1986, it has been possible to carry out field work of many kinds including over 70 interview surveys and to place this work within the general field of rural development. For

Table 1.2 Sectoral Employment by District - 1970

ACTIVE POPULATION							
	AGRICULTURE	%	INDUSTRY	%	ADMINISTRATION	%	TOTAL
F. Foz	6720	37	5515	30	6005	33	18240
Montemor	5090	57	1415	96	2470	27	8925
Soure	4465	59	965	13	2175	20	7605
Condeixa	2450	53	855	18	1285	29	4590
Coimbra	1790	4	13500	37	21320	58	36610

Source : After: A Regiao Centro: (Comissao de Coordenacao
Regiao Centro, 1981), p. 428.

the region studied there are great deficiencies in published data, for example demographic and employment and financial statistics and analyses are very few and quite inadequate for detailed research. The candidate has had to utilize what little background information exists and rely to a large extent on rural interview material, including estimates and opinions expressed by local inhabitants, to whom he owes considerable thanks for their cooperation.

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2. Veloso, A. Santos - O Programa Integrado de Desenvolvimento Regional do Baixo Mondego, Apresentacao, Fevereiro 1986 - p. 1.
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15. Ibid., p. 8.

Chapter 2

PHYSICAL RESOURCE POTENTIAL

1. Climate (Fig. 2.1)

Adequate records of meteorological data are important for the planning and management of agricultural projects. The results presented here are selected from data recorded at several meteorological stations depending on the duration of consistent recordings.

Air Temperature (Table 2.1)

The absolute maximum daily temperature rises to more than 40°C in Coimbra and Montemor-o-Velho.¹ Lesser values occur near the coast. The average minimum temperature increases from Coimbra to the coast and occurs mostly in February. The winters are mild and allow the growth of a wide range of crops. The occurrence of snow is so rare that it is never referred to in agricultural reports. Frosts, however, occur frequently mainly in December and January.

Precipitation

Rainfall - The study of the annual pattern and its geographical distribution in the Mondego valley shows that the difference between annual average rainfall between Figueira da Foz and Coimbra is about 300 mm (see Table 2.2). Precipitation is markedly seasonal, July and August each receiving less than 15 mm, whilst average monthly rainfall exceeds 100 mm in December, February and March.

Table 2.1 - Temperature : Mean monthly, Mean monthly Maximum and Minimum (°C) - 1941/1970

	Coimbra			Coimbra(Benc)			Montemor-o-Velho			Figueira Da Foz		
	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
Jan.	9.1	13.6	5.5	9.4	14.7	4.4	9.9	14.3	5.2	10.3	13.2	6.1
Feb.	10.0	15.2	6.1	10.4	15.6	5.0	10.5	15.2	5.7	10.3	13.7	6.7
March	12.1	17.4	8.3	12.9	18.1	7.5	13.1	17.5	8.5	13.1	16.5	9.4
April	13.8	20.2	9.0	14.5	20.6	8.2	14.6	19.6	9.5	15.0	18.4	11.0
May	15.6	22.3	11.2	16.6	22.3	10.7	16.3	20.8	11.8	15.7	18.5	12.6
June	19.0	25.7	13.7	19.1	25.3	13.0	18.7	23.3	14.1	18.1	21.2	14.7
July	20.7	27.8	15.0	21.1	28.0	14.2	20.1	25.3	15.1	18.9	22.2	15.3
Aug.	20.9	29.0	14.8	21.2	28.2	14.2	20.3	26.0	14.7	19.1	22.6	15.2
Sept.	19.6	26.7	14.4	20.2	26.9	13.3	19.4	25.2	13.6	18.4	22.1	14.8
Oct.	16.3	22.6	11.8	17.0	23.6	10.4	16.6	22.2	10.6	16.4	19.6	12.4
Nov.	12.3	17.1	8.5	13.2	18.9	7.6	13.0	17.8	7.7	13.5	16.7	10.0
Dec.	9.5	14.3	6.2	10.4	15.2	5.6	10.2	14.8	5.5	10.9	14.1	7.5

Source : Santos, Lousada Dos - Climatologia Da Bacia Do Mondego
(Agosto 1977) 16, p.20.

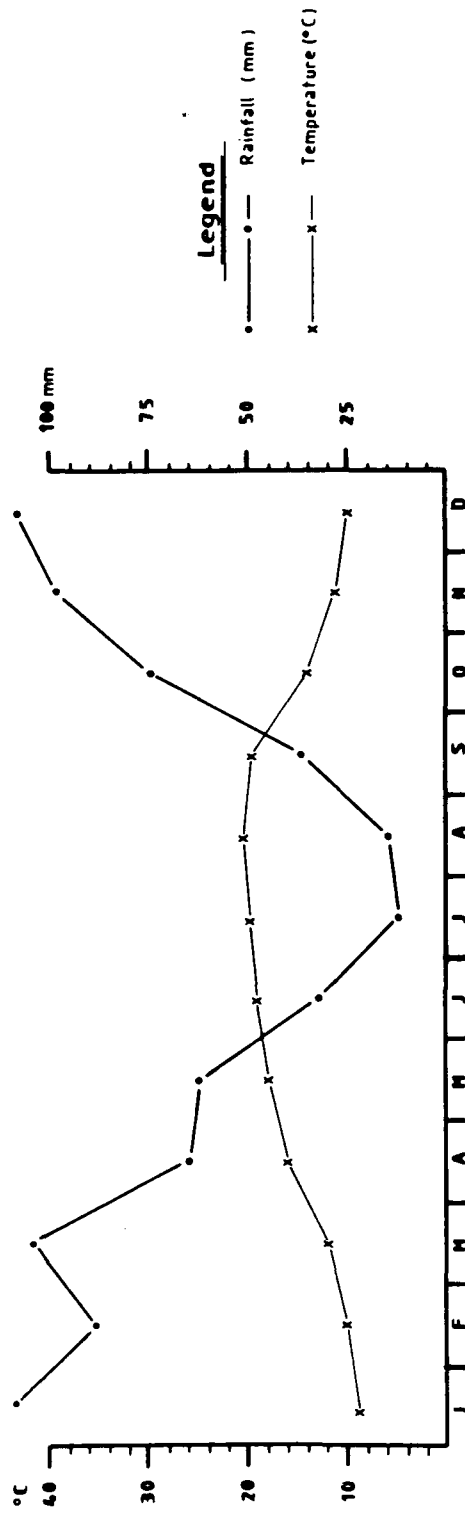
Table 2.2 Average Annual Rainfall

	AVERAGE RAINFALL (mm)	YEARS
COIMBRA	928	94
COIMBRA (BENCANTA)	774	12
FIG. DA FOZ	615	32
MONT. O VELHO	821	29
SOURE	825	27

Source : "Climatologia da Bacia do Mondego"

(Agosto 1977), p. 2.

Fig. 2.1 - CLIMATIC DIAGRAM, MONDEGO PROJECT AREA - PORTUGAL



Source: After Dr. Heinrich Speetzen, Mondego Project

Wind

The prevailing winds are from N and NW, except in Coimbra where it sometimes blows from the South-East.² Strong winds blow mostly near the coast decreasing in intensity towards Coimbra, but apart from its normal component effect on evapo-transpiration, wind is not a significant factor in agriculture.

Evaporation and evapotranspiration (Table 2.3)

Evaporation decreases from the coast to Coimbra. The maximum and minimum values are registered in August and December respectively. Evapotranspiration represents the most important factor of water consumption in the hydrological cycle. The higher values occur in summer (July) and the lower ones in winter (December), with daily values in Summer of 5 mm and in Winter of less than 1 mm.³

2. Topography

The main local topographic distinction in the Mondego valley is between the "Campo" - the floodplain - and the "Monte" - the junction slopes between floodplains and surrounding hills. The floodplain itself under natural conditions carried a main river-channel, meandering and with bordering levels. The channel has now been artificially straightened and is edged by artificial banks. Away from the river bed natural terraces have been almost obliterated by centuries of levelling for rice irrigation by flood. The thalweg of the Mondego is extremely flat and gradients from valley side to river bed are equally low. In the tidal

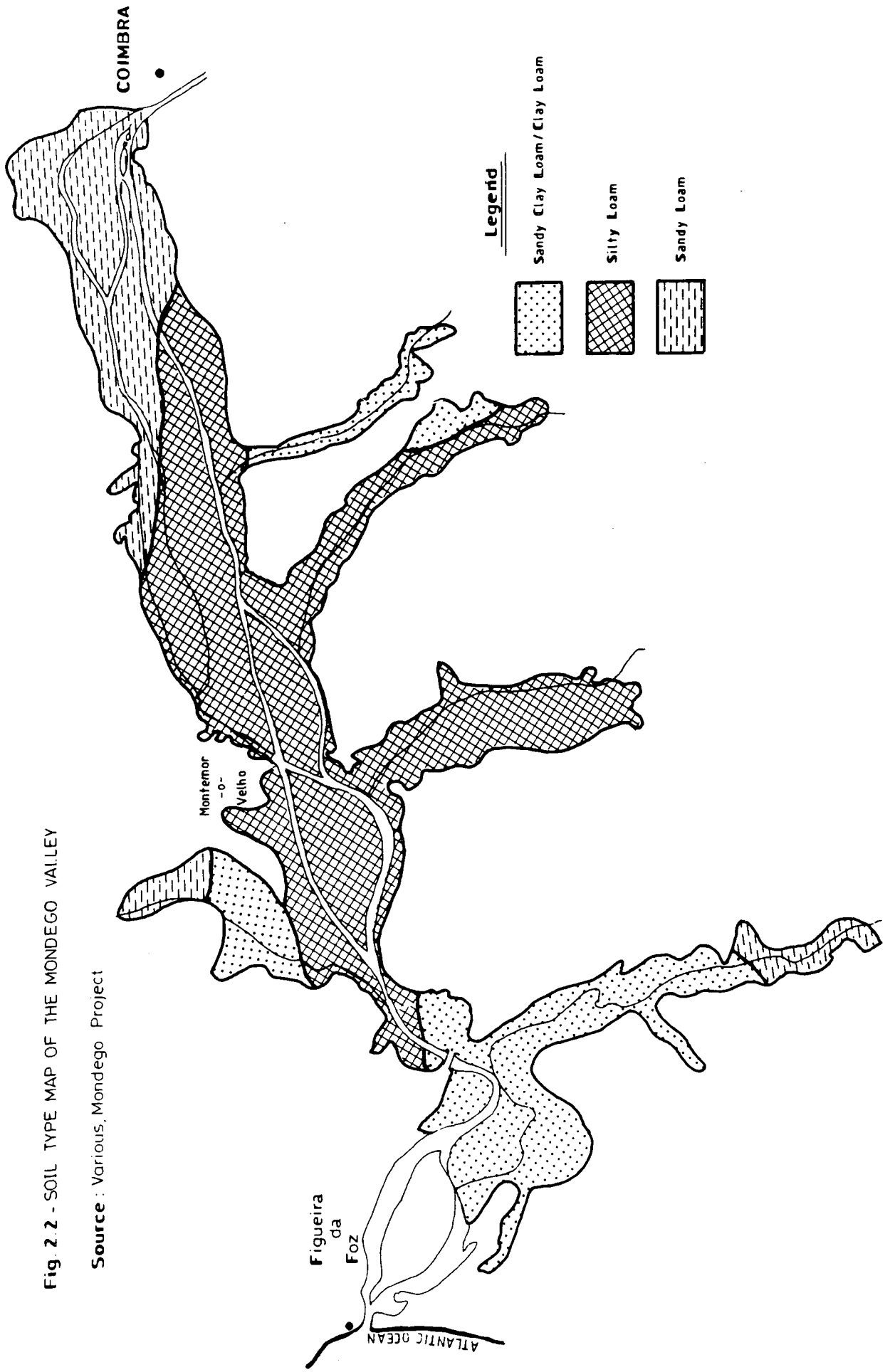
Table 2.3 : Potential Evapotranspiration (Penman - mm)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Coimbra	24.8	31.6	69.7	90.7	121.5	124.8	149.0	152.8	94.9	59.9	29.2	16.9	963
Bencanta	14.6	24.4	54.5	79.6	108.1	129.6	137.1	125.0	74.6	45.4	19.4	11.2	820.5
Montemor-o Velho	14.9	24.5	55.3	72.4	95.5	118.3	126.7	111.1	75.4	37.8	20.7	15.3	767.9
Figueira Foz	22.3	37.3	67.5	99.1	129.2	137.8	152.5	137.2	86.3	52.3	26.8	23.3	965.6

Source : Santos, Lousada Dos - Climatologia da Bacia do Mondego (Agosto 1977) p.37.

Fig. 2.2 - SOIL TYPE MAP OF THE MONDEGO VALLEY

Source : Various, Mondego Project



section, downstream of Montemor, the ground water-table is about one metre below ground level.

3. Soils (see Fig. 2.2)

The lower Mondego valley in which the project area is situated is a depression which runs from NE to SW along the river Mondego, from Coimbra to Figueira da Foz. The soils have been formed under alluvial conditions. The following soils are found in the area:⁴

Calcareous soils : Occur in most of the secondary valleys to the South of the project, i.e. Cernache, Ega and Arunca and also in the Anca valley to the North.

Non-Calcareous soils : Occur in most of the main valley and of the secondary valleys Foja to the North and Pranto to the South.

The soils classified by texture and permeability are shown in Fig. 2.2:

- 1) Zone A - Light or medium texture with good natural drainage.
- 2) Zone B - Medium or heavy textures naturally well drained.
- 3) Zone C - Heavy or medium textures, poor natural drainage and occurrence of salinity problems.

Most of the soils in the valley are deep, level and nutrient rich (Class A) and water retention of the soils is favourable. In general these soils are suitable for any cropping system.

Near the coast where the soils are heavy with a low permeability and with an impermeable hard pan layer at about 50 cm depth, rice is grown from May till October. The land is left fallow in Winter. In this part of the valley other crops can be grown provided artificial drainage is available. Soil maps with information concerning texture of soils, depth layers, salinity and alkalinity were prepared by the Mondego project team in order to supply the necessary data for the selection of the most appropriate drainage system.

4. Hydrology and Water Resources

Before the completion of Aguieira and Fronha dams, water for the irrigation of Mondego fields was pumped directly from Mondego river and its tributaries or from wells.

The whole new watershed plan as summarily described in Chapter 1 (Fig. 1.2) and which includes the control of water in upper mountain regions, is now completed; the main reservoirs have been built and a steady supply of water flowing down to Coimbra is assured. At this point there has been built a water level regulatory system by weir which enables the irrigation canal to take the required amount of water for irrigation. This includes the whole requirement of gravity flow irrigation systems for various cropping systems which will be considered later in this thesis, of pressurized irrigation systems including sprinkler and any other overhead or drip-trickle irrigation systems and also a flow large enough for pumping water further downstream for non-agricultural purposes. The flow of water through the main irrigation canal is now sufficient to allow all the various types of irrigation to be carried downstream.

Main Irrigation System

Briefly, the main irrigation system consists of the main distribution canal, which starts at the Coimbra weir and follows along the northern dyke of the river for about two thirds of its length, then crossing the river to the southern side. It continues down-valley to the pumping station which supplies water to the paper factories of Soporcel and Celbi and to the town of Figueira da Foz. There is a branch leading from the pumping station to the Quinta do Canal block. Sub-canals will branch off from the main canal to supply irrigation water to the fields. Pump stations, distribution chambers and elevated reservoirs will be built to ensure an adequate water supply for irrigation (also see Chapter 5.2).

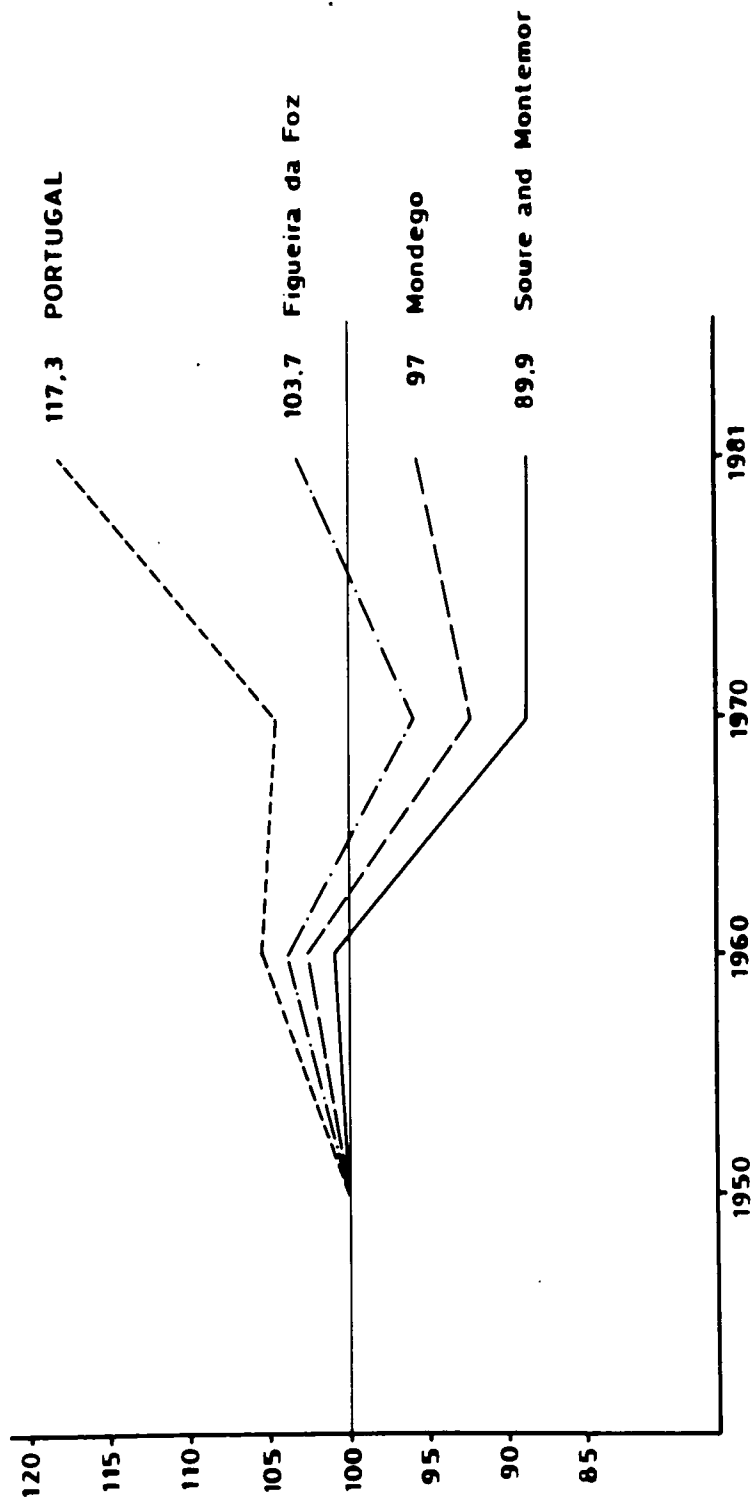
Clearly in the Mondego valley there are considerable possibilities for agricultural production and there are no important natural resource deficiencies. What is equally important therefore is that the human resource inputs match the potential of the physical resources. These aspects will be considered generally in Chapter 3.

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Fig. 3.1 -SELECTED POPULATION TRENDS, 1950-1981 (BASE 1950 = 100)

Source : X, XI e XII - Recenseamentos Gerais da População- I.N.E., 1960,1970 e 1981



Chapter 3

HUMAN POTENTIAL

1. Introduction

The total population of the Mondego valley region in 1981 was estimated at 107,731 inhabitants.¹ As can be seen in Fig. 3.1 there has been a heavy influx of people into the area since the mid-seventies, this following an earlier decrease in numbers. Three factors were involved:²

- Emigration between 1950 and 1975 for economic reasons.
- The return of soldiers after the war in the colonies.
- The return of Portuguese colonists from the colonies after their independence.

2. Population Structure

Sex ratio statistics are not available for the farming sector but it can be said that women play an important role in much of the valley, especially in the subsistence units, where they are responsible for most of the work.

More data exists on the age structure of farmers (Table 3.2). Most of the farmers (61%) are more than 50 years old, the value of those between 36 and 41 years being just under 31%.³ A worrying factor

Table 3.1 - Age Structure of the Population (1970)

	0-14	%	15-34	%	35-64	%	+65	%	TOTAL
Figueira									
da Foz	13,080	24	14,540	27	20,110	38	5,795	11	53,525
Montamor-									
o-Velho	6,190	23	7,125	27	9,605	36	3,190	14	26,410
Soure	1,660	22	5,825	26	8,600	39	2,910	13	22,025
Condeixa-									
a-Nova	2,705	21	3,420	27	4,745	37	1,995	15	12,865
Coimbra	27,260	25	32,560	30	38,475	35	10,865	10	109,160

Source : A Regiao Centro (Comissao de Coordenacao da
Regiao Centro, 1981), p. 428

Table 3.2 - Age of Farmers (%)

AGE	18-24	25-35	36-49	50-65	>66	TOTAL
FARMERS (%)	0,7	7,9	30,6	45	15,8	106

Source : Estructura actual das Exploracoes Agricolas
(Projecto do Mondego, 1981), p. 38

for the future is the very low percentage of farmers younger than 35. In so far as this represents a repulsion of young people by agriculture and if this were to be maintained, the tendency would be for agriculture to be left more and more to a residual old population, the least likely to take productive advantage of the new technical and commercial opportunities.

3. Education

Most farmers (74.5%) are able to read and write and have at least attended primary school. The illiteracy rate is on average 21.3% and applies mostly to farmers in the 50-plus age group. Only a small minority (4.2%) has more than a primary school education. An even smaller minority (2.3%) at the other end of the training scale with higher education qualifications (University or equivalent) is found among the farmers in the valley.⁴

In general, therefore, Mondego farmers have acquired almost all of their farming knowledge from local traditions passed on through the communities and families. Until recently hardly any of them were trained in the use of those more modern techniques and machinery which they have "picked up" in recent years.

4. Health and Health Services

The most serious problem that affects the health of people in the region are the lack of basic structures and an inefficient hospital and sanitary service, but unfortunately there are no health or medical data available even for the provincial level. In the

distribution of the hospitals and of medical equipment, subregional variation is noticeable. There is a concentration of doctors and facilities in Coimbra, whereas other centres are relatively deprived. Thus, deficiencies are not in terms of total quantity or quality, but of distribution. The predominant countryside with almost one-third of the region's population is perceived to be worst off. This is partly an inevitable result of the need for and the logicity of locating the most sophisticated health services, e.g. specialist hospitals, in the largest centres of population, i.e. the towns.

The context of such regional disparities is considered later under the general heading of rural development in Chapter 7.

5. The Farmers

In a region such as the Mondego Valley, for development planning it is clearly necessary to distinguish between the basic farming population and the larger rural population. At the beginning of the Mondego project a farming typology was established in order to create a base on which to plan.

Who and what are the farmers?

The term is used throughout this thesis as synonymous with the working occupiers of registered landholdings, whatever the tenure may be. The form of tenure together with the working characteristics of the farmer provide the basis for the following typology the interpretation of which is further based on personal sample survey and interviewing (see also Table 4.1).

A. Subsistence - This type is not literally subsistence farming in that there is usually some production for off-farm sale, but has subsistence type characteristics in that landholdings are small to very small⁵ - 1 to 3 ha in size - and are most cultivated by owner-occupiers consisting of aged farmers and wives and, occasionally a daughter or son. Incomes are very low, production potential is very low and consumption is met as far as possible from own production. Holdings are usually fragmented into several plots and farming techniques are primitive.

B. Familial - The dominant characteristic here is social in that a whole family including two or three generations will carry out all the operations on a holding which, typically, will be between 4 and 10 ha.⁶ This holding will consist of several non-contiguous plots, balanced between campo and monte land to take advantage of the associated different production potentials.

From personal experience it is known that most land in these holdings is owned by members of the family but additional plots are also rented. The crop range is standard for the particular district but most products are grown for sale. Techniques are more advanced than in A, and there is more use made of machinery which is generally owned by the farmer.

C. Part-time - These are holdings, usually rented, generally held by young men (20-40 years old) who are employed full-time in non-farming jobs generally in towns but also elsewhere. The holdings vary greatly in size from 1 to 15-20 ha,⁷ the work being generally carried out by the tenant without hired labour but with

the proportionately heavy use of machinery and advanced techniques. This latter situation is especially associated with a commercial profit making attitude which goes with relatively low wage and salary levels in e.g. industry, government employment, trade, etc. Some part-time farmers will grow a few crops for home consumption but the main incentive in this type arises from the fact that a typical 30 year old urban employee receiving wages of 30,000-40,000 escudos a month (approx. £150) can, for example, double his income by the sale of rice from 2 ha. Rented land may cost no more than 25,000 to 30,000 escudos a year.

D. Patronal - The "patron" is the landowner who operates his own farming enterprise with the assistance of some hired labour and a relatively heavy investment in machinery, equipment and technology. Farm sizes can range from as little as 3 ha to 40 ha,⁸ varying with crop specialization and intensity of production systems. Production here is totally geared to the market. This type represents the only commercially viable, profitable system of farming.

6. Farm Incomes

The incomes of the different farming types vary compared with the farming model of Mondego Valley, whose characteristics were adjusted according to the basic farm enquiry carried out at the beginning of the project. The development project even at this stage, however, has raised incomes in all farm types (and see Chapter 7).

Table 3.3 - Farm Income Evolution Goals

(Before Project = 100)

Situation	Farming type			
	Familial	Part-time	Subsistence	Patronal
Advanced situation				
without Project	120	130	100	180
With Project				
(1986/87)	600	520	300	390

Source : After Estudo dos Impactos Sociais
do Projecto do Mondego, 1980, p. 39.

7. Employment⁹

The situation of employment in the agricultural sector before the execution of the project, was influenced by several factors:

- Small farm size
- Losses caused by floods
- Low investment
- Insufficient income

The project has improved significantly that situation by:

- Creation of new jobs and the raising of demand for workers.
- Increasing of salaries.

The "familial" and "part-time" farms have benefited most from the change. The increase of the income of the farmers and the needs created by the project will continue to lead to an increase of employment in the non-agricultural sector in the local centres.

8. General Attitudes Towards the Project¹⁰

The attitude of the farmers towards the present agricultural situation is important regarding the solution of the existing problems. It is also necessary to be aware of their attitude in order to assess their acceptance of the project.

An inquiry was made to collect the necessary information to assess the acceptance of the project by the farmers. The change in the

agrarian structure, land reallocation, introduction of new crops, intensification of cattle keeping, cooperative movement, awareness of the aims of the project and improvement of irrigation conditions were the subjects on which the farmers were asked to give their opinion.

The introduction of new cropping systems is regarded favourably by 60% of the farmers, this including crops for which markets are already available.

Since irrigation is generally now regarded as inadequate, the majority of the farmers (86%) agree with the improvement of the situation regarding the irrigation system, supply method and water quality.

For optimal use of irrigation water and application of new technologies, a new layout of land in production is necessary. This is understood by the majority of the farmers (79% of the total) that agree with land reallocation in Mondego Valley.

The idea of cooperatives is however not well accepted and it will be necessary to promote its development by creating favourable conditions (see Chapter 8).

Whilst the human, social and economic factors involved in the Mondego project plan indicate a generally low base level from which progress has to be made, there can also be identified some relatively favourable factors. First, it is clear that some farmers have already seized on market opportunities and the possibilities

for higher productivity with enthusiasm. Up to the limits imposed by holding size and fragmentation, a significant amount of technical progress is already being made. Secondly, the attitudes expressed suggest that objection to further change is not likely to be a major constraint (except possibly for the rice mono-culturalists in the lowest part of the valley). Lastly, mainly because of the widespread ownership of land, there are no obvious tenurial factors making for rural socio-political instability.

References

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7. Ibid., p. 14.
8. Ibid., p. 16.
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Chapter 4

THE ASSESSMENT OF THE PRESENT AND PLANS FOR THE FUTURE

1. Present Land Use: Traditional Methods

The level of agricultural production in the valley is, with the exception of some farms, very low. The use of good seeds and advanced technology has been limited (see Chapter 3.5).

The rate of agricultural development has been generally low in spite of the high physical potential.

A. Crops and general cropping patterns

The climate and soils of the project area are favourable for the cultivation of a wide range of crops. However, the actual number grown is fairly restricted, maize and rice being the prevailing crops in Mondego. The cultivation of maize is particularly associated with low productivity in agriculture. In fact, fertilizers are not used properly, and cropping techniques are primitive in most cases, where machinery is used only to prepare the land, resulting in average yields of less than 2,000 kgs per hectare, while the optimal yield for this environment ranges from 8,000 to 10,000 kgs per hectare.¹ The crop is usually grown together with beans, and a top fertilizer application of less than 30 kgs of nitrogen per hectare is usual. Hybrid seeds are used for a very low percentage of the total area of maize in the valley. These facts reflect in part the low technical level of the farmers.

Cultivation of rice is technically more advanced in general, although in some cases, primitive technology is still used. Animal traction (oxen), sowing and application of fertilizer by hand are common. Even so the average yields in the valley are low (3.5 - 4.0 tons per hectare)² compared with yields of 7 tons in the Tejo Valley, due to a combination of an unfavourable climate and poor crop husbandry. The temperature is the main limiting factor. Temperatures between 22 and 30°C are required for good growth at all stages and this explains in part the low yields obtained in the valley,³ since the average daily temperature during the growth period of rice is never higher than 22°C. The reasons for rice growing in this non-optimal region are partly a near-subsistence response to local demand, and the use of seasonally flooded land unsuitable for other crops (see also Chapter 6).

Potatoes are cultivated for home consumption, mainly in the "monte", when water is available.

In winter the main crop is grass cut to feed green to livestock. The bad natural drainage is normally the limiting factor for the cultivation of winter crops. The cultivation of olive trees in the "monte" and in some parts of the valley is not considered commercially profitable because of increasingly adverse economic conditions, such as high labour costs, low yielding varieties and low technology.

Poplars for the match industry are planted in some areas between Montemor-o-Velho and Coimbra (also see Chapter 7.2).

Table 4.1 Cropping Systems and Types of Farming (%)

Farming Type	CROPPING SYSTEMS								Total
	Rice	Maize/Beans Grass or others	Garden	Winter Cer- eals. Forage or fallow	Vineyard	Uncultiv- ated	Others		
Subsistence	32.7	46.1	3.5	2.5	6.5	4.2	4.5	100	
Familial	77.3	16.1	0.9	1.9	1.1	1.4	1.3	100	
Part-time	53.1	32.8	1.7	4.0	3.7	2.5	2.2	100	
Patronal	85.6	4.7	0.0	5.8	1.3	1.5	1.1	100	
Partnership (or society)?	93.6	2.9	2.4	0.0	0.0	0.0	1.1	100	

Source : "Estructura Actual Das Exploracoes Agricolas (Projecto do Mondego, 1981), p.30.

For all crops in general, because cultivation methods and practices are of a low standard, yields are rather low. The main reasons among others are water lodging and salinity problems. Table 4.1 shows the main cropping patterns for different types of farming systems.

B. Mechanization

This has not proceeded far in the Mondego Valley and, as is illustrated by Table 4.2, the degree to which machines are used is closely associated with farm size (see also Chapter 4.2). The type of husbandry practiced, actual and potential, is obviously also important and is considered below.

C. Irrigation

Irrigation has been practiced in the Mondego for many years. Rice and the mixture of maize/beans are the most important irrigated crops.

Traditionally the fields are supplied by shallow wells or, bordering the Mondego river, by earth canals. Several systems of irrigation are used: flooding for rice, furrow irrigation for maize and basin irrigation for vegetables. Sprinkler irrigation is only used by a few farmers mainly for vegetables and maize.

In part of the valley, near the coast where the influence of the tides is noticeable, water quality can be affected by salinity. In

Table 4.2
Use of Machinery*(1981)

Type	Number of Machines														
	F. Foz			Montemor			Soure			Condeixa			Coimbra		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Fuelled engines	16	1080	1086	93	2845	2936	36	985	1021	5	765	770	21	1955	1976
Electric motors	7	580	587	21	275	296	22	65	87	4	20	24	13	390	403
Tractors	12	30	42	33	175	208	10	10	20	2	22	22	5	70	75
Motocultivators	1	-	1	2	20	22	3	-	3	1	5	6	2	-	2
Threshing machine (simple) (maize)	5	70	75	10	40	50	3	15	18	-	10	10	-	15	15
"	1	40	41	9	210	219	3	15	18	2	30	32	1	25	26
Harvesters (combine)	5	10	15	10	20	30	-	-	-	1	-	1	-	-	-
Hay baling machines	1	50	51	3	5	8	3	5	8	-	5	5	-	-	-
Milking machines	-	-	-	-	-	-	2	-	2	-	-	-	1	-	1

1. Used in farms with more than 20 ha.

2. " " less than 20 ha.

3. Total

Source: A Regiao Centro, Caracterizacao e Perspectivas de Desenvolvimento, 1981, p.483

* including "Monte"

the Pranto valley the fields are protected from water by a system of sluice gates. The tidal effect is used to lift good quality water into the canal system.

D. Crop production and husbandry⁴

Under the conditions (of varying irrigation water availability, periodic flooding and a reliance on natural drainage) which occurred before the present project was commenced, most crops were (and are) grown in the summer, and much of the land left fallow during winter.

Rice is cultivated in about 63% of the total area of the valley and in 23% a maize/beans mixture is grown. Besides these, potatoes, vegetables and fruits are produced on a small scale, in most cases only for home consumption. For rice a rice-fallow-rice alternate year sequence is generally used. Maize is grown every year in the same fields, either alone or together with beans. The land is left fallow in winter or, when natural drainage exists, the rotation maize-grass-maize is used.

In the "monte", pine or eucalyptus trees cover most of the area. In winter grass or cereals are grown where soil drainage is good, otherwise the land is left fallow.

Straw, rice and maize stubble, cultivated grass or natural pasture grown on the river banks or elsewhere are used to feed the livestock. Vines, olives and various fruit trees are grown for family consumption.

Winter crops are cultivated from the end of October till the end of April and summer crops from May till October.

As already mentioned, cultivation methods are of a low standard. All agricultural inputs are available, such as certified seeds, fertilizers and plant protection chemicals, but most farmers do not yet make a balanced use of these factors.

E. Animal production⁵

At present fodder production is not well developed, animals are fed on concentrates, cereal straw and forage from the "monte". In winter, sheep and cows graze on fallows. In Table 4.3, the estimated number of livestock in the whole valley is shown.

Milk production on a relatively large scale started with the introduction of Friesian cattle around 1976. However, only a few farmers have more than 20 cows and most of them only have 1 or 2. In the valley in 1983 it was estimated that there were about 4,000 milk cattle, 7,700 meat cattle and 9,240 working cattle; the latter are used for soil preparation, transport and other field work. The cows' milk yield is approximately 3,500 l/year and milking is done mechanically in collective milking parlours.

The future of dairy farmers in the lower Mondego valley looks promising considering the present low level of consumption milk per capita in Portugal. As consumption rises (and present trends are favourable), the present production will not be able to cover the demand, therefore investment in milk production can still be

Table 4.3 - Estimated Number of Livestock in the Mondego

Project Area

(1980)

PRODUCTION					WORK	
CATTLE		SHEEP	GOATS	PIGS	CATTLE	OTHERS
MILK	MEAT					
4100	2800	3900	2000	5800	4100	2400

Source : "Estructura Actual des Exploracoes Agricolas,
Project do Mondego, 1981 - p. 32.

recommended. Mondego farmers are technically able to survive in a more competitive market.

Cattle of the local race "Mirandes", are normally used for working. These animals are fed on maize and rice straw, freshly cut forage and some concentrates in winter. Meat cattle in the Mondego are cross-breeds of local types with either "Charolais" or "Friesian" stock and rarely pure breeds. The animals are kept in stables and are fed the same as working cattle, but with more concentrates added to their rations.

Sheep are kept in flocks of about 100 head. Many small farmers have 1 or 2 sheep which graze on the stubble after the cattle. The most common race is "Bordaleira", either for milk or meat production. They graze on rice stubble, fallow and pasture. Only when the weather is bad, are they kept inside. In addition to sheep milk and meat, wool is sold in the local markets.

Lamb production is the animal production system which presently is facing the least marketing difficulties. There is no acknowledged surplus in the EEC and this factor helps to increase sheep production. Most farmers are not aware of the real situation in which at present, prices are low and unsteady due to the apparent impact of New Zealand lamb on the European market, and the changing balances of support for different products within the CAP.

Stock feeding, as indeed the entire keeping, is not according to the needs of the animals, but rather based on the educational and

traditional experience level of the farmers. Thus, many mistakes are made which could be corrected through the extension service and professional education.

2. Land Holdings, Marketing and Economics

A. A study of land holding structure carried out in 1980-1981 showed that within the total area of the valley (14,610 hectares) there were then some 7,600 farms and 13,000 land owners. The average farm size was 3.5 hectares with an average area of 1.6 hectares in the "campo" and 1.9 hectares in the "monte".⁶

The number of farmers and consequently the number of persons engaged in agriculture is high, considering the low average net incomes in traditional agriculture. Unemployment in the area cannot be solved by the provision of more farm work within the agricultural sector alone.

In this region of Portugal it is generally agreed that the land redistribution process required is that of consolidating small holdings into larger units. This process started in 1965, was interrupted in 1974 and started again in 1979 with the Mondego project team. S. Martinho is the only block where land reallocation has been completed.⁷

A study of the distribution of farms according to size was carried out in 1980-1981, and of the degree of fragmentation of holdings into separate plots and the situation then is shown in Table 4.4.

Table 4.4 - Farm Size and Plot Distribution in
the Mondego Valley

AREA (in Campo only)	NR. OF FARMS (%)	% OF TOTAL CAMPO AREA
<1 Ha	61	16
1-5 Ha	33	43
5-20 Ha	5	29
>20 Ha	1	12

PLOT DISTRIBUTION (in the Campo only)

Number of PLOTS	% of Farm FARMS
1	25
2-3	38
4-9	32
>10	5

Reff. - Feasibility Study, Mondego, 1983.

Source : Feasibility Study, Mondego, 1983, p. 44.

Increasingly larger units of land are expected to appear in the long run, as small farmers give up farming and their farm lands contribute to an increase in the number of viable medium (of about 30 hectares) and large (over 50 hectares) sized farms. As noted in Chapter 5, the reallocation of land for several reasons is an integral part of the project plan.

B. Markets⁸

The entrance of Portugal into the EEC alters significantly the existing conditions for production and commercialization of agricultural products, on a scale which is not predictable yet, and falls outside the time-scale of this thesis. For this reason, future planning and the selection of products is made more difficult.

Because of increases in production, farmers will be confronted with a number of marketing problems. Thus, the creation of additional markets will be an important factor for the regional development. A study on the market conditions for several conditions was carried out in 1985. This study includes the following products: rice and maize, milk and meat, vegetables and potatoes. The commercialization of the products was considered at a regional and national level, and for export. For the vegetable and the milk sector, marketing facilities were regarded as poor. At present, the commercialization of most products now grown does not create major problems since demand is high at a national level. However, this situation will change as Portugal comes into line with E.E.C. policy during its transitional period.

Since the Mondego valley has a high potential for forage production and because of the large quantities of milk produced and the closeness of the region to consumer centres, the project area is a very competitive area for milk production, compared to other regions. In spite of the opening of the Portuguese borders to dairy products from the common market and the consequent competition, milk production is recommended for Mondego Valley.

C. Agricultural Economic Modelling⁹

The various reviews and surveys carried out both before and as part of the Mondego project planning have enabled the categorization of the pre-project agricultural situation into various classes of cultivation system and type. Whilst it is clear that so-called traditional farming was not wholly static or unchanging, nevertheless some characteristics of the base level from which it is planned to raise agricultural wealth have been identified. Thus main farming types were defined for the valley as a whole as four in number: subsistence, part-time, familial and patronal (see Ch. 3.5).

At the same time the valley region was perceived to consist of three main zones of actual and potential cultivation, based on the type of irrigation system and the physical resource base. The upstream zone is regarded as most suitable for sprinkler irrigation, the central zone for improved gravity irrigation with artificial drainage and the downstream zone for slightly modified flood irrigation. In the three zones, the actual (without project) and future situation (with project) were compared, and the activities recommended for each model of farming type were selected according to the needs of the

regional and national market, balanced farming activities and soil fertility. This work was carried out mainly in 1984. The farm model proposed for the upstream zone indicated a significant improvement in product value compared to the actual situation in which rice was in 1984 the prevailing crop (58.5% by area) followed by maize (25.1%). The improvement is based on the introduction of sprinkler irrigation and artificial drainage enabling the production of higher value crops.

In the central zone the main input change is the provision of a controlled gravity distribution system based on the main longitudinal canal and the installation of an integrated drainage system. This implies in particular a change from the present dominance of rice cultivation (77.8% by area). Along with changes in cultivation, including maize and beans, feeds and fodders, it is also proposed to encourage milk and meat production. The models proposed show the feasibility of significantly raising net farming income.

The cropping system most representative of the downstream zone is rice in monoculture (95.4%), and for the future the continuation of rice cultivation is technically recommended chiefly due to soil characteristics. Here, the increase in farmer's income is not significant in the future models since the general condition for cultivation and the cropping system will remain the same.

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Chapter 5

THE PROJECT : TECHNICAL ASPECTS OF PRODUCTION

The last section of Chapter 4 summarily considered the main sectoral elements in the Mondego project development plan and the need for an integrated approach to these elements. In Chapters 5 to 9 inclusive the various project sectors are considered in more detail, commencing with the general technical aspects.

1. Land reallocation

The process of consolidation of Mondego farm holdings is one of the key factors for the development of existing farm structures and for the improvement of agriculture in the valley, but is one in which success is not yet assured.

As noted in Chapter 4.1.B. and 4.2.A. farm sizes are on average very small, and are further fragmented into non-contiguous plots. These small fragmented farms do not allow, economically, the mechanization of or any other modern technical improvements in irrigation, cultivation or livestock farming. However, although consolidation both of plots and of farms is necessary, progress is slow.

Until 1983¹ the land consolidation team of the Mondego project had only reached the preliminary planning stage because of the undetermined canal and road network situation for all blocks of the valley. The complete network had still not yet been constructed by

the end of 1987. More serious are the inherent legal and other complexities involved in dealing with some 9,300 landowners, 7,600 farmers and approximately 35,000 plots of land.²

An area of about 2,000 hectares was programmed to be consolidated each year,³ after a period of training of the technical team in charge. Many obstacles were expected and the IGEF had prepared a law to overcome these difficulties. The situation however remains that by 1987 only the S. Martinho block of land had been reallocated. This problem of small fragmented farms is not unique to Portugal. FAO reports on land reform since the early 1960's contain studies of the need for and the difficulties of consolidating such land units, e.g. "Land Settlement and Cooperatives, 1969". There is no simple answer. Compulsion is now socially, economically and politically unacceptable and the detailed negotiations needed in practice, even when a majority of farmers approve of the principle of reallocation (see Chp. 3.8) are complex, slow and numerous. The importance of this part of the programme must however be stressed and it must not be neglected; adequate farm incomes cannot be assured nor can the benefits of other technical improvements be gained without a successful consolidation programme.

2. Irrigation and drainage

Improved irrigation and drainage installations and facilities are the most critical technical engineering requirements for the development of agriculture in the valley.

In 1981 a detailed study on the water requirements of the main crops grown in the valley was carried out by the Mondego project team. These requirements, based on evapotranspiration rates, were identified as shown in Table 2.3. The peak water requirement (mm/day) and the volume of water (m³/ha) per year for normal growth of different crops cultivated in the valley are shown in Table 5.1.

According to soil characteristics, topography, and ground water level and quality, different types of irrigation are proposed for the various valley zones (see Fig. 5.1).

For the lower part of the valley where rice is now grown, alternative crops can only be grown successfully provided drainage is possible. This part of the valley covers an area of about 4,500 hectares,⁴ from Montemor-o-Velho to Figueira da Foz and here minor but significant improvements to the existing system of flood irrigation of rice are the most appropriate. In the rest of the valley, central and upper parts, where natural drainage is reasonably good, other crops can be grown.

Plans therefore could include irrigation both by gravity and pressurised systems. In the first case both basin and furrow systems could be used.

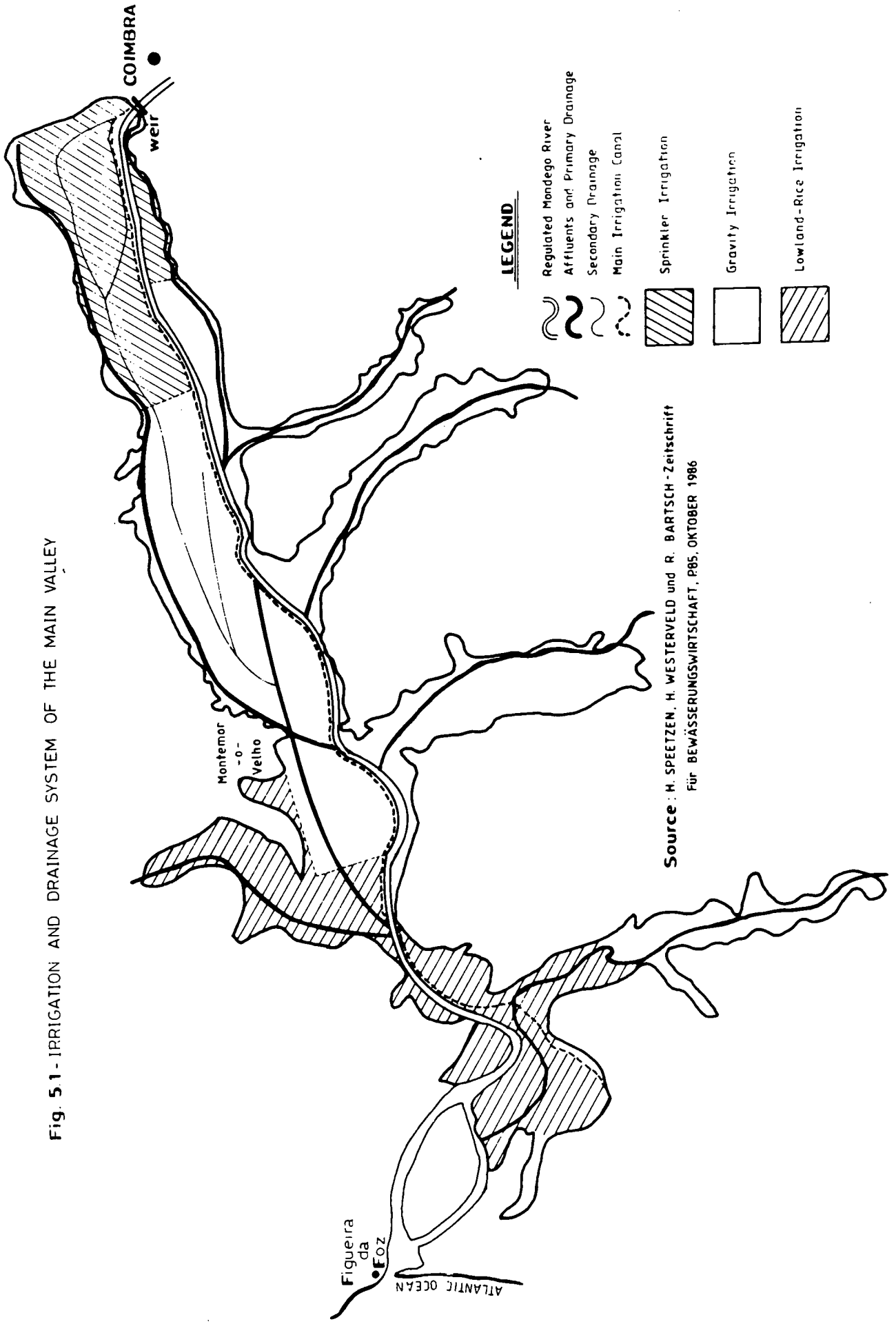
In the upper part of the valley (S. Martinho, S. Silvestre, Bola and Taveiro districts), in an area of about 2.150 hectares the soils are light and have high infiltration rates.⁵ Therefore overhead irrigation systems are recommended here, using sprinklers or rain-guns.

Table 5.1 - Peak Water Requirements (mm/day)
and Volume (m³/ha/year) of Water

	<u>mm/day</u>	<u>m³/ha/year</u>
<u>VEGETABLES</u>		
Green Beans	4.9	2835
Grain Beans	6	4658
Cauliflower	5.4	3253
Brussel Sprouts	5.4	3253
Paprika	5.4	5069
Melon	5.7	4280
Onion	5.7	5962
Green Onions	5.3	2366
Red Pepper	5.7	4901
Tomato	6.3	5812
Egg plant	5.7	5060
<u>FIELD CROPS</u>		
Sugar Beet	5.4	6293
Soya	6.0	5544
Sunflower	6.0	5204
Sorghum	6.0	5204
Maize	6.3	5862
Forage	5	4150
<u>FRUIT TREES</u>		
Vines	4.2	4350
Citrus	5.6	5510
Other fruits	6	5800

Source : Personal communications from research station
 "Quinta do Canal".

Fig. 51 - IRRIGATION AND DRAINAGE SYSTEM OF THE MAIN VALLEY



Source : H. SPEETZEN, H. WESTERVELD und R. BARTSCH -Zeitschrift
Für BEWÄSSERUNGSWIRTSCHAFT, P85, OKTOBER 1986

Based on studies made by Mondego project technicians, surface irrigation was found to be the most suitable for the central region's cultivated land (ca. 4.000 ha).⁶ It was affirmed that basin irrigation has some practical advantages when compared to a furrow irrigation system, since most of the farmers are already familiar with this system already used for rice cultivation. Basin irrigation is also easier to apply when land is divided into many small plots of land. Even though for some crops, mainly for those which are planted in rows, furrow irrigation is more suitable, graded land in sufficiently large units to be practicable may not be available at the moment.

Because it is proposed to utilise different main types of irrigation application, overhead pressurised as well as basin and furrow gravity systems, in various zones, an irrigation and drainage network has to be designed accordingly (see Fig. 5.1).

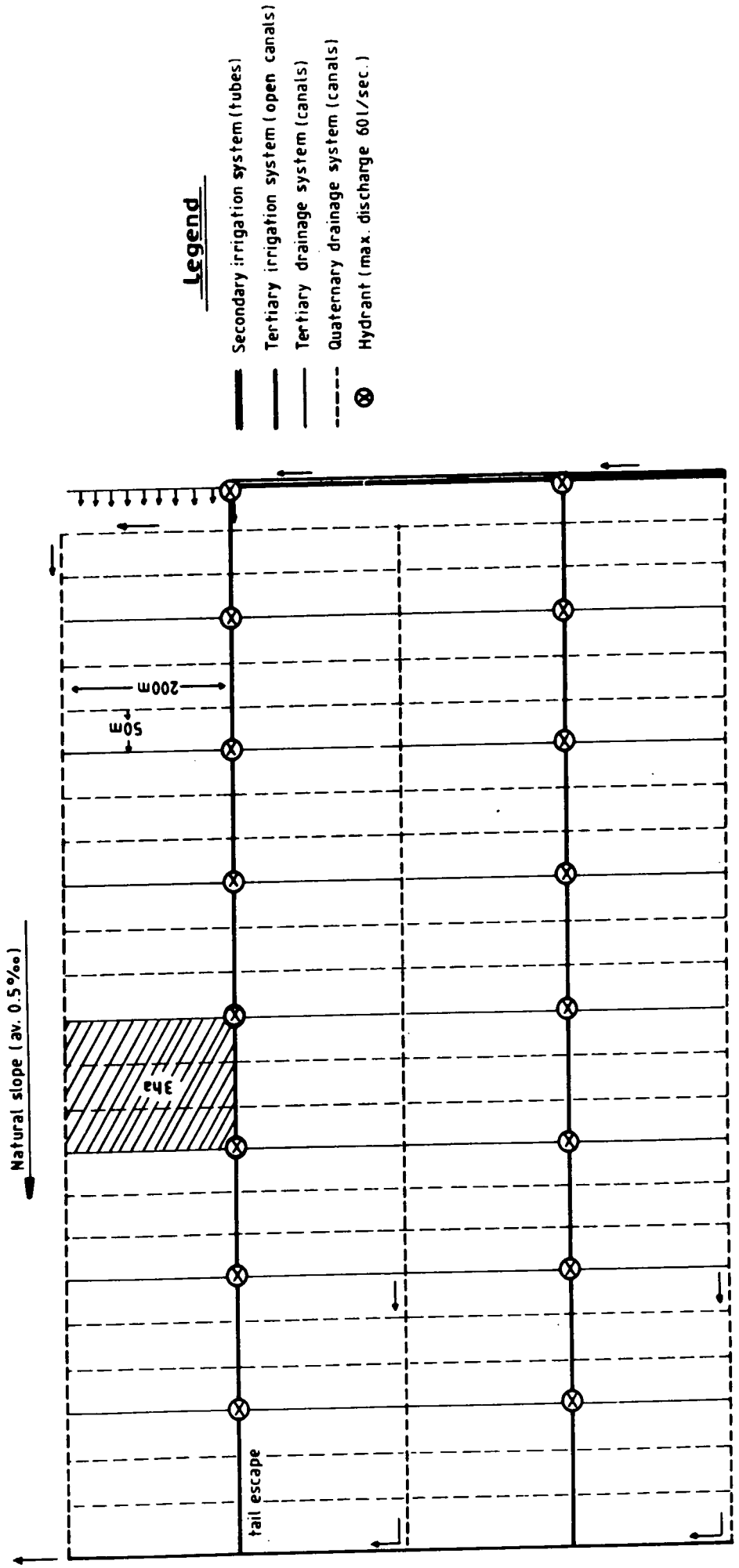
The irrigation network

In order to take full advantage of the head of water in the main canal, there will be a sub-surface tube system (secondary system) leading from the main canal to the tertiary system.

The tertiary distribution system for the use of gravity irrigation (basins and furrows) is composed of earth canals for distribution of water to the fields. Distribution boxes distribute water from the main tertiary canal into field ditches. The water for overhead irrigation can be pumped from the open primary canal and a pumping station will supply the whole system.

Fig. 5.2 - LAY-OUT OF TWO IRRIGATION/DRAINAGE UNITS (BASIN IRRIGATION)

Source: After Feasibility Study, Mondego Project, p. 81



For rice cultivation, irrigation will be based on an underground tube network with hydrants for units of 3 to 5 hectares each,⁷ the network fed from the main canal.

Drainage system

The natural slope of the valley (0.5%) running from East to West will be utilised in determining the alignment of drainage canals. The existing canals and river beds will also be used, whenever possible, to minimize costs.

From Ereira to Coimbra, in the area where rice is not cultivated, the removal of excess water from the "monte", will be assured by the "leito periferico direito" (see Chp. 1). In the upper part of the valley (Carapinheira, Tentugal e Pereira, S. Silvestre, S. Martinho e Bolao) the secondary drainage system will consist of the original river channel and other existing canals. The tertiary system is based on canals flowing from South-East to North-West into the secondary system.

The excess of irrigation water and surface water in winter will be drained by small canals at the end of each field unit (Fig. 5.2).

In some parts of the valley subsurface drainage will have to be applied due to the existing ground-water problems. The river-bed of the old Mondego river ("rio velho") will be lowered, in order to collect water from the drainage system of Alfarelos, Carapinheira, Tentugal, S. Silvestre, S. Martinho and Bolao.

3. Soil Conservation

Land degradation in the Mondego river basin has several causes, which can be for instance, erosion, sedimentation, salt accumulation and other results of improper soil management.

In order to assure the proper use of land, in spite of the potential threat of land degradation, the following in particular are needed

- Reafforestation of the wasteland area in the mountains upstream of Coimbra
- Particular attention paid to proper soil management and cultivation methods on the slopes of the valley, to prevent erosion and sedimentation
- Drainage of groundwater and the leaching of saline soils
- Correction and control of the pH of the soils

The measures which have to be taken are of various orders of magnitude and involve different agencies. Reafforestation for example would be a matter for an official Department whereas the lowering of acidity levels and detailed improvements in drainage would need action by the farmers under the supervision of extension workers.

4. Road network

Whenever possible, the existing roads will be maintained but the final road network must be compatible with the new irrigation and drainage system. The primary roads will be 5 and 3 m wide and the secondary ones 4 and 2 m wide, built not only to serve the maintenance of the drainage and irrigation but also as feeder roads to farms.

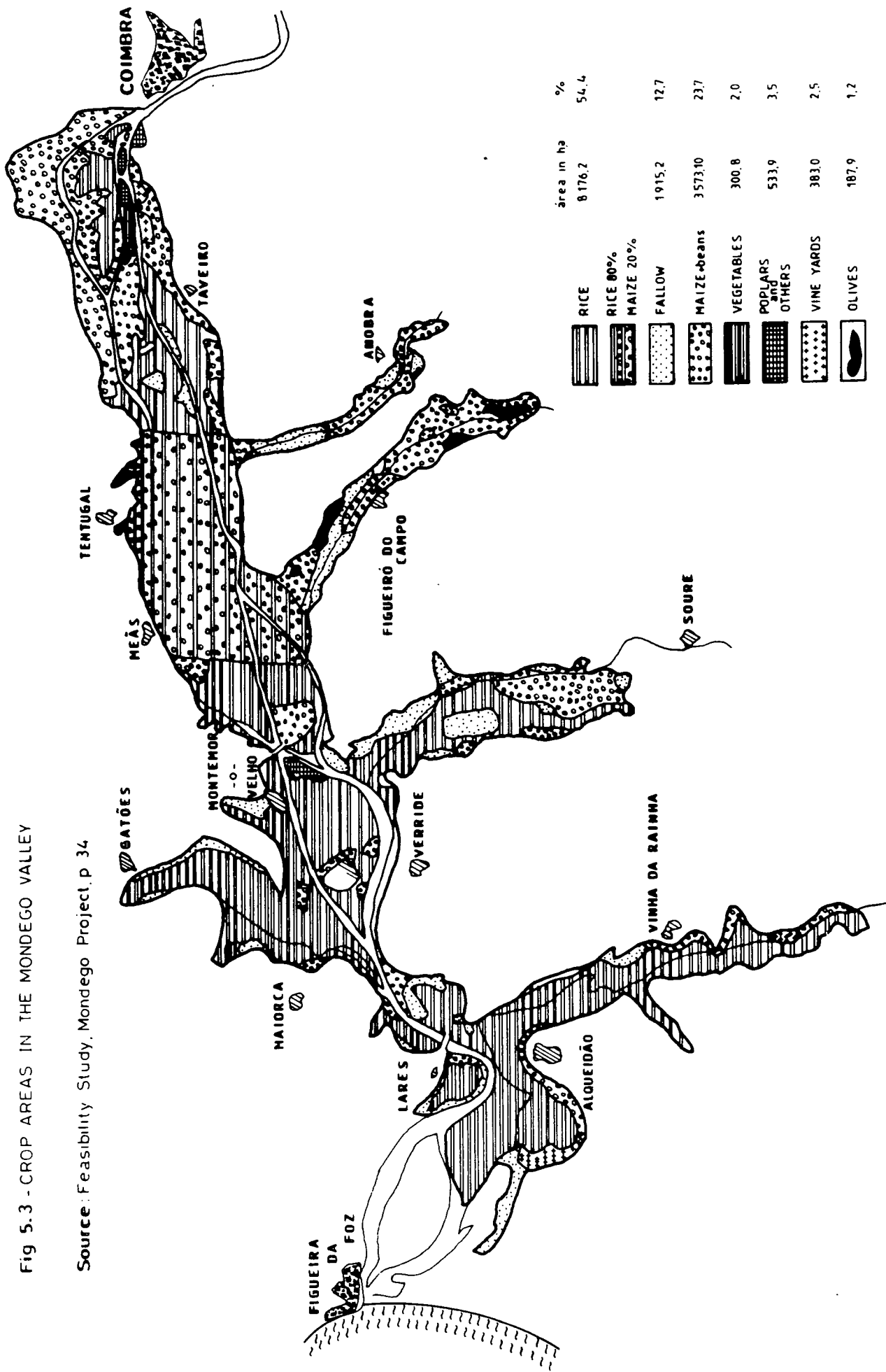
5. The research station of Quinta do Canal⁸

The Quinta do Canal research station was established in 1979 especially to provide basic data for the hydraulic and agricultural production studies of two types of soils - clay loam and salty compact soils.

The main objectives of work at the Quinta do Canal station were: the study of drainage, leaching of soils and experiments with winter and summer crops. However, due to the lack of assured supplies of good quality irrigation water during summer, field research on a significant scale was not possible until the summer of 1986. Because the data base is therefore limited, several variants of the programme were introduced with the aim of supplying information to help improve agriculture in the valley. Drainage and irrigation techniques, improvement of soil structure, cropping systems and rotations have been given preliminary evaluation.

Fig 5.3 - CROP AREAS IN THE MONDEGO VALLEY

Source: Feasibility Study, Mondego Project, p 34



A complete field meteorological station was installed to provide data for these studies. For adequate drainage of these types of soils the following research was undertaken:

- Distance between pipe drains : 9, 18, 27 and 36 m distances were investigated.
- Depth and the most suitable gradient for drains, i.e. depths of 0.9, 1.1, and 1.3 m and gradients of 1, 2 and 3 ‰.
- Tube diameters of 50 and 65 mm.
- Material for drain filters.
- Influence of subsoiling on drainage.
- The effect of the application of different quantities of lime and gypsum on leaching and drainage of the soils.

6. Agricultural production

As earlier stated, the climate and soils of the Mondego valley are favourable for the cultivation of many crops. However, the pre-project actuality was the predominance of rice, this because of:

- the occurrence of floods in Winter
- the lack of good quality water in Summer
- the high salinity level in some soils
- the poor natural drainage in most soils and the absence of artificial drainage.

Completion of the works for the regularization of the Mondego river and the projected irrigation and drainage systems will allow the introduction of new alternative and more profitable crops than rice and also the intensification of the land use.

6.1 Crops and cropping patterns (Fig. 5.3)

A key reason for the installation of the Bolao and Quinta do Canal research stations was the study of cropping systems adapted to the conditions in different parts of the project area. The results of crop trials were as follows in terms of crop selection:

A. Crop selection

Maize can be grown everywhere in the valley, provided the water quality is good and drainage exists.

Good soil preparation, the use of hybrid varieties, good plant protection (weed and pest control), the availability of good quality water and balanced fertilizers are the key factors for the achievement of high yields. Some farmers in the valley have already achieved yields of 10-12 tons of grain per hectare.⁹ The present low yield of 3.3 tons per hectare in the valley is mainly due to the low-yielding regional varieties, namely "regional white" and "regional yellow" together with the unbalanced and insufficient application of water and fertilizers.

In addition to grain production varieties of maize suitable for silage are grown successfully in the valley.

Rice

Due to the high soil infiltration rates of the lighter soils existing in the upper part of the valley and the low yields obtainable, the cultivation of rice is not recommended for this area. Five varieties are now used by the farmers : Ribe, Bogar, Aricombo, Ponta Rubra and Allorio. The average yield is about 3.5 tons per hectare.¹⁰ The reasons for the low yields are the low fertilizer application and the generally low temperatures during the growth period of the crop. Due to the unfavourable climatic conditions, yields over 5 tons per hectare are difficult to obtain.

By using the most suitable varieties in combination with an effective weed control, balanced application of fertilizers and a good control of the water supply, higher yields can be reached in suitable areas.

Wheat

Wheat is not usually sown now by farmers, but based on the results obtained in the Quinta do Canal research stations and in other locations in the valley, where yields of 5 tons per hectare were obtained, wheat will be recommended as a possible Winter crop for all soils of the valley, provided drainage is possible.

The bread type varieties Xevora, Mexicano and Anza were tested and Anza proved to be the highest yielding under local conditions.

Forage

Forage production can be very successful as proved by the results obtained in Quinta do Canal. Many grasses and clovers are appropriate for conditions in the region. A mixture of Persian clover with *Lolium multiflorum* or *Trifolium alexandrinum* (Berseem) with *Lolium multiflorum* achieved the best results. The production of the first 3 cuts was sold as green fodder and the last cut was for dry hay, illustrating the possibilities.

Vegetables and Horticulture

Based on the climatic and soil conditions of the project area and also on the experience of some farmers, a great number of vegetables can be grown in the valley, e.g., tomatoes, sweet corn, peas, cabbages, onions, cauliflower, brussel sprouts, asparagus and carrots. In Bolao, near Coimbra, vegetables are grown in green houses and outside with good results. However, present inadequacies in transportation, packing, grading and all other aspects of marketing hinder the exploitation of the large potential consumer market.

In addition to the crops mentioned above, others can be grown, such as sunflower, sugar and fodder beet, beans, sorghum, rape and cereals. The production of flowers also has good prospects either for the local market or for export, but faces the same difficulties (see also Chp. 6). However the use of the appropriate inputs for each and every crop and the application of suitable technologies are essential to reach good yields of marketable produces. Fruit trees

are programmed to be planted particularly in the upper valley, near Coimbra. The use of advanced irrigation systems, such as drip irrigation and sprinklers, guarantees an increase in almost every field of production of about 15%, as proved by the experience of same farmers. At present, grapes are grown in some parts of the valley, but in future will be grown only in the "monte" where soil and climatic conditions are more appropriate for the crop.

The cultivation of olive trees is decreasing rapidly due to the low yields obtained, mainly because of the low technological level and bad maintenance of the crop. Farmers believe that the reason for that is the polluted air coming from the paper industries of Celbi and Soporcel.

About 200 hectares of land have been planted with poplars to supply timber for the match industry.

B. Field trials and yields

In the Quinta do Canal research station and in other fields established in the valley, the yield capacity of several crops has been tested in order to answer questions asked by farmers concerning the most profitable way of using their land.

Maize, sorghum, sunflower, beet, lolium, clover, rape, vetch, cabbage, rice and wheat were planted in the first two years (1979/1980) to test the suitability of these crops under existing conditions. The results obtained were very promising (see Table 5.2).

Table 5.2 - Research Station of Q. Do CanalAverage Yield (tonnes/Ha)

<u>CROP</u>	<u>YIELD</u>	<u>OBS.</u>
Wheat	4	
Rice	43	
Lolium + Clover	106	
Lolium + Berseem	100	4 cuts
Lolium	100	3 cuts
Oats + Peas	60	
Oats + Vetch	60	
Oats	60	
Peas	60	
Vetch	40	
Fodder Beans	50	
Sorghum (Fodder)	73	
Rape	70	
Beet (Fodder)	96	
Beans	08	
Sunflower	2	
Maize	8	
Berseem	70	3 cuts
Clover (red)	45	2 cuts
Cabbage	20	

The yields recorded for Maize and Sunflower are low due to insufficient application of nitrogen.

C. Experimental Projects¹¹

The formulation of the most appropriate intensive cropping systems of the irrigated land of the Mondego valley and the recommended technologies to be used, will finally be based on experimental work obtained from three different trial areas established at Quinta do Canal, Quinta de Foja and Taveiro. This programme is scheduled to continue up to 1990 and is supervised by the National Institute for Agricultural Research (INIA). It comprises 5 projects, with the following activities:

Project I

Intensive cultivation in the lower Mondego valley; this project started in 1984 with two plots in Taveiro and Quinta do Canal.

Experiments:

- 1 - Intensive cropping systems
Crops: Maize (grain and fodder); sugar beet; beans; green pepper and others.
- 2 - Varieties of sugar beet.
- 3 - Varieties of maize (Fao 400) with and without CaCO_3 .
- 4 - Varieties of maize (Fao 400-600).
- 5 - Maize: Fertilization and pH correction.
- 6 - Sorghum: Fertilization and pH correction.
- 7 - Varieties of pea-nuts.
- 8 - Green pepper fertilizer use.
- 9 - Soil preparation methods.

- 10 - Cropping systems adaptable to intensive sub-superficial drainage (Q. Canal).

Project II

This project is carried out at the research station of Quinta do Canal.

Experiments:

- 1 - Cropping systems adapted to surface drainage:
- Rice (Monoculture)
 - Rice + clover + lolium
 - Rotation pasture (4 years) - rice + lolium (3 years) with minimum tillage
 - Permanent pasture
- 2 - Crop systems adapted to sub-surface drainage:
- Lolium + maize - wheat + fodder - maize - lolium + sugar beet
 - Alfalfa (4 years), followed by the previous rotation starting with maize.

Project III

Production of seed of new varieties of rice adapted to Mondego valley condition - Quinta do Canal.

Project IV

Plant protection:

Experiments:

- 1 - Weed control in rice-cultivation
- 2 - Control of "piricularis" of rice
- 3 - Control of rodents
- 4 - Evolution of population of nematodes in soil under intensive cropping systems.

Project V

Crop fertiliser experiments:

- 1 - Study of soil fertility of Mondego soils
- 2 - Fertilizer use of different crops
- 3 - Soil fertility under different cropping systems
- 4 - Use of soil nutrients by different cropping systems
- 5 - Technology of fertilizer application for different crops.

D. Husbandry

In most cases cultivation husbandry is of a very low standard. Land preparation depends largely on animal traction and is in some cases inadequate and superficial. This is mainly due to the lack of machinery and other inputs, this partly because of the small farm

size. Other agricultural inputs such as good quality seeds are not available in some cases, but it is not always appreciated by the farmer how beneficial their use can be.

Soil cultivation and seeding

To identify suitable mechanization systems for new alternative crops and also to study new methods for soil improvement, trials have been carried out in the Quinta do Canal research station since 1979.

Seed-bed preparation is in some cases a limiting factor for production. Thus, care must be taken in this operation, especially for fine seeds. The existence of clods prevents the germination of seeds, and also promotes the appearance of harmful soil insects.

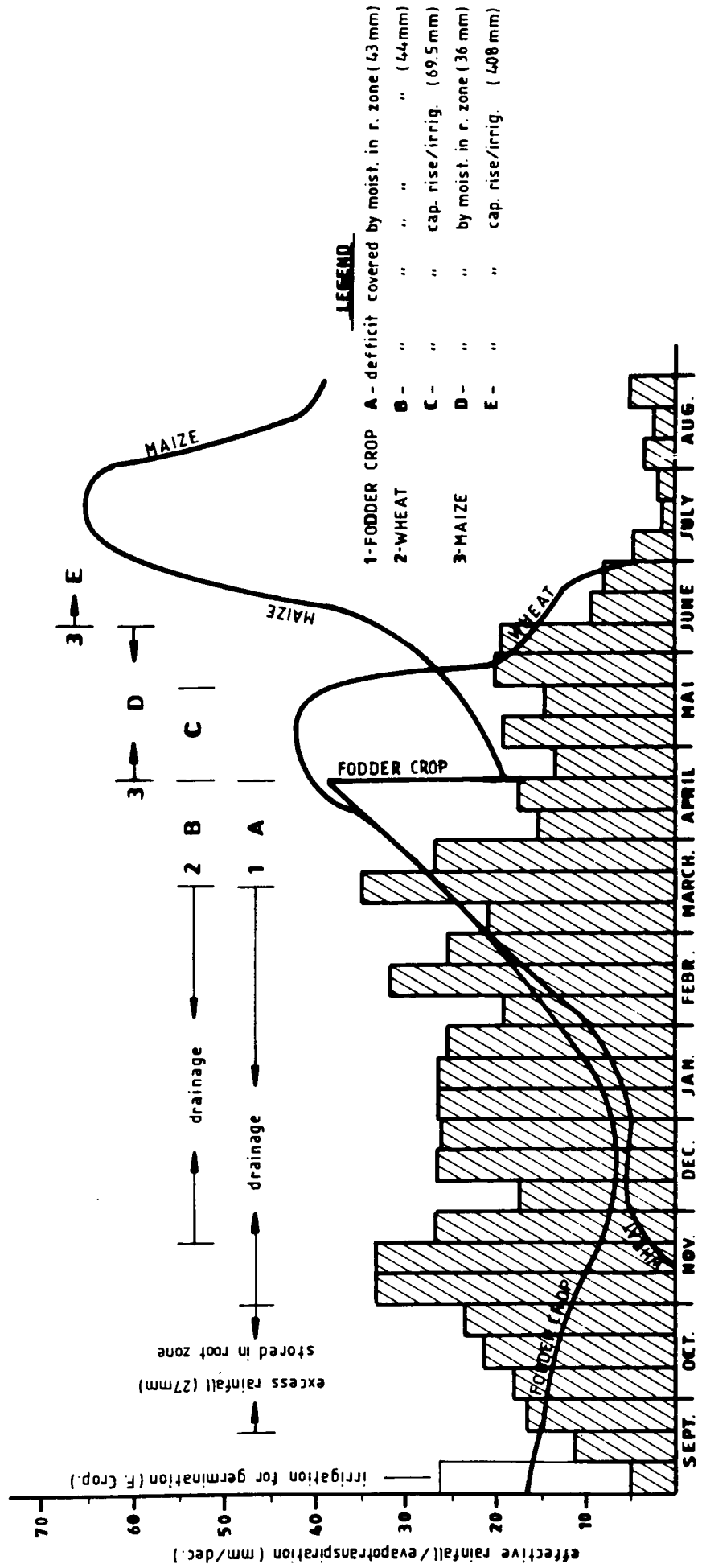
The use of machinery is unavoidable, and this is especially true for heavy soils, where the available period for proper soil preparation is short. Therefore it is crucial that sufficient machinery is available when required. However many farms in the project area are not large enough to justify investment in appropriate machinery for soil cultivation. The only practical solution to the problem is the use of the required tractors and implements by more than one production unit. The machines may be owned by one or several individuals, the state, cooperatives or machinery pools.

Land Maintenance; Weed control and plant protection

Pests and weeds are widespread in the area and control of both is very weak but is essential for carrying out any programme for agricultural improvement.

Fig 5.4-EVAPOTRANSPIRATION (F. CROP, WHEAT, MAIZE) ACC. TO PENMAN

Source : After Dr. H. SPEETZEN



Crop maintenance work is mostly done manually and the knowledge of the farmers is not adequate to meet requirements. More assistance and information must be supplied by the rural extension service.

E. Water demand and supply

Water for use in agriculture in the project area is available from:

Precipitation

Ground-water

The Mondego river and its afluent

The main irrigation canal

All these supplies are suitable for irrigation except for the lowest tidal section of the Mondego.

Crop water requirements¹²

Crop water requirements based on evapo-transpiration and calculated according to the Penman formula, were shown in Table 2.3. This data is still the basis for irrigation planning although there has not been sufficient experimental work carried out to confirm these results. Typical crop water budgets, in this case for wheat, maize and a fodder crop, are illustrated in Fig. 5.4.

A separate calculation was made for rice cultivation in 1982. It was found that the maximum water demand occurs between April 20 and April 30, with a demand of 3 l/s (for medium infiltration rates).

The average demand was found to occur between June 21 and July 4, with a demand of 1.3 l/s (for medium infiltration rate).

In aggregate, it is calculated that enough water can be obtained from all the available sources to supply adequate irrigation to the whole cultivated area. This has assisted the preliminary identification of crops suitable for different districts, but further research work is required.

7. Innovations and Plans for the Future: General Principles

The goal of the Mondego Project is to increase the productivity of agricultural land as well as that of the labour force, by providing adequate conditions in which such improvement can occur.

Agricultural development in the Project area depends largely on the existence of properly functioning service departments, such as research stations, the extension or advisory service, a credit system, marketing organizations, education, training facilities etc. The physical resource potential has to be harnessed in the first instance by the construction of certain physical installations; for example, the ensuring of the supply of sufficient water to the fields is an engineering task on which agricultural development depends. On the other hand, the effective value of water as a medium to produce crops and livestock depends on the technical skill and marketing capability of the farmer, and also on his financial resources. Both human and physical potential have to be realised in an integrated programme. For example, the new 36 km of main irrigation distribution canal makes it possible and necessary for

the long established individual extraction and distribution of water by farmers, costly and hydrologically inadequate as it is, to be replaced by the co-ordinated cooperation by associations of farmers. The creation of appropriate institutions and services which will assist the farmers through technical, financial and social assistance thus becomes an important factor for the successful agricultural development of the valley. These services will be available to give guidance and adequate support which will enable farmers to cope with their new tasks and seize new opportunities.

The form in which assistance will be offered to the farmers varies with the different requirements associated with differences in agrarian structure. At present, most farmers are used to traditional farming methods of low productivity. They will have to be trained in the use of the new irrigation system and more effective and intensive farming methods. There are still wider areas of change which will need assistance in adjustment. Before the construction of the new river control and irrigation and drainage structures, only seasonal rice cultivation was feasible as a commercial activity in the valley, which meant only 6 month of agricultural production per year. Already in some parts of the valley, and in the future, after the completion of the hydraulic structures in the entire valley, permanent year round agricultural production is possible. In terms of agricultural production this implies milk and meat production, and the growing of fodder crops, such as beet, grass, clover, barley, sorghum and maize will be the main crops. In terms of demands for labour, quantitatively and qualitatively, the implications are vast whilst at the same time changes are implied for seasonal and daily work and social regimes.

The role of rural extension services of many kinds will be important in a very large number of ways if the development response by local communities is to be successful.

High intensity production can be achieved with vegetables, fruit trees or any other crops by using high yielding varieties, with the application of the right amounts of fertilizers and skilful application of water and generally with the use of balanced crop rotations. For this, more than average farming skill is required. For farmers with low levels of education and technical understanding less intensive, fairly simple forms of farming should be chosen at the beginning of the process of modernisation. The technical extension service will be of particular importance in improving the farmers' ability first to go with and then to generate gradual changes in the types of farm enterprises.

The advisory service to farmers provided by the rural extension service, represents the medium through which farmers will become acquainted with the farming operations appropriate for the best utilization of the irrigated land.

The extension service agents will be responsible for on-farm teaching and, at special locations, the demonstration of new techniques, such as the practice of irrigation, proper preparation of the fields, selection of varieties and application of fertilizers and insecticides. Agricultural schools and special training courses also have to be organised to prepare farmers to achieve good results.

At the other end of the production linkage other institutions such as credit and marketing services have also to be adapted to the new situation. The creation of well functioning credit and marketing organisations must be guaranteed. Existing credit facilities for agriculture have either to be expanded or a special credit institution has to be established for the purpose.

The marketing problem must be given special care. Ignorance of marketing situations and prices, lack of storage facilities and other factors, result in the farmers having to accept receipts for their products which hardly cover their costs. The profits go mainly to the wholesalers. Therefore the creation of institutions to organise the commercial sale of agricultural products is essential for the financial success of the farmer at least during a period in which farmers develop their own economic skills.

There is a plan to create a market ("mercado de origem") for the products in the area between Coimbra, Figueira da Foz, Mira and Cantanhede, where producers will negotiate sales with wholesale buyers. The wholesale retail market ("mercado abastecedor") will be built in Coimbra. All the products will finally be available to the consumers in the consumer retail markets ("mercados consumidores") of the main centers, Coimbra, Figueira da Foz, Montemor-o-Velho, Condeixa and Soure.

It will not be enough to create a first set of changes; there must be ongoing monitoring of future possibilities. A research programme will be maintained permanently in order to provide new information on the basis of which farming operations can steadily be improved

and new problems be tackled, such as plant infestation, introduction of new technological developments, changes in market demands and introduction of new crops.

The whole integrated institutional approach outlined here is as important as the creation of new production structures such as the irrigation system, drainage, feeder roads, canals etc. which will enable in part the improvement of agricultural situation of the project area. At the same time the wider physical and socio-economic infrastructural needs of the region have to be met (see Chp. 6).

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Chapter 6SPECIAL AGRICULTURAL PRODUCTION SECTORS AND ASSOCIATEDNON-FARMING ACTIVITIES

Most obviously important here are the newly proposed specialised production lines such as those for some vegetables and fruit, but even some established farm production is already naturally linked to processing e.g. milk. In this case there is a natural unbroken linkage from feed and fodder growth to the conversion into animal products, parts of which - e.g. milk - are then further processed. This association of farm cultivation with the production of a variety of natural and processed commodities for sometimes distant and discriminating markets is characteristic of all developed market economies. From the development point of view, success in this area can bring:

- higher farm incomes
- higher farm created added value
- a regional diversity of production even though including individually specialised production units
- accessibility to a wider range of markets
- a greater range of employment opportunities

Here are considered a few of the production sectors and their non-farm linkages. Others are examined in Chapter 7, e.g. Lacticoop, in association with a consideration of cooperatives.

1. Vegetables

The cultivation of vegetables in the lower Mondego valley is mostly for home consumption although some processing industries exist. These units have some farmers under contract to whom they supply technical assistance, production means and guarantee the sale of the products.

In order of their importance, tomatoes, peas, tobacco, beans and broccoli are the most representative crops. Green pepper and french beans are also cultivated but to a less extent.

The agro-industrial sector is, as a rule, well organized. However, the attribution and level of prices is decided by these units without participation by the farmers. The commercialization of vegetables produced either in glass houses or in fields is influenced by the existence of middle-men entrepreneurs. The creation of producer markets and package centres has been initiated in order to improve marketing conditions and to increase the quality and presentation of the products.

A group of horticulturists has established an association called Hortifoz to work as the organizational centre of the producers between Leiria and Aveiro and also as the coordinating agent of future actions and decisions.

The deep freezing industry handling agricultural products is not technically well developed in the area. The only existing company is Monliz, with its headquarters and main plant in Monte Real: a

second plant is located in Tocha. This industry has recently been taken over by "Tabaqueira" which has the monopoly of tobacco processing in Portugal.

The activity of Monliz is based on the freezing of peas, sold in the market in plastic bags of 500 grammes. These are grown by local farmers, under contracts with Monliz. The company supplies seeds and technical assistance. Finally the product is selected and purchased by the company according to its classification in terms of grain size, maturity and quality.

2. Cereals

Maize and rice are the most important cereals in the valley, followed by wheat, oats and barley. The yields for rice are on average 3.5 tons per hectare,¹ and for maize between 1 and 14 tons per hectare.²

Wheat, oats and barley yield usually less than 1 ton per hectare and are cultivated in the "monte". However, in the valley, yields of about 4-5 tons per hectare have been obtained.

Maize and rice are cultivated all over the valley but the only cereal processing activity is associated with rice i.e. rice milling.

There are several units for rice processing in Mondego valley, which assure the preparation and packing of all rice cultivated in the

area, i.e., about 25-30,000 tons per year. Some of these units have still to buy more rice in the south of Portugal in order to utilise their processing capacity and to fulfill the market needs. Some "Carolino" type varieties are more easily obtained from southern producers because of more favourable climatic conditions for its growth than in the north. These rice processing units do their own marketing.

For Mondego valley rice growers and industries, Spanish producers are regarded as future potential competitors, as their technical and economical level and also their marketing structures are more developed and good quality rice can be sold at lower prices to the consumer. The main constraints to a market invasion by Spanish companies at the moment are transport distances and, mainly, the custom barriers still existing. Since in the near future the second barrier should disappear under EEC regulations, Mondego farmers and industrialists have to prepare themselves, by creating market structures and improving the technical level of their units and the quality of rice to face competition.

3. Fodder and animal production

Before flood control, fodder production in the valley was based mostly on winter grown feeds e.g. *Lolium multiflorum* or an Oats-Vetch mixture. Soil preparation is the same as for summer crops, and the vegetation growth period is from October/November to March/April. Farmers only harvest daily feed for their animals and there is hardly any storage of feeds. Forage production can be very

successful in the valley because many grasses and clovers are suited to the soil and climate, as proved through the trials carried out in the research station of Quinta do Canal. Straw, rice and maize stubble, cultivated grass and natural pasture grown on the river banks can also be used to feed livestock.

In 1983 a feasibility study estimated the total number of cattle in the project area was 21.023, broken down into 3.994 milk cattle, 7701 meat cattle and 9238 working cattle.*³ With the exception of cattle keeping it is likely that animal husbandry will remain more or less at its present production level. The change in cattle keeping will be due to the increase of the farm unit areas as a result of the establishment of the project, in which working cattle will be replaced by mechanical traction. Their place will probably be taken by milk cattle and meat cattle. If a farm as a whole becomes orientated to animal production, i.e. intensive beef or milk production, in the near future, rice will be substituted by maize for forage in rotation with pastures (and see Chp. 7 Section 3).

4. Poplars and the match-industry⁴

The growing of poplars for timber in the Mondego valley is very profitable and could be the answer for the use of marginal soils where other crops can not be cultivated. They could also be planted

* The discrepancy between these figures and those given in Table 4.3 is recognised but is explicable only in terms of slightly different areas covered by field survey and estimation.

in small plots in the whole valley to create wind protections. However, so far, poplar cultivation in the valley is against the law, strictly allowed only on second class soils of which there are none in the valley lowlands.

Poplar timber is used in the local match-industry, a factory for which exists in S. Silvestre, near Coimbra, with an annual capacity for about 500 hectares of poplars. In the valley there are about 170 hectares planted, which are insufficient for the needs. Every year many m³ of poplar wood are imported from Spain.

5. Machinery-hire

Because of the small average farm size in the project area, some 3.5 hectares including "campo" and "monte", and of the fragmentation of most of these farm holdings (see Chp. 4.2A and 5.1), individual farm mechanization is not economically feasible for most agricultural enterprises. Many farmers have therefore to turn to machinery-hiring. Some companies are already established in the valley with this type of activity, normally also based on their own farming production units, thus employing their machinery more efficiently.

The main services requested by farmers are those appropriate to rice and maize cultivation, ranging from soil preparation to harvesting. Some of these companies have also drying facilities for rice and maize. There are also many small farmers working 1-2 hectares with their own tractor and basic implements (e.g. plough, disc-harrow, rotary cultivator) who hire their services to other small farmers.

Machinery hiring is regarded as an important factor in agricultural development in the valley, as the present land holding structure does not allow, economically, individual mechanization of most farm units, and land consolidation will take a long time.

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Chapter 7

SOCIO-ECONOMIC ASPECTS OF RURAL DEVELOPMENT

In Chapters 5 and 6 the emphasis has been on the technical aspects of on farm production but, as noted in Chapter 1 and re-iterated later, other socio-economic factors are critically significant to successful rural development. The most important of these factors, ranging from the training and organization of farmers to marketing and economic and physical infrastructures, are considered below.

1. The training of producers; extension services

Most farmers in the Mondego valley and in Portugal in general are not sufficiently trained from the technical point of view for the demands of modern agriculture.

Adequate techniques, new forms of organization and farm management, and suitable technologies, together with accurate and timely advice to correct and solve problems, are basic requirements for the successful development of agriculture in Mondego valley.

The existing extension service officers are not sufficiently trained as far as technical knowledge is concerned, and tend usually to concentrate their efforts on "pilot farmers" who are most likely to adopt farm innovations. To reach the entire farming population and to overcome the short-comings of the extension service, the government must not only concentrate on pilot programmes but use pilot farmers to get a more effective wider response.

To build technical competence, some farmers, once chosen, should receive long-term training in new farming techniques at the professional training centres of Loreto and Gafanha. However, innovations and recommendations should also be made attractive to other farmers at a lower level of technical understanding and extension officers need special training for this.

Professional training¹

The first professional training centre was started in 1967-1968, when it was operated by the "Junta de Colonizacao Interna".

Since the installation of the centre in Gafanha (Ilhavo), 50 kms north of Mondego, courses for young farmers have been given with a duration of 3-4 months (600 hours). Four main subjects are covered : mechanization, cattle keeping, book keeping and general agriculture.

The centre is now run by the Regional Directorate of Beira-Litoral province (DRABL).

Between 1980 to 1985 the centre had the financial support of the German government, based on the Luso-German cooperation agreement.

The most recent professional training centre was established at Loreto, near Coimbra, in 1984, also as part of the Luso-German development efforts. Different courses for farmers based on their experience are given; a total programme consists of 400 hours that can be taken during a period which the work load of the farmers is

lowest. Subjects like milking cows, cultivation of potatoes, rice growing, vine growing and the use of machinery and tractors are taught.

A basic course for young farmers aged between 18 and 25 is available, for which candidates are selected by field workers of the extension service. It is an intensive course, with 600 hours of lectures during 15 weeks, from Monday to Friday. Other courses, e.g. on machinery and implements, new crops, new technologies, irrigation and drainage, have been taught in Montemor-o-Velho, Soure and Cantanhede.

2. Cooperation between farmers

Cooperation between farmers can take many forms and develop for a variety of functional reasons. In the Mondego valley the traditional structure of farming, as outlined in Chapter 3.5, has not encouraged the widespread spontaneous growth of cooperative institutions. Given small farms, low incomes and, traditionally, low expectations of income raising opportunities, together with all the other characteristics noted previously, formal institutionalised cooperation as opposed to personal contact between farmers has been viewed with suspicion. This is the classic situation observed in almost all rural development studies. However, in the Mondego Project area some official and some spontaneous developments have been taking place.

A. Farmer Cooperatives²

After the 1974 revolution, cooperatives were established in the place of the existing "Gremios da Lavoura" which were institutions owned by the state. The basic organization was kept by farmers, who decided to create the agricultural cooperatives. Each district is normally covered by one cooperative, and in some cases more. Thus, in each "Concelho" within Mondego development area there is an agricultural cooperative:

- Cooperativa Agricola: da Figueira da Foz, de Montemor-o-Velho, de Soure, de Condeixa-a-Nova e Penela, de Coimbra.

Some of these cooperatives have several branches in one district.

The main activity of these cooperatives has been the supply of agricultural inputs to their members. They also offer other services, such as veterinary and technical assistance. Cooperatives act also as intermediates between milk producers and Lacticoop, having their own milk-parlours where the milk is collected and then delivered to Lacticoop (see below).

Productivity can be substantially raised provided agricultural inputs are available, the extension service works effectively, and markets are organized in such a way that the flow and sale of products are reasonably guaranteed. For the improvement of all these activities, cooperatives can play an important role, in particular because of the small size and weak economic power of the vast majority of individual farms. For example, the low level of

mechanization noted in most farm units and which is an obstacle to the adoption of new production systems, cannot be removed by individual investment by small farmers. However, the cooperatives could invest in machinery and make it available to their members. The greater use of cooperatives to strengthen the collective bargaining power of small scale producers when dealing with the already well-organized merchants, could also be beneficial.

There are already various specialised associations of farmers and these, together with wider cooperative membership, suggest one of the important socio-economic development paths.

Table 7.1 : Agricultural Cooperatives in the Mondego Valley (1983)

Name of Cooperative	Area of influence (000 ha)	No. of Members	Capital (000 escudos)	No. of Employees	Turnover (000 escudos)	No. of Branches	Milk Production	
							No. of cows	000 litres annually
Figueira da Foz Montemor	35.5	6,800	770	107	555,300.0	3	1,213	16,618.6
Soure	23.5	3,010	332.8	83	431,638.1	7	1,187	10,987.4
Condeixa	26.2	4,429	455.4	19	196,497.4	12	267	2,083.4
Coimbra	26.6	1,161	508.8	11	121,523.0	32	155	2,865.5
Ferreira-a-Nova	31.6	8,100	120.4	20	192,847.0	2	n.a.	3,635.1
Bebe Douro	35.5	2,000	292.4	43	317,750.0	n.a.	n.a.	n.a.
Figueira do	6.7	1,405	419.8	72	102,744.0	"	"	"
	n.a.	180	n.a.	n.a.	3,440.5	"	"	"

n.a. Data not available

After: Siebler, B., Analysis of the situation of Agricultural Cooperatives in the Mondego Valley, PIDRBM, 1984

B. Farmers' associations and enterprises³

Portuguese rice growers association - This association has a delegation in the lower Mondego valley with a membership of about 300 farmers. As part of the European rice growers association it is member of a commission to discuss prices, to import new varieties, new techniques and new technology and promotion of the most suitable varieties for different areas.

Association of farmers of Meas - This was spontaneously formed as a non-political local production association. It was founded in 1976, with a membership of 10 farmers aged from 28 to 40. The basic idea was to create a group for the common use of machines, drying and storage of cereals. The main activities are the cultivation of maize, rice and vegetables. The group cultivates approximately 200 hectares of land of which about 60% are rented. The machines used belong to the association.

The Young Farmers Association of Mondego Valley - This association was also spontaneously created in 1985 in Loreto, near Coimbra, by a group of young farmers. It is based in Montemor-o-Velho and has a membership of 60, aged between 18 and 40. The aim was to represent young farmers in negotiations with the government, and the statutory position in accord with the rules of the Association of Portuguese Young Farmers (AJAP). However, as with many such bodies some advisory and/or leadership guidance from e.g. extension officers is needed to build up momentum.

The Quinta das Flores Nursery, Bolao - This association is based in Coimbra and operates at a national level. Owned by 4 partners, it was established 50 years ago near Coimbra and only moved to Bolao two years ago.

The main activities are the cultivation of all types of fruit-trees for exportation and for the national market, rose-plants for export and strawberry plants for national growers. The nursery covers an area of 11 hectares, and has been developed without any external financing.

According to the members, the main constraint to growth is the lack of EEC legislation encouraging growth in the sector of garden plants and horticultural nurseries. This type of activity was not considered in the projects of investment aid by the Portuguese national decree of 797/85.

"Quinta do Bolao" - This is an individually owned enterprise, existing since 1983. The cultivation of strawberries in glass-houses (8.5 ha) represents 90% of the activity; roses and pinks are also cultivated at a smaller scale. Lettuces and frenchbeans are grown in rotation with the strawberries. All the production is sold in the regional market (Coimbra) and in Porto. The surplus production is absorbed by the national processing industries. The organization of marketing is based on the normal intermediate marketing organization and agents who deliver the product to the main markets in Porto, Coimbra and all Beira province.

The Horticultural Association - Uncertainty with regard to future prices and marketing facilities has a negative effect on the level and pattern of agricultural production in general and horticultural products in particular. Due to the inefficiency of the markets and fluctuating prices, some 200 of the horticultural producers of the area have created an Association which covers the districts of Coimbra, Leiria and Aveiro.

This association of private owners, non-political in its activities, is being established to cover:

- Production
- Experimentation
- Demonstration
- Professional training of members
- Promotion and creation of producer markets, cooperations, packing and normalizing centres.

Lacticoop - The union of Cooperatives of milk producers in the area between Douro and Mondego, was created in 1971, replacing an earlier group of Cooperatives in the area between Douro and Vouga. At present, there are 25 Cooperatives associated in Lacticoop, covering the districts of Aveiro, Coimbra and parts of Leiria and Viseu.

The activities and objectives of Lacticoop for milk production are the following:

- Installation of experimental fields of maize and forages.
- Laboratory support for disease control.

- Technical support to the associated Cooperatives.
- Financing of new milk parlours and refrigeration systems.
- Improvement and selection of dairy animals.
- Professional training of farmers.
- Technical and financial support to the formation of new Cooperatives.

Generally the milk is collected by the individual cooperatives and delivered to Lacticoop for processing, either in Tocha or Sever do Vouga (district of Sanfins).

The number of people employed is shown in Table 7.2

Table 7.2 - Employment in Lacticoop processing plants

1980	1981	1982	1983	1984	1985	1986
647	703	764	798	782	748	765

Milk production increased in 1986 by 15.7%² compared with 1985, mainly because a great number of high yielding cows were imported.

Table 7.3 - Animal Milk production (1,000 litres)

1975	1980	1981	1982	1983	1984	1985	1986
101,621	168,593	183,472	188,417	175,510	158,385	155,347	179,768

Other sub-products derived from milk are produced, such as cheese, cream and butter. In 1986, the production of cheese and butter increased substantially over the previous year (+18% and +84%).

Milk production in Mondego valley has a great potential, but given the surplus in the EEC and the production levels of dairy farmers, the question arises as to whether it is worth encouraging an increase in milk production. However, considering the present low consumption of milk and cheese per capita in Portugal, a large domestic market potentially exists and to reach market saturation a large amount of milk is required. All depends here on national economic development and on actual growth in the Portuguese consumption of dairy products.

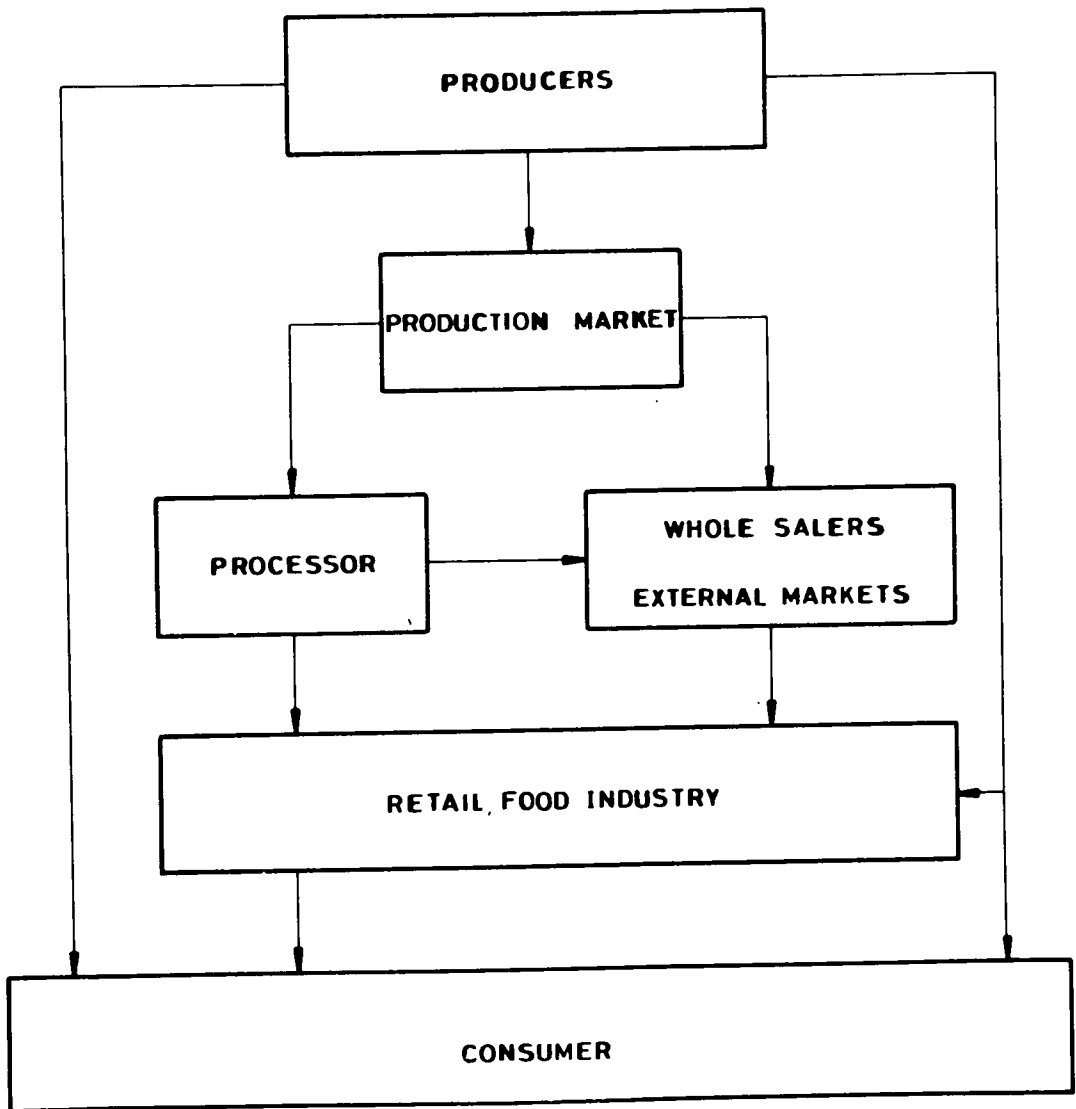
3. Prices, markets and organization of marketing of agricultural products⁴

The production and commercialization of agricultural products will change significantly with the accession of Portugal to EEC. The decision and planning of the agricultural activities will become more difficult, because the impact of this change on the agricultural sector is still not predictable. Prices and marketing structures for agricultural products will change in ways which it is not wholly possible to foresee.

For each of the main production sectors, the commercialization at national and regional level and sales and marketing systems for each area, effectively are still under consideration. The present position can be summarised in Fig. 7.1 in which the general marketing system of agricultural products is illustrated.

Fig 7.1 - MARKETING SYSTEM OF AGRICULTURAL PRODUCTS

Source: After J.N.P.P., 1987



For rice and maize, the marketing structures at national level are shown in Figures 7.2 and 7.3

At project level, in general, the commercialization of agricultural products is not well organized, except for milk and cereals. The milk market organization by Lacticoop, the regional union of cooperatives of milk producers, has already been considered.

For cereals, before the 1974 political revolution, the market structure was based on several different organizations, which were later replaced by EPAC - Empresa Publica de Abastecimento de Cereais. The government now fixes every year the minimum support price for each cereal which is paid by EPAC. Some farmers sell their cereals directly to the industry, in return for a higher price. However, because few farmers have storage facilities, the role played by EPAC in all the marketing systems is important. The meat market even in small regional markets is state controlled and works as shown in Figure 7.4.

4. Agricultural financing⁵

The provision of an improved system of agricultural financing for Mondego valley farmers will contribute to the development of agriculture in the area. In addition to seasonal needs farmers have also a need for medium and long-term financing.

Meeting the financial needs for modernization of agriculture and regional development has to be accomplished within the framework of EEC rules for credit supply. Before the EEC integration a

Fig 7.2. - MARKETING STRUCTURES OF RICE IN PORTUGAL (1984/1986)

Source: Alter E.P.A.C., 1987

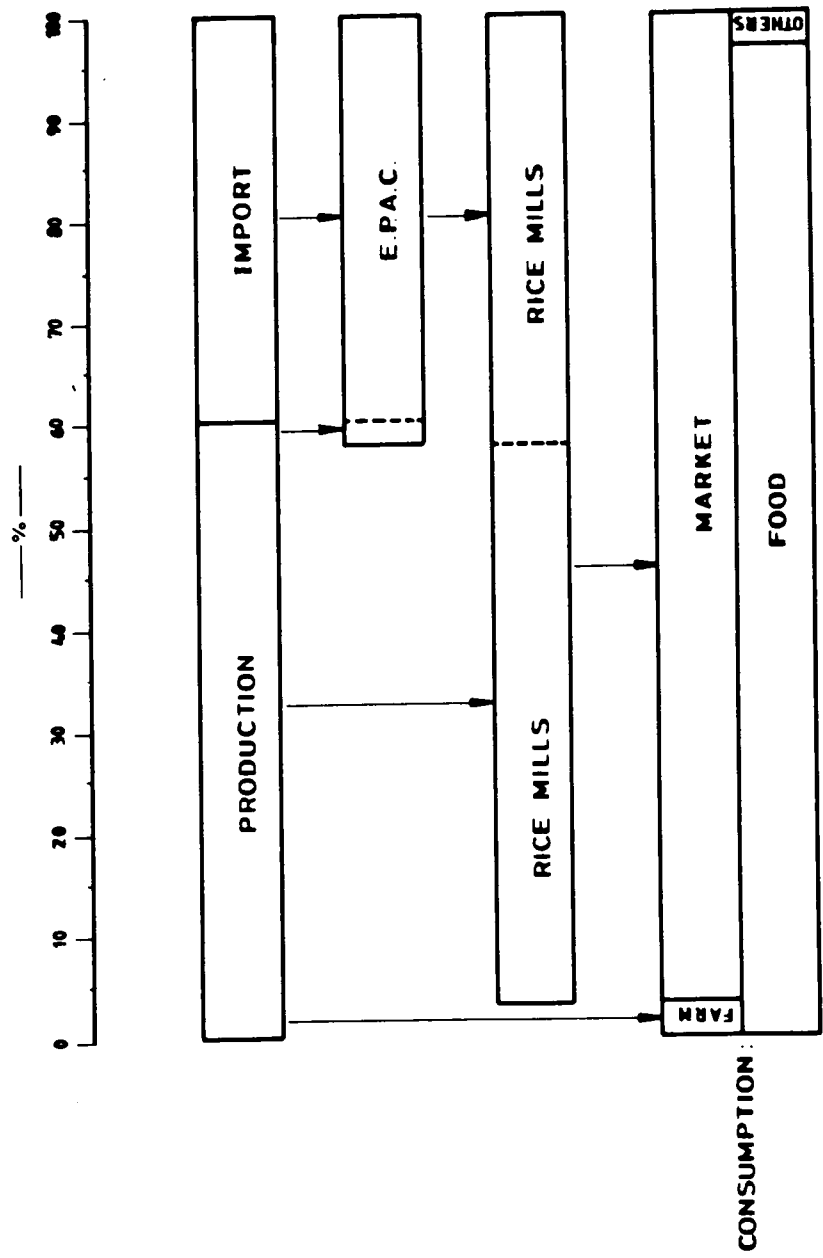
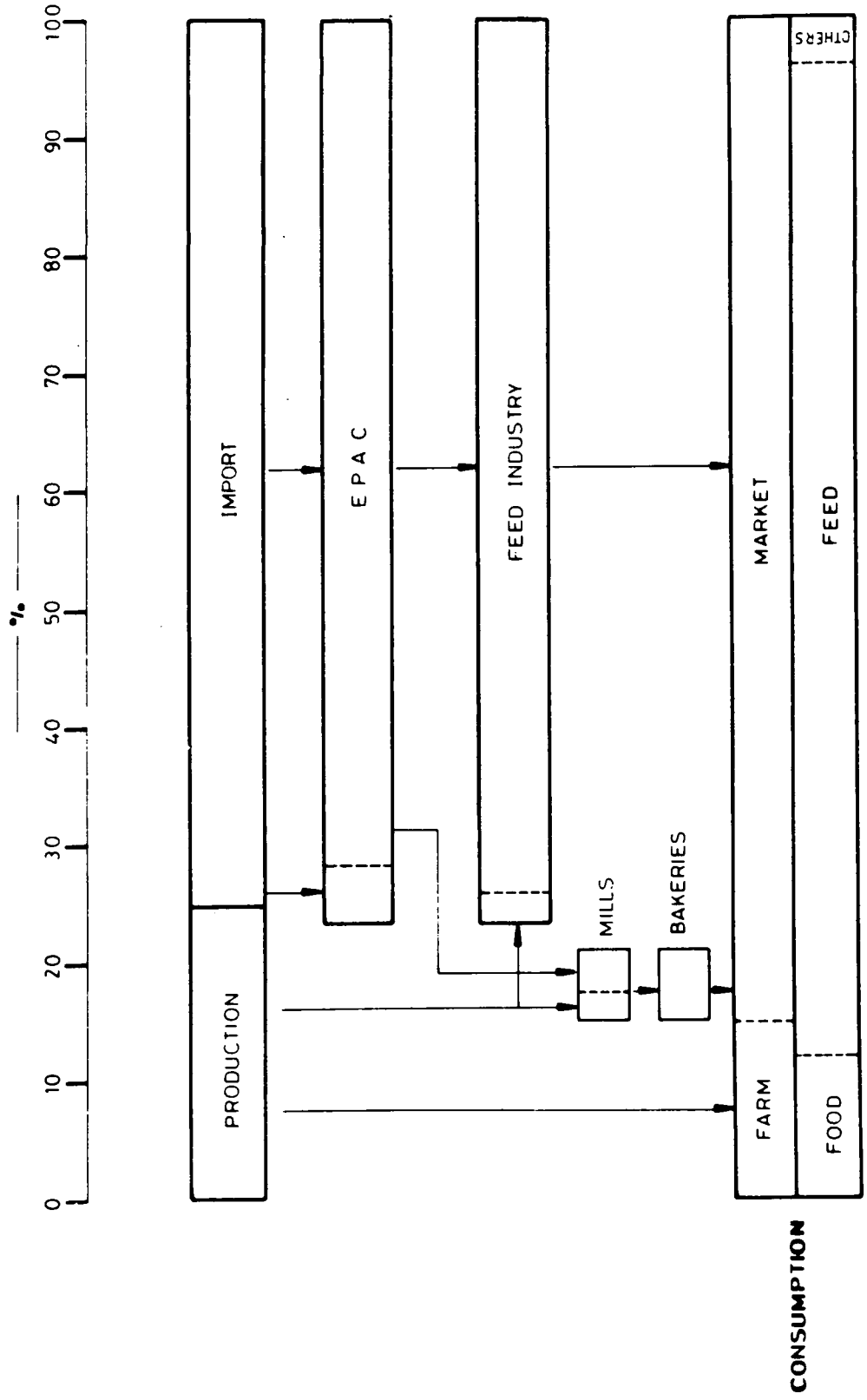


Fig. 7.3 - MARKETING STRUCTURES OF MAIZE IN PORTUGAL (1984 / 1986)

Source: After E.P.A.C., 1987



Portuguese system of financing of agriculture and fishery - SIFAP - existed. Now the credit system has changed, based on an EEC regulation which was applied to Portugal through a national decree, Regulation 797/85, which favours mostly young farmers (18-40).

Much more is implied than subsidies and price support, important though these are in both the EEC Common Agricultural Policy and in the existing Portuguese system. A government institution - IFADAP - is already responsible for the distribution of the 797/85 subsidies.

For development purposes funds for investment and adjustment are required and those require accessible and reasonably cheap credit. Because conventional credit programmes often exclude small farmers, more attention should be paid to the creation of alternative and more participatory strategies for the distribution of credits. According to IFADAP, an office for the preparation of investment programmes for Mondego farmers should be created to give support to all types of farmers. Another approach is for credit agencies to supply loans to groups of farmers rather than to individuals. Also, committees of local authorities and farmers should be empowered to screen loan applications and to define, modify or make more flexible definitions of credit worthiness in order to allow more farmers to take advantages of the 797 loan programme.

The position at the moment is extremely fluid. Farmers can borrow through normal commercial banks using their land as security but interest rates are high - about 18%. IFADAP can make interest-bearing loans, part of the cost being met by government, but only for projects of which the feasibility can be demonstrated.

IFADAP and some commercial banks are already giving credit servicing assistance. The meeting of the lowest possible cost of the modernization expenses incurred by farmers in exploiting the potential created by the Mondego project, e.g. machines, storage equipment, etc. is one urgent need. Another may be bridging the extra cost of payment for irrigation water once the complete distribution system is established and a water purchasing scheme is introduced.

The complex distinction that lies behind the obtaining of credit and the avoiding of debt may have to be reinforced by the provision of financial guidance to farmers.

5. Transportation and the communication infrastructure⁶

The new road network which covers the lower Mondego valley fields is built to guarantee the transportation of agricultural products and inputs from and to the fields. Large quantities of material, machinery and products are already moved in the area, apart from traffic loads arising directly from agricultural operations.

The tertiary road system was planned around the installation of drainage and irrigation earth canals, and in some cases existing field roads were improved. A secondary road system includes those already existing access roads which were used and also newly designed roads (see Fig. 5.1).

From Coimbra to Figueira da Foz road connection through the fields is almost complete; asphalt roads have been built along both river

sides, from which several secondary roads branch out into the fields and to main centres. Five concrete bridges were built across the new river channel to connect the road network. A railway from Coimbra to Figueira is mostly used for transport of people and non-agricultural material. The national road between Coimbra and Figueira provides the main external infrastructure channel for agricultural products.

Maintenance and improvement of the communication network in the valley will be executed by the Water Association of Mondego valley. Outside the lower Mondego valley and within the project area, connections and transportation of products are assured through the old existing communication infrastructures.

In all rural development projects the number and variety of economic and social interests involved is considerable. Farm production is only one part of a complex which includes, for instance, transport, regional communication planning, industrial processing, and the servicing of heavy machinery. The organisation and coordination of the relationships between the many component elements requires administrative and executive project structures. These themselves necessarily exist in relationship to larger general administrative systems e.g. Ministries, national technical agencies etc. The way in which the administrative and organisational structure responsible for the Mondego project has evolved is examined below in Chapter 8.

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Chapter 8

GENERAL ADMINISTRATION

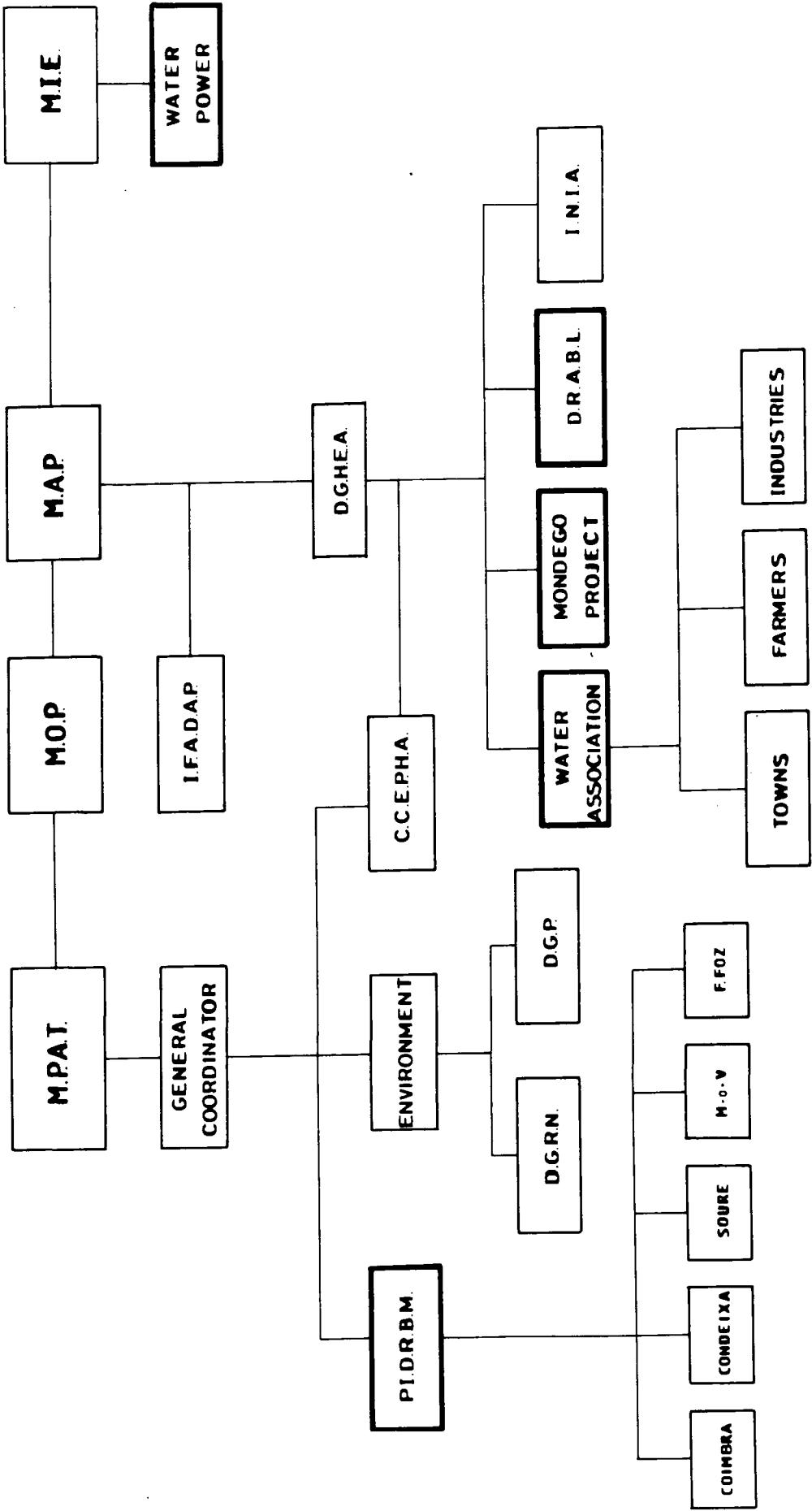
1. Regional Development Planning and the PIDRBM

In Chapter 7 the most relevant local organizational elements in the changing agriculture of the Mondego valley were examined. Here, the wider context of administrative and organizational responsibility is considered, i.e. the responsibilities of the various Ministries and Departments, the hierarchical structure of administrative authorities, and the linkage between different sectors and agencies. In Fig. 8.1 this linkage is illustrated diagrammatically, selecting those components of greatest relative importance to the success of the whole rural development programme. Not only are there four national Ministries directly involved - MPAT (Ministry for the Planning and Administration of the Territory), MOP (Ministry for Public Works), MAP (Ministry for Agriculture and Fisheries) and MIF (Ministry for Industry and Energy), - but also a series of other implementing and co-ordinating bodies.

Under MPAT a General Co-ordinating Board (CCG) is responsible for the organisation and guidance of the three main activity areas described below in Chp. 8.1.

The Regional Development Programme for the Lower Mondego Valley (PIDRBM)¹ is the overall programme concerned with all aspects of rural development including the agricultural sector, the latter generally called "The Mondego Project".

Fig. 8.1 - GENERAL ADMINISTRATION AND HIERARCHIC STRUCTURES



Under the PIDRBM programme several elements of the development projects have actually been initiated in the most complex development plan ever undertaken in Portugal. The first four of these are essentially the sections examined in this thesis:

- a) - Development of lower Mondego valley farming potential.
- b) - Development of the irrigation, drainage and road network.
- c) - Land reclamation and reallocation.
- d) - Agricultural research.
- e) - Improvement of the port of Figueira da Foz.
- f) - Conservation and improvement of the natural resource environment.
- g) - Education and professional training.

The sector of natural resources and environment are identified as one important part of the plan, as also is the port of Figueira da Foz.

The towns of Coimbra, Condeixa, Soure, Monte-mor-o-Velho are the main centres in the area to be developed and these local authorities play an important role in this process.

Other projects which have to be considered for the success of the programme are referred to in Chapter 9.

Ministry of Public Works (MCP)

This Ministry is responsible for all major works of the project, such as the constructions necessary for the regularization of river flow, canals, bridges and others.

Ministry of Agriculture and Fishery (MAP)

Within this Ministry the administration of agricultural resources and their development is the responsibility of the General Directorate of Hydraulics and Agricultural Engineering (DGHEA). Another government institution (IFADAP) regulates the agricultural financing system and is therefore also relevant for the success of the program (see also Chp. 7.4).

The Co-ordinating Board for the Hydro-agricultural Project (Conselho Coordenador Especifico do Projecto Hidro-agricola) guarantees the necessary linkage between PIDRBM administration, Local Authorities and the agricultural project.

The General Directorate of Hydraulics and Agricultural Engineering (DGHEA) regulates the activity of the Water Association, the Mondego Project, INIA and DRABL (although the last is more directly dependent on the Ministry of Agriculture), also acting in parallel to the others.

2. The Mondego Project - the Agricultural Sector

PDRBM, the programme for rural development of the Lower Mondego Valley² was created on 11 May 1977, the organization for developing agriculture consisting of technical specialists drawn from the MAP and MOP. In October 1978 this team was reinforced as the result of cooperative assistance from GTZ, the German Agency for Technical Development, whose technical support is still and will continue to be of great importance.

In Fig. 8.2 are illustrated the network of main component elements and fields of activity involved in the agricultural work of PIDRBM, i.e. the Mondego Project. As shown in Fig. 1.3, the construction works necessary to enable improvements in agricultural production have been completed in Blocks 1, 4 and 17. Land re-allocation has started but has been delayed by the continuing work on canal and road networks (see Chap. 5.1); by 1987 only the San Martinho block has been completed. These latter activities are now controlled by DGHEA.

The first studies of and experimentation with alternative crops, new technologies and more profitable production systems were designed by the Mondego Project Team at the Quinta do Cabal Research Station. The scale of effort required was very great and eventually INIA, the National Institute for Agricultural Research, became involved in an experimental programme scheduled to last until 1990 (see Chap. 5.6.1.c).

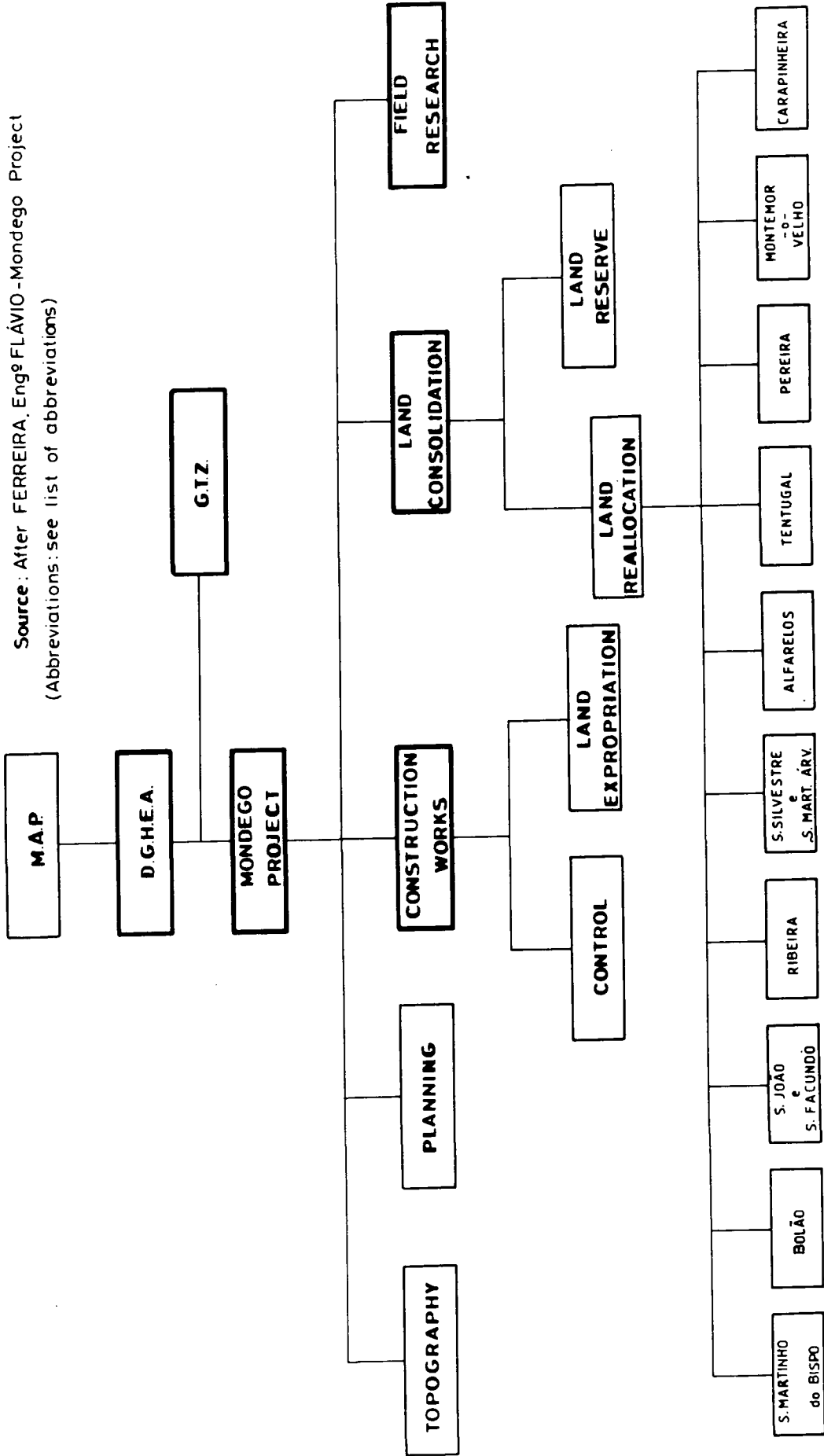
3. Regional Directorate of Agriculture of Beira Litoral - DRABL⁴

This Directorate is directly responsible to the Ministry of Agriculture and includes the following agrarian zones (Zonas Agrarias created by the decree of 240/81) : Aveiro, Aveiro Interior, Bairrada (Agueda), Coimbra, Gandaras (Figueira da Foz), Beira-Serra (Oliveira do Hospital), Pombal, Dao e Mondego (Mangualde), Tondela, Viseu e Moimenta da Beira. The "Zonas Agrarias" of Coimbra and Figueira da Foz are directly involved with the rural development plan of the Mondego Valley region. Coimbra Z.A. includes the districts of Penela, Coimbra, Condeixa, Lousa, Miranda do Corvo,



Fig. 8.2- THE MONDEGO PROJECT ORGANIZATION

Source: After FERREIRA, Engº FLÁVIO - Mondego Project
 (Abbreviations: see list of abbreviations)



Penacova e Vila Nova de Poiares. Figueira da Foz Z.A. comprises the districts of Soure, Montemor-o-Velho, Carapinheira, Mira and Figueira da Foz. In each of these towns there is theoretically, an establishment for a team of Rural Extension and Agricultural Production working ("Equipa de Extensao e Producao Agricola"), although in practice the assistance given to the farmers most often is not sufficient or is lacking.

The structure of DRABL is based on 5 divisions, each one directed by its own Director ("Chefe de Divisao"). Within the Rural Extension Division, the sector of professional education and training is the most important because the Centres of Loreto, Gafanha and Viseu, which are well established, carry out the training of farmers and are in fact the most positive element of the Rural Extension Service in the region.

4. Water Distribution and Administration - EDP (MIE)

As noted earlier, as well as below in 5, agricultural development is wholly dependent on improvements in irrigated farming. Whilst this thesis has emphasised this latter aspect, the stable exploitation of the whole Mondego river system for a variety of purposes is also involved.

The Ministry of Industry and Energy (MIE) is responsible for water distribution and administration and EDP (Electricity of Portugal), through its HEP interests, plays an important role in controlling the utilization of Mondego water (see Fig. 8.3). The control of the dammed reservoirs of Agueira, Fronha and Raiva (see Fig. 1.2) is

exerted by EDP, this to ensure that water is available in the required volume at appropriate times not only for irrigation but also for municipal and industrial water supplies.

5. The Creation and Functioning of the Water Association

The last agency with which we are concerned and the lowest in the hierarchy of government bodies, but in many ways the most crucial to the success of the agricultural development project, is the Mondego Water Association. This was founded on the 4th of August 1988, in Montemor-o-Velho. Temporarily, it is based in Quinhendros, Montemor-o-Velho, where the Mondego project has its headquarters. The construction of the permanent head-office near Montemor-o-Velho is planned.

The statutes of the Association are based on the decree nr. 269/82, of July 10 1982⁴, which was intended to review the functions of the former "Associacoes de Regantes e Beneficiarios" and to allow the beneficiaries more participation in the planning of development works and their administration, exploitation and conservation, as stated in the Diario da Republica, I series, nr. 255, 4/11/1982, p. 3717, line 33-36.

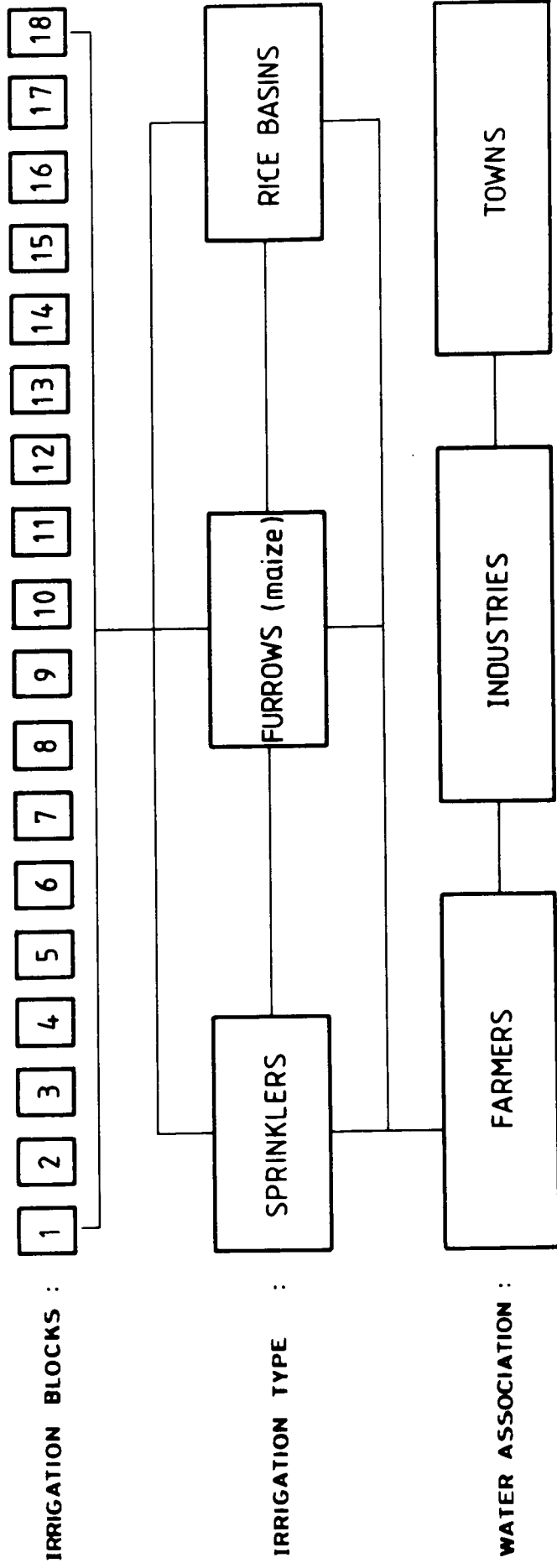
Theoretically, the Association is run by and for the interests of its members i.e. farmers, industrialists and municipalities. According to the 1982 Decree, industries and municipalities are regarded as no more than individual members but in reality their status as water consumers and their political influence make them far more powerful than any farmer or group of farmers. Celbi and

Soporcel (see Fig. 8.3) as noted earlier, are the two main paper industries in Portugal, whilst Figueira da Foz district has 45% of the population of the lower Mondego Valley. These industrial and municipal authorities, moreover, have the power to participate in the maintenance and improvement of the structural works in the Project in ways in which small farmers cannot.

The design and early development of the Project was in fact carried out without farmer participation. An attempt to influence the form of this Water Association was made by suggesting a model based on the water associations in German Lower Saxony, but so far, this has had no influence on the creation of the statutes of the Water Association of Mondego. According to the German model, the right of self-management would have been conceded to the Association, whose structure and operation would be based on 3 main elements : the 18 irrigation blocks in which the valley is divided, the 3 zones of irrigation type, and the Association itself with its three equal membership groups - farmers, towns and industries (see Fig. 8.4).

Within the agricultural allocation, distribution of water would be adapted to the irrigation type and to the crop grown. The organization and orientation of this operation in each block be assured by a person elected by the farmers of the zone, who in turn, would supervise employed technicians who would distribute the water. Each block would work as a small association and together be coordinated by the main Association's farming group. The model presented could serve for the formation of a functioning water association and is indubitably suitable for Mondego Valley agriculture. A legal base could be found which would be suitable for other sectors.

FIG. 8.3 - FUNCTIONING OF A WATER ASSOCIATION ACCORDING TO GERMAN MODEL



So far, the tendency to centralise authority has triumphed. The members at the moment are not allowed to run the Association and the project independently. Some of the responsibilities may be taken by the Association, but main decisions depend always on the approval of the DGHEA i.e., the state.

In those cases where the Association would be responsible, these are mainly in areas normally regarded as State's duties, such as maintenance of the works, access roads, improvement of the structures etc., and the Association should then be reimbursed by the State.

Moreover, should an association be created after the Saxon model, the State would have to convey some greater authority to the member beneficiaries, because the Association would carry out even more responsible duties of the State. This devolution of power could be done without the state losing the right and obligation to intervene whenever the Association abuses its authority.

These last points illustrate one particular problem facing not only this particular integrated rural development programme in the Mondego Valley (and although outside the scope of this thesis the whole Beira-Litoral), but all regional development in relatively poor countries. In such countries and regions the social, economic and technical backwardness of the agricultural communities relative to industrial enterprises and trade-based urban centres is always apparent. Chapter 3 indicates the disparities involved in the Mondego valley. Any multi-sectoral development programme launched under these conditions tends, either to assume that most decisions

must be taken for farmers by external authorities rather than by farmers, or to allow a type of laissez-faire competition between sectoral interests of unequal strength. There is field-interview evidence (which, as is common, cannot yet be supported by significant statistical data), that a large number of agricultural producers in the Project area are developing so rapidly in technical and commercial capability that they should be given a larger active role in Project management. Moreover, in order to encourage farmers' further development, greater emphasis on technical training and extension inputs should also be associated by more involvement by farmers' in running Project activities such as those of the Water Association. In Chapter 9, various other aspects of organization and management are considered in the concluding evaluation.

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Chapter 9

ANALYSIS OF REQUIREMENTS; STRATEGY FOR DEVELOPMENT AND CONCLUSION

1. Analysis of Requirements

The requirements for the successful development of any region are always quite stringent. This concluding Chapter examines the PIDRBM programme, concentrating on the agricultural sector, in the light of the foregoing examination to consider (a) the requirements for rural development in the Mondego Valley and (b) the strategy which, consequently, has to be adopted.

In Chapter 8, an outline of the administrative and organizational structure and context of PIDRBM and the Mondego agricultural project, indicates one fundamental requirement for success viz: the creation of an organizational and decision-making structure which does not only obstruct progress but which actively assists progress. This is true everywhere and some general guide-lines can be established, although each situation in practice is unique in the way in which an ideal structure is composed. Two key facts have to be recognised. First, even in a rural development programme, farming is only one of the many sectoral interests involved. In the lower Mondego valley as a whole, farmers are greatly out-numbered by townspeople, the value of agricultural production is being rivalled by that of commerce and tourism, the critical resource of water is required for manufacturing and urban use as well as for irrigation.

Within the region therefore there is competition - for land, water, investment, labour etc - and this is accentuated by the speed of current economic and social change. So far, the only organization within which these different and possibly conflicting interests meet is the Water Association, and this is too limited in its area of responsibility and in its powers to be generally effective (see Chapter 8.5).

Secondly, rural development involves many different national governmental bodies and agencies each of which has its own technical and political priorities (Chapter 8). The necessary co-ordination of the project-relevant activities of these bodies, from Ministries downward, is itself necessarily a cumbersome matter and the existence of inter-agency linkages (see Fig. 8.1) only provides the possibility not a guarantee of co-ordinated action. The more complex the linkage the slower the process of decision-making and the Mondego project is the most inter-sectorally complex development programme undertaken in Portugal. Moreover, Portugal's long history until recently of centralised government authority has not been conducive to flexibility in inter-agency relationships or to speed in implementation. There are no simple solutions to these problems of co-ordination in principle because the latter are inherent in all development situations.¹ It therefore becomes especially important that the most significant and critical components within each sector are recognised and continuously emphasised in any specific development strategy - here of PIDRBM.

2. The General Context and PIDRBM

The Mondego Valley region has faced the same difficulties as the entire country of Portugal, i.e., a traditional and inadequate agriculture, a low standard of life and high inflation rates in recent years, together with a generally low level of education, although, compared with the rest of the country the Mondego Valley is a privileged area in terms of natural resources. The cost of the new structures, the enormous total of money invested in the regional development plan outlined in Chapter 1, and also the social importance of the development programme, all justify an insistence that the best use be made of these resources. In order to achieve this, for the first time in Portugal a rural development programme for a whole region was evolved.

The lower Mondego region was officially defined as suitable for the implementation of a regional development programme. With this objective, the activities concerned with the general hydrological improvement plan of the Mondego watershed area (see Figure 1.2), agricultural development project and new construction in the port of Figueira da Foz, were integrated under a single plan, i.e., the Rural Development Programme of the Lower Mondego, PIDRBM. This programme eventually has included many non-farming socio-economic areas of development, e.g., industry, fishery, education and health (see below).

The present programme comprises some twelve projects, each identifiable by type and each including a set of associated activities, each of which in turn is based on a particular need,

opportunity or constraint. The schematic analysis shown below has been derived from data obtained partly from the reports of the co-ordinating team of the PIDRBM Director's office² and partly from personal surveys and knowledge of the situation:

I - Improvement of the Mondego valley region:

- a. Hydrological control structures in the Mondego catchment basin.
- b. The agricultural development project (the main subject of this thesis).
- c. Maintenance of water supply and quality of the lower Mondego.
- d. Afforestation.

II - Improvement and conservation of estuarine potentials:

- a. Development of specialised agriculture.
- b. Fisheries.
- c. Salt production.
- d. Port improvement at Figueira da Foz.

III - Industry:

- a. Planning of feasible industrial projects.
- b. Modernization of the industrial sector.
- c. Formation and training of new young entrepreneurs.
- d. Creation of industrial zones.

IV - Tourism:

- a. Promotion of tourism in the lower Mondego.
- b. Establishing controlled hunting and fishing regimes.

- c. Improvement and maintenance of Spas (watering places).
- d. Construction of horse-riding centres.
- e. Improvement of the beaches at Figueira da Foz.
- f. Planning and construction of golfing centres.
- g. Introduction of water sports.
- h. Maintenance of the historic and cultural patrimony.

V - Communications:

- a. Development and improvement of the national and international road network and communication infrastructures.
- b. Railway and air transportation.

VI - Improvement of the telecommunication services.

VII - Maintenance and improvement of the water supply and installation of sewerage systems.

VIII- Education.

IX - Professional training in different sectors of commerce and industry.

X - Health and health services.

XI - Improvement of social security provisions.

XII - The Environment; Ecological maintenance and improvement.

Most of the project sections identified above are outside the scope of this study which concentrates on agriculture, i.e. Ib, but the requirement that attention has to be paid to all sections even for the agricultural project to succeed can easily be demonstrated. For example, any increase in local market demand for livestock products and other high-value farmed commodities is dependent mainly on the growth in regional non-farm wealth which in turn will be generated by III Industry, IV Tourism etc. Any such non-agricultural growth demands improvements in V and VI, communications etc. Similarly, the technical and commercial capabilities of agricultural producers cannot merely depend on the training of existing farmers and cannot be divorced from the general educational and training projects VIII and IX.

Ultimately, what is required for the success of PIDRBM is multi-stream developments, starting from several different bases and being mutually supportive. This, perhaps, makes greater demands on development capability - not merely in design but in effective implementation - than can in the end be met, remembering also the changing position during the next few years of Portugal within the EEC.

What is certain is that the success of the agricultural sector project is crucial to the whole programme. Without such success, the movement of people off the land could accelerate, the quality of land utilisation in the lower Mondego valley deteriorate, much of the general investment so far made be wasted, and the positive contribution made to Portugal's need for key commodities such as milk, meat, maize and rice replaced by an increase in the national import bill.

3. Agriculture - The Mondego Project and Conclusion

Increase in agricultural production and productivity is then essential for the economic development of the region and is therefore regarded as the main objective of this project. In order to guarantee success, the completion of the following activities is essential:

- 1 - Definition and completion of the new irrigation, drainage and road network systems.
- 2 - Land consolidation.
- 3 - Creation of an efficient rural extension service; the training of farmers.
- 4 - Field research and experimentation; Soil conservation; Plant protection; Adequate fertilizer use; Alternative cropping systems and new varieties; Increase of productivity.
- 5 - Creation of markets and organization of marketing structures for agricultural products.
- 6 - Support of cooperatives; Creation of an effective Water Association.
- 7 - Creation of an improved system of agricultural financing for Mondego Valley farmers.

As discussed in earlier Chapters, some of the activities mentioned are already initiated and some are even completed. It is essential that all these operations are completed, but two particular elements in the whole agricultural strategy must also be given the attention they deserve.

In the first place, there is need for great flexibility, over time, in the way in which technical farming problems are approached and the results divulged. As noted in Chapter 5 the first need was for the experts to inform themselves of the basic technical possibilities, for example, through research on soil characteristics, crop-water requirements, ecologically appropriate cropping systems and methods of husbandry. Some of this research needs to be extended, some continued monitoring, but equally important, the technical information which farmers need to have is now of sufficiently high quality to be passed on more rapidly and widely to them through the extension services.

At the same time more effort has to be put into seeking the answers to a different set of agronomic questions. For example, along with the establishment of more numerous and varied demonstration plots (run on *farm* style) throughout the valley and the dissemination of the results obtained by the experimental teams of "Quinta do Canal" and INIA, serious research is needed into:

- the creation of extra-regional markets.
- the processing and preserving of local agricultural products, including the freezing industry.
- what forms of cooperation between farmers should be promoted.
- other analyses of social and economical aspects of rural development.

According to DGHEA planning, the agricultural project will be completed in 1997, with all the potentials fully developed not until the year 2,000.³ This seems to be a long period, considering the

integration of the Portuguese agriculture into the EEC's near future and also the scheduled completion of the primary works (irrigation, drainage, road network) programmed for 1989/1990. There is therefore a need both for urgency and continued up-dating of required responses - not only by the planners but by the farmers.

There are two particular areas of work in which speed and flexibility are required. The first is that of land re-allocation, noted earlier in Chapter 4. If modern technical production possibilities are to be exploited and if farm incomes are to rise to satisfactory levels then many of the present small land units will have to be consolidated into larger units. Therefore the irrigation drainage and road network system should be completed as soon as possible, as the progress of land consolidation, a key factor in the whole process, depends on the completion of those systems. At the same time the ratification of the new land consolidation law is urgently demanded to guarantee the maintenance of the new land-holding structure. It is essential that ways be found of overcoming obstruction and lethargy in this difficult but critical area.

The second has to do with the spontaneous and guided changes, social, economic and psychological in agricultural producers. The type of persons engaged in Agriculture, must be capable now or in the very near future of absorbing all the new technical, economical and marketing organization opportunities available. Hopefully this will improve by the continuous training given by the professional formation centres and the assistance provided by the rural extension service. This, which in theory has already been established, and

whose functioning is the responsibility of DRABL, is in practice non-existent. As already stressed this is a key factor for the success of the agricultural project, and which has been neglected until now.

Fortunately, there has been some spontaneous response by producers, which owes little either to farm consolidation or extension work. In spite of the statistical evidence given in Chapter 3 that farming has been left to an ageing residual population, more recent personal observation which cannot yet be quantified is encouraging. Chapters 6 and 7 provide evidence of initiatives in cooperative enterprises. The EEC backed scheme for training young farmers appears to be working well. There is also considerable evidence, mentioned in Chapter 7 of rising market-awareness both amongst young tenant-farmers and technically skilled, small-scale but intensive producers who operate land part-time in addition to holding down responsible urban jobs.

Today, ten years after the commencement of the agricultural project, Mondego Valley looks the same, although in fact many things have changed. The crops are more rational, productions have increased, machines have largely replaced manual labour, the income from the land has risen. But, it is above all, the spirit of the men that has changed, and this is already an excellent achievement. For, once the socio-economic problems have been overcome, there is no technical problem, however arduous, to which a solution cannot be found.

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