

UNIVERSITY OF SOUTHAMPTON

PETROLEUM DEVELOPMENT AND AGRICULTURAL CHANGE
IN THE NORTH-ORINOCO REGION OF VENEZUELA

by

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To my husband, Seraidi, Dylan and
my mother

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ABSTRACT

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The thesis identifies and examines the spatial and economic effects arising from the interaction between petroleum and agricultural development. The analysis has required an integrated methodological framework and takes account primarily of the development issues in relation to petroleum production, focusing on its effects upon agriculture in a broader context. Secondly, the thesis underlines changes in the agricultural space economy, farming structure and the management of agriculture in the North Orinoco region of Venezuela. The basis of the research is a sample survey of farmers in communities selected within a 20-Km radius from the oil-industrial sites. Similarly, a series of interviews with officials from the different governmental and development agencies involved in the region's policy-making was undertaken.

The study demonstrates intra-regional variations among the three different states that comprise the region in terms of land-use patterns, agricultural outputs and sales, farm occupancy and agricultural land values. These changes are in most cases associated with the development of the oil-industrial economy. Furthermore, the research reveals intra-regional disparities in the pattern of government financial support to agriculture and a limited contribution of the petroleum industry to the management of the region's agricultural space economy. The study of the petroleum-agriculture interface has suggested issues for further research.

PREFACE

This is a thesis on economic geography. Within the context of the role of energy in the development proces, it focusses upon a part of Venezuela where traditional agricultural patterns and systems are being substantially modified as a result of the development of petroleum resources. Its purpose is to analyse and explain the spatial and economic implications arising from the interaction between petroleum exploitation and associated changes in agricultural geography in the study area.

Training in the field of Development Studies, and work experience in regional planning in Venezuela, have equipped me to analyse economic and social phenomena in systematic terms. This may be regarded as advantageous in the context of the present geographical study. My concern for, and appreciation of, the spatial aspects of development has arisen from my professional experience as a planning officer and partly through postgraduate courses in regional economic development.

The research on which this thesis is based has therefore been conceived and pursued in this dual context. In undertaking this work I also accepted a dual challenge: to analyse the petroelum/agriculture interface in the North-Orinoco region of Venezuela in terms of its geography as well as within an economic context; and to undertake an investigation the results of which would be found useful in a planning framework as well as acceptable in an academic environment.

I acknowledge the help of many people in Venezuela and in Britain who have advised and assisted me during the 1985-87 research period. I record my gratitiude to the Fundacion Gran Mariscal de Ayacucho (Venezuelan Scholarship Programme) in my home country for the financial support that has enable me to carry out this work, and to the University of Southampton which has been my academic home for three very happy years.

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CHAPTER 1: RESEARCH CONTEXT

The pattern of development in the energy resource owner-countries, particularly oil-exporting countries, is the result of a range of factors with emphasis upon (a) economic efficiency, in order to guarantee a reasonable place in the world market; (b) growth and development, to ensure economic and social benefits for society, and (c) environmentally sound policies, to assure a positive balance in the oil production/consumption cycle.

In the oil-exporting developing countries, the impact of the export-oriented oil sector upon development is influenced by economic, social, political, historical, technological and other factors, most of which are interrelated. These factors have, through their complexity and interdependence, had a diverse impact on the economic geography of these countries, expressed in tendencies towards the development of highly sophisticated large-scale industrial complexes.

The economic implications of oil industry development have been widely assumed to be especially devastating for the agricultural sectors of those oil-producing countries where historically a large proportion of the national output has been derived from agriculture. The most common indicators of what is assumed to be the disadvantageous impact of petroleum production upon agriculture are expressed in terms of declining agricultural output, contribution of the agricultural sector to GNP, employment, and income. Despite their general importance, these broad indicators are inadequate if it is intended to study the economic and spatial changes that have taken place at a local level in agricultural areas where the oil

industries have been established. This study attempts to examine interrelationships between petroleum and agriculture at a local level in Venezuela.

It will be useful at this point to give a general outline of the country's geography. Venezuela, with 912,500 km² and a population of 14,516,735 inhabitants according to the 1981 census, may be divided into four general regions, each with its own distinctive climate, physiography, culture, population and economy: the Coastal region, the Andean west, the Inland Llanos and the Guayana highlands. The most important region has always been the coastal strip, broadly encompassing the humid lowlands and the bordering foothills which stretch from Lake Maracaibo in the west to the Orinoco delta in the east. The next in importance are the Andean states; then the Llanos, flat, low plains that lie between the Orinoco river and the coastal foothills; and lastly the Guayana highlands south of the Orinoco river stretching to the Brazilian border (Fig. 1.1).

Before the expansion of the petroleum economy, integration between the different regions of the country was essentially dendritic. This pattern of integration was partly the response to market forces in the commercialization of primary export crops (cacao, coffee, sugar cane, cattle and copper) and partly the result of the prevailing national governmental policy for the spatial integration of the country. The national urban system was characterized by the existence of some port cities with specialized functions in trade and transport; some intermediate cities for transport, storage, bulk-breaking facilities; and dispersed local market centres involved in trade to port cities as well as in local

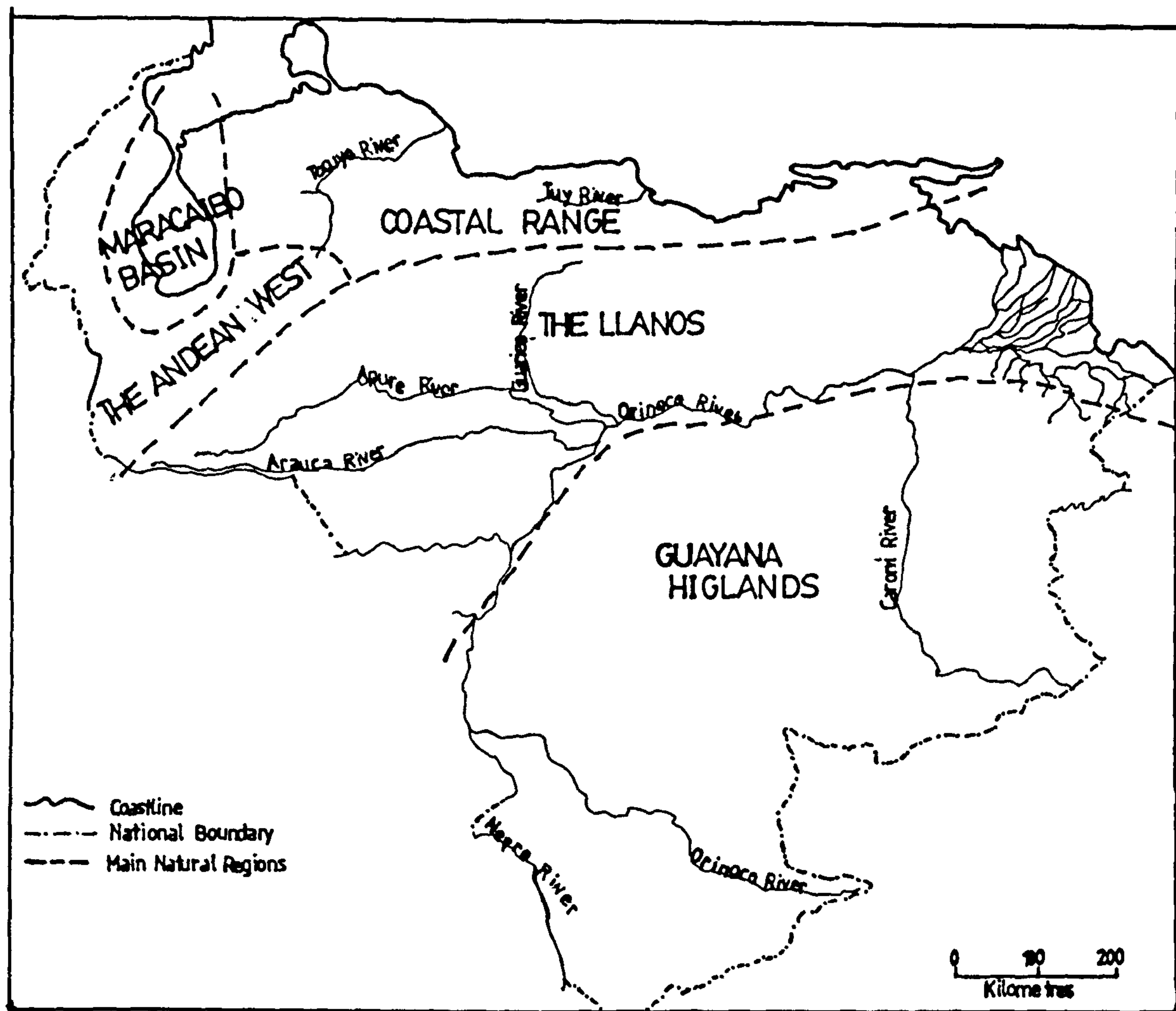


Fig. 1.1 Major physical regions in Venezuela (after Morris, A. 1979, p. 232)

exchange.

A spatial transformation occurred^r in Venezuela when petroleum began to dominate the country's economy: from a dendritic penetration-line system of settlement and transport to a central-place type. Various cities closely linked to the oilfields emerged, exhibiting a certain degree of specialization and particular communication networks. Because there was no longer a primary export-orientated economy the prevailing port cities gradually lost their predominance as several new port cities emerged. Moreover, oil revenues gave rise to the development of a more extensive seaport, industrial and administrative growth zone concentrated in the Caracas-Valencia area as well as the subsequent development of other urban-industrial complexes in Guayana region. In the rest of the country, especially in some agricultural regions, central market cities have developed along the principal routes, ultimately generating their own feeder networks and links with small towns and villages, as well as to the principal economic and population centres (Fig. 1.2).

The initial phase of petroleum resource development gave rise to the settlement of some previously undeveloped and sparsely inhabited zones, which became areas of in-migration from surrounding agricultural areas. However, in the later stages of oil development, the revenues generated stimulated changes in the spatial distribution of the population. As Cole points out, "from an initial concentration of population in the Andes there has been a redeployment of people over the northern half of the country, particularly to the oilfields and to Caracas, but also to new agricultural areas and industrial centres such as the site of the new iron and steel industry

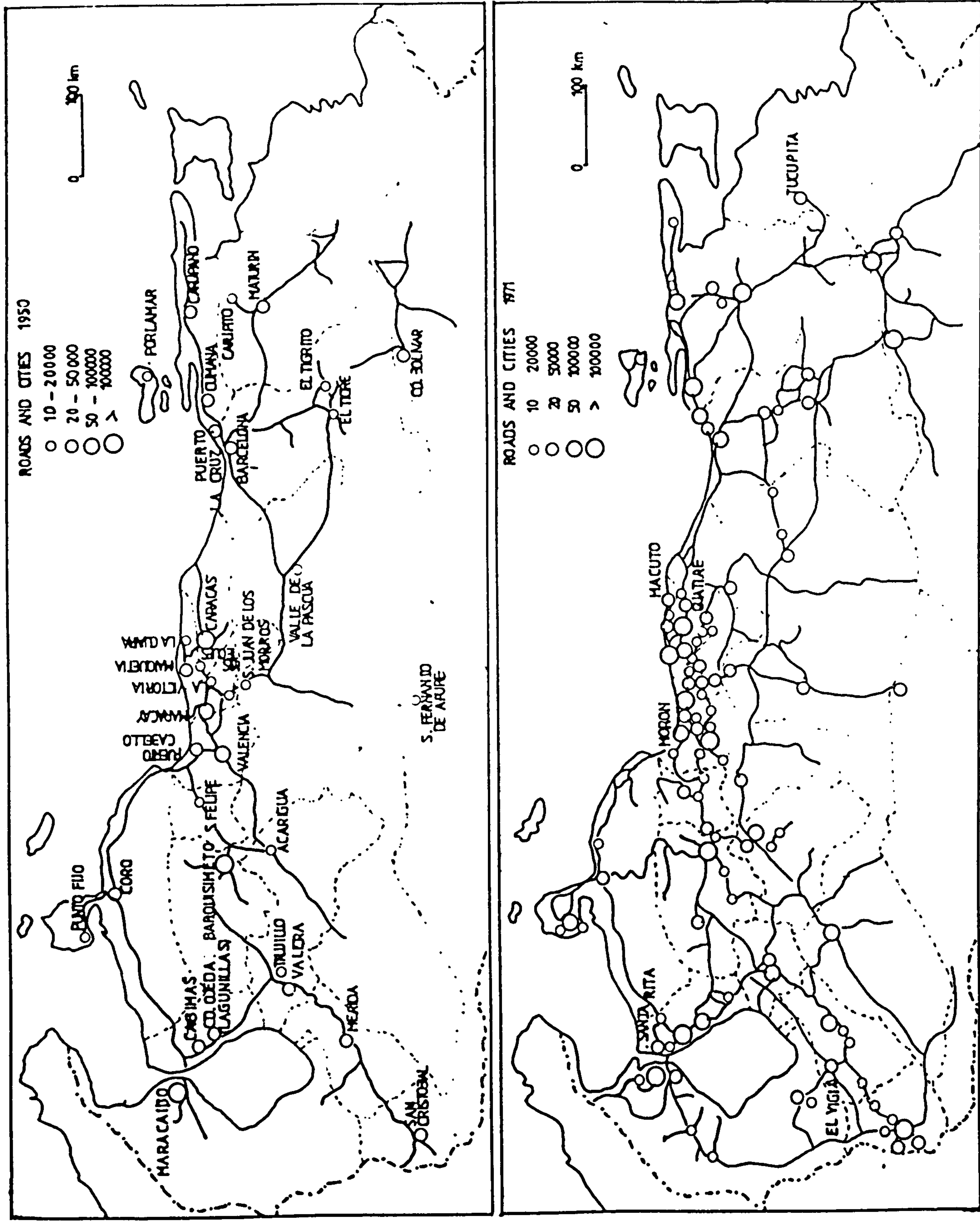


Fig. 1.2 Venezuela: changes in the spatial structure of transport and settlement, 1950 and 1971 (adapted from Gorsmen, E. 1978, pp. 151, 153)

of Venezuela near the Orinoco delta" (Cole 1979, 336). Data available show that a relatively rapid urban growth has taken place. In 1950, 22 settlements had attained urban status (20,000 inhabitants) whereas in 1980 over 70 settlements were defined as urban centres. In 1960 the urban population as a percentage of the total national population was 47 per cent, whereas in 1980 it was 67 per cent. Consequently, less than 30 per cent of the population is now thought to be living on farms or in small rural settlements (Fig. 1.3). This pattern of urban growth "based in part on the expansion of the petroleum industry" (Gilbert 1974, 85) has been accentuated by the country's centralization of government activities and expenditure particularly in Caracas and its immediate region, concentrating people and economic activities to the "detriment of the level and range of economic activities in the country's smaller towns" (Odell and Preston 1973, 197).

Coincidentally an intense competition for the use of space has emerged. This has come about through the use of good quality agricultural land for urban development which, in its turn, represents a serious restraint on achieving any increase in agricultural production. Of the total area of the country, 53 per cent is occupied by forestry and woodlands, and just 28 per cent is classified as agricultural land. The remarkable development of the urban settlements has limited the expansion of land under cultivation: from 2.8 per cent in 1966-70, the annual rate of growth had fallen to 1.5 per cent in 1981-83. In this context, it can be seen that Venezuela's rapid petroleum-associated economic development, together with its increasing pace of urbanization, has been paralleled by a decline in agricultural land and by the

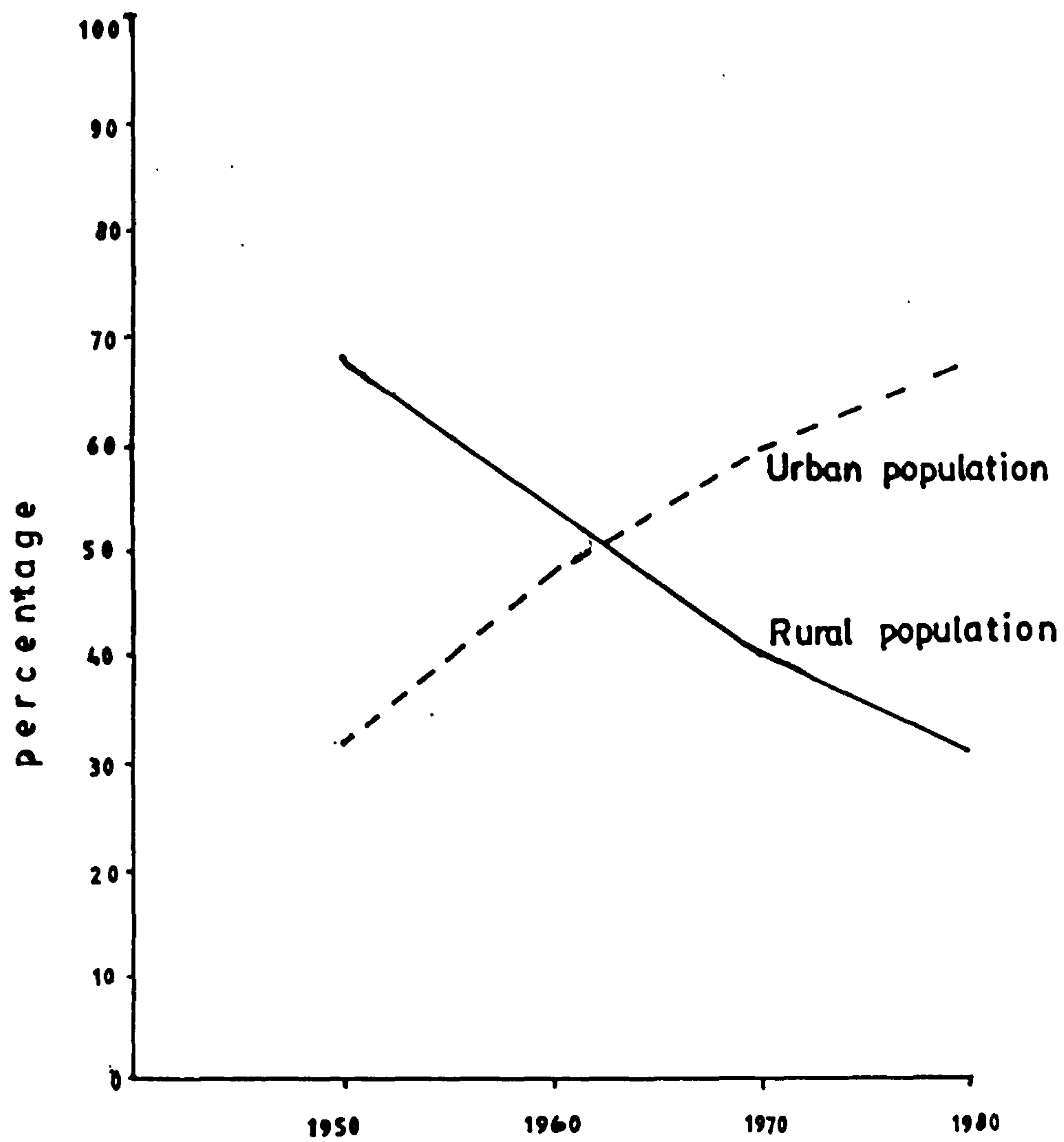


Fig 1.3 Venezuela: changes in the population distribution, 1950-80
(source of data: Statistical abstract of Latin America)

resultant spatial transformation of the country. These changes have posed particularly acute problems in the agricultural areas directly affected by petroleum exploitation.

1.1 RESEARCH OBJECTIVES

The development of a petroleum-based industry cannot be looked upon as a process isolated from other aspects of the economy, and cannot be considered without taking into account the character of the regions in which it operates. In oil-producing areas, the interaction between petroleum and agricultural activities generate changes in the economic and spatial structure. This research is designed to provide, within the context of modern geography and development studies, an understanding of the problems arising from that interaction, with particular reference to the North-Orinoco petroleum region of Venezuela (Fig. 1.4) which comprises parts of the three states of Guarico, Anzoategui and Monagas.

The first objective is the study of the patterns of interaction between petroleum and agriculture in general, by establishing the economic and spatial impacts on the agricultural sector of the oil-producing countries as an economic group within the global economy. The second objective is to investigate the current spatial and economic structure of the North-Orinoco region of Venezuela and by making use of empirical evidence to establish the changes in the agricultural development patterns of the region as a result of oil developments. The third objective is to evaluate policy-making criteria in relation to the North-Orinoco region and the implications of petroleum-based development

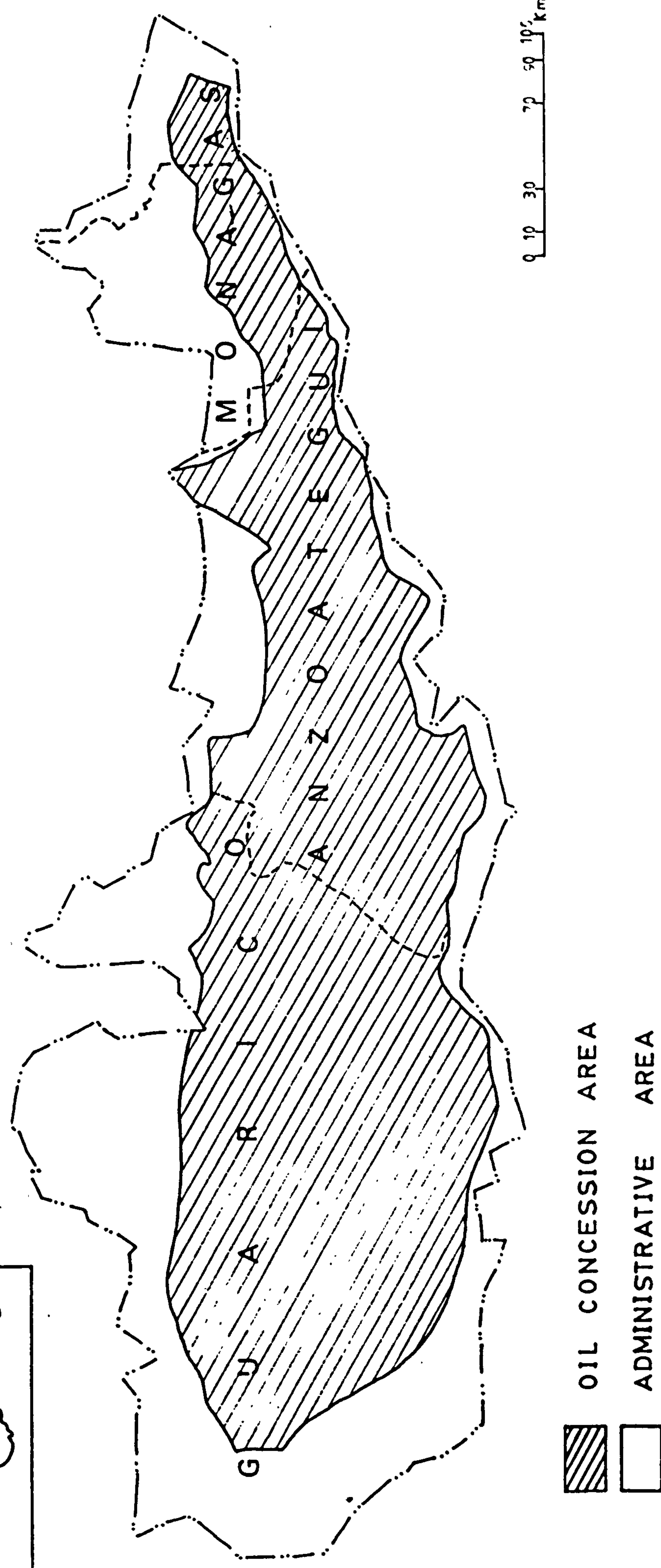
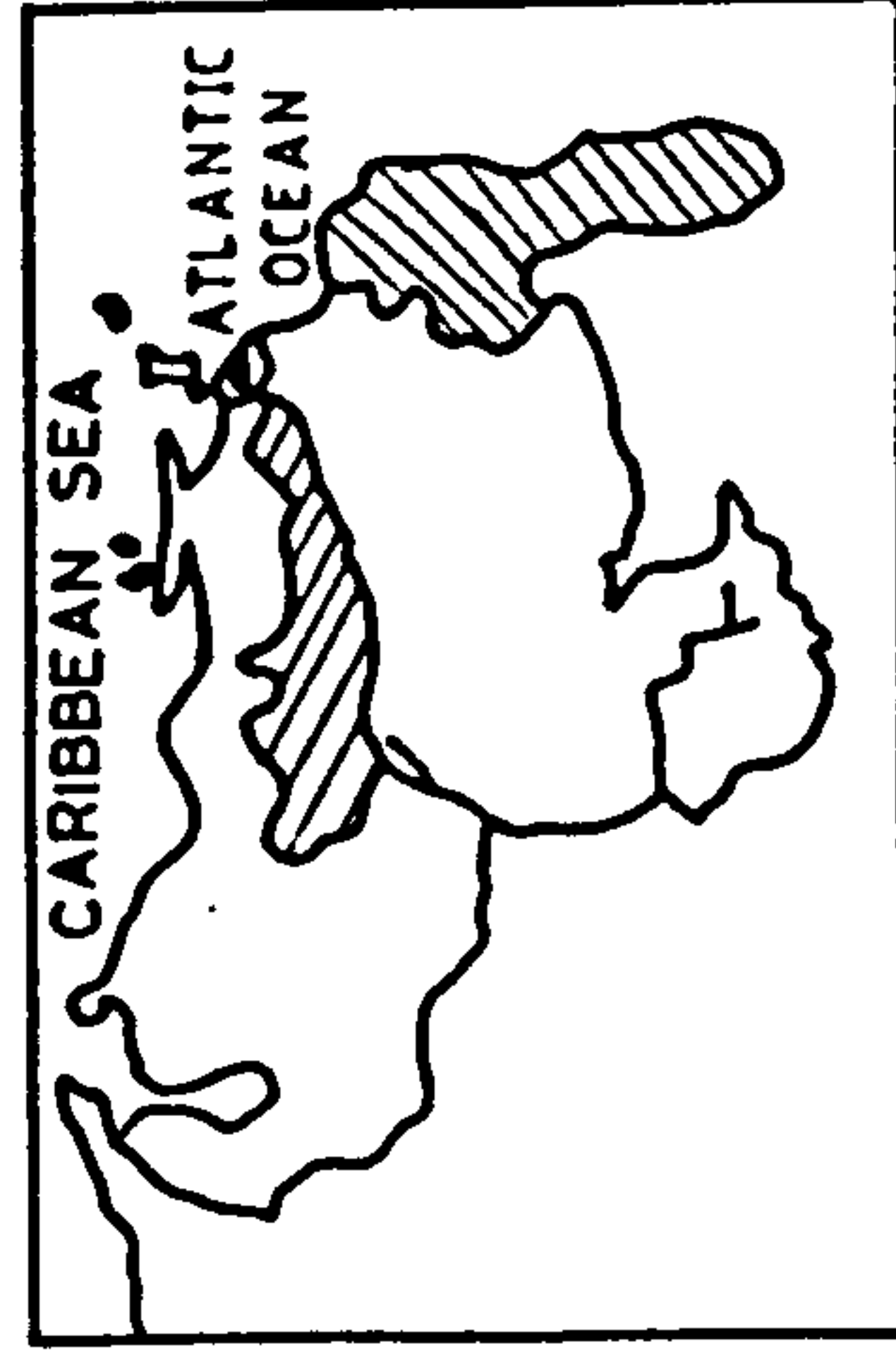


Fig. 1.4 The North-Orinoco Petroleum Region

for the patterns of agricultural development in this part of Venezuela.

An analysis of these inter-related elements requires the development of a structurally and spatially integrated approach to the problem. The methodological framework to be used in the investigation will be discussed in more detail in Chapter 2. The need for an integrative approach is founded upon the assumption that within the geography of the country, the area of study constitutes a region of considerable importance in terms of its physical resource potential for the establishment of an oil-based industry. In its turn, this could act as a stimulus for the further economic development of the region on a more diversified basis, with special reference to agriculture.

By means of this approach, this study is directed towards the achievement of several aims. Firstly, it is proposed to identify ways in which petroleum production, as a radically different form of economic activity, may limit or expand the development of agriculture in the North-Orinoco region. Secondly, it is intended to present an analytical framework which may be applicable to the economic geography of less-developed countries other than Venezuela, although any such relevance should be considered in the context of the different historical, political, cultural and institutional factors involved in specific cases. A third aim is the development of a methodology which might enable policy-making bodies to formulate integrated agro-industrial programmes while developing their awareness of spatial and economic impacts. Fourthly, the study will indicate possible avenues for further

investigation in this field.

1.2 LITERATURE REVIEW

The study of the patterns of economic development is one of the most challenging branches of the broader disciplines of geography, economics, history and development studies. It is not possible, nor appropriate in this context to provide a comprehensive review of the existing and extensive literature of all these diverse fields, but it is necessary to note some of the more important contributions to the analysis of development issues in the less-developed economies.

Much of the related literature comes from the field of economics. In the first place, the work of the so-called neo-classical and neo-keynesian economic theorists, produced for the understanding of the economies of advanced countries, was originally considered to provide useful conceptual framework to analyse the problems emerging in the Third World nations. Those problems primarily involved the efficient least-cost allocation of scarce productive resources and the optimal growth of these resources over time so as to produce an ever expanding range of goods and services (Mundell, 1968; Heller, 1975).

However, many of the fundamental concepts and principles of traditional economics were found to be insufficient for an understanding and comprehension of the characteristic features of Third World nations. This limited relevance of traditional economic theory is recorded by many writers (Seers, 1965; Myrdal, 1970; Kaldor, 1972; Hollis and Neil, 1975). All of them agreed that theories and

principles that might be valid and appropriate for one economy in any given region or at a given moment may not be valid for other regions at the same or different times. The development and consolidation of spatial growth theory initiated by Myrdal (1957) and Hirschman (1958) and followed by Chenery (1960), Rostow (1960) and Friedman (1972) can be identified at this point.

As the nature and scope of neo-classical economic theory became questionable, there emerged an increasing need for a much more broader perspective within the overall social system of any particular country. The formulation of a theoretical framework for dealing with the complex and multidimensional problems of the less-developed countries, by analysis of economic and non-economic factors, became increasingly crucial. For instance, Lewis' development theory (1963) reflects the increasing importance given to non-economic factors. He considered a series of economic dichotomies together with a geographical dichotomy that separates the "modern" and the "traditional" sectors of society.

The late 1970s witnessed significant and wide ranging changes in the perception of development issue and the strategies to tackle the state of underdevelopment in the Third World (Frank, 1971; Chenery, 1974; Amin, 1976; Lipton, 1977). Within this new perception, planning at the macro-level needed to produce solutions to the problem of reconciling the values of large economic aggregates, together with the analysis of planning at the micro-level, particularly the selection and regional distribution of new projects (Little and Mirrless, 1974; Fitzgerald, 1978; Mosloy, 1981). Until then economists tended merely to discuss the development issue in terms of national aggregates and

in terms of projects, with little if any consideration of the spatial dimensions involved in economic development and in the planning process.

However, prior to the 1970s, analysis had already begun of the spatial aspects of development. The question of spatial scales in less-developed countries received more attention when development models and their related projects started appearing in particular regions of a country. A clear trend towards a much broader view of the problem emerged, in which the economic features of development were seen alongside the geographical characteristics (Wood, 1977; Parr, 1979; Mabogunje, 1980; Enders, 1980; Cole, 1981; Wong and Saigol, 1984).

Studies related to the present research include early geographical works which analyse the impacts of regional oil development in Iran and Nigeria. An early paper by Melamid (1959) attempted to evaluate the cumulative effects of oil production in Iran on the pattern and functions of transportation, which in turn strongly influence geographical patterns of urban and rural development. Work on the Nigerian petroleum industry evaluated the geographical trends in production, refining, transportation, pricing and marketing of petroleum products (Melamid, 1968). The author made use of an historical approach to analyse the evolution of the structure of the petroleum industry in its geographical setting. In both studies Melamid suggested the existence of common geographical patterns which can be found in some other areas both in developed and less-developed countries. Other studies (Pearson, 1970; Melamid, 1973; Olu Abiodun, 1974; Melamid, 1975; Schliephake, 1977) analyse the impact of the oil

companies' operations on economic and political geography and on regional settlement patterns in the countries concerned. Moreover, these studies provide significant clues for the identification of economic regions together with the transportation and hierarchical structures that emerge in those regions as development proceeds.

A more recent Iranian study by Melamid (1973) appears to be relevant to the analysis of petroleum production and development in other areas. The spatial implications of the policy of reducing the geographical dispersal of ancillary activities and services related to crude-oil production in Iran are analysed. He identifies a "satellization" scheme through which two major interrelationships between petroleum activities and development take place. One concerns the indirect accumulation of additional revenues from petroleum production since half of the savings from satellization are passed to the oil-production states. The other concerns the way in which the spatial centralization of oil-related activities induced the concentration of settlements that in the Iranian context seems to be a serious constraint on development plans.

Schliephake (1977) provides an interesting account of indirect and direct effects of the oil industry on regional development. In the context of the present study a major contribution is the analysis of problems of spatial structures, locational preferences and economic mechanisms affecting regions where an oil industry is to be developed. The study highlights in a very precise way the problems deriving from connections between the upstream and downstream petroleum operations and agriculture in Algeria. Emphasis is also placed upon the changes in cropping patterns as a result of

labour-intensive trade and the arrival of new food consumption patterns emerging alongside the oil-related developments.

Other useful work closely related to the present study includes that presented by Allan (1973), which aims to analyse Libya's transformation as a result of oil developments up to 1967, with particular emphasis on its implications for agriculture. Agricultural development patterns in the early oil years are discussed and the radical changes from 1911 to 1960 are analysed. The author suggests that besides the inherent problems of agriculture reflected in its competitive position against integrated modern industries, Libya's development of domestic agriculture has been directly and indirectly affected by the increased income from oil. In the context of the present study this work provides a basis for the discussion of land use and agricultural development and how these are reflected in the spatial structure of a less-developed country. Similarly important is the effort to present an account of investment in Libya's agriculture, since investment patterns constitute an important element in the analysis of economic and geographical patterns involved in agricultural development.

With regard to the North-Orinoco region, some studies have been published in Venezuela. The most useful study is the Plan de Ordenamiento para la Faja Petrolifera del Orinoco (Ministry of the Environment, 1982) which provides qualitative and quantitative data on the region in terms of its physical and socio-economic structure, and suggest regional policies for urban and rural development, industrial growth, agricultural expansion and service improvements. Similarly, the Centro de Estudios de Desarrollo de la Universidad Central de

Venezuela (1982) has produced an account of the spatial and socio-economic changes taken place in the region as a result of the development of the Orinoco oil fields, with particular attention to the changes that have occurred in the portion of the state of Anzotegui that forms part of the North-Orinoco region.

Finally, some theoretical concepts can be derived from the works of Von Lazar and Duersten (1976), Carmoy (1974), Al-Sabah (1980), El Mallakh (1982) and Rauch (1982) in relation to economic development and policies in the context of less-developed countries. Moreover, there are some recent studies that, although referring to the problem of oil impacts in the development countries, provide an important framework for the present study. McNicoll (1980), McDowal and Begg (1981), Blackadder (1982), Mc Nicoll (1984) analyse the implications of onshore activities in the United Kingdom associated with North Sea oil developments, essentially focussing on the rural regions of Scotland. The importance of these studies, particularly McNicoll (1984), is that they demonstrate the underlying similarities in the patterns of oil impacts on Scottish rural areas due to a "mismatch" between the oil industry requirements and the supply capabilities of the region. McNicoll in his empirical work suggests that his conclusions may be applicable to other areas although he does not specifically mention less-developed countries.

1.3 STRUCTURE OF THE THESIS

The literature cited in the foregoing review provides a relevant and useful basis from which to proceed with the investigation and

development of the present study.

This thesis is organized into eight chapters. Chapter 1 is an introduction to the study, which outlines the objectives and research methodology together with an account of the related literature. Chapter 2 provides a background to the problem of petroleum resources and development and focuses on the analytical framework considered essential for the understanding of the problem in question. In Chapter 3 an account is given of the different kinds of interaction between petroleum production and agriculture in oil-producing developing countries.

From this point onwards, the thesis examines the petroleum-agriculture interactions in the North-Orinoco region of Venezuela. Some relevant physical and economic features of the study area are outlined in Chapter 4. Chapter 5 assesses changes in the agricultural patterns in the area of study: land-use, cropping patterns and input requirements in the agricultural sector are viewed in relation to the influence and impacts of the oil-industry development. Chapter 6 evaluates the changes in the farming economy as a result of the growth of oil-based development. Chapter 7 explores the question of the management of the agricultural space in the area of study by focussing on the attitude of the petroleum industry towards an integrated petroleum-agriculture development. Chapter 8 presents the conclusions of the research and some suggestions for the further study of the spatial interactions between petroleum and agricultural activities.

1.4 RESEARCH METHODOLOGY.

In order to achieve the main objectives of the study various research activities were undertaken. The first activity includes the review of published and unpublished materials related to the subject, such as books, periodicals, statistical sources, newspapers, government documents and theses which were acquired through libraries in both the United Kingdom and Venezuela in 1985-1987.

The second activity was a fieldwork programme carried out in Venezuela in 1986, during which data were gathered mainly in the South of Monagas and Anzoategui States. Minor work was accomplished in Guarico State. This was done in this way due to the fact that oil-related activities in the North-Orinoco region have been concentrated primarily in Anzoategui and Monagas States while in Guarico State oil development has hitherto been marginal. During the fieldwork programme conversations and interviews were held with officials of the governmental institutions at the national level (such as the Venezuelan Petroleum Industry, the National Planning Office, and the Ministry of the Environment) as well as with academic staff of the Departments of Economics and Geography and the Development Studies Institute of the Universidad Central de Venezuela. At the regional level, interviews took place with regional officials of the national oil subsidiaries of Petroleos de Venezuela, S. A. responsible for the exploitation of the Orinoco oil fields. Moreover, it was possible to participate as an observer in seminars organized by public bodies involved in the formulation of regional policies and in the analysis of the problems of the area of study. Useful information was also obtained by examining land-use maps and visiting the sites of oil developments to observe the physical and

structural components of the oil industry. Revision and analysis of statistical data was also undertaken during the fieldwork programme.

In addition, a survey was made to obtain information at the farmers' level in relation to the changes observed in agriculture since oil development was initiated. Because the area of study is very extensive and could not be fully covered in the time available some limitations were imposed. Three scales of analysis were established for the purposes of this study: a regional scale, a community scale and a farmer scale. In establishing the regional scale, a grid was used to subdivide the areas of the three main states according to current oil production. Thus, representations of 50 per cent, 30 per cent and 20 per cent were given to the states of Monagas, Anzoategui and Guarico respectively. From the total of 30,444 rural households in the area a sample of 200 respondents was selected, which represents 0.656 per cent of total households. Thus according to the percentage of representation in each state, the sample of respondents was geographically distributed as follows: 100 in Monagas State, 60 in Anzoategui State, and 40 in Guarico State.

The sample at the community scale was based on localities within a 20-km radius of oil-based developments. The assumption in this case being that such communities would be more likely to be affected by oil activities than more distant communities. Ten communities were selected by this criterion. In each, 5 per cent of the total number of households (based on the 1981 census) were chosen; this yielded a distribution of the sample among the different communities as shown in Fig. 1.5.

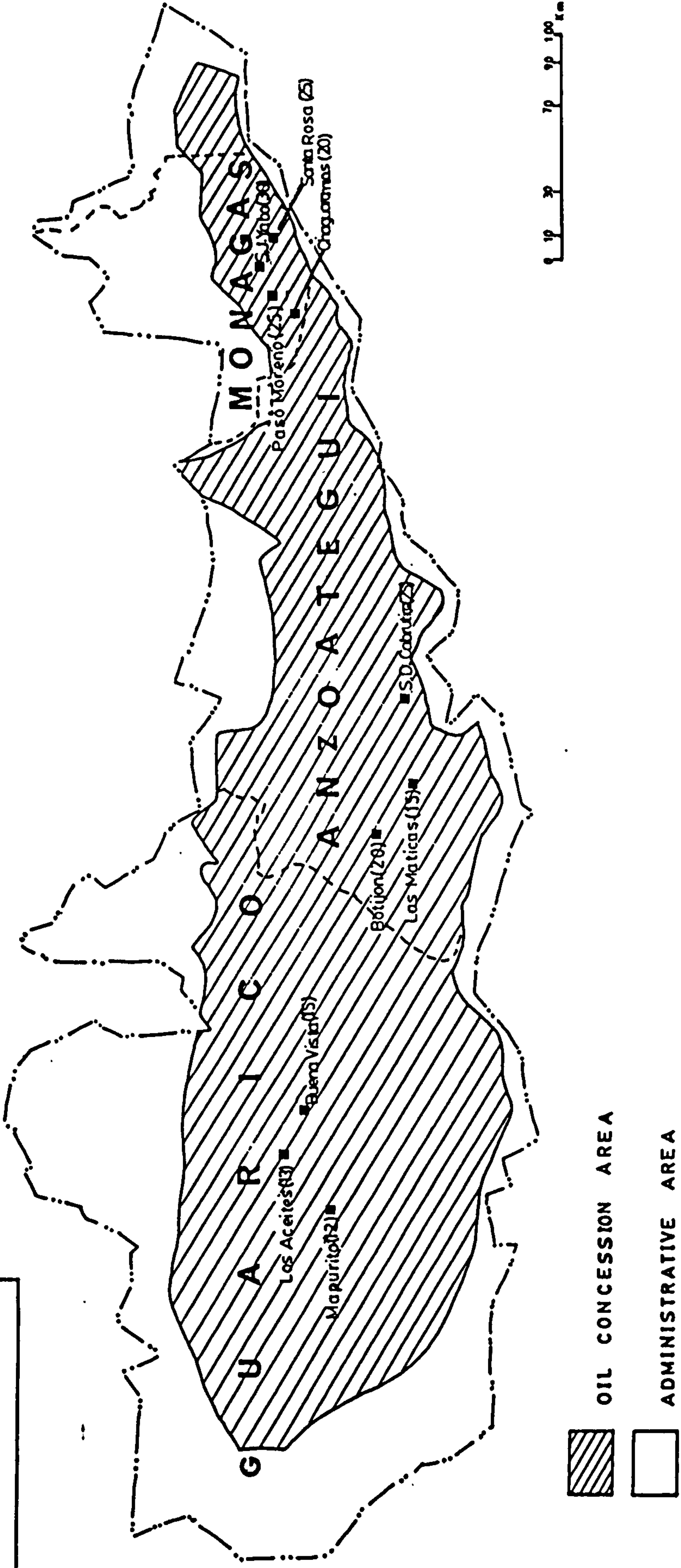
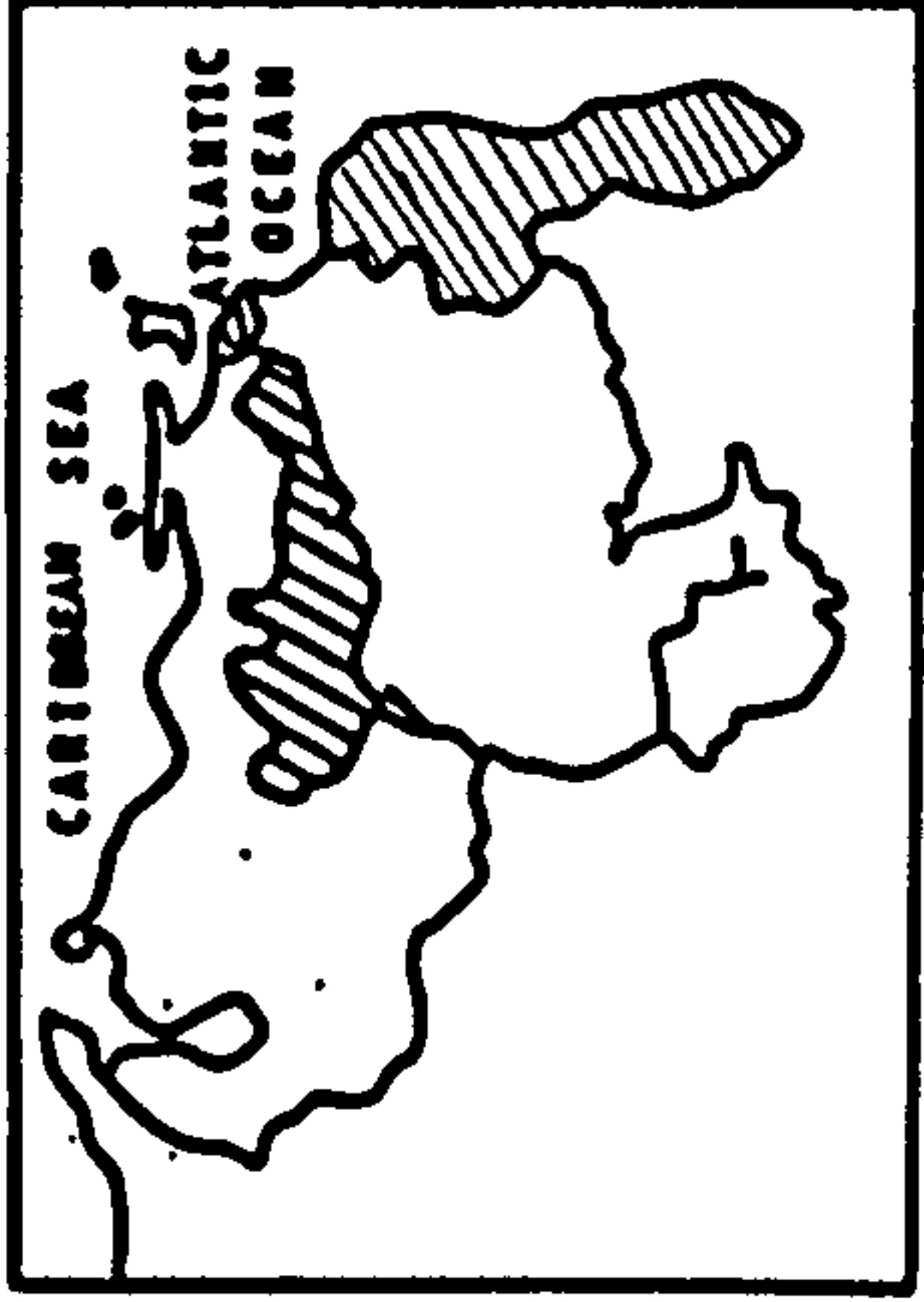


Fig. 1.5 The North-Orinoco Petroleum Region: graphic representation of the sample.

On the farmer scale the selection procedure consisted of choosing farmers according to the size of each farm, assigning 75 per cent, 20 per cent, and 5 per cent of representation to farms with 0-500 ha., 500-5000 ha., and >5000 ha., respectively. This was made on the assumption that farmers within the first and second groups would be more likely to be affected by the oil-based activity. A questionnaire was applied to one in every five households and the selection was accomplished by means of a Table of Random Numbers (using the first number in the first column of five-digit numbers and then proceeding downward in the table, re-starting in the second column until necessary numbers were achieved).

At this point it is important to mention two key methodological problems of this study. The first one concerns statistical analysis, since quantitative description of macroeconomic aggregates and land resources are basically recorded at the regional level, and therefore disaggregated data at the farm level is extremely difficult to obtain. For example, investment in agriculture, cropping patterns, employment structure, service facilities, and energy supplies are not standard categories which can be used for explanation at the local level. However, in order to overcome this problem in the present study, some assumptions valid at the regional level will be applied systematically to the local level. The second important constraint has been the reluctance of farmers to provide the information required. This is a common handicap in the country as a whole as a result of the over-use of surveys by different governmental institutions and the unfulfilled expectations created in the minds of local people with regard to the solution of some of their

basic problems. Nevertheless, to compensate for this difficulty, additional information has been obtained from leaders or other influential individuals of the communities studied. These limitations do not appear to have seriously undermined the relevance or potential usefulness of the study as a whole, as far as can at present be determined.

Analysis of data for the study has been accomplished seeking to test relationships between a wide range of variables derived from the sample of farmers. The nature of these variables suggested the application of non-parametric test. The Chi-square test, frequently used by geographers, seemed the most appropriate. All of the quantitative analysis involved much use of the University of Southampton Computer Services.

1.5 CONCLUSIONS

This chapter has outlined the context and purposes of the research by providing an introduction to the problem and to the means by which the findings have been obtained. In the chapter which follows, the interrelationships between petroleum resources and development will be looked at more closely, starting with a consideration of the role of energy resources in development, followed by an analysis of the nature of interdependence in the present context.

CHAPTER 2: PETROLEUM RESOURCES AND DEVELOPMENT: AN ANALYTICAL FRAMEWORK

The first chapter of this thesis set out the aims, methods and structure of the study in the context of earlier work. Now we turn to an examination of the question of relationships between petroleum resources and development in structural terms. This chapter begins with a brief account of the general role of energy in development, concentrating on the implications arising from the interaction between petroleum resources and development in the oil-exporting developing countries. The analysis of these aspects will provide a theoretical framework for the understanding of the role that the energy-resource base of the North-Orinoco region of Venezuela is expected to play. The last section of the chapter will present the methodological approach selected for the study of the North-Orinoco region.

2.1 THE DEVELOPMENT ISSUE AND ENERGY

The question of energy problems and their implications in terms of both national and international space is a matter of increasing concern to many individuals, to governments and to the world as a whole. Several major studies (Manners, 1976; Niermg, 1980; Smil and Knowland, 1980; Maull, 1980; Shaw et al., 1984) have sought to analyse the late twentieth century period of energy transition, in which a crucial factor is the attempt to move away from the use of finite and easily depletable resources, notably hydrocarbons, which at present constitute the world's most important sources of energy (Fig. 2.1). This period of energy transition has arisen as a response to different objectives, decisions, strategies and political factors in both the major world areas involved in the process, namely

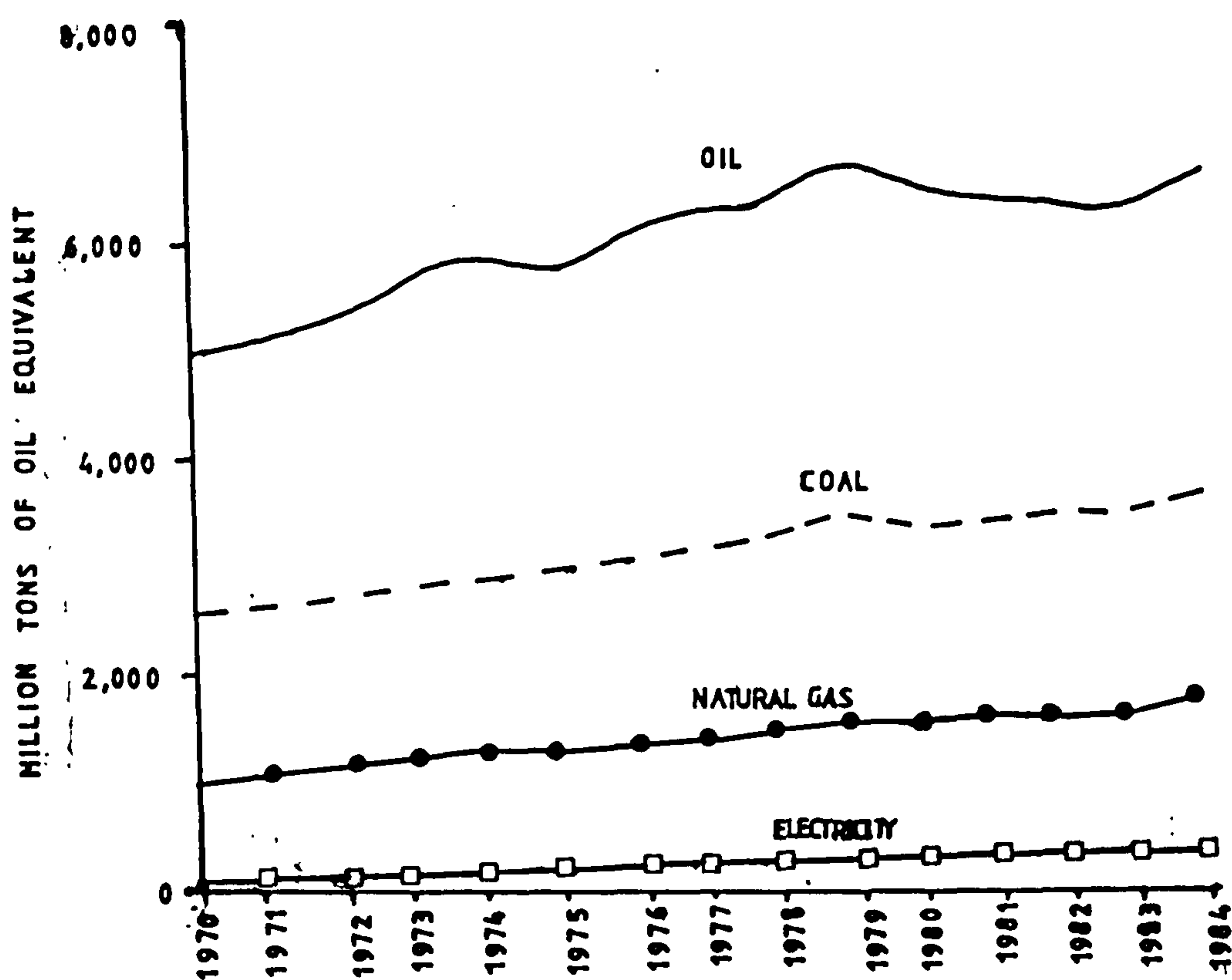


Fig. 2.1 World pattern of commercial energy consumption, 1970-84 (adapted from Energy Statistics Yearbook, 1984)
The values are individual values not cumulative.

the advanced industrialized nations and the less-developed countries. It does not seem to be clear, however, whether, how or when the end of the period of energy transition will be reached and a new energy era will be inaugurated. The patterns of oil consumption, for instance, after the 1973 increases in oil prices, do not appear to suggest any reversal or even a substantial modification of established trends (Fig. 2.2). As Odell and Rosing (1984) have argued the world's energy system is and is likely to remain dominated by hydrocarbons.

It is not the concern of this chapter to discuss these points in detail, for any such discussion would require an analysis of structural changes in international power politics at the global level. Nevertheless, the importance of these issues must be stressed in the light of the new international economic order, in which oil-exporting nations, mainly OPEC member nations, have started to insist that the problems of energy supply and demand are only a part of the broader problem of restructuring the world economy. In order to ensure long-term exploration and development of energy for the whole world, the creation of a favourable international economic framework and a more stable political climate is a general requirement alongside more specific agreements about fairer terms of world trade, balance of payments, greater access to advanced and appropriate technology, and ways of diminishing the impact of world inflation.

Energy problems today are not exclusively the concern of the physical and technological sciences - in terms of physical availability, finiteness and the non-renewability of fossil energy, but they have also become a focus of attention within many other disciplines which deal with the broad range of socio-economic and spatial aspects of

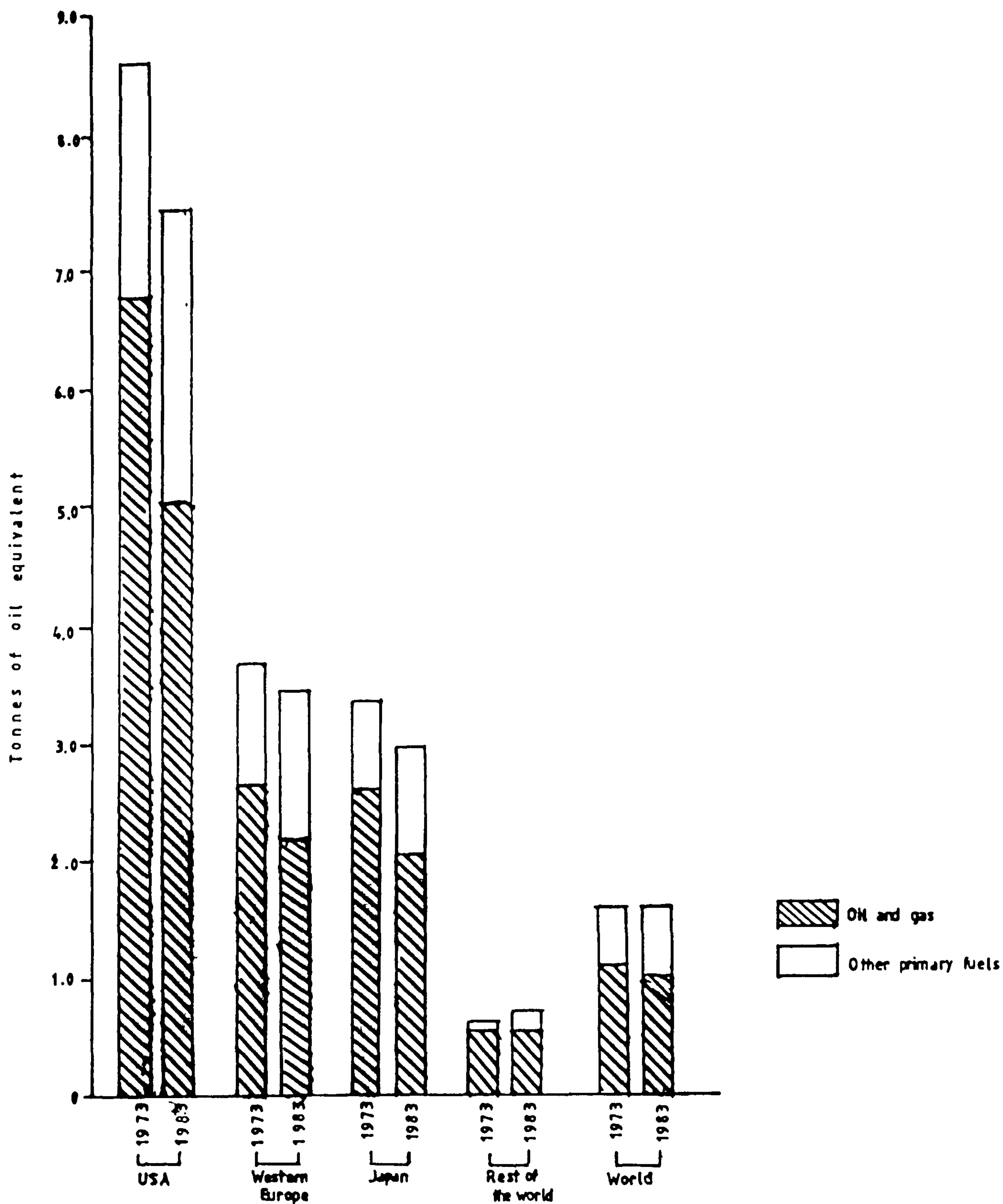


Fig. 2.2 World energy consumption by major geographical areas, per capita, 1973 and 1983 (adapted from British Petroleum, 1984)

energy production and energy-related developments. Energy issues are fundamentally related to the concept of resources, but resources should not be perceived merely as a gift of nature, and the products derived from them treated simply as a form of capital. Nor should resources be seen as "mere factors of production commanding a rent just as any man-made fixed asset does" (Dormer and El-Shafie, 1980, 252). Rather, energy issues should be seen in relation to a concept of resources which has changed over time and which varies in spatial terms due to technological innovations and the world's changing economic condition. Three elements in particular should be taken into account: a) the economic efficiency of energy use; b) the role of energy in economic development; and c) environmental impacts. Each of these elements will be discussed in further detail.

2.1.1 Economic efficiency

The question of energy efficiency can be analysed from many diverse perspectives. According to Willrich (1975) there are several alternative ways of measuring efficiency in relation to the development and use of energy resources. It can be done by means of assessing the least costly use of energy; or by establishing the relationships between energy consumption and the gross national product (GNP), the interlinkages between energy and the development of specific processes or activities, or the relationships between levels of energy consumption and standards of living. Although, as Willrich has pointed out, all these alternative approaches to the assessment of economic efficiency present limitations in their use, the "least cost" criterion seems to be most reliable. It can be argued that sources of energy such as coal and nuclear power are today cheaper to produce than

oil per barrel of oil equivalent. Nevertheless, as Sayigh (1983) emphasises, the substitution of oil by either of these alternative sources of energy is very limited because of technical particularities that are very expensive to overcome. In this context oil still remains an efficient energy resource.

2.1.2 Energy in relation to growth and development

The role of energy in relation to economic development involves a dual perspective: on the one hand, the role of energy in the specific context of economic growth; and, on the other hand, the role of energy in the wider context of the multidimensional process of development. During the 1950s and 1960s it was argued that economic development could be measured by the overall "ability of a nation to expand its output (i.e. rate of growth of per capita GNP) at a rate faster than the growth rate of its population" (Todaro, 1981, 68). Moreover, this improvement in the growth rate of GNP seemed to be largely possible in those circumstances in which the energy-fed capital goods have made available the process of production. In other words, it can be argued that there is a direct relationship between the use of energy and the overall economic development of any given society, when that development is measured in terms of GNP (Fig.2.3).

As long as a society relies upon energy to change its pattern of productivity in relation to labour and capital, increases in per capita GNP would be expected. In some of the already industrialized countries there is a correlation between changes in consumption of energy per capita and changes in real GNP per capita that may be considered to support this argument. However, as Willrich (1980) has

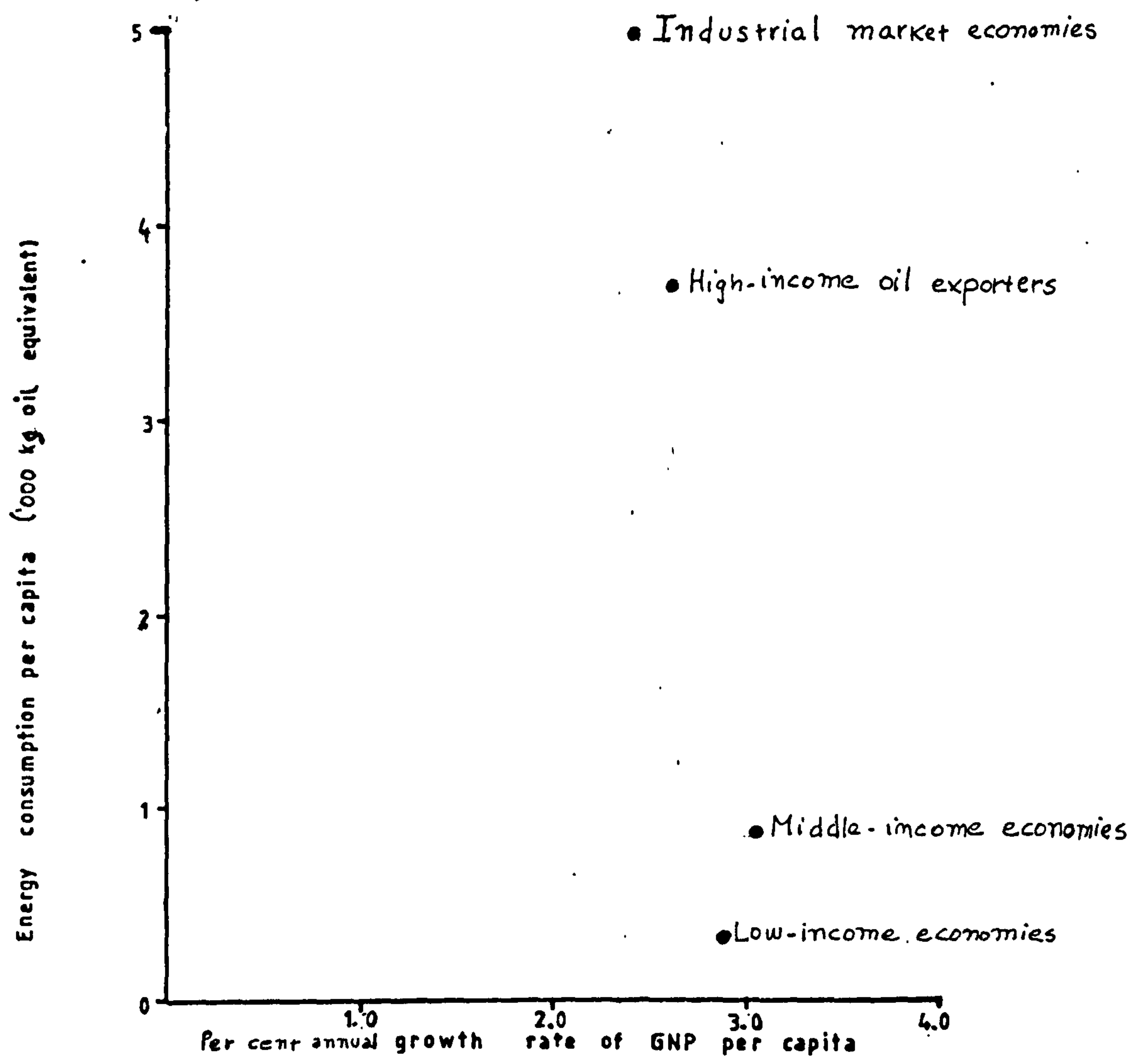
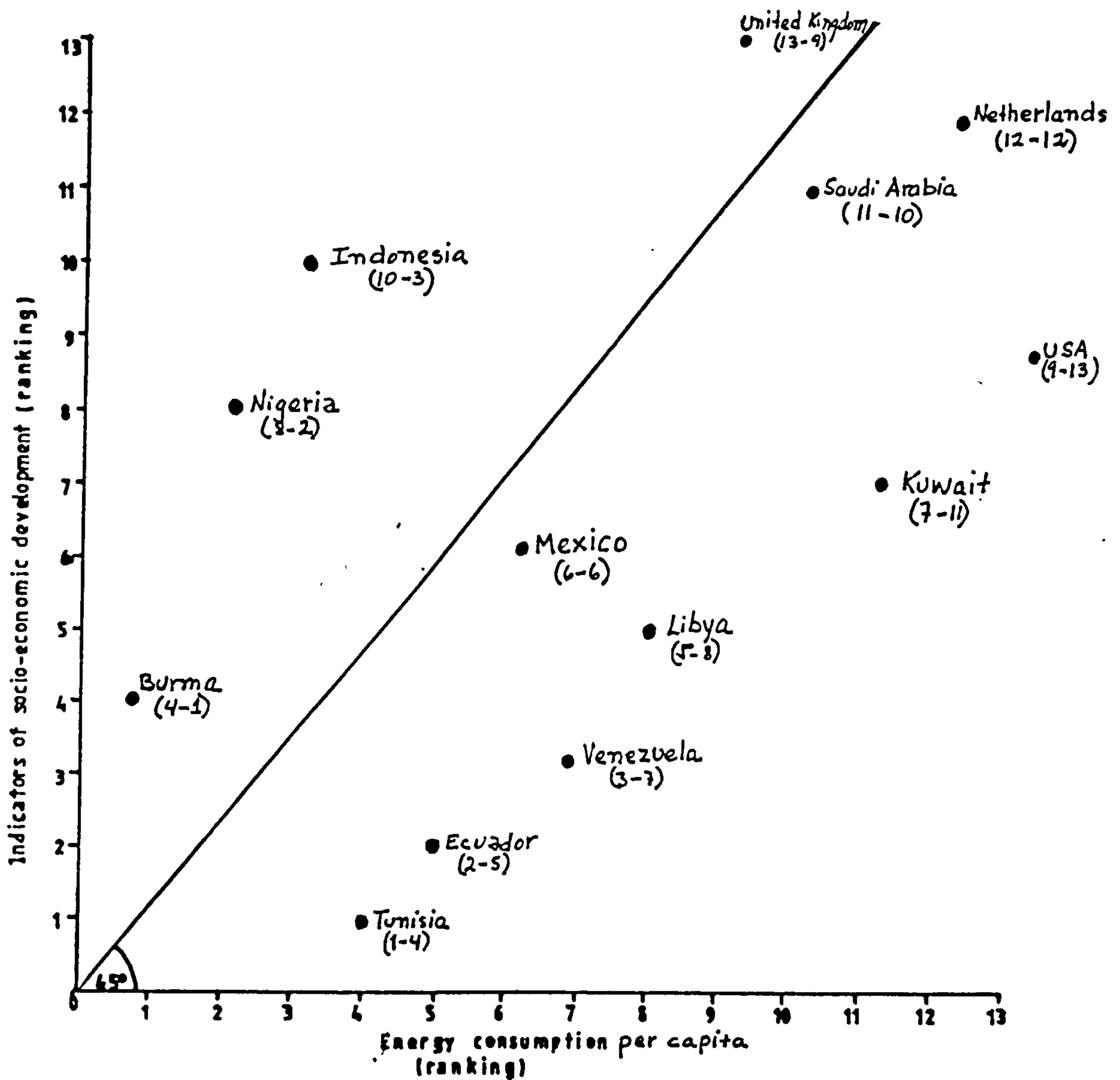


Fig. 2.3 The relationship between energy consumption per capita and GNP per capita by major country groups, 1985 (source of data: World Development Report, 1987)

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pointed out, in the long run, economic growth does not necessarily depend upon corresponding growth in energy use; in Denmark, West Germany and Sweden, for example, GNP per capita is comparable to that in the USA, although they use only 40-50 per cent of the United States' per capita energy consumption. Furthermore, most of the low-income developing countries have shown relative increases in energy consumption during recent years, and yet they are considered to be the poorest countries with the lowest anticipated economic growth rates. Therefore, according to these criteria, economic development in these countries has not been satisfactorily achieved despite the energy consumption growth rates that have occurred.

How far is it appropriate, then, to assess the role of energy in the economic development of nations by ability to generate and sustain an annual increase in a country's gross national product? To what extent is it necessary to reformulate and broaden the question towards a point where the role of energy is judged according to its impact on society as a whole? An appropriate answer is that the development of a country should not only be measured by the acceleration of economic growth, but also by the ability to provide people with the means of raising their standard of living, represented by greater employment opportunities and income, and by more substantial and assured access to food supplies, adequate housing, health care and education facilities. Energy should be understood in this context, not *solely* as a tool to increase GNP; development should be considered and measured in terms of the ^{wider} links between energy and the multidimensional process of development (Fig.2.4). According to this last criterion, one can look at some countries, both in the industrialized and the developing



* Note: Indicators of socio-economic development are: income, birthrate, deathrate, life expectancy, infant mortality, literacy.

Fig. 2.4 The relationship between energy consumption per capita and socio-economic development for selected countries, 1985 (source of data: World Development Report, 1987)

world, in order to establish the patterns in the role of energy. It seems that energy has served directly the development of society as a whole in some countries, but in others development has been less successful and no clear correlation with energy consumption has been established.

2.1.3 Environmental impacts

A third element, by no means the least significant, in the consideration of energy issues is the environmental risks and uncertainties emerging from the increasing use of energy. A great deal of concern has been shown in recent years about the links between energy resources and environmental impacts. One of the first approaches to this problem came from a report of the Club of Rome's project where it was considered that the carrying capacity of the environment (i.e. the capacity for continuing production and consumption of both renewable and non-renewable resources and the capacity of the environment to absorb and cycle waste from industrial processes) merited further research (Meadows et al., 1972). In the context of energy-related activities, as Willrich (1975) pointed out, production and consumption have been vigorously encouraged before a clear understanding of interrelationships with the environment has been elucidated. The operations in the energy industry were considered as beneficial to society in general, and environmental impacts were not regarded as a serious problem. But since the industrial countries realized that adverse environmental effects have been accumulating more rapidly than the positive benefits of energy use, this assumption appears to have been increasingly questioned.

An examination of the environmental consequences in the energy-production/consumption cycle (extraction of resources, and the generation, transportation and consumption of energy) can be attempted by means of the spatial separation of cause and effect. This is true both in advanced and in less-developed countries. In the geographical and environmental circumstances of the developing countries, environmental problems may be considered in a more general perspective. The effects of energy production may be seen locally, at the place of resource extraction, or elsewhere, at the place of consumption, or in a wider international context. Areas within a national territory that are sources of fuel needed elsewhere can be affected not only by the resource extraction measured in terms of the irreversible changes in land use and in the condition of the land; they can also be affected by effluents such as smoke or waste heat from places where fuel is converted to heat.

Those energy consumption areas within the national boundaries which are recipient of energy production, although gaining benefits from much more efficient industrial processes, are trapped by the environmental consequences of the industrialization process. Individual emissions, measured in terms of their effects on human health and in terms of the ecological imbalance, may result from the incomplete consumption or uncontrolled venting of fuels and their associated effluents. Thus, as Garvey emphasised, "Industry performs magnificent feats... to take things from the land, refine them, and mass-manufacture, mass-market and mass-distribute them to the so-called consumer; then the same mass of material is left, after use, to the so-called public sector, to be disposed of" (Garvey, 1972,

70-71).

At the international level, furthermore, environmental implications transcend inter-state boundaries. On the one hand, the over use of certain energy sources such as firewood which might threaten the international environment are located within (or below) national space. This is a rather difficult problem to tackle because decisions are often likely to be restricted to a specific territorial or jurisdictional area. According to Willrich, "it is unlikely that a national government would permit any outside interference with its sovereign prerogatives on environmental grounds. The rest of the world so far has no alternative but to trust the good judgement of the resource owner" (Willrich, 1975, 154).

Fuelwood resources can be considered as an alternative source of energy, mainly for the non-oil producing countries, and are a relevant example in this respect. According to Chatterji (1981), in the less-developed countries 90 per cent of the population use firewood as an energy fuel. In the Amazon region of Brazil, considerable changes in the forest landscape have taken place as a result of government policies designed to face problems of sovereignty in Brazil's frontier zones and to address problems of population growth in the North-east region. As Dickenson has noted, the scale of deforestation in Amazonia is imprecise but some figures suggest a current loss of 100,000 ha. of woodland per year. He suggests that for some critics, the actual rate of deforestation represents the "loss of the last great forest, the destruction of as yet unknown forest resources, the creation of a red desert, and, to some, a threat to the world's oxygen supplies" (Dickenson, 1983, 169). The environmental effects of

the depletion of fuelwood are recognised by the international community, which in the long run is likely to be affected by the uncontrolled exploitation of Amazonia. However, decisions are assessed, and standards established and administered at the national level. To the benefit of the entire world today, there appear to be increasing signs of national awareness within Brazil of the present hazard associated with the natural environment of Amazonia, but international involvement in this matter has not proved to be entirely successful.

In contrast, the development of off-shore resources, mainly represented by petroleum exploration and production, has produced a more obvious and immediate effect on the international environment. The location of such activities eventually affects a wide variety of birds and other wildlife species. Moreover, since off-shore oil and gas developments invariably require on-shore support in the form of terminals, platforms and a variety of support industries, the concurrent growth in population and economic activity may lead to a further impact on the ecosystems of the oceans.

Therefore, as the energy production/consumption cycle runs its course, the emergence of environmental costs can take place either nationally or internationally. This matter has been of great concern in recent years. For some, it represents a threat to the earth's resources and peoples of today and the depletion of natural resources to the detriment of future generations. However, a critical question is how national economies could function adequately, taking fully into account environmental values and social costs, without foregoing opportunities to achieve economic improvements. In the context of the

North-Orinoco region of Venezuela, the incorporation of these environmental considerations within the decision-making processes is of great significance.

The three elements outlined above, namely economic efficiency of energy use; energy and economic development; and energy and environmental impact, provide us with a framework for proceeding with the discussion of petroleum resources and development. At this point it is relevant to state that in the development of the North-Orinoco region these elements ought to be taken into consideration if a satisfactory outcome of the relationship between energy production and development is expected to occur.

2.2 PETROLEUM AND DEVELOPMENT

The study of the extent to which petroleum resources have been instrumental in promoting development must be regarded as an issue in which certain interdependent factors are involved. There are economic variables intimately related to petroleum resources such as revenue utilisation the analysis of which should not only take into account the effects on the whole structure and organization of the economy but should also involve a geographical dimension, with attention being given to the patterns in the use of financial resources and its distribution at the national, regional and local level. Similarly, consideration of the petroleum resource endowment available to facilitate the development process, it is important to consider physical and technological factors such as exploration and exploitation, transport systems and service facilities as well as the geographical location and the environment in which the oil industry and associated activities are set.

Thus there are problems related to petroleum resources and development that demand disaggregative approaches (Brookfield, 1975). If one agrees with the assumption that there is a totality formed of constantly changing and interrelated structures that underpin the process of development, irrespective of the concepts and values of the pattern of development adopted, a balanced assessment of the different factors involved is clearly required.

Regarding the significance of the oil industry, it is possible to identify various factors involved in situations where petroleum activity is expected to serve as an impulse for development, at least in theory. According to Maul (1980) these are: forward linkages, technological linkages, local expenditure on goods and services, infrastructural development, and capital and foreign exchange flows. It is relevant to consider the performance of these factors in the petroleum-exporting developing countries and to examine ways in which socio-economic and spatial dimensions are intimately related in some of these contexts.

2.2.1 Forward linkages

These are understood to include the development of activities and capabilities falling within, and required by, downstream operations such as refining, petrochemical industries, tankerage and distribution, and activities in support of ancillary and generally-associated industries. Sayigh (1983) points out that a leading oil industry should produce not only first generation activities such as those named above but also second and third

generation of forward linkages expressed in high levels of investment and employment, diversification of the economy, and increases in contribution to GDP. In the context of the petroleum-exporting developing countries (with few exceptions such as Iraq and Kuwait) these forward linkages have been established in such a way that economic activities are not located in the same region or even the same country where oil industries are situated (Bosson and Varon, 1977; Spooner, 1981). Furthermore, the expected multiplier process increases income and employment; yet investment and diversification of the economy, when they take place, have little impact in the intervening areas. The outcome has been a short life span of intensive development in the early stages of oil production followed by a series of improvements in areas far away from the oil-producing regions. This geographical dissociation between producing regions and developing regions in a more general sense is particularly characteristic of oil-dependent economies, and contrasts sharply, for example, with coal-dependent economies a century ago.

2.2.2 Technological linkages

These are recognized as another important factor in the development of the petroleum economies. Maul (1980) has pointed out that technology is not only responsible for improvements in the productivity of the petroleum resource base but it should additionally allow the acquisition of technical and organizational expertise to be transferred to other sectors of the economy. It is widely accepted that technical skills are one of the scarcest commodities throughout the world, especially in the case of the developing countries where this constitutes one of the major barriers to development. In

oil-exporting developing countries, technological developments are generally associated with the nature of the oil-resource base, the economics of petroleum production and the patterns in the marketing of petroleum products (Manners, 1964).

In the course of the normal operations of the petroleum industry, technological linkages are expected to be achieved when constraints in the physical environment, manpower, infrastructure, and transport facilities are overcome. Yet again, as is the case in the developing countries, the nature of the hydrocarbon-base industries necessitates highly sophisticated technology and a highly specialized labour force which can hardly be used in other sectors of the economy and the source of supply of which is in general terms the western world. As Pearson (1970) has singled out, these linkages are not particularly effective in breaking up technological bottlenecks. Technological linkages, therefore, are established but not within the producing country.

2.2.3 Expenditure linkages

Within the process of development of productive activities, a production-consumption mechanism takes place (El Mallakh, 1982), generating an expansion of demand for consumer-oriented goods and services from the increased number of workers employed in those activities (Chorley and Haggett, 1967). If this assumption is valid and is applied to the case of petroleum production, one should refer, then, to the ability of an oil-producing country to absorb wages and salaries derived from the oil industry in such a way as to generate demand of goods

and services produced within the national/regional territory. However, what is found in most oil-producing countries is that, although wages and salaries are paid locally at the place of oil production, expenditure on goods and services does not occur in the same way. The impact on the local economy is relatively modest since the proportion in the earnings of the labour force spent locally, appears to be well below the earnings spent in extra-local goods and services. Moreover, as a result of "display effects" by a western lifestyle, which seems to be a very common feature in the consumption patterns of the oil-producing developing countries, the demand for imported goods increases. This reduces the chances for diversification and the possibilities of stimulating local goods and service industries. All this creates a situation in which multiplier effect of expenditure on goods and services is unlikely to be wholly localized within the oil-producing region, since the operation of the oil industries will demand a large proportion of manufacturing, trade and service activities and employment mostly concentrated in certain growth centres.

2.2.4 Infrastructural development

There is an assumption that economic growth and development is inconceivable without the formation and constant development of the infrastructure (Bognar, 1969). The provision of economic infrastructure (railways, roads, power stations, ports) and social infrastructure (schools, housing and medical facilities) which economists term economic and social overhead capital, has become part of planned or systematic development, either as a first priority to attract investment in productive activities or as a response to

demand. In the first case, the result has been the configuration of growth-centre policies that emphasize economic expansion primarily obtainable through the concentration of infrastructural investment (Spooner, 1982), and in the second approach integrated development schemes have been set up (Hilling, 1978). In the less-developed countries there is a recognition of the need for a proper infrastructure that can be beneficial to all sectors of the economy. However, solutions to development problems cannot be achieved simply by the formulation of schemes concentrating on infrastructural projects.

In oil-producing developing countries it can be found that there are serious constraints affecting the relationship between infrastructure and development. Despite the fact that infrastructure has been considered inadequate and sometimes over-used (Mountjoy, 1982), the vast investment involved in the construction of infrastructural facilities to serve oil-related developments in the early stages implies the creation of job opportunities and demand for local goods. Nevertheless, in later stages, more permanent uses not linked solely to petroleum production are unlikely to be found. Moreover, the infrastructure developed for the oil industry tends to reflect the export-oriented structure of the oil economies, where as the national transport and communications system are mostly located in the coastal growth-pole areas, benefitting export and import flows but establishing and encouraging a highly diversified development surface involving limited 'islands' of advancement. Such a pattern implies considerable disadvantages in local production and other features of development.

In general, complex infrastructures for the petroleum sector of the oil-exporting developing countries may act as a disincentive to the development of other productive activities and may appear to be designated or adopted in such a way as to restrict the spread of benefits.

2.2.5 Financial development

The significance of oil resources in a developmental context lie in their capability to generate revenues and thereby to promote economic development, diversification, and especially regional development. The benefits of increasing revenues can be seen in increases in per capita GNP and in higher income growth, and also in the magnitude of consumption and high levels of imports. In the majority of oil-developing nations statements about the proper use of revenues have been repeatedly made. For instance, it has been argued that far from being merely economic in nature and scope, oil revenues should be related to "the performance, the well-being, and the future of the many millions of human beings they are supposed to serve" (Sayigh, 1983, 15). Moreover, as Niblock (1980) has stated, there is a firm decision - at least in theory - by the Arab Gulf states to invest oil revenues in modern science, technology and management in order to develop all resources in the Gulf countries including those in the agricultural sector. However, in reality what is recorded is a structural imbalance between a large financial sector and small underdeveloped other sectors such as agriculture, which has implications for the spatial and economic structure of the country. The volume of fiscal earnings is not fully disbursed throughout the economy so as to develop a

promotive force for the building of productive capacity nor so as "to achieve economies of scale to increase employment, to reduce dependence on one source of export earnings ..." (Maul, 1980, 127).

The problem of allocating revenues derived from resource exploitation is in general a very difficult task in developing countries. Several options are available: disbursement among the various sectors of the economy, among various projects within a sector, among various regions of the country in which the projects are more feasible. In oil-producing developing countries the preference in allocation of revenues seems to lie with modern capital-intensive technologies supportive of the oil sector such as petrochemical industries, which may widen the gap between a rapidly growing sector and a traditional one. Furthermore, in this process of allocation of oil revenues it does not seem that there exists a geographical distributional pattern of revenues favouring the oil-producing areas. On the contrary, it seems that oil-generated revenues being obtained by the exploitation of a finite resource in any given region are normally shifted towards the more developed centres where administrative, political and service activities are concentrated.

Thus it appears insufficient to evaluate the real impact of petroleum revenues upon oil-developing countries solely in terms of the quantitative aspects of revenue utilisation. It is relevant also to measure the implications arising from the use and distributional patterns of oil revenues in relation to the spatial structure of any given country. The factors already described are all expected to play some part in the process of development of the oil-producing

developing countries. Nevertheless, the complexity of these interdependent factors makes the design and achievement of an appropriate developmental path a very difficult task. Consequently, a process of radical change in the economic geography of these countries may develop, especially in the early stages of the development process, bringing about new patterns of economic activity, regional structure, social mobility and standards of living. In some cases this process may tend to generate distortions in the countries' spatial structure. As far as the North-Orinoco region is concerned, the essential question that arises is whether petroleum development takes place within an interdependent framework, being related to the development of other sectors of the economy, particularly agriculture. Chapters 5, 6, 7 will address these issues in more specific terms.

2.3 METHODOLOGICAL APPROACH

The study of the relationship between petroleum resources and development may involve several alternative approaches. The following section outlines the most common approaches including the regional multiplier analysis, the spatial impact analysis and the developmental models. The main features of an integrated approach, within which the intricacies of the present study can be appreciated in some depth, are also introduced.

2.3.1 Major related approaches

2.3.1a The spatial framework

In this line of methodological thought the regional multiplier analysis has been suggested as a model of spatial variation in economic development within regions of countries, dealing with the mechanisms by which a "rise in income, production or employment in one group of economic activities in a region stimulates the expansion of other groups, through an increased demand from the former group and its workers for the goods and services produced by the latter" (Chorley and Haggett, 1967, 275). According to this analysis, a propulsive force -termed an export-base industrial sector - is established, generating multiplier effects which would supply the needed inputs of the national economy and would bring about the development of the local economic system in general. In Hirschman's terms (1958), this process would create backward and forward linkages by which "master industries" would induce the development of other industrial activities close to the existing industries' location.

This model was first used for identifying the economic impact of employment, income, household purchases and induced investment upon regions as in the case of the study produced by Barford (1938) about the effects of a large local oil factory upon the city of Aarhus, Denmark. Later contributions to the problem of regional analysis (North, 1955; Isard, 1960) caused the method to be subjected to several criticisms and corrections. As Isard (1960) showed there are technical and conceptual difficulties in the use of the regional multiplier analysis. These difficulties are concerned with the selection of units of measurement for employment, income and production; the components present in basic and service industries; the

delineation of the geographical area; the application to projection purposes. The most relevant criticisms are in respect of the locational implications and the overall regional growth. Firstly the development of industrial activities in a region does not necessarily reflect in the development of locally-oriented production and consumption of goods and services. It may bring about the development of those activities in other regions and thus may transmit to them elements of its dynamism as might be the case in the Guayana region of Venezuela which according to Stohr (1975) has not yielded the expected development in this remote and empty eastern region and has caused considerable economic and spatial changes in the geography of the country.

On the other hand, as Myrdal (1958) put it, there may be the case of increasing returns in the region subject to development but this might have adverse effects on surrounding regions. "The positive flows to the favoured region will create backwash or negative effects upon other regions, for they will lose skilled and enterprising labour and capital, and will lag even more behind the growth region which will go on increasing its competitive activities and its real income" (Mountjoy, 1982, 87). Secondly, there is the assumption that multiplier effects take place in theory in conditions of external capital accumulation; with an adequate and well-established infrastructure; with a trade system operating on the basis of comparative advantage and equal exchange; and with equal stages of economic growth in all nations (Stohr, 1981). Clearly in this context, multiplier effects are unlikely to occur in less-developed countries where these conditions are not entirely fulfilled. However, paradoxically, in a less-developed area the mere fact of

the provision of economic and social overhead capital alongside the industrial base development may "generate more economic expansion than... in a mature region which already is well equipped with facilities and services" (Perloff, 1960, 94).

Another model which has been developed to cope with spatial urban and regional development is Spatial Impact Analysis which aims to provide an integrated picture of the consequences of a public policy plan for regions, rural areas or cities. The model deals with exogenous changes in a system within a specific time period (such as rises in oil prices) and in relation to policy measures such as the establishment of an industrial oil development. According to Nijkamp (1983) the model may be important for analysing the effects of complex decision-making, where a whole set of decision levels are involved. Perhaps the model gives a realistic view of regional problems, since it incorporates in the analysis economic, spatial and environmental variables. This is its advantage. Nevertheless, a strong criticism can be based on the argument formulated by Nijkamp (1983) that the model can be used to analyse any real-world situation and that consideration of differences in welfare and development patterns should not be taken into account. Most developed countries contain backward areas while many developing countries also incorporate economically advanced zones.

The regional multiplier model thus helps to explain some of the micro-economic aspects of the development issue including price levels, productivity, wages, employment, and market conditions in a situation of equilibrium in the economy. The spatial impact analysis goes a little further by integrating different

variables in the context of regional problems. However, it seems that both models have only a limited degree of usefulness and validity in the understanding of the relative economic and spatial advantages and disadvantages of development, particularly when referring to the geography of the developing countries.

2.3.1b The developmental model

The body of theories and models concerning the study of development is very wide and varied and is the subject-matter of many different disciplines. These theories have been used to study development between nations, or between different parts of a country, or between different sectors of the economy. In all cases, the studies have intended to offer explanations of the development problems giving emphasis either to the spatial aspects or the economic levels of development. For some (Myrdal, 1957; Friedman, 1973) the problem to be analysed is the process of diffusion- "spread effects" or "trickling down effects" that can be used to reduce the periphery's dependence on core regions. Put in another way, the argument is that there are developmental spread effects arranged in a functional hierarchy from higher to lower centres benefitting first the innovation in large cities as a way to ensure the development of the whole system. In this regard Berry (1966) noted the importance of analysing the innovation diffusion process and its backwash effects which in some cases - such as that of India, for example -has not resulted in a filtering down of development from the core to its periphery. In this same line of thought is the modernization theory which considers industrialization as a vital mechanism for keeping the momentum of development going and at the

same time a form of diffusion which brings about side-effects. The spread of modernization is not necessarily equivalent, however, to the spread of any one of its parts such as manufacturing, services, transport or administration; and the spread of modernization is not always a beneficial diffusion process since its scope for operation in economic and geographical terms is limited by a set of social, political or institutional factors.

For others (e.g. Harvey, 1973) the study of development is concerned with the instruments and mechanisms of the allocation and redistribution of resources. In this regard, Wilkinson (1973) has offered an ecological model of development in which there is special consideration of the technical elements needed to overcome resource scarcity. However, this model has been criticized on the grounds that it gives little emphasis to the redistributive aspects of the interconnected world system and does not consider the managerial processes. Even so, studies in this line of thought are relevant in as much as they view development as referring to all changes in man's use of environment in both space and time.

Perhaps the most controversial approach to the study of development is that adopted by Brookfield who suggests that the field of development studies should concern not only the problems of the poorer countries but also the study of change in world societies and economies as a whole. He notes that "since the developing countries are orientated toward metropolitan economies and dependent on them, what happens in the metropolis and their central cities has organic interrelation with the worldwide process of development" (Brookfield, 1975, 189). It is a valid framework of analysis in so far as the

global economic system is favourable to the economic development of both the developed countries and the Third World nations. However, the hypothesized spread effects of economic growth have not involved a balanced process yielding wealth and growth; and repercussions are not the same, for instance, in European societies as compared to the smallest countries in Latin America.

Another contribution to contemporary development analysis comes from regional science and geography which draw attention to the various interactions between spatial structures and economic processes. Following the work of the UNCRD (1977), Lo and Salih (1981) have suggested that the study of rural-urban relations and their effects appears to be the key element in the understanding of the patterns and processes which occur within specific social structures at the local, regional and national levels. According to these authors there is a need for a macro-spatial development framework which seeks to explain the dimensions of development and also to account for the existing different territorial conditions, paying attention to the problems of resource endowment and population pressure, technological constraints, social and institutional relationships and patterns of production. This approach, in principle, permits explanation of aspects such as migration, rural-urban relations and internal development disparities and, as the authors conclude, "It represents the more important parameters within which policies for rural-urban transformation in regional development may be formulated" (Lo and Salih, 1981, 146). Other studies of this type, which involve geographical considerations, focus upon determining the image of reality of a place and its resources, or upon explaining the role of resources in regional planning and development. These studies have been concerned with

themes such as resource conflicts (Day, 1975) and impacts of recreational innovations upon regional economic development (Tempelman, 1975). However, as Mitchell (1979) has pointed out, relatively littlework has been done on the kind of social and economic distortions as a result of non-renewable resource extraction or exhaustion/depletion.

In summary, the investigation of the development issue and its implications upon society have been the concern of many different disciplines and groups of researchers. There is no doubt that their contribution to the understanding of the development issue is of immense value. However, there is a remaining question about the recognition of an interdependent approach. In the next section the way in which development studies should be pursued, in the opinion of the present writer, will be discussed.

2.3.2 Towards an integrated approach

2.3.2a Conceptualization

Until recently the process of economic development and the geographical location of economic activities were studied relatively independently of one another in a monodisciplinary way so that the impacts between different variables were rarely considered. Under such conditions, it was nearly impossible to include the spatial, environmental and demographic effects of socio-economic activities within the same framework of analysis. The economist was inclined to look for the explanations of the socio-economic phenomena through market mechanisms. The physical scientist was concerned with the carrying capacity of the environment and the technical features of the

production process.

However, the dynamics of present-day society and the enormous complexity of economic and social systems have underlined the need for methods to analyse the increasing scale of socio-economic and technical development as well as environmental change over space and time. Economic activities are spatially interrelated to such an extent that it is impossible to bring about any radical change in the spatial structure without taking full account of the social, technical and environmental factors that may constrain the development of those activities. Therefore, interdependence between the different factors involved in the development process appears is relevant in understanding and projecting the impacts in any particular socio-economic and environmental situation.

The methods and models already described - referring to macro-economic analysis, sectoral analysis and regional analysis - are all partial in nature. What is far more appropriate is an integrated approach which investigates the underlying processes that bind together natural ecosystems, resources systems, socio-economic systems and spatial structures and processes. In the context of the present study an integrated regional model, based on the work of Nijkamp and Opschoor (1977), Arntzen et al. (1980), Brouwer et al. (1983), appears as the most appropriate methodological tool. This approach has been developed as an instrument for spatial planning on a regional level for the medium to long term. Through the model economic, geographical and spatial elements are analysed on the same scale as the environment. Here environment is understood as the whole set of

biophysical surrounding conditions and the subsequent artificial transformations, as well as the effects of human production and consumption activities upon some of the natural environmental systems.

According to Nijkamp (1980), several reasons can be given to justify the selection of this kind of approach: a) the spatial reality is complex and cannot be wholly analysed in a comprehensive way by means of a single-indicator approach; b) spatial side-effects, spatial externalities and intangible effects become increasingly important; c) the regional decision-making process is very heterogeneous, often has a multi-level structure and is often affected by policy priorities and institutional power conflicts. Moreover, the basic socio-economic structure in which processes take place is dominated by patterns of production and productivity, marketing and distribution, capital accumulation, income and social welfare which are all relative to the world economic system. Transformations within the national space encompass these overall variables. Thus, the task of an integrated approach is to analyse how the different factors involved function, what is their relevance in the interaction between resources and development, and what are the changes likely to result from that interrelationship.

2.3.2b Profile of the elements of analysis

The model originally developed by Amtzen et al. (1980); and Nijkamp (1977), was used by Brouwer et al. (1983) in a case study carried out in the West Brabant region in the Netherlands. The model has been designed to have a set of modules that consist of selected themes

which specify variables and causal relations in either a quantitative or a qualitative way. In principle the model consists of five modules: demographic, economic, ecological, facilities and intermediate. The spatial and environmental effects are presented in relation to the direct and indirect economic, demographic and facility effects. Brouwer et al. (1983) point out that alterations in the modules can be made as required by specific circumstances. Thus, for the present study, the modules considered to be are as follows:

a) Macro-institutional module

Theme: Patterns of national development

Variables: Government expenditure, agricultural policies, expansion of oil industry

Links: To economic module through economic structure; to geographical module through agricultural policies

b) Economic module

Theme: Economic structure, agricultural production and sales, agricultural land values

Variables: Farm finance, farm economy

Links: To macro-institutional module through expansion of oil industry; to geographical module through land productivity; to environmental module through agricultural production

c) Geographic module

Theme: Land use, spatial distribution of agricultural activities, energy inputs and sources

Variables: Agricultural spatial use

Links: To economic module through economic structure; to environmental module through man-land relationship; to macro-institutional module through expansion of oil industry

d) Environmental module

Theme: Management of agricultural land

Variables: Man-land relationship, petroleum industry flexibility

Links: To economic module through economic structure; to geographical module through spatial distribution of agricultural activities

These modules and the links between them constitutes the basis for the establishment of a set of relationships and interactions which in the final analysis may help to explain the stimulus-response relations that characterize the process of development (Fig. 2.5).

2.3.2c Applicability

The methodological approach presented here has initially been developed as a framework for research for physical planning. However, according to its structure and flexible nature it seems useful as an instrument for economic and spatial planning. Through the approach the importance of analysing topics which require an integrated perspective can be seen. Figure 2.6 shows that in the particular case of research on petroleum resources and agricultural development in the Orinoco region of Venezuela, the approach provides the framework for the

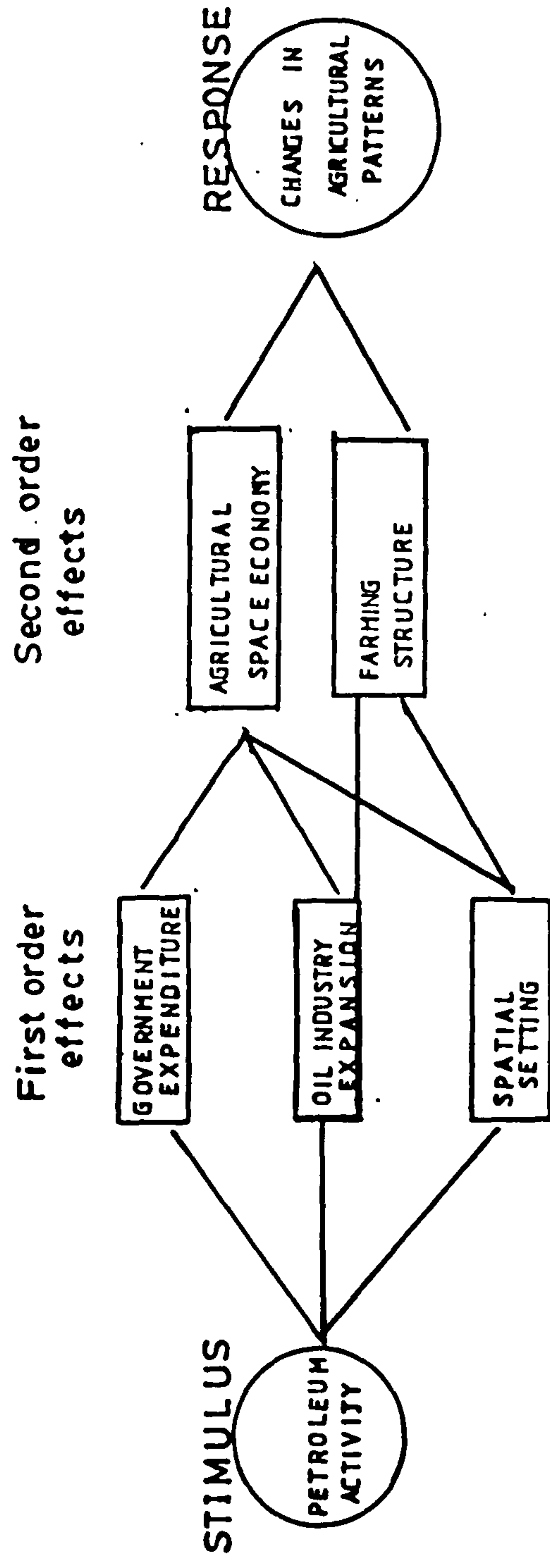


Fig. 2.5 Petroleum activity and its effects upon agriculture
(adapted from Nijkamp, 1983)

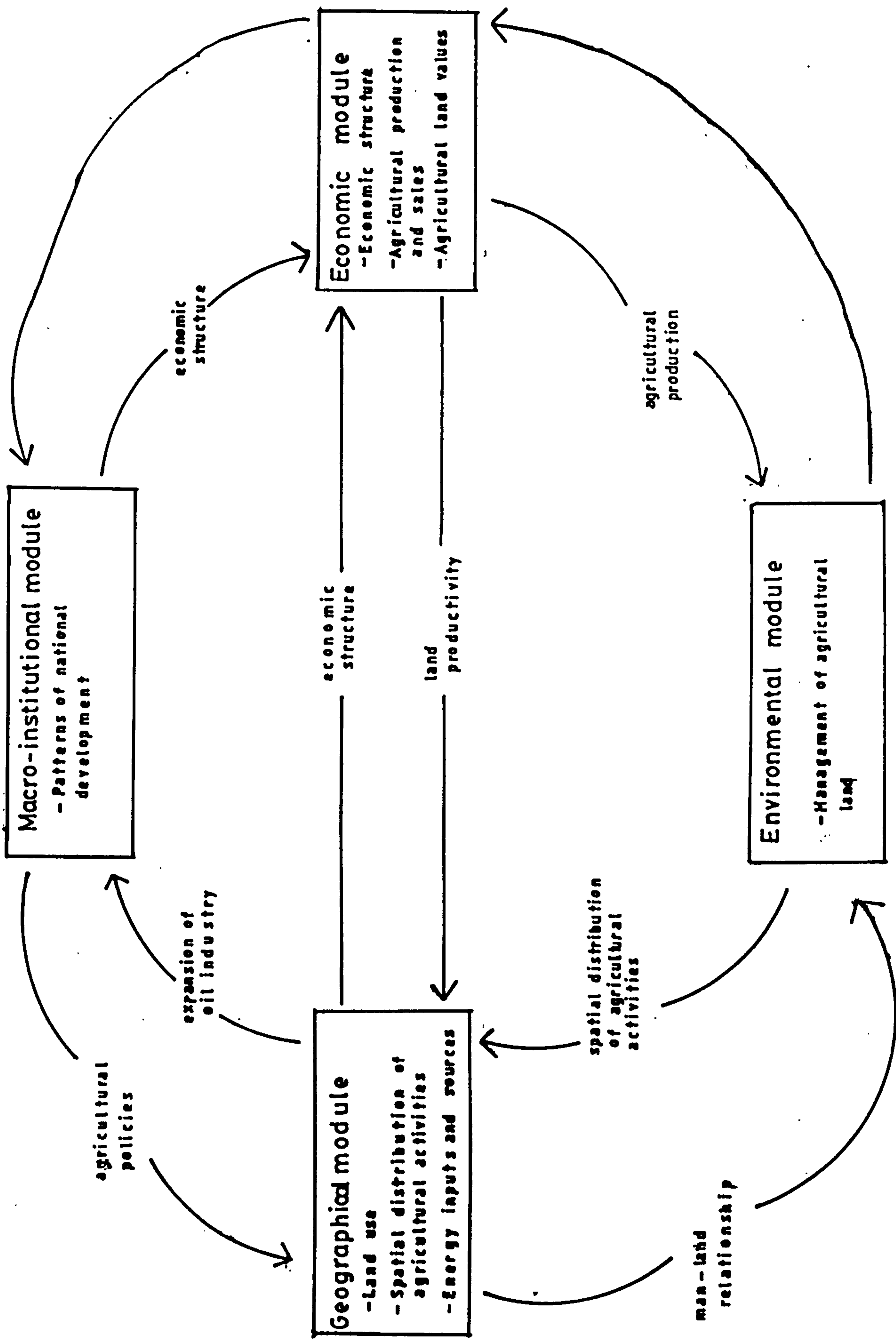


Fig. 2.6 Graphic representation of the Integrated Approach (adapted from Brouwer et al., 1983)

analysis of the different aspects involved and its interactions, and a perception of the cause-effect relationships.

2.4 CONCLUSIONS

The foregoing analysis has demonstrated that in analysing petroleum resources and development, firstly, it is necessary to give an account of the elements by which energy issues are related to the broad concept of resources and development. These elements have been identified as economic efficiency; growth and development; and environmental impacts. Similarly important has been the presentation of the notion of interdependence of factors, namely, forward linkages; technological linkages; local expenditure; infrastructure; capital flows, where petroleum resources are expected to be instrumental in achieving sound economic and spatial development. In order to identify the intricacies of this complex issue, the application of an integrated approach appears to be a useful method. It can be said that after examining several related approaches the integrated model provides the means to relate spatial, economic and environmental variables in such a way that they would yield the necessary sources of information for rational spatial-economic policies. The next chapter will examine the interactions between petroleum resources and agricultural development in the context of the oil-exporting developing countries.

CHAPTER 3: PETROLEUM-AGRICULTURE INTERACTIONS

In a methodological context the preceding chapter addressed the need for an integrated perspective on the problem of petroleum resources and development. This chapter turns towards a discussion of the economic and spatial interactions of the petroleum and agricultural sectors, which constitutes one of the most common problems faced by the oil-exporting developing countries. Firstly, an account is given of the patterns of government expenditure, considering initially the world oil market fluctuations which in principle, as a critically important external factor set a basic constraint on national levels of resource available for development. Government allocations of resources are then discussed in a spatial dimension. Secondly, the expansion of the oil industry in terms of its interactions with the local and regional agriculture are also discussed. Similarly, the utilization of oil-related service facilities by agriculture and the changes in land use arising from the development of petroleum activity in the region are examined in this chapter.

3.1 PATTERNS OF GOVERNMENT EXPENDITURE

Problems associated with the orientation of government expenditures in the oil-exporting developing countries have been a subject of attention in the oil-related literature for many years (Pearson, 1970; Amuzegar, 1977; Penrose, 1978). Concern about public revenues dates back to the early 1960s when governments of oil-producing developing countries started to emphasize that oil revenues should be disbursed far beyond general budgetary expenditures and should in part be earmarked for development purposes. Prevailing patterns of government expenditure were heavily

criticised. In Iran, for example, in the early 1950s, it was stated that the prevailing pattern of "utilization of oil revenues placed the Iranian government in a dependent position on payment by oil companies to Iran... such revenues should not be squandered by the present generation on non-productive purposes that do not contribute to an increased level of economic development of benefit to future generations" (Barstch, 1971, 252). In the case of Libya, for instance, in the 1950s, oil-derived government revenues were applied mainly to the development of infrastructural features such as roads and urban housing. Oil revenues should have been primarily injected into sound productive economic sectors such as agriculture and industry (Allan, 1973).

The utilization of accrued oil revenues to fulfill immediate improvements in economic welfare as well as to generate diversification of the economic base became the accepted economic strategic model in the 1960s (Higgins, 1968). By this means dependence on public revenues and its impact on the development projects was supposed to be minimized. However, the increasing availability of oil revenues during the 1974-82 period and its management entirely by the public sector influenced spending patterns and strategies, giving heavy emphasis to non-developmental outlays and, therefore, affecting the development of domestic commodity-producing sectors, particularly manufacturing and agriculture. Moreover, inter-regional disparities of the countries involved tended to be exacerbated.

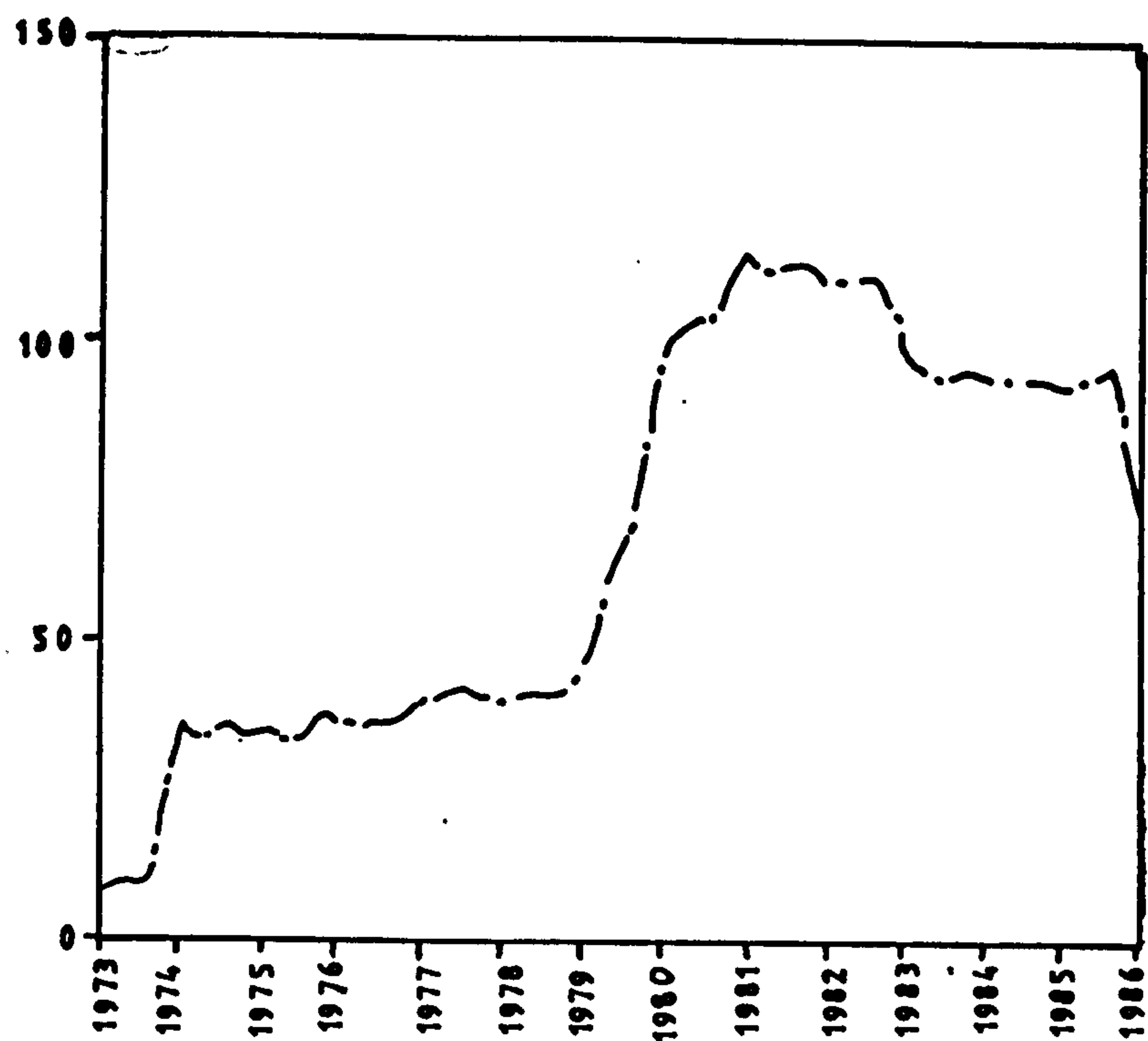
3.1.1 The external factor

World oil market fluctuations constitute a critically important external factor in the analysis of public expenditure patterns in the oil-producing developing countries. On the one hand, oil market fluctuations can be considered a negative externality in the sense that they might modify the financial capability of the oil-producing countries to accomplish their development objectives. On the other hand, they can be regarded as a positive externality since they may encourage oil-producing countries to allow economic diversification to take place.

It is generally agreed that oil-producing developing countries do not face the capital constraints that affect other less-developed countries. They possess opportunities effectively to structure their economies in such a way as to achieve maximum benefits from petroleum exploitation. However, as the experience of most oil-producing developing countries demonstrates, hydrocarbons play an ambiguous part in national economies. Oil is the means of getting the modern development of a country moving, but at the same time the existing traditional economic structure requires massive amounts of capital for its further development. Thus, oil is a means of giving impetus to the economy, yet it is hoped that the oil sector would be made more profitable by associated industrial development. Under these circumstances oil prices changes, in either an upward or downward direction, impose conditions that are reflected in changes in the patterns of public expenditure (Madellini, 1975).

In periods of high oil prices (e.g. 1973-76), the oil-producing developing countries have also experienced a national-level boom during which national oil-derived revenues induce greatly-increased spending. The expenditure pattern is one in which there is a high level of public spending on major projects within the oil sector as against non-oil development projects. This is because there is a need to extend the volume of probable and proved reserves, and to expand production capacity and facilities in order to ensure more oil revenues from a satisfactory international market. In the case of Mexico, investment in the oil industry grew from about 12 per cent in 1970-76 to 23 per cent of the GNP in 1977 and continued to grow to 44 per cent in 1978 (Buzagalo, 1984). In Nigeria, where the oil industry has provided the country with about 90 per cent of national income, most of the nation's fixed investment will continue to be concentrated in the oil sector (Onoh, 1983). In the years of low world oil prices (e.g. 1979, 1982-87), oil-exporting developing countries have tried to keep up the same levels of public expenditure, and this has inevitably resulted in substantial deficits both in the public sector and in the balance of payments. Expenditure patterns, however, have changed, and are characterized by basic investment plans designed to maintain the capacity of the petroleum industry to respond flexibly in a highly competitive world oil market. Alongside the petroleum industry there has been a consideration of investment in non-oil development projects amongst which agricultural projects have gained relevance. For instance in Venezuela, besides investments in the petroleum industry, major projects in the steel, aluminium and electricity sectors and in agricultural development projects have been financially supported. Figure 3.1 shows that in the light of the

A1



B)

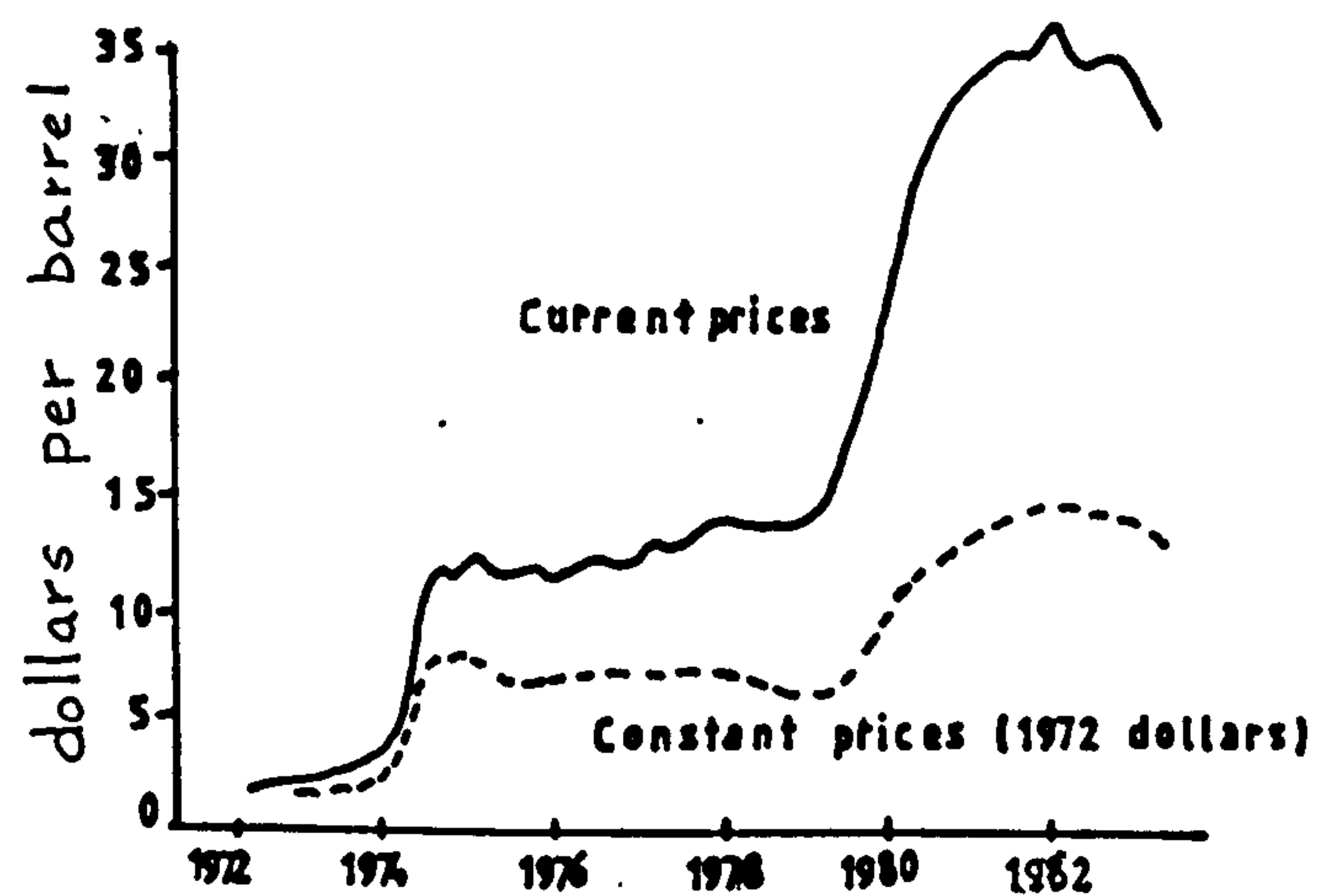


Fig. 3.1 A) World movement of crude petroleum. Export price index 1980=100 (after United Nations, 1984)
B) Petroleum prices, 1972-83 (after the World Bank, 1983)

present world oil market changes, the current expansion of oil incomes does not appear to favour the oil-producing developing nations. Thus, it is important to bear in mind this basic external element. The next section will focus upon economic and spatial changes in the patterns of government expenditure in relation to the world oil market.

3.1.2 The allocation of resources

Sustained growth of oil revenues in the majority of oil-exporting developing countries has determined the level in the allocation of resources. As long as oil revenues have increased, some oil-producing developing countries experienced changes in the proportion of revenues disbursed to developmental outlays and those to private and public expenditure. It is important to make clear, however, that in the national accounting of the countries studied, the volume of fixed capital formation (development projects in agriculture, petroleum, education, health and transport) does not record the amount of current expenditures which in some circumstances must precede or coincide with developmental outlays. Therefore, the data presented here would exclude current expenditure associated with development projects from gross fixed investment category allocations.

The examples of Nigeria and Venezuela have been chosen to illustrate relationships between oil revenue allocations and GDP at different periods. In the case of Venezuela, during the period 1977-82, the highest expenditure in development outlays was in 1978, 42 per cent of GDP, despite a decrease in the country's GDP which fell

from 6.7 per cent in 1976-77 to 2.1 per cent in 1977-78. In the rest of the period gross fixed investment ranged from 24 per cent to 39 per cent of GDP (Fig. 3.2). These percentages may be regarded as high if account is taken of the drastic fall in the country's GDP which in the year 1979-80 fell to the lowest level of -2.0 per cent to increase only slightly to 0.7 per cent in 1981-82. Although the proportion is high, it has to be seen in the context of how the Venezuelan government employs its revenues for capital expenditure as contrasted with current expenditures. Moreover, the proportion of revenues going to development outlays is high in relative terms but once the absolute magnitude of private and public consumption are taken into consideration, the outlay will prove quite small for countries such as Venezuela with a relatively high potential for agro-industrial development.

During the 1968-73 period the proportion of GDP going to gross fixed investment in Venezuela was relatively high, an average of 35 per cent of the GDP. For the period 1974-79 the pattern of allocation of resources to gross capital formation in Venezuela seems to be more favourable than in the previous period. Over 50 per cent of the total expenditure was allocated to gross fixed investment in a period in which oil revenues ranged from 62 per cent to 70 per cent. An interesting question is whether this suggests a greater degree of discipline in spending and of moderation and realism in development planning in Venezuela. In fact, the 1974-76 period coincided with a time when the government in power began to implement a number of measures directed towards the establishment of a mandatory austerity policy in current expenditure and the avoidance of administrative waste (Oficina Central de Informacion, 1975). It seems

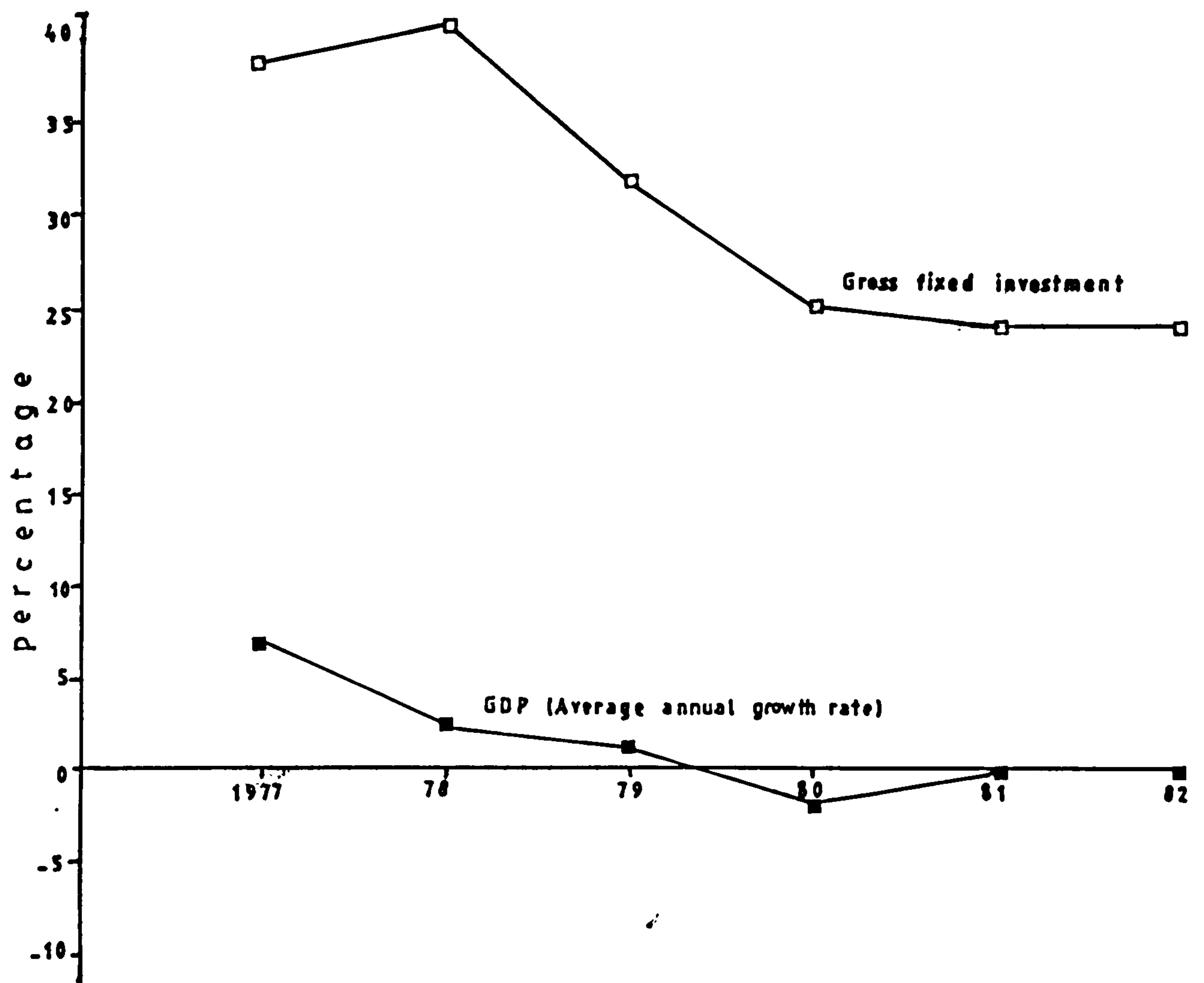


Fig. 3.2 Venezuela: pattern of gross fixed investment and growth in GDP, 1977-82 (source of data: United Nations, Statistical Yearbook, varios dates)

that in the case of Venezuela the pattern in the allocation of resources to gross fixed investment has been sustained over time, even during a period of drastic fall in GDP.

Taking the case of Nigeria we may note that in the period 1977-82 the country experienced a drastic fall in GDP, and yet as in Venezuela the allocation of resources to gross fixed investment appears to be high in relative terms, ranging from 19 per cent to 30 per cent, although this could be regarded as low in comparison to the high proportion of resources going to public and private expenditure (Fig. 3.3). For the period 1967-73 when oil revenues began to be an important component of the total revenues, gross fixed investment in Nigeria did not exceed 24 per cent of total expenditure. The country's performance indicates a change in the patterns of growth of investment expenditure, from a rapid growth during the 1960s attributable in large part to activities in the oil sector to a moderate decline in the 1970s. This fluctuation forced the country to look for external loans if the development plans were to be completed successfully, allowing in its turn the continued growth and attraction of private investment and savings. Here can be found the major explanation for the steadily increasing expenditure on fixed capital formation in the late 1970s and early 1980s, despite the sharp decline in GDP.

Bearing the question of investment expenditure in mind, the study of sectoral shares in investment and public spending now requires attention, with particular reference to agriculture, in order to determine more precisely the impact of petroleum production and revenues upon agriculture. Considering again the countries discussed

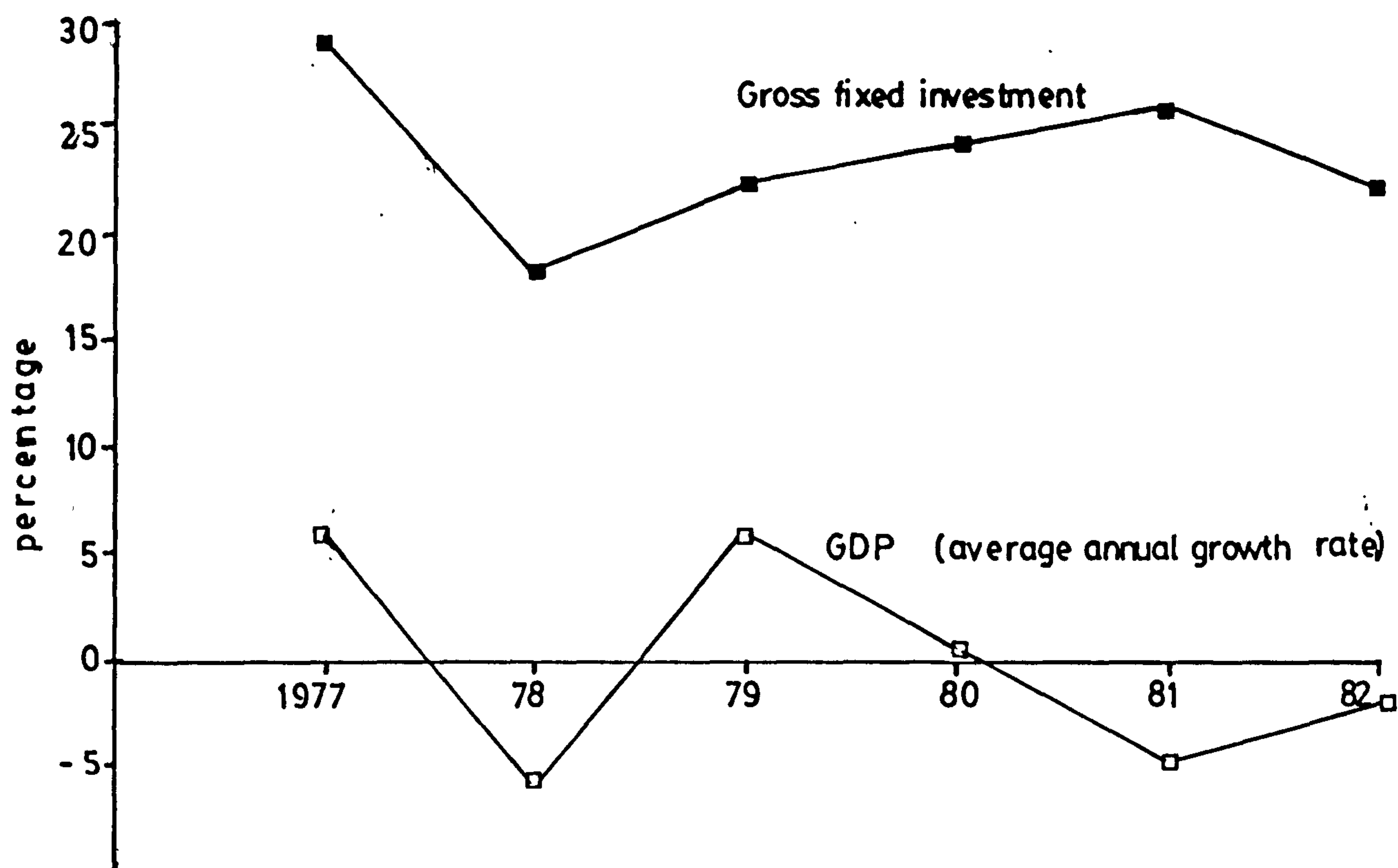


Fig. 3.3 Nigeria: pattern of gross fixed investment and growth in GDP, 1977-82 (source of data: United Nations, Yearbook of National Statistics, various issues)

above we may note the prevailing pattern for the period 1977-82.

In the case of Nigeria, data available for the sectoral composition of investment shows that throughout the period 1977-82, agriculture remained with a low share- 8 per cent - of the total fixed investment as compared to other sectors such as construction, manufacturing and public administration (excluding petroleum sector activities). In contrast, the period 1960-68 shows that from the N2-million Plan allocations to fixed investment, 13.58 per cent was devoted to improvements in agriculture. This percentage seems to be relatively high if compared with the period 1970-74 when federal revenues were about N10 billion throughout the period, allowing the government to increase its level of expenditure, and yet allocations to agriculture (both current and capital) were only 0.6 per cent of the total government revenues and just over 1 per cent of the plan public sector investment. Even more striking is the situation in the period 1975-77 when out of a total federal revenues of N30 billion, expenditure on agriculture was only 5 per cent over the three years (Fig. 3.4). It might be argued that in absolute terms there has been an increase in financial resources devoted to the improvement of agriculture as a result of the sharp impact of petroleum revenues. Nevertheless, in relative terms, allocation of resources to agriculture does not indicate such an increase. Agriculture has shown a relatively high level of government expenditure (both current and capital) in the years of lower proportion of oil revenues.

It has been stated that in Nigeria investment programmes alone cannot create conditions in which an adequate response in terms of



Fig. 3.4 Nigeria: share of fixed investment in agriculture, 1960-82
(sources of data: World Bank, 1974 and International Monetary Fund, 1985)

agricultural production is assured (World Bank, 1974). This argument may be valid from the point of view of the GDP rate of growth, which depends not only on the rate of investment but also, inter alia, on factor-productivity and technical changes. However, from an overall perspective of agricultural development this statement may not be sustained; in the first place, investment in agriculture has not grown in direct proportion to revenues; and secondly, from the amount of expenditure disbursed to agriculture a large percentage goes to current expenditure (salaries, administration) leaving only a small proportion to investment in agriculture itself.

In the case of Venezuela during the period 1977-82 expenditure on agriculture, as a proportion of total capital outlays, ranged from 2.72 per cent to 3.79 per cent (Fig. 3.5). This is lower than in the period 1970-76 (3.37 per cent to 6.64 per cent). However, in the period prior to 1970, when oil revenues were less significant, the government assigned a much higher priority to agriculture: the proportion of total capital investment devoted to agriculture increased slightly during the decade (between 12 per cent and 15 per cent of the gross territorial product), thus keeping pace with investment in the economy as a whole.

It has been argued that the pattern of allocation of resources away from agriculture began as early as the 1950s when Venezuela experienced its first oil boom (Allen, 1977). Nevertheless, comparison of official data shows that for the 1950s decade total revenues were only half of those recorded during the 1960s and only one-third of those in the 1970s. Yet capital investment in agriculture reached high levels throughout the 1950s (up to 21.47 per cent in

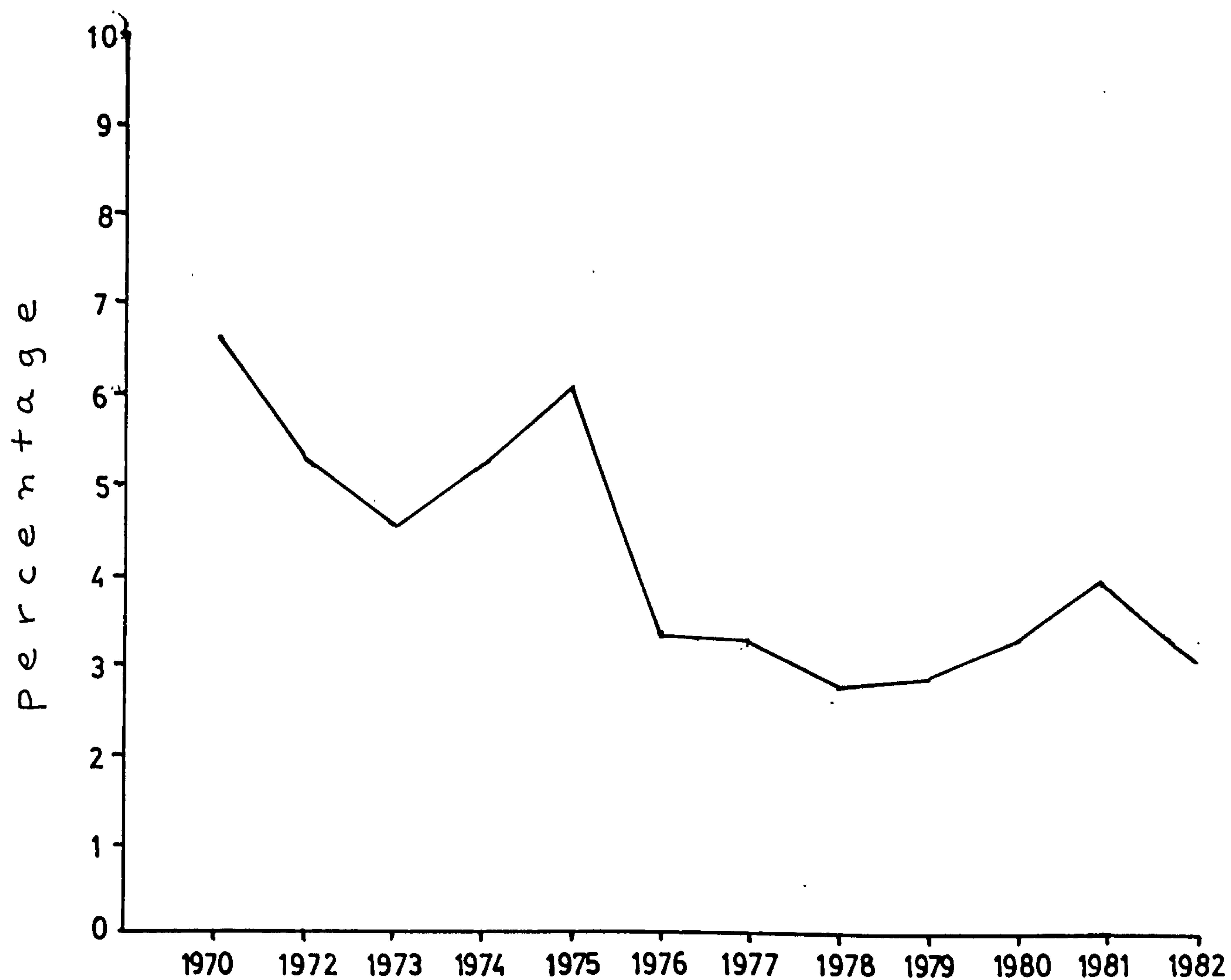


Fig. 3.5 Venezuela: share of fixed investment in agriculture, 1970, 1972-1982 (source of data: United Nations, Yearbook of National Accounts, varios issues)

1953 alone) that have not subsequently been achieved. In other words, it seems that the initial development of the petroleum industry and its impact on the pattern of investment did not adversely affect agriculture in the early stages; but as the proportion of the economic rent from petroleum increased, a different distribution became apparent, modifying the pattern of investment to one unfavourable to agriculture as opposed to other sectors.

3.1.3 The spatial pattern of expenditure

Attention has hitherto been directed towards the pattern of the allocation of revenues towards agriculture in the petroleum-based economies analysed. It appears that expenditure on agriculture is relatively high in periods of lower oil revenues as compared to less favourable allocations when oil revenues have been greater. The approach followed has so far been a sectoral one, referring to quantitative indicators of the countries' functions and activities. However, as already noted in Chapter 2, petroleum revenues and expenditure also imply the recognition of the spatial framework within which funds are raised and decisions made. Analysis now therefore turns towards this dimension, in an attempt to identify the geographical patterns associated with expenditure in agriculture in the oil-producing developing countries. Nigeria and Venezuela will again be used as examples.

In the case of Nigeria, available data show that significant differences in the spatial patterns of expenditure can be found. Capital expenditures were concentrated in the Western State in 1968-69 whereas for 1969-70 the Southern and Western States gained more

resources for capital expenditure. From 1970 onwards the Rivers, East Central, Kano, and Mid-Western States started to receive a higher allocation from the increasing proportion of oil revenues (Fig. 3.6). The nature of the data available makes extremely difficult to estimate capital expenditure on agriculture in each of Nigeria's regions. Nevertheless, some adjustments can be made in order to identify the geographical pattern of expenditure in agriculture. Since the late 1950s the Nigerian government's distribution of resources clearly reflected the beginning of a petroleum-orientated economy and the government's desire to attend to the needs and aspiration of its peoples. It was considered essential that "wherever oil royalties may arise, all regions should have some share" (Adedefi, 1969, 131). In the 1970s half the available funds were disbursed in 12 equal parts, i.e. to the twelve states and half in proportion to the population then in existence (Best and Blij, 1977). The North Eastern State thus received more funds as a result of its large population, irrespective of its contribution to the state's finances and its physical resource base. This is a sound and fair criterion of distribution of resources which does not seem to neglect disfavoured regions. However, it introduced a pattern of expenditure which does not focus on regions with relatively high potential, diminishing the opportunity for integrated development in areas such as the Rivers and Eastern States where both petroleum and agricultural development can be made compatible.

By looking at the areas of commercial agricultural activities within Nigeria it can be seen that the Mid-Western, Rivers, East-Central and Southeast states have experienced substantial development of cash crops such as oil palm, cocoa and rubber, and

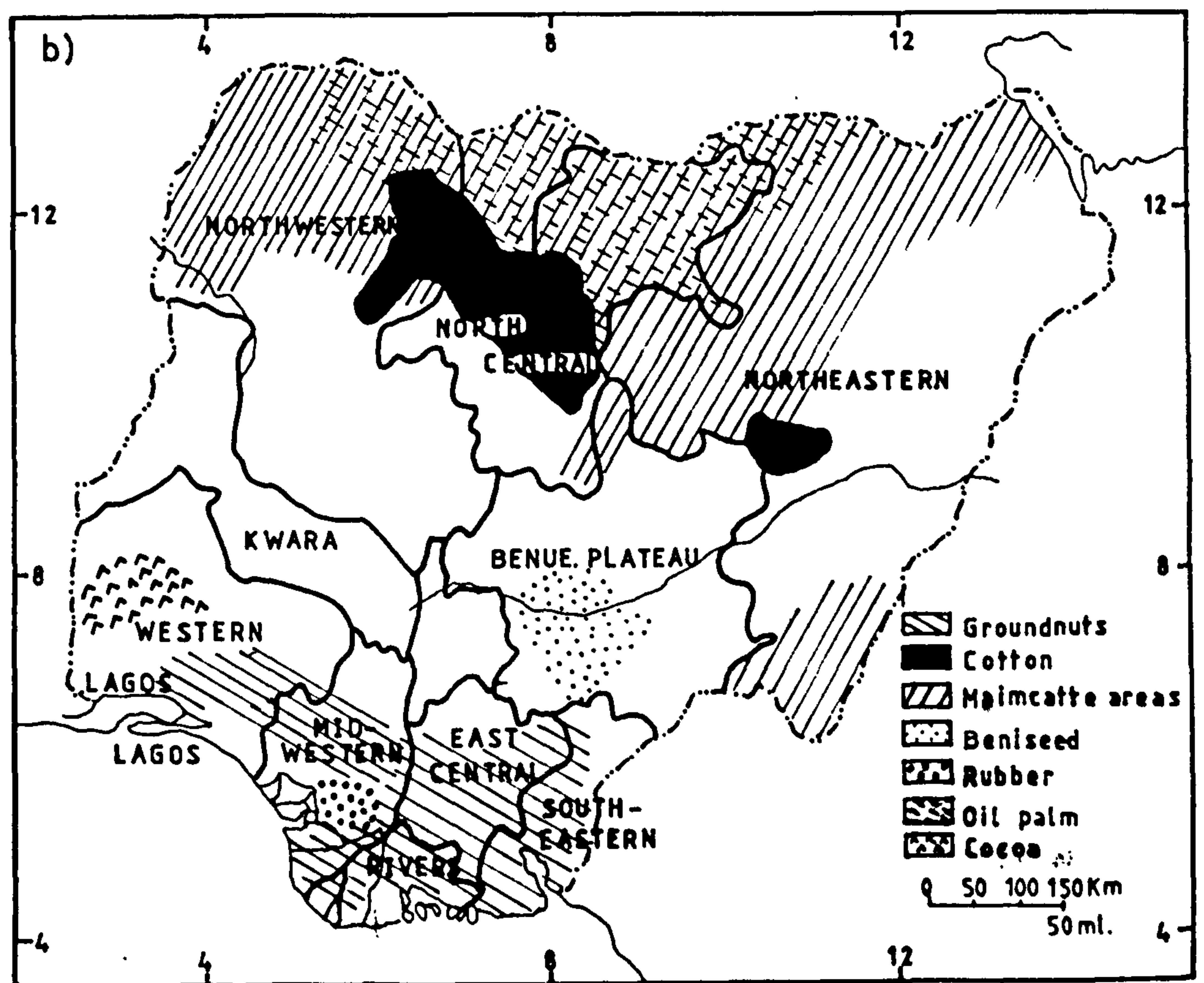
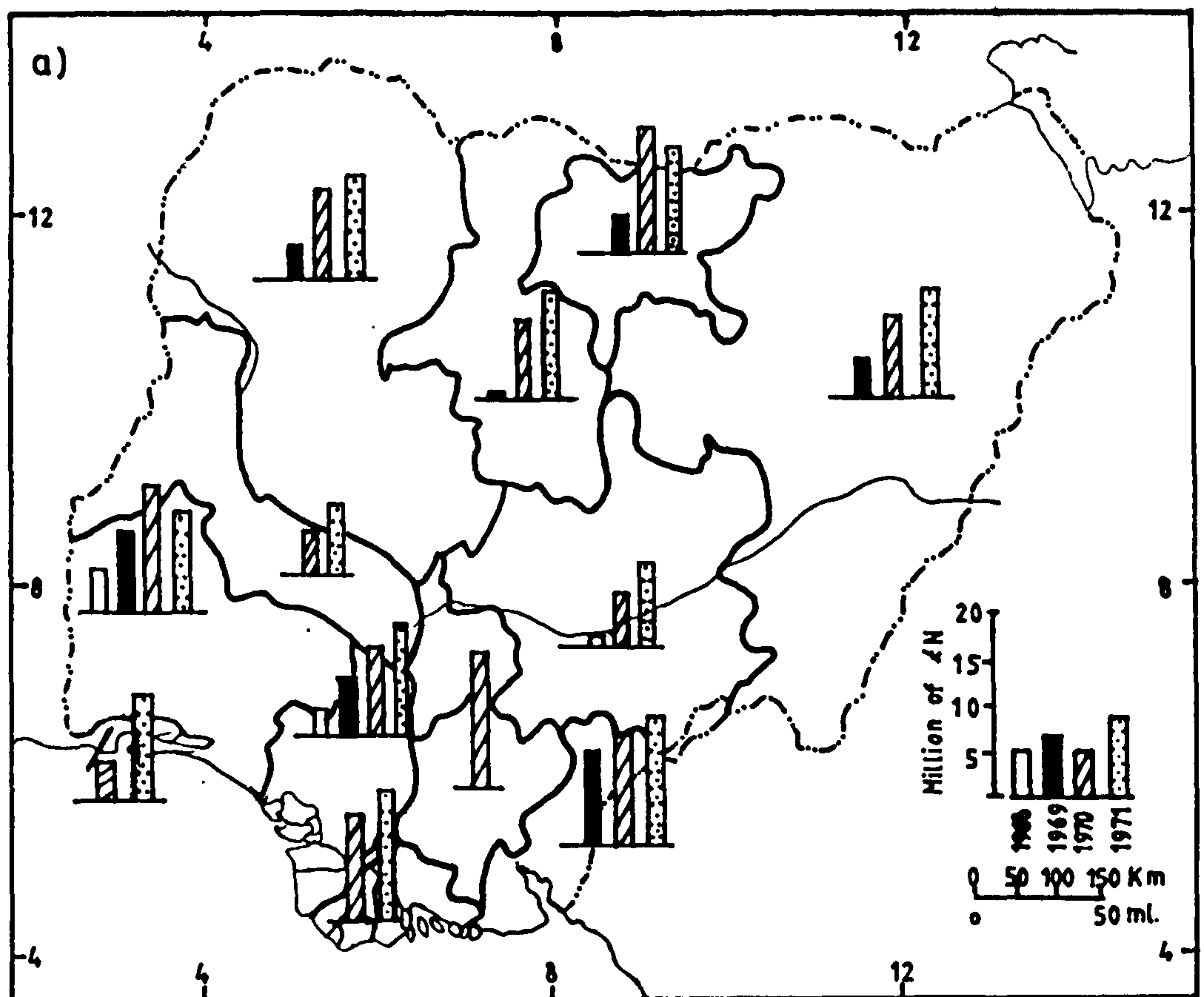


Fig. 3.6 a) Nigeria: spatial allocations of financial resources (source of data: The World Bank, 1974)
 b) Nigeria: spatial distribution of agriculture (adapted from Best and Blij, 1977, p. 157 and the World Bank, 1974)

have generated considerable revenues since the late 1950s. Yet these states do not appear to have received substantial amount of revenues in the form of capital expenditure until the early 1970s. It may be that improvements in agriculture did not attract significant allocations since a high priority was assigned to the development of other sectors more closely related with the oil industry such as transportation and infrastructure. On the other hand, the northern States which show a relatively low agricultural potential due to physical conditions gained more financial resources during the 1968-72 period, especially as a result of the very rapid growth in oil production and the substantial increases in revenues available to all states. In 1974-75 alone a series of agricultural development projects assisted by World Bank loans were located in the Jusan, Funtwa and Sombe areas of northern Nigeria on the basis of their agricultural potential. In terms of meeting social objectives, investment was reported to be successful but the spatial and environmental costs were high since these areas are characterised by low and uncertain rainfall (World Bank, 1981). This lack of spatial correspondence between resources and needs in the country's agricultural development is greatly institutionalized and reinforced by a strong financial unit responsible for the distribution among the regions of federal government's public expenditure.

In economic terms, federal capital expenditure does not seem to favour agriculture, representing only 3.59 per cent of the total federal capital expenditure for 1970-71. Geographically, capital expenditure for federal agricultural projects in the same year have been located in the north while easterners have benefitted less from

the siting and development of national institutions. This uneven spatial pattern of expenditure has caused regional differences in the rate of growth among the various states. As Prest (1962) reported, state revenues and expenditure gaps would increase, the areas with the faster growth benefiting relative to the others and those state governments which develop less rapidly are highly likely to demand assistance of one sort or another from the federal government, increasing their degree of dependence. On the whole, the spatial pattern of expenditure in agriculture seems to be greatly influenced by the presence of petroleum revenues. Nigeria's desire to re-invest part of her oil wealth back to the vast and densely populated rural areas has involved substantial changes in the agricultural geography of the country.

Changes in the spatial patterns of expenditure in agriculture have also taken place in Venezuela, associated with increases in petroleum revenues (Gorsmen, 1978). Figure 3.7 shows that from the 1960s the north-central region absorbed a large quantity of resources from oil revenues while the eastern and southern states received a smaller proportion. It was considered necessary to support the development of the northern-central areas on the grounds that this region supported all the administrative and commercial activities related to the exploitation of petroleum resources. The spatial allocation of resources to agriculture has changed from the traditional settled uplands to the lowland regions of the country. This has been based on the view that in a context of regional and economic diversification equal opportunities should be given to the different regions. Available data show that in the 1940s resources were allocated mainly to the northern coastal zone and the western

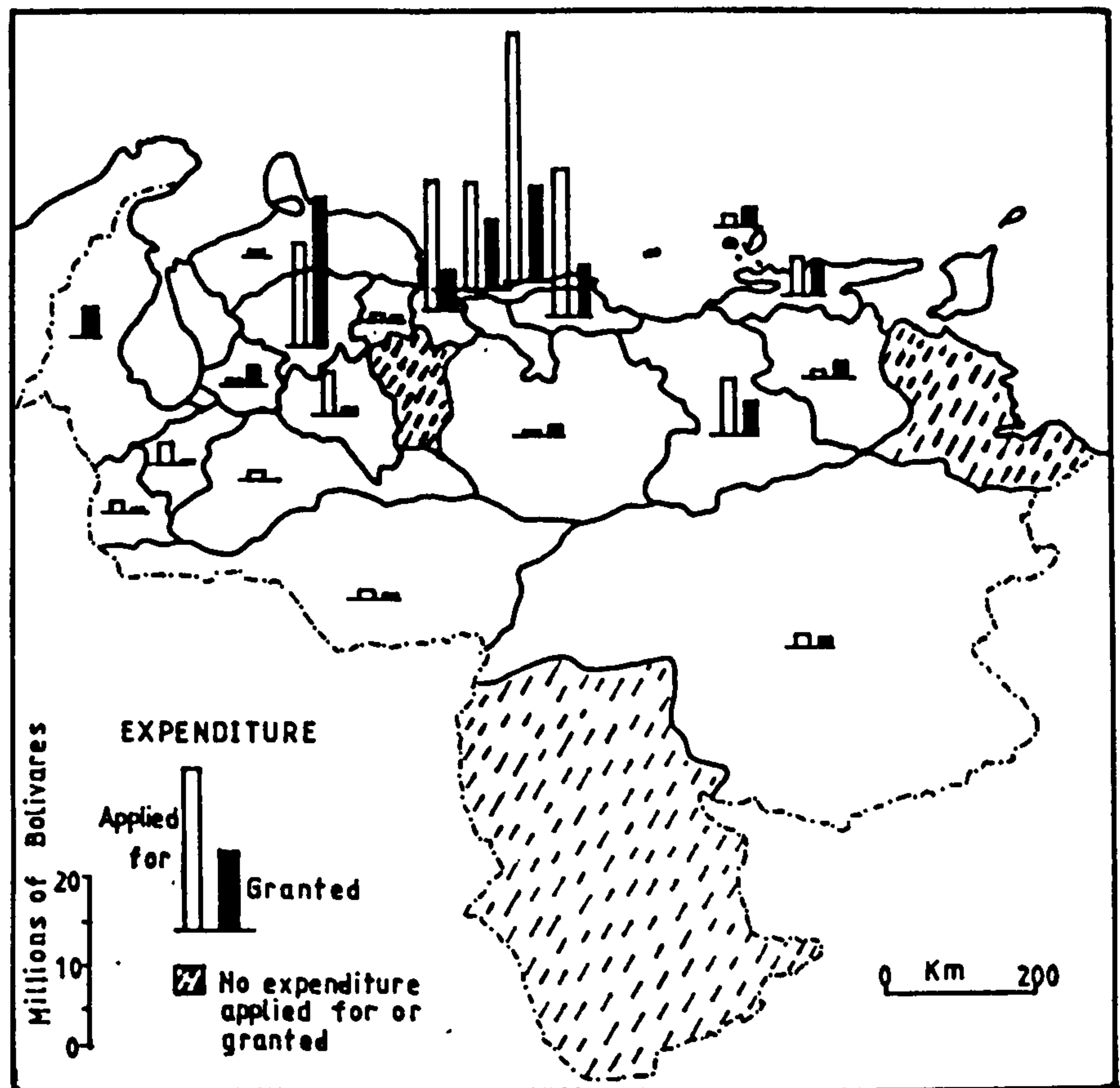
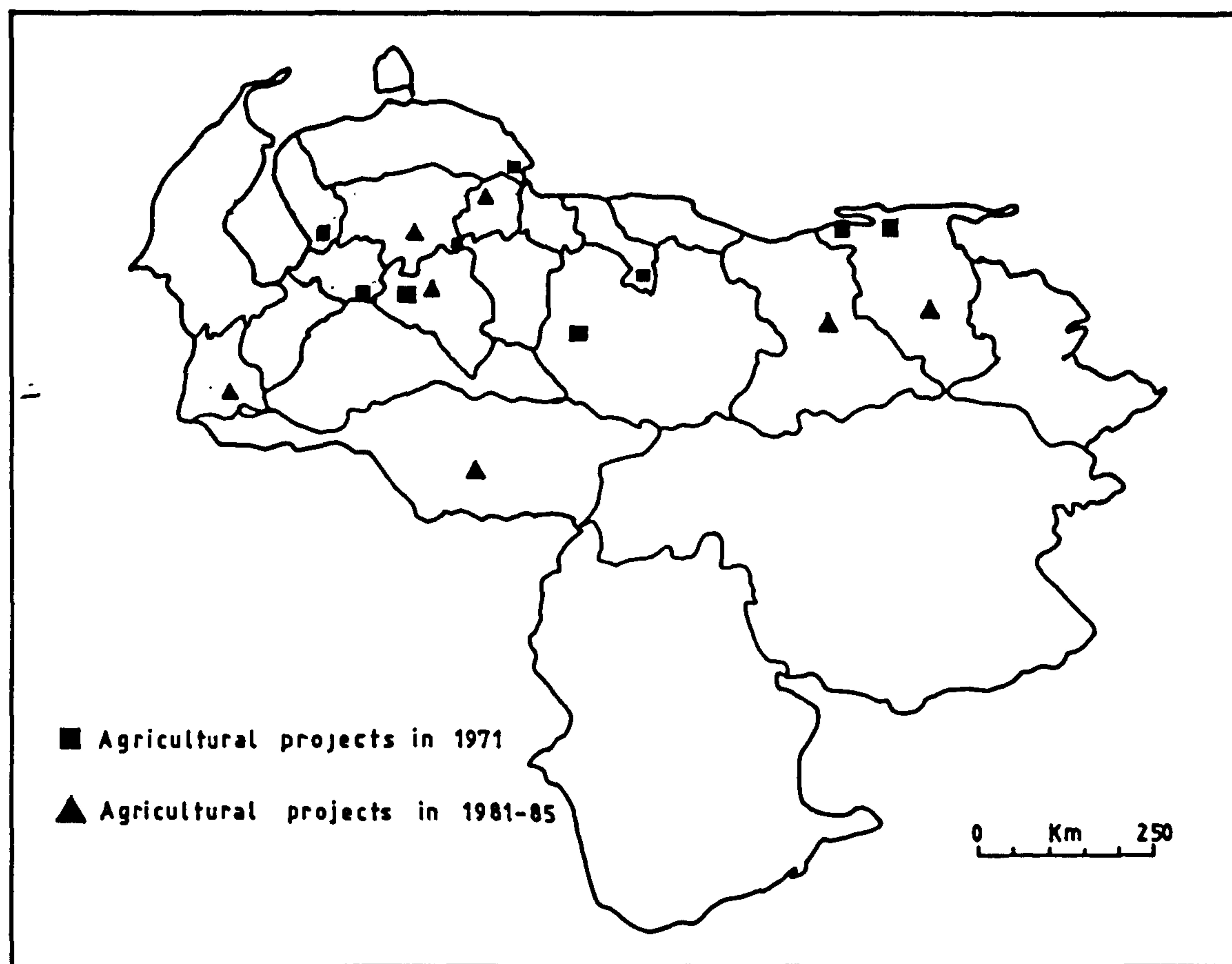


Fig. 3.7 Distribution of public financial resources in Venezuela, 1965 (after Blakemore and Smith ed., 1971)

llanos in the form of irrigation schemes. In the early 1960s when there was a significant rise in revenues from petroleum activity, the government invested substantial sums in capital-intensive irrigation projects, mainly in the western and central llanos. For the Fifth National Development Plan (1976-80) the government established an investment programme geographically located in the western and northern part of the country. Under the Sixth National Plan (1981-85) allocation of resources to agriculture was directed more towards the central llanos and the eastern part of the country.

There has been a highly dispersed pattern of resource distribution into agriculture in Venezuela. The prevailing pattern has not particularly favoured the areas where petroleum developments are in progress and in which agricultural development is possible as a result of favourable ecological and economic conditions. This is the case in Zulia, Monagas and Anzoategui States. Perhaps a change in the prevailing spatial pattern of expenditure may be seen in the Sixth Development National Plan (1981-85) which refers to the consolidation of development in areas where existing agricultural potential or productive capacity is under-utilised (Fig. 3.8). However, investment has been planned to go towards improvements in infrastructure and housing to give support to agricultural development projects (Greenwood, 1984). Therefore, financial resources for projects to increase agricultural production do not seem to be favoured.

There are many similarities between Venezuela and Nigeria in terms of the spatial allocation of expenditure in agriculture. The willingness of governments to scatter the seeds of oil-derived revenues widely through the economy and the geography of the country



has implied changes in the spatial organization of agriculture affecting especially but not exclusively those regions where income from petroleum resources is obtained.

3.2 THE EXPANSION OF THE OIL INDUSTRY

In the course of development, the adoption of policies to promote interaction and integration between different economic sectors have important spatial and economic implications. Most frequently, the consequences of the relationship between different forms of economic activity are measured in terms of output, income or employment (McNicoll, 1984). In the context of oil-producing countries the relationship between agriculture and oil industry can be assessed by the "two-way flow of materials, labour, capital and technology" (Hoyle, 1974, 4). But it seems also relevant to evaluate the direct contribution of the oil industry to development projects in the zones it operates. This is the focus of attention of this section, in which there is an assessment of ways in which oil operations interact with local agricultural development, of ways in which oil-related facilities allow agriculture to develop, and of the changes in terms of petroleum/agriculture land use.

3.2.1 Oil-industry operations

Many different activities are related to petroleum production: these include upstream operations (exploration, production, marketing, infrastructure) and downstream operations (transport of oil/gas, gas processing, oil refining, and petrochemical and other oil/gas related activities). At first, these activities do not seem to have any direct

connection with local agriculture.

However, it is relevant, especially in the case of downstream operations, to consider that an economic utilization of hydrocarbons resources would be sub-optimal unless it comprised the development of the resources beyond the production and export of crude oil, as well as the control by the society of subsequent advanced processing of oil and gas and their transformation through industrial (and agricultural) activity. In other words, as was discussed in Chapter 2, it is expected that oil industry operations will be developed in such a way as to permit the expansion of the local economy including in this particular case the local agricultural sector. How far these expectations has been realised? The experience of various oil-producing developing countries is relevant.

In the development of upstream operations, the oil industry has set economic and spatial locational preferences which suggest a significant orientation towards international markets. These preferences have produced changes in the performance of local agriculture which has changed from a situation in which it dominated the spatial economic structure of the majority of oil-producing developing countries to a position in which the economic space was penetrated by a new and radically different type of economic activity: petroleum production.

In the case of Iran, for instance, the improvement of communications facilities by the petroleum industry encouraged local population to respond to the economic opportunities offered in the areas of oil operations. As Melamid (1959) suggested, this is the case in which

agricultural activities, although not greatly expanded due to physical limitations, benefitted considerably from improvements in the local transportation system developed as a result of the needs of the oil industry. In the case of Libya it is argued that through oil exploration and perforation operations, the chances of finding water resources have been improved. This constitutes an important contribution to agricultural development since it is assumed that agriculture will continue to be the predominant user of water in Libya (Allan, 1973). Work on Nigeria (Melamid, 1960) suggested that in the Port Harcourt oil region the location of rail and road networks needed for supply facilities have allowed the continuation of commercial palm oil production as well as subsistence agriculture and fishing which might not otherwise have occurred.

In the case of Venezuela, it has been claimed that the oil industry has made a positive contribution to agriculture. As early as 1947 almost 35 per cent of the transport network established in Venezuela had been constructed by the oil companies in order to allow not only better communication facilities for their upstream operations but also to open new frontiers for local agriculture which had limited market access before oil development began (Dupoy, 1948). In other words, a direct linkage between the use of petroleum roads and farm-to-market transport was established in Venezuela at an early date.

However, oil-industry upstream operations are not always regarded in a favourable light by local farmers. In contrast with Melamid's findings, Okoro (1977) states that although road construction and maintenance by the oil industry are claimed to be a

major contribution to agricultural development in Nigeria, these facilities are rarely used by the farmers since their transportation needs do not coincide with the direction and location of the oil industry facilities. Perhaps this is the only recorded argument showing negative impact of upstream operation upon agriculture, yet it seems very likely that similar inconsistencies occur elsewhere in oil-developing countries.

In the development of downstream operations the most fundamental question involves the analysis of the pattern of refinery and petrochemical production and the way in which these operations are expected to serve as feedstocks for agricultural production. There is a tendency to suggest that agriculture uses only relatively small amounts of oil energy supplies (Wood, 1980), and that there is therefore no need to stress linkages between the oil industry and agriculture. However, among the common requirements of agriculture in oil-developing countries, there are those with a direct oil/energy usage including petrol, diesel and electricity used in on-farm operations; and those indirect oil/energy requirements, including inputs that are depleted in a short period such as commercial fertilisers, agricultural chemicals, seeds and feeds. It is clear that the existence of recent highly oil-based development schemes have important direct and indirect implications for the productive capacity of agricultural systems. Is there an integrated pattern by which downstream operations in the oil industry encourage agricultural oil-related schemes to take place? Some economic and spatial implications of this relationship can be illustrated in the context of oil-developing countries with reference to selected examples.

In the case of Nigeria, it is argued that almost all fertilisers have to be imported; the Kaduna superphosphate fertiliser factory, which was opened in 1979, has hardly affected this situation. Even with the Ome fertiliser factory, to be completed in 1987, the situation is unlikely to change substantially. In Libya, fertiliser production increased rapidly during the 1970s and yet attempts to supply fertilisers nationally have failed because nitrogen fertiliser factories have been created to produce mainly for the export market (Allan, 1981). In contrast, the Venezuelan pattern has been one in which internal demand is satisfied while a smaller volume of fertilisers is devoted to foreign markets. During the period 1968-78, 98 per cent of the fertiliser production was devoted to national markets.

In the case of Saudi Arabia, the petrochemical industry has received great emphasis under the Third National Development Plan (1980-85), but it seems that little support for national agricultural activities has so far occurred. A plan to produce ammonia-urea fertiliser was first proposed in 1965, but did not materialize for many years for several reasons including insufficient natural gas feedstock, and inadequate water and electricity supplies (Niblock, 1982). Even when the project was eventually developed thanks to government intervention, urea fertiliser was not used nationally. On the contrary, it was marketed largely in India, Egypt, Bangladesh, Iran and twenty other countries. This means that the pattern of development adopted was one which did not satisfy the domestic agricultural requirements.

In contrast, the Algerian pattern of downstream development constitutes a relevant example in this context. The Algerian

perspective on the utilization of hydrocarbon deposits assumes that the optimum strategy is to avoid exportation of natural resources without making a profit for the domestic economy and to take advantage of locational benefits before the natural resources are exhausted. In this context agriculture and the oil sector have to be closely linked. In fact, in Algeria the oil and petrochemical industries supply the necessary energy for agriculture in the form of fuel and electric power, raise its productivity by providing artificial fertilisers and means of pest control and fabricate plastic items (packing material, pipes, foils, tools) that facilitate agricultural work and the shipment of products. The first petrochemical projects were launched to produce nitrogen fertilisers for agriculture (Schliephake, 1977).

A rather general statement can be made here. It seems that the failure to integrate downstream oil operations and agriculture occurs when the oil-producing developing countries encourage the development of oil refineries and petrochemical industries to capture foreign markets instead of producing for the fulfilment of domestic needs. This is a critical obstacle for the development of agriculture in the context of oil-producing developing countries where a national/regional spatial integration of the downstream oil operations with agriculture is expected to take place. Chapter 7 will focus attention on this issue with reference to the North-Orinoco region of Venezuela. On the whole, it can be stated that in Venezuela agriculture seems to have absorbed a very small proportion of nationally refined or produced petroleum by-products during the period 1973-83, 0.073 per cent being the highest level of consumption in 1983.

In the spatial distribution of refined products, the oil-processing regions appear to consume large amounts (especially Zulia region), mainly because they are at the same time both oil-producers and oil-consumers, while the rest goes to satisfy demand of administrative centres or growth poles. Thus, the areas predominant in agriculture seem to be outside the pattern of preferences. This reflects the fact that with regard to the dynamics of agriculture, the ownership of an oil-energy resource endowment does not guarantee energy security. Oil-based energy has to be channelled to the right places in the agricultural sector, including the major components of rural-energy needs such as diesel, gasoline and natural gas by-products.

3.2.2 Oil-industry service facilities

Oil-industry service facilities are primarily concerned with the fulfilment of the industry's own requirements in the form of administration, storage, supplies of equipment, maintenance, residential and amenities sites. Alongside the industrial operations, the location of these services and facilities has evolved towards a more concentrated pattern, which has been called satellization (Melamid, 1973). By this means, oil-industry requirements are met in such a way as to prevent increases in capital costs involved and to control the evolution of settlement networks and hierarchies normally emerging in the course of oil-industrial development. In several countries, including Iran, Mexico and Nigeria satellization has been achieved; yet certain effects in the local vicinity have been produced especially in agricultural communities.

The spatial pattern of concentration of ancillary services and facilities has also implied the concentration of employee settlements which are regarded as providing a strong potential demand for local agricultural products. Most agricultural areas, however, have been unable to meet the demands of the oil industry's labour force since existing resources have been developed to serve pre-existing local requirements. Thus, in the medium and long term, serious implications for the agricultural economies have emerged.

Has the oil industry contributed to towards minimizing the disadvantageous effects upon agriculture? Is the oil industry providing additional services that could benefit the development of agriculture? There has been a wide range of discussion about whether the oil industry should devote itself solely to its unique task of petroleum production while leaving the solution of its effects to the regional and national governments? Examples show different attitudes towards these questions.

As early as 1945 the Arabian American Oil Company (ARAMCO) started to intervene in agriculture. It provided for the construction of pumps and irrigation facilities for the Al-Kharj agricultural project southeast of Riyadh in Saudi Arabia, and it provided experts and operated the project for a number of years. Similarly, it provided technical assistance to local farmers by introducing modern agricultural methods to improve crop quality and yield (Aramco, 1960). In Nigeria, Shell-BP operates agricultural development centres at Umpechen, Kpite, Bori and Kwawa aimed at teaching local farmers to adopt modern farming techniques and animal husbandary methods

(Obgonna, 1979).

In the case of Venezuela, there is evidence that by 1947 the foreign oil companies set up a programme of commercial promotion of agriculture, fisheries and livestock in locations acquired by the oil companies throughout Maracaibo, Carabobo, Portuguesa and Miranda States. It is interesting to note that with the exception of Maracaibo state, the other states do not constitute oil-producing regions of the country. Thus, it can be assumed that the interest of the oil companies was not necessarily to develop the agricultural sector in the oil-producing regions but in those areas with a higher market potential. Nevertheless, in establishing the pattern in the provision of community services by the oil industry, it seems that a lower priority is given to the provision of agricultural services than to other developments such as hospitals, schools, housing and recreational centres. The reasons for this pattern can be found firstly in the interest of the oil industry to reduce and ultimately eliminate the need for the industry itself to provide services which are not an integral part of its industrial operations.

Secondly, in the short run the industry needs to concentrate on those tangible projects which may show the industry's positive attitude towards the public. In Venezuela, for instance, for the period 1973-83, the contribution of the petroleum industry was primarily directed towards the construction and maintenance of hospitals and housing while programmes related to food supply and agricultural projects did not receive great support, except for the year 1981 when the oil industry devoted more resources to the operation of commissaries in which sales of foodstuffs for the industry's employees took place (Fig. 3.9). Even then, their

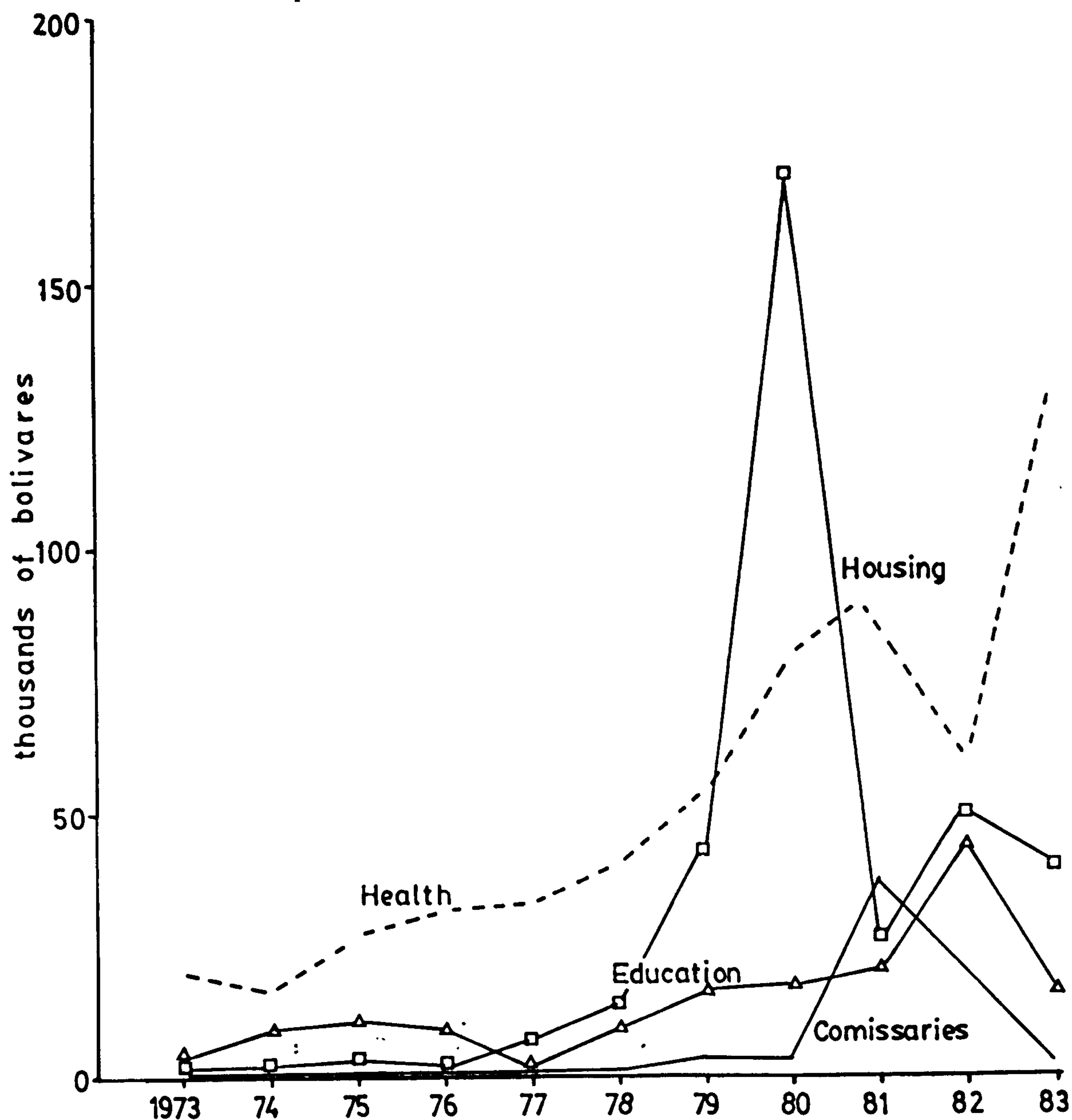


Fig. 3.9 Oil industry contribution to community services in Venezuela, 1973-83 (source of data: Ministerio de Energia e Hidrocarburos, 1983)

contribution was directed towards the acquisition of foodstuffs coming from outside the oil-producing regions and much less attention was paid to local agricultural production.

To a certain extent, the emergence of oil-related developments and the provision of services has facilitated the development of the agricultural sector. However, it remains in question whether the provision of services for agriculture constitutes a high priority in the oil-industry and whether the oil industry has defined a policy towards the development of agriculture within the areas of oil activity. In Chapter 7 this issue will be discussed in detail.

3.2.3 Changes in land-use patterns

There are many factors normally associated with changes in agricultural land use. Rural depopulation, land tenure systems, transport facilities, accessibility to markets and ecological conditions are all considered to play an important role in determining the national proportion of land under farming. In oil-exporting developing countries the question of the changing land-use patterns in agriculture has also been associated with the pattern of current and development expenditure which, as has been discussed already in the present chapter, exhibits an inter-sectoral bias unfavourable to agriculture. In these countries, furthermore, it is not merely the monetary effects of the oil industry that are responsible for changes in agricultural land use. Another dimension is added when considering the spatial interaction between oil-related development and agriculture at the

regional and/or local level.

In the course of oil developments, land occupation by the oil industry takes place through the well-known mechanism of granting exploration and production concessions by central governments. This process of land concessions has been regarded as the first step toward the release of land from agriculture use. It could be argued, however, that this process may constitute the least disturbing factor in changing agricultural land use, especially in recent oil-developments where technological innovations have reduced the amount of land needed for that purpose. As shown in the case of Venezuela, since 1942 the area under concession for oil activities reveals that the oil industry has occupied a very small percentage of the total land surface of the country (91,205,000 hectares). In the years of domestic operations by large international companies no more than 13 per cent of the total land surface was acquired by private petroleum companies. After nationalization, concessions have been gradually dwindled to 4 million hectares (4.87 per cent) of the total land surface by 1984 (Fig. 3.10). Since 28.5 per cent of the total land surface is classified as arable land, the proportion taken by the oil industry operations is not as much as to jeopardize agricultural developments.

A more significant factor in understanding changes in agricultural land use is the assumed need to increase efficiency in the agricultural sector in order to preserve its position in the regional economy, which in its turn would lead to a reduction in the conflict between petroleum development and agriculture. In this context, several sources of economies of scale and economies of joint

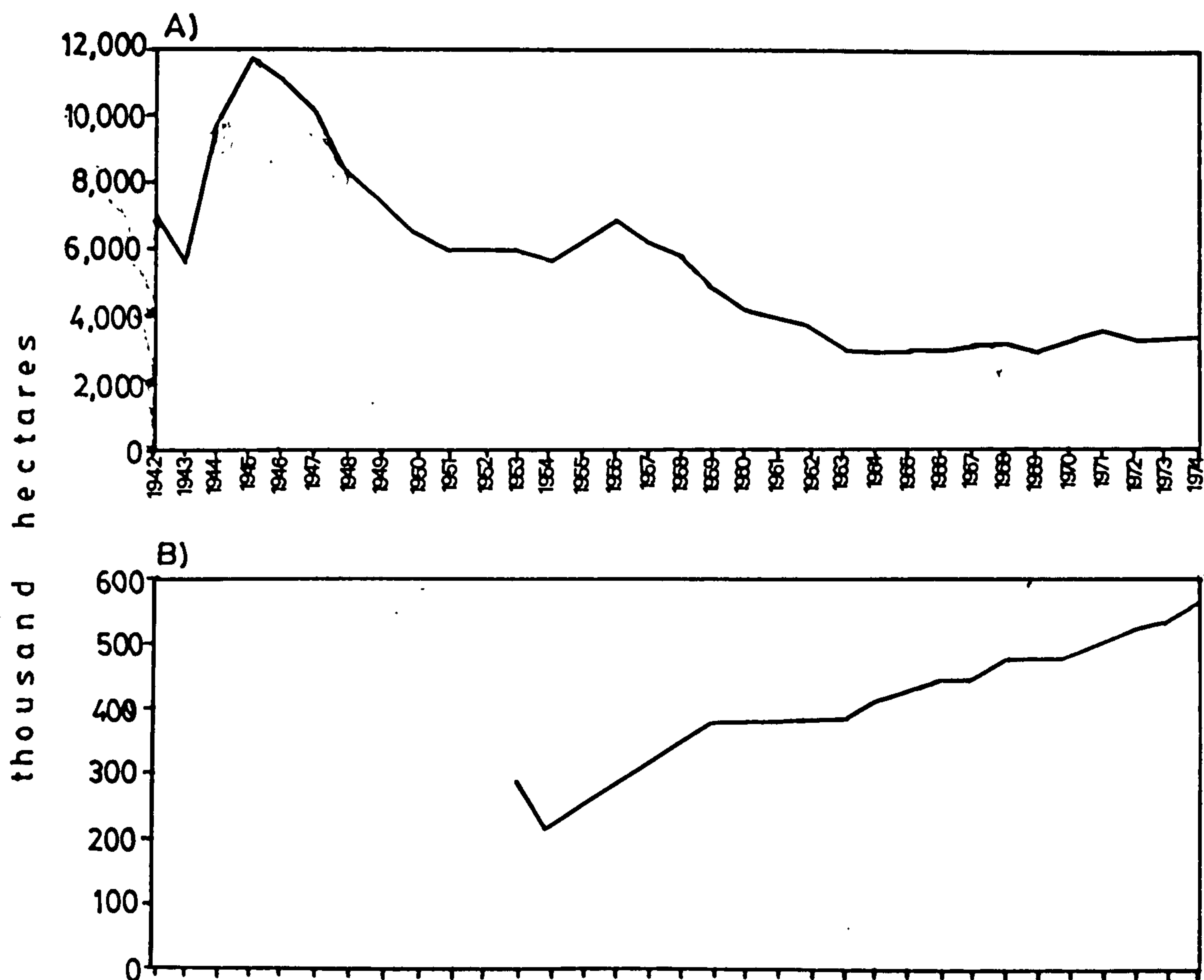


Fig. 3.10 A) Total area of oil concession in Venezuela ;
 B) Total exploited area within the oil concession areas of
 Venezuela (after Academia de Ciencias Físicas,
 Matemáticas y Naturales, 1976, p. 26)

production are available: expansion of farm size, increase in the use of more specialized equipment, specialization of the workforce, and savings in crop production. In the attempt to expand the scale of production capacity, pressure towards changing the agricultural land-use patterns emerges. It may be valid to argue that this cannot be regarded as a direct effect of the oil-industry activities and that it happens not only in these circumstances. It may occur in any other reciprocal economic relationship where no part of an economic system is independent of any other, and all the components interact as part of a spatially and economically cohesive whole. Nevertheless, since petroleum development in developing countries occurs mostly in pre-existing agricultural areas, its impact upon the spatial structure of agriculture is relevant.

There is not sufficient available evidence showing land-use changes in agriculture as a result of petroleum activities. It seems this is a branch of research hardly yet explored. Some examples, however, can be cited. In the case of Algeria, after oil activities began, the oasis agriculture in Aoulef and In Salah was partly changed to the production of melons and winter tomatoes to be exported to Europe. It implied the introduction of market-intensive agricultural practices affecting the pattern of crop production (Schliephake 1977). In eastern Saudi Arabia, oasis agriculture abandoned date production to supply fresh fruits, vegetables and poultry to the oil fields (King 1977).

In the Mexican Gulf-south state, the major oil-producing region of the country, agriculture has been expanding more rapidly than in any other region, although its cropping pattern has not been much altered and

almost all of its traditional crops have been increased in roughly the same proportion. Agricultural land values, however, have considerably increased in the region, tripling its value from 24.70 dollars per acre in 1940 to 68.85 dollars per acre in 1970, the year of the great oil expansion in the country (Yates, 1981). In the case of Libya, it has been argued that oil operations have had only a minor direct effect on the agricultural area. Yet its indirect impact on the pattern of land use has been considerable, observed especially in the remarkable expansion in irrigation schemes and semi-irrigation techniques in formerly dryland orchards (Allan 1973).

On the whole, changes in agricultural land use have been made possible to a large extent by spatial interactions with petroleum development. The impact of land-use changes on the economy and on the natural resource endowment can be regarded as either beneficial or detrimental according to the nature of interaction between the two individual sectors. This is the focus of attention in Chapter 5 when we consider the agricultural development of the North Orinoco region of Venezuela in spatial terms.

3.3 CONCLUSIONS

The present chapter has been designed to present the two major elements of interaction between petroleum and agricultural development, namely, the patterns of government expenditure and the expansion of the oil industry. It has been noted that through the patterns of government expenditure, largely determined by the level of oil production, expenditure in agriculture has not expanded

in accordance with the increases in oil revenues. On the contrary, more capital has been generally invested in agriculture during the periods of lower availability of oil revenues. Moreover, the pattern of government expenditure towards agriculture has encouraged a certain degree of project dispersal, in which the oil-producing regions become the least favoured.

Furthermore, in the process of expansion of the oil industry, agriculture has benefitted from the development of upstream operations. The establishment and/or acquisition of the infrastructure needed for operations such as gathering and separation networks, pipelines, loading terminals and tankers, appear to be largely used by the local agriculture. Clearly, a linkage between upstream operations and agriculture is likely to take place. But as far as downstream oil operations is concerned, there has been a failure to integrate these operations to the regional and local agricultural development, basically with regard to the provision of petrochemicals and refined products required by agriculture for the improvement of its physical and economic structure.

The analysis of the above issues is vital when considering the extent to which integration between the two sectors, petroleum and agriculture, has been achieved. We can say in closing this section that the oil-producing developing countries have paid an unduly large amount of attention to the exogenous factors that affect petroleum production and the volume of revenues needed to meet their basic financial requirements for development, whilst the spatial and economic integration of the petroleum sector with

agriculture has not been fully explored. The chapters that follow will re-consider the discussion in a specific geographical case, that of the North-Orinoco region of Venezuela.

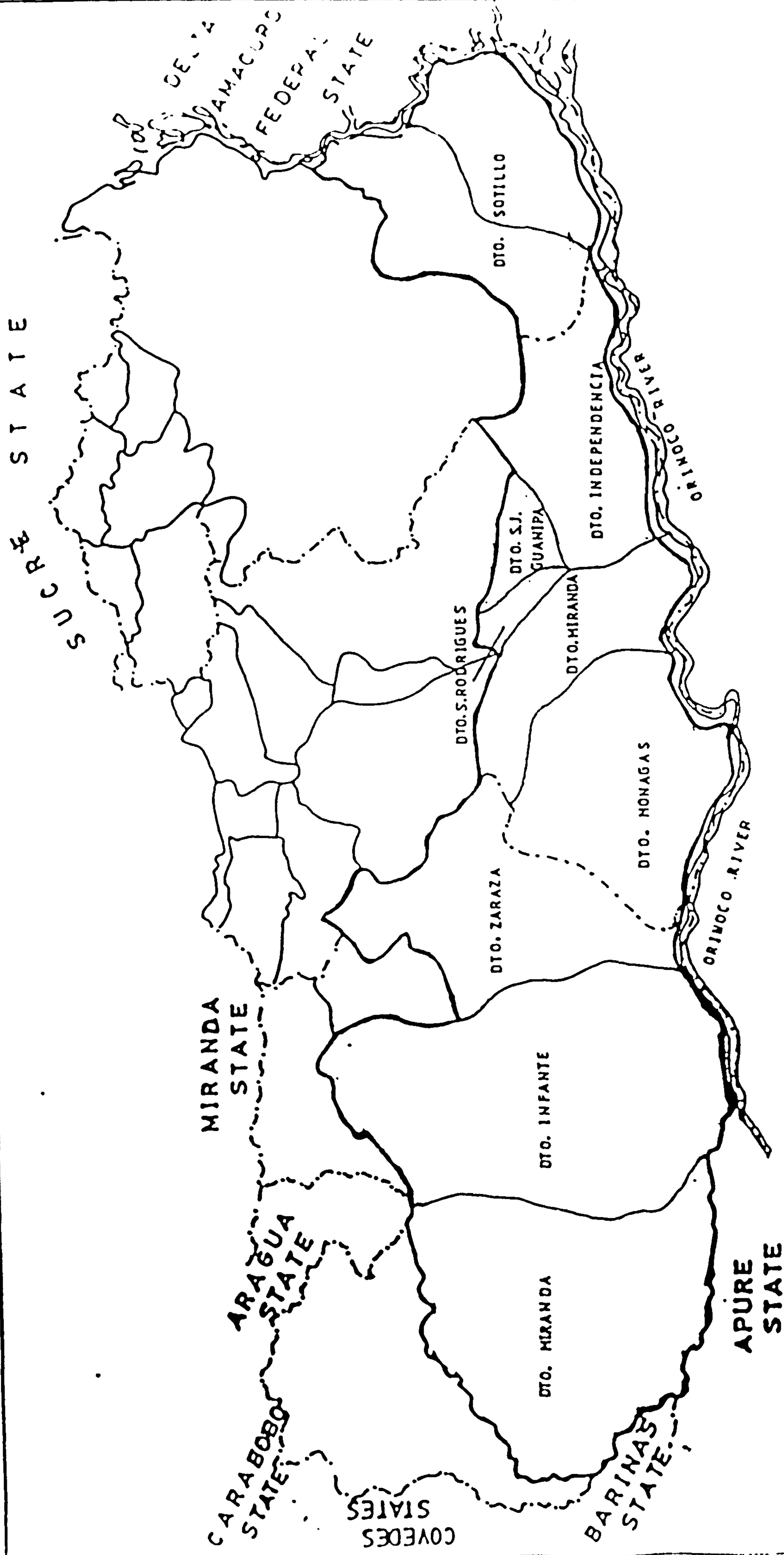
CHAPTER 4: THE DEVELOPMENT OF THE NORTH-ORINOCO PETROLEUM REGION

This chapter outlines the physical, spatial and economic features of the North-Orinoco region. After focusing on the physical features, attention is paid to the demographic aspects, the regional organization of space and the analysis of the different economic activities that prevail in the region. Since this study is concerned with a petroleum-based region, particular emphasis is given to the main characteristics of the oil developments that have taken place up to 1985, the year in which fieldwork was carried out for the present study.

4.1 LOCATION

The North-Orinoco region represents around 9 per cent of the total area of Venezuela and is located in the southern part of the eastern zone of the country, north of the Orinoco river and within the central and Eastern Llanos region. Initially the area was confined to the 55,000 Km² designated to oil exploration activities, but later the area was modified for planning reasons to a wider region of 82,000 Km², including the administrative division of the states of Guarico (Districts of Miranda, Infante, and Saraza); Anzoategui (Districts of Independencia, Miranda, Monagas, Simon Rodriguez, and San Jose de Guanipa); Monagas (District of Sotillo) ; and Territorio Federal Delta Amacuro (Figure 4.1).

The region extends 650 kms. from east to west and 70 kms. from north to south. It is located between 61° 30' and 68° 00' longitude west and 7° 30' and 9° 30' latitude north. The limits of the area are specified as follows: North, the southern part of the area of oil



- Region boundary
- District boundary
- - - - State boundary

Fig. 41 North-Orinoco region: administrative divisions (source of data: Oficina Central de Estadística e Informática, 1985)

concessions given for the exploration, exploitation and production of the traditional oil fields in the Oriental petroleum region of Venezuela; South, line east-west at 25 or 30 km. north of the Orinoco river towards the Complejo Basal of Guayana; to the East, although the limits are not accurately defined, the area includes part of the Territorio Federal Delta Amacuro with a possible extension to the sea in the Orinoco Delta; West, the Alto de Baul, in the surrounding areas of the Calabozo town, in the state of Guarico.

4.2 PHYSICAL FEATURES AND RESOURCES

4.2.1 Landscape

There are basically two units of landscape in the region: (a) a plateau relief, called "mesa", which extends to the north-east of the area and covers 60 per cent of the total area; and (b) an alluvial plain in the south and in the western part of the region.

4.2.2 Geology

The area of the "Faja Bituminosa del Orinoco" - Orinoco Oil Belt - contains stratigraphic units which date from the pre-Cretaceous up to the Quaternary. Pre-Cretaceous formations include: a) an igneous-metamorphic base which forms an integral part of the "Guayana Complex"; and b) the formations of "Hato Viejo" and "Carrizal", in discordant contact above a base of entirely continental origin. The Cretaceous formations are represented by the "Temblador" group which consists of glauconites, "Tigre" formations

and the inferior "Canoa". Over this group the "La Pascua" formation lies discordantly in western zones. It is an Oligocene formation of clean, compact sandstone, in concordant contact with the "Roblecito" formation, characterized by lutites. During the middle and late Oligocene and the early Miocene, "Chaguaramos" deposits were formed in the western zone, and the "Oficina" in the rest of the region. These formations contain petroliferous sandstone of commercial value. In the middle Miocene the "Freites" deposits were formed in the north-central and eastern areas extending to the south-central parts of the region. During the late Miocene and Pliocene, "Las Piedras" was formed, a large-grained powdery sandstone, with interstratifications of grey-green lutites, and some lignites. The Pleistocene is represented by the "Mesa" formation in the north-central and eastern areas, consisting of loose sandstones, conglomerates, and clays. Generally the sediments of this part of the region contain numerous porous and permeable sandstones, saturated with heavy hydrocarbons.

4.2.3 Geomorphology

The area of study extends to the east of the country in an extensive plain relief usually known as the Llanos, which is located between the Caribbean Mountain system and the Guayana highlands.

The main physiographic units can be classified in terms of two kinds of natural relief: the landscape of ablation origins and the landscape of accumulation origin. The plateaus or mesas and the hills form the first type of landscape. The main mesas are located in the southern part of Anzoategui state and in the northeastern part of Monagas

state, and the main hills extend to the northwest. The accumulation origins landscape is formed by the piedmonts, valleys, and plains. The central part of the study area, Guarico state and some small sectors in Anzoategui and Monagas states reveal a piedmont landscape. River valleys include those of the Orinoco and its tributaries. Several kinds of plain are encountered in the region. The alluvial plains extend along the rivers Guarico, Guariquito, Orituco, Pao, Chimire and Iguana; deltaic plains stretch along the Tigre and Guanipa rivers; and aeolic plains extend along the Zuata and Manapire rivers in the southwestern part of the region (Fig.4.2).

4.2.4 Soils, Vegetation, Fauna and Conservation areas

To start with, four types of soil are present in the region. Clay soils are predominant in the Territorio Federal Delta Amacuro. Sandy soils are found in the state of Anzoategui and the western part of Monagas state. A variable texture mixed with clays prevails in the western part of the state of Guarico and in the eastern part of the state of Monagas. Silty soils predominate in the eastern part of Guarico state.

Soils with fine texture predominate in the alluvial plains and in low relief areas subject to constant flooding. These are areas of severe limitations for agricultural use during the period of excessive rain. Permeable soils occur in the plateaus, which present problems of erosion and low fertility. However, these areas have been successful in the production of certain annual crops such as sorghum and peanuts as well as in forest plantation programmes. Several forest

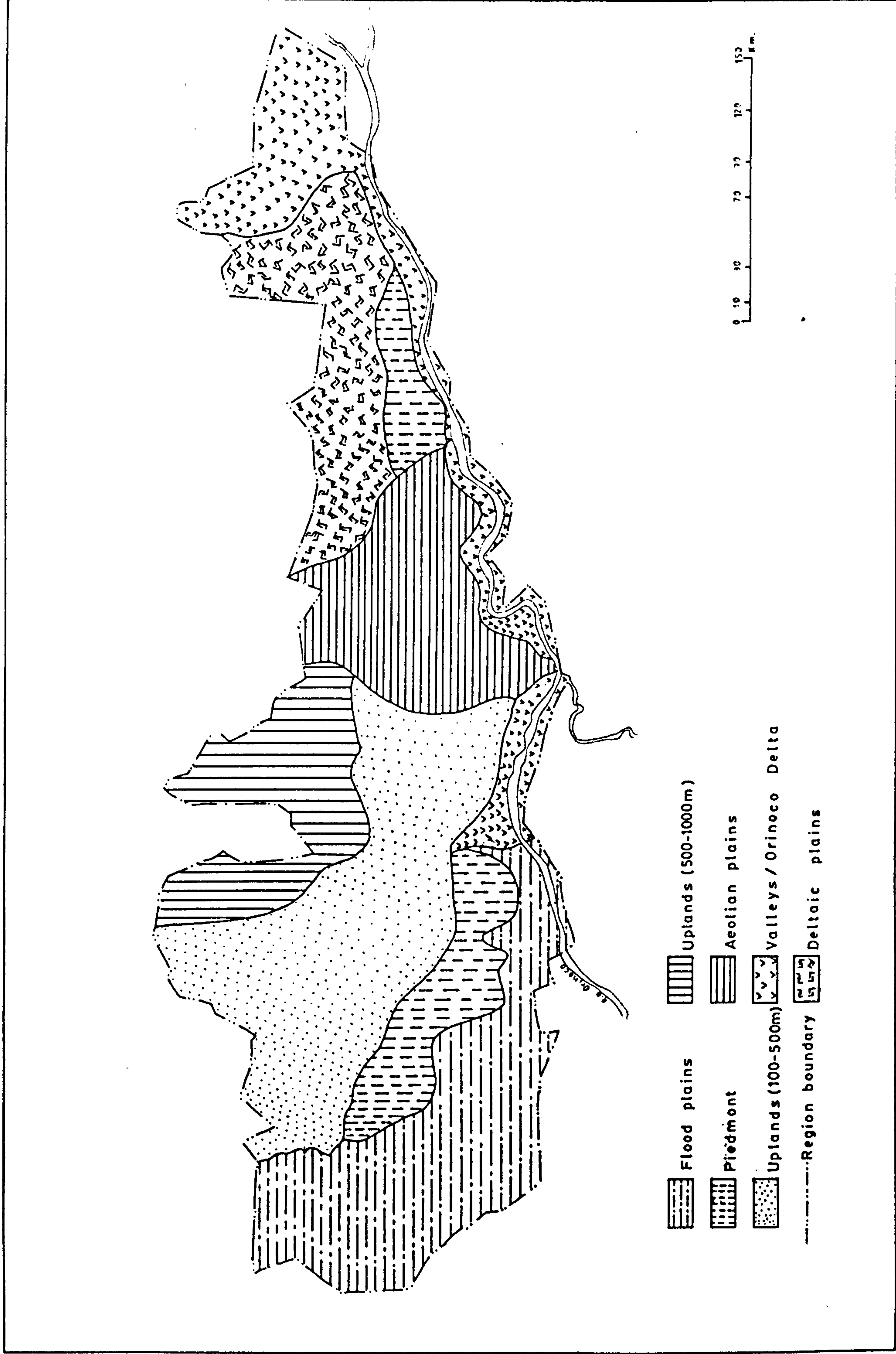


Fig. 4.2 North-Orinoco region : physical features (adapted from Ministry of Environment, Informe tecnico, 1982)

plantation projects have been undertaken in the south of Monagas and Anzoátegui states. These projects are based on the plantation of pine and eucalyptus species covering an area of 110,000 ha., and which are expected to cover 449,000 ha. by the year 1989 (Franco and Acosta, 1985).

The classification of soils for the region corresponds to that used at the national level (COPLANARH, 1974). It uses a scale of 1:250,000 which clearly does not allow representation of areas with detailed or complex soil patterns. The absence of studies with a greater detail constitutes a serious restriction in the definition of the actual and potential use of land for agricultural purposes.

In terms of vegetation, about 70 per cent of the study area is covered by grassland, which corresponds mainly to natural savannas of different kinds. In addition, 20 per cent of the total area is covered by tropical forest (MARNR-COPLANARH, 1983). The natural vegetation is closely associated with the different landscapes already mentioned. The alluvial plains account for a great diversity of the natural vegetation; the tropical forest predominates and gallery forest occurs along the rivers. Species resistant to excessive flooding are located in these lowlands.

Dry savannas occur on the plateaus. Many shrubs and small trees appear in these savannas, especially in zones where the hydrological balance is favourable to their development (i.e. chaparros, mantecos and alcornoque). The dominant grass species in the savannas is the *Trachipogon*, with low nutritional value thus affecting further development of these areas. The sandy llanos and the small watercourses

are dominated by gallery forest and Moriche palm trees. These forests are important in water conservation, fauna protection as well as in terms of scenic value (Perez, 1981). The Delta area of the Orinoco river is mainly covered by natural formations of tropical rain forest, and is regarded as having a high ecological value.

A rich variety of fauna dominates the area of study. Species include the manatee, iguana, water lizard, caiman, anaconda, owl, armadillo, wild rabbit, limpet, skunk, otter, tiger, tapir, deer, heron and various kinds of tortoise. Some of these species are under study for further protection and some are seen to be in danger of extinction as is the case of the manatee (*Trichechus manatus*) in the Delta zone, the Arrau Tortoise along the Orinoco river and the "perro de agua" (*Pteronura brasiliensis*) in the flooded savannas.

Finally, although many zones of the study area contain valuable ecosystems, there is only one National Park, the Aguaro-Guariquito National Park. This is located in the south of Guarico state and covers 500,000 ha. Due to its lush vegetation and fauna resources it is considered to be an important site for recreation and nature conservation.

4.2.5 Climate and Hydrology

The main parameters related to climate can be described as follows. The region is situated in a zone of relatively high temperature, where extremes in precipitation and drought can be found.

Sunshine hours range between 6 and 10 per day. The average annual

temperature falls within the 25 - 29 Celsius degrees range, with extremes reaching approximately 35 Celsius degrees. The prevailing winds come from the east and northeast, and the speed is about 3 to 4 metres per second. There are on average between 100 and 200 rain per year, and amounts fall generally within the 1000-1500 mm range. Potential annual evaporation varies from 1500 to 3000 mm.

In conditions such as these, agricultural activity can, in general, be developed without major restrictions, especially in the dry season. With regard to the region's hydrology, it may be noted that the Guarico dam is the most important reservoir of surface water in the area of study. At its maximum level it would irrigate 16,000ha. of agricultural land. The lower zone of the Tigre river and the medium and lower Morichal Largo and Yabo rivers are additional possibilities for water reservoirs, although a limited use of these reservoirs may persist due to ecological restrictions.

The ground water level of the region has also been considered as a potential reservoir. This is based on the result of an assessment of water capacities at 200 m depth which gives an estimate of some $900-1000 \times 10^9$ cubic metres of available water. Flooding in the region is caused mainly by the Orinoco river. The sediment calculations on different rivers indicate that major erosion problems exist along the Unare, Tiznados and Guanipa rivers, particularly in the dissected mesa-basins.

4.3 POPULATION

The results of the 1981 population census show a total population for the region of some 409,833 inhabitants, an increase of about 21 per cent compared to the 1971 census. However, as Table 4.1 shows, the rate of population growth shows a decrease from 4.12 per cent for the period 1950/71 to 2.61 per cent for the period 1971/81. About 60 per cent of the population live in localities with more than 5,000 inhabitants, while the rest of the population is largely scattered in rural areas.

This dispersed settlement pattern of population gives a density of population of 5.21 inhabitants per square kilometre, which is low for the area as a whole compared to the national average density of 15.9 inhabitants per square kilometre. However, as Figure 4.3 shows, within the area the density is higher in the east, representing 5.96 inhabitants per square kilometre while in the western part it is 3.98 inhabitants per square kilometre.

Many factors account for this pattern, but two are of particular importance. One is the distribution of rainfall which in combination with other elements of a rich resource base encouraged settlement in the plateau. The other is the occurrence of mineral wealth and subsequent industrialization in the south-east of the area.

Among the rural areas three diverse settlement types can be identified. (a) One which is directly the response of the development of the oil activities in the region; (b) another which is associated to agricultural development projects; and (c) another which is

Table 4.1 North-Orinoco region: General pattern of population growth, 1950-1981

ADMINISTRATIVE UNIT STATE/DISTRICT	P O P U L A T I O N				Annual % Increase	
	1950	1960	1971	1981	1950-1971	1971-1981
ANZOATEGUI	65,468	103,998	120,565	159,104	4.00	3.19
Independencia	11,296	13,276	16,398	16,398	1.82	0.49
Miranda	12,730	14,510	21,100	21,100	1.56	2.47
Monagas	9,274	11,953	10,579	10,579	2.38	-2.39
Simon Rodriguez	21,952	43,059	75,026	75,026	6.38	4.60
S. Jose de Guanipa	10,216	21,200	36,001	36,001	5.83	5.84
GUARICO	97,324	140,783	228,428	228,428	4.39	2.20
Miranda	27,863	43,906	92,874	92,874	6.82	3.69
Infante	35,870	52,854	85,154	85,154	4.60	2.06
Zaraza	33,591	44,023	50,400	50,400	2.15	0.32
MONAGAS*	18,406	19,267	33,435	33,435	1.90	2.96
Sotillo	18,406	19,267	33,435	33,435	1.90	2.96
TOTAL	181,198	264,048	420,967	420,967	4.12	2.62

* The administrative division of Monagas state has been changed since 1983.
District Sotillo has been divided into Municipio Libertador and Municipio Sotillo

Source: O.C.E.I. Central Office of Information and Statistics, 1985 .
Ministry of Production. Census of population and household, Various issues.

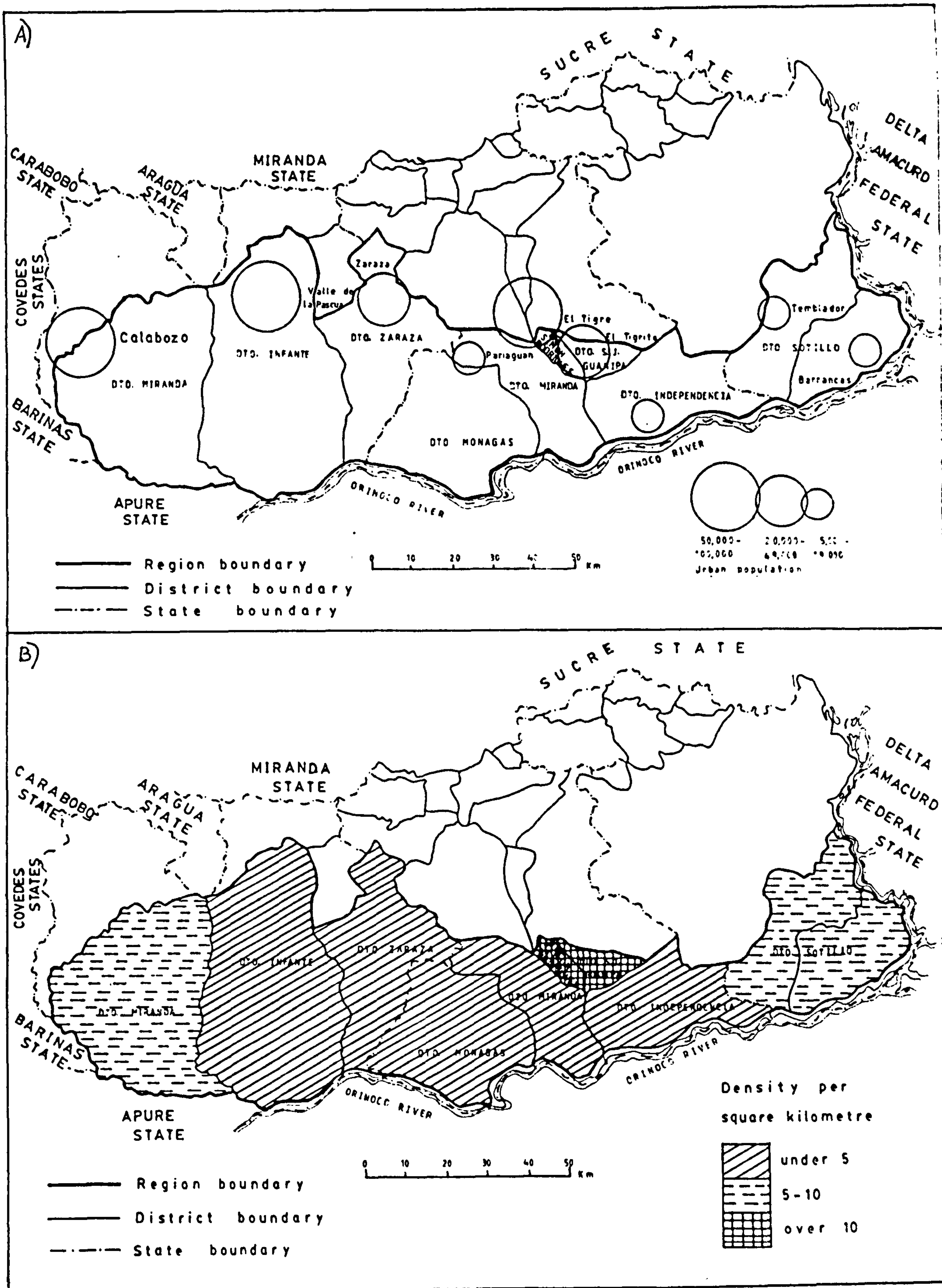


Fig. 4.3 North-Orinoco region : A) Urban population distribution
 B) Population density
 (source of data: Oficina Central de Estadística e Informática, 1985)

intimately related to the provision of services for areas of extensive livestock raising. Those rural areas connected to livestock activities and those associated with petroleum development present a more dispersed settlement pattern while those rural areas associated with agriculture shows a cluster settlement pattern.

4.4 THE REGIONAL ORGANIZATION OF SPACE

The area of study does not constitute a geographical region in itself other than in administrative terms. It is a juxtaposition of areas with hardly any relation to each other due not only to their physiographic characteristics, but even more to their attachment to different administrative entities, and to the presence of governmental agencies with different interests in the region. In administrative terms this constitutes a serious obstacle to planning and investment policies.

The area has been regarded as a region outside the boundaries of the actual occupational pattern of the country, already described in Chapter 1 (Ministry of the Environment, 1982). Nevertheless, the natural and strategic resource endowment of the area may imply a widening of the frontiers of investment, industrialization and urbanization processes towards the region. This in turn, may affect the future spatial structure of the country.

Historically the area has acquired different spatial roles according to the nature of the development policies pursued within and around it. In the 1930s the region facilitated the establishment of spatial



relations between the Central region and the North-oriental and Guayana regions. This was the result of the development of an international export-oriented economy, with efficient production levels and high returns deriving from petroleum development in the northern borders of the area. Later, in the 1950s, the development of an industrial mining complex along the southern border implied for the region the formation of a highly-mechanized agricultural centre capable of meeting the nutritional requirements of the growing industrial-urban centre of Guayana. In the later 1970s, the development of the Orinoco heavy oil deposits implied the spatial transformation of the area into a centre of urban concentration and of the provision of goods and services. Most recently, in the later 1980s, the region has acquired a rather different spatial role which is connected to the establishment of a water transportation network and its related infrastructure and service facilities. This is the result of the approval of a fluvial development in the Orinoco-Apure basin which attempts to counterbalance the traditional spatial pattern of Venezuela that has been so far clustered around the central part of the country.

These factors, together with the internal economic dynamism of the area, have served to shape different spatial interactions and links between the area and the country as a whole. As Figure 4.4 shows, the western part of the area is mainly linked to the Central and Capital regions of the country, the central part of the area is linked to the North-oriental region while the east part is linked to the Guayana region.

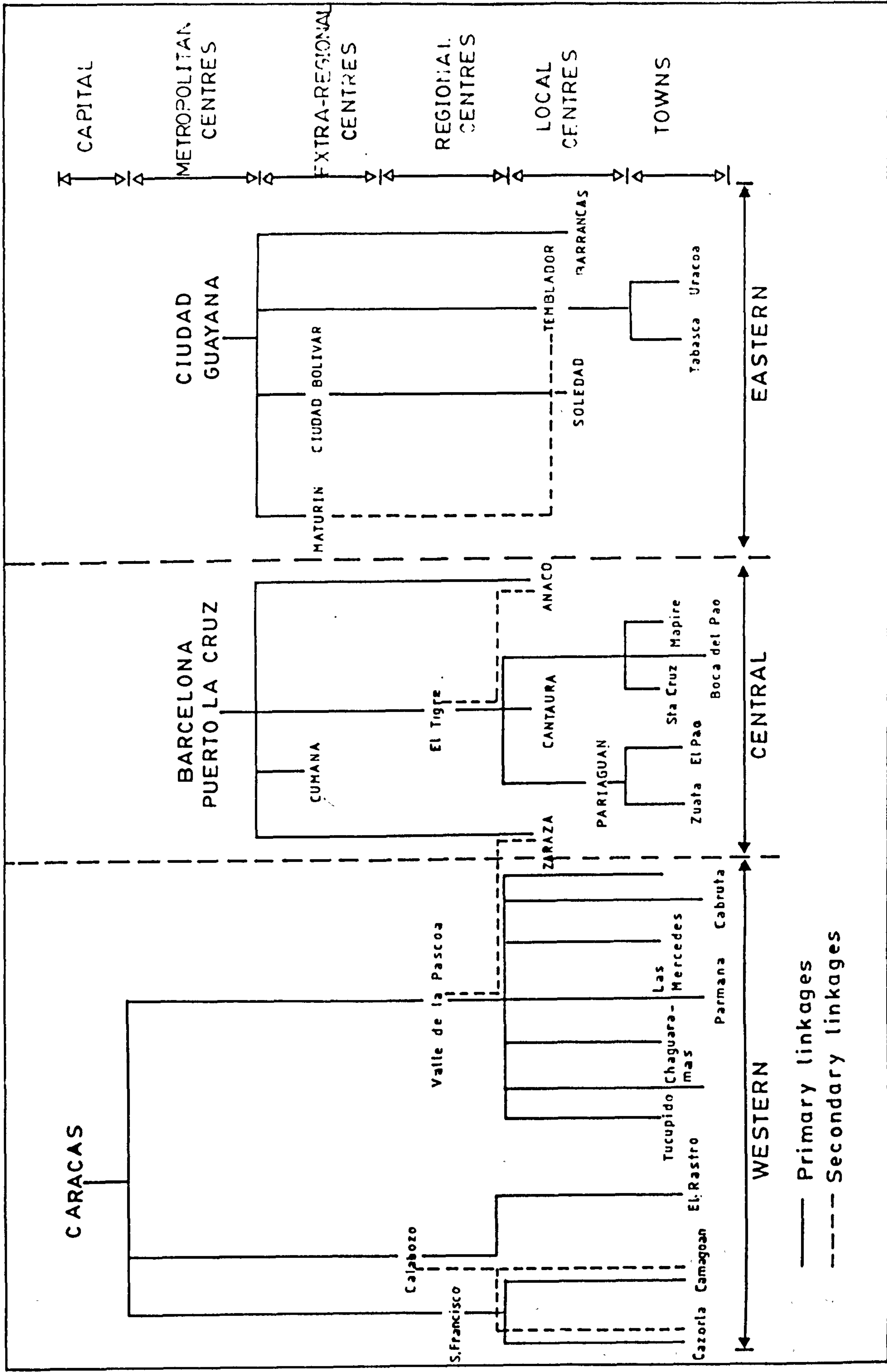


Fig. 4.4 North-Orinoco region : spatial interactions (source: Ministry of Environment, 1982)

4.5 CURRENT OIL DEVELOPMENTS

In 1979 an exploration programme was initiated to delineate and quantify resources in the Orinoco Heavy Oil Belt. This process lasted from 1980 to 1983, revealing the existence of some 1.2 trillion (10^{12}) barrels of oil in place and recoverable resources estimated in 200 billion (10^9) barrels. Thereafter the phases of perforation and production started to slow down as a result of the fluctuations in the international oil market. Thus the initial programme of production of some 50,000 b/d for 1983 was not accomplished as scheduled and the expected 1 million b/d in the year 2000 has been scale down.

Data available show that there are different stages in the development of the Orinoco oil deposits. There are four subsidiaries of 'Petroleos de Venezuela' with oil concessions for the exploitation of the oil resource, as seen in Figure 4.5. Each one has stressed in different ways the level of development in oil activity within its designated area. Table 4.2 summarizes the intra-regional variations in oil developments. The Machete oilfield (24,000 km², subsidiary CORPOVEN, State of Guarico) is the least evaluated, though it is regarded as containing huge volumes of oil in situ. The subsidiary CORPOVEN has drilled over 24 wells since 1982 with API gravity (classification of the crudes according to their density) between 7° and 12° and individual capacities of 50-750 b/d.

The Zuata oilfield (14,500 km², subsidiary MARAVEN, States of Guarico and Anzoategui) is formed by 82 drilled wells which have shown an individual potential production of 20-300 b/d and API gravity between 10° and 20°. MARAVEN has recently received approval for the commercial exploitation of oil reservoirs in the central part

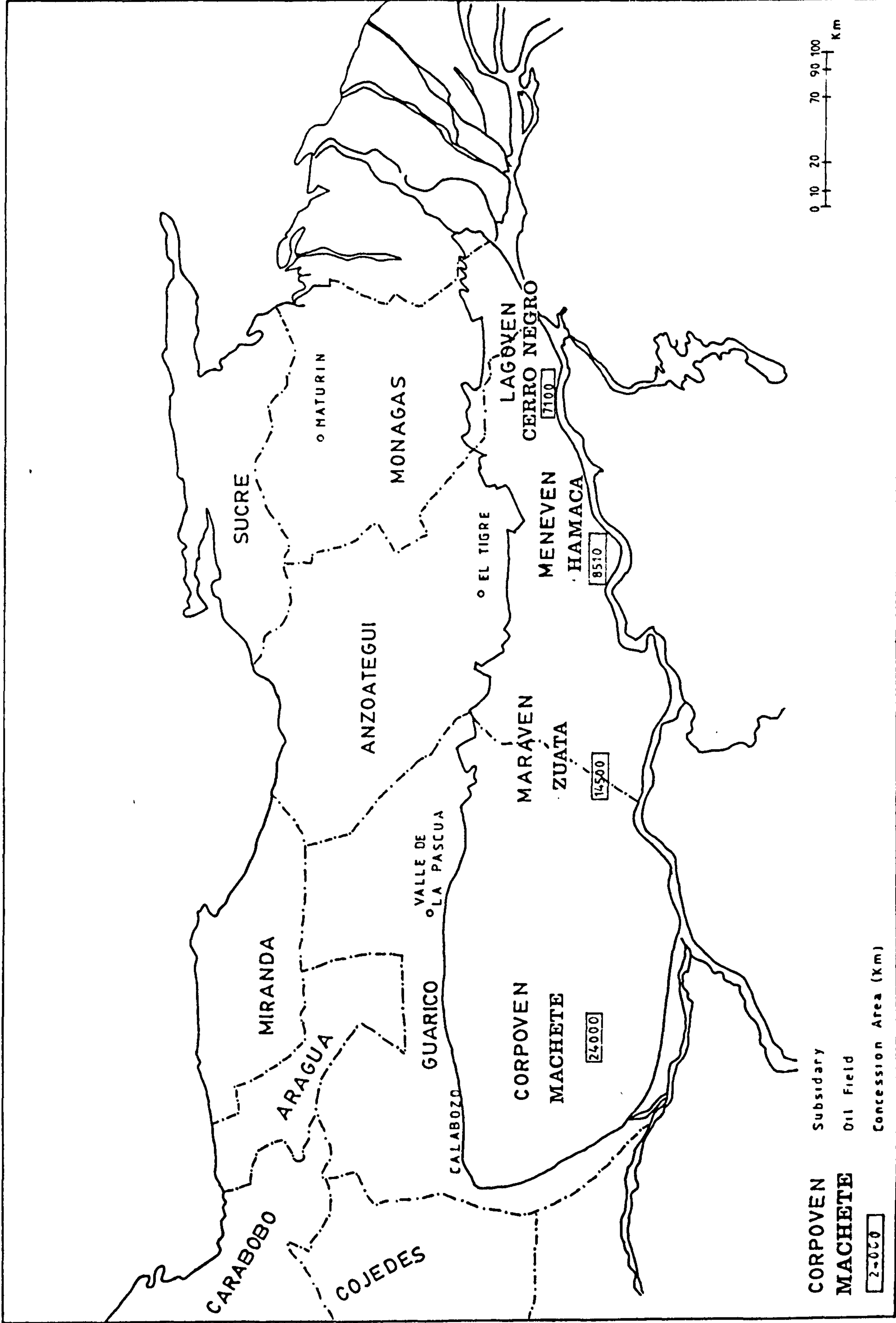


Fig. 4.5 North-Orinoco region : oil concession area (adapted from Ministry of the Environment, 1982)

Table 4.2 North-Orinoco region: Areas of petroleum activity

OIL FIELD	AREA (km ²)	LOCATION (State)	OIL SUBSIDIARY	API GRAVITY	CAPACITY b/d	DRILLING (wells)
MACHETE	24,000	Guarico	Corpoven	7° - 12°	50-750	24
ZUATA	14,500	Guarico & Anzoategui	Maraven	10° - 20°	20-300	82
HAMACA	8,510	Anzoategui	Meneven	8° - 18°	100	169
CERRO NEGRO	7,100	Monagas	Lagoven	8° - 12.50°	40,000	149

Source: Petroleos de Venezuela, S.A. 1982

of the sub-area, where crude presents 10 API and production capacity may reach up to 1,000 b/d.

The Hamaca oilfield (8,510 km², subsidiary MENEVEN, State of Anzoategui) is formed by 169 drilled wells which have shown individual potential capacity of some 100 b/d and API gravity between 8° and 18°.

The Cerro Negro oilfield (7,100 km², subsidiary LAGOVEN, State of Monagas) is the area where more operating activities have hitherto been developed. The subsidiary LAGOVEN is involved in a programme known as Experimental Production Blocks (EPB) which consists of 143 wells with 8° API gravity for virgin crude and 12.5° API for diluted crude. It is complemented with two flow stations with individual capacities of 40,000 b/d; a 24-inch diameter oil pipeline of approximately 15 miles; a 4-inch diameter gas pipeline; and the supportive oil-related infrastructure. The EPBs started to operate in October 1984 with an initial average production of 10,000 b/d. Output had risen to 20,000 b/d by December 1984, and in April 1987 averaged 30,000 b/d.

One of the notable aspects of this project is the use of directional cluster drilling in groups of ten wells with a spacing of 5-20 m between columns and 25 m between rows. The surface area occupied per well is effectively reduced by this means from 0.35 ha during normal drilling operations to 0.04 ha, i.e. a reduction of 89 per cent. The use of cluster wells may eventually minimize the project's impact on the area's ecology, making it possible to produce oil on a commercial scale at the same time as forestry and agricultural

programmes are developed (Plates 4.1, 4.2, 4.3).

4.6 THE REGIONAL ECONOMY

The regional economic geography of the study area may be sectorally viewed by reference to Figure 4.6 which depicts the different economic activities in each area in terms of the inter-sectoral balance. The main sources of economic activity are those of the primary sector of the economy - mining, agriculture, forestry, livestock and fishing -. The areas of subsistence agriculture are basically associated with zones adjacent to rivers, streams and mangroves as well as with 'islands' in the Orinoco river valley, where shifting cultivation constitutes the technique most commonly adopted. Besides subsistence agriculture, there is a plantation agriculture system which, together with an increase in mechanization, has served to initiate agro-industrial activities.

Livestock activities occupy large zones of the region, mainly in the savannas, but do not constitute a significant source of direct employment. This is due to the fact that within this sub-sector activities are concentrated on dairy production, which is accomplished at the extra-regional scale. Fishing activities on a commercial base are mainly developed in the area of Barrancas (Monagas) and part of Anzoategui state.

Forestry constitutes an important economic activity in the area. It occupies a vast zone of some 171,000 ha. (1984) in the south of the states of Monagas and Anzoategui. And although it has not yet entered



Plate 4.1 Administrative and residential areas of the Cerro Negro oilfield. Monagas state



Plate 4.2 Directional clusterwells along the concession area of the North-Orinoco region. Cerro Negro oilfield.



Plate 4.3 A forest plantation within the zones of oil operations in the North-Orinoco region. Cerro Negro oilfield

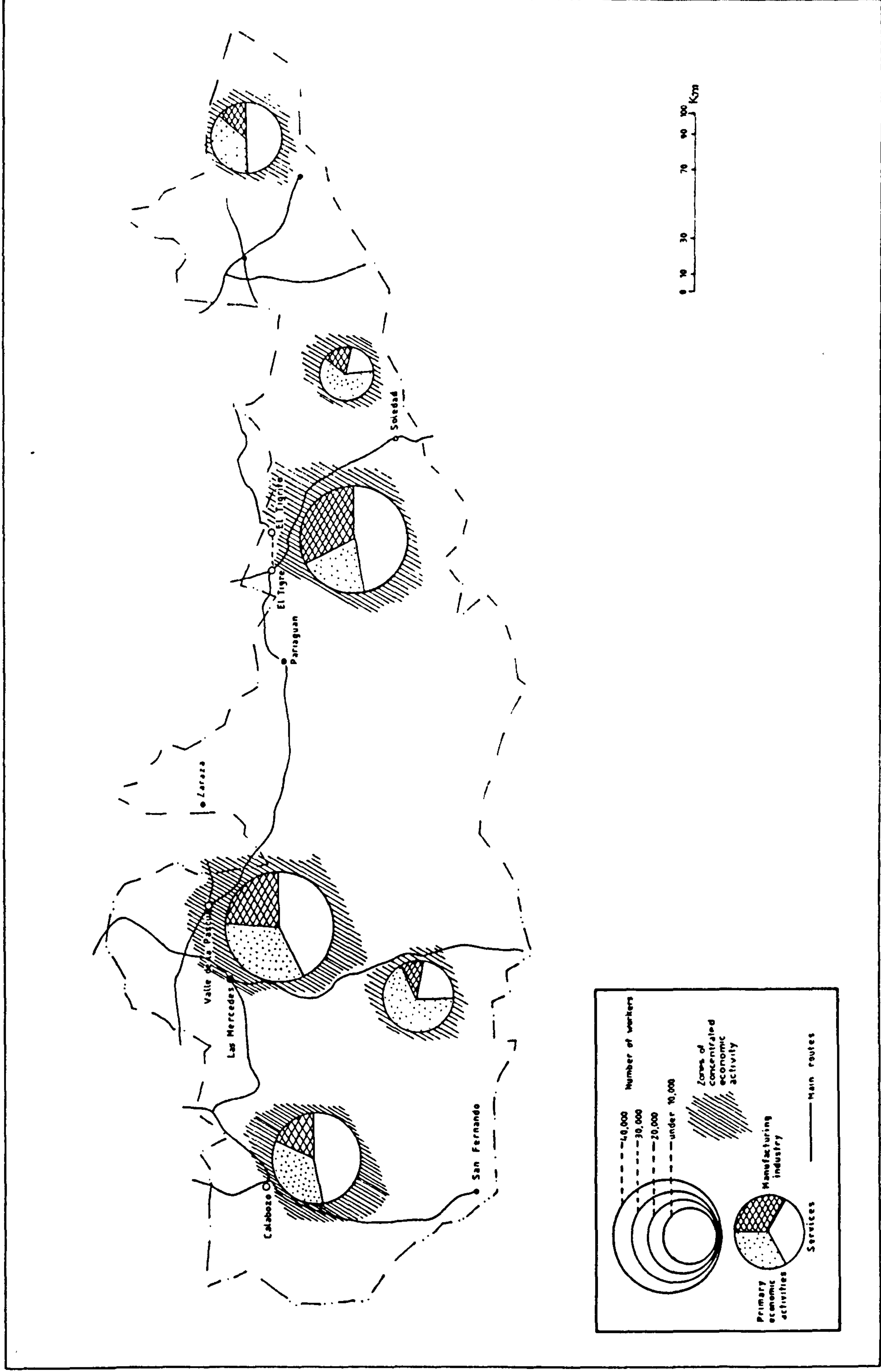


Fig. 4.6 North-Orinoco region : distribution of economic activities (source of data: Ministry of Production, 1980)

into a phase of permanent production, it has attracted a significant proportion of labour and investment, generating another source of income for the region.

The petroleum industry, in principle, constitutes an important direct and indirect source of income and employment. However, the establishment of technological and investment linkages with the extra-regional and international areas implies the transfer of wealth to other regions throughout the country and overseas.

Industry and manufacturing activities are very scarce, and are basically devoted to the processing of goods for final consumption, they include building and construction industries and the processing of timber. These industries are located in El Tigre-El Tigrito, Valle de la Pascua, and Calabozo.

With regard to services there is a strong participation of the public sector in the provision of education, health facilities, transport development, production of electricity, and water supply. This implies a high concentration of investment and employment reflected in the high proportion that this sector represents in the overall economic structure of the region. The services are distributed in the area according to the national/regional urban hierarchy, which benefits mainly the urban centres. Private banking, commercial and business services are less frequent and are also concentrated in urban centres.

The coexistence of these different types of economic activity defines a spatial and economic pattern of linkages in the exchange of goods

and services from and to the area. Figure 4.7 indicates the extra-regional primacy in the supply and acquisition of goods and services and limited exchange flows within the area itself.

On the whole, the regional economic structure reflects a relatively low level of dynamism. Data available show that the region's share in the GNP for 1971 is only 6.2 per cent, which is mainly derived from activities in the tertiary sector (67 per cent). Meanwhile agriculture and manufacturing generate 8 per cent and 17 per cent respectively.

The petroleum industry's contribution to regional development is relevant in terms of financial rewards to local factors, e.g. high level of wages and salaries to local personnel. But is not very significant once one takes account of the fact that it a) generates less than 2 per cent of the regional employment; b) goods and services required by the industry are of extra-regional origin; and c) income derived from petroleum activities brings about the establishment of less productive activities such as commerce which, by having increasing returns, limit the possibility of investment in other more productive activities such as agriculture.

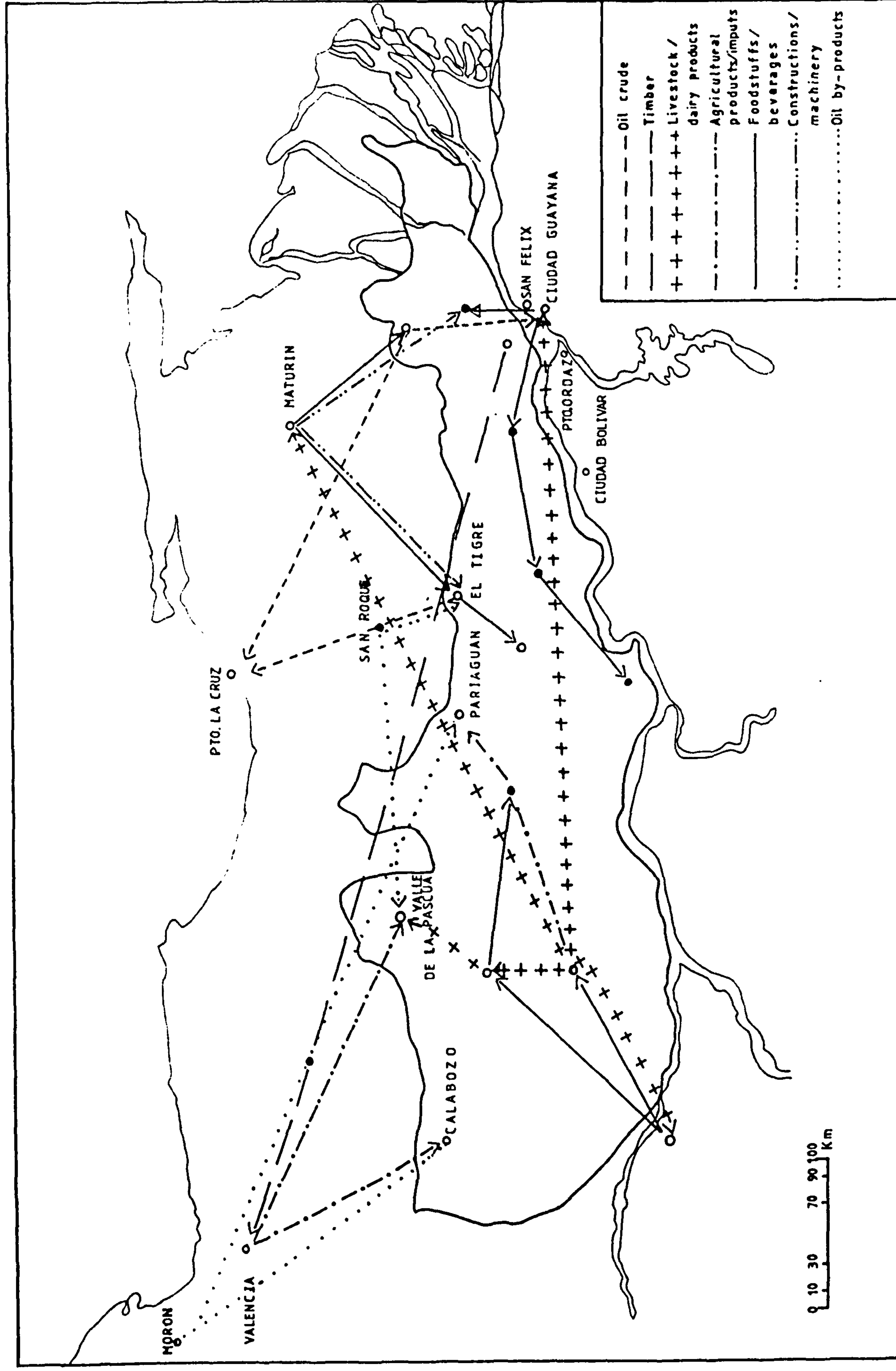


Fig. 4.7 Flows of goods to and from North–Orinoco region. (source: fieldwork survey)

4.7 CONCLUSIONS

The purpose of this chapter has been to describe the most significant features of the North-Orinoco region. At this stage, several points are relevant to bear in mind. Firstly, with regard to the physical environment the region appears to present favourable conditions for the development of agriculture. Nevertheless, more sound studies are needed to determine, for instance, soil capabilities for the harvesting of alternative and/or more varied crops. Secondly, in spatial terms the region shows a marked east-west contrast which implies that the region cannot be considered homogeneous. This pattern of intra-regional disparities is accentuated by the relatively high level of urbanisation and industrialisation prevailing in the areas that surround the North-Orinoco region, especially the industrial-urban centre of Guayana in the southern borders. Lastly, despite the growing development of the petroleum industry and associated activities, the region is relatively slow to change its economic structure. Agriculture and livestock activities remain as the largest economic activity in the region while services constitute the major receiver of both public and private investment.

The attempt to illustrate the main characteristics of the North-Orinoco region will allow the present writer to proceed with the next chapter, in which the structure and changes in the agriculture space-economy of the region will be examined.

CHAPTER 5: THE AGRICULTURAL SPACE ECONOMY OF THE NORTH-ORINOCO REGION

The previous chapter has outlined the physical, economic and geographical characteristics of the North-Orinoco region. The present chapter examines the pattern of agricultural land use in the region, and analyses the changes in the farming system which have occurred since 1980, the date when the development of the Orinoco oil fields was initiated.

5.1 AGRICULTURAL LAND USE

In the pre-colonial era, some agriculture activities were developed along the Orinoco River. The greatest concentration of activity is thought to have been predominant in the vicinity of the town of Barrancas; it was confined to the production of yucca (cassava), with some fishing and trapping of tortoises.

During the period of conquest and colonization (the 16th century) the principal crops were yucca, cotton, maize and some other root crops. By the 17th century livestock raising had started to become an important economic activity, implying changes in the geographical patterns of land use. By the 18th century the northern areas of the region, Calabozo, Valle de la Pascua, and Maturin, were incorporated in the space economy of the region due to the fact that cattle had to be transferred from the lowland areas in the dry season to the higher areas during the rainy months. Towards the second half of the 18th century production of cotton became more important since it entered into a phase of commercialization. By the later 19th century, however, cotton experienced a rapid decline, after a brief revival during the U.S. Civil War.

During the early twentieth century (until 1930) an expansion of agriculture and livestock activities occurred, and 1919 was the year with the maximum level of land under livestock grazing and cultivation during this period. After 1930 some important changes in the cropping patterns took place. First of all, there was a cotton boom in 1938 as a result of a pricing policy which aimed at encouraging the sowing of this crop, and thus cotton cultivation became more widespread. However, at a later stage, the development of the oil fields to the north of the North Orinoco region brought about the consolidation and growth of some urban areas and infrastructures. This resulted, on the one hand, in migration from rural areas and in a decline in agricultural activities; and on the other hand in improvements in the accessibility of regional agricultural products to a wider range of markets and consumption centres. Until then agriculture had received little official attention. The state did not allocate resources to agriculture to the same extent as to other economic activities such as oil production.

In the 1950s agricultural land use changed quite dramatically, aided by the greater use of irrigation and by greater infrastructural development. These changes demonstrate the first substantial impact of petroleum production and fiscal revenues upon the agricultural sector. Cotton cultivation declined after the earlier pricing policy was abolished. Rice and groundnut schemes emerged, replacing cotton plantations.

In the early 1960s the production of sorghum was introduced in the semidesert area in the northeast of Guarico state, which brought about a decline in the use of land for maize cultivation on the Chaguaramas-Valle de la Pascua-San Tome axis and the utilization of land for sorghum in El Tigre and other eastern savannas. By 1975 a significant and expanding area had been given over to forest plantations, an activity that had first been started on a very limited scale in 1962. Figures 5.1 and 5.2 present the pattern in the location of agricultural activities in the region for the year 1980.

The evolution in the amount of land under cultivation from 1950 to 1980 is represented in Figure 5.3. It shows that in 1950 the predominant use of land throughout the area was livestock grazing which together with cultivation covered about 2.75 million hectares, of which 97 per cent was devoted to livestock alone. For 1961 an increase of 33,651 hectares for crop production was reported. This represented an annual growth rate of 3.07 per cent of the area devoted to crop production for the period 1950-61. Similarly, by 1961 there was an increase of 1.75 per cent in the area devoted to pasture in relation to 1950. In 1971 agricultural land use increased only 15.58 per cent in relation to 1961, the area devoted to crop production decreased by 1.02 per cent while livestock grazing increased at an annual rate of 5.9 per cent. In 1980 the amount of land used for agriculture increased again covering an area of 3.47 million hectares, including 520,000 hectares of natural grazing in the Aguaro-Guariquito National Park (State of Guarico). There was an increase of 278,457 hectares for crop production, representing an annual growth rate of 12 per cent

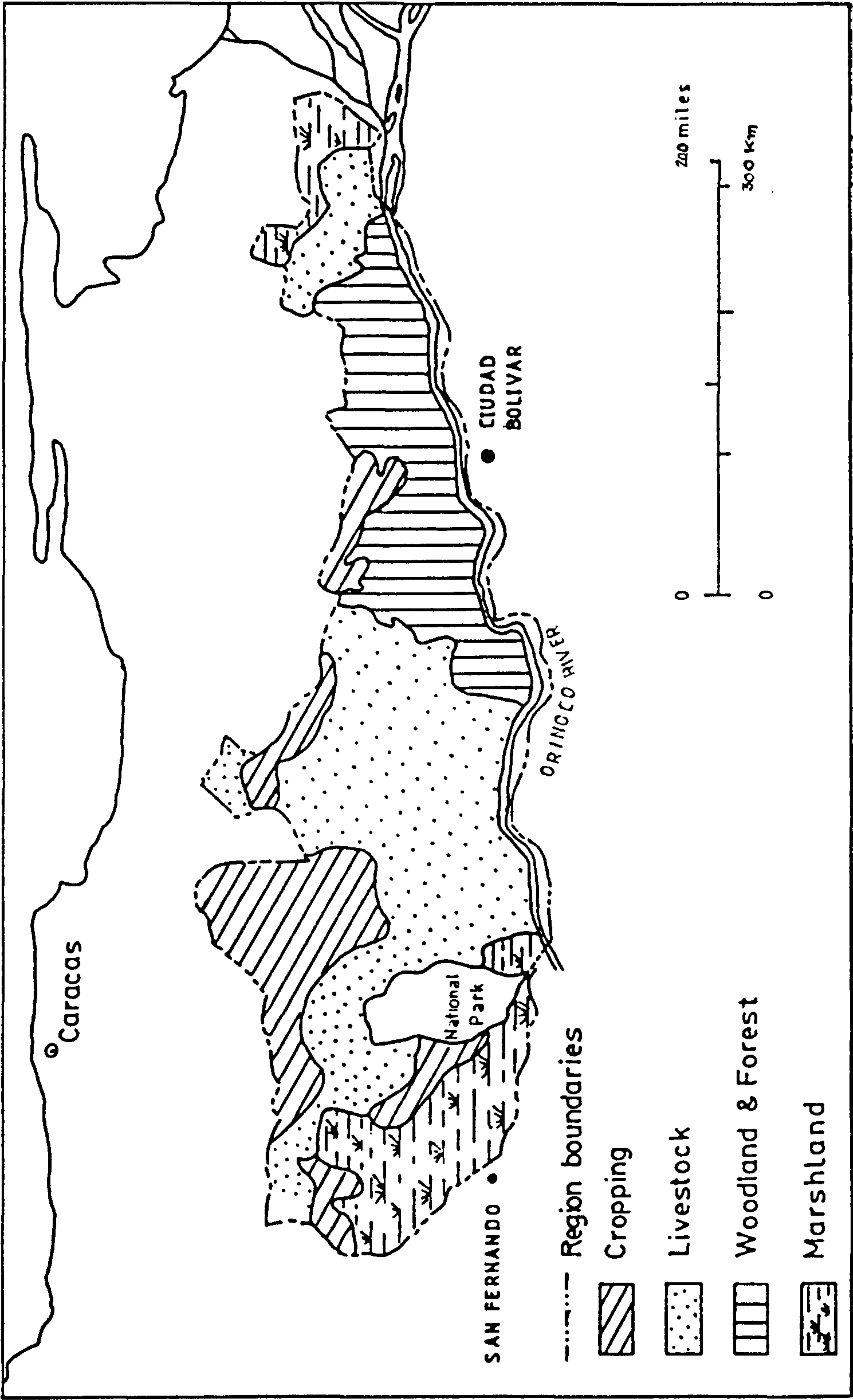


Fig. 5.1 North-Orinoco region : dominant land-use zones
(adapted from Ministry of the Environment, 1982)

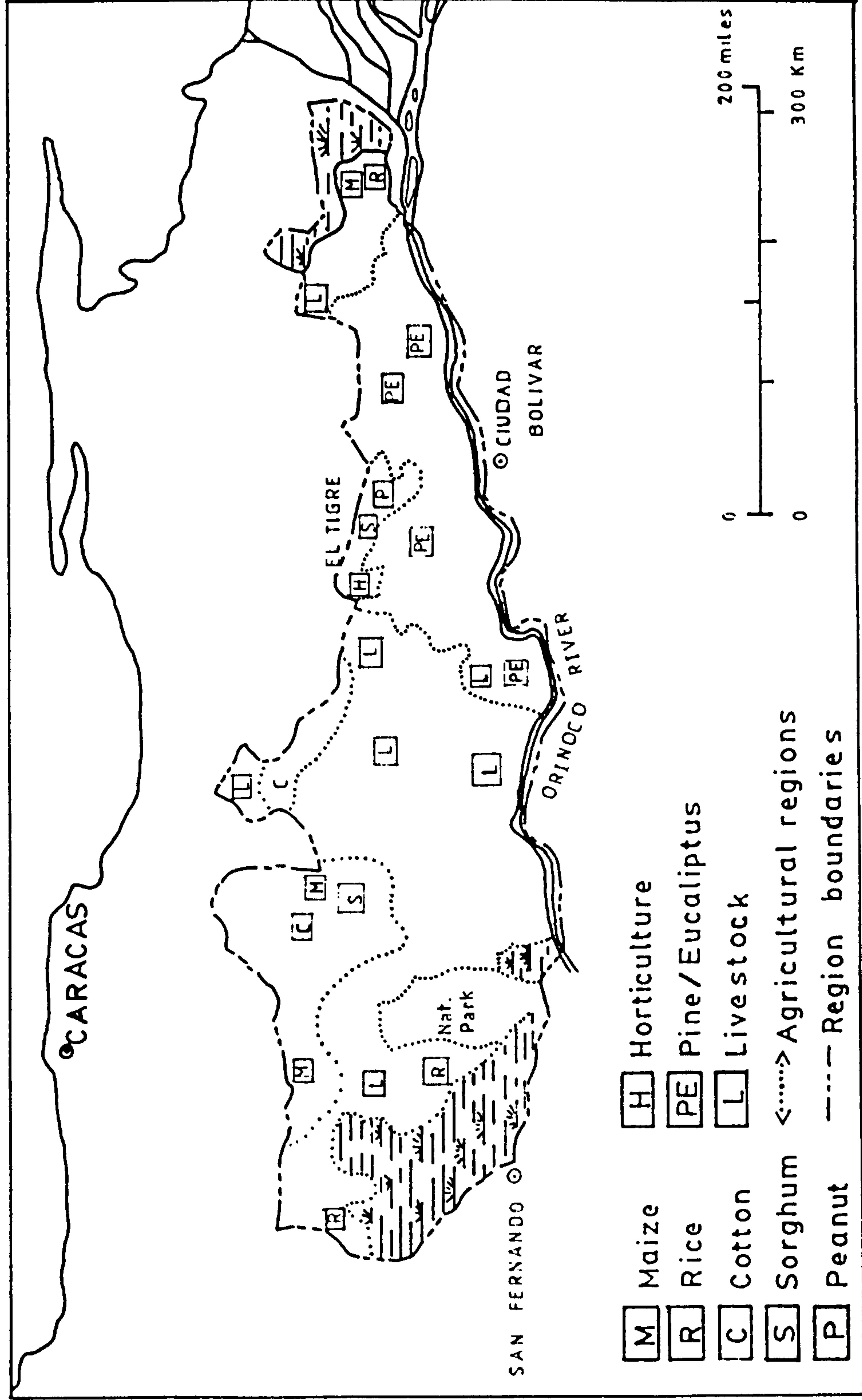


Fig. 5.2 North-Orinoco region : dominant land-use zones and important areas of crop and livestock production (adapted from Ministry of the Environment, 1982)

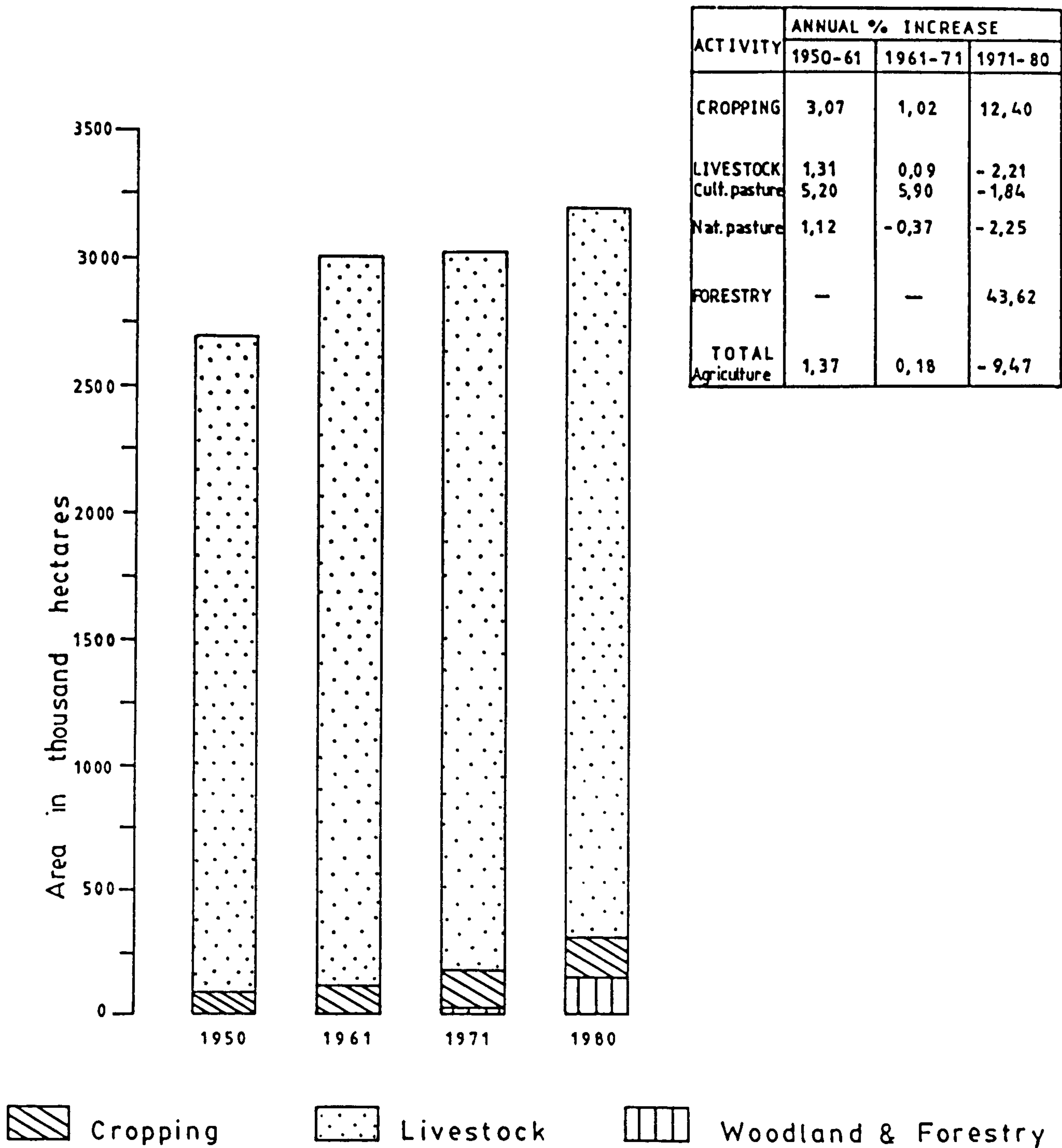


Fig. 5.3 North-Orinoco region : changes in agricultural land-use, 1950-1980.
(sources of data: Ministry of Agriculture and Livestock)

in relation to 1971. This was mainly due to the transfer of land from pasture to the production of sorghum which was regarded as a more profitable agricultural activity. Thus sorghum production was a determinant factor in the expansion of agricultural land.

In general, the expansion of the agricultural frontier over the past 30 years has comprised only 7 per cent, representing an average annual growth rate of 0.2 per cent. In addition, agricultural land use has been concentrated in just 48 per cent of the total potential agricultural land, which has been estimated as 7,021,000 hectares (Ministry of the Environment, 1982).

At the intra-regional level, the state of Guarico has retained by far the most significant areas of land under crop production, increasing from 53 per cent of the region's cropped area in 1950 to 83.8 per cent in 1980. Regarding livestock grazing, the state of Guarico once again occupies the largest area, representing 70 per cent of the total livestock land use for 1980. Woodland and forest land use is of recent introduction on an extensive basis in the region and is mainly concentrated in the state of Monagas and the state of Anzoategui; in these states forestry occupies 47.22 per cent and 52.77 per cent respectively of the total area under this category of land use (Table 5.1).

Cropping in the region has been mainly devoted to cereal crops, which have increased in acreage from 42 per cent in 1950 to 81.2 per cent in 1980. Fruits were the second category in importance in 1950, covering 29 per cent of the cultivated land. However, fruit gradually started to lose importance, occupying just 3 per cent of the cultivated

Table 5.1 Land use in the North-Orinoco region, 1950 and 1980
(in hectares)

ACTIVITY	STATE	1 9 5 0				1 9 8 0				% INCREASE 1950 - 1980			
		GUARICO	ANZOATEGUI	MONAGAS	TOTAL	GUARICO	ANZOATEGUI	MONAGAS	TOTAL	GUARICO	ANZOATEGUI	MONAGAS	TOTAL
CROPPING		45,292	18,566	7,825	71,683	232,011	32,803	5,468	270,282	13.74	2.55	-1.00	9.23
		63.18%	25.19%	10.91%	100%	85.84%	12.13%	2.02%	100%				
LIVESTOCK		2,020,000	547,000	71,000	2,638,000	1,777,244	578,053	156,730	2,512,027	-0.40	0.18	4.02	-0.16
		76.57%	20.79%	2.64%	100%	70.74%	23.01%	6.23%	100%				
FORESTRY		-	-	-	-	-	62,330	55,770	118,100	-	-	-	-
							52.77%	47.22%	100%				
TOTAL CULTIVATED LAND NORTH-ORINOCO REGION		2,065,292	565,566	78,825	2,709,683	2,003,255	673,186	42,840	2,719,281	-0.10	0.63	-1.52	0.01
		76.21%	20.87%	2.90%	100.0%	73.66%	24.75%	1.57%	100.00%				

SOURCE: M.A.C. Ministry of Agriculture and Livestock. Anuario Estadístico Agropecuario, various issues.

land in 1980. Fibre and oilseed crops increased their proportion of cultivated land but diminished in relative importance due to the growth of cereal crops.

During the period 1950-1980 the state of Guarico retained its lead in the use of land for cereals, fibres, oilseeds, grains and legumes. The state of Anzoategui has retained considerable importance in the use of land for fruits, horticulture, and root crops. Whilst the state of Monagas has developed crop production at a relatively lower level than in the other two states (Table 5.2).

5.2 CHANGES IN AGRICULTURAL LAND USE

So far, changes in land use and cropping patterns have been presented with reference to the period 1950-1980. For the purpose of this study, this period has been designated as the pre-1980 period, that is to say, the period prior to the development of the Orinoco oil fields. After a graphic representation of the pattern of land use for 1980 (Fig. 5.4) this section will deal with the analysis of the changes in land use that have taken place in the North Orinoco region after 1980.

During the fieldwork programme, the North-Orinoco region was traversed from the western to the eastern margin, and special attention was directed to the pattern of land use in a selected area of the state of Monagas (Fig. 5.5). It must be said that this area is not typical of all of the region but it represents the kind of land use now present at different places of the North-Orinoco region. Fields are irregular

Table 5.2 Crop production in the North Orinoco Region, 1950 and 1980
(in hectares)

YEAR BY STATE	1 9 5 0			1 9 8 0		
	GUARICO	ANZOATEGUI	MONAGAS	GUARICO	ANZOATEGUI	MONAGAS
CEREALS	12,060	2,846	653	210,896	6,240	2,345
TEXTILES & OILSEEDS	450	-	190	12,921	15,973	676
LEGUMES	5,910	849	220	6,902	3,966	193
ROOTS	1,873	671	590	1,062	1,534	538
FRUITS	3,869	1,147	1,220	180	4,490	1,716
HORTICULTURE	-	-	-	50	600	-
FALLOW	21,130	13,053	4,952	-	-	-
T O T A L	45,292	18,566	7,825	232,011	32,803	5,468
	71,683			270,282		

Source: M.A.C. Ministry of Agriculture and Livestock. Anuario Estadístico Agropecuario
various issues

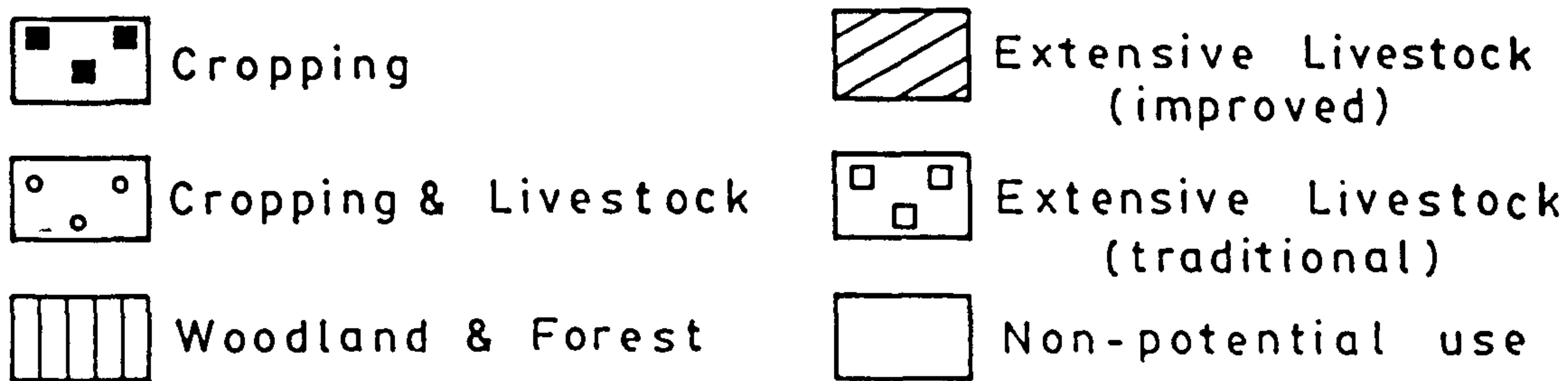
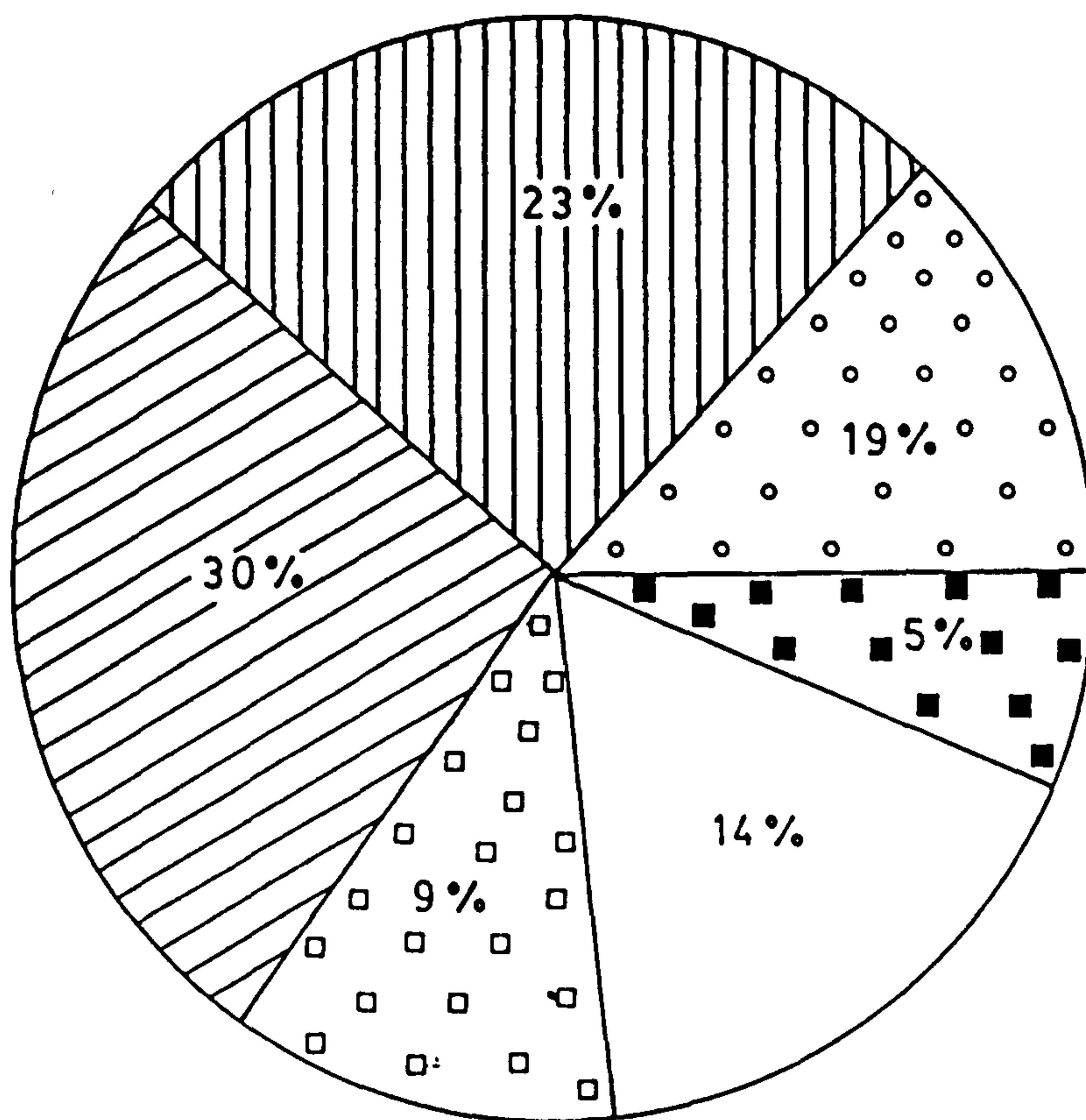


Fig. 5.4 North-Orinoco region : agricultural land-use, 1980
(adapted from Ministry of the Environment, 1982)

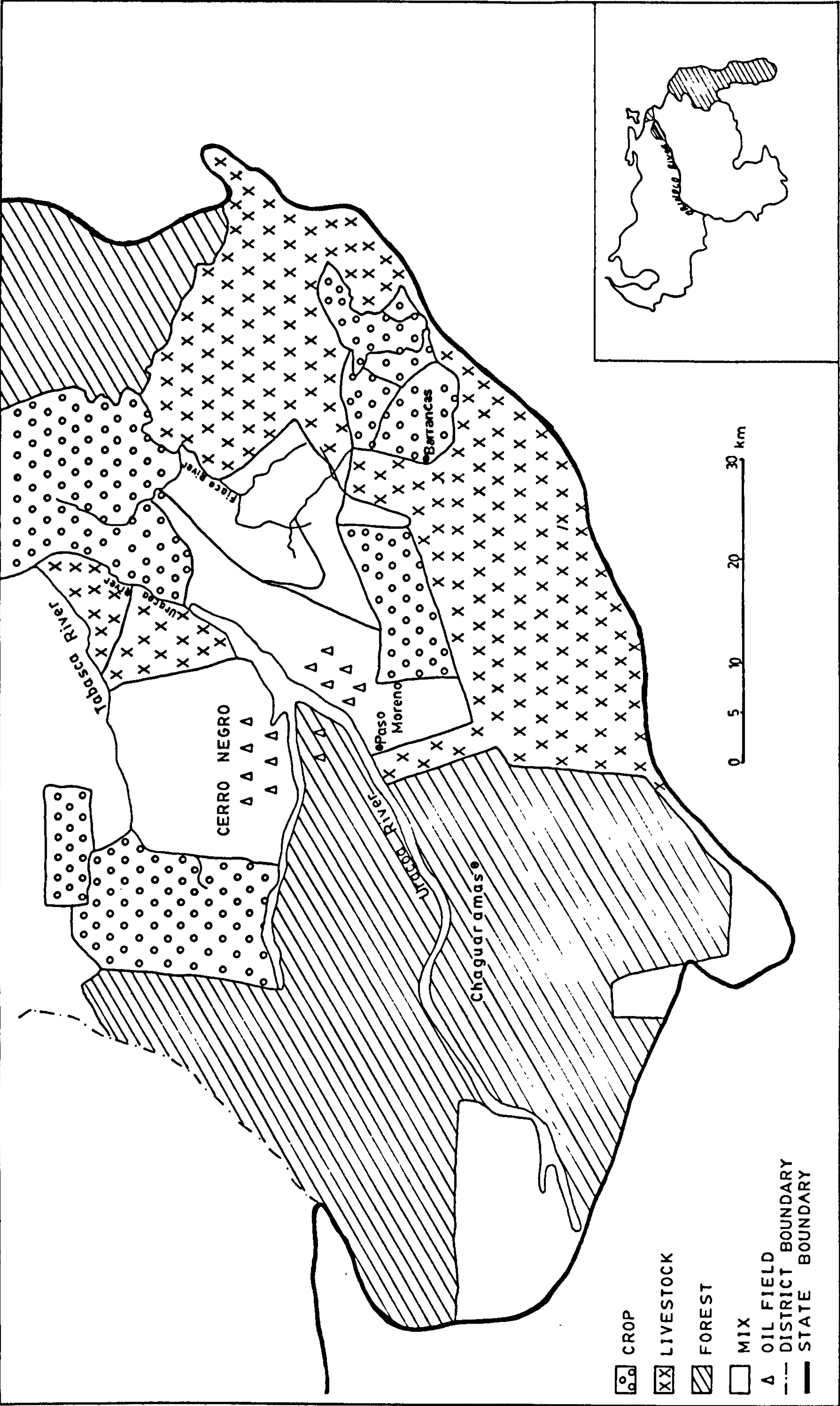


Fig. 5.5 SKETCH MAP OF LAND USE IN THE SOUTH-EASTERN PART OF THE NORTH-ORINOCO REGION (SOURCE: FIELDWORK SURVEY)

in form and size. Pasture occupies a majority of the fields, most of them of natural growth, a few improved by technological methods. Fields with both livestock and crop farming are encountered very often across the area. Forest activity occupies a large portion of the area selected and constitutes the greatest plantation project of the region as a whole. The oil industry is clustered around the central part of the area. The oil wells themselves are basic items in the pattern. Most of them are distributed evenly. A few are scattered beyond the central point.

The data for the post-1980 period (it refers to the years 1981-85) are primarily based upon a survey of farmers undertaken in 1985-6, of which sampling procedures and size justification are described in detail in Chapter 1. The data were analysed by means of Chi-square tests and the aim was to establish statistical significance in describing variations in agricultural patterns among the three zones of the states of Guarico, Anzoategui and Monagas that constitute the North-Orinoco region. It is important to point out that the calculations are made on the basis of a 95 per cent confidence limit.

In analysing farming systems, relationships were sought and tested by chi-square between the reported farming patterns of the farmers and other variables such as length of residence, agricultural services and environmental impact. In most cases associations at or above the statistically significant 95 per cent confidence limit were not found, or the tests were invalidated by not meeting the test conditions.

Two relationships were found to be statistically significant. The chi-square test showed a strong relationship ($\chi^2=60.04$ & $p=0.00$) between sub-regions and farming structure (Table 5.3). In general, crop farming appears to represent the most important type of farming. In the sample survey between 50 per cent and 42 per cent of the farmers devote land for crop production as the main form of agricultural activity, whilst livestock farming is developed by a proportion of farmers between 25 per cent and 23 per cent, and forestry by a proportion of farmers between 23 per cent and 18 per cent. However, in terms of administrative units the relationship is quite different. In the portion of the state of Guarico that forms part of the North-Orinoco region, livestock contributes highly to chi-square (44 per cent); as in the state of Monagas where 23 per cent of the contribution to chi-square emerges from livestock farming. Thus, a grand total of 67 per cent derived from these two states contributes to chi-square.

The result is initially surprising. A significant deviation away from livestock farming on the basis of the pattern of farm size was expected. In the region, as in the rest of the country farming size structure is characterized by enormous concentration of land in few large holdings or latifundio while the rest of the agricultural land available is distributed among a large number of farmers or minifundio. As suggested by data available, the general trend in the region, particularly in the state of Monagas, has been the use of land for livestock farming in the large holdings while crop production is concentrated in those farms with 500 ha. or less.

Table 5.3

North-Orinoco region: land use by state
(sample survey, 1985)

STATE	OBSERVED VALUE	CROPPING	LIVESTOCK	FORESTRY	MIXED(1)	ROW TOTAL
	EXPECTED VALUE					
G U A R I C O	14 18.6 (2%)	26 9.8 (44%)	0 8.4 (14%)	0 3.2 (5%)	40	
A N Z O A T E G U I	25 27.9 (0.50%)	17 14.7 (0.59%)	12 12.6 (0.04%)	6 4.8 (0.49%)	60	
M O N A G A S	54 46.5 (2%)	6 24.5 (23%)	30 21.0 (6%)	10 8.0 (0.83%)	100	
COLUMN TOTAL	93	49	42	16	200	

Figures in parenthesis refer to cell contribution to chi-square

(1) Crops and livestock

Chi-square = 60.04 with 6 degrees of freedom
Significance = 0.00

In the sample survey, between 90 per cent and 85 per cent of the farms are small and medium-size holdings (less than 500 ha.) Contrary to the overall trend, the present study test reveals that the use of land in favour of livestock activities, even within small and medium-size holdings is statistically significant. It seems that after the commencement of the oil-industrial development, crop production does not appear to have been a competitive kind of agricultural activity. Instead, livestock farming on a more intensive basis seems to be more likely to respond to a marketable structure, which in its turn means that farmers have to prepare themselves to switch their farming activities according to the law of comparative advantages.

Forestry land use reflects a significant intra-regional differentiation. Quite surprisingly because forest and woodland land use in the state of Guarico is almost non-existent, the value of chi-square in this state contributes more than the value of chi-square in the other two states. There is a factor which might account for this result. This is the existence of 570,000 hectares of woodland in the Aguaro-Guariquito National Park, which has been regarded as having a potential alternative land use for natural pasture.

The other statistically significant relationship is between intra-regional differentiation and production patterns in the pre-1980 period and the post-1980 period (Tables 5.4 and 5.5). It is necessary to remember that 1980 is the year in which the Orinoco oil-industrial development was officially initiated. In the questionnaire farmers were asked to provide information for these two periods. From the evidence several significant points can be drawn.

Table 5.4 North Orinoco region: agricultural production pattern pre-1980, by state (sample survey, 1985)

STATE \ FARMING PRODUCTION	Cereals/ Fibres/ Oilseeds	Horticulture/ Fruits/ Vegetables	Livestock	Mixed(1)	Forest Plantation	Row Total
G U A R I C O	0 2.0 (3%)	14 14.6 (0.03%)	26 10.0 (40%)	0 5.0 (8%)	0 8.4 (13%)	40
A N Z O A T E G U I	4 3.0 (0.51%)	20 21.9 (0.25%)	18 15.0 (0.93%)	6 7.5 (0.46%)	12 12.6 (0.04%)	60
M O N A G A S	6 5.0 (0.31%)	39 36.5 (0.26%)	6 25.0 (22%)	19 12.5 (5%)	30 21.0 (6%)	100
Column Total	10	73	50	25	42	200

Figures in parenthesis refer to cell contribution to chi-square

(1) Crops and Livestock

Chi-square = 64.49 with 8 degrees of freedom
Significance = 0.00

Table 5.5 North-Orinoco region: agricultural production pattern post-1980
by state (sample survey, 1985)

FARMING PRODUCTION STATE	Cereals	Fibres/ Oilseeds	Horticulture/ Fruits/ Vegetables	Livestock	Mixed(1)	Forest Plantation	Row Total
G U A R I C O	6 8.6 (18)	5 4.2 (0.308)	3 5.2 (18)	26 9.8 (438)	0 3.8 (68)	0 8.4 (138)	40
A N Z O A T E G U I	13 12.9 (-)	4 6.3 (18)	8 7.8 (-)	17 14.7 (0.588)	6 5.7 (0.028)	12 12.6 (0.048)	60
M O N A G A S	24 21.5 (0.468)	12 10.5 (0.348)	15 13.0 (0.498)	6 24.5 (238)	13 9.5 (28)	30 21.0 (68)	100
Column Total	43	21	26	49	19	42	200

Figures in parenthesis refer to cell contribution to chi-square

(1) Crops and Livestock

Chi-square = 62.02 with 10 degrees of freedom
Significance = 0.00

To start with, the chi-square test reveals that the three different states that comprise the North-Orinoco region are very close to expectations in both the pre-1980 and the post-1980 period. Therefore, a wide spread of agricultural activities through the whole region and a limited intra-regional bias can be observed. Secondly, it appears that on the whole a big change through time took place from pre-1980 to post-1980, especially in cropping production. There is an increase in cereal/fibre/oilseed crops from at least 3 per cent in the pre-1980 period to a post-1980 figure which with 95 per cent confidence limit is at least 28 per cent and could be as high as 35 per cent; and horticulture, fruits and vegetable crops decrease from a highest 39 per cent in the pre-1980 to a lowest 10 per cent in the post-1980. By assessing their contribution to chi-square it appears that in the pre-1980 period these crops contribute 3 per cent to chi-square while in the post-1980 period their contribution is 5 per cent.

Thirdly, within each sub-region of the North-Orinoco region, the evidence displays significant results. For instance, in the state of Anzoategui the sample survey of farmers indicated a significant deviation towards cereal, fibre and oilseed crops from the pre-1980 period to the post-1980 period. The explanation of this change can be found not only in the impact of a national policy to increase cereal and fibre production, but also in the fact that the oil industry subsidiary in the state of Anzoategui has financially supported agricultural projects, basically in cotton, rice and sorghum production. With regard to livestock activities the chi-square test shows no significant

change from the pre-1980 period to the post-1980 period in the state of Anzoategui. However, supported by qualitative observations during the fieldwork, a locational differentiation in types of livestock farming was detected. This variation was strongly influenced by the existence of a road transport system facilitated by the oil-industrial development. The areas near the oil-industry sites have moved substantially towards a more intensive livestock farming system facilitated by the transport network, while the more distant areas with more limited infrastructural facilities have been slow to modify their practices with regard to livestock improvements (Fig. 5.6).

In the state of Guarico variation in cereal/fibre/oilseed crop production between the two periods has been minimal. In the pre-1980 period, 3 per cent of the contribution to chi-square came from these crops while in the post-1980 these crops represented only 1 per cent of the contribution to chi-square. The explanation for the lower level of utilisation of land for these crops post-1980 lies partly in the sharp drop in the state's area under cultivation between 1980 and 1985 as compared to the period 1950-1980 when the area under cultivation experienced a rapid growth as is shown in Table 5.6).

It is not clear whether the limited extent of cropping land in the state of Guarico post-1980 is due to physical restrictions, or to national/regional policies, or to the intervention of the petroleum industry in the state's economic structure. What is evident from the sample survey, however, is that in the amount of land currently

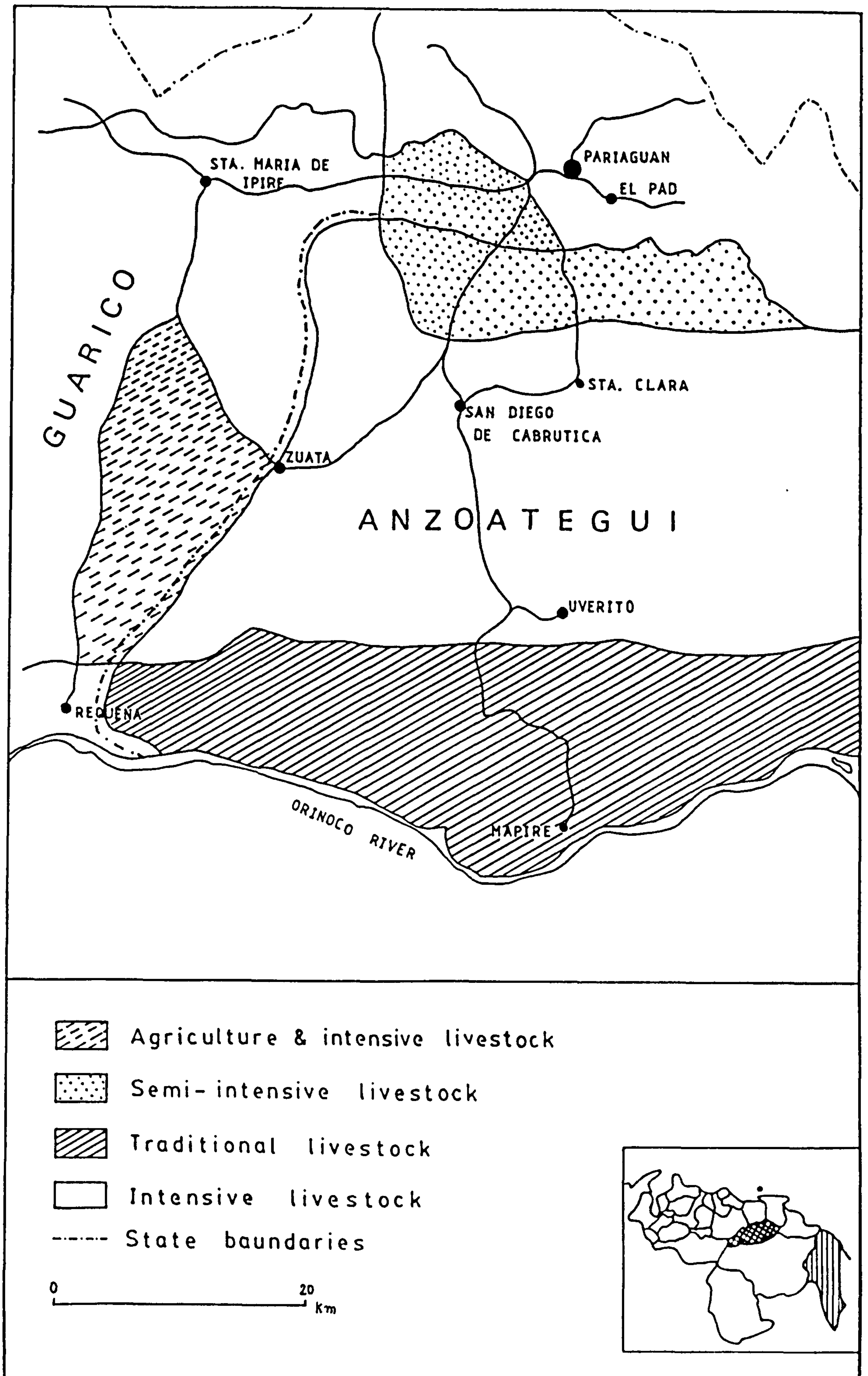


Fig. 5.6 Generalised livestock farming zones in the state of Anzoategui and eastern Guarico state, 1980 (adapted from CENDES, 1983, p.25 A)

Table 5.6 Indices of increase in cropping area
by state, 1950; 1971-1985

STATE \ YEAR	1950	1971	1980	1985
G U A R I C O	100	194	512	295
A N Z O A T E G U I	100	89	176	297
M O N A G A S	100	119	70	128
Total region	100	183	377	272

(1) 1950 = 100 year base

Source: MAC. Ministry of Agriculture and Livestock, Anuario Estadístico Agropecuario, various issues.

devoted to cropping is not high and the general trend of increasing cereal/fibre/oilseed crop production in the state has been reversed. In contrast, livestock farming seems to keep the same growth path over the pre-1980 period as compared with the post-1980 period.

In the state of Monagas there is no significant change in the farmers' patterns of cultivation from the pre-1980 period to the post-1980 period as compared with the other two states. Cereal/fibre/oilseed crops cell is very close to expectations in the pre-1980 period and the post-1980 period. The same pattern is noted in horticulture/fruits/vegetables with 0.26 per cent contribution to chi-square (pre-1980) as against 0.49 per cent (post-1980). Strictly, there are minimal changes in the state's cropping pattern. Nevertheless, an important factor to take into account is the change in the localization of the different crops. Among other things this is the result of improvements in infrastructure, including transport, and in the commercial system which have been made possible by the intervention of the oil industry in the state. During the fieldwork it was not possible to quantify the magnitude of the changes in cropping localization, nor was there data available to reflect this change. But through interviews with farmers and community leaders it was seen that the traditional crops (roots, legumes, tubers) are still cultivated in communities more distant from the markets and road networks such as San Jose del Yabo and Santa Rosa. Meanwhile those communities with more access to transport and market facilities, such as Paso Moreno and Chaguaramas, have replaced some of the traditional produce (yuca, ocumo, plantain) by oranges, peanuts, and maize crops which were not cultivated in this

part of the state in the pre-1980 period (Fig. 5.7). This change has, in its turn, brought about a closer association of farmers with the agro-industrial sector already in existence in the region.

The locational differentiation of farming that has emerged in the state, in principle, could be explained by means of Von Thunen's model, which relates farming practice with distance from market and with transport costs. His model seems to be useful when considering that transport facilities emerged as a direct result of the agricultural development of any particular region. This relationship between agricultural production and transport facilities, however, is not always accomplished in that way. In the case of the agricultural development in the North-Orinoco region, transport facilities and transport improvements are greatly reinforced by the impact of comparative advantages associated with petroleum developments. Therefore, the real transport costs are accounted outside the agricultural sector. This is an aspect not included in the model. However, it seems to be relevant in explaining the location of different types of farming in the context of oil-producing regions in the less-developed countries.

The changes in the patterns of agricultural land use in the three main zones of the states of Guarico, Anzoategui and Monagas appear to have taken place in a way that has not given rise to any serious negative effects. It cannot be claimed that there are pressing conflicts at present such as to impede a reasonable performance of the agricultural sector. Although about half of the

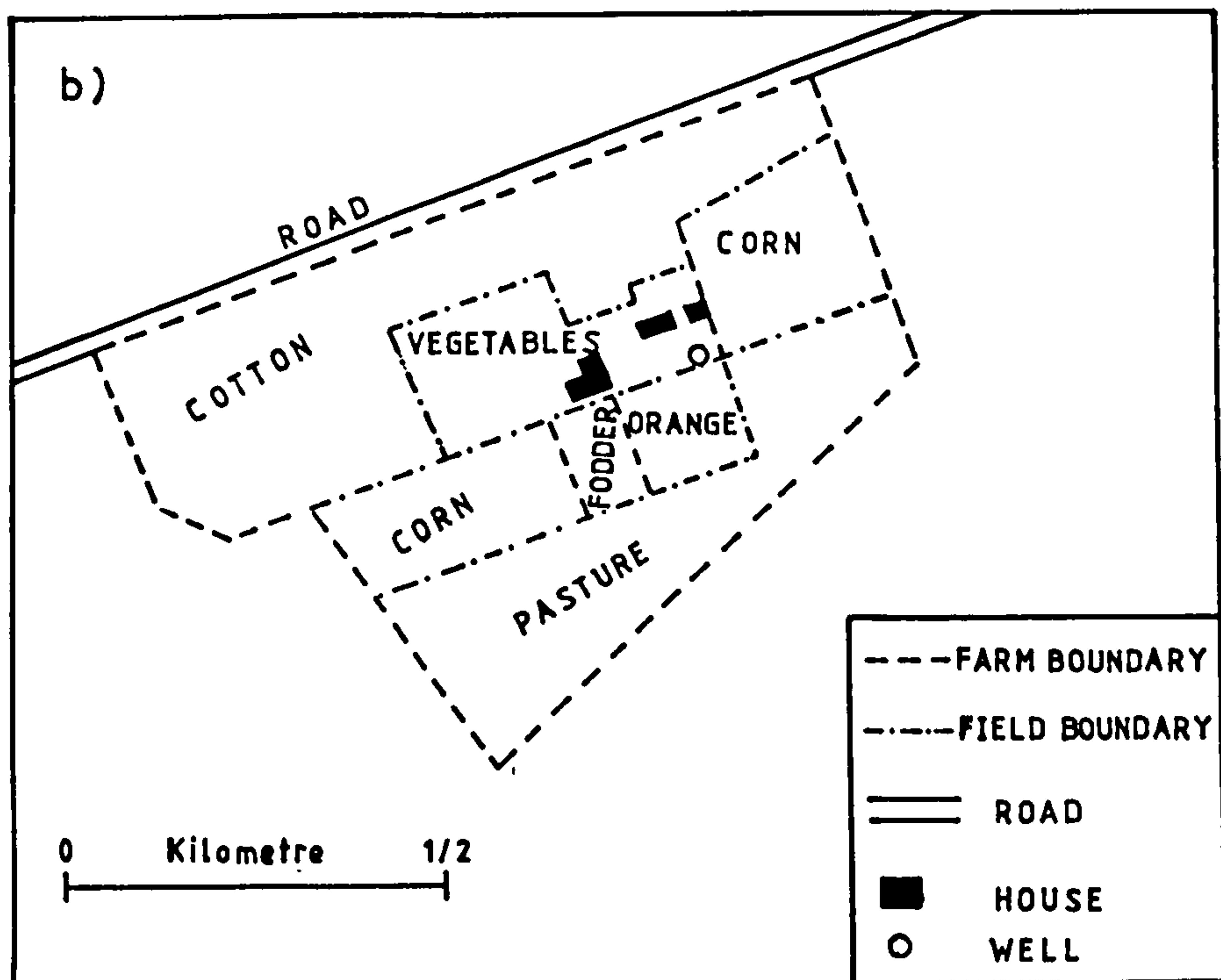
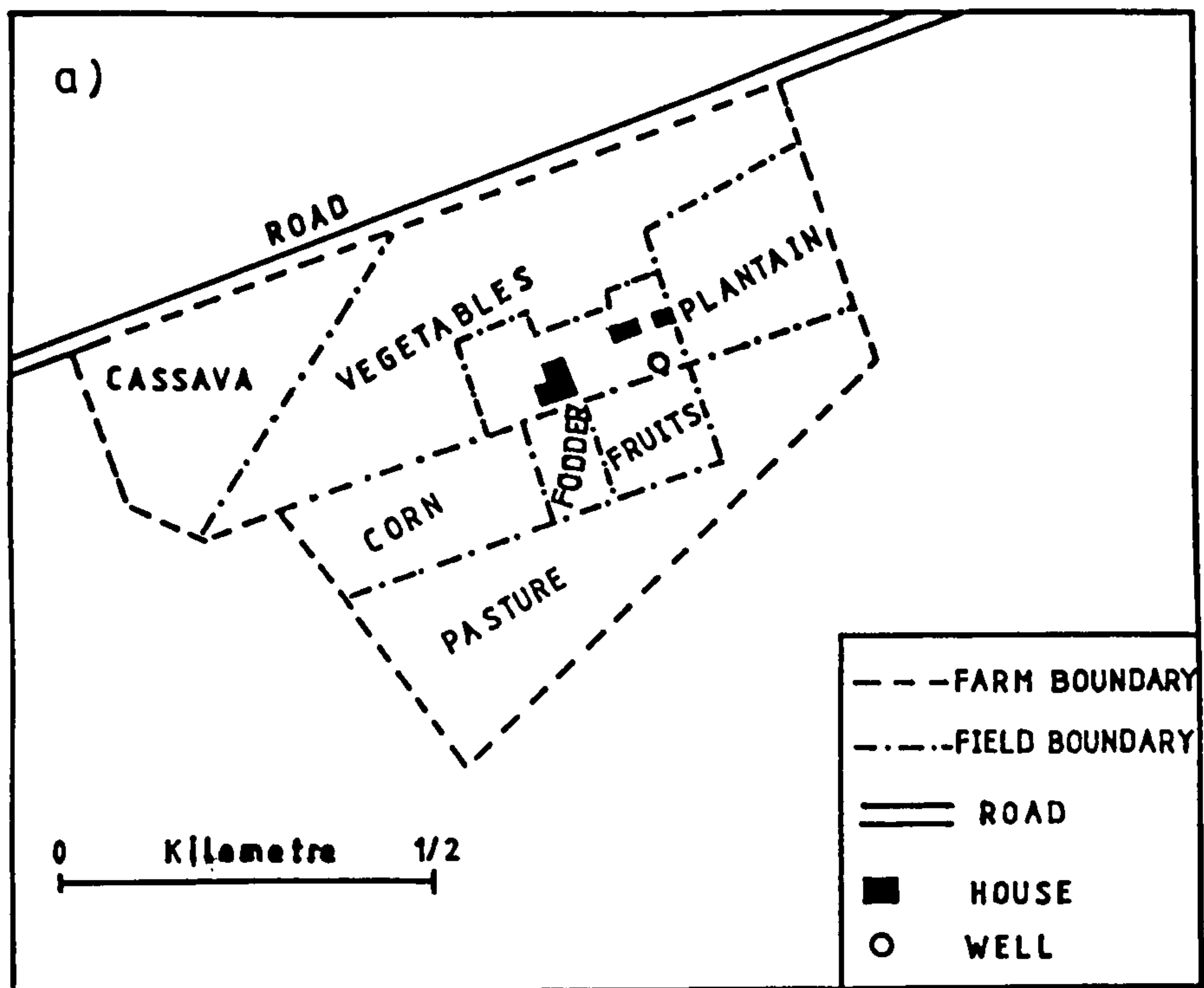


Fig. 5.7 Land use in a farm unit of the community Paso Moreno, Monagas state: a) in the pre-1980 period, b) in the post-1980 period (source: fieldwork survey)

potential arable land is already under cultivation, the highly statistically significant deviation towards the use of land for livestock farming implies a slow process of intensification in the use of agricultural land. Nevertheless, through observations in the field, more far-reaching repercussions of the development of the petroleum sector upon the agricultural system within the region were detected.

As has been stated in Chapter 3, in order to improve agriculture's performance the oil-producing developing countries have sought to devise and implement a policy designed to increase agriculture's competitiveness in relation to the petroleum-industrial developments. In the case of the North-Orinoco region, action to achieve this stage has been directed towards the intensive utilization of the current irrigation system located in the Calabozo reservoir (a 13-Km barrage across the Guarico valley) and the Mesa de Guanipa as well as the incorporation of its immediately adjacent areas in the production process. Table 5.7 shows the changes in the area under irrigation and Table 5.8 the natural hydrological balance sheet of the region.

This intensive use of irrigation, financed by the country's oil revenues, has caused regional constraints, especially in the state of Anzoategui. There has been an increase in the level of production of annual crops with higher water requirements such as rice and cotton, and yet the actual use of the water resources of the state is restricted by the poor reliability and accessibility of supplies from the existing irrigation system. This lack of

Table 5.7 Area under irrigation by state, 1980 and 1985
(in hectares)

STATE \ YEAR	1980	1985
G U A R I C O	26,900	21,450
A N Z O A T E G U I	7,000	16,390
M O N A G A S	-	2,750
TOTAL	33,900	40,590

Source: MARNR. Ministry of the Environment.
Informe Tecnico, 1982

Table 5.8 North-Orinoco region: Hydrological balance
1980

VOLUME OF WATER (m ³ x 10 ⁶ /year)	S T A T E		
	GUARICO	ANZOATEGUI	MONAGAS
ACTUAL DEMAND	665.5	129.0	7.0
EXISTING CAPACITY	1119.0	92.0	19.0
POTENTIAL CAPACITY	2245.0	1255.0	800.0

Source: MARNRR. Ministry of the Environment
Informe Tecnico, 1982

of water supply in its turn has introduced a serious obstacle mainly in relation to small-scale holdings. Unless labour is available to apply the water requirements of crops, part of the holding has to be left idle in order to irrigate the annual crops, a procedure which inevitably reduces the level of productivity of the farms. Besides, the irrigation schemes sponsored by government have been launched to provide fodder for cattle in the large holdings while small farmers are less favoured with adequate water supply.

It can be argued that this is a side-effect of the oil-based development. However, it is significant here to state that, in the process of the expansion of the petroleum sector, interrelated economic and social structures function in such a way as to allow changes in the existing agricultural system. In Chapter 3 the case of some oil-exporting developing countries such as Nigeria was discussed where the evidence shows that the links between petroleum activity and agriculture have not been fully established or exploited. In the context of the North-Orinoco region, the expansion of the petroleum sector directly influences the expansion of the agricultural sector: massive land re-distribution programmes, falling production costs and favourable crop prices, highway construction programmes which facilitate the transportation of farm produce, and agricultural research. This stimulus has brought about a transformation of the regions's cropping pattern. In some areas a remarkable amount of change has taken place over the post-1980 period, more especially in the surroundings of the Guarico basin (state of Guarico) where, with the advantage of irrigation, new crops have been introduced accompanied by modern technology. Other

areas have changed little and the farmers remain dependent on the traditional crops (Plates 5.1, 5.2, 5.3, 5.4).

The initial hypothesis of this study, that there was close interaction between cropping patterns and the oil-industrial development is thus partially demonstrated on the grounds of the above evidence.

5.3 ENERGY INPUTS AND SOURCES

Let us now turn the discussion to examine the changes in farmers' spatial behaviour and in land-use patterns that have occurred as a consequence of the inputs required by agriculture and the location of the input-supplying markets. In the context of oil-producing developing countries, attempts to reduce the uncertainties associated with food production have been made on an energy-intensive basis. Agricultural inputs in the form of irrigation water, application of nitrogenous and other commercial fertilizers, and chemical methods of weed and pest control all incur high energy usage. The North-Orinoco region does not escape from this pattern, which has been accentuated by the view that modernization of agricultural production in the region constitutes an important breakthrough. This view is held on the grounds that agriculture can be affected by the development of such a competitive activity as the petroleum industry absorbing the labour force and capital resources available for the region.



Plate 5.1 Storage building of a farm unit in the North-Orinoco region.
Anzoategui state



Plate 5.2 Newly cleared farm unit, made by cutting and burning, for
plantain cropping. Anzoategui state



Plate 5.3 Oranges fields in a farm unit. Monagas state



Plate 5.4 Plantation fields of grapefruits in a farm unit. Guarico state

The expansion of agricultural products in the region during the period 1980-85 (Table 5.9) is based in large part upon a remarkable increase in the use of fertilizers, biocides, and herbicides (Table 5.10). Changes in agricultural land-use patterns have in part influenced the demand for farm machinery, fertilizers, pesticides, and even petrol. Even more, the pattern of input use has frequently been determined by the impact of the input-supplying system. This in its turn has a direct effect on the spatial structure and farming system.

The sample survey shows that between 75 and 80 per cent of the farmers obtain their inputs from the regional and extra-regional sources while between 19 per cent and 24 per cent of farmers can meet their inputs needs from the local markets. In looking at the intra-regional variations, the chi-square test shows that the state of Anzoategui is very close to expectations, and as a result the individual cell contribution to chi-square appears to be very small.

In the state of Guarico the result is quite different: 45 per cent of the contribution to chi-square arises from the extra-regional markets while 22 per cent is concentrated at the local level. Similarly, in the state of Monagas with a 28 per cent contribution to chi-square, there is a significant deviation away from local and regional markets while 18 per cent of the contribution to chi-square is derived from extra-regional sources (Table 5.11). One can say with 95 per cent confidence that in the state of Guarico the proportion of farmers using local input-supplying markets lies between 17 per cent and 47 per cent. Meanwhile in the state of Monagas the proportion of farmers

Table 5.9 North-Orinoco region: recent and projected output,
1980-2000, from cropping, livestock farming and
forestry

ACTIVITY	1980	1985	1990	2000
CROPPING (ton)	635,821	1,037,261	1,438,701	2,073,578
LIVESTOCK (head)	32,289	43,760	55,232	113,539
FORESTRY (m ³)	-	70,000	140,000	480,000

Source: MARNR. Ministry of the Environment. Informe Tecnico, 1982
MAC. Ministry of Agriculture and Livestock.
Anuario Estadistico Agropecuario, Various issues.

Table 5.10 North-Orinoco region: recent and projected use of inputs, 1980-2000, for cropping, livestock farming and forestry

INPUT	CROPPING			LIVESTOCK			FORESTRY		
	1985	1990	2000	1985	1990	2000	1985	1990	2000
HYBRID SEEDS (met. tonnes)	-	-	-	2,033,035	2,463,910	3,325,660	-	-	-
FERTILIZERS (tons)	12,682	43,656	105,603	138.66 ⁽¹⁾	155.07 ⁽¹⁾	187.88 ⁽¹⁾	-	-	-
HERBICIDES (litres)	139,730	582,062	1,466,725	-	-	-	-	-	-
BIOCIDES (tons)	-	-	-	1145	1259.6	1487	123	151.5	208.5
OTHER INPUTS	1,992,122 2,489,529	2,484,948 3,106,184	3,470,599 4,339,493	-	-	-	-	-	-

- (1) Figures in thousands
(2) Figures refer to drinking water (m³)
(3) Figures refer to salt (kg)

Table 5.11 North-Orinoco region: location of input-supplying markets (sample survey 1985)

OBSERVED VALUE EXPECTED VALUE STATE	LOCAL	REGIONAL	EXTRA- REGIONAL	ROW TOTAL
G U A R I C O	13 8.8 (22%)	22 19.2 (4%)	5 12.0 (45%)	40
A N Z O A T E G U I	13 13.2 (0.03%)	29 28.8 (0.01%)	18 18.0 (-)	60
M O N A G A S	18 22.0 (8%)	45 48.0 (2%)	37 30.0 (18%)	100
COLUMN TOTAL	44	96	60	200

Figures in parenthesis refers to cell contribution to chi-square

Chi-square = 9.04 with 4 degrees of freedom

Significance = 0.05

from which the sample was taken lies between 10 per cent and 25 per cent. Considering both states together, the proportion of farmers with a local orientation towards input-supplying markets lies between 15.1 per cent and 29.18 per cent.

This result raises several particularly interesting issues. First of all, the acquisition of inputs from extra-regional sources involves (in most cases) a high level of capital investment, which might affect the small and medium-size farmers who are unable to pay the costs. In the short term this might imply a reduction of the productivity level and in the medium and long term the move towards the subsidising of inputs.

The lack of statistical data or detailed surveys on the cost of inputs at different scales of markets (either local, regional or extra-regional) makes it difficult for the writer to quantify this rather general statement. This is a subject on which information is difficult to obtain from farmers. However, through fieldwork observations a variation of inputs costs was revealed. Between 64 per cent and 55 per cent of the farmers in the state of Monagas declared higher input costs as compared with the highest recorded level of 37 per cent in the state of Guarico. The explanation of this variation can be associated with the relatively distant location from the centres of distribution and commercialization of petrochemical products and with the transport costs involved.

The second issue is concerned with the cropping patterns of the region. Since different crops have different requirements for energy (from different sources), it follows that costs in energy inputs may

affect some crops more than others. As shown in Table 5.12, data available for the region suggests that rice, peanuts, banana and plantain require large amounts of fertilizer as compared to sorghum, beans and some fruits. Therefore, the cost would be higher in the first group of crops, especially when the inputs are acquired at the extra-regional level. This being the case, a major regional restructuring of the prevailing energy-use pattern takes place, which in the long term may result in large increases in the acreage under the least-costly crops reflecting a substitution of land for energy-intensive inputs.

In summary it can be said that energy-requiring processes might influence the longer-term evolution of land-use patterns and in this connection the interaction between petroleum and agricultural activities seems to be crucial. The most important questions to raise are whether agricultural land use would develop smoothly by establishing policies to reduce input-supplying dependence from extra-regional sources and promoting the development of input-supplying structures regionally located, with the strong and direct intervention of the petroleum industry. In Chapter 7 some of these issues will be raised again in the context of the management of the North-Orinoco agricultural space.

Table 5.12 North-Orinoco region: input requirements by
crops, 1980

Types of Crops	Biocides (units/ha)	Fertilizers (kg/ha)
RICE	135	600
MAIZE	5	400
SORGHUM	5	300
COTTON	17	400
PEANUT	28	500
SUNFLOWER	5	300
BEANS	6	300
YUCCA	4	300
BANANA	120	1000
PLANTAIN	125	500
CASHEW	2	200
FRUITS	120	200
GREEN VEGETABLES	17	600

Source: M.A.C. Ministry of Agriculture and Livestock.
Anuario Estadístico Agropecuario.

5.4 CONCLUSIONS

It has been shown that over time the North-Orinoco region has experienced important changes in its agricultural spatial structure. These changes are the result of economic forces, of which the petroleum-industrial sector, both outside and within the region, has a significant practical relevance.

The changes in agricultural land use taking place in the region after the development of the Orinoco oil fields have resulted in an intra-regional differentiation of the farming structure. In terms of the type of farming and production patterns before 1980 and after 1980, it has been seen that the state of Anzoategui appears to show the most significant changes, followed by the state of Guarico and the state of Monagas. In terms of the input-supplying system, a remarkable growth of dependence on the extra-regional market has taken place, establishing intra-regional variations according to the proximity to the centres of production and commercialization of petrochemical products used by agriculture. All this suggests a positive correlation between land use and economic development which may simply reflect the structure of the farming economy under the influence of the petroleum sector. The next chapter will examine in more detail the characteristics and the changes which have occurred in the farming economy of the North-Orinoco region.

CHAPTER 6: THE FARMING ECONOMY IN THE NORTH-ORINOCO REGION

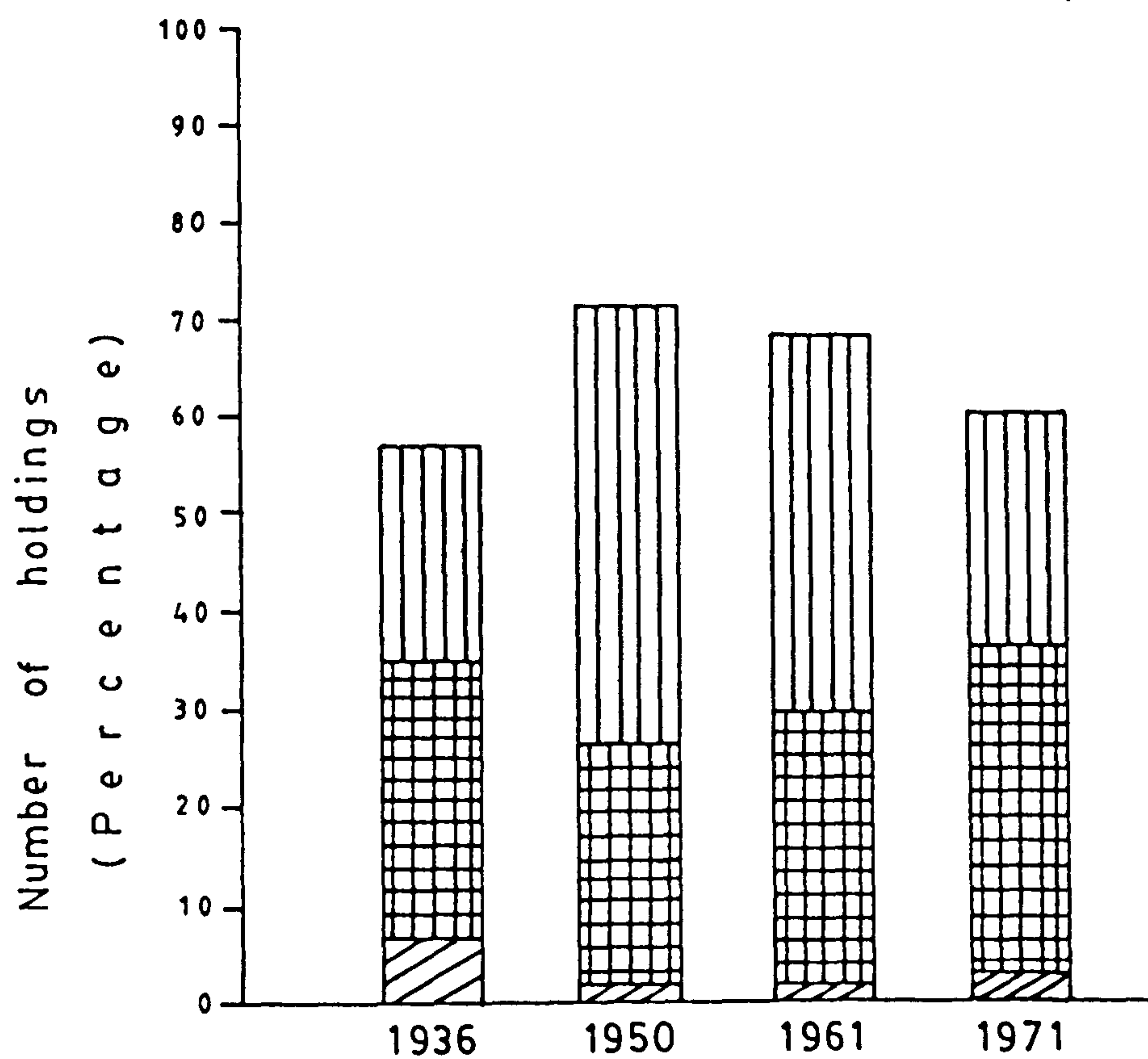
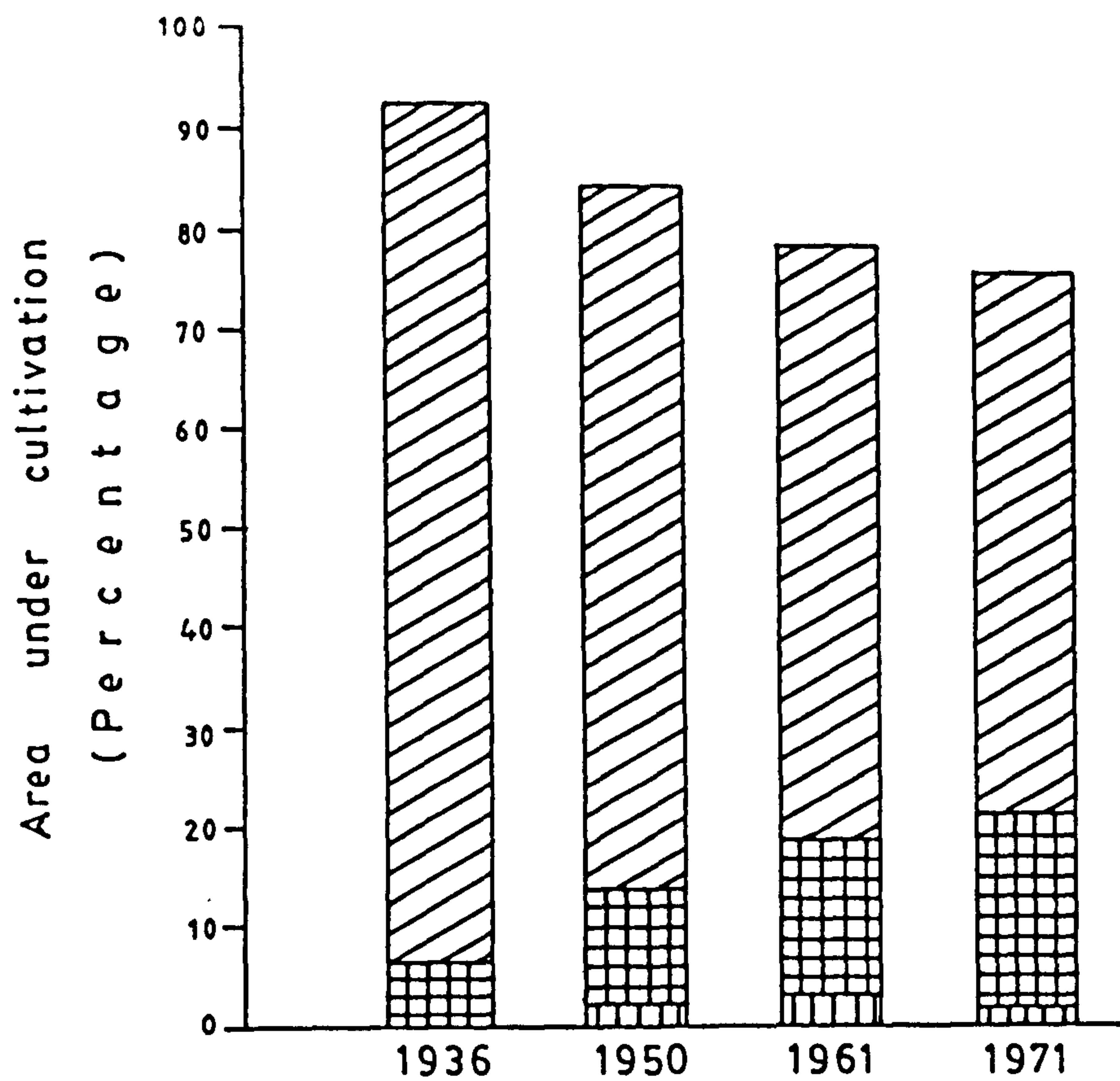
This chapter is concerned with the agricultural economy of the study area and with changes in the structure of farming. An attempt is made to establish the impact of the introduction of oil-industrial development upon the factors of production for agriculture in the North-Orinoco region. The discussion is based upon the study of the variations in farm size, land tenure, agricultural land values, farming output and marketing, and farm finance. A survey of farmers and the use of the chi-square test as well as information from official sources provide us with the required data base.

6.1 FARM STRUCTURE

An important concept affecting agricultural geography is the change in the economic environment and its repercussion on the farm structure. In its turn, farm structure must be regarded as a fundamental factor in the determination of agricultural patterns since, as Bowler suggests, from it stem "economies or diseconomies of scale in the use of labour and machinery; often it controls the availability of capital for investment in existing new forms of agricultural production; increasingly, economies external to the farm, for example in the marketing of produce or the purchase of farm supplies, are denied to the occupiers of small or fragmented farms; above all farm structure is a major determinant of farm income" (Bowler, 1983, 46). Moreover, in some instances the farm structure might be affected by changes in the economic space of a particular region. This in its turn may impose conditions on the agricultural production pattern.

Obviously, there are structural factors affecting the farm system defined in terms of the farm size, the land-tenure system, and the pattern of agricultural land values. In the case of Venezuela, as in many other Latin American countries, these factors are closely related to the historic patterns of land ownership and concentration of land in large holdings on the one hand, and the shortage of land available to small holders on the other. This is best described as the latifundio-minifundio system, in which much of the best land is in large estates, the haciendas. Absentee ownership, low levels of land utilization, technological backwardness, low productivity, and lack of responsiveness to the market are the principal features of these haciendas. The small plots -the minifundios- have even lower productivity, and many are so small that the peasant glean only a subsistence from them.

Since the mid-1960s no major structural change in land tenancy has occurred in Venezuela, although the agrarian reform programme has had some success in increasing the number of small agricultural owner-operators. As shown in Figure 6.1, out of the 237,700 farm units in 1950, only 3,500 were properties in excess of 1,000 ha. These large units, however, controlled 79 per cent of the agricultural land area. At the other extreme, 168,000 farm units were properties of 5 hectares or less, but these small plots were less than 3 per cent of the agricultural land. In 1961 there were 4,200 haciendas among 315,000 farm units and they still controlled less than 3 per cent. In 1950, 42 per cent of the farm units were farmed by their owners and 15 per cent by cash renters. The remaining 43 per cent of farm units had no title to the land. By 1961 cash renters had declined to 9 per cent but the other non-owning category increased to 49 per cent while



< 10 Ha.



10 - 500 Ha.



> 500 Ha.

Fig. 6.1 Size of farms and number of holdings in Venezuela, 1936-1971.
(based on data derived from Ministry of Agriculture
and Livestock)

the relative number of owners remained the same. Owners were in control of 85 per cent of the land in 1950, falling slightly to 84 per cent in 1961, while the share controlled by cash-renters declined from 3 to 2 per cent. Other non-owners controlled 14 per cent in both years. Thus the distribution of land among categories of users changed little in the 1950s. Furthermore, the initiation of agrarian reform did not contribute substantially to the redistribution of land during the 1960s. The land tenure system in the 1970s was basically the same as it had been in the 1950s.

As far as the North-Orinoco region is concerned, the size of the farm, the tenure system, the landholding structure and the value of land are the result of the above-mentioned historic processes which, together with the presence of oil-industrial developments in the region, have defined both qualitatively and quantitatively the spatial and economic structure of agriculture. Three factors were statistically significant in explaining variations in the farm structure, namely, farm-size structure, tenure and farm-occupancy patterns, and agricultural land values. Let us examine in detail each one of these aspects.

6.1.1 Farm-size structure

It has been found that there is a great amount of land in large holdings, with a traditional pattern of livestock farming and low levels of productivity while a large number of holdings possess small amounts of land. Data available for 1971 show that, in the region as a whole, 87.1 per cent of the holdings with 500 ha. or less occupied only 12.1 per cent of the agricultural land, while 12.83 per cent of the holdings operating 500 and more hectares occupied 88 per cent of

the agricultural land available. This means that in the large holdings (>500 ha.) the average number of hectares per holding was extremely high (2,372.6) as compared to the smallholdings (<500 ha.) where the average number is just 45.91 hectares per holding. This clearly reflects the distribution of land dominated by the latifundia land-tenure system (Fig. 6.2).

This general pattern has a different dimension when looking at the intra-regional scale. Unfortunately, the available data on the size of farms are quite limited and not always consistent. Thus, one should proceed cautiously in accepting these data as a basis for making comparisons between states. However, the data do permit some rough judgements of the farm-size spatial variations. Figure 6.3 shows that in the state of Monagas, the total number of farms for the year 1971 was 1,444, covering a total area of 186,704 hectares. Out of this number, 72.36 per cent were farms with less than 20 ha. occupying only 2.68 per cent of the land available. Some 18.76 per cent of farms operating 20-500 ha. occupied 15.87 per cent of the agricultural land. In contrast, there were 4.4 per cent of farms with more than 500 ha. which occupied 81.4 per cent of the total arable land. In the state of Anzoategui, 1,666 farms covered an area of 892,224 hectares, 18.42 per cent of the farms operated less than 500 ha. occupying 3.55 per cent of arable land while 81.51 per cent occupied 96.44 per cent of the land available. In the state of Guarico, 10,021 farms covered an area of 2,938,670 ha. Only 2.05 per cent of the farms with more than 500 ha. occupied 88.39 per cent of the agricultural land while there were 98.60 per cent of farms with less than 500 ha. occupying 11.60 per cent of the land available.

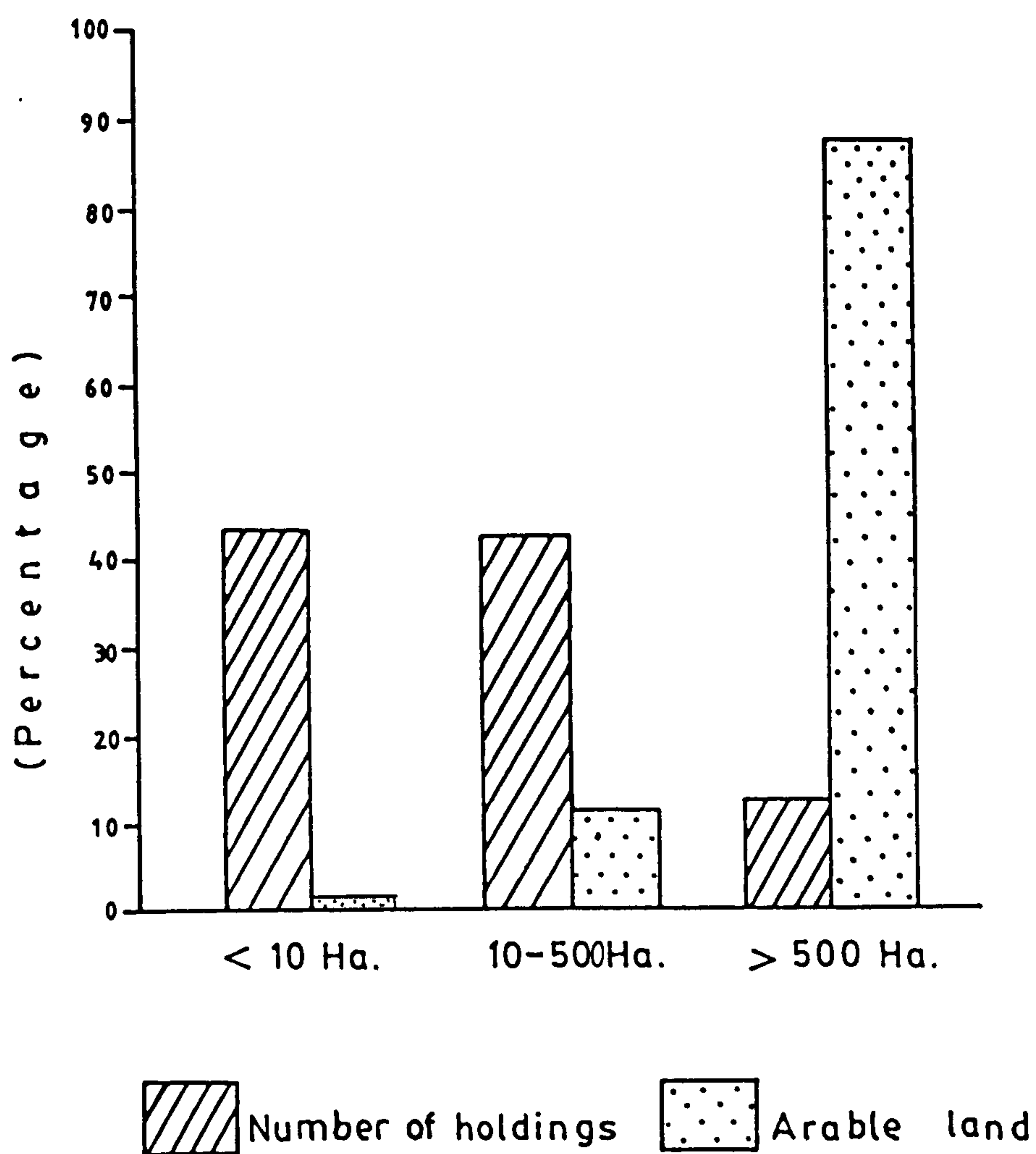


Fig. 6.2 North-Orinoco region : land tenure, 1971
(source of data: Instituto Agrario Nacional, 1971,
Ministry of Production, 1971)

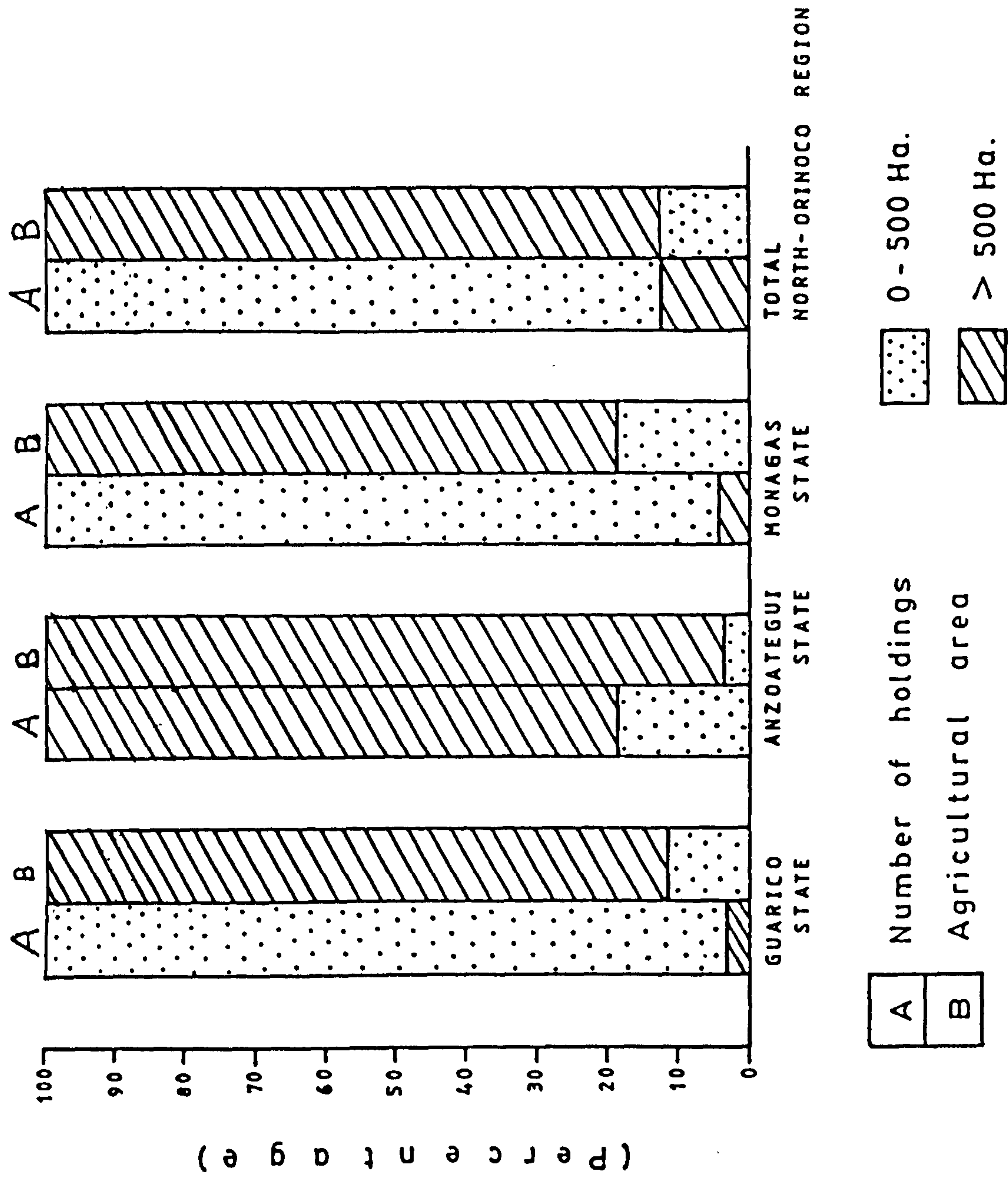


Fig. 6.3 North-Orinoco region : farm size and number of holdings by state, 1971
(based on data derived from - Ministry of Agriculture and Livestock, 1971)

These figures suggest a relatively high concentration of agricultural land in the state of Guarico followed by the state of Monagas. In contrast, the state of Anzoategui shows a rather particular structure. The number of holdings operating 500 and more hectares is quite large in relation to the amount of land available. This relationship indicates an average size of 633 hectares per holding, a figure relatively inferior to the same relationship in the other two states. It seems that in the state of Anzoategui there exists a fairly even distribution of land compared to the state of Guarico and the state of Monagas. The main geographical significance of this trend is the variations in the spatial distribution of farm sizes, which show an extensive spread of large-scale farming over the region as a whole. This spread has been most prominent where irrigation favours farming and where large farms permit greater productivity as in the case of the state of Anzoategui.

The sample survey undertaken during this study involved 200 farms, 25 per cent of the sample in >500 ha category and 75 per cent in the small and medium-size holdings (less than 500 ha.). The use of this stratified sample was based upon the assumption that if there was any effect of the oil-industrial development upon the farm economy, it might have been much more significant among small and medium-size farms than in the large holdings. In this way the sample was expected to reflect a better and more realistic understanding of the changes that might have occurred among small and medium-size holdings. It is worth noting that the 95 per cent confidence limits have been calculated as percentages derived from this sample and that the confidence levels express the probability of values lying within

specified limits on either side of the mean. For the 95 per cent confidence limits the values are ± 2 S.E.

However, the comparison of the sample data with 1971 data to test for significant changes in the farm size structure has made the result inconclusive. Consequently, the result does not appear to be useful in examining intra-regional variations. These variations could be the product of random error in the sample. Due to the inconclusive nature of the result, association between farm-size structure and regional oil-based developments cannot be drawn. But supported by fieldwork observations, one can say that in the state of Anzoategui and the state of Guarico the farm system has experienced a process of re-adjustment to the new region's economic structure and that there is an established tendency toward farm fragmentation which it seems is being maintained and reinforced by the petroleum sector. Under these conditions, the motives and ambitions of farmers might develop towards a farm-size structure where reductions in unit costs and operational processes seem to be achieved at the optimum point in small-size farms. Such in the long run are the most likely types of farm enterprise to benefit from internal economies of scale stimulated by the petroleum economy.

6.1.2 Tenure and farm-occupancy

Systems of land tenure in the North-Orinoco region have shown the same pattern as in Venezuela as a whole, where a large amount of land is under private ownership and limited control of the state in the possession of agricultural land exists. As Tovar (1970) points out, the dominance of private ownership of land is very significant in the

agrarian structure of the country. In Venezuela as a whole the ratio of private/public farm units has been two to one and the ratio of private/public land acreage almost ten hectares to one. The ratio of private/public land for the North-Orinoco region may be inferred from Figure 6.4 which shows that for 1971 the ratio was six hectares to one and public land represented only 13.67 per cent of the total. At the intra-regional scale, in the state of Anzoategui only 5 per cent of the total agricultural land is public whereas in the state of Guarico the proportion of land in the public domain is 15.26 per cent. The state of Monagas presents a higher proportion of public land, 28.52 per cent. The results for the post-1980 period obtained from the sample survey of farmers cannot be quoted. The chi-square test applied to the sample appears to be inconclusive and, once again the possibility that intra-regional variations have occurred purely by chance cannot be excluded.

As far as the type of farm-occupancy is concerned, traditionally the agricultural development in the region has been based upon owner occupation with a very small number of farmers tilling the land as tenants or share-croppers. Figure 6.5 shows that for 1971, 82.36 per cent of the total agricultural land was under direct owner occupation and only 1.65 per cent of the land rented by tenant farmers, while 15.22 per cent of the land under cultivation involved occupation on a temporary or permanent basis and, in some cases, land had been illegally acquired. The latter has been a common practice and has occurred in large and medium-sized holdings, often as a result of feuds between local families. The invaders or illegal occupiers camp on the properties, perhaps for weeks, until their claims to the land (all or a portion of it) are satisfied or they are

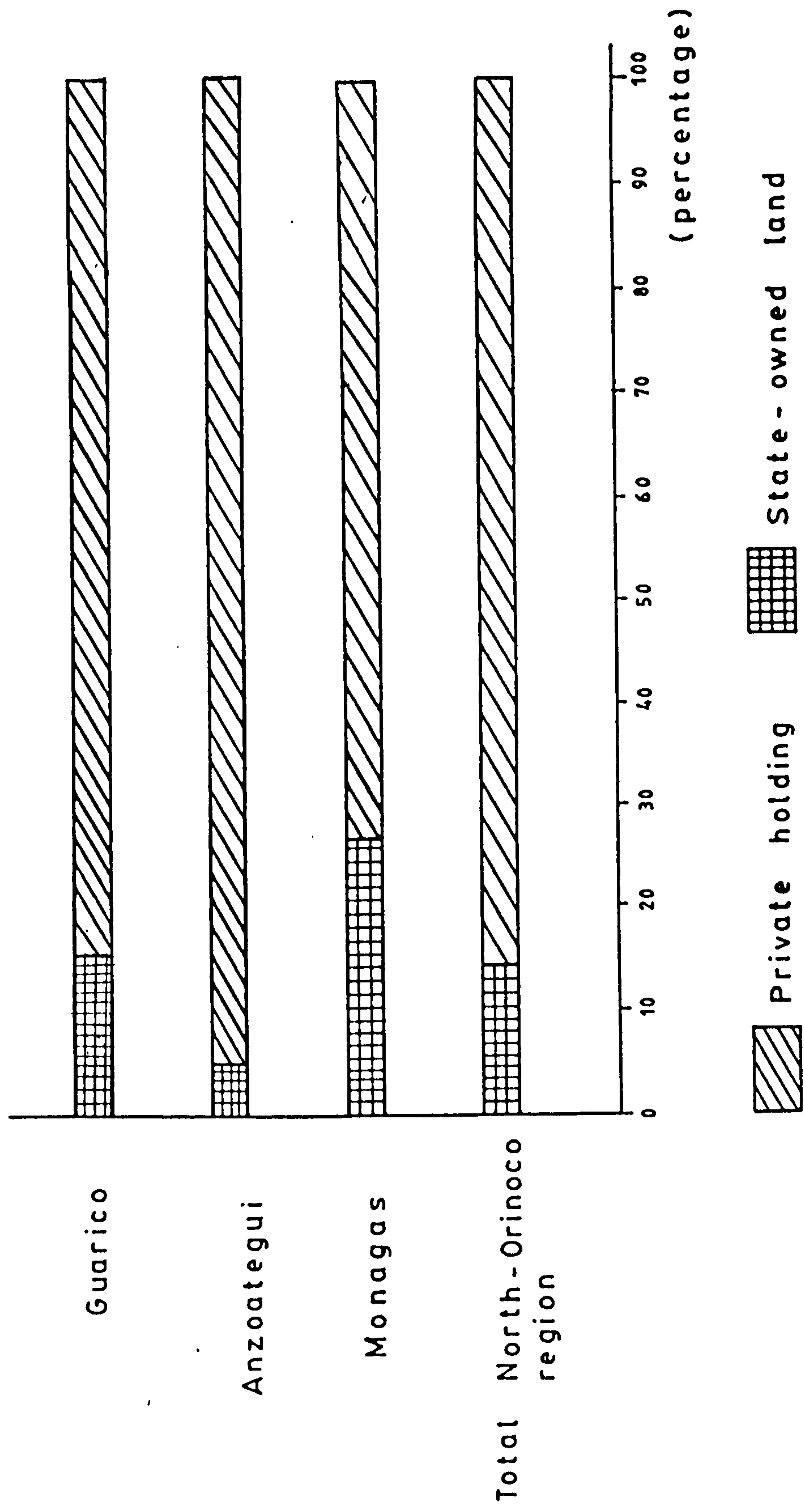


Fig. 6.4 North-Orinoco region : land tenure by state, 1971

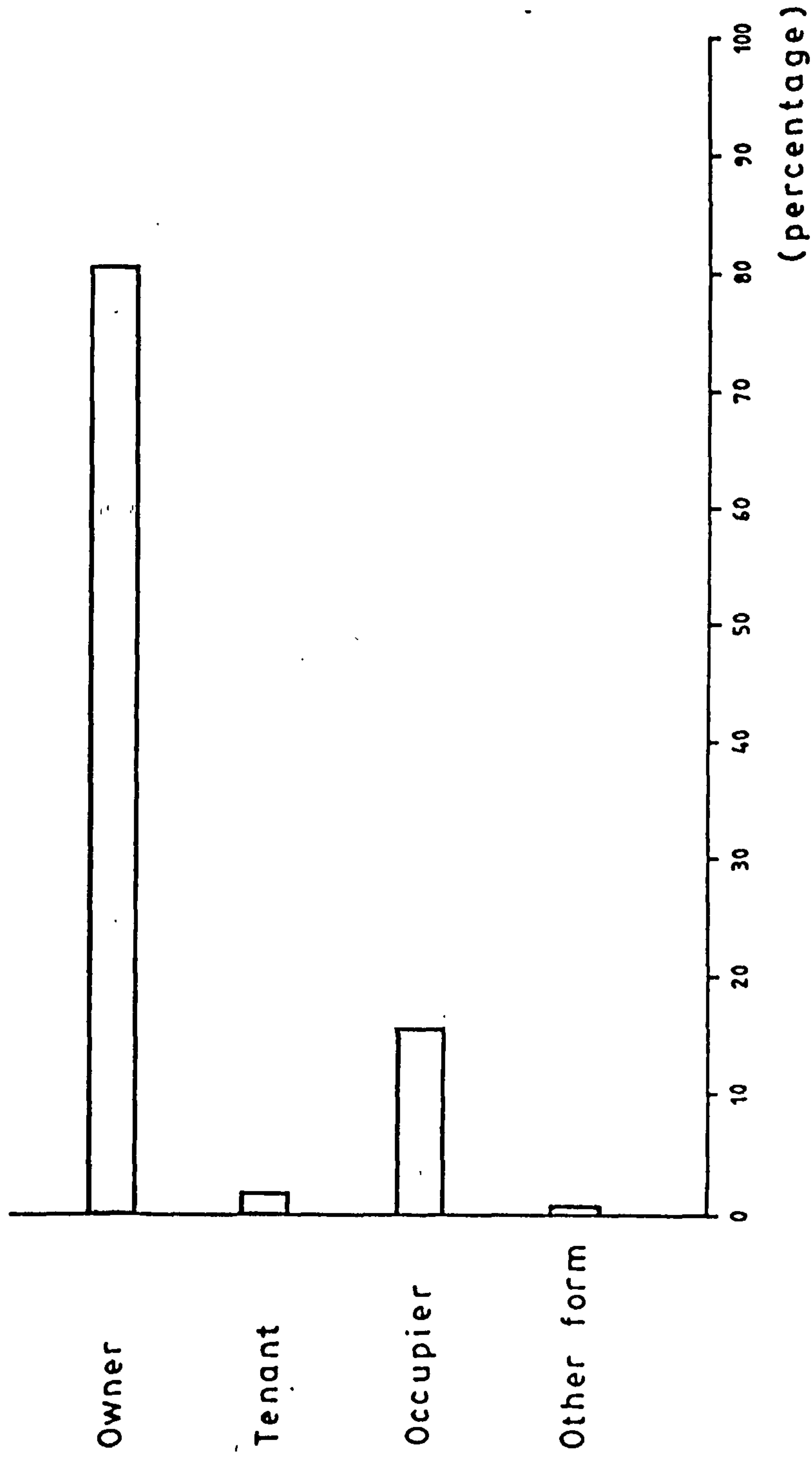


Fig. 6.5 North-Orinoco region : pattern of farm occupancy, 1971 (based on data derived from Ministry of Production, 1971; Oficina Central de Estadística e Informática, 1974)

expelled by force. The proportion of land occupation by illegal means in Venezuela as a whole increased from 11 per cent in 1950 to 13 per cent in 1971 (Ministry of Production, 1981).

Has this pattern of owner-occupancy changed since petroleum activities started in the region?. In order to investigate this issue farmers were questioned on their conditions in the use of the holdings. Table 6.1 shows the result of the sample survey of farmers, in which a sample error of 3.45 per cent has been estimated. There is a proportion of farms rented by tenant farmers or sharecroppers that lies between 41.31 per cent and 27.49 per cent of the total farms. The large proportion in this category of tenant occupancy may be explained by the growth of share-cropping practices, mainly because land owners have moved into more remunerative activities connected with the oil industry.

The results of the Chi-square test appear to be statistically significant in assessing the pattern of owner-occupancy in the region, especially in terms of intra-regional variations ($\chi^2 = 22.86$ & $p = 0.00$). Table 6.1 shows that the state of Guarico represents a significant deviation towards direct owner-occupancy, 23.5 per cent of the contribution to chi-square. The occupation category in both Guarico and Anzoategui States represents a proportion that is above 5 per cent of the contribution to chi-square. The most striking figures are encountered in the category described as 'other forms of farm occupancy', where there is a highly significant contribution to chi-square, 37.27 per cent in the state of Guarico and 16.58 per cent in the state of Anzoategui. The state of Monagas displays a result close to

Table 6.1 North-Orinoco region: farm-occupancy by state,
sample survey, 1985-86

STATE OBSERVED VALUE EXPECTED VALUE	DIRECT OWNER	TENANT	OCCUPIER	OTHER FORM	TOTAL
G U A R I C O	14 7.6 (23.5%)	14 12.4 (0.90%)	6 3.8 (5.56%)	2 12.2 (37.27%)	36
A N Z O A T E G U I	10 11.6 (0.96%)	15 18.9 (3.51%)	3 5.8 (5.90%)	27 18.6 (16.58%)	55
M O N A G A S	16 20.7 (4.66%)	36 33.7 (0.68%)	11 10.4 (0.15%)	35 33.2 (0.42%)	98
T O T A L %	40 21.2	65 34.4	20 10.6	64 33.9	189 100.0

Figures in parenthesis are cell contributions to chi-square
Chi-square = 22.88 with 6 degrees of freedom
Significance = 0.00

expectations.

If one considers the intra-regional variations in oil developments, already mentioned in Chapter 1 and Chapter 4, an inverse correlation between oil development and owner-occupancy structure can be recognized. One can say that in the state of Guarico the structure of owner-occupancy has experienced changes despite the low level of petroleum activities. The explanation for this unexpected result cannot be assessed on the grounds of the available data. This constitutes a field for further research. What the sample figures show is that in the state of Guarico the maximum probability of 'other forms' of land occupancy to occur is 13.3 per cent. In the state of Monagas it ranges from the low level of 26 per cent to the highest level of 46 per cent. In the state of Anzoategui it ranges from 35.52 per cent to 62.48 per cent.

6.1.3 Agricultural land values

Economic considerations affecting the market value of a farm are those factors that determine the supply and demand for that particular type of holding. These are related to its profit potential, namely, quantity of land, climate, the income-producing potential of the farm, communications, labour cost and availability, and state of development.

The influence of all of these components of land value varies greatly according to the quality of the land and its location. Yates (1981) points out that a landholding is obviously worth more when it can support two or even three crops each year and when it is within

commuting distance of a city and is situated in an attractive landscape. In addition, the presence of an industrial site and the infrastructural improvements and facilities connected with it, stimulates and encourages changes in the land values. As McBeth (1983) singled out, in Venezuela since the early years of oil development the pattern of land values has changed, especially in the areas around the oil camps where the price of agricultural land naturally increased beyond the reach of the average farmer.

There is little point in quoting an overall value per hectare of farmland because of differences in terms of the physical and economic components. In the North-Orinoco region there is no reliable and consistent information about land prices. There are reasons for suspecting that farm land has been somewhat undervalued by informants and, therefore, official data are not publicly available. Despite this lack of information the aim of the present section remains the discussion of changes in the value of land as a result of oil development. For this purpose an aim of this research has been to investigate whether in the post-1980 period there have been changes in the value of agricultural land or whether land values have remained stable in comparison with the period prior to 1980, the date of commencement of the Orinoco oil fields' development.

On the whole, with a sample error of 3.78 per cent, 59.5 per cent of the farmers declared that the value of agricultural land had increased in relation to the years before the oil development began in the region, whereas 40.5 per cent of the farmers considered that land values had remained unchanged. The chi-square test reveals that in the state of Guarico there is a significant deviation, 30.73 per cent,

away from agricultural land values being greater than in the period prior to 1980 and a 45.14 per cent deviation towards land values remaining unchanged, whereas the state of Monagas and the state of Anzoategui together exhibit a deviation towards land values equal to those in the pre-1980 period, which represents 14.12 per cent of the contribution to chi-square (Table 6.2).

The extent to which an oil-based development reflect changes in land values seems to be partially verified by means of the chi-square test. A tendency to maintain land values unchanged is derived from the Chi-square test. It has been argued that a major factor in determining land values is and will always be land quality (Byrne, 1986). There is little doubt about the significance of this factor and the marked effect on the pattern of land prices and values. In the case of the North-Orinoco region it seems to be a very important factor to bear in mind since, as Figure 6.6 shows, there is 38.7 per cent of agricultural land of the lowest quality, often showing quite serious limitations due to physical factors. But the establishment of an oil-based regional economy has been shown to play an important role in maintaining the pattern of land values in the North-Orinoco region. Observations in the field have revealed that farmers tend to sell and to buy land according to the increasing opportunity costs that emerge in the region's economic structure. This in its turn creates a market condition in which land prices cannot easily be increased to a higher value. As has been declared by some big farmers: "It is better to keep land today and bear in mind the effects of the oil economy upon land prices. Without doubt, the land is more valuable today than in the early 1980s". For these farmers the value of keeping farm property

Table 6.2 North-Orinoco region: changes in agricultural land values, sample survey, 1985-86

STATE \ OBSERVED VALUE EXPECTED VALUE	GREATER THAN PRE-1980	EQUAL THAN PRE-1980	TOTAL
G U A R I C O	19 23.8 (30.73%)	21 16.2 (45.14%)	40
A N Z O A T E G U I & M O N A G A S	81 76.2 (9.59%)	47 51.8 (14.12%)	128
T O T A L %	100 59.5	68 40.5	168 100.0

Figures in parenthesis are cell contributions to Chi-square
Chi-square = 3.15 with 1 degree of freedom (before Yates correction)
Significance = 0.07

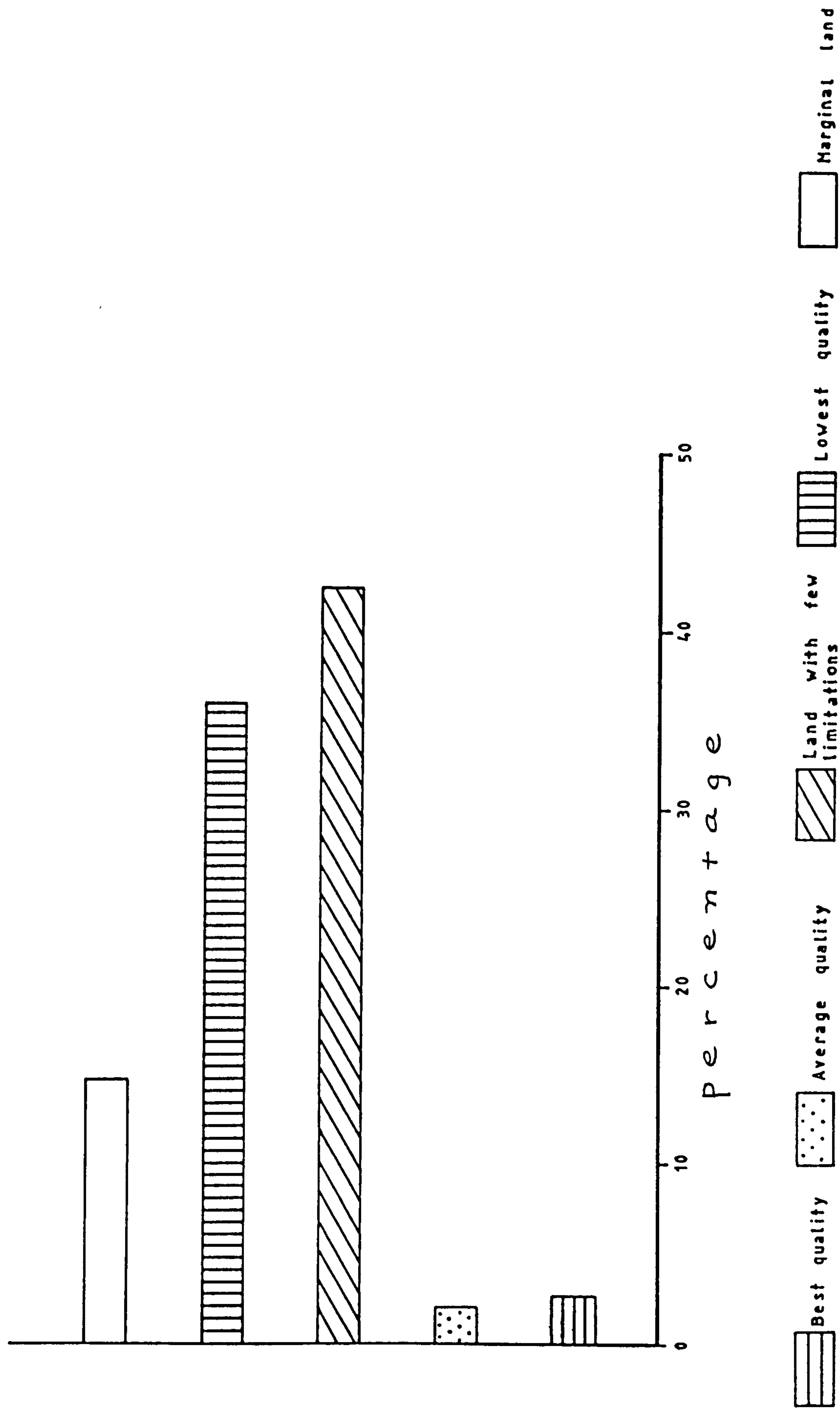


Fig. 6.6 Agricultural land quality in the North-Orinoco region.
(source of data : Ministry of the Environment, 1982)

is more and more in evidence, especially when the oil industry itself has become a great buyer with a strong financial capability to acquire big extensions of land at relatively low cost. Still further evidence of the structural effects of oil development upon agricultural land values is to be found. For this analysis, it is interesting to see how the inclusion of a new economic environment can add substantially to land values structure.

6.2 FARMING OUTPUT AND SALES

Generally speaking, changes in the patterns of farm output in the developing regions have been attributable to the process of modernization of farming experienced in the last 35 years by those countries. The means and effects of the expanding increase in crop yields has been widely discussed. For some it has been a matter of increasing the cropping area as well as the result of improvement and extension of irrigation schemes (Grigg, 1986). For others, it is a matter of increasing the application of inputs, either labour-hours or fertilizers (Dumont, 1975). In any case, beyond the biological and physical conditions around the production process, supply and demand of agricultural products determine the output farmers are prepared to produce under the conditions of market intervention.

In the specific case of oil-developing countries it is not only the internal forces of the market acting in favour of increasing crop yields, but also the fact of the vast financial inputs derived from oil revenues that bring about massive subsidies to the development of the agricultural activities. Beaumont (1985) points out

the impact of the capital investment programme in the richer oil-producing states of the Middle East. He recalls the example of Saudi Arabia and the United Arab Emirates where with the rise in oil revenues during the 1970s, these states used capital to overcome natural constraints and, as a result, there has been an impressive achievement in terms of crop production.

In Venezuela, agricultural output has been considerably expanded during the 1970s and 1980s. Available data indicate that the rate of growth in yields of several crops (sorghum, rice, cotton) was 4.6 per cent for the period 1973-78 and a further 2.3 per cent during 1978-83 compared with only 2.2 per cent in the period 1968-72 (Ministry of Agriculture and Livestock, 1985). By these means the country aimed to increase agricultural self-sufficiency. This has been made possible by the rapid growth in foreign exchange earnings from petroleum production. Even so, the impact on imports of farm products has been minimal since increases in consumption requirements and changes in consumer behaviour have also taken place.

As far as the North-Orinoco region is concerned official data reveal that in the late 1960s crop yields were below or at the level of the national average of 1,000 Kg/ha. By 1978 the crop yields had increased rapidly, achieving improvements that ranged from 637 Kg/ha. in beans to 7,604 Kg/ha. in cassava crops. These figures represented values well above the national average. By 1980 there was a further increase in yields of several crops which was twice the national average as can be seen in Table 6.3. The data reveal a substantial rise in the production of crop land even before 1980, and a further increase from 635,821 tons in 1980

Table 6.3 Average crop yield for selected crops.
North-Orinoco region and Venezuela, 1978 and 1980

C R O P S	NORTH ORINOCO REGION		VENEZUELA
	1978	1980	1978
	Average yield kg/ha	Average yield kg/ha	Average yield kg/ha
Cereals			
Rice	3,493	6,500	3,019
Maize	1,636	3,500	1,430
Sorghum	2,288	3,000	1,832
Textiles and Oilseeds			
Cotton	1,000	2,100	1,266
Peanut	1,500	2,500	1,558
Grains			
Beans	754	1,300	637
Black beans	885	1,300	437
Roots			
Cassava	7,604	18,000	7,335

Source: Ministry of Agriculture and Livestock
Anuario Estadístico Agropecuario.
Various issues

to 654,580 tons in 1985 for crops and from 32,289 tons in 1980 to 27,616 tons in 1985 for livestock. Forest productivity was not recorded before 1980 due to non-existent commercial use. According to these figures the level of overall productivity for crop yields has been above the potential capacity of production, estimated at 1,065,721 tons for the year 1980. In livestock farming and forestry production the increases in the level of production, in principle, do not exceed their potential capacity (Ministry of the Environment, 1981). At the intra-regional scale, the state of Guarico registered the highest proportion in agricultural output for most of the crops referred in Figure 6.7.

From the sample survey of farmers it can be seen that with a sample error of 5.10 per cent, 62.22 per cent of the farmers declared they obtained yields over 1,000 Kg/ha. while 37.77 per cent harvested yields below 1,000 Kg/ha. during the year 1985-86. Figure 6.8 shows this outcome and the pattern in each one of the states comprising the region. It can be argued that in fact agricultural output started to increase prior to the initiation of petroleum activities in the region, closely associated with the establishment of major irrigation works. Significantly, the fastest growth in productivity was registered in those areas which most benefitted by irrigation, as in the state of Guarico, which incidentally displayed a certain shift to higher value crops, for example sorghum. In the other two states the relatively low level in yield increases has taken place not merely in relation to irrigation but also owing to a comprehensive policy of subsidies to farmers. It is important to note that by no means have increases in yields implied the achievement of agricultural

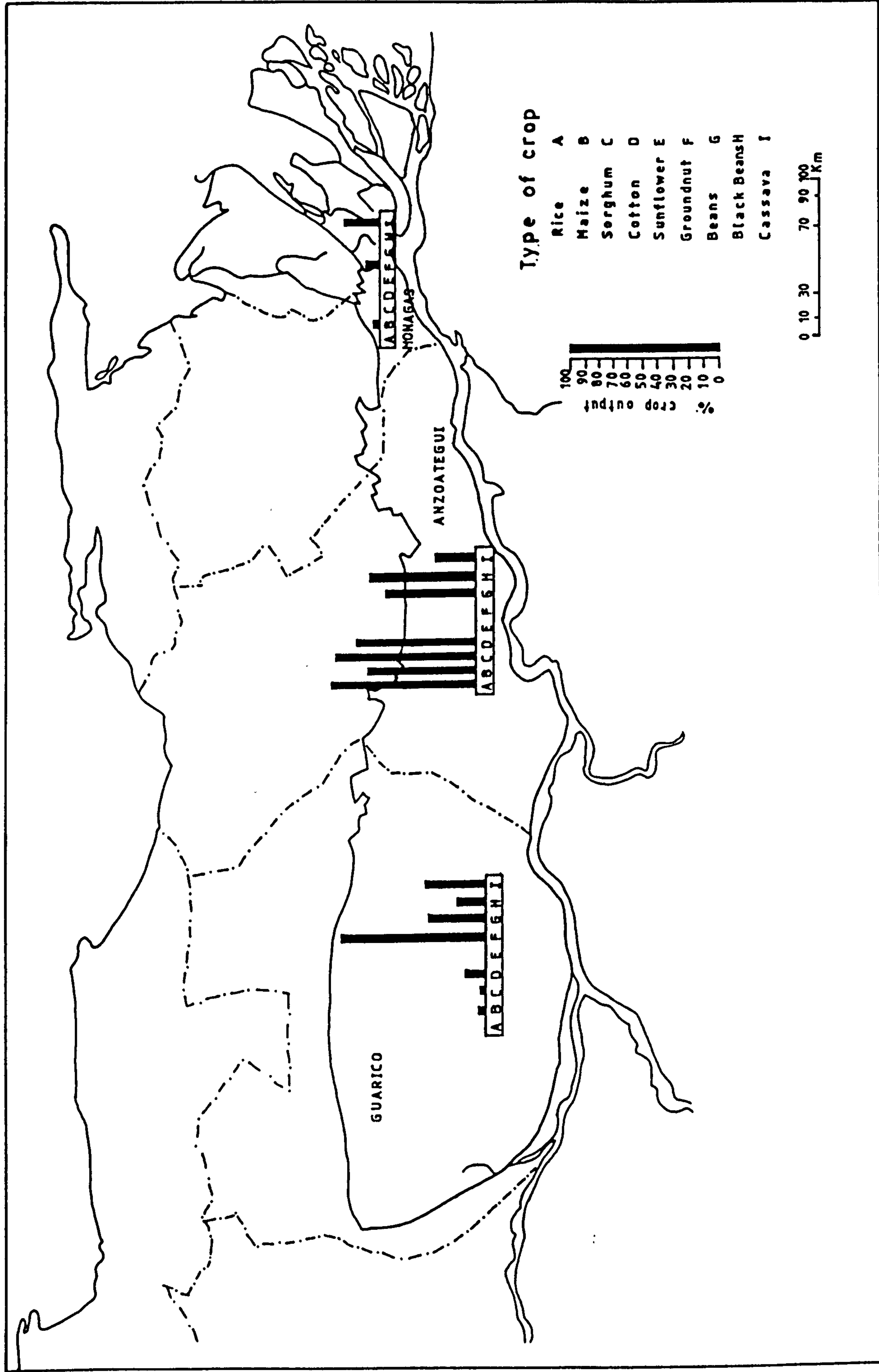


Fig. 6.7 North-Orinoco region : Output for selected crops, 1980
(source of data : Ministry of Agriculture, Anuario Estadístico, 1980)

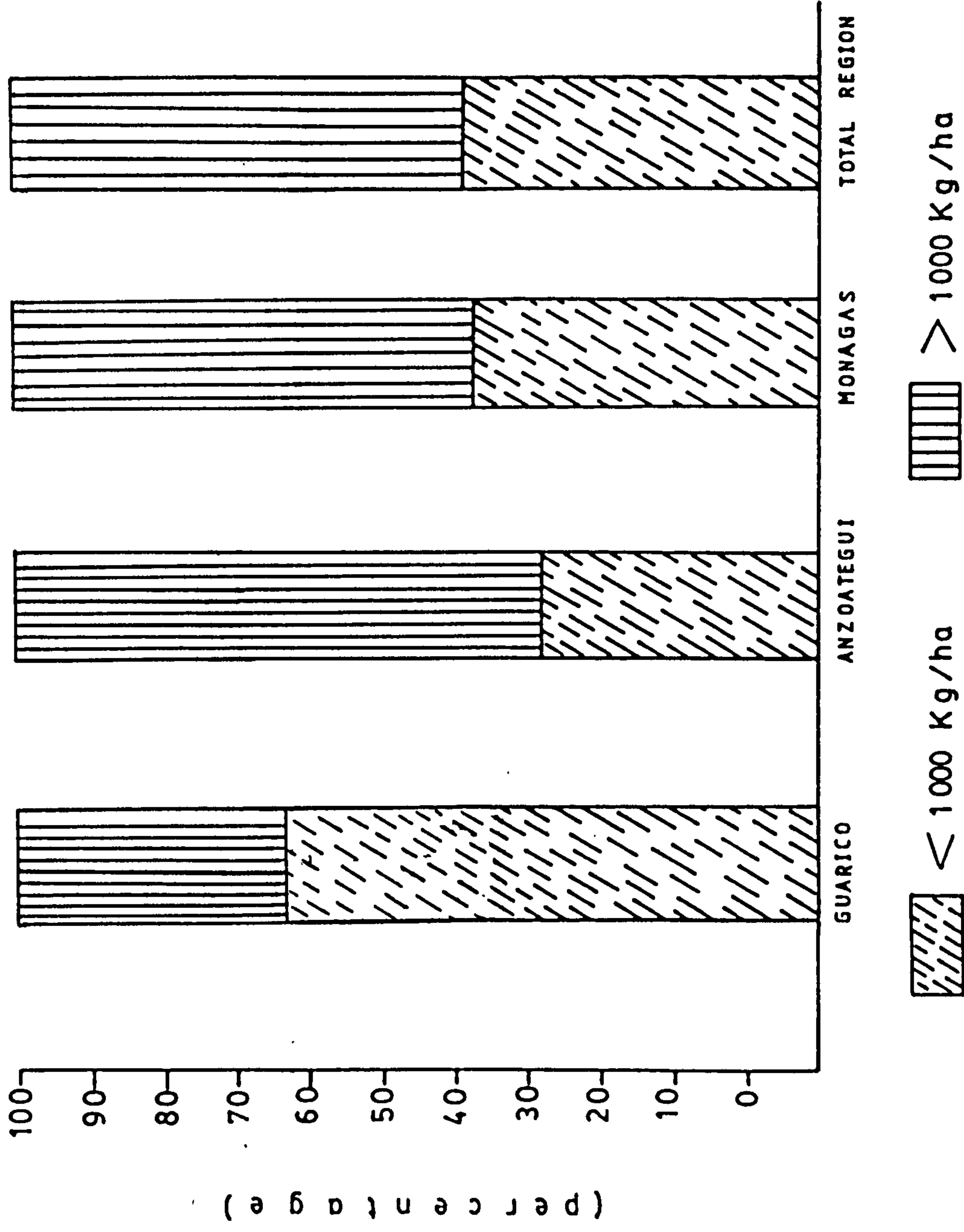


Fig. 6.8 North-Orinoco region : Crop output (source : fieldwork survey, 1985)

self-sufficiency in the region. Because the petroleum activities and associated services have stimulated the flows of population towards the region, a growing demand for imported foodstuffs and dairy products has become significant.

On the question of marketing the agricultural production the concern is about the physical environment in which the marketing of agricultural goods supplied by farmers takes place. This has been of interest principally because of the constraints and/or feasibility implied in the transaction as well as the spatial patterns derived from the marketing operations. For instance, as Mitchell (1985) noted, producers in remote areas with poor communications and transport facilities will often be forced to sell to a restricted number of buyers prepared to arrange transport. This sets a pattern in the size and nature of the markets which can be determined by the internal forces that affect the agricultural system. However, the spatial structure of the agricultural marketing system has not solely been determined by the needs of agriculture. Also social and economic factors, from which the economic incentives facilitated outside the farm sector especially those emerging from the urban and industrial activities, may be regarded at least in some small proportion as helping to shape the spatial structure of the agricultural production market.

In some oil-developing countries, as Dutton (1985) has argued, the oil-based development has created distortions in the marketing system. That is the case in Bahrain where local contractors who supplied fruit and vegetables preferred to turn to importing foodstuffs. These imports undercut local prices and therefore

inhibited local production and sales. In contrast, there have been cases where farmers enjoy transport cost reductions, facilitated by the development of infrastructural facilities to serve the oil-industrial sites. In its turn, this has merely diverted an existing agricultural pattern of production sales in response to a regional or extra-regional urban demand. Moreover, as the oil sector expands its oil-processing activities, built alongside are the oil towns which have stimulated changes in production sales as is recorded in Venezuela. In this country, particularly after the nationalization of the oil industry, farmers have benefitted from the opening of routes that connect them with extra-local consumer centres. Thus, one can argue that there has been a local multiplier effect associated with the development of the oil industry in this particular case and that infrastructural linkages have operated to some extent.

The study of the agricultural production sales in the North-Orinoco region of Venezuela brings this discussion into a regional context. The sample survey of farmers reveals that in the pre-1980 period with a sample error not greater than 4.44 per cent, 22.5 per cent of the farmers sold their produce in the local markets while 51 per cent used regional markets and 26.5 per cent bulked their agricultural products to the extra-regional markets. The post-1980 period shows a certain change in this pattern of marketing agricultural products. With a sample error not greater than 3.52 per cent local market systems are used by 46.5 per cent of the farmers, while 27.5 per cent and 26 per cent of the farmers sell their products to regional and extra-regional markets respectively (Table 6.4). From the available evidence, there is merit in the argument that the prevailing market

Table 6.4 Location of agricultural market places in the North-Orinoco region: a) the pre-1980 period
b) the post-1980 period (sample survey 1985-1986)

A)

STATE \ OBSERVED VALUE EXPECTED VALUE	LOCAL	REGIONAL	EXTRA-REGIONAL	TOTAL
GUARICO	12 9.0 (11.86%)	22 20.4 (1.48%)	6 10.6 (23.68%)	40
ANZOATEGUI	13 13.5 (0.22%)	35 30.6 (7.50%)	12 15.9 (11.34%)	60
MONAGAS	20 22.5 (3.29%)	45 51.0 (8.37%)	35 26.5 (32.34%)	100
TOTAL	45 22.5%	102 51.0%	53 26.5%	200 100.0%

Figures in parenthesis are cell contributions to chi-square

Chi-square: 8.43 with 4 degrees of freedom

Significance: 0.07

B)

STATE \ OBSERVED VALUE EXPECTED VALUE	LOCAL	REGIONAL	EXTRA-REGIONAL	TOTAL
GUARICO	11 18.6 (11.99%)	22 11.0 (42.48%)	7 10.4 (4.29%)	40
ANZOATEGUI	29 27.9 (0.18%)	19 16.5 (1.46%)	12 15.6 (3.20%)	60
MONAGAS	53 46.5 (3.50%)	14 27.5 (25.59%)	33 26.0 (7.27%)	100
TOTAL %	93 46.5%	55 27.5%	52 26.0%	200 100.0%

Figures in parenthesis are cell contributions to chi-square

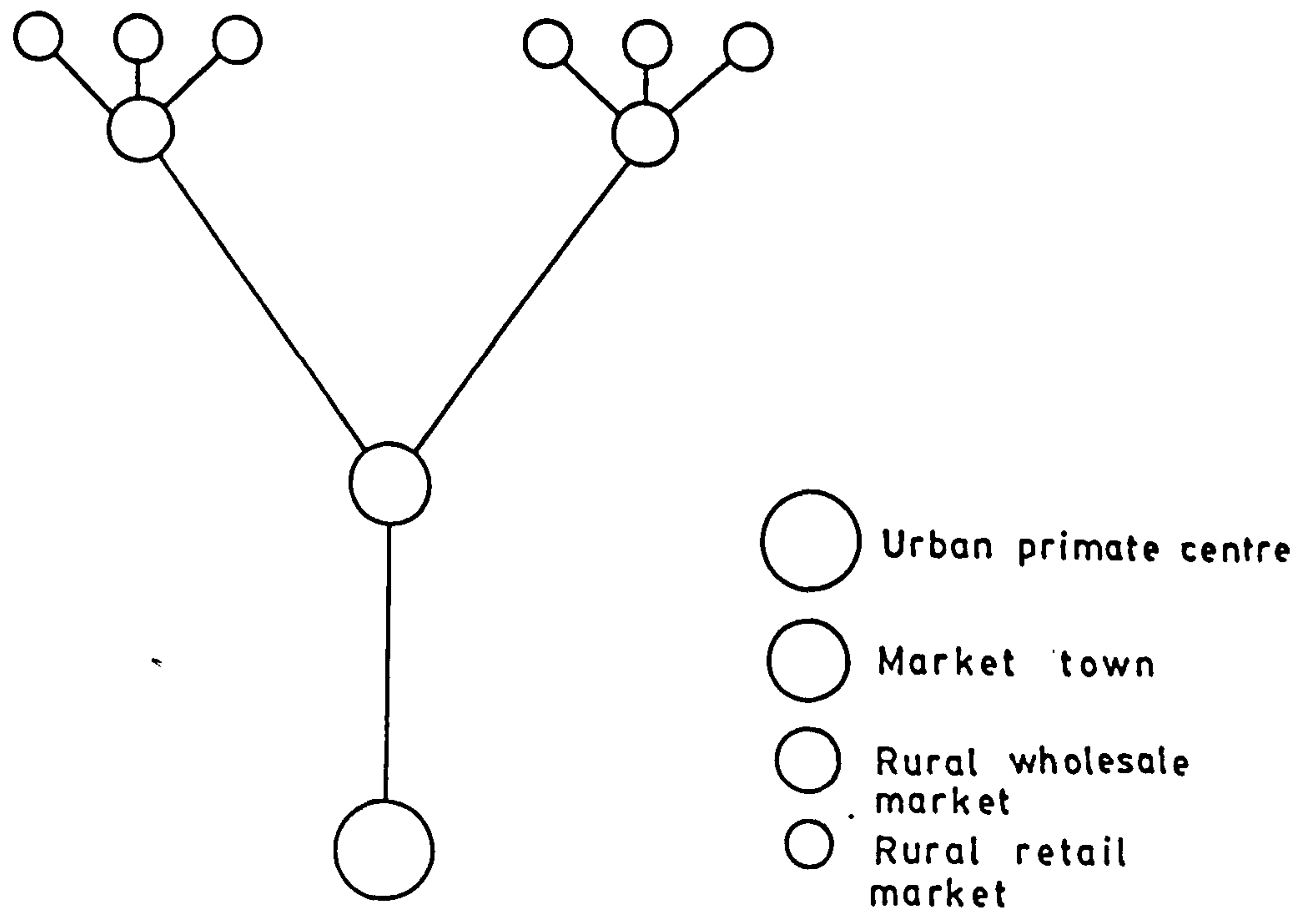
Chi-square: 25.89 with 4 degrees of freedom

Significance: 0.00

pattern has emerged as a result of stimulus from the oil-industrial development. In fact, the data indicate that there is a growing use of local markets since the oil industry initiated its operations within the region in the post-1980 period while the regional and extra-regional markets have decreased its relative importance. This change can be attributable to a 'visible supply of incentive', namely the oil industry, capable of tempting some producers to raise more and better farm crops for local market towns.

But does this change imply a development of a rural-marketing structure with little primacy of central-place markets? Historically, the region has been characterized by the presence of a commercial central-place hierarchy, where farmers have a strong dependence upon wholesalers and traders located in major markets not evenly distributed throughout the region but rather concentrated along the major routes. The fieldwork has revealed a very interesting feature in this respect. As Figure 6.9 illustrates, there is a tendency to maintain an essential type of dendritic marketing system, which is characterized by the presence of lower-level centres that are tributaries to one high-level centre and where the terms of trade for agriculture are mainly determined in urban centres (Smith, 1976). However, in the region's agricultural production process, peasant-produced goods are not necessarily flowing directly from small towns to urban centres. There exists scope for horizontal trade at the local level where supply and demand of agricultural products are greatly stimulated by the presence of the oil-based industry. It could be argued that farmers' sales are not only dependent on the traditional marketing structure of primary market centres against small feeder rural markets, for the geographical distribution of the

A)



B)

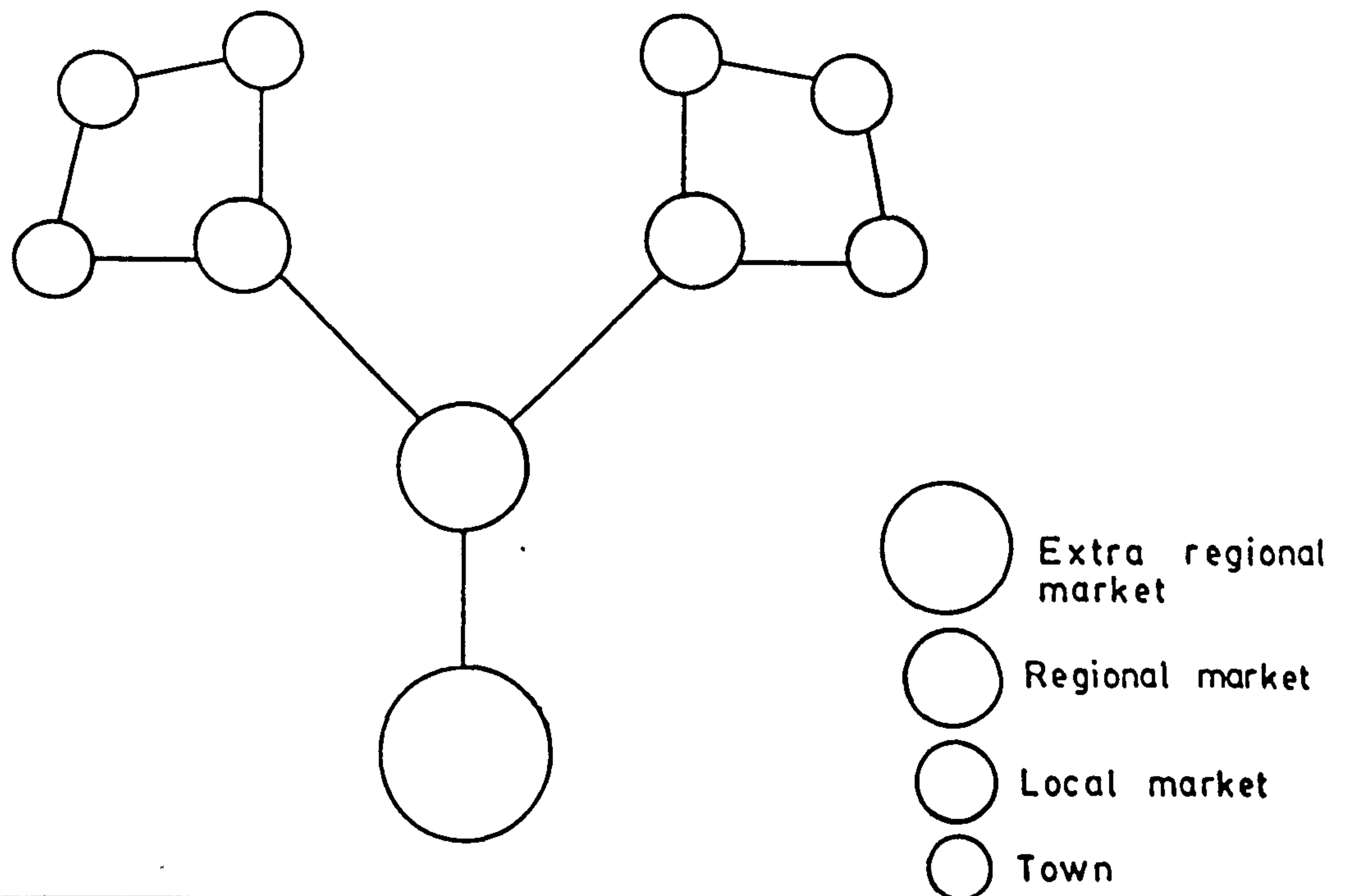


Fig. 6.9 North-Orinoco region : generalized agricultural market pattern
 A) pre-1980 period,
 B) post-1980 period,
 (source: fieldwork survey)

oil industrial operations within the region has also shaped the spatial market pattern which exhibits relatively important local and regional linkages.

Obviously, there are intra-regional variations in the spatial use of market places. Through assessing the contribution of each state to chi-square, Table 6.4 shows that in the state of Guarico the regional markets contribute 42.48 per cent to chi-square in the post-1980 period, which contrasts with the primacy of extra-regional markets (23.68 per cent contribution to chi-square) in the pre-1980 period. The state of Anzoategui does not exhibit significant changes while in the state of Monagas there is a relatively significant contribution to chi-square (25.59 per cent) from regional market places for the post-1980 period as compared with an 8.37 per cent contribution to chi-square in the pre-1980 period. Surprisingly, the result of the chi-square test shows an inverse association between the level of the states' oil development in the post-1980 period and the kind of market places used. It was expected that the state of Guarico would display the lesser contribution to Chi-square in local and regional markets as compared with the state of Monagas where a greater contribution in the local markets cell was expected due to the greater level of oil operations in this state. In addition to the fact that the state of Guarico has experienced a growth in the local population demanding agricultural products, the explanation of this inverse relationship could be found in the increasing number of agro-industries located in the state of Guarico and the growing expansion and consolidation of their operational capacity, which have implied greater utilization of agricultural output.

Data available show that in the year 1980, 62.50 per cent of the agro-industries of the North-Orinoco region were concentrated in the state of Guarico and for the year 1984 the figure had increased to 80 per cent of the total number of agro-industrial establishments (Ministry of Agriculture, 1984). Therefore, the above evidence reflects that in the North-Orinoco region changes in the pattern of marketing agricultural output are not strictly associated with the impact of the oil industry. Nonetheless, the oil-based development seems to accentuate this pattern inasmuch as it serves as a stimulus for population growth and for the expansion of the agro-industrial sector, both demanding greater amounts of agricultural items produced locally.

6.3 FARM FINANCE

The financial environment in which farming functions constitutes another important element for the analysis of the agricultural sector and the pattern of agricultural production. In this respect there has been a general concern, among other things, about farmers' investment in their land, the farm credit system and output prices as well as the public agricultural investment pattern. Looking at the specific case of the North-Orinoco region, oil production has not yet fully entered into a commercial phase, so revenues cannot yet be applied directly to the enlargement of the government budget for agricultural investment and projects. Nevertheless, the growth of petroleum activities in the region and its surrounding areas has been seen as the economic generator of investment for the expansion of agricultural activities at the regional scale. For instance, the spreading of trade, commerce,

construction, and social services have attracted a significant number of migrants to the region, which in its turn, has involved increased demand for agricultural products, increases in the agricultural labour force, rises in the earnings of farmers, and investment in agricultural inputs. Data available show that there was an increase of 3.11 per cent of agricultural workers between 1971 and 1980 whereas between 1981 and 1985 there was an annual increase of 1.66 per cent of agricultural labour force. Moreover, farmers' earnings have experienced a slight increase of 1.2 per cent between 1981 and 1985 as compared with the income of 4,800 Bolivares per capita earned between 1978 and 1980.

The survey of farmers undertaken for this study was in part intended to find out changes in the volume of employment, periodicity of employment, and agricultural wage rates. But there was little success in assessing the trends in these aspects since the statements by the farmers of their working conditions and earnings received were not always reliable. Therefore, this section reflects merely some aspects of the costs of agricultural production and the trends in the capitalization of agriculture. These aspects directly provide a basis for an understanding of the pattern of finance and investment, mostly generated by the government, a topic that will be treated in the next chapter. Whenever it is possible, intra-regional variations will be presented trying to associate them with the oil-industrial developments of the region.

In terms of farmers' expenditures, differences emerge in respect of the farm size and patterns of land tenure and owner-occupancy. Data from official sources for the period 1981-1985 reveal that in the state of Guarico average total expenditure for middle-size farms (100-500 ha.) harvested by tenant farmers was around 1,174 Bolivares per hectare (US\$ 273 per hectare at 1980 exchange rate), those middle-size farms harvested by the owner had an average expenditure of 1,552 Bolivares per hectare (US\$ 360 per hectare) while a large holding (>500 ha.) plotted by a tenant farmer could have an average total expenditure of 1,877 Bolivares per hectare (US\$ 436 per hectare). In the state of Anzoategui middle-size farmers under the tenure condition of tenant should have to spend 5,824 Bolivares per hectare (US\$ 1,354 per hectare) in order to produce a peanut crop. In the state of Monagas the occupants of middle-size farms could have expenditures between 2,491 Bolivares per hectare (US\$ 579 per hectare) and 5,346 Bolivares per hectare (US\$ 1,243 per hectare) while middle-size farms cultivated by owners had expenditures of some 2,109 Bolivares (US\$ 490 per hectare).

These figures do not provide evidence for small farmers' expenditures. It is thought that they spend very little in order to keep production at the subsistence level. The high level of expenditure is among middle-size farms harvested by occupiers, basically because expenditure goes on the hiring of labour and for the payment of commissions to institutional officials who are always searching for those farmers without legal rights to plot the land. Given the data available it is not possible accurately to discuss intra-regional variations. Nevertheless, the data suggest a low level of farmers' expenditure in the state of Guarico as compared with

the other two states. The explanation for this outcome is that farmers in this state receive more technical and financial assistance from the government.

On the question of capital assets, there are several items typically classified under this heading including land, livestock, buildings, irrigation works, machinery, vehicles, equipment and materials. Farm land values have been already discussed when analysing the farm structure of the North-Orinoco region. About the rest of the components of agricultural capital it can be said that considerable sums of capital are, at present, invested in buildings and construction works, followed by road construction, irrigation works, land reclamation and improvements, and the final item to account for capital investment is machinery and equipment. In addition, as Table 6.5 shows, it appears that the state of Guarico presents the highest percentage of capital expenditure on buildings (61.78 per cent), the state of Anzoategui accounts for the highest investment expenditure in irrigation works (70 per cent), while over 60 per cent of the total capital expenditure for forestry goes to the state of Monagas. The scale of total agricultural capital in the state of Guarico is twice as much as in the state of Monagas. This is largely because of the low level of livestock activities in the state of Monagas and because many landowners in the state of Guarico own their assets, mainly land and livestock capital as a result of family inheritance. This has provided them with high shares of capitalization, which to a lesser extent is encountered in the state of Monagas, especially after inflation and devaluation of the national currency started to affect the country's economic and financial system. The level of total capital expenditure

Table 6.5 North-Orinoco region: distribution of farm capital by agricultural activity and state, 1980-2000

	GUARICO	ANZOATEGUI	MONAGAS	TOTAL
	Million of 1980 Bolivares			
CROP	1,023.8	871.4	232.5	2,127.7
Irrigation	75.3	372.5	41.7	489.5
Road construction	277.3	176.8	41.5	495.6
Buildings	75.0	108.1	18	201.1
Land reclamation	247.4	117.9	32.3	397.6
Land Improvements	322.2	-	23.8	346
Harvesting	26.6	96.1	75.2	197.9
LIVESTOCK	922.2	451.4	28.6	1,402.3
Road construction	127.4	73.7	0.6	201.7
Buildings	794.8	377.7	28	1,200.5
FORESTRY	-	373.7	671.7	1,045.4
Road construction	-	74	133	207
Machinery	-	1.5	2.7	4.2
Buildings	-	2.2	4	6.2
Plantations	-	296	532	828
TOTAL	1,946.0	1,696.6	932.8	4,575.43
	Percentage Distribution			
CROP	52.00	51.36	24.92	46.50
Irrigation	3.86	21.95	4.47	10.69
Road construction	14.24	10.42	4.44	10.83
Buildings	3.85	6.37	1.92	4.39
Land reclamation	12.71	6.94	3.46	8.68
Land improvements	16.55	-	2.55	7.56
Harvesting	1.36	5.66	8.06	4.32
LIVESTOCK	47.39	26.61	3.06	30.64
Road construction	6.54	4.34	0.06	4.40
Buildings	40.84	22.26	3.00	26.23
FORESTRY	-	22.02	72.00	22.84
Road construction	-	4.36	14.25	4.52
Machinery	-	0.08	0.28	0.09
Buildings	-	0.12	0.42	0.13
Plantations	-	17.44	57.03	18.09
TOTAL	100.00	100.00	100.00	100.00

Source: Ministry of Agriculture. Farm report. Various issues.
Ministry of the Environment. Report 1981

in the state of Anzoategui is similar to that in the state of Guarico, except that investment includes forestry activities, which in the long run might be regarded as a major component in the capitalization of the region's agricultural sector.

From this last statement the effect of the oil industrial development upon the farm finance structure can be appreciated. A strong financial investment programme towards the development of forest activities has been launched in the states of Monagas and Anzoategui since the oil industry started to operate in the region, in some cases directly backed by the oil industry itself. Obviously, this has produced changes in the region's pattern of capital expenditure, affecting primarily the state of Monagas, secondly the state of Anzoategui and lastly the state of Guarico where the only concern in terms of forest activities has been the development of the Aguaro-Guariquito National Park. The overall impression gathered from the analysis of capital investment is one of relatively significant changes in the post-1980 period, and of a clear trend in the influence of the new region's economic environment, greatly stimulated by the presence of the oil industry.

6.4 CONCLUSIONS

The preceding sections of this chapter have been concerned with a discussion of the economic components of the farm system in the context of the North-Orinoco region. The different agricultural factors affected by the region's oil-based industrial development have been analysed; namely the size of farm, tenure system, landholding structure, agricultural land values, farming output and marketing, and farm finance.

In terms of the farm structure, the research has shown whether or not the level of oil developments within the region has been significant in bringing about changes. The pattern of farm size, for instance, has not been changed in the state of Monagas where a more intensive development of oil activities is at work. Meanwhile the state of Anzoategui and the state of Guarico have displayed changes in the category of farm-size 10-99 hectares that seems to be associated with the changes in the economic structure since oil development began. This inverse correlation is also found when considering the land tenure system and owner-occupancy structure. The greater changes have occurred in the state of Guarico and the state of Anzoategui where low levels of petroleum activities exist. In contrast, agricultural land values have not been substantially modified in the region. The state of Monagas and the state of Anzoategui appear to have the same pattern of land values as the pre-1980 period.

Farming output and the marketing structure have shown the most relevant results of this research. Clearly, output had increased prior to the establishment of the petroleum industry in the region but

significant changes have taken place in the post-1980 period as a result of increases in the regional food demands. The marketing system has experienced very significant changes in its spatial structure due to the greater utilisation of local and regional market places as compared with the extra-regional markets. Finally, this chapter has observed the financial features of the farm system, revealing that the pattern of investment as well as its scale has been influenced by the size distribution of farms and also by the changing economic structure of the region, in which the oil industry constitutes an important economic generator.

CHAPTER 7: AGRICULTURAL MANAGEMENT IN THE NORTH-ORINOCO REGION

The discussion in this chapter turns toward an examination of the national/regional involvement in the management of the North-Orinoco region's agriculture since petroleum activities were initiated in the region. The first section looks at government intervention in the agricultural sector. The second section places particular emphasis on the involvement of the petroleum industry by looking at the perceptions of farmers as well as public officials, including the representatives of the petroleum industry itself. The last section of the chapter raises the issue of an environmental concern for the region as a managerial response to the resolution of conflicts between petroleum and agriculture.

7.1. GOVERNMENT INTERVENTION

There has been widespread concern in many countries about the leading role that government plays in managing the use of agricultural land. Bowler (1986) has pointed out that government intervention is greater in agriculture than in any other sector of the economy and as a result the state has become an important factor in shaping both the structure of farming and the location of agricultural production. Among the many reasons for the substantial spread of public assistance for agriculture are the need to ensure food supplies for the expanding populations; the declining importance of the agricultural sector in terms of overall national economic development; increases in costs of the factors of production; instability in agricultural prices; and the need to increase the amount of land available for rural populations. All these factors contribute towards straight-forward policies for agriculture

from which significant improvements in the performance of the agricultural sector may be expected. Such policies are critical in helping the farm sector as it undergoes a process of change as a result of the evolution of the industrial sector of the economy.

This is even more striking in the specific case of agricultural development within an oil-based context, in which the farm sector and agricultural production can be substantially affected by the intensity of development in the oil activity. Government intervention towards the agriculture-petroleum economic and spatial interactions can be achieved in various ways: by establishing a policy of direct investment in the agricultural production process; by increasing attention to integrated rural development programmes and infrastructural improvements; and by encouraging the petroleum industry to minimize its distorting impact upon the agricultural economy.

In the North-Orinoco region of Venezuela, the agricultural sector has been subjected to the intervention of many different national and regional development agencies (Fig. 7.1). The degree and style of intervention has varied over time, displaying very significant spatial variations within the region, particularly since 1980. Let us examine in this section the pattern of public agricultural investment; firstly, in relation to farm production expenditure and secondly, in terms of services for agriculture and social development.

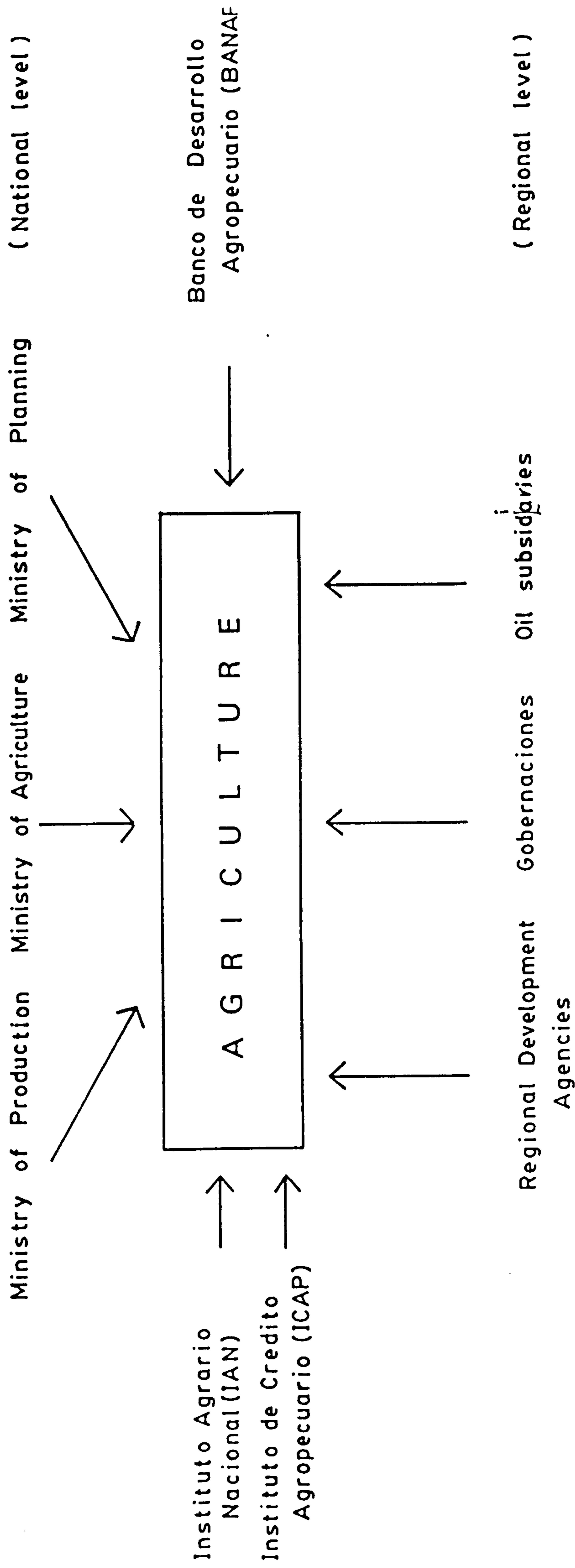


Fig. 7.1 North-Orinoco region : Schematic representation of institutional involvement in agriculture

7.1.1 Public investment for agricultural production

Farm credit has become a very popular government policy in Venezuela, aiming to stimulate the development of the North-Orinoco region's agricultural sector as well as to spread the benefits of petroleum development more widely. Through this policy, farmers are able to obtain loans and subsidies on a substantial scale, and these are regarded as essential elements for the improvement of farming practices and the transformation of agriculture into a more profitable and competitive sector.

Data available show that for the year 1980 the government allocated a total of 105,640 Bolivares per hectare (US \$24,566 per hectare at the 1980 exchange rate) while for 1985 there was a significant increase in public funds that amounted to 362,520 Bolivares per hectare (US \$84,306 per hectare). As shown in Table 7.1, 88 per cent of the total investment in 1985 was directed towards crop production, especially to cereals and to textile and oilseed crops. It appears to be very significant that investment for forest activities has risen from 1,200 Bolivares per hectare in 1980 (US \$279 per hectare) to 38,819 Bolivares per hectare (US \$9027 per hectare) in 1985, which shows again the changes in the government's perception of and attitudes towards agriculture at the regional scale.

With regard to the intra-regional variations in government investment for 1985 the figures show clearly the concentration of public investment in the state of Guarico (62.81 per cent) while the state of Anzoategui receives 31.91 per cent of the investment expenditure and only 5.25 per cent is allocated in the state of Monagas (Table 7.2). This pattern is accentuated by the fact that there are different

Table 7.1 North-Orinoco region: public investment by agricultural activity, 1980 and 1985, (Bolivares/hectare and percentage)

Public Investment	1980	1985
Crop	99,500 (94.23)	318,721 (87.9)
Livestock	4,890 (4.62)	4,980 (1.37)
Forestry	1,200 (1.13)	38,818 (10.70)
Total	105,640 (100.00)	362,520 (100.00)

Source: Ministry of Agriculture. Agriculture and Livestock Census 1980
Ministry of Production. Agriculture Statistics 1985

Table 7.2 North-Orinoco region: public investment by agricultural activity and state, 1985 (Million Bolivares and percentage)

Public Investment	Guarico	Anzoategui	Monagas	Total
Crop	357.3 (87.73)	191.6 (92.60)	22.3 (65.39)	571.2 (88.10)
Livestock	49.9 (12.25)	12.1 (5.84)	6.9 (20.23)	68.9 (10.62)
Forestry	-	3.1 (1.49)	4.8 (14.07)	7.9 (12.18)
Total region	407.25 (62.21)	206.9 (31.91)	34.1 (5.25)	648.3 (100.00)

Source: Ministry of Agriculture. Report, 1985
Ministry of Production. Agriculture Statistics, 1985

development agencies dealing with the agrarian aspects, each one with its own geographical, financial and institutional framework within which to respond to the demands for investment in the region. For instance, investment in cotton production is administered and distributed by the Institute of Agricultural Loans in the Orinoco islands while the Bank of Agricultural Development concentrates its operations in the northeastern part of the state of Guarico.

It is neither feasible nor sensible to aim at an egalitarian geographical distribution of public investment expenditure. In the case of the North-Orinoco region the strong bias of investment towards the state of Guarico seems to be partially justifiable since by this means agriculture in the state could be provided with sufficient capacity to meet a further expansion of petroleum activities, if the government continues to invest at the present scale. However, this pattern of investment has adverse effects on those agricultural zones of the states of Anzoategui and Monagas where the national oil industry and its oil subsidiaries made heavy demands on available investment resources, causing a restriction on the volume of credit available to finance agricultural activities. Thus, the intra-regional disparities in the farming economy that emerge as a result of the impact of petroleum developments are sustained by the government's agricultural policy.

7.1.2 Public investment in services for agriculture and social development

The lack of an adequate system of infrastructure and social services to support the development of the agricultural sector undermines the process of overall social and economic development exacerbates the disparities between agriculture and other sectors of the economy. This is more significant in those agricultural regions where changes have taken place as a result of the initiation of urban-industrial developments demanding considerable amounts of investment to fulfill their physical requirements; but if the government intervenes by supplying services to agriculture, then the impact is substantially reduced.

For the North-Orinoco region, the disparity between the services for agriculture and for the petroleum industry has been a matter of great concern, especially after looking retrospectively at the outcome in other oil-producing regions of Venezuela, where the public revenues generated by the oil activities were insufficiently re-invested in infrastructure and social services to serve the agricultural rural areas. Revenues originated from petroleum activities in the North-Orinoco region cannot yet applied to the provision of public infrastructure and services for the agricultural economy. Nevertheless, supported by field evidence, one can describe here the government's attempt to benefit agriculture, at least in principle, while the oil industry is gradually developing up to the level of achieving its full industrial capacity.

In terms of road infrastructure, the region has evolved into a more accessible space, encouraging farmers to increase agricultural output and to expand the marketing of agricultural products to a large

number of market places. Generally speaking, the main roads have been provided as a result of the development of the oil activities in the region, but the government has made a substantial investment in the provision of local roads to connect villages with cities and towns of the region. The length of the asphalt road network in 1979 was about 50 per cent of the total network for main roads and 10 per cent for local roads. Between 1980-1985 some other local roads have been constructed, providing the region with about 30 per cent of asphalted local roads. Although the proportion of asphalted local roads is greater as compared with the year 1979, it must be regarded as low, especially when considering the intra-regional distribution (Plate 7.1).

Government investment in the road network has been concentrated in the state of Anzoategui and the state of Guarico while the state of Monagas possesses a very poor communication system to connect the agricultural areas, except for the areas of forest development where about 60 per cent of the total road network for this portion of the North-Orinoco region is concentrated (Plate 7.2). With regard to public investment for irrigation and drainage, storage, and farm buildings, official data show that there has been a relatively significant increase in the proportion of investment devoted to those items. Thus, the region seems to be in a better position as compared with the year 1978. Table 7.3 shows the changes in the number of establishments to support the agricultural production. It also exhibits the intra-regional primacy of the state of Guarico in the possession of government-sponsored infrastructure.



Plate 7.1 Asphalted local road in the community Paso Moreno. Monagas state



Plate 7.2 Local road to connect the communities Buena Vista and El Aceital. Guarico state

Table 7.3 North-Orinoco region: number of establishments to agricultural activities, 1978 and 1985.

INFRASTRUCTURE	GUARICO		ANZOATEGUI		MONAGAS		TOTAL	
	1978	1985	1978	1985	1978	1985	1978	1985
Centre of animal rep	25	30	2	4	2	4	29	38
Dryer machine	13	15	1	2	2	2	16	19
Silos	10	12	3	5	2	2	15	19
Storage	10	12	8	12	3	4	21	28
Wheat Processor	1	3	-	-	-	-	1	3
Wheat Classifier	1	3	-	-	-	-	1	3
Groundnut Processor	-	-	3	6	-	1	3	7
TOTAL	60	75	17	29	9	13	86	94

Source: Ministry of the Environment, Informe tecnico, 1982
Ministry of Agriculture and Livestock, Report 1985

By considering the farmers' views concerning government intervention in regional agriculture, the sample survey of farmers undertaken for this study reveals that 41.5 per cent of the farmers regard the present government level of investment in agriculture as fair, 26 per cent of the farmers express the view that there are comprehensive farm-support measures to boost production levels, 25.5 per cent acknowledge a limited support by the government, and only 7 per cent of the farmers interviewed consider that there is no government support in the provision of services for agriculture. At the intra-regional scale, it is found that out of the total farmers in the state of Monagas, 44 per cent regard as fair the government intervention for agriculture and 25 per cent think government policies towards agricultural services have been comprehensive. In the state of Anzoategui, 39 per cent of the farmers have considered government support to agriculture to be comprehensive while 31.66 per cent have expressed the view that the level of intervention has been fair, leaving 25 per cent who have declared that there exists only a limited government intervention for agriculture. In the state of Guarico 50 per cent of the farmers regard the public provision of services for agriculture as fair while 15 per cent view the intervention of the government in agriculture as comprehensive (Figure 7.2). Significant intra-regional contrasts in the farmers' perception of government support to agricultural services cannot be stated with assurance on the basis of the survey. What the evidence suggests, however, is the farmers' relatively positive perception of government intervention in agriculture within the region as a whole. The faith in government is such that farmers exhibit a strong reliance on government financial schemes each time they are prepared to

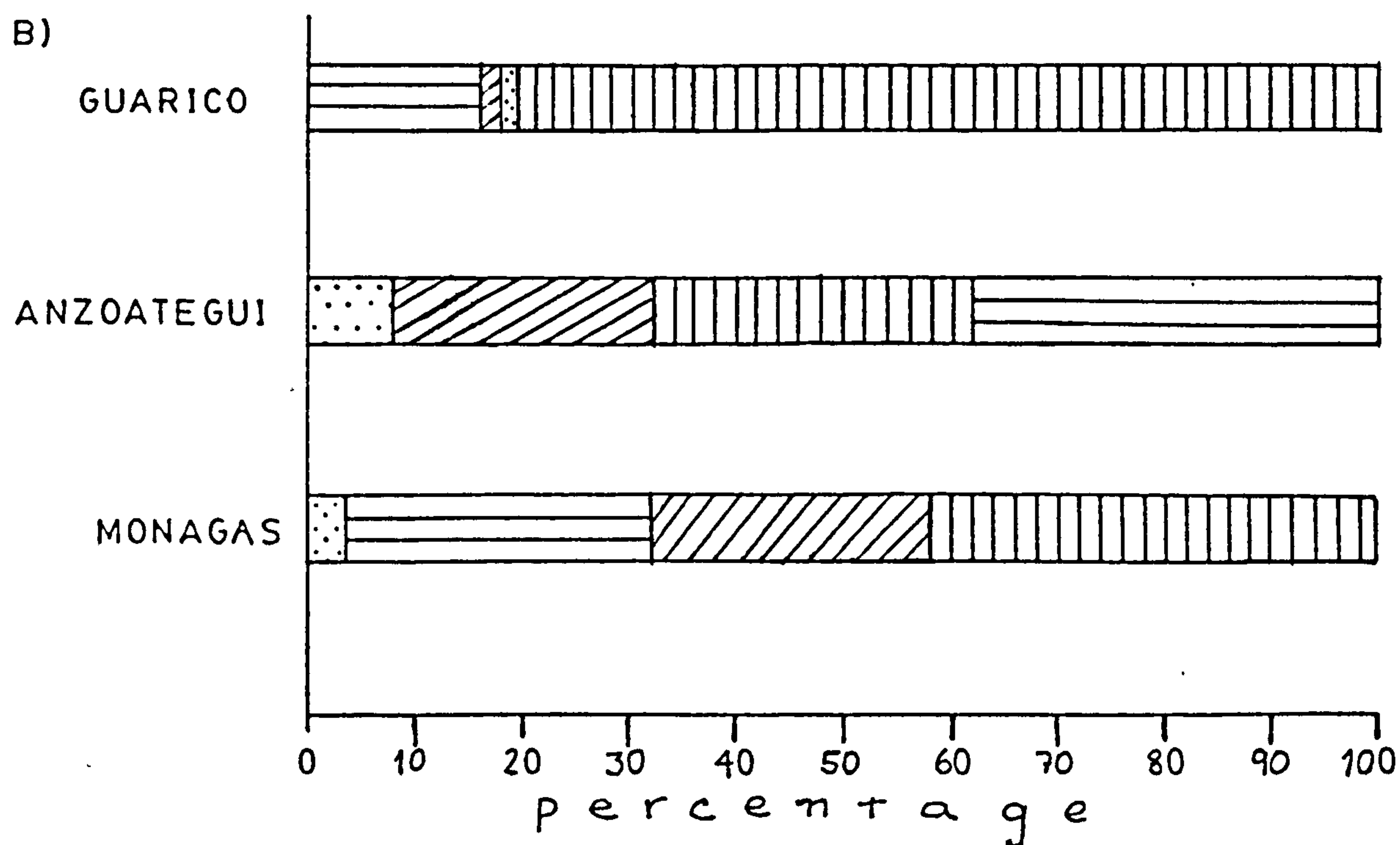
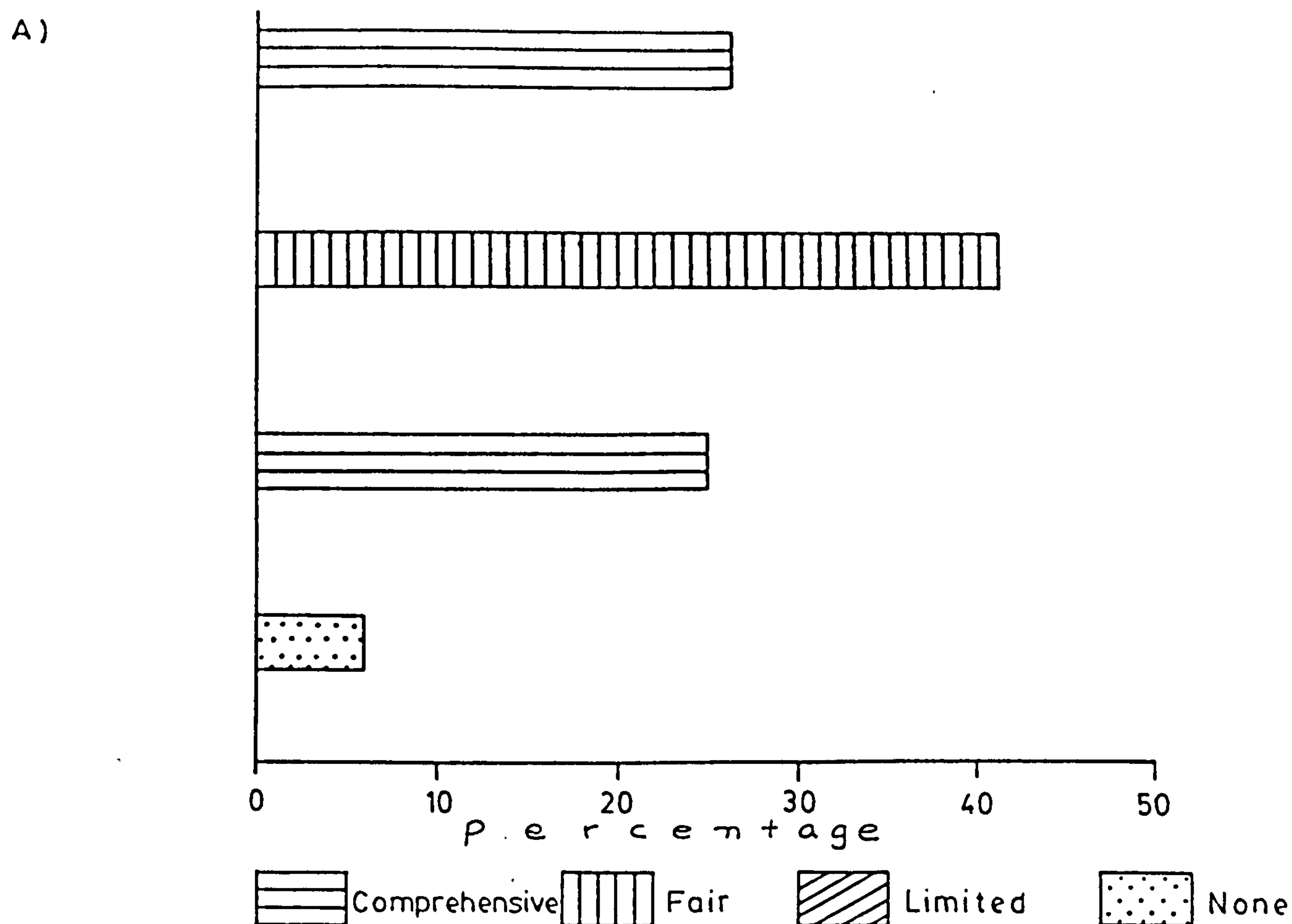


Fig. 7.2 North-Orinoco region :

A) services in agriculture for the total region;

B) services in agriculture by state.

(source: fieldwork survey, 1985)

initiate new farming operations.

Another feature of government investment in the agricultural areas of the North-Orinoco region is the provision of social services. This seems to become an increasingly important part of the agricultural resource development equation. Data obtained for the different communities included in the survey of farmers carried out in 1985-86 show a considerable qualitative improvement in the conditions of those services in existence prior to 1980. Similarly, it is found that there has been a recent provision of services such as potable water supply, electrification, sewage and drainage, health, education, and telecommunication networks. Table 7.4 illustrates the changes which occurred in the provision of public services for the communities included in the 1985 survey. The outcome is that as compared with the year 1980, out of the total for 1985, seven communities were provided with educational services, ten with health services, ten with telecommunication services and eight with potable water supplies. In looking at the intra-regional variation in quality of services, it can be argued that the state of Anzoategui shows the best quality level of services while the state of Monagas exhibits a less satisfactory degree of government support in the provision of services.

On the whole, the increase of agricultural infrastructures and social services has been used by the government as a strategy to counterbalance the impact of the urban-industrial development generated by the oil industry. Whether this strategy has succeeded in offsetting the oil-industrial impact upon agriculture remains a very controversial issue within the region. During the fieldwork, the interest has not been primarily to evaluate the government planning

Table 7.4 North-Orinoco region: provision of public services
in selected communities, 1980 and 1985

COMMUNITY	1 9 8 0					
	Potable water	sewerage & drain	Electricity	Telecom	Education	Health services
GUARICO						
Los Aceites	■	■	▲	■	■	■
Mapurito	■	■	■	■	▲	■
Buena Vista	■	■	■	▲	■	■
ANZOATEGUI						
Botijon	■	■	▲	▲	■	▲
Las Haticas	▲	▲	▲	■	▲	▲
S D de Cabrutica	▲	▲	■	■	▲	■
MONAGAS						
S J del Yabo	▲	▲	▲	▲	▲	▲
Santa Rosa	▲	■	▲	▲	▲	■
Chaquaramas	▲	■	▲	▲	■	▲
Paso Moreno	■	■	▲	▲	■	■

COMMUNITY	1 9 8 5					
	Potable water	sewerage & drain	Electricity	Telecom	Education	Health services
GUARICO						
Los Aceites	▲	▲	■	▲	■	▲
Mapurito	■	▲	■	▲	▲	▲
Buena Vista	▲	■	▲	▲	■	▲
ANZOATEGUI						
Botijon	▲	▲	▲	▲	■	▲
Las Maticas	▲	■	▲	▲	▲	▲
S D de Cabrutica	▲	■	▲	▲	▲	▲
MONAGAS						
S J del Yabo	■	▲	▲	▲	▲	▲
Santa Rosa	▲	▲	▲	▲	▲	▲
Chaquaramas	▲	▲	▲	▲	■	▲
Paso Moreno	▲	▲	▲	▲	▲	▲

Source: fieldwork survey

existent ▲
non-existent ■

policies for the agricultural sector. Rather the concern has been to evaluate the oil industry's contribution to agricultural development. Nevertheless, it can be concluded that although considerable improvements in agriculture have taken place, the government response has not been sufficient to create a totally new situation in which the problems associated with the existing social and economic agricultural structure could be circumvented.

7.2 PETROLEUM INDUSTRY FLEXIBILITY

The problems of agriculture in the context of regional planning require a variety approaches. In Venezuela, broadly speaking, attempts have been made to protect farmland from urban sprawl, to provide a balance between regions, to protect landscapes, and to reconcile the conflicting demands upon agricultural land that emerge with the pressures of economic and social change. But all these approaches have one thing in common, in that they focus upon the resolution of conflicts between urban development and the agricultural sector. In the case of agricultural areas within oil-producing regions, it is not only the preservation of farmland from urban expansion that matters. Concern must be also be shown for the pressures exercised by the oil industry and its associated development. The planning system must be aware of this condition in order to analyse problems, assess conflicts and wherever possible resolve difficulties.

As discussed in Chapters 5 and 6 of this study, the economic, social and spatial changes arising from petroleum development have by no means bypassed the agricultural sector in the North-Orinoco region. A

generalized argument suggests that petroleum-agriculture confrontations in the region are thought to take place as a result of the oil industry's practices of land expropriation, pollution, and ecological destruction, as well as its failure to produce the expected linkages to the local economy and society. However, these unpopular and negative viewpoints of the side-effects of the oil industry in the region are hardly documented publicly. Therefore, in this research heavy reliance is based upon direct sources of information, which in the regional context are the field observations, the oral accounts of the local population and the opinions of officials of the oil industry itself and of development agencies.

To start with, the issue of the petroleum industry's contribution to agricultural development acquires another dimension in the context of the North-Orinoco region. The pattern of petroleum-agriculture interactions in other oil-producing regions of Venezuela has been one in which the petroleum industry had a spatially foreign-orientated connection that implied little concern about the spread of benefits at the regional and local level. In contrast, the development of oil activities in the North-Orinoco region has been fully integrated within a national-orientated framework, with the petroleum industry expected to serve the interests of the nation, acting not as an enclave but as a key factor designed to generate economic and social development. In terms of the management of the agricultural space economy this perspective provides a very significant starting point that should be regarded as a positive and beneficial factor in the overall petroleum-agriculture interface as compared to the relationship previously experienced in some other oil-producing regions of Venezuela.

During the fieldwork carried out in 1985-86, it was relevant to consider the viewpoints of the petroleum industry's officials as well as other individuals involved in the region's policy making. The survey undertaken included six questions concerning the direct contribution of the petroleum industry to agriculture, and the spatial and socio-economic impact of the petroleum industry operations. As shown in Figure 7.3, from the sample of respondents about 50 per cent of the officials regarded as positive the attitude and participation of the oil industry in the provision of services to support agriculture; in the allocation of funds to finance agricultural projects; in the flexibility of the oil subsidiaries to the recognition of managerial plans for the regional agricultural sector; and in the resolution of conflicts of land use affecting farmland areas. Most respondents agree that there has been a strong illusory attraction of farmers to oil-related employment. On the one hand, the petroleum industry has created great expectations about job opportunities but, on the other hand, due to the highly-technological nature of its operations, the requirements in manpower are mainly directed to skilled labour, by which a very small percentage of farmers are eventually employed in petroleum-industrial activities.

Evidence obtained during the fieldwork suggests that there are relatively few methods by which the petroleum industry has attempted to serve the development of agriculture, the principal ones being direct investment, provision of infrastructure, and research and technical assistance. Firstly, the oil subsidiaries are directly involved in the finance of agricultural projects such as the case of a major cotton project in the state of Anzoátegui, covering about 15,000 hectares with an investment of 2 million Bolivares. Also there is

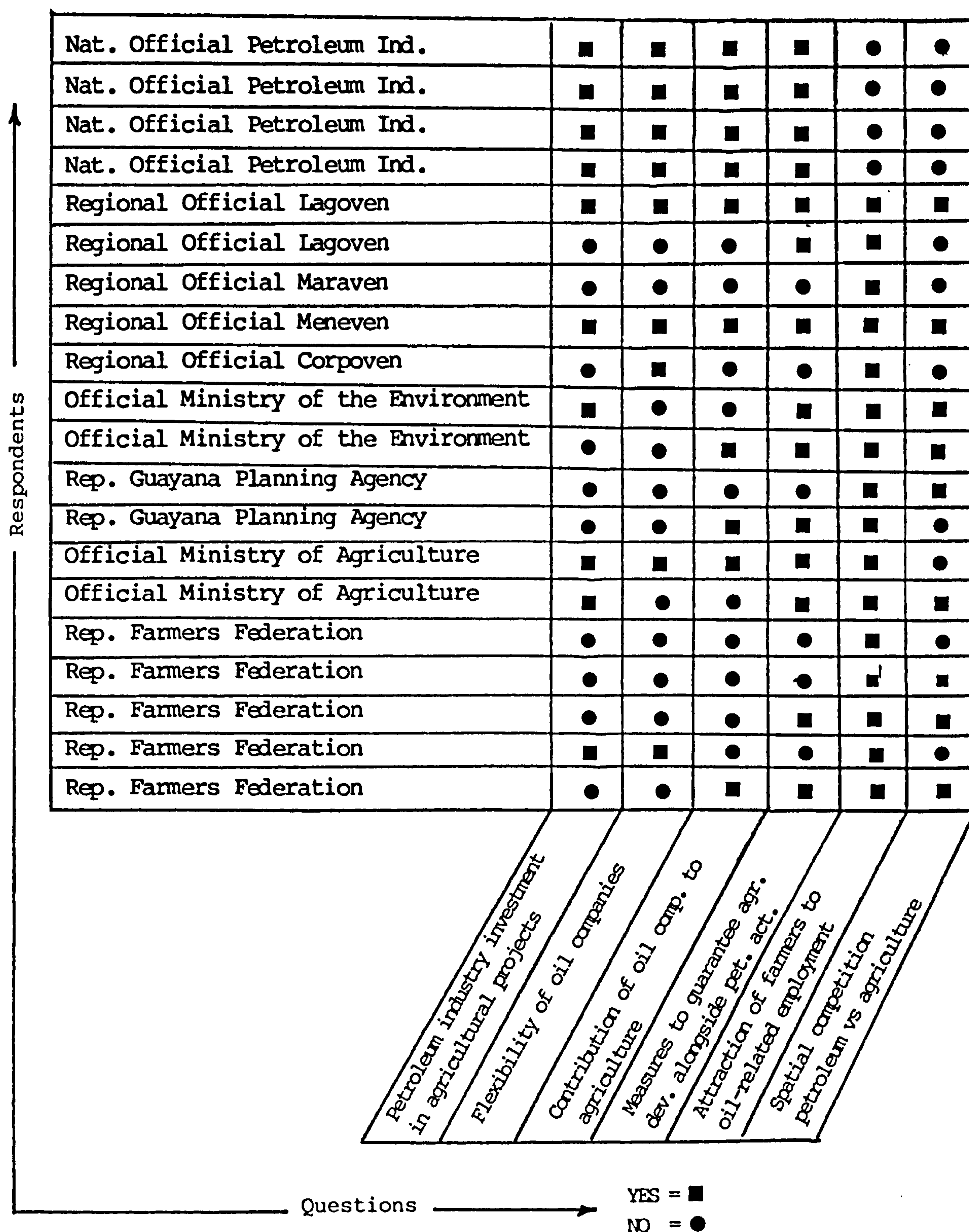


Fig. 7.3 Officials' perception of petroleum-agriculture interface (source: fieldwork survey)

investment for the formation of *single-family* and *multi-family* farms for annual and perennial production in ten communities of the state of Monagas. Similarly, there is a growing promotion of farming activities through the direct contracts with farmers to produce agreed quantities of food for a fixed price. The agricultural products bought by the oil subsidiaries are later sold to the oil industry's personnel in the establishments organized for that purpose.

Secondly, the petroleum industry has provided with infrastructure the immediate vicinities of the oil sites, with emphasis on road networks, piped water, electricity supplies, and sewerage systems. Mostly the diffusion of infrastructure has been accomplished in the state of Anzoategui and the state of Monagas where officials of the petroleum industry have claimed to have done much more for the provision of services to the agricultural communities than was expected by the farmers.

Thirdly, in respect of research and technical assistance an important link between farming and petroleum production seems to be achieved. In the state of Guarico, the development of programmes to instruct farmers in the best use of fertilizers has been launched by the petroleum industry. For instance, the introduction in the market of the new fertilizer 13-26-0GCP, designed to increase the productivity of soils with a low phosphate content and a high level of potash, has required the oil industry to develop a programme of technical assistance to farmers in order to achieve the most satisfactory results in the use of this fertilizer, especially for the cultivation of sorghum and maize crops (Corpoven, 1987). Similarly, while the oil industry continues its study of

exploration and exploitation of the oil resource endowment in the whole region, it has embarked, in conjunction with the Ministry of the Environment, on the production of a more complete survey of local groundwater resources that could be used for agricultural purposes. This survey has been especially undertaken in the state of Anzoátegui where groundwater availability and irrigation schemes constitute a critical issue.

Broadly speaking, the petroleum industry shows signs of concern about its impact on the agricultural space-economy of the region by developing either unilateral or co-ordinated actions in the interests of the farming communities. However, it can be said that the actions undertaken are not the result of decision-making policies conceived within a regional managerial framework. Rather every particular action is directed, planned and executed by the corresponding oil subsidiary, which has significant spatial consequences on the region, favouring some areas more than others.

So far the issue of the management of the interactions between petroleum and agriculture in the North-Orinoco region has been described from an institutional perspective. This reflects one angle. It is also relevant to examine how the farmers themselves perceive this problem. Let us focus on the results of the sample survey of farmers in this context. Farmers were asked about the same issues as the officials, that is, questions concerned with the direct and indirect contribution of the oil industry to agriculture, the flexibility of the oil industry and the environmental impact as a result of its operations. Figure 7.4 shows that 70 per cent of the farmers agree on the recognition of a satisfactory indirect

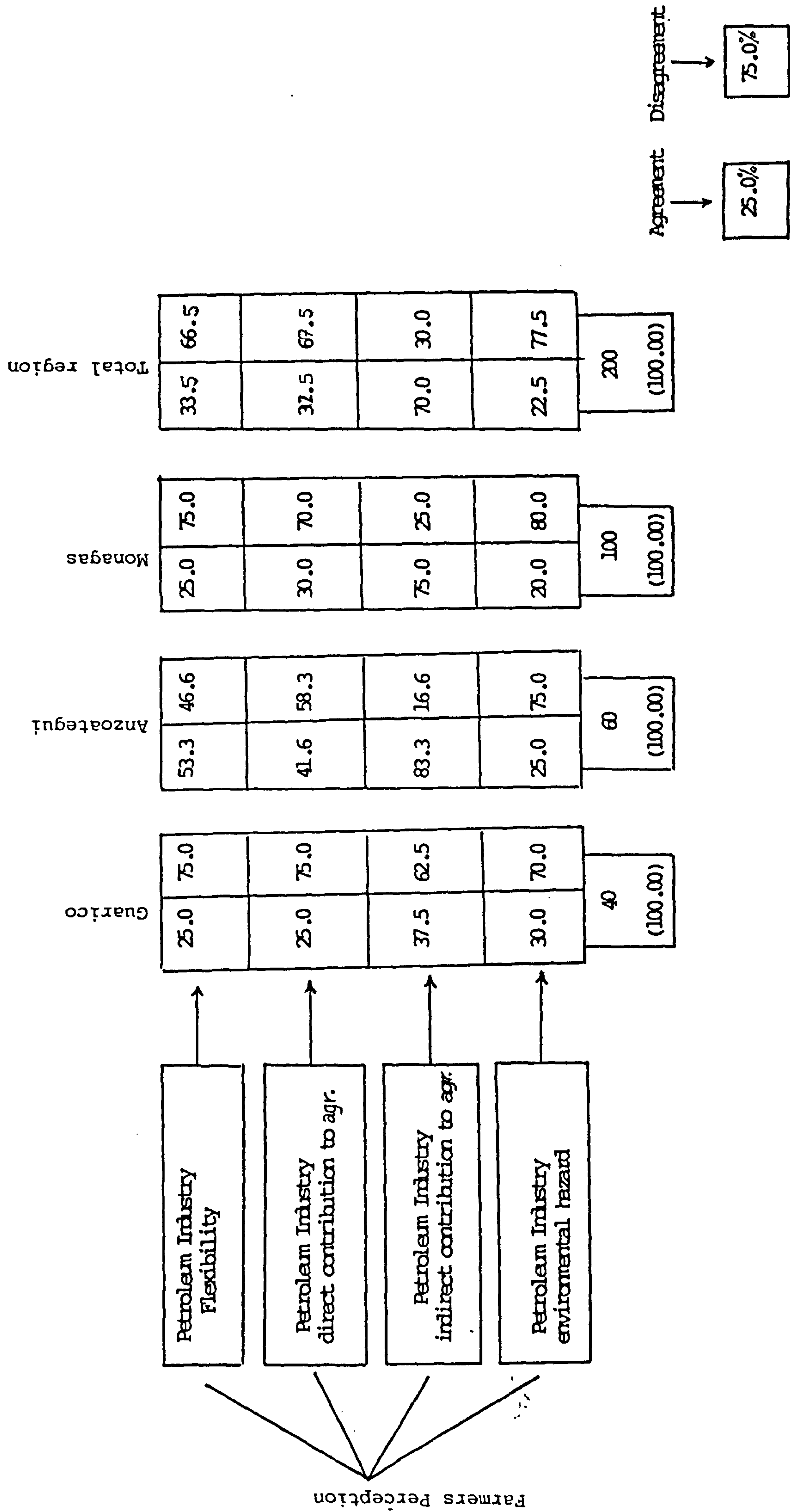


Fig. 7.4 Farmers' Perception on petroleum-agriculture interface
(source: fieldwork survey)

contribution of the oil subsidiaries to agricultural development. Farmers regard the initiation of oil activities in the region as the economic/spatial force that has allowed a rapid diffusion of their agricultural products. The petroleum industry's intervention in the expansion of the road and transport networks has been greatly influential. Otherwise, according to their perception, the cost of reaching more markets for their produce might be high.

With regard to the other issues above-mentioned, over 65 per cent of the respondents think that the oil industry does not possess a comprehensive and sustained view about its role in the management of the region's agricultural space and that any attempt to fulfill this requirement is just at the discretion of the officials responsible in each oil subsidiary. For instance, farmers complain about the way the petroleum industry has dealt with the land expropriations in order to accomplish its operations of drilling wells or build road and pipelines. Evidence supplied by the farmers and observations in the field suggests that land-use changes affecting agriculture take place as a result of the oil industry's policies. This was confirmed in the state of Monagas where an official of the oil industry declared that little chance exists to maintain the present pattern of agricultural land use, because of the oil industry's demands in terms of land for its operations.

In this process, small and medium-sized farmers are more likely to be exposed to the oil industry's unilateral activities and policies, because in such cases the farmers are not politically strong enough to prevent the petroleum companies from achieving their aims

and from assuming a determinant role. Another general complaint is about the ecological impact of the petroleum industry operations. Farmers refer to the low but persistent contamination of crops and pasture, fisheries destruction, death of cattle, and water pollution; although they recognise the recent efforts of the oil subsidiaries to regularize many oil production operations and improve pollution controls.

The farmers' perception of the oil industry role in the management of agriculture varies within the region. As shown in Figure 7.4 the state of Guarico exhibits the highest level of farmers' disagreement about the issues already mentioned. According to them the state of Anzoategui displays the greatest flexibility of the oil subsidiary towards a compatibilization of petroleum and agricultural activities as well as in terms of the indirect support to agriculture. Farmers in the state of Monagas appear to have a less negative view of environmental hazards. On the whole, a relatively low improvement in the performance of the petroleum industry with regard to the management of agriculture seems to characterise the region. The lack of a unidimensional and congruent policy brings about intra-regional disparities and this might be accounted a serious obstacle to the further development of the agricultural sector.

7.3 ENVIRONMENTAL CONCERN

In the context of the type of economic activity that prevails in the North-Orinoco region, namely petroleum and agricultural activities, the state, through its policy-making institutions dealing with the environmental issues, has seen it as necessary to formulate a strategy to protect the environment in the region. It has been argued that these activities would not themselves cause negative impacts. Rather, it is the management and lack of control that lead to the deterioration of the environment (Ministry of the Environment, 1982). Although one might agree with this statement, it is particularly relevant to stress that since petroleum activities were initiated in the region, there has been a potential environmental impact upon the agricultural resources. From fieldwork observations one can assess a relatively minimal, almost non-existent direct ecological impact of the oil subsidiaries upon agriculture. For instance, cases of crops and pasture contamination, fisheries destruction, death and illness of cattle, water pollution, leaks of chemicals etc. were rarely if ever detected. Nevertheless, one might point out that the initiation of petroleum activities in the region has encouraged a certain pattern of development, which may eventually be expected to be a source of significant environmental impact.

The pattern of development for agriculture, as discussed in Chapter 3, is one in which a short-term, mixed, intensive and concentrated production process has been launched in order to take away the possible imbalances between the oil-industrial development and the agricultural activities. As a result, emphasis is given to the incorporation of areas where irrigation systems already exist, to the expansion of areas with potential groundwater irrigation, to the

promotion of development in the semi-arid regions, to the specialization of production for agro-industrial purposes and to the mechanization of agricultural practices. These measures clearly have implications with respect to present and future growth and conservation of resources. The process of artificialization of agriculture which aims at maximize the factors of production such as land and labour, increase the environmental cost through the over-utilization of land, salinization, erosion, and poor drainage (Gligo 1983). Moreover, the intensification of the agricultural activities implies the growing integration of industrial and financial activities with those of agriculture, especially with its forestry, food and raw materials. Under these circumstances, the financial and industrial sectors may impose their rationale on agriculture determining, for instance, purchase of land, machinery and equipment, chemical products, fertilizers and seeds. Again, this may have serious repercussions on the environment.

The question that arises, firstly, is whether this pattern of development and the potential environmental impact have emerged only because of the growth of the petroleum-industrial sector; and secondly, whether the environmental impact applies at the same spatial scale. To start with, it is argued that the agricultural economy of the region has over time moved towards a production system marked by the presence of regional agro-industries which absorb great amounts of the region's agricultural produce. Nonetheless, the evidence obtained from fieldwork observations suggests that the initiation of the petroleum-industrial activities has provided the regional agro-industries with a comparative advantage necessary for their consolidation. This expansion has been accomplished in such a way that

there is little apparent concern regarding the appropriate technology for a given environment.

Rather the pattern adopted has been to reduce dependence upon the natural environment not only by interfering with the ecosystem but also by exercising manipulation on the economic factors of production. For instance, the mere fact of fixing high prices for the production of sorghum has resulted in over-utilization of the soil whereas low prices for fruit production has left large areas unproductive or devoted to the production of crops to which they are not ecologically suited. Similarly, the establishment of forestry activities in the region exhibits the same dilemmas in terms of the environment. The agro-industries operate at their full capacity in order to generate a reasonable profitability, adopting a wide variety of sophisticated technologies with no regard for the environmental costs of their intervention in the forest resource. Clearly, one cannot assume that petroleum development is responsible for a direct environmental impact on agricultural resources. However, there is a substantial indirect impact derived from changes in the economic structure of the region in which the petroleum activities play a significant role.

Viewed in the intra-regional terms, areas with a high proportion of agro-industries and petroleum-related industries have more scope for environmental pollution than those in which these types of economic activity are under-represented. There is a spatial concentration of these economic activities, which not only accentuates the inevitable pollution problems but also makes it difficult to reconcile environmental policy objectives with the continued growth of local and

regional economies largely influenced by petroleum development. The areas more sensitive to environmental impact in the North-Orinoco region and its surroundings are identified as the Guarico irrigation system, the Isle of Guara, Ciudad Bolivar, Ciudad Guayana, and the production zones of the oil subsidiaries Maraven and Lagoven.

There are no official data available to assess the changes over time, before and after the initiation of petroleum activities. The evidence derived from fieldwork shows that in the state of Monagas the petroleum industry generates the most direct impacts through oil extraction, coupled with side effects in promoting population growth, related services and industries and regional multiplier effects. In the state of Guarico conflicts in the agricultural resource system are not created by the petroleum-industrial activities but by the agro-industries, which have been established as a result of the attraction displayed by the petroleum-related development in the state. The state of Anzoategui shows a minimum level of environmental hazards. The most significant factor available to explain this pattern is the behaviour and policy of the oil subsidiary operating in this state. The Meneven oil subsidiary has developed sound programmes of environmental conservation in connection with the control of air and water pollution as well as the protection of groundwater and vegetation resources. In its attempt to deal with the environment, attention has been given not only to the physical environment but also to the social impact that its operations could produce over the towns and villages surrounding the industrial sites, and special attention is provided to the farm communities settled in this portion of the North-Orinoco region.

To sum up, it can be said that given the multisectoral nature of the North-Orinoco region, which comprises the development of the oil industry, the growth of commercial and financial enterprises, and the development of agriculture, concern for environmental features is greatly significant. Before the nationalization of the oil industry, environmental research and policies to deal with the impact of oil activities were virtually non-existent. By contrast, the development of the Orinoco oil deposits since 1980 has been launched within a different context and has involved a different approach: in principle, there must be a sufficient recognition of the spatial and economic impact of development upon the region's environment. Although this is a great step forward, it must be said that, in practice, what it is happening is a proliferation of protective and conservationist regulations which are taken as merely a management exercise intended to cope with the environmental hazards derived from the pattern of economic development now emerging.

7.4 CONCLUSIONS

This chapter offers a broad perspective on the issue of agricultural resource management. It stresses the role of the government in shaping the spatial and economic patterns of public investment of the North-Orinoco region. There have been several government approaches designed to produce mutual harmony in the interaction between petroleum and agriculture at the regional level. This has been accomplished via policies such as investment programmes designed to allow changes in the level of agricultural production, and through the allocation of resources to provide services and social development to

the farm communities of the region. From the government's own viewpoint the investment pattern favours agricultural development, although intra-regional disparities in financial allocation can be observed. According to the farmers' perceptions, improvements in their social conditions and investment to support agricultural productivity have been greater since the region started to experience petroleum-industrial development.

The issue of petroleum-industry flexibility is particularly examined in this chapter on the grounds of its heavy involvement in the transformation of the spatial and socio-economic structure of the region. The evidence suggests that despite a considerable change in the perception of its role in the management of the local and regional agriculture, the petroleum industry still tends to maintain an omnipotent and unilateral approach that hardly ensures a balanced and sustained development of agriculture. The environmental considerations within the decision-making process have also been discussed in this chapter.

It seems evident that despite the efforts of the oil industry to establish a more uniform managerial policy towards agriculture, the nature and implementation of existing policies have ensured that they have been by no means spatially neutral in their effects. Clearly, this implies serious constraints upon the definition of a comprehensive package of environmental legislation designed to deal with the region's agricultural resource management problems as a whole.

CHAPTER 8: CONCLUSIONS

This thesis has been concerned with the interactions between petroleum and agriculture at the regional/local scale and has attempted to reach an understanding of the changes in the spatial and economic structure arising from that process. In this final chapter the objective is to provide an overview of the thesis, focusing on the main issues presented throughout the work; to identify some topics for further research; and to consider the usefulness of the research in a broader context.

8.1 AN OVERVIEW

After indicating the aims and objectives of the research as well as the methodology employed to collect the data and information required, the investigation in this thesis began with an examination of the development issues in relation to the concept of energy resources, particularly those of petroleum. It is suggested that three different elements should be taken into account when dealing with development in an energy-producing country: economic efficiency, the role of energy in economic development and the environmental impacts. It has been stated in the thesis that this is the most appropriate way to assess the role of energy in development within the context of energy-exporting developing countries. For those countries the question is not just to increase or reduce the consumption rates, not to deal with the price of energy supplied, nor to meet the cost of purchasing and installing equipment to use energy for their specific needs. Rather, attention must be primarily directed towards the way in which the exploration and production of the energy-resource

endowment might generate the necessary financial resources which in the long term could continue to provide their domestic economies and societies with the means to achieve sustained development. This has to be assessed in terms of the patterns of use of financial resources and their spatial distribution at the national, regional and local levels. Also an evaluation should be of the linkages that a leading energy-based industrial development should produce to benefit the nation's development as a whole, and especially the energy-producing areas. These linkages are identified in this thesis as forward linkages, technological linkages, local expenditure on goods and services, and infrastructural linkages.

The study of the petroleum-resource base and the potential links between petroleum and development in the context of this thesis have been analysed within an integrated methodological framework. Through the use of this model it has been possible to assess the spatial and economic elements involved in the development process of the North-Orinoco region, their relevance in the causal interaction between resources and development, and the changes likely to result from that interrelationship. As compared with most studies of agricultural development which concentrate on issues such as agriculture's contribution to GNP, the advantage in adopting this methodological framework has been the flexibility to associate and analyse at the same scale the different variables involved in the petroleum-agriculture interface. In order to determine the changing patterns of agricultural land use it is relevant, for example, to consider the structural and institutional factors involved. For the North-Orinoco region, in particular, the evidence reveals that agricultural patterns and

systems are directly and indirectly modified by the conditions under which the oil resource development has been effected.

The region's oil production is derived and the revenues generated are applied within the framework of an oil industry that is wholly nationalized, and the direct intervention of the state therefore facilitates and in part controls the exploitation of the Orinoco oil fields. Despite this, the present development of the Orinoco oil deposits is strongly affected by world price fluctuations in the oil market, particularly since 1986, to a point where the programme of exploration and exploitation conceived during the period 1980-1982 has been drastically reduced until international market conditions and national economic planning might favour oil production up to full capacity. The sequence of expansion and constraints in the region's oil development has implied that agriculture has had to adjust to the changing economic situations, which in turn, have led to substantial changes in agricultural land use.

8.2 MAJOR CONCLUSIONS OF THE RESEARCH

To facilitate the comprehension in this summary of the empirical investigation, the underlying objectives of the research are taken as a basis upon which to build the major conclusions concerning the changing patterns of agriculture in the oil-producing regions.

8.2.1 Agricultural development in a petroleum region

Through the expansion of the petroleum industry, agricultural development can be facilitated or impeded by means of upstream and downstream operations. Chapter 3 has illustrated several cases throughout the oil-producing developing countries where oil exploration and production have improved the physical conditions for agriculture. Generally speaking, transport networks, communication facilities and groundwater resources have been extensively used by farmers in the oil-producing areas.

However, downstream operations of the petroleum industry do not always have favourable repercussions on agriculture. Petrochemical industrial operations are mostly associated with the international market, whilst the domestic agriculture lacks the petroleum by-products needed for its improvement. Moreover, the geographical location of these petrochemical plants and refineries, exhibiting very often an externally-orientated pattern, means that local agriculture receives a smaller proportion of agricultural inputs. Refined petroleum products are spatially consumed within the administrative centres and the petroleum zones whilst agricultural regions have relatively less chance to satisfy their demands in gasoline, diesel, gas and ammonia. With regard to service facilities, the evidence shows that the oil industries have supplied the petroleum regions with services such as schools, hospitals, housing and public utilities in general, which are relatively more viable to support. However, agricultural service facilities do not appear to be accorded a very high priority in the industry's projects in relation to the community.

This thesis has also discussed land-use patterns as a result of

the petroleum-agriculture interface at the regional/local level. Unfortunately, there is not sufficient evidence clearly to identify in all areas the detailed changing patterns in land use since petroleum activities have been initiated. Despite this, the thesis has shown that, in order to assess the possible conflicts that arise through interactions between petroleum and agriculture, one can identify primary and secondary types of land use within any specific area. In most oil-exporting developing countries, agriculture remains the primary form of land use within the areas where petroleum development exists as a secondary form of land use. Compatibility between these two land uses does not seem generally to be in question, nor can substantial losses of agricultural land be everywhere reported. However, changes in land use can clearly be observed in the patterns of crop production, agricultural land values, output and sales exhibited by agricultural areas after the development of oil-related activities.

8.2.2 The changing farming environment in the North-Orinoco petroleum region

Changes in the structure of farming and its distribution and location in the North-Orinoco region have been analysed in the thesis by comparing, whenever possible, the period prior to 1980 against the post-1980 period, the date when the development of the Orinoco oil fields was launched. The thesis highlights the tendency to devote land to crop production in the region as a whole but draws attention to intra-regional variations among the three different states that comprise the region. As regards production patterns, the sample survey of farmers reveals a change in the use of land towards the cultivation of more commercial crops such as rice, sorghum, maize and cotton, as

well as changes in the type of livestock activities developed. Again, intra-regional variations were observed. As the thesis has suggested, this is largely the result of oil-industrial development which has influenced the growth of economies of scale in the region.

Equally significant is the changing pattern in the type of cropping according to the proximity to the oil-industrial sites and its development areas: communities more distant from road and markets still cultivate traditional crops while communities clustered around the nodal points in the transport network, and market facilities have replaced traditional agricultural produce by a range of energy-intensive crops. This production pattern has created a demand for agricultural inputs that in its turn has determined the spatial structure of the input-supplying system. The study shows the primacy of extra-regional markets in the supply of inputs which creates a secondary set of effects upon the farming system, mainly in respect to costs in energy inputs. The lack of a regionally located input-supplying market system is seen in the present study as a direct target for the intervention of the petroleum industry operating in the region.

The study also indicates a minimal change in farm size in the areas with a more intensive oil-industrial development as compared with those areas with a relatively low level of oil activities in which fragmentation of farm units seems to take place. The changes in the land tenure system of the region could not be assessed because the chi-square test appears to be inconclusive. Farm-occupancy patterns have experienced considerable changes since petroleum activities were

initiated in the region, mainly because land owners have rented their land in order to initiate ventures in more remunerative activities connected with the oil industry.

The economic and financial features of agricultural development in the North-Orinoco region have also been examined in this study. In terms of agricultural land values, the role of oil-industrial development in shaping the pattern of land values has been discussed, revealing the tendency of the farmers to use the land in accordance with changes in the intensity of oil development. Moreover, farming output in the region started to increase prior to the initiation of petroleum activities, basically as a result of the improvements in the irrigation system available for the region. In terms of agricultural production sales, the evidence displays an intra-regional variation in the use of market places. Within the region as a whole there have been changes in the use of local, regional or extra-regional markets but these changes are not strictly associated with the presence of, and intensity of, oil development.

8.2.3 Management of agriculture in the North-Orinoco region

In the assessment of the relative significance of the management of agriculture, the research has employed two sources of information: a) official information provided by the representatives of the institutions involved in the development planning of the region, and b) a sample survey of farmers. The first factor used to identify the national/regional involvement in the management of the region's agriculture has been described under the heading of government intervention. This has been viewed mainly in terms of direct

investment for agricultural production and in services for agriculture and social development.

With regard to the officials' opinions, and the published sources of data, the most important point to emphasise in conclusion is that the intra-regional disparities among the three states of the region, which developed as a result of petroleum activities, are sustained by the government's pattern of investment in agricultural production. The state of Guarico presents the highest concentration of public investment which reflects the state's policy of attempting to guarantee a fair performance in the agricultural sector even after a further expansion of petroleum activities. Furthermore, an increasing proportion of public investment in services associated with agriculture is absorbed by the state of Anzoategui and the state of Guarico.

With regard to the farmers' perception of government intervention in agriculture, the study has shown in general a relatively positive perception of public involvement within the region as a whole. Intra-regional contrasts have been identified, however, notably in the state of Anzoategui where a greater proportion of farmers agreed on the positive performance of the institutions involved in agricultural development.

A further element considered concerning agricultural management in the North-Orinoco region has been the petroleum industry's contribution to the compatibilization of petroleum and agricultural development in spatial terms. According to the officials' viewpoint, there is a positive participation and attitude from the oil industry towards

agriculture which is reflected in its attempt to provide direct investment, infrastructure, as well as research and technical assistance. The evidence which arises from the fieldwork has shown, however, that these attempts are not the result of decision-making policies conceived within a unified regional orientation, but the result of unilateral actions taken by the different oil subsidiaries based on their interests and resource availability. According to the farmers' perception, the oil industry has made a satisfactory indirect contribution to agricultural development, but there is a lack of recognition of its role in the management of the region's agricultural space. The farmers regard this aspect as a very difficult task to deal with. Again, this appears to be a crucial point to consider when identifying the obstacles to the development of agriculture at the local/regional scale.

8.3 FURTHER RESEARCH

The thesis has examined a topic which involves the consideration of structural and spatial factors underlying the unstable nature of the petroleum-resource development and which determine the conditions for the socio-economic development of the resource-owner country. Due to this vulnerability the analysis of the interaction between petroleum and agriculture at the regional/local scale acquires a different dimension each time internal and external factors induce changes in the oil market situation. This suggests that, in terms of further research, it will be beneficial to continue an investigation of the period after 1986, the year in which a sharp reduction in oil revenues

occurred in the country. The comparison of this period with the two periods already observed in this study could produce a valuable understanding of the changing pattern in agriculture over time, from an oil-stable period (prior to 1980) through an oil-boom period (1980-1985) to an oil-declining period (after 1986).

Due to time limitations and the size of the area it was not possible to assess the total spread of the effect of oil-industrial development upon the pattern of agricultural production. The research concentrated on communities located within a 20-kilometre radius from the oil-industrial sites and development areas. Essentially, two groups of farmers were identified, one being located close to the oil-industrial sites and which has changed its production patterns, and a second group being distant from the oil industry base and which has continued farming traditional crops. From the evidence obtained it seems relevant to continue the research, firstly by looking at the changes occurring during the oil-declining period (after 1986) in the agricultural production pattern and farming structure of the communities located within a 20-kilometre radius. Secondly, it seems appropriate to extend the analysis to those communities outside the 20-kilometre radius in order to identify whether there have been changes in their agricultural production pattern which could be associated with the influence of petroleum development in the region. This perspective could offer an overall analysis of the effects of oil activity.

The emphasis throughout the thesis has been on the effects of petroleum development upon the agricultural system. It has, however, become clear that other effects of the petroleum activity may be of

equal, and perhaps even greater concern to policy-making. The potential for the development of the natural resource base of the North-Orinoco region (petroleum resources, water resources and ecological resources) may lead to the establishment of an urban-industrial system which will involve the changing location of amenities and facilities away from small and scattered rural settlements towards the more viable markets offered by larger urban and industrial centres. In terms of further research, it seems pertinent to assess the implications for the location of urban-industrial developments and its effects on the rural resource system. Research must develop a greater understanding of these effects and must devise and use methodological approaches that can provide a useful structure to deal with the planning of rural development in the oil-producing regions.

8.4 A BROADER PERSPECTIVE

Finally, it is appropriate to take a broader view of the research presented in this thesis. The study has been conceived not only as an academic exercise but has been planned and developed with the idea of producing a useful report to be considered by the decision-making agencies. It has been concluded that policy planning for agriculture must pay attention to the effects of the interaction between petroleum and agricultural activities at the local scale, and must recognise that although the North-Orinoco region appears to be well endowed with regard to natural resources, the possibilities of improvements in agriculture can be adversely affected by the formulation of policies which in the very short term could result

in even more profound disruption in the social and economic conditions necessary for a sustained development of the region's agriculture.

APPENDIX A

QUESTIONNAIRE

I Identification

- 1) Farm unit No. _____
- 2) Community _____
- 3) District _____
- 4) State _____

II Socio-economic aspects

1) Period of residence

- | | |
|-------------------|-------|
| less than 5 years | _____ |
| 5 - 10 years | _____ |
| 11- 15 years | _____ |
| 16 and more years | _____ |

2) If less than 5 years, where did you live before?

Community _____

District _____

State _____

3) Why did you move to this locality?

4) Do you work on the farm unit for:

familiar consumption	___
direct sales	___
sales to intermediaries	___
combination of any three	___

5) How much do you earn (monthly) for your agricultural sales?

less than 1,000 Bolivares	___
1,001 - 3,000 Bolivares	___
3,001 - 6,000 Bolivares	___
6,000 and more	___

6) What is your working condition at the farm unit?

all time working the land	___
temporary outside the land	___
seasonal work	___

III Farm characteristics

1) What is the size of the holding?

less than 10 Hectares	___
10 - 99 Hectares	___
100 - 499 Hectares	___
500 and over	___

2) What is the main type of agricultural activity in the holding?

- crop production _____
- livestock _____
- forestry _____
- mix _____

3) What is the form of tenure of the holding?

- private with title _____
- private without title _____
- state-owned land _____
- other form _____

4) What is the form of occupancy of the holding?

- owner _____
- tenant _____
- illegal occupier _____
- other form _____

5) What is the value of the land?

- greater than 1980 _____
- equal than 1980 _____

IV Changes in farming structure

1) Indicate the main types of agricultural products:

In the pre-1980 period		In the post-1980 period	
cereals	_____	cereals	_____
fibre/oilseed	_____	fibre/oilseed	_____
hort./fruit/veg	_____	hort./fruit/veg.	_____
mix	_____	mix	_____
cattle	_____	cattle	_____
pine tree	_____	pine tree	_____

2) Indicate the agricultural yield:

In the pre-1980 period		In the post-1980 period	
0 - 1,000 kg/ha.	_____	0 - 1,000 kg/ha.	_____
1,000 and over	_____	1,000 and over	_____

3) What is the origin of the agricultural inputs:

In the pre-1980 period		In the post-1980 period	
local	_____	local	_____
regional	_____	regional	_____
extra-regional	_____	extra-regional	_____

4) Indicate the location of the markets for agricultural sales:

In the pre-1980 period		In the post-1980 period	
local	_____	local	_____
regional	_____	regional	_____
extra-regional	_____	extra-regional	_____

IV Institutional involvement in agriculture

1) How do you consider the government intervention in service facilities for agriculture?

comprehensive _____

fair _____

limited _____

none _____

2) How do you consider the attitude of the petroleum industry, when oil operations affect the farming activities?

comprehensive _____

fair _____

limited _____

none _____

3) How do you consider the contribution of the petroleum industry to the development of agricultural projects?

comprehensive _____

fair _____

limited _____

none _____

4) How do you consider the contribution of the petroleum industry to the development of service facilities to be used by farmers?

comprehensive _____

fair _____

limited _____
none _____

5) Do you think that the petroleum industry causes
environmental hazard to agriculture?

Yes _____
No _____
Not known _____

-----OOOOOO-----

APPENDIX B

Computer programme SPSSx

FILE: CAMP03 SPSSX A1 SOUTHAMPTON UNIVERSITY 3090-150/VF. VM/SP HPD 4.2.

TITLE 'OIL-AGRICULTURE INTERACTIONS'

DATA LIST /ID 1-3 COMMUN. 5-6 STATE 8 RESIDENCE 10-11

FSIZE 13 TFARM 15 PATTERNB 17-18 PATTERNA 20-21

TENANCY 23 OCCUP 25 YIELD 27 INPUTS 29 SALESB 31

SALESA 33 VALUE 35 WCONDIT. 37 SERVICES 39 FLEXIBI 41

DIRCON 43 INDIRCON 45 ENVIRON 47

MISSING VALUES FSIZE,TENANCY,OCCUP,YIELD,VALUE(9)

PATTERNB,PATTERNA(99)

VARIABLE LABELS FSIZE 'Farm Size'

TFARM 'Type of farming'

PATTERNB 'Production pattern before 1980'

PATTERNA 'Production pattern after 1980'

OCCUP 'Occupancy'

SALESB 'Production sales before 1980'

SALESA 'Production sales after 1980'

VALUE 'Value of agricultural land'

WCONDIT. 'Working condition last five years'

SERVICES 'Services facilities for agriculture'

FLEXIBI 'Flexibility of oil industry'

DIRCON 'Direct contribution oil industry'

INDIRCON 'Indirect contribution oil industry'

ENVIRON 'Environmental hazard of oil industry'

VALUE LABELS COMMUN. 01 'Roblecito' 02 'Las Mercedes'

03 'El Carmen' 04 'Zuata' 05 'Uverito' 06 'Boca del Pao'

07 'Corozal' 08 'Mata Negra' 09 'Las Alhuacas'

10 'El Aceital'

STATE 1 'Guarico' 2 'Anzoategui' 3 'Monagas'

FSIZE 1 '<than 10 ha.' 2 '10-99 ha.' 3 '100-499 ha.'

4 '500-2499 ha.' 5 '2500-4499 ha.' 6 '>5000 ha.'

9 'Unknown'/

TFARM 1 'Cropping' 2 'Livestock' 3 'Forestry' 4 'Mix'/

PATTERNB,PATTERNA 01 'Cereals' 02 'Fibres/oilseeds'

03 'Horticulture' 04 'Fruits' 05 'Vegetables' 06 'Mix'

07 'General crops' 08 '<100 heads' 09 '100-500 heads'

10 '500-1000 heads' 11 '>1000 heads' 12 'State plant.'

13 'private plant.' 14 '<100 ha.' 15 '100-500 ha.'

16 '500-1000 ha.' 17 '>1000 ha.' 99 'Unknown'/

TENANCY 1 'Private with title' 2 'Private without title'

3 'State own land' 4 'Other' 9 'Unknown'/

430 OCCUP 1 'Owner' 2 'Tenant' 3 'Illegal occupier'

440 4 'Other form' 9 'Unknown'/

450 YIELD 1 '0-1000 kg/ha.' 2 '1000-3000 kg/ha.'

460 3 '3000-5000 kg/ha.' 4 '>5000 ha.' 5 'Not value'

470 9 'Unknown'/

480 INPUTS,SALESB,SALESA 1 'Local' 2 'Regional'

490 3 'Extraregional'/

500 VALUE 1 'Greater than 1980' 2 'Equal 1980' 9 'Unkwon'/

510 WCONDIT. 1 'All time on agric.' 2 'Temp. outside agric.'

520 3 'Completo. outside agr'/

530 SERVICES 1 'All three' 2 'Two out three' 3 'One out three'

540 4 'None'/

550 FLEXIBI,DIRCON,INDIRCON,ENVIRON 1 'yes' 2 'No' 9 'Unknown'

560 FREQUENCIES VARIABLES= ID TO ENVIRON/STATISTICS=ALL

570 BEGIN DATA

580 001 01 1 10 1 1 03 01 3 2 1 2 2 2 2 1 2 1 1 1 1

FILE: CAMP03 SPSSX A1 SOUTHAMPTON UNIVERSITY 3090-150/VF. VM/SP HPO.4.2.

```
590 014 02 1 13 1 1 05 01 1 9 3 2 1 2 1 1 2 1 1 1 1
600 029 03 1 04 2 1 05 01 2 2 5 2 1 1 3 1 3 1 1 1 2
610 035 03 1 12 3 2 08 08 9 4 5 3 3 1 3 1 4 2 2 2 2
620 057 04 2 10 4 3 12 12 3 4 5 3 3 3 9 1 3 2 2 1 2
630 062 05 2 08 1 1 04 02 3 4 2 2 1 1 1 1 1 1 1 1 1
640 104 07 3 05 1 1 05 01 2 1 1 2 1 1 1 1 1 2 1 1 1 1
650 131 08 3 02 1 1 04 04 2 1 1 2 2 1 1 1 1 1 1 1 1
660 182 10 3 15 1 1 05 02 1 2 2 1 2 1 1 1 2 1 1 1 1
670 197 10 3 25 3 3 13 13 3 4 5 3 3 3 2 3 3 2 2 2 2
680 END DATA
700 FINISH
```

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