To Adriana, my wife
Felipe and Marcelo, my sons

And to Santiago and Olivia, my parents.

REGIONAL DEVELOPMENT AND THE ENVIRONMENT. THEORY AND POLICY

Volume 1

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S.A.T.

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SUMMARY

In this work we have attempted to present a comprehensive methodological and analytical framework for dealing with regional development within the context of the Latin American countries' reality.

The connection between 'environment' and 'development' is essentially established by defining the latter as a process of environmental change, the 'human environment' being defined as a multidimensional concept containing three major interacting dimensions: the social dimension (man, his communities, institutions and values); the technodimension (man-made artifacts and the knowledge on which they are based); and the ecodimension (physico-natural environment).

Based on these definitions, and on the basic features characterizing the Latin American environmental change process, we concluded the need for any development planning attempt at the regional level to deal, in an integrated and simultaneous way, with three fundamental areas: economic growth, income distribution, and ecodimensional change. Additionally, we stated that for this approach to be meaningful, it has to explicitly consider structural and institutional factors, from both the social and spatial points of view.

Theoretical and some basic planning and policy issues associated with the stated approach to regional development were considered.

In the theoretical side, we reviewed the most fundamental strands, with an economic perspective, connected with regional growth, income distribution and ecodimensional problems. We concluded that the conventional, optimality-oriented, approach to economic growth should be disregarded and replaced by one that takes into account the fundamental facts of:

(i) a community constituted by socio-economic groups presenting particular and specific behaviour and also facing different problems, and

(ii) an ecodimension of the human environment playing a relevant role in the community's welfare possibilities through a set of multifunctional capital assets which are neither given nor without limits, but assets the services of which are the result of complex and dynamic processes and eventually subjects to depreciation.

The essentially conflictive character of the relationship between the ecodimension and the sociodimension (society's attempts to achieve ever increasing welfare levels) is fully recognized. Nevertheless, our theoretical analysis suggests a rich set of options for solving such conflict implying a relatively high degree of harmony between both dimensions and, at the same time, the possibility of achieving more equitative patterns of environmental change.

With this outcome in mind, we then attempted the formulation of a general methodological and analytical framework, as a basis for the formulation of an operative planning aid tool, allowing the possibility of evaluating such options.

The main characteristics of this framework are:

(i) It corresponds to a 'supply and demand' paradigm. As such, it allows compatibility analyses, specially in the areas of labour employment and unemployment, and ecodimensional problems (depletion, pollution and congestion).

(ii) It is defined at the level of a particular region and thus, it implies the consideration of space in very concrete terms which, in turn, allows a meaningful definition of the ecodimensional capital.

(iii) Although we focussed our attention on the formulation of our framework for a typical, particular, peripheral region, its connection with the regions system is suggested and discussed in general terms,

by means of the consideration of this framework as a subsystem within a more ample methodology which includes a set of scenarios in relation to which the former has to be operated (on the basis of a conversational or interactive mode). And it is the scenarios-designing activity the one allowing the integration of the (variable) overall spatial structure.

(iv) It explicitly distinguishes the rural from the urban sector, and within each, it also distinguishes different relevant socio-economic groups. Therefore, it allowed the inclusion of specific factors influencing each socio-economic group's income-earning capacity and determining their particular connections with the ecodimension (as a source of productive capital and as a source of consumption commodities).

Assuming an overall development 'goal-image' containing objectives in the areas of economic growth, income distribution and ecodimensional quality, we used the suggested framework for identifying the most relevant intermediate target variables to which the planner should assign specific values. Among them, we mentioned:

* increases in the volume of capital stocks conditioning the regional productive capacity
* changes in the availability of labour supply (mainly through migration targets and human capital quality)
* availability and type of technological innovations
* regional demand (level and structure) for consumption commodities
* regional investment (supply and demand of investment funds and level of entrepreneurial capacity)
* regional levels of labour employment (unemployment and underemployment) for each socio-economic group
* productive capacity of each socio-economic group
* human capital quality of each socio-economic group
* rates of depletion of ecodimensional replenishable and non-replenishable resources
* pollution levels (intensity and structure of increases in regional production and consumption; propensities to generate wastes; location of waste-generating activities).

In the analysis of each identified target variable we also included a review of the most relevant examples of associated policy instruments. From this discussion, we concluded that the 'a priori' establishment of trade-offs between targets could be a misleading procedure for dealing with the compatibility issue.

Considering the planning institutional and informational 'environment' of most Latin American countries, we finally suggested the following basic criteria that should be accomplished by any attempt to formulate an operative planning aid tool along the lines of our analytical and methodological framework:

(i) It should be able to incorporate information coming from models and analyses that are not necessarily compatible between them.

(ii) It should be able to handle different 'qualities' of information and to keep an explicit ranking or identification of its reliability so that the outcomes of the instrument can be correspondingly assessed.

(iii) It should imply a relatively easy way for exhaustively identifying the different elements of the underlying model with the institutional planning and decision-making apparatus.

(iv) It should allow the possibility of and stimulate a fruitful interdisciplinary dialogue.

(v) Its basic and general features should be constructed with the active participation of the actual decision-making agents.

We end our discussion suggesting the 'weighted digraph' model as a starting point for achieving a realistic and flexible approach to the regional development planning activity which, at the same time, offers the possibility of considering most of the features of our comprehensive framework and presents a high potentiality for improvement.

INTRODUCTION

Perhaps one of the most paradoxical situations in the Latin American development planning experience is represented by the fact that, despite the relative high involvement of the government in the evolution of the national systems since the colonial independence movements (1), and despite the markedly disintegrated character such systems have historically shown, it has been only until recently that the planning activity in different countries of the region has started to become concerned about the spatial dimension of the development process.

This lack of concern has had a double (and in many cases, multiplicative) effect. On the one hand, most development planning approaches attempted in Latin America have used techniques developed in quite different realities, one of their main features for our purposes being the relatively well integrated character of the social systems in which such techniques were originated. The application of these planning frameworks at the national level have often implied the agudization of the spatial disintegration of the national societies. On the other hand, where explicit consideration has been given to the spatial phenomena (2), it has suffered from a low degree of theoretical support, having to rely, again, on 'borrowed' theories and schemes designed for, or originated in, structurally different spatial problems from those the region presents. One of the most clear symptoms of this scarcity of theoretical formulations is the use of partial theories mainly stressing the investment-location issue and therefore, assuming (most of the times, implicitly) a wide-spread, 'fertile' or responsive, structural ground.

Apart from the neglect of structural elements in spatial terms (3), the partial economic location-oriented approach given to the regional development planning activity, has also implied the exclusion of, at least, other three important dimensions or problem-areas:

(i) The patterns of income (and other direct welfare components) distribution among the members of different communities. In fact, the most conventional theories of regional development (we should rather name as theories of regional economic growth) tend to deal with inter-regional income disparities and with regional stability (cycle) problems. In the first area, which is the most relevant in this context to the problems faced by Latin America, the attention of the planner is oriented towards the task of diminishing such differentials with no or little consideration to the desirability or degree of acceptability of the actual patterns of personal income distribution within each region. The neglect of this aspect could very well imply the implementation of policy-measures effectively smoothing inter-regional income disparities but, at the same time, making more accute inequalities existing in personal income distribution. And if the overall regional policy is oriented not only towards increasing the global national growth rate, but also aiming at welfare improvements of the national and regional communities, the shortcomings of this kind of approach become evident (BOISIER, 1975).

(ii) The 'natural environment' over which the social systems operate. In connection with this issue we may find three basic ways in which it has been considered in regional analysis: one, where the 'natural environment' (as natural productive resources) constitutes 'locational constants'; it is also included among certain kinds of agglomeration economies (as consumption-amenity resources) somehow influencing the household's locational preferences (see RICHARDSON, 1973). Another type of approach can be found in an instrumental rather than strictly theoretical way, through the use of input-output techniques at the regional level, which explicitly include - in a variety of alternative forms - the 'environmental area' and therefore, linking it through technical coefficients with the conventional economic sectors (or commodities or industries). This corresponds to the most frequent kind of approach relating both the regional economy and the environment. It must be said, however, that most of these analyses have been done particularly in connection with the pollution problem (4). A third type of approach corresponds to that in which environmental factors

are included as a constraint in regional planning models, by means of given standards reflecting the objectives of environmental policies.

The main problems affecting all these approaches is that the inclusion of the 'environment' is done in rather static terms (without considering the ecosystems' dynamic behaviour and therefore, its usefulness for long term planning purposes is doubtedfull. The case of input-output approaches allow a much more explicit treatment of the particular features of the environment itself. However, they have all the limitations attributed to this technique (see RICHARDSON, 1972), apart from the fact that it does not provide an interpretation of regional development in general; additionally, the kind of informational requirements this tool implies makes its specification, even in the forseeable long term, a completely non-feasible task within the context of the Latin American informational and statistical reality.

On the other hand, neither of them allow the treatment of the relations existing between the environmental problems (and policies) and the distributional situation in terms of welfare or real income.

Opposite to this trend of neglecting this dimension, characterizing so far most of the regional development (and growth) theory, it has been suggested that the regional development plans should consider "as a matter of high priority - the preservation and restauration of regional ecosystems that otherwise will be destroyed by the process of regional modernization itself" (BOISIER, 1975; pg. 57).

(iii) The structural (non-spatial) features characterizing the social systems in general, and with special reference to Latin America.
It has been suggested that, whatever the level in which they are acting, "the planning authorities, who are themselves part of this 'environment' (5) must necessarily assume the environment itself to be relatively stable; if it is not, planning will be hardly possible" (DASGUPTA, 1974; pgs. 46-7). This categoric statement is implicitly

or explicitly accepted in a great number of planning frameworks, and specially in those having the form of models where the relevant elements of the system, which performance is to be planned, are linked together through a set of specified functions. It must be emphasized however, that this kind of assumption involves in itself the adoption of a given development strategy. By this procedure, the adopted strategy is left ou of the scope of the planning activity's analytical stage and therefore, its evaluation with respect to alternative strategies, assuming or stating different structural arrangements of the overall social system, is not done. If we interprete planning models or frameworks as being an aid for making rational decisions about the ways and means through which certain objectives could be achieved, then the quoted statement limites to a relevant extent the range of possibilities among which the decision-maker has to choose.

Such a restraint is particularly relevant when dealing with Latin America, due to the role played by structural factors (see note 5) in the way in which its social system in general has evolved, and as obstacles for achieving self-sustained development (see, for instance, UNITED NATIONS, 1976; SUNKEL, 1973; FURTADO, 1964, among others). Not only when speaking about development (which, by definition involves structural changes in the social systems) but also when dealing with economic growth alone, the former statement could be misleading for the planning activity because contiuous and self-sustained growth cannot be achieved unless structural changes occur (see KUZNETS, 1966; KUHN, 1962; BOULDING, 1956, among others). Therefore, structural elements should be considered as an explicit category in any model or analytical framework conceived as a planning tool, giving to strategic specific factors the category of intermediate target variables (and in some cases, constituting instrumental variables themselves).

The absolute and relative importance of explicitly considering each one of the former dimensions of the social systems' evolution within comprehensive and integrated planning methodologies certainly depends on the chosen 'development model' and its underlying global strategy. The selection of such a model, on the other hand, corres-

ponds to a political decision which bases are, to a great extent, ideological (6). There are however, some essential elements allowing the statement of a normative general definition of development to which a great degree of concensus can be attached and that, consequently, would serve as a good basis for approaching the task of defining the dimensions that should be included in a methodology for comprehensive development planning purposes.

Together with the historical experience and actual situation of a given community's social system, the acceptance of a concept of development to which, growth constitutes the basic fundament, equality constitutes the principle orienting the distribution of such growth's benefits, quality of life (defined for each urban and rural social group) the main objective of society, and the management of the physical environment "a means for achieving a rational use of resources allowing at the same time, the control of man's impact over nature" (STRONG, 1973, quoted in HURTUBIA et.al., 1976), clearly gives to the dimensions or problem areas mentioned before, a strategic value in the planning process, specially if one considers that each one of the former principles does not automatically imply the rest.

Based on these considerations, we may state the main purposes of the present work as follows:

(i) To formulate a general methodological and analytical framework allowing the integrated treatment of

- *** the process of regional (subnational) economic growth,
- *** the patterns of welfare distribution from the points of view of both the system of regions within the national society and the individual members of the community
- ** the process of ecodimensional change (7) characterizing the evolution of the regional human environments
- ** some relevant structural (both social and spatial) and institutional patterns characterizing the whole process of environmental change

(ii) To derive a set of criteria which an operative planning and deci-

sion-making aid tool designed along the lines of the general framework to be suggested should accomplish, in order to become a feasible instrument within the institutional conditions characterizing the Latin American countries.

(iii) To suggest the main features this framework should adopt, on the basis of (i) and (ii) before.

Apart from the former, the following subsidiary purposes may be stated as well:

(i) To discuss, critically, the most common strategies suggested in the specialized literature for coping with the problems of regional economic growth, income (welfare) redistribution and ecodimensional change, by adopting an integrated view.

(ii) To discuss the issue of trade-off points between economic growth, redistribution and ecodimensional protection or improvement.

(iii) To survey the set of instrumental variables available to the decision-maker when facing the task of promoting development at the regional level.

The work has been divided in four main parts which are contained in two volumes, the first one (including Parts I and II) being mainly focussed on theoretical aspects and the second one (including Parts III and IV), basically oriented towards questions of strategy, policy and planning.

In Part I we establish the conceptual frame of reference on which the rest of the work will be based. It is composed of two two brief chapters. Chapter 1 deals with some essential definitional issues. First, we introduce the idea of total human environment, which we define as a multidimensional concept containing the most relevant elements for a comprehensive definition of the process of development.

The latter is then conceived as a process of environmental change to which some general normative characteristics are attached.

In Chapter 2 we establish the context to which our discussion will be referred, by analyzing some of the most important characteristics and trends of the Latin American development experience. Based on the latter and considering our definition of development given in Chapter 1, we end this part suggesting a set of questions of policy. These are mainly referred to the relationships existing between growth and income distribution; some basic institutional factors conditioning the process of resources allocation and distribution; the orientation of the economic system and the composition of its results in sectoral terms; and the spatial behavior of the process of environmental change.

Part II deals mainly with theoretical issues. It is divided in four Chapters.

The first chapter (Chapter 3) deals with the theories of regional economic growth. It constitutes a rather brief discussion of the relevance of some basic theoretical bodies in relation to the Latin American reality. Most of the discussion however, is centered on the theory of polarized growth formulated by Friedmann which is strongly based on the author's experiences in Latin America (see note 3).

The second and third chapters (Chapters 4 and 5) correspond to an extensive analysis of the ecodimension of the human environment. Its orientation is mainly economic (8) and starts with the definition of the general roles this dimension plays in the functioning of the social system. Then it reviews the three major problem-areas that have been widely recognized in the environmental literature, i.e. the problem of resource-depletion (both replenishable and non-replenishable), the problem of congestion, and the problem of pollution. In each case, the analysis is referred to the Latin American situation and thus, their relative urgency is stressed in one way or another (9).

These three chapters being rather independent one from another, in the last chapter of this part (Chapter 6) an attempt to relate them

is done, introducing at the same time, the distribution issue. The connections between regional economic growth, ecodimensional changes and welfare distribution are analyzed. In Chapter 7, the questions of policy stated in Chapter 2 are reviewed.

Reckoning the need for formulating a development analytical framework that explicitly takes into account both distributional and ecodimensional issues, Part III corresponds to an attempt of formalizing the previous discussion (of Volume 1) in a paradigm where the most relevant variables influencing the regional economic growth, the distributional situation and the ecodimensional change process, are stated in a functional way. The general form given to this paradigm is that of what we may call, a supply and demand model. In this context, the process of regional growth is represented by the growth of the regional income, following Siebert's basic formulation who states the growth of this element as being determined by the minimum increase of the effective demand the region faces or its productive capacity, and somehow corrected by changes in the regional terms of trade (SIEBERT, 1969). In order to introduce the distributional situation both as a resultant of and as a conditionant for the patterns of regional economic growth, we dissaggregate the process of product generation and income formation by distinguishing the rural from the urban sector and within them, by distinguishing income-groups (low, middle and high income groups).

Ecodimensional changes are explicitly introduced under two main headings: On the one hand, we consider the ecosystems providing a differentiated kind of productive capital, and on the other, providing a particular set of consumption commodities. Therefore, ecodimensional changes affect both the productive capacity of the regional economy and the level of welfare or real income of the regional community. Both the main causes and principal effects of these changes are considered for each sector and for each income group.

The former analysis is organized in five chapters. The first one (Chapter 8) is addressed towards the establishment of the methodological features that will characterize our analytical framework.

Chapter 9 deals with the supply determinants the analysis of which is done for each socio-economic group. In Chapter 10 we analyze the demand-side determinants of regional income growth, considering too the differences characterizing each socio-economic group. The supply and demand of public services and ecodimensional consumption commodities are discussed in Chapter 11 where we also analyze the indirect effect of the government's involvement in the provision of such facilities. Finally, in Chapter 12, we deal with the main problems that arise from discrepances between supply and demand factors. Unemployment, ecodimensional problems (depletion, pollution and congestion) and poverty problems are discussed.

Part IV deals mainly with regional policy and with particular planning issues; it is composed of two chapters. In the first one (Chapter 13), we discuss the main strategies that has been independently suggested for dealing with regional economic growth, income redistribution and ecodimensional improvement and/or protection. Following this discussion and based on the analytical framework suggested in Part III, we identify the major intermediate target variables involved in any developmental attempt along the lines of our definition of such a process. The most relevant examples of instrumental variables associated with each of the former are also surveyed. We end this chapter with a discussion of the trade-off issue.

The second chapter (Chapter 14) is dedicated to analyze and discuss the criteria that should orient the design of a concrete, operative, framework or model for planning purposes, considering the situation existing in most Latin American countries in terms of institutional background, availability of information and data, and theoretical support. Then, and finally, the principal features such a planning model should have in order to accomplish the stated criteria, are suggested.

NOTES

(1) Although systematic efforts to promote national development can be traced back in Latin America only to the early 60s.

(2) The concern on spatial aspects of development can be established around the late 60s, most of it being a short term-oriented response to natural accute phenomena and therefore, isolated, on-the-spot, approaches (STOHR, 1975).

(3) Although spatial structural considerations have been advanced in the treatment of spatial development problems (see, basically, HIRSCHMAN, 1958 and MYRDAL, 1957), they are not properly elaborated for regional planning purposes. Other approaches in this sense can also be found (see, for instance, ZIOLKOWSKI, 1967), but without attempting a comprehensive theoretical formulation of regional development. The most relevant exception to this situation corresponds to the work of Friedmann (mainly, FRIEDMANN, 1973) who has attempted to formulate a much more comprehensive theory of regional development where these structural factors are explicitly accounted for. Later on we will discuss in more detail this approach.

(4) Among the most relevant studies associated with this approach are: CUMBERLAND and KORBACH, 1973; VICTOR, 1972, 1971; CONSAD, 1971; ISARD, 1969; DALY, 1968. A good review of these and other models can be found in PEARCE, 1976 and in RICHARDSON, 1972.

(5) Environment in this context is used to basically represent a particular institutional framework, a given structure of property relations, and specific rules of income formation.

(6) We are using the concept of 'ideology' to represent the 'goal-image' a community has about its long term future, together with a set of ethic or moral principles limiting the range of technically possible alternative paths, eventually existing for achieving a state close to that of its 'goal-image'.

(7) The meaning and scope given to this concept is discussed in Chapter 1.

(8) It defines the existence of ecodimensional problems in terms of their welfare-effects and deals only with those problems that are man-induced.

(9) It must be emphasized that the relative length of this discussion does not necessarily mean an overemphasis on the role this dimension plays in the process of general development. Rather, it is in part due to the interest the author has on the subject and, to a great extent, due to the lack of clarity it is possible to find about it in the context of the development process and its planning requirements.

PART I : DEVELOPMENT AND ENVIRONMENT

INTRODUCTION

Since the "environment" became a relevant area for concern in the mid 60s (1), "zero-growth" has been one of the most wide-spread theories of how to prevent "environmental crises" and thus, avoid an eventual environmental collapse (2). In this debate, the topic of development versus the environment has also acquired a relevant position in the environmental literature (3). The basic point of discussion in this latter area is to what extend development and environmental protection are compatible processes and thus, to what extent no-growrh suggestions are applicable to developing nations (whether such suggestions are referred to economic or population growth).

Although we do not pretend to deny the validity of such controversy (4), it seems that at least a significant part of it arises from semantic problems: both the concepts of environment and development have been used without clearly stating their exact meaning, making difficult the identification of real conflictive arguments on the one hand, and obscuring the general debate, on the other.

We have then considered it convenient to start our discussion by stating, as clearly as possible, our terms of reference in connection with these two issues. This is done in the first chapter (Chapter 1), where we define the concept of environment and introduce a congruent definition of development. Our main point in this sense is that the environment cannot be considered except as a multidimensional concept which includes both the social and natural systems in an integrated way. Therefore, development itself should be understood as a process of environmental change in which goals and objectives must cover and refer to relevant phenomena occurring in both the social and natural dimensions.

With the former definitional elements in mind, in the second chapter of this part (Chapter 2), we proceed to establish the context or frame of reference for our attempt to integrate the environmental dimensions in a comprehensive development planning methodology. In this context, we analyze the most relevant features characterizing the process of environmental change in Latin America.

We end the chapter by making a preliminary statement of basic questions of policy that derive themselves from the analysis made in the two chapters. These constitute the guidelines for our discussion in Part II.

NOTES

(1) Which origins are mainly due to the generalized presence of accute problems in industrialized areas of the world, which in turn, correspond basically to problems of environmental pollution and congestion.

(2) See, for instance, MEADOWS et al., 1972 and FORRESTER, 1971. A good selection of papers discussing the no-growth approach can be found in OLSON and LANDSBERG, 1975.

(3) The Founex Report (UNCHE, 1971) constitutes a pioneer piece of work trying to connect development and the ecodimensional problems in the context of underdeveloped (developing) nations.

(4) On the contrary, one general hypothesis on which we base our discussion is that the relationship between the natural environment and society's developmental attempts presents an essentially conflictive character. It will be however, the exact way in which such a conflict is solved what will determine the kind and acuteness of the problems associated with this conflict-area.

CHAPTER 1: ENVIRONMENT AND DEVELOPMENT. DEFINITIONAL ASPECTS

We will start our discussion by clarifying the general meaning of the concept of "environment". We then suggest a general definition of "development" and discuss some of the most important implications of such a definition for our purposes. We also establish qualifying statements giving sense and direction to our general definition and mention the most obvious methodological requirements for planning purposes that derive from these statements.

1.1 : THE ENVIRONMENT. A MULTIDIMENSIONAL CONCEPT

When speaking about environmental issues, one of the first difficulties that arise is a semantic one: there are a great variety of different interpretations and uses this concept has been subject to, which makes the task of putting together what has been written on it very difficult. Moreover, within the different works dealing with the environment it is possible to find cross-references to other works without enough clarification of the way in which the concepts are interpreted or conceived. It must be pointed out, however, that it is pretended neither to solve in general any semantic problem, nor end any discussion about the best way to define the environment. What we intend to do in this section is to make clear some of the concepts we will use in this work.

Starting from the most direct and simple source, the dictionary, it is possible to define the "environment" as "surroundings, circumpstances, influences" (HORNBY, 1974), also as "conditions of life or growth" (FOREMAN, 1975). Obviously, these are extremely general and non-operational definitions. However, they are usefull to establish the scope of the concept in its 'pure' meaning. Joining together the two former definitions, the environment can be conceived as "the surroundings, circumpstances and influences that compound the frame or conditions in which something or someone lives and grows".

There are, at least, two main elements in the previous definition that must be specified in order to make it more operational: it is necessary to identify the kind of subject the environment is being referred to; and it is necessary to distinguish among the whole world of circumstances, surroundings and influences, some categorisation that makes feasible the use of analytical techniques and tools from different disciplines. It must be pointed out however, that independently from the way in which the former specifications are made, the definition involves the principles of interdependence and dynamic inter-relationships between the subject and his environment.

The Multidimensionality of the Environment

It is quite clear that in our real world everything affects and is affected by everything. Nevertheless, among these interactions, both because of practical and theoretical reasons, there are only relatively few relationships that become analytically relevant when studying a particular system. Because of this, it is the kind of subject selected which will define the real size and level of the relevant-environment (1) and it will vary from microscopic to planetary or even greater dimensions. What we are interested in is the 'human environment', i.e. the conditions in which MAN lives and grows. Obviously, the exact characteristics and dimensions of the human environment will also vary if we consider MAN from an individual or from a collective point of view.

Beside differences in the quantitative aspects, the environment that could be defined in relation to man as an individual or as a community also differ in qualitative terms. The main difference in this sense lies on the type of relationships that are established between the subject and his environment: while the individual changes his environment mainly by moving himself, physically, from one environment to another, at a collective level the group achieves the desired situations by changing elements or features of its own environment. That is to say, in general terms, while for the individual his envi-

ronment is fundamentally given, for the group it is a variable that could be modified and virtually controlled (2).

Within the environment as defined previously we can distinguish three main dimensions, which apply no matter what the level in which the subject is defined:

(i) the physico-natural dimension, constituting all the living and non-living things (and the interconnections between them) that surround man and his aggregations, and which we are going to name the 'ecodimension' (3),
(ii) the man-made dimension, constituting all those things man has designed and produced in order to achieve directly or indirectly better living conditions. This includes the knowledge on which those things are based, and which we are going to name the 'technodimension', and
(iii) the 'sociodimension' that corresponds to the complex of institutions, values, inter-personal and inter-group relationships, as well as other men and/or communities.

These three dimensions interact one each other, giving to the human environment its general dynamic characteristic.

1.2 : DEVELOPMENT. A PROCESS OF ENVIRONMENTAL CHANGE

Based on our definition of the human environment, we will define development as a goal-oriented process of environmental change in which the essential goal is to assure, to each and every member of society, a continuously improving quality of life on an equitable basis.

One way for specifying and making more operational the former definition is to establish the scope and meaning of the concept of 'quality of life' and to clarify the meaning of its 'improvements'. Here we will adopt a partial approach by focussing our attention on

the real income attained by the community-members. Consequently, improvements in the quality of life (welfare) will in general be positively correlated with increases in the community's real income levels (4).

Aware of this partial approach's limitations, we may then rephrase the former definition by stating that development constitutes "a goal-oriented process of environmental change where one of the most important goals is to assure, to each and every member of society, a continuously increasing level of real income on an equitable basis".

Considering that the main purpose of this work is to formulate an integrated framework for development planning purposes, there are five basic questions and secondary objectives underlying our definition of development that we should make explicit at this stage.

(i) Any given level of real income and rates of income growth will imply different environmental conditions - in terms of welfare achievements - whenever the personal distribution fo such income differs. The more unequal the real income distribution, the lower will be the levels of social welfare achieved by the community.

In connection with this statement, there are two related issues we have to account for: first, the precise effects of different distributive conditions in themselves over the welfare levels of the community as a whole given the global level of real income; and second, the relationships (normally involving some kind of trade-off) existing between the distributive situation (and any subsequent redistributive action) and the increases of the real global income.

Attempts at solving the first issue clearly involve the introduction of value-judgements. The way in which such value-judgements should or could be explicitly introduced and the difficulties in doing so have been widely discussed in the welfare economic theory. Rather than entering into a theoretical discussion of this (5), we will state that the role of the planner (in 'technical' terms) is to detail and make specific such value-judgements and to spell out the consequences of the different welfare functions that it is possible to

specify within the normally broad political criteria given by the authorities (DASGUPTA, 1974).

The second issue introduces a theoretical requirement to the formulation of a planning framework in terms of identifying both the direct and indirect links between these two elements. It also places a methodological requirement to such a formulation, in terms of allowing a procedure for making compatible the values given to the intervening intermediate target variables in the process of objectives-formulation. These requirements are dealt with in the next two parts (Parts II and III) and in Part IV, respectively.

(ii) The structure and direction of the environmental changes must guarantee the satisfaction of the vasic needs of the whole population.

Although this statement underlying our general definition of development could be considered as being implicitly included in the former aspect of real income distribution, the need for it to be explicitly expressed derives itself from the existence in the Latin American context of acute absolute (as well as relative) poverty problems (6).

(iii) The process of environmental change must assure better living conditions (increasing levels of real income) for both actual and future generations.

It could be argued that, insofar as economic growth constitutes a 'sine qua non' condition for increasing the levels of real income which, in turn, will be not possible unless capital accumulation occurs,the bases for improving the living conditions of future generations will be automatically ensured. Under this assumption, the basic problem-area would be then that of deciding the investment path allowing the maximization of the inter-temporal social welfare function. Traditional welfare economics would then be the most appropriate theoretical approach for dealing with it. Nevertheless, even if we do not consider the limitations of this approach mentioned in point (ii) before, there are some structural and functional elements characterizing the ecodimension of the human environment that are not accoun-

ted in it and that make necessary the explicit formulation of our former statement in the terms it is done (7). If we add to our statement the goal of maximizing the inter-temporal welfare function in social terms (notice that it implies 'satisficing' rather than 'maximizing' criteria in the terms in which it is stated), it would involve the establishment of a subordinate objective to be accomplished by the process of development in connection with the ecodimension: "to maximize the long-term functional efficiency (in terms of energy flows, productivity and cycling) of the natural and modified ecosystems, respecting both the local ecological conditions and the socio-cultural characteristics of the involved human communities" (HURTUBIA et al., 1976; pg. 15) (8).

Given the variety of alternatives allowing, at least theoretically, the possibility of closing the "ecological gap" (9) we discuss in Part II and the elements involved in any decision about redistributive issues, the planning process becomes less restricted by determiner relations, implying at the same time, higher informational requirements. Among these, special mention deserve the specification of the communities' schemes of social choice and the inclusion within the national accounting systems of the ecodimensional capital assets a nation (or a region) has, together with the estimation of the depreciation such assets could be subject to (10).

This latter issue also involves methodological requirements when considered explicitly seeking for the subordinate objective under analysis, the most relevant aspect being the method for evaluating the 'natural resources' involved in any development strategy. Not only the general approach used to consider these resources should be changed (in terms of roles and priorities) but also the way in which the evaluation is done must experience drastic transformations.

The usual relative neglect most 'natural resources' are subject to in the design and implementation of planning exercises (11) must come to an end. This does not mean that the trend should be reverted

and that development efforts have to rely mainly on the nation's (or region's) natural resources (12). Rather, it means that the role they would play and thus, the priority assigned to them should be determined in the process of strategy selection and evaluation, according to the existing conditions of the nation (region) and to the community's social choice schemes expressed in operational terms (rather than based on 'a prioristic' conceptions about development strategies). In any case, their treatment should be done considering their quality of being capital assets which multifunctional character involves the risk of them to become a restraint for further development if the eventual depreciation they could be subject to are not properly considered and tackled.

(iv) The statements already discussed imply that the planning of the process of environmental change should explicitly consider another subordinate objective, this time concerning the technodimension: "to establish the creation of a technology environmentally adequate that contributes to maintain and increase the ecosystem's productivity (13), achieving high levels of efficiency and full employment of the local population's labour force" (HURTUBIA et al., 1976; pg. 18).

The connection of this with our first statement, i.e. that the process of environmental change (development) should tend to an equitable distribution of its main benefits, is established through the employment requirement and the efficiency of the labour force. Although the employment situation answers not only to technological but also to other, mainly institutional and structural, factors, the relevance of the former derives itself from the relative high importance it has as a direct conditionant of the levels of employment and from the influence it exerts, in the medium and long term, over the institutional framework in which the social system operates (14).

On the other hand, it is clear that high unemployment (and underemployment) levels are incompatible with equitable real income distribution. Furthermore, when these high rates of unemployment and underemployment are endemic, they are normally associated with relatively

high proportions of the population living below the poverty line (15).

Although the connection between technological features of the process of environmental change and the possibility of maximizing the long term efficiency of the ecosystems (which, as we have stated, is a condition for assuring better living conditions to future generations) is still a controversial issue, there is some evidence supporting the argument that the present trend of technological changes (mainly originated in industrialized countries) imply a high risk of ecodimensional deterioration, even in those environments where these changes are originated (see, for instance, COMMONER, 1971). The adoption of these technological changes by developing nations, which usually do not properly assess their suitability to these nations' own environmental characteristics, involves a much higher risk of inducing ecodimensional deterioration processes.

Our statement imposes on technological changes not only the condition of being ecologically sound (16), but also of achieving or assuring full employment to the local communities' labour force. Although this could be a primary objective, which advantages, conveniences and feasibility should be studied to each particular situation, it does not imply that eventual trade-offs between employment and ecodimensional objectives as well as in connection with other goals, will be necessarily absent.

As a derived target, Hurtubia et al. suggest the convenience of promoting what they call "endogenous technologies" (17). This target however, must be included at the level of regional or local communities only after a proper assessment of the socio-economic, cultural and ecological conditions existing in the involved human settlements. It seems more convenient to impose the requirement of explicitly having a multipurpose character (18) if the newly created (or adapted) technology is intended to contribute to the objectives of development as a whole. Insofar as the generation or the adaptation of a given technological change is done considering the main parti-

cular features of the human environments in and by which it is going to be used, and oriented towards the achievement of both general and particular goals, the question of being endogenous or exogenous becomes a secondary issue.

In terms of the environmental change planning process, what it is important to emphasize is the need for explicitly including technological aspects and to do so in a wider and more disaggregated way than that usually adopted by economic planning (19). In Part III we discuss in some detail this issue and the problems involved in accomplishing the former requirement.

(v) Our basic definition of development and the previous qualifying statements imply a final methodological requirement to the planning process, we should express at this stage. It deals with space and could be stated as follows: because of the ecodimension of the human environment cannot be meaningfully defined except in physical spatial terms and because the sociodimension involves systemic arrangements having concrete spatial (space conceived as field of forces) expressions, the activity of directing and orienting the overall process of environmental change towards the specified general objectives should consider both kinds of space as an integrated explicit analytical category. In other words, we may state this requirement by emphasizing that the development planning process must consider the regional dimension as an indispensable component. This does neither mean that the global national development plan, once formulated, has to be regionally disaggregated, nor that the national plan corresponds to the aggregation of regional plans. Rather, both the global and regional expressions of a national development strategy (plan) are simultaneous products of the planning process which attempt should be done by following some kind of iterative procedure.

One of the most important tasks the planner has to face within the context of our previous discussion, is to attempt the compatibilization of the general objectives we have stated as qualifying ele-

ments of our definition of development. Although they may be seen as desirable, it is highly probable that trade-offs between them will normally appear. Therefore, the planning activity should be able to clearly spelling out the types of compromise between such objectives which have to be accepted if a realistic approach to development is to be achieved.

Within this general methodological context, we will concentrate ourselves on a particular region's development process (20). The main generic characteristics of this region will be derived from the analysis we attempt in the next chapter.

NOTES

(1) The relevance can be established either by the extent of the influence exerted by the subject over his environment of by the extent of the influence exerted by a marginal element of the environment on the subject. Although we will account for both types of influences, it will be mainly the former the one which we will use for establishing the relevant-environment.

(2) This does not mean that the individual man is passive by nature or that he accepts the situation of his environment as he finds it. On the contrary, it must be recognized that the political activity of any individual member of society is, in fact, an attempt to change the environment (or part of it). However, until he becomes able to induce collective action in order to achieve defined objectives (environmental changes), he is not in a position to produce any significant change by himself. Then, the change is a result of social actions, even though the first impulse is produced by individuals.

(3) This concept can be considered as almost equivalent with concepts such as "ecosphere" or "biosphere" as they are found in the ecological literature (among others, see for instance MASTERS, 1974 and COOPER, 1970). The expression "ecodimension" is used to achieve certain semantic unity within this work, as well as because we consider the concept of 'dimension' more accurate from a theoretical point of view, than the concept of 'sphere' with all its implications.

(4) This approach by no means implies an undue importance being given to other elements contributing to the quality of life, such as the existence of fraternal social relationships, and solidarity among in-

dividuals and social groups; or the sense of being an active member of a community in terms of direct participation in the decision-making processes affecting the community's life, etc. Rather, it results from three factors: first, to the relatively unavoidable economic bias derived from the professional training of the author; second, to the consensus existing around the fact that real income constitutes an important element of both social and individual welfare achievements. Insofar as the evolution of these other components of the quality of life (welfare) interact with the process of achieving increasing levels of real income, the shortcomings of our partial approach will become stronger; and third, from experiences that have been attempted for achieving more comprehensive measures of the community's welfare levels (see, for instance, McGRANAHAN et al., 1972; NORDHAUS and TOBIN, 1972; and the comments about their work in LECOMBER, 1975), it seems that such a measure faces serious problems which solution is far beyond the purpose and possibilities of the author.

(5) For this theoretical discussion see ARROW, 1970; 1964, and the extensive and growing general literature on welfare economics (BOHM, 1973; NATH, 1973; SEN, 1971; COLEMAN, 1966; ROTHENBERG, 1961, among others).

(6) A good analysis of both relative and absolute poverty and some estimates about the extent of this problem in Latin America can be found in AHLUWALIA, 1974. The existence of poverty and its particular characteristics constitute in turn, a strong argument for discarding, on theoretical grounds, "the conceptual separation between optimum growth and distribution policies that lies at the heart of traditional welfare economics.." and for supporting its replacement "by the notion of a development strategy having growth implications for different groups in society that can be modified by fiscal measures only within fairly narrow limits" (CHENERY, 1974; pg. XIII). This means that, if poverty is to be eliminated, the planner should orient the policies of environmental change towards strategic institutional characteristics of the sociodimension. These structural elements are analyzed in Parts II and III.

(7) The way in which traditional welfare economics deals with problems appearing in the ecodimension (normally treated as 'externalities') could imply, at least theoretically, a process of deterioration in the living conditions of future generations in absolute terms (see our analysis of Part II, pgs. 158 - 166).

(8) In terms of the analysis we do in Part II in connection with pollution, the former objective implies the need for closing the ecological gap which is, as we try to demonstrate, the only way to assure the maximization of the long-term volume of commodity-flows provided by the multifunctional ecodimensional capital assets (although the referred analysis is focussed on pollution, it is also possible to be applied to other ecodimensional problems, where the ecodimensional capital is subject to some kind of - normally unconsidered -

depreciation process). Therefore, not only the distributional but also the ecological requirements of developmental objectives imply the abandonment of paretian optimality rules.

(9) This concept is discussed later on in Part II, pgs.

(10) Due to the special characteristics affecting the depreciation of ecodimensional capital assets and the peculiar features of the process of 'depreciation-replacement', the treatment depreciation in general has received in the conventional economic growth planning (mainly based on the GNP rather than on the NNP) involves in this case, a much higher risk of misleading conclusions.

(11) Which is reflected by the fact that most of the emphasis (within essentially economic growth-oriented strategies) is placed on investments allowing desired rates of growth of the GNP. In turn, these requirements are mainly thought in terms of directly productive investments and of social infrastructure within a situation where the natural resources are given for the planned period. Therefore, no allowances are made for the depreciation of the capital providing the current natural resources, and consequently, no provision for their replacement (when possible at all) is considered. This trend acquires its highest expression when related to those strategies giving priority to industrial deployment as compared with primary activities in general and agriculture in particular.

(12) Although in many cases, this could very well be the best strategy.

(13) In other words, technology should aim at the achievement of high levels of sustainable yields derived from the exploitation of the commodities provided by the ecosystems.

(14) Insofar as technological changes imply greater efficient-plant sizes, the relative importance of small and medium firms in many areas would tend to decrease, whether because of the lower efficiency levels of the latter would imply their impossibility to stay in the industry, or because they would be absorved by larger and more powerfull units. In this context, the property of the means of production will tend to become more concentrated and the employment levels will tend to decrease. These elements, together with highly imbalanced bargaining powers between owners and workers derived from such a concentration, will tend to change the income-appropriation schemes against the workers.

(15) Again, in this case, the structural and institutional factors aurrounding the poverty problem should be properly considered. Although the correlation between poverty and unemployment and underemployment has been proven in general for most developing nations, causal relationships have not been clearly established in theoretical terms. Furthermore, some studies have shown that, in statistical terms, a great proportion of the populationthat can be aggregated as lying below the poverty line is somehow employed (see, for instance, FISHLOW, 1972, for the Brazilian case). This apparent paradox, due

in part to data limitations and statistical problems, makes that employment objectives as a means for achieving redistributive targets should be established and assessed having in mind the mentioned difficulties.

(16) Certainly the concept of ecologically sound technology is a very broad one and thus, possible to be interpreted in quite different ways. Although we will not pretend to define it in detail, the main criteria for technology to be considered ecologically sound are derived from our discussion in Parts II and III.

(17) Those coming through the "experiences of the communities to which they will affect or benefit, and that appear within a definite social, economic and cultural context and through determined social organizations" (op. cit., pg. 18n).

(18) This is opposed to the uni-purposive character most technological changes have frequently had, in terms of seekinf for instance, mainly to increase the productivity of the labour force without considering its effects over the employment situation and/or over the related ecosystems the activities applying the new technologies would affect.

(19) In regional economic growth theory and its derived planning models, we find two main ways in which technological change is considered: as an autonomous or exogenously determined element (see, for instance, FUNCK, 1972), and as a variable determined by innovation difusion processes conditioned by elements inside the model (see, for instance, RICHARDSON, 1973 and SIEBERT, 1969). There is a third kind of approach where technological change is considered only implicitly or not considered at all (export-base type models and neoclassic models in general).

The common characteristic of all those models explicitly condidering technological change, is its level of aggregation (the highest disaggregation found is that of distinguishing between product, process and organizational innovations, and between innovations or inventions generated 'in situ' and adopted innovations that have been generated elsewhere). This degree of aggregation allows the consideration of neither the effects of technological changes over the institutional framework, nor their effects (positive or negative) over the ecodimension.

(20) The main reason for choosing this approach lies on the fact that, insofar as we intend to explicitly integrate ecodimensional phenomena in a planning methodology, we need to consider the spatial elements in a fairly detailed way. The required degree of detail cannot be achieved, without making the analysis excesively cumbersome, by considering the whole regions system. It must be recognized however, that this corresponds, theoretically, to the right approach. We will try to overcome the most gross defficiencies of our single-region approach by specifying, when necessary and possible, the connections of our particular region with the rest of the national system.

CHAPTER 2 : THE PROCESS OF ENVIRONMENTAL CHANGE IN LATIN AMERICA

In this chapter we intend to analyze the main features characterizing the process of environmental change in Latin America. Its main purpose is to establish a general context that will serve as a guideline for the orientation and emphasis we should place on different environmental elements, in our attempt to set the basis for a comprehensive planning framework compatible with the definition of development stated in the previous chapter. Therefore, the analysis will be not exhaustive. Rather, it will give emphasis to those aspects the qualifying statements of Chapter 1 deal with: the distributional patterns; the treatement given to the ecodimension; some basic technological features; and the spatial patterns adopted by the process of environmental change in Latin America. In doing so we will have to discuss the main features characterizing the evolution of the national systems' economic structure.

We will end the chapter by stating some basic questions of strategy which derive from the confrontation of the Latin American experience with the normative elements contained in our definition of development.

2.1 : THE LATIN AMERICAN INDUSTRIALIZATION PROCESS. A Historical View

Although the controversy between industrial-oriented, agriculture-oriented, and 'equilibrated' strategies of economic growth has reached a point where the strategic role of agriculture and thus, the arguments in favour of more balanced and integrated growth strategies have gained increasing ground, the historical experience of Latin American development (or underdevelopment) has to be analyzed by mainly focussing the attention on the industrialization path which, as we are going to see, has played the most active role in shaping the region's economic and social landscape (1).

Even though it would be possible to generalize about environmental changes at the regional level, it seems convenient to distinguish those national systems which internal characteristics (in terms of population, resource endowment, general geographical area, and certain structural elements) implied a more complex response to the external stimuli coming through the export activities involving primary production, from those countries in which the latter element constituted the basic dynamic factor of economic growth until much later date and where the industrialization process mainly started as a deliberated effort promoted by the national authorities (2). In any case, this distinction is by no means clearcut. In fact, there exists a whole range of variants from the Brazilian case (representing the upper extreme of the first group) to the Bolivian or some of the Central American cases (representing the low extreme of the latter group).

Following Furtado's interpretation of the process of economic development (or underdevelopment) characterizing the countries of the region (FURTADO, 1964) we may briefly establish the main patterns present in each group as follows:

In the first group, we find, as distinctive conditions,

(i) the existence of a rather highly elastic supply of production factors connected with primary export activities, mainly derived from the country's size and endowment of natural resources,

(ii) the reinvestment, as a consequence of the former condition, of a comparatively high proportion of the profits derived from the exploitation of the natural resources, within the sector, and

(iii) the appearance of a relatively significant monetary economy allowing an important internal market for manufactured consumption goods.

These conditions, together with the instable character of the country's import capacity due to the instability of international prices for raw materials, generated an early process of import substitution of consumer goods, creating an industrial nucleus within the

national economy.

The growth and diversification of this industrial nucleus, induced by the posterior process of decline in the prices for exported goods, had however an in-built limitant factor that called for greater diversification in terms of the production of not only consumer but capital goods as well. Although the primary dynamic force continued being mainly external, the whole economic system became comparatively less dependant from the instable conditions of the international markets for raw materials.

In the second group of countries, the overall situation differs either because the geographical size and the kind of resources available for export-oriented production were not enough to allow a significant reinvestment of surpluses derived from the exploitation activities, or because the type of resource implied a highly capital-intensive technology which did not generate a significant pay-roll to the labour force. Under these conditions, the economy became mainly characterized by the encrusting of an export-oriented capitalistic sector (which expatriated most of the economic excedent generated by the activity) within a pre-industrial simple economic structure and therefore, by the incorporation of a low proportion of the population into the monetary system.

The consumption of manufactured goods by this segment of the community was almost completely satisfied by imported commodities. The general economic and social conditions generated by this pattern of evolution gave rise to governmental concern about the need for promoting an accelerated process of economic and general development. In the economic arena, the keynesian and post-keynesian theoretical schemes became the principal guidelines mainly expressed through ECLA's propositions of import-substitution as the key strategy for achieving such goals. Industrialization in these countries started later and under much more heavyly protective schemes (import tarif and non-tarif controls and promotion through the creation of better social and economic infrastructure, credit and fiscal policy, and

through direct productive investments).

Despite these historical structural differences affecting the process of industrialization within the countries of the region, there are some elements which can be seen as common features and that constitute key issues in the analysis of the environmental problems. Among them, the most relevant for our purposes are:

(i) the fact that industrial growth in general relies very much upon the richest segments of the population and therefore, the whole process is oriented towards the production of rather luxurious consumer goods (HIRSCHMAN, 1968), relative to the needs of the community as a whole,

(ii) the fact that, mainly due to behavioural factors, the cost structure of the firms and industries producing the import-substitutes is more or less the same as that existing in the countries originally supplying such goods, regardless the internal situation in terms of productivity and relative prices of the factors (implying the adoption of technologies designed in different environmental conditions),

(iii) the fact that the locational patterns followed by the industrialization process maintained the spatially concentrated character of the 'pre-industrial' society around one or few urban centers corresponding to former colonial contact-points with central, industrialized, nations, and

(iv) the fact that development strategies underlying governmental actions normally implied the transfer of real resources from the rest of the system towards the industrial sector, through the supply of cheap financial resources and/or preferential treatment for the import of the physical capital required to deploy the sector under the mentioned technological features (which is made effective either through protective tarifs of overvalued exchange rates).

The first feature mentioned before originates in and has consequences over the distributional situation of the regional human environments. As Lacroix argues, the process of import-substitution as a strategy for industrialization implied an answer to the existing

patterns of demand which, in turn were the reflect of the established institutional framework (in terms of basic structural elements characterizing the sociodimension of the national human environments). The industrialization process failed to generate the environmental changes (principally within the sociodimension) required for allowing the industrial activity to play a stimulating role in promoting further development (LACROIX, 1965; pg. 174).

In general, the whole industrial structure has been oriented towards the production of goods that, within the context of high inequality, has a limited market with almost no possibilities for enlargement: on one hand, the involved technologies do not imply a rate of job-creation high enough as to self-generate a potential market for further industrial deployment; and, on the other hand, the type of product generated by the industrial activity (derived from the strategy of import-substitution) has little or no chance at all to compete properly in the international markets (FURTADO, 1967; FELIX, 1964).

Not only the relative failure of the import-substituting industrialization strategy in promoting self-sustained development (or even simply economic growth) partially has its roots in the demand structure derived from extreme inequalities in income distribution, but also it tends to reinforce and make more accute such distributive situation. Both the reliance on foreign capital investment sources (normally implying a relatively high repatriation of profits) and the adoption of capital-intensive technologies by internally generated (financed) investments as a response to specification and quality requirements implicit in the process of import-substitution, tend to have undesirable effects on employment and income distribution (SUTCLIFFE, 1971; pg. 176).

Yet another aspect related with market sizes and technological features (3) that should be considered, is the effect of the overall strategy over the level of national income, as compared with alternative strategies. The misallocation of resources can be appreciated

by contrasting levels of unemployment and underemployment of labour force that reach values of up to 20% or even more in certain cases, with high levels of excess capacity in the industrial sector (4). And still, a significant proportion of the population lacks the means for satisfying its basic needs.

2.2 : SPATIAL FEATURES OF THE LATIN AMERICAN PROCESS OF ENVIRONMENTAL CHANGE

Completing the whole frame of characteristics of the industrialization process experienced by the countries of the region which are relevant for the analysis of the environmental problems in general, are the spatial features adopted by this process. In general terms, we may describe it as a process of spatial concentration of both population and productive non-agricultural units. The technological characteristics of the industrialization process have implied, as we already mentioned, that the total volume of labour-supply existing in the concentration areas has largely exceeded the total volume of labour-demand originated by the activity of the industrial units.

Apart from the effects this feature has contributed to generate within the urban environment, it has also been an important causal factor in the creation of ecodimensional problems appearing in the rest of the nationa territory. These effects have been generated directly as a result of the pressures exerted by the concentrated population over the national ecosystems through direct ecological and socio-economic links. They have also been indirectly caused as a result of the general social and economic 'backwardness' characterizing the 'peripheral' segments of the national human environment, which has multiplied and amplified the environmental problems typical of underdevelopment itself.

Among the direct ecodimensional effects this demographic and economic concentration have produced in segments of the environment outside the urban limits, it seems convenient to distinguish those affecting the closest ecosystems from those affecting the rest of the

ecodimension at the national level. Within the first group of effects we find those that come along mainly through ecological links and, particularly, through water ecosystems (i.e. rivers and lakes), that can be considered as the most important linking elements in this sense. Socio-economic factors also account, nevertheless, for rather significant ecodimensional impacts outside the urban area itself. Among these we may mention the displacement of usually fertile lands from agricultural towards residential and industrial uses. In this case, the effect might be seen as a complete and radical change of both the structure and function of the involved ecosystems, which assessment in terms of social (present and future, actual and potential) welfare is by no means a straightforward issue, but one that must take into account the fact that an important and almost irreversible change is implied in the process.

Another rather direct socio-economic link between the urban area and its most immediate geographical periphery is that one involved in temporal movements of population out from the cities and into the relatively near countryside for recreational purposes. In this case, apart form congestion problems that have arisen in customary terms (both in the access-vias and in the sites used for recreation), the effect has been expressed by ecosystemic degradation as a result of either overpassing the involved ecosystems' carrying capacity or increasing the frequency of ocurrence of ecologically harmful vectors (e.g. forest-fires). Given the fact that the concentrated character of the evolution of the national systems has been expressed not only in terms of rural-urban trends, but also in terms of concentration in few (if not only one, in many cases) urban areas, these effects over the immediately connected non-urban segments of the ecodimension has had a rather limited spatial scope.

The effects of the urban concentration over the global national rural ecodimension is more important than the sometimes acute but spatially limited effects exerted over the immediate urban countryside. Among such effects, the most important are those derived from the ans-

wer given to the population's pressure over food-producing ecodimensional capital assets, by those segments of the rural population that are somehow connected with cash-crop activities. The main patterns of such a response are going to be analysed in some detail later on, in Part II (see pgs.).

The indirect effects caused by the concentration of activities and population and the consequent 'dualistic' character of the regional human environments must be analyzed having in mind the role played by the government in the evolution of the different national systems and also the development strategies underlying this intervention both from sectoral and spatial viewpoints.

Although the region (with the exception of Cuba since Castro) is usually identified with the western capitalistic system and therefore, the market-oriented character of the decision-making process on the use of resources is regarded as a relevant institutional feature, the role of the government has been much more decisive than that implied by those theoretical models in which the state-action is mainly regarded as a corrective one in a system that otherwise would generate an inefficient resource allocation. In fact, as we mentioned before, since the 30s the state has played a major role in the industrialization process of most Latin American countries, whether such role consisted in the promotion of industrialization itself or in the protection and support of a process of industrialization already showing some degree of development.

Given the important effective influence of the state in the whole economic and social evolution, the spatial patterns of the administrative and political systems become a relevant factor affecting the spatial patterns of the process of environmental change. Thus, initially due to historical colonial inheritage and later due to the structure of the planning function (influenced by the earlier pattern of political and economic development); to the role played by the state in the promotion and support of industrialization (STOHR, 1975);

and to the belief that certain structural changes together with an autonomous national policy are feasible only under strong central governments (ECLA, 1970), both the political and administrative decision-making processes were highly centralised until recently, when some kind of concern about regional differences has arisen within the general development planning process and thus, followed at least by attempts of descentralization.

The described patterns of the planning activity within the countries of the region have usually resulted in the establishment of plans concentrated at the national level, situation that is reinforced by the kind of planning models and techniques used, normally coming from developed and relatively well integrated systems. The most important and direct consequences of the derived accross-the-board policies within a context of already high regional subnational heterogeneity, has been the widening of the gap existing between the few regions benefited by such policies (owing to their relative advantage in terms of initial favourable conditions) and those regions that have remained almost untouched by them (STOHR, 1975).

Insofar as the neglect of the periphery by national development strategies have affected almost all aspects of the development requirements, ecodimensional problems affecting the poorest segments of the urban communities (such as congestion of basic services, contamination problems threatening the community's health, etc.) become apparent with even more strength in the backwarded areas, despite their comparatively lower population densities. Also, this situation constitutes an amplifier element for the structural conditions existing in the agrarian sector, aggravating the mismanagement and overexploitation of the ecodimensional capital and thus, accelerating the degradation processes affecting the involved ecosystems (see pgs.)

The across-the-board pattern of most development policies have also been present, to some relevant extent, in the attempts of structural changes such as the agrarian reform most of the countries of the region have undertaken. In this case, the heterogeneity of the whole

environment has been largely neglected not only in the design of changes of the land tenure system, but also in the design of complementary measures associated with agricultural modernisation (in its widest sense). This pattern of agrarian reforms has also been strongly conditioned by their character of being, to some extent, the response of central governments to the 'peasant-pressures' over land and thus, allowing the relative success of global policies in this sense. Nevertheless, they have proven to be highly inefficient in coping with the population-pressures over the resources (ecodimensional capital), usually implying the creation of aditional or the reinforcement of the existing processes of ecodimensional decay (in addition to inefficiences in connection with other environmental problems, these reforms were supposed to solve).

Most of the discussed consequences of this centralized and concentrated character of the process of environmental change in Latin America have been well summarized by de Matos, who claims the principal problems as being, in general:

(i) "Relative deterioration of the living conditions of significant sectors of the population located in the periphery, that are not favoured by the geographic distribution of the results of the economic growth process. This situation becomes especially relevant in those countries having peripheral regions with high demographic concentrations, as it happens in the Brazilian Northeast or in the Peruvian "Sierra". This implies unfavourable conditions to the periphery in terms of income distribution, employment opportunities, and access to goods and services".

(ii) "Disproportionated growth of metropolitan areas in most Latin American countries. Insofar as this phenomenon has not been accompanied by the establishment of the proper conditions for absorving the associated demographic growth, it has implied a significant increase of urban marginality. Thus, marginality constitutes a phenomenon affecting not only peripheral but also an increasing sector of the metropo-

litan population in each country".

(iii) "Need for investing an increasing volume of scarce financial resources in major urban concentrations - mainly in infrastructure - in roder to maintain proper functioning conditions in the growing metropoly. It could be assumed, especially in the medium and long term, that these resources could contribute to increase the overall growth rate if they were allocated in investments in other places of the national territory, particularly once agglomeration external diseconomies become apparent".

(iv) "Margination from the productive process of some part of the national resources, especially natural resources. The incorporation of such resources could have contributed to divesify the economic structure and to increase the growth rate in the medium and long term" (5).

(v) "Increase of the problem of environmental contamination due to the disproportionate concentration of activities in the great Latin American metropolis. In most of these agglomerations the problem has reached magnitudes making any proposed solution a highly costly one, so that few countries could face the task in an integral way. On the other hand, this kind of proposals acquires real meaning only if they are conceived and implemented coordinately with those measures aiming at stopping the growth of the respective metropolitan areas, wich in turn, requires the allocation of a significant volume of resources in other parts of the geographical space".
(de MATOS, 1975).

2.3 : SOME BASIC QUESTIONS OF STRATEGY

Despite that in most cases government intervention and the process of development planning in the countries of the region have been inspired by goals (whatever their degree of specification) of economic growth, equality and national self-reliance, we still appreciate acute and frequently increasing problems of poverty (in urban as well as

in rural areas), low rates of growth, and dependence (if not political in the most formal sense of the word, at least technological and economic). Accompanying these problems we find a situation of extreme and increasing spatial concentration of both population and economic activity and high degrees of centralization of the process of decision-making, together with notorious problems of both margination and destruction of important natural resources on one hand, and accute congestion and pollution problems, on the other.

This apparent failure of the underlying strategies followed so far by the countries of the region (considering the normative elements associated with our definition of development) demands the statement of some basic questions of strategy the planner and the policy-maker should face and answer, conscious of their implications especially in the long term. Without trying to be exhaustive, we may indicate the following as being among the most important:

1: Considering the actual situation in terms of income distribution, what should be the goal-path of distributional changes compatible with a specified set of sequencial growth rates constituting the goal-image of the overall growth path ?

Underlying the statement of this question as a matter of strategy is the recognition that there is no optimal growth path which could be considered independently from the behaviour of the distributional situation. As we are going to discuss later on when analyzing the theoretical foundations of our approach to the planning issue, there exists a complex web of inter-relations between distribution and growth which fully consideration demands growth strategies that take into account not only income links between socio-economic groups, but also particular characteristics of each group (in terms of their responsiveness to different growth policies). The answer to this question, as we mentioned earlier, places both theoretical and methodological requirements to the planning activity: the planning model or framework to be used should explicitly incorporate inter-group income links as well as the most relevant features conditioning each group's income genera-

ting capability and the mechanisms of income appropriation.

Closely connected with the former question of strategy and determining, to a great extent, the range of possible, alternative, answers to it, there is another important question, this time dealing with the institutional arrangements the process of environmental change would rely on. We may state this question, from an economic point of view, as follows:

> 2: What role should be given to the market mechanism in determining the way in which resources are allocated and thus, in determining the patterns of evolution of the economic structure ?

The main reason for establishing this as an explicit, relevant, question of strategy lies in the observed fact that the resource allocation process characterizing most countries of the region, strongly conditioned by the demand structure derived from the existing patterns of income distribution (and reinforced by governmental intervention supporting import substituting activities), has resulted in basic needs of significant volumes of population not being satisfied on one hand, and in low levels of employment of the installed capacity (mainly oriented towards non basic consumer commodities demanded by relative minorities), on the other. In this context, there are some questions about market characteristics the decision-maker should answer if any redistributive action is going to be accompanied by the correspondent growth patterns. The most relevant of these questions is to what extent, given the overall institutional framework, the market would be capable of shifting the resource allocation patterns so that the changing character of the demand structure due to redistributive measures is matched by the corresponding changes in the economic structure.

Failure to appreciate rigidities of the market in this area could very well imply that any advancement achieved in the distribution field is liable to be checked by inflationary processes.

This problem about the 'efficiency' of the market mechanism could

be stated in more direct terms: given the political constraints (among others) for achieving a rapid income redistribution and considering present inequalities, what are the chances for the market to generate, both in the short and long term, a path of resource allocation that is compatible and in accordance with the schemes of social choice ?

Even though resource allocation in the past has been mainly oriented by the demand structure prevailing in the national societies, the government has played a relevant role in making feasible such allocation patterns. Therefore, no matter what the relative importance of the market mechanism is (obviously, within reasonable margins), the policy-maker should face - together with the question of strategy stated in the first place - the question of deciding the relative importance different sectors of the economy would have within the overall process of environmental change. We may state then, a third relevant question of strategy:

> 3: Given the growth and distribution goals, what should be the optimal sectoral composition of the economy at different stages of achievement of the environmental change process (6) ?

Underlying this question of strategy are largely debated, though not yet dilucidated, issues such as industry versus agriculture, industry versus primary production, industry versus infrastructurem and 'equilibrated' growth.

Rather than entering into the analysis of the different positions (7), it seems more convenient at this stage, to emphasize that the answer to this question should be endogenously given according with each system's particular conditions and therefore, any planning framework should allow the explicit treatment of this issue. Furthermore, an adequate answer to the question of sectoral priorities in the development strategy should come as a result of the simultaneous answer to another relevant question:

> 4: What are the optimal patterns the spatial structure should adopt through the process of environmental change ?

The need for this latter question to be included as an explicit element contributing to the definition of the overall development strategy, arises from the observation of the highly inefficient (both in social (8) and economic terms) spatial structure characterizing the countries of the region, and from the fact that the observed trends of spatial change are likely to continue unless actions are taken to reorient the whole process (9). Any modification in this sense will be conditioned by and have influence over the sectoral composition of the economy; over the overall growth rate; and over the distribution of the benefits derived from the socio-economic activity.

Finally, it should be emphasized that facing the former broad questions of strategy so that the process of environmental change results in development as defined, requires the definition of subordinate strategies and policies dealing with the institutional framework within which the social systems should operate; with the patterns the process of technological innovation and difussion should adopt; and with the position the ecodimension should occupy at different achievement stages of the development process.

The task of dealing with this wide range of strategy and policy issues in an integrated way clearly requires the formulation of a comprehensive planning framework. The establishment of its theoretical foundations is the subject of Parts II and III.

NOTES

(1) The influence of which in many countries, can be traced back to the collapse of the international trade system in the early 30s.

(2) For understanding, at least, some of the differentials characterizing the Latin American countries in terms of their degree of industrialization.

(3) And intimately connected with the problem of economies of scale and minimum plant-sizes, involved in the transferred technology.

(4) Sutcliffe, quoting BAER and MANESHI, 1969, reports, in the Brazilian case, utilization of capacity of only 53% for capital goods and of 65% for consumer goods under the assumption of only one shift (SUTCLIFFE, 1971; pg. 205). References to this problem in the cases of Mexico and Argentine can be found in WYGARD, 1968 and FERRER, 1967, respectively.

This situation should be also qualified by considering the fact that Latin American countries' capital resources are relatively scarce.

(5) Here, it should be emphasized that degradation processes affecting other segments of the ecodimension constitute part of the same global picture.

(6) Although we are referring to 'different stages of the development process', this should not be understood as an identification with the 'rostowian' approach, of development stages (ROSTOW, 1960).

(7) For a good synthesis of this controversy and extensive bibliographic references, see SUTCLIFFE, 1971; pgs. 71-105.

(8) By social inefficiency we understand a situation that has in built factors generating inequality between community groups and individual members, and implying the margination of significant community sectors from the social, political and economic life.

(9) Based on international cross-section and on some time series analyses, Williamson suggests that there exist some empirical evidence to support the hypothesis that while in the early stages of development, regional inequalities tend to increase (which would correspond to the case of the Latin American region), when the national systems become more mature and developed, inequalities start to decrease (WILLIAMSON, 1965). However, mainly being a descriptive work, it does not establish a causal relationship between national development and regional inequality and therefore, it has relatively little significance for defining spatial strategies and policies.

PART II : REGIONAL DEVELOPMENT, DISTRIBUTION AND THE ECODIMENSION. THEORY

INTRODUCTION

In Part I we defined the concepts of environment and development, reviewed the most general patterns followed by the process of environmental change in Latin America, and derived some relevant questions of strategy. The latter were referred to some structural and institutional elements conditioning the growth of income and its distribution, to the patterns characterizing the economic structure of the national systems, and to the spatial dimension of the human environment. Underlying these questions of strategy was the unitary character of the human environment and thus, they also deal, directly or indirectly, with the ecodimension as a relevant one which changes should constitute a matter of direct concern to the policy-maker. We also mentioned that such questions implied the need for comprehensive planning frameworks.

Considering the methodological requirements for the planning activity stated in Chapter 1, and particularly tha one establishing the need for explicitly including the spatial dimension, we will attempt our approach within the context of regional analysis.

The main subject we should discuss at the theoretical level is the extent to which regional theory has achieved an adequate integration between the three basic problem-areas we have identified as relevant when dealing with the process of development: the increase of real income (economic growth); the distributional situation; and ecodimensional changes.

The purpose of this Part then, is to establish the theoretical foundations for the formulation of a planning framework that properly considers these problem-areas. It has been divided in four chapters.

The first chapter (Chapter 3) corresponds to a brief discussion

of the theoretical bases regional economics relies on for explaining the process fo development. In this analysis we will discuss the extent to which this theoretical body has explicitly included the issues of personal income distribution, and the role played by the ecodimension and the interconnections it presents with the other dimensions of the human environment. We will also discuss the treatment it has given to technological change and to the institutional framework in which the regional system operates.

Emphasis will be given to Friedmann's theory of polarized regional development and to Siebert's model of internal and external determinants of regional economic growth.

In the second and third chapters (Chapters 4 and 5) we will attempt an extensive analysis of the ecodimension of the human environment. The basic roles played by this dimension and the problems normally associated with each role will be discussed in some detail. We will also discuss the ways in which the issues derived from this analysis could be integrated into the theoretical body analyzed in the previous chapter.

The fourth chapter (Chapter 6) deals with the distribution issue. The theoretical bases explaining the distribution of income among community members will be discussed. As in the case of the ecodimension, we will also discuss the ways in which personal-income distribution issues should be integrated in the analysis of the regional development process.

Finally, in Chapter 7, an attempt to synthetize the discussion of the former chapters will be done. The questions of strategy will be revisited and we will establish a more detailed and specific set of issues in this sense. The guidelines for the formulation of a comprehensive analytical framework for regional development, which is the subject of Part III, will be derived from this analysis.

Although most of the discussion of the present Part is done in

theoretical terms, it will be frequently referred to the Latin American case, so that the brief characterization done in Chapter 2 will be enlarged.

CHAPTER 3 : REGIONAL DEVELOPMENT THEORY

Regional economic analysis has mainly emerged as an applied branch of economics, responding to the need of considering the concrete problems posed by the spatial organization of the social systems and thus, greatly ignored by the generalizations characterizing conventional economic theory. Thus, most of the work that has been done connected with regional analysis is policy-oriented. However, we also find theoretical attempts for explaining the spatial phenomenon and the process of economic development within spatially heterogeneous systems.

In spite of the great number of problems arising from the spatial patterns that characterize the process of underdevelopment and that strongly affect the development possibilities of most countries of the Third World, most of the theoretical work in spatial development has been originated in industrialized nations (mainly U.S.A., Great Britain, France and Germany) (1). Most of the current regional economic theory is then concentrated in regional economic growth, inter-regional disparities and regional stability being the principal issues it is addressed to (with the areas of urban growth and urbanization gaining increasing ground).

We will start our analysis with a brief discussion of the theories of regional economic growth, mainly focussing our attention in Friedmann's and in Siebert's approaches (2). Then we will analyze the treatment given to the issues of personal income distribution and ecodimensional problems, and how the theory considers technological change and the institutional framework characterizing the human environment of different communities.

When dealing with the theories that have been developed in order to explain the process of tegional economic growth we may find a variety of classifications. Fullerton and Prescot, for instance, aggregate these theories in three main groups, i.e. those of the eco-

nomic-base; those of location of inter-regional trade; and those of the economic sectors (FULLERTON and PRESCOTT, 1975). On the other hand, Stilwell distinguishes between those theories approaching the regional economy from a micro-economic point of view, from those that do so from a macro-economic one (STILWELL, 1972). Location theories of both firms and households belong to the first group and within it, a distinction can be made according to the basic motivations the economic agents respond to for deciding their location between alternative sites (or regions). This distinction is important because of the policy implications derived from different assumptions in this sense are also different (3). Among macro-economic theories dealing with the issue of regional economic growth, Stilwell distinguishes between those considering growth mainly arising from resource allocation (both within and between regions); those giving to the expansion of the regional export-base the character of being the leading force; those focussing in investment and its relationships with growth of regional productive capacity; and those considering growth as a cummulative process (op. cit., pg. 30).

Yet, another classification can be found by considering the ways in which each theory treates space. Friedmann, for instance, aggregates regional theories in two main groups: those 'non-spatial' approaches that consider the national system as composed of a set of discrete linked regions, and those 'spatial' theories, which consider the national system as a continuous development surface having a spatial structure (FRIEDMANN, 1975).

Whatever may be the criteria used to aggregate different approaches to the spatial phenomena involved in the development process, their usefulness and relevance for policy purposes (which is one of the main, if not the most important, role of theory) should be the main qualifying elements. Thus, and based on the major features characterizing the Latin American experience reviewed in Chapter 2, we will assess the regional theory in terms of the answer it allows to problems such as:

(i)excesive spatial centralization of the decision-making structure,
(ii) margination of community segments from basic benefits of the socio-economic activity, considering the problem in its rural-urban and centre-periphery dimensions,
(iii) destruction on one hand, and underutilization on the other, of important segments of the ecodimension,
(iv) high rates of urbanization in few centers and the subsequent existence of spatially concentrated, accute, congestion and pollution problems, and
(v) economic and social disintegration of the nationa space and the internally dominated character of peripheral, backwarded, regions.

3.1 : THE LOCATION THEORY

The uneven distribution of population and social activities over a certain space characterizing the human environment being the central feature that gives raise to regional analysis as an individual disciplinary branch, the location of social units and the factors determining locational patterns constitute its cornerstone. From the economic point of view, it is the location of firms and households what corresponds to the relevant analytical issue. Location theories, i.e. those theories explaining how the individual firm of household decides to locate, do not provide by themselves however, an explanation of aggregated phenomena such as differences in the economic landscape between regions. Furthermore, the possibility to integrate it with dynamic frameworks upon which economic growth theories should be based, constitutes an extremely difficult task which attempt has been rather unsuccessful so far.

This does not mean that regiona growth theories and locational theories constitute parallel, independent, theoretical bodies. On the contrary, it is possible to state that, although no formal integration between them has been achieved, different lines of thought in the area of regional growth owe their basic differences, to a great extent, to the adoption of different location theories (basically expressed

in different sets of assumptions concerning the firm of household motives). Insofar as we are interested in regional growth within the Latin American context, the type of location theory applicable to this reality will give us an indication of the relevance of different approaches to the growth issue. That is why we have considered it convenient to start our discussion of the theory of regional growth with the location area.

We may aggregate the theories of firm location in two broad categories: those assuming the firm as deciding where to locate after the application of some kind of optimization criterion, and those assuming the firm as being simply a satisficing unit.

The first type of approach is in line with the classical tradition of micro-economics and therefore assumes in general, perfect information (of market conditions and of particularities characterizing each and every alternative location site), absence of uncertainty, no restrictions of managerial and technical capabilities and a static world where time plays little or no role at all. Although these assumptions are hardly identifiable with reality, no matter what the characteristics of the economy may be, their degree of unrealism becomes a serious misleading element when applied to developing economies in general.

Leaving aside the phenomenon of 'spontaneous' firms (4), Alonso analyzes the major features characterizing the developing nations, that give ground to doubt the applicability of this classical approach (5). Among such features he mentions (ALONSO, 1975):

(i) A transport network requiring more complicated transformations into economic space, insofar as distances (especially between peripheral points) should be considered in terms of specific routes (6).

(ii) A rather inefficient transportation (shipment) system that makes the consideration of time-costs dependant on a great number of factors other than distance, and which valuation is partially conditio-

ned by the attitude of the manager and/or owner in front of risk, frequently under conditions of great uncertainty.

(iii) Lack of enough information about both advantages and disadvantages of alternative locations, especially of those belonging to the periphery (7), that makes highly uncertain the business environment for any individual firm.

(iv) Most individual firms have rather short financial planning horizons. This, together with the long-term character of many investments firms should make in peripheral areas (especially in terms of training the required labour force) imply the trend of most firms to locate in center regions in spite of the fact that peripheral locations could be more profitable in the medium and long term.

(v) Most firms of developing countries can be considered as 'new industries' and thus, as very open systems oriented to external economies. Particular external economies - normally existing in central regions - become heavily weighted locational factors.

(vi) Because of social, cultural and economic reasons, it is very hard to mobilize skilled labour, especially at the executive and managerial level, away from major cities. This makes this factor highly expensive in peripheral regions (when available at all) and therefore, most locational advantages associated with the latter should be assessed considering this element.

(vii) Finally, the former characteristics together with limited global managerial resources and structural changeability (the 'ceteris paribus' clause being highly unrealistic) complete the frame supporting the statement of the classical assumptions as being inadequate for dealing with location analyses in underdeveloped countries (to which Latin America constitutes no exception).

It is this set of features characterizing in general the loca-

tion issue in most countries of the region, what should constitute the basis for approaching the question of regional economic growth. While profit maximization-based location theories lie on the basis of (or are congruent with) neoclassical inter-regional equilibrium growth models, behavioural approaches (which are much more in line with the former elements) to the location of the firm lie at the heart of the cummulative causation theory of regional growth (RICHARDSON, 1973; pg. 57).

3.2 : REGIONAL GROWTH THEORY

Based on the former correspondence we will concentrate our analysis of regiona growth on the centre-periphery approach in general and particularly on the theory of polarized development suggested by Friedmann (FRIEDMANN, 1973) that further advances on these lines. We will then try to draw some connections between this theory and the model developed by Siebert to explain the process of regional economic growth, which comprehensiveness and formal treatment to the major determinants of this process allow an analytical representation that is suitable for our purposes, i.e. the discussion of distributional and ecodimensional issues in the context of planning a growing economy.

The Theory of Polarized Growth

Considering the fact that economic growth does not appear everywhere but in specific points (8) and with varying intensity, there will be an uneven distribution of growth through the whole economic space which main patterns will be determined by the composition of such development poles or growth points over it; by the efficiency of the channels spreading growth from these poles towards the rest of the economy; and by the characteristics of the terminal effects each pole has over the economy as a whole. Dominant industries will make then, the agglomerations where they are located in, the poles of their regions (PERROUX, 1955).

The concept of growth poles is operationalized in geographical terms by Boudeville (BOUDEVILLE, 1966; 1961; 1957), who identifies them with the idea of polarized region (9). Hirschman in turn, states that "whatever the reason, there can be little doubt that an economy, to lift itself to higher income levels, must and will first develop within itself one or several regional centers of economic strength. This need for the emergence of 'growing points' or 'growth poles' in the course of the development process means that international and inter-regional inequality of growth is an inevitable concomitant and condition of growth itself" (HIRSCHMAN, 1958; pg. 183-4).

It will be mainly and in general terms, through the domination of the center over the periphery in both its economic and non-economic expressions, that the 'backwash' (desequilibrating flows of labour, capital, goods and services from poor to rich regions) would prevail over the 'spread' effects (markets for the poor regions' products and difussion of innovation) of the polarized growth and thus, the inherent regional growth imbalances will become cummulative (FRIEDMANN, 1966; MYRDAL, 1957) (10).

Based on the theory of polarized growth, Friedmann has suggested a theory of polarized development (FRIEDMANN, 1973). We may summarize the central content of this theory by quoting Friedmann himself, who states:

> "This theory treats economic growth as a function of changes in the structures that inevitably limit a system's capacity for expansion and, in the specific case of growth based on the application of science to problems of economic production, also of the system's capacity for the continuous generation and absorption of innovations. This formulation assigns a decisive influence to the institutional and organization framework of society and, specifically, to the patterns of authority and dependency that result from the unusual capacity of certain areas to serve as cradles of innovation. In this view, it is by no means indifferent what regions organize the new investments and make the relevant decisions on location, or what purposes are to be served by these activities. Dominant core and dominated periphery together constitute a relatively stable spatial system in which the latter is successfully 'colonized' chiefly to sustain the

continued growth of the former.

> The further growth of core regions, however, is in the final analysis constrained by the tensions that tend to built up from the ever more visible discrepancies in the rates of expansion and modernization between core and periphery. The increasing flow of information from core to periphery, together with an aroused awareness of potentially modernising elites in the periphery of the conditions of their own dependency, produce conflict with core region authorities over the extent of permissible autonomy" (op. cit., pg. 57).

The final outcome in terms of the growth of the overall system will strongly depend on the way in which the core-periphery conflict is solved and on the attitude of the leading elites, whenever the solution implies more power to the periphery.

There are, at least, five elements contained in this theory of polarized development that are worth noting for our purposes:

(i) It conceives growth as a dominant pattern of development, the latter being a discontinuous, cummulative, process in which structural changes allowing the system's growth to become permanent constitutes a necessary condition for the realization of society's innovative potential which, in turn, constitutes development's more relevant feature.

(ii) It explicitly incorporates the most relevant spatial feature characterizing the Latin American region, i.e. its concentrated and centralized character, and suggests the mechanisms allowing either the reinforcement of the modification of such patterns as an endogenously determined change.

(iii) The institutional and organizational framework is conceived as a variable rather than as a parameter of the system's evolution, which changes will result from the way in which the conflict between innovative forces and 'establishment' is resolved.

(iv) It suggests the existence of an inverted-U pattern of the deve-

lopment process: the dynamics of innovation will initially tend to raise the development rate of core regions relative to peripheral ones (11) and therefore, to increase the degree of systemic polarization. At latter stages, core regions will suffer from a weakening of their hierarchical order and the whole spatial system will become more integrated due to the appearance and spread out of a rather continuous web of core regions (12). The turning point will be the result of growing political and social tensions between center and periphery, which solution - if development is to continue - should favour the latter.

(v) It recognizes the urban type of settlement as a point in the communications field where the probability of information exchange is higher than elsewhere and therefore, it gives to the urban system and to urbanization a relevant role in the process of innovation and consequently, in that of development itself.

As stated, though giving insights on patterns usually unconsidered by conventional regional analysis, the theory does not give clear lines along which the policy-design could be advanced in order to manipulate the system's behaviour so that development is promoted. This shortcoming of the basic theory of polarized growth is, to some extent, overcome by the complementary formulation of a paradigm of urbanization (13) in which four fundamental processes leading to specific patterns are identified: innovation difussion, political and socio-economic control, migration, and investment.

These processes connecting core and periphery are by no means symetric and thus, create disequilibria in the organization of the spatial system. It will be through the manipulation of these processes and consequently through inducing desired changes in the patterns they generate, that the planning activity would be able to induce higher degrees of spatial integration of the social system (14). The operation of these processes and the patterns they generate are conceived in the following terms:

"The volume of controlling decisions that emanates from the core is greater than the reciprocal volume of controls from the periphery to core. This causes a net-flow of capital from the periphery which, in turns, give rise to a net-flow of migrants into the core area. At the same time, a continuous stream of innovations diffuses from the core to the periphery where it ultimately helps to create conditions that lead to demands for at least a partial restructuring of the fundamental dependency relation.

Unless the social-political tensions produced by these four sets of disequilibrium can be successfully contained (or creatively resolved), development of the spatial system will either stagnate or break down.

Each of the four basic processes affects a subsystem of the spatial system: innovation diffusion alters the socio-cultural pattern of the spatial system; control processes yield a pattern of power relationships; migration leads to changes in the settlement pattern; and investment processes affect the spatial pattern of economic activities in both core and periphery.

These spatial patterns are closely interrelated. The partial integration of power and socio-cultural patterns may be defined as the spatial organization of modernization, while the joint effects of economic activities and settlement produce a unique spatial organization of the economy.

Finally, the two sub-organizations - spatial organization of modernization and spatial organization of the economy - combine to form the spatial organization of society".
(op. cit., pg. 69)

Finally, a fifth process is identified in terms of partial dependency of the national spatial system (acting as periphery) from external cores and is expressed through the same categories internally linking core and periphery.

Internal and External Determinants of Regional Growth. Siebert's Approach (15)

Although Siebert uses the concepts of development, growth and expansion as synonymous, in terms of our definition and also considering Friedmann's interpretation, his approach deals exclusively with what we called economic growth. Therefore, it corresponds to a narrower approach to the problem of regional development insofar as the institutional framework characterizing the whole human environment is con-

sidered as given. Later on, in the following section, we will analyze the treatment given to ecodimensional changes and to the distributional situation as relevant patterns in the evolution of the human environment. In this section we will try to present the relevant features of this model and its connections with the former theory of regional development.

Siebert's formulation could be aggregated, to some extent, within the neo-classical tradition of regional growth analysis and thus, many of the underlying assumptions of his model present serious shortcomings when applied to the realities of the Latin American countries (16). Despite this character, we consider convenient to analyze it because it constitutes an attempt for dealing with the problem of regional growth in quite a comprehensive way (17); it also deals with both the growth process of an individual region and that of the regions system; and because it is detached from the neo-classical tradition (maintaining a relatively high degree of formalization) in many aspects that are relevant for the nalysis of the growth process in developing countries (18). Besides, it isorganized in such a way that constitutes a suitable framework for the inclusion of more realistic assumptions in terms of the Latin American experience (see our global discussion of the following section).

With regard to the location phenomena, the individual decisions are assumed to be the result of the intersection of a set of geographically identified locational characteristics and a set of locational requirements (19). Given the interdependence of location decisions within and between different activities (identified as agricultural, industrial, tertiary production and residential activities), the conformation of the economic landscape, in analytical terms, should account for feedbacks between these activities. Although specific partial location theories are suggested (20), the general formulation does not necessarily implies any of them.

The region being an open system and the real income growth being

a function of increases in both productive potential and effective demand, actual income increases will be determined by the lowest value of the increases in the two former variables (assuming an initial condition of potential being equal to actual output) considering also regional exports and imports, and corrected by gains or losses due to variations in the regional terms of trade (21).

The analysis of the determinants of the productive potential is made by distinguishing internal from external determinants. These are associated with conventional productive factors, i.e. capital, labour and land, to which the author explicitly adds technical knowledge, transport resources and the social system (social structure, institutional setting, behavioural patterns, and attitudes of the regional community).

Connected with these elements, the following features and assumptions dominating the whole model are worth noting:
(i) land is considered as a given and completely immobile factor (22),
(ii) changes in the social system, as conditionants of growth, are neglected. In this sense, one could interprete this approach as one related to short term growth (23),
(iii) apart from stating the dependency of the expansion effects of labour force changes, not only on the number but also on the quality of such force, the formal model considers labour as an homogeneous factor, and
(iv) technical knowledge is loosely defined (information about production processes at a moment in time) and technical progress is conceived as positively correlated with increases in the productive potential, though not operationalized either.

The configuration of the overall economic spatial landscape as well as that of particular regions will be the result of the joint action of both internally generated changes in the growth determinants and changes due to inter-regional processes.

Although the treatment given to changes in internal growth determinants is in line with the (neo-classical) theory of national growth, some generalizations including the spatial dimension are introduced. However, the connection established between the process of regional growth due to changes in internal determinants and the spatial structure is unidirectional: depending on the degree of mobility of those growth determinants actually generating increases in the region's productive capacity, the growth process would be accompanied by a change in the spatial structure. This latter, however, is not explicitly considered as conditioning the growth possibilities of the region.

In terms of growth induced by the interaction between regions, four conditioning processes are identified: movements of labour, movements of capital and consumption goods, and diffusion of technical knowledge.

The effects of factor movements on each region's growth is expressed by shifts in the respective transformation curves. In terms of labour and capital, some classical assumptions are made. The direction of such movements is determined by inter-regional return (wages and rates of return) differentials (factors would move from regions with lower to regions with higher factor returns) which, in turn, are assumed to result from productivity differentials. These movements then, will tend to induce, ceteris paribus, equalization of factor productivity and of factor returns between regions.

Under these assumptions, changes in the overall spatial economic structure generated by inter-regional growth differentials are a function of factors' mobility which, as opposed to the classical approaches, is assumed to be restricted in varying degrees. The lower the mobility of production factors and the higher the initial differences in each region's capability to internally generate favourable changes in growth determinants, the higher the inter-regional growth rate differentials will tend to be.

Any differential in growth rates due to factor immobility, could be either reinforced or smoothed by interchange of consumption goods, depending on the behaviour of the inter-regional terms of trade.

3.3 : A GLOBAL APPRAISAL

In terms of development planning in the context of the Latin American experience, both Friedmann's and Siebert's approaches present some limitations.

While the theory of polarized development succeeds, to a great extent, in the attempt to integrate socio-political and economic processes that constitute joint and inseparable conditionants of the patterns of spatial development, it is loosely formulated and uses too globally specified analytical categories. It fails to present an analytical framework allowing the decision-maker to design and evaluate concrete alternative development policies and strategies.

On the other hand, Siebert's approach, being formulated in a much more formal way and identifying in more precise terms some of the most relevant elements conditioning the growth process, fails to integrate institutional and structural elements of the sociodimension which variability constitutes both a characteristic and a requirement determining the development possibilities of the national and regional communities (24). Besides, and strongly connected with the neglect of the former elements, the assumptions made in terms of individual and social behaviour give the model a determiner character to a greater degree than it is advisable for dealing with many features of underdevelopment.

The task of overcoming these limitations brings about one of the most difficult problems model-designers have to face: solving the conflict between simplicity and realism so that the result becomes a manageable analytical instrument and yet, allows the policy-maker to reach reasonable conclusions at a reasonable level of specification

and thus, to avoid misleading intervention. Closely connected with the way in which the mentioned trade-off is solved, we find the issue of availability of information. In general the lack of data about many strategic elements of the human environment characterizing the underdeveloped countries' information systems has emphasized the need for simplicity and therefore, most of the planning frameworks that have been traditionally suggested suffer from rather low levels of realism. The frequent use of the 'thumb rule' for making decisions and the detachement we can find, also too frequently, between planners and decision-making agents correspond, to a great extent, to a result of the former tendency.

In Part IV we suggest some criteria the planning-modeling activity should follow in front of this kind of conflict. In connection with the arguments we give there, we may state the possibility of linking together both Friedmann's and Siebert's approaches within a wider planning framework: while the first essentially constitutes the basis for setting up development scenarios which will give the frame for strategy and policy design, the latter gives a good starting point for the formulation of the explanatory models to be used within different sets of scenarios. Having stated this basic connection, some of which particular elements are discussed in Parts III and IV, in what follows we will take a closer look to these two approaches.

The Spatial Processes and Behavioural Assumptions

In terms of the processes affecting the overall spatial structure both approaches stress the importance of migration, capital movements and technological (innovation) diffusion. Siebert implicitly assumes an institutional setting where the control over strategic elements underlying such processes is evenly distributed through space. Consequently, he states both the intensity and direction of the flows involved in the mentioned spatial processes as a function of the degree of mobility of labour, capital and technological knowledge, assuming certain behavioural behavioural elements as being the original motives

for these factors' moving trends. Basically, as we mentioned, labour will tend to move following actual wage-differentials (25) and capital, following differences in rates of return. These trends are limited by the degree of mobility of these factors. In the case of labour, actual knowledge of inter-regional differentiation of variables influencing the individual's attainment levels and its behaviour, the efficiency of both formal and informal information channels together with the search-behaviour of the individual, and pecuniary costs of moving, constitute elements limiting his mobility. On the other hand, capital mobility is constrainedby physical limitations and information problems.

Although within this framework, the model is able to explain spatial changes implying agudization of inter-regional growth differentials, it does not allow for any explanation of such change when accompanied, for instance, by simultaneous 'margination' of significant proportion of immigrants and community segments in general, in those regions that are growing at relatively higher rates. As we mentioned before, this constitutes a relevant feature of most Latin American countries' environmental change patterns. Furthermore, an increase in factors' mobility could be very well associated with the aggravation of such trend (26).

Therefore, the treatment given by Siebert to these spatial processes should be modified in, at least, two aspects that are accounted in Friedmann's formulation: first, the spatial control (power) structure should be considered as an explicit category insofar as it gives direction to the whole spatial system in terms of defining authority-dependency relationships (which, in the case of Latin America, configurate a center-periphery pattern) and therefore, in terms of stressing the assymetric character of the mentioned spatial processes; and second, the consideration of behavioural assumptions in terms of location, allowing the explanation of rather 'counter-intuitive' patterns (from the point of view of conventional location theory) characterizing the process of spatial environmental change in Latin America.

Technological Change and Institutional Setting

Another limitation that affects, this time, both Friedmann's and Siebert's approaches, deals with the degree of generality in which the technological (innovation)issue is treated. Although in both approaches it plays a relevant strategic role not only by conditioning the growth (development) possibilities of any individual region, but also by conditioning the shape adopted by the process of change of the spatial structure as a whole, neither Friedmann nor Siebert discuss the possibility of different types of technological change (innovation) resulting in different effects over the national and regional human environments.

Both authors concentrate in the analysis of how these changes will be spatially diffused, emphasizing the fact that the greater the innovative potential the greater will be the growth (development) potential characterizing those spatial points where the former is located, and the more efficient the diffusion mechanisms (the greater the mobility of innovations), the smaller will tend to be the spatial growth differentials (the greater will be the possibilities of the national spatial system to achieve high levels of integration).

Friedmann refers himself to innovations as "the successful introduction of ideas or artifacts perceived as new into a given social system". "Innovation and medium - he adds - must be structurally compatible" (op.cit., pg 45). Such compatibility could be achieved either by organizing and adapting the innovation to the conditions and requirements of the medium, or by changing the medium itself. Considering the fact that most new ideas and/or artifacts (specially the latter), in the context of underdeveloped countries, appear as the result of imitative attitudes, normally involving the borrowing of inventions generated in highly industrialized societies, the degree of initial compatibility between innovation and medium is likely to be quite low. In terms of development (see our definition in Chapter 1) however, it is not indifferent whether the compatibility is achieved by adapting

the innovation to the medium or viceversa.

Using Friedmann's own framework, one could interprete the actual situation of most Latin American countries as the result of a process of innovation (the successful introduction of attitudes, consumption patterns and productive methods prevailing in industrialized nations, within the national environments of the region) which 'compatibility' with the medium has been achieved by adapting the latter to the former. This adaptation has resulted in the creation of an institutional setting where the majority of the population is marginated from the benefits of such innovations. Therefore, the use of the idea of 'successfully introduced ideas and artifacts' as a developing force becomes ambiguous, to say the least, if one limits the analysis only to horizontal (spatial) processes of challenging the authority-dependency relationships. Although a successful process in this latter sense may induce a greater degree of spatial (horizontal) integration, it does not necessarily imply the achievement of greater levels of social (vertical) integration. And both elements constitute basic conditions of development in the terms we conceive the latter.

In spite of giving great emphasis to structural changes (in terms of the institutional and organizational framework of society) as a condition of development, Friedmann centers most of his attention on the spatial structure and fails to give enough importance to social (vertical) structures and the effect different kinds of innovations would have over them.

The same criticism can be done in connection with Siebert's consideration of technical knowledge as "information about potential production processes", though, in this case, the weakness comes not only from the unqualified character of technical changes, but also from the very fact of assuming the institutional setting as given and therefore, not affected at all by the process of technical progress whatever the form such progress adopts. Both the long-term effects of technical changes over the institutional framework of different regions (as

spatial social systems) and the short-term effects of such changes over elements conditioning spatial processes (mainly, migration) are to a great extent, ignored.

The Distribution Issue

The former observations about the treatment given to innovations (technical progress, in its narrower sense) and the related issue of institutional changes, bring about the convenience for looking into the distribution problem and the way in which the analyzed approaches cope with it. In general terms, we may find a great lack of concern about this issue in both approaches to the process of regional growth (development).

When discussing the policy areas that should be included within the urban-regional frame, Friedmann states the significance of social development policies mainly based on the importance of the geographical dimension of the marginality phenomenon. Nevertheless, the issues of distribution patterns and the segmentation the distribution of opportunities creates in the community (in terms of social groups having particular problems and particular behaviours in front of different stimuli) and their connection with the spatial processes and patterns of development and growth are by no means clearly drawn in his theoretical formulation. Furthermore, this insufficience of the theoretical formulation appears as conducting to eventually incompatible and rather contradictory policy implications when one compares the characteristics given to the former policy area with that of the regional economic one. While refering to the social development policy, the author emphasizes the idea that where marginality problems exist, "the urban-regional frame requires the choice of a social approach to problems of economic, physical and politico-administrative development" (27), when dealing with the definition of the regional economic policy, he states:"Core regional may be thought of as equivalent, in spatial terms, to the leading sectors of an economy. The main idea underlying a core-region strategy of regional

development is that investments should be concentrated in a small number of areas identified as having a high potential for economic growth. These areas are usually centered on cities of metropolitan size. The strategy for these areas envisions a planned program of coordinated investments in infraestructure and more directly productive activities which will be carried out over a period of time sufficient to permit the core economy to be pushed across the threshold of self sustaining growth" (op. cit., pgs. 141-2).

This latter statement can be interpreted as being in line with the conventional welfare economics approach of detaching optimal growth strategies and equity considerations, as issues that can be dealt with independently one from another.

This neglect of the distribution issue is also present in Siebert's model. The only consideration given to this issue corresponds to quite a marginal one, as a determinant of the composition and level of profits and wages and thus, of the level of regional savings insofar as the propensities to save from wages and profits are likely to be different. However, as we are going to see in Chapter 6, the functional approach to the distribution problem - even in terms of its influence on the savings behaviour of the community - is rather irrelevant in the context of Latin America due to the highly loose connection existing between the relative importance of socio-economic groups in terms of their income-shares (which, in the final analysis, corresponds to the relevant category both in terms of actual welfare distribution schemes and in terms of a conditionant element of the savings behaviour of the community) and their status in terms of income sources. Besides, apart from stating the former functional relationship between income distribution and regional savings, the author gives no further attention to this element and develops his theoretical framework on the assumption of a given distribution scheme.

The inclusion of distributional patterns and particularly those aspects connected with absolute poverty problems, corresponds then,

to a fourth area (together and connected with those dealing with the power structure, behavioural patterns and further specification of the issue of technological changes) where Siebert's approach should be reformulated in order to gain a higher degree of applicability and relevance for spatial development planning purposes in the Latin American context.

The Ecodimension of the Human Environment

The final issue we have to discuss in connection with our definition of development and environment is the consideration given to the ecodimension the approaches under analysis (28). In this case, we may appreciate too, an almost complete and absolute neglect of this dimension of the human environment in both Friedmann's and Siebert's theoretical formulations.

Friedmann's lack of interest about this dimension can be explained as the result of two main factors: first, the theory of polarized development is concerned with the shape the overall spatial structure of the national systems would adopt as development occurs. Consequently, the author addresses himself to variables that are located at a different level of integration in the environmental spectrum and which treatment is possible at a much greater degree of generalization. Second, the author adopts a rather frequently found approach to the identification of relevant policy areas, that assumes the existence of some kind of identifiable and clearcut sequence of problems that appear at different stages of the development process. He establishes that in early phases of industrialization the basic policy area is that of spatial integration, to become at a later stage one of concern about regional inequities. Finally, in the post-industrial period, environmental quality (29) becomes a primary policy objective. Being concerned with the problems existing in the early and intermediate stages of industrialization, he drops the environmental (ecodimensional) issue altogether.

This position can be challenged , at least, on two grounds: First, the ecodimension - being constituted by multifunctional elements in terms of human uses - is subject to strong pressures no matter what the stage of development a community my be in. Furthermore, in societies characterized by extreme inequalities - where it is found a mixture of phenomena that can be attributed to different stages of development - the ecodimension presents a corresponding mixture of problems. In the next chapter we further analyze some of the ecodimensional problems affecting the Latin American region, stressing their relative urgence.

Second, the inevitability of certain kind of ecodimensional problems (30) underlying the statement of 'environmental quality' as being a post-industrial stage-concern is, by no means, a 'natural' consequence of the evolution of the human environment. Rather, the appearance of problems generating such a concern at that stage of the development process corresponds to an almost inevitable outcome of the planning activity's neglect of this dimension at earlier stages in the process of environmental change.

Contrary to this approach, we may establish as a working hypothesis, that the earlier the planning activity starts considering the ecodimensional problems (in both its actual and potential manifestations) as a relevant factor in strategy-design, the less probable will be their appearance as a matter of prior concern for policy in more advanced development stages.

Implicit in this hypothesis is the belief that environmental (ecodimensional) concern and the need for accelerating the process of development as we have defined it before, are not <u>necessarily</u> incompatible. And whenever trade-offs appear as inevitable, their solution should be approached, in any case, as the result of a conscious evaluation.

The same neglect of this environmental dimension is found in

Siebert's model. Apart from his mention of land as a productive factor (see note 23) and from a brief reference to natural resources as an immobile factor and thus, as an element that could induce (and that has historically induced) permanent growth differentials, the ecodimension is completely absent from Siebert's formulation.

Even if we accept the ecodimensional problems as being properly represented or expressed by the concept of 'externality' (31), the inclusion of external economies in the model (which, in any case, is limited to the author's verbal argument and thus, not formally expressed) is done in terms that do not allow an adequate treatment of such problems (32) as eventual constraints to economic development at both the regional and national levels.

NOTES

(1) As Friedmann and Alonso recognize however, in the last few years the regional planning issue has also been subject of increasing interest in Latin America, Africa and Asia (FRIEDMANN and ALONSO, 1975; pg. XIX). It must be emphasized that in any case, this increase in the interest around this subject has not been yet accompanied by an equivalent increase in new theoretical contributions.

(2) Friedmann's approach goes beyond the purely economic interpretation of the spatial phenomenon, addressing the attention to the development concept in broader terms.

(3) While the assumption of firms being profit-maximizers, for instance, would imply the need for policy measures seeking the equivalence of profits maximization and social optimum in terms of location, the assumption of 'satisficing' firms would probably require simpler and perhaps direct administrative controls in order to cope with location decisions which do not strongly respond to monetary incentives or desincentives (CABLE, 1966).

(4) Spontaneous firms in this sense refer to those units which locational decision is not taken consciously and therefore, non of the analytical factors belonging to 'pure' economics that may be used to estimate locational patterns, but to some extent stochastic methods, are applicable to them. The analysis of these firms' location should consider socio-cultural and political rather than economic factors as

basic conditionants . The relevance of this type of firms is likely to be higher the lower the degree of deployment of non-primary activities.

(5) Although Alonso interpretes the classical tradition mainly with cost (transport)-minimizing criteria, his criticism is also valid for optimization approaches in general (revenue- and profit-maximization).

(6) This specific feature does not imply inadequacy of the classical theory in itself, except for the fact that the analysis each individual firm makes of alternative locations in order to maximize some objective function, becomes more difficult and therefore, it is likely that only few possible locations would be considered.

(7) In terms of the advantages, this corresponds to the "failure to perceive peripheral investment opportunities" (FRIEDMANN, 1966).

(8) In this context, these points are related to the economic rather than to the geographical space.

(9) For an accurate discussion of the relationship between the ideas of economic and geographical polarized space, see HANSEN, 1967.

(10) Another strand in the analysis of the cummulative character of regional economic growth is represented by Kaldor's work, who departs from the theory of the export-base and explains the cummulative process by means of inter-regional differentials in the 'efficiency-wages' movements (KALDOR, 1970). Apart from some criticisms this approach is liable to in general terms (see, for instance, RICHARDSON, 1973; pg. 33), it seems rather irrelevant for the Latin American context insofar as the assumption that regional growth rates depend on relative wages becomes legitim only if it is also assumed that regions are in direct competition, which is hardly the case of any country of the region.

(11) Core-regions, being constituent elements of a hierarchical system, those located in the higher orders will present higher innovative potential and higher rates of effective innovations. In a situation where a primate system (as opposed to a rather continuous hierarchy of core-regions) is the salient feature, as in the case of Latin America, these differentials in development rates will be much greater.

(12) This should be regarded, however, as a different kind of pattern from that suggested by Williamson (WILLIAMSON, 1965). While the latter refers mainly to a convergence of regional income, the former must be interpreted in terms of spatial integration, which does not necessarily mean regional income convergence.

(13) It should be emphasized that the urban center (core) in the context of this theory is conceived, together with its relevant periphery as a complete spatial system and therefore, when speaking of urbanization, it must be understood as a process dealing with (or affecting), not a particular city or a complex of cities, but the spatial system (or subsystem) as a whole.

(14) Which disintegration is regarded as one of the most critical variables constraining the development of actually underdeveloped nations.

(15) The discussion of this section is mainly based on SIEBERT, 1969.

(16) The assumption of profit-maximizer locational decisions of individual firms being one of the strongest underlying the formulation under analysis.

(17) Being perhaps the most comprehensive single model that has been formulated in the regional economic growth field.

(18) Worth noting are the inclusion of some generalizations about the role of the transport sector, about the presence of polarization vectors, and the inclusion of the spatial diffusion of technical knowledge.

(19) "Minimum values of spatial characteristics which must be met for a firm to locate at a spatial point" (op. cit., pg. 13).

(20) A system of Thunen rings around population centers for agricultural activities; maximum-profit location approach for industrial activities; terciary activities follow the locational patterns of the former; and residential activities are located following the former and resulting in a hierarchy of central places.

(21) Notice that this formulation of growth determinants makes those partial theories stressing either the demand or the supply sides, particular cases of this approach.

(22) Despite the recognition of this feature, this factor is not considered as an eventual constraint in the process of economic growth, except as affecting the competitiveness of a relatively expanding region due to higher demand of this factor which, facing a rigid supply, would imply higher prices and thus, increasing costs.

(23) The higher the degree of institutional disfunctionalism and/or instability (typical of most Latin American countries), the sooner the assumption of a given social system would become inadequate or, in other words, the sooner the social system's characteristics - if unchanged - would become a constraint for further growth.

(24) Obviously, in this case, the 'required' changes should be properly directed and oriented in both time and space.

(25) Although the basic motivation for migrating is stated as a function of opportunities-distribution (in terms of income, rate and stability of employment, cost of living, availability of a oultural infraestructure such as educational facilities, social positions and amenities), the formal model is built over the assumption that wage-differentials would represent, in a proper way, the motivations of labour to migrate.

(26) Whether it is referred to labour, capital or even to technical knowledge. An increase, for instance, of capital's mobility (especially when referred to financial resources) may result in higher withdrawals of resources from the periphery into core regions. An increase in technical knowledge mobility, on the other hand, could result in the generation of higher unemployment levels in the periphery (especially when oriented towards primary activities in general and to agriculture in particular) and in higher rates of migration from the rural sector to urban areas of not only the periphery, but of the core regions as well.

(27) Implying the design of special programs that create expanded economic opportunities for the marginal population and explicit redistribution of real income in their favour.

(28) In this chapter we discuss this issue in general terms. In the following two chapters we will return to it in more detail and discuss the consideration given to the ecodimension in each of its functions by regional economics in general and, particularly, by these approaches.

(29) Environment, in this context, is referred to as equivalent to our concept of ecodimension, and 'environmental quality' is only partially applied in connection with problems of pollution and, to some extent, with congestion problems.

(30) Mainly those connected with the waste-assimilative function of this environmental dimension.

(31) Approach which is discussed, to some extent, in the next chapter.

(32) The author expresses that because technological external economies play a role only in static-equilibrium theory and in the discussion of pareto optimum, their relevance for economic development is questionable (op.cit., pg. 125). For a different appreciation of this issue, see our discussion of the concept of 'ecological gap' in Chapter 5, pgs. .

CHAPTER 4: THE ECODIMENSION OF THE HUMAN ENVIRONMENT AND THE ECODIMENSIONAL PROBLEMS

In the former chapter we stated that the ecodimension and its problems constitute largely neglected issues in the theory of regional economic development. Based on the analysis done in Part I, we also stated the need for its inclusion in the reviewed theoretical formulations so that they could become proper guidelines for the formulation of an explanatory model or framework, we will attempt in Part III.

As we mentioned before, we base our position of considering this environmental dimension a relevant element in the development process under the actual circumstances characterizing the Latin American countries, on the following propositions:

(i) The ecodimension constitutes a dynamic system of interrelated elements playing multiple simultaneous functions within the human environment.

(ii) There are functions played by the ecodimension over which underdevelopment itself exerts high pressures and that will not necessarily dissapear as development occurs (UNCHE, 1971).

(iii) Although pollution has appeared in relatively few concentrated areas within the whole region, to neglect its actual existence as well as the possibility of it to appear more widely distributed as growth occurs, imply the adoption of a strategy for facing the problem which efficiency in terms of long run resource allocation, is questionable to say the least.

The purpose of the next two chapters is then, to discuss the interpretation economics in general has given to the ecodimension and its associated problems and thus, to set the bases over which their explicit inclusion into a framework for development planning purposes at the regional level can be approached.

Although this and the next chapter deal with the same general thematic subject, i.e. the ecodimension, its problems and the regional development process, we have decided to break it in two chapters mainly because of the detailed treatment of the issues involved implies a rather long discussion (1).

In terms of the ecodimensional problems we have separated that of commodity-depletion (discussed in this chapter) from those of congestion and pollution (discussed in the next chapter).

This aggregation answers to two main criteria. The first one deals with the position these problems occupy in front of the spatial structure of the national human environments. While the depletion problem, and the role of the ecodimension as a commodity source in general, can be considered more as a conditionant than as a result of the spatial processes that have shaped the Latin American socio-economic spatial landscape, congestion and pollution correspond to problems strongly conditioned by the specific spatial patterns characterizing the national systems of the region.

The second criterion corresponds basically to a matter of relative urgency. The solution of the problems actually affecting a great proportion of important replenishable ecodimensional commodities and the attitude adopted in front of the depletion of non-replenishable ones (that, as we are going to discuss, conditions the appreciation of such - inevitable - depletion process as an ecodimensional problem or not) constitute strategic elements that will shape the development possibilities of most countries of the region. The solution to and, what is perhaps even more important, the avoidance of further congestionand pollution problems on the other hand, is very much conditioned by the type of development strategy adopted. In other words, while most of the depletion problems affecting the countries of the region require corrective actions that should be taken as a condition for achieving higher development rates, to a great extend the problems of pollution and congestion require pre-

ventive measures that should be integral part of the development strategies themselves. Obviously this does not mean that preventive measures in the former case and corrective ones in the latter are not needed. Rather, it should be considered mainly as a question of relative emphasis.

This chapter then, has been organized in three main sections. The first one defines the basic roles played by the ecodimension within the human environment and identifies the major problem associated with each ecodimensional function. The second section deals with the depletion problem and analyzes it both for replenishable and non replenishable ecodimensional commodities. In the final section we briefly rewiew the treatment this specific function of the ecodimension (i.e., as a commodity-source) has been subjected to by regional economic analysis in general, in an attempt to establish the way in which it could be introduced in a more comprehensive framework, starting from the formulations discussed in the previous chapter.

4.1 : THE ROLE OF THE ECODIMENSION

There are three major roles that have been recognized as the most important this environmental dimension plays in the attempt human communities make to achieve increasing welfare levels:

(i) it consitutes the primary source of materials, energy and other services man uses. This includes both intermediate productive inputs and final consumption commodities,

(ii) it also constitutes the 'sink' where man disposes of the wastes (matter and energy) derived from the productive activities he undertakes and from the consumption he makes of the commodities produced, and

(iii) it constitutes the physical space where man settles himself and

locates his social activity. Obviously, in practice this role cannot be dissociated from the previously mentioned ones which, in fact, condition the relative suitability of physical space for human settlement purposes.

The quality of being a 'life sustaining' system certainly constitutes an essential feature of the ecodimension which underlies and dominates the already mentioned functions. Indeed, the relevance of this dimension in terms of human welfare (and ultimately, of mankind survival) cannot be fully understood except with reference to this basic function. Therefore, the discussion of the roles mentioned above and of the problems associated with them, which are the subjects of this and the next chapter, will be based on the recognition of the overriding position occupied by the ecodimension's 'life sustaining' function.

The Ecodimension as a Commodity-source (2)

Man uses most of the superior form of the elements constituting any particular ecosystem (3) as resources for satisfying, directly or indirectly, his needs and wants. Some kind of producers and, in general, the superior levels of the consumers in the trophic webs constitute the main resources for man's needs of food and, to some extent (which has been decreasing through time) of clothing and shelter.

It is not only some particular elements of the ecosystems man uses as resources, but also functional segments of them as well as complete ecosystems in themselves. Soil, for instance, corresponds (with all its biotic and abiotic components as well as the particular relationships between them and thus, as an ecosystem in itself) to one of the most important ecodimensional resources. Another rather different role played by ecosystems as a whole is found in turistic, recreational and in general, aesthetic resources, which normally correspond to rather stable natural ecosystems (lakes, rivers, forests, etc.).

Minerals and organic compounds deposited in earth by slow geo-

physical and geochemical processes constitute another important group of resources man uses to satisfy his needs of material goods.

The processes of transformation, transport, consumption (4), and storage characterizing socio-economic systems in general, involve not only materials but also energy when is used to execute the different steps and actions constituting such processes. Apart from human energy (represented, in this context, by the labour force) it is the ecodimension that constitutes also the basic source of this element, through solar and physical energy (5). Normally, the latter is stored in the ecodimension in its potential form so that some kind of process must be applied to transform it into effective, available, energy. It is useful to distinguish between that potential energy stored in materials which transformation into effective energy implies physico-chemical modifications of the storing-materials, and that potential energy stored in (or effective but not available energy derived from) natural phenomena which transformation into effective (or available) energy implies the intermediation of mechanical devices not affecting the physico-chemical properties of the materials or elements involved in the process.

Among the first type we include that energy produced by the combustion, fission and fusion of the products of mining and refining processes, and which is transmited in solid, gaseous, liquid or electrical forms (KOENING, COOPER and FALVEY, 1971).

Among the second type, we include that energy (potential) existing in water level differentials which transformation into effective energy is done by means of hydroelectrical power plants; also that energy (effective) existing in air movements (wind), water movements (waves) and solar energy itself which availability is achieved by means of mechanical special devices.

Although the function of being a commodity-source is invariable in terms of it generic importance no matter the degree of development

a community shows, the relative importance of one type of commodity to another, experiences a great variability. In this sense, the general trend that can be attached to development or, more accurately, to economic growth (6) is an increasing importance of energy, minerals and organic compounds deposited in earth relative to the more directly consumable commodities constituting what we may call the 'current ecosystemic production'. This shift is due in general, to the increase in the consumption per head together with the technological characteristics that have accompanied this increase. As the per capita consumption increased, more sophisticated, rapidly depreciating and highly energy consuming goods have become an increasingly important proportion of the production sector. Besides, natural-based essential consumption commodities that, insofar as constituted current ecosystemic production, get a great proportion of the energy required for its synthesis directly from the solar energy, have been replaced for synthetic materials based on organic deposited elements (mainly petroleum) which production involves huge amounts of physical energy.

It is in the ways and intensity man extracts or uses the commodities provided by the ecodimension where lies one of the most important conflict-areas between this environmental dimension and the sociodimension. The more careless the technological responses given to it and the more disfunctional the social institutional framework in relation with the internal dynamics of the ecodimensional processes, the higher will be the probability of ecodimensional problems to arise from such conflict-area.

The Ecodimension as a Waste-receiver

When analyzing the ecosystem's function (see Apendix No. 1), we identify the processes of energy flow and materials cycling as being its generic characteristics. These processes, it should be said, are present no matter the level we adopt for defining the ecosystem's domain, even at that of the total human environment considered as a biophysical system.

The bio-physical and chemical principles governing these processes imply that man's productive and consumption activities generate variable amounts of material- and energy-wastes that should be somehow disposed of. Except for those materials and energy increasing inventories, and adding to those residuals generated in different stages of the productive process, final goods ultimately become residuals (COMMONER, 1971).

Man has in general three alternatives in connection with the wastes he generates:

(i) to process them and then to discharge a modified flow of materials into the ecodimension,
(ii) to directly discharge them into the ecodimension, and
(iii) to recycle such wastes by reintroducing them back into the productive processes instead of discharging them into the ecodimension.

Considering the two first courses of action, man is using the ecodimension's capabilities to cycle those materials useless to him. It is the rather limited character of this capability (without implying serious ecological disturbances) what gives rise to interdimensional conflicts and it is the answer man gives to these conflicts (in terms of spatial and temporal patterns of discharge, physical and chemical composition of the discharges, their volume, etc.) what could generate and has generated ecodimensional problems.

Again, the generic importance of this ecodimensional function is independent from the degree of development achieved by different communities. However, the relative importance of particular segments of the ecodimension and the demand exerted over their waste-assimilative capacity will vary with the level and patterns (technological and spatial) adopted by the productive and consumption activities of human societies. The general trend that is possible to observe is that the higher the degree of industrialization of a community, the higher is the volume of wastes particular segments of the ecodimension have to

absorve and the more difficult becomes their successful behaviour in this sense.

The Ecodimension as Space

The third function of the ecodimension we have recognized is that of serving as the physical space where man settles himself and locates his social activity.

In general terms, we may say that the location over this physical space of those elements constituting the sources of the two former functions determines, to a great extent, the suitability of different territorial areas for the settlement of human communities. Therefore, when speaking about the spatial function of the ecodimension, we have to consider these quality differentials as affecting in different ways the different requirements of space man has (residential, recreational, industrial, agricultural, etc.) and implying a conflictive relationship between the sociodimension and the ecodimension.

The main conflic-area that is possible to identify in this sense, derives itself from the correspondence that should exist between the patterns of social settlement and the quality of the space in which these settlements are located. The way in which different communities solve this type of conflict determines whether serious problems will appear of not in connection with this ecodimensional function.

It is possible to state that the higher the proportion of the population of a given community belonging to urban type of settlements and the higher the density of each settlement, the higher the probability of problems of space to arise will be. It should be recognized however, that space (this time as an element that separates different components of the social systems) will involve the presence of problems also within widely distributed or scattered patterns of human

settlement insofar as the connectiveness between such components constitutes an important welfare-creating (directly or indirectly) factor.

The Ecodimensional Problems

Given the principal conflict-areas implied in the use man makes of the ecodimensional functions already established, we will accept the existence of an ecodimensional problem whenever the situation and conditions of the ecodimension of a given community's environment imply a relative damage or loss to that community's welfare (and/or the welfare of any other related community) whether such loss is expressed in terms of economic, health , social, cultural or any other welfare-component. In order to limit the scope of this principle, three main qualifications are going to be established. First, conditions implying welfare losses are man-created; that is to say, the welfare loss is a result of a change in the existing situation of the ecodimension due to social activities undertaken by the affected communities themselves or by any other social group. Second, effective changes in welfare must be determined both in actual and future terms according to the welfare goal-image prevailing in the affected communities and thus, expressed by means of their own political mechanisms (7). Third, the relevant welfare concept to be used should correspond to one involving a long-term approach; the exact meaning of this qualification will be discussed later on.

Although we recognize the unitary character of the ecodimension in its multifunctional role and thus, the difficulty to distinguish in practice the problems appearing from each of the analytical conflict-areas mentioned before, we will associate to each one a particular kind of problem, which analysis will be done separately.

We will identify then the problem of commodity-depletion as affecting the first function mentioned before; the problem of pollution as affecting to or arising from the second function; and the problem of congestion as associated with the third one.

It must be emphasized however, that the effects of any problem belonging to any group will be felt throuth a decrease (actual or potential) of either the volume or the quality of the commodity-flows provided by the ecodimension. Differences existing between these groups are mainly due to differences in the mechanisms and processes by means of which such decreases are caused and, to some extent, to differences in the persistence of the flow-lowering effect. While in the depletion case, the decrease in the commodity-flows are rather permanent due to the relative irreversibility of the phenomena causing it; in the cases of pollution and congestion, such decreases can be considered as temporal, unless they provoke intermediate effects leading to much more permanent ecological conditions (in which case, they could be considered within the commodity-depletion group).

4.2 : THE COMMODITY-DEPLETION PROBLEM

The commodity-source function played by the ecodimension gives ground to a special chapter in the analysis of ecodimensional problems in general, which has traditionally been indentified with those environmental (ecodimensional) problems connected with the management of natural resources. The United Nations Economic Commission for Latin America (ECLAO stated in a recent report this problem -area as a crucial one when facing the region's need for accelerating its development rate. It establishes:

> "Most processes affecting the natural resources-component of of the environment (8) constitute old problems and to them it has lately added - as in the case of large urban centers - the effect of the greater speed of changes connected with the acceleration of the development process.
>
> "The general orientation of the social and economic development of the region has been characterized in the last decades by a strong emphasis on industrialization oriented towards manufactured goods import substitution. It is not therefore, strange, that in centers of industrial deployment and in their surrounding regions, profound changes in the relation man-environment have been experimented. In spite of, with only few exceptions, primary activities tend to lost importance, whether such activities are based on mining, fishing, forestry or agriculture, they still constitute the major employment source and, in many

> countries, the principal income-generating activities. There are many problems in common but, at the same time, great differences due to the different importance the primary sector has and thus,to the different policies adopted for its development. The natural resource base decay is, in some cases, the result of the persistence of anachronic exploitation methods in front of a changing social and economic situation. In other cases, it has resulted from the difficulty for assimilating new systems and practices. To the former, it may be added those problems created by the urban and industrial expansion, such as directs effects of contamination, occupation of agricultural sites, amenity requirements, etc. "
> (ECLA, 1976; pg. 61)

We have aggregated those problems that derive from this area, i.e. those connected with the management of natural resources, under the generic denomination of commodity-depletion problems.

The wide range of different kind of commodities the ecodimension provides, which could be subject of depletion processes, demands some classification to be made. The first and most obvious distinction is that between replenishable and non-replenishable commodities. Both kinds of commodities present not only differences in the way depletion may occur, but also in the way the latter affects the levels of social welfare.

By non-replenishable commodities we understand those which total availability is fixed and invariable or that, being subject to some kind of regeneration processes, these are so slow to be considered as meaningful in human-time scale. Replenishable commodities, on the other hand, are those which use or consumption does not necessarily mean that less amount or lower quality remain for further use or consumption. When the commodity is physically consumed, its replenishable character is due to the fact that it is able to regenerate itself at rates enabling a permanent, constant or increasing, equivalent-flow of extraction by man. Examples of this type of commodity are fish, forest products and the like. In the case of the commodity being a service provided by a segment of the ecodimension (and thus, not physically consumed), its replenishability is due to the fact that the segment (which we will call 'ecodimensional capital') providing

such service is not subject of irreversible (9) depreciation created by the use of its services. Examples of this type of commodity are amenity resources in general, non-withdrawal uses of water resources, et, (10).

Obviously the replenishability of any commodity is a relative concept that must be referred to the way in which man uses it. If, for instance, typical non-replenishable commodities like minerals, are used in such a way that implies perfect recycling possibilities (11), they will become replenishable and would allow increasing flows until the whole availability of them has been transferred from its deposited (ore) to its actual useful condition; from that point onwards, the flow of services such commodities would provide will remain constant and therefore, still satisfying the stated condition of replenishability (12).

On the other hand, typically replenishable resources like fish, forests or aesthetical resources provided by rather stable ecosystems, could become non-replenishable commodities if the rates of extraction in the first two cases are persistently higher that the rates of regeneration so that the species will be finally extincted (13) or if the capital providing the latter type of commodity is fully depreciated either because of the way in which its services are used or because of side-effects of other human activities indirectly connected with it; and in these cases, such depreciation may be considered as completely irreversible.

The Depletion of Non-replenishable Commodities

Insofar as any positive flow of extraction and use of a given resource under this category will imply that there will be less left for the future, the welfare problem associated with the resource depletion must be approached in an inter-temporal basis. The most common way in which the depletion problem is presented corresponds to the question of what will be the optimal allocation between different periods of time of a finite, exhaustible, stock of resources ? The main

line of argument has been established by welfare economics and, although there existe some sophisticated treatments to this issue, we may simply state it as follows.

In a world behaving under the assumption of perfect competence (14), the market will secure an optimal allocation of the resource over time (PEARCE, 1976). The main intervening factors that guarantee this optimum to be reached are the price of the resource in question and its behaviour through time, the respective marginal costs of extraction, and the interest rate at which the flow of benefits is discounted. The conditions for achieving the optimum are represented by the following expression:

$$(4.1) \quad B_o = B_1 (1 + r)^{-1} = B_2 (1 + r)^{-2} = ... = B_n (1 + r)^{-n}$$

Where B_t is the net marginal benefit generated by the resource's exploitation (its price minus the margina costs of extraction) in year t, and 'r' is the equilibrium-market interest rate, which in this case represents the social rate for discounting the future and thus, the care present generations give to future ones. Underlying this condition is the assumption that the exploitation is undertaken following a profit ('royalty') maximizing criterion.

Starting from this, considered 'ideal' situation, most of the controversy around the economics of resource depletion has been centered on the anlysis of those conditions existing in the real world which would imply biased deviations from the 'ideal' exploitation rates. However, no agreement has been reached on whether the resources are actually being exploited too fast or too slow (15).

Among the sources of bias, the most frequently found in the literature on the economics of resource depletion are:

(i) Existence of monopoly in the extractive industry. The presence of considerable profits earned by resource owners even when the glo-

bal stock of such resources is still high relative to its current consumption levels, reveals the existence of monopoly. Under these circumstances and specially when the resource has inelastic demand, we may expect under-exploitation to occur (PEARCE, 1976; KAY and MIRRLEES, 1975).

(ii) Uncertainty about future conditions. The non-existence of forward markets and of contingent commodities markets (16) implies that actual decisions about rates of exploitation and sales must be based on the owners' own estimates about future prices of the resources and also that different attitudes in front of the risks involved in any decision taken under these circumstances would imply different rates of exploitation. It has been frequently suggested that the economic system will react in front of expected future shortages by raising its price. If the price increases are expected to continue, this would cause the holders of the resource to hold stocks off the market and buyers to economice on its use generating at the same time a process of more intensive search for substitutes. The appearance of effective shortages would be delayed and the higher prices would imply a relatively smooth transition to the use of substitutes when the stocks of the resource in question run out.

Nevertheless, such a behaviour of the trading parties is by no means automatic but will depend on the exact ways in which price expectations are formed and on the degree of risk-aversion characterizing each of the market agents. Although there is no complete agreement in the precise outcomings of these circumstances affecting non-replenishable resources' markets, some theoretical ground exists to believe that, in general, uncertainty would tend to rise the depletion rates (17) and therefore, the resources would become overexploited as compared with the 'ideal' optimum exploitation rates (see, for instance, HEAL, 1975).

(iii) Taxation schemes affecting the resource exploitation. There are two ways that has been recognized as affecting the rates of deple-

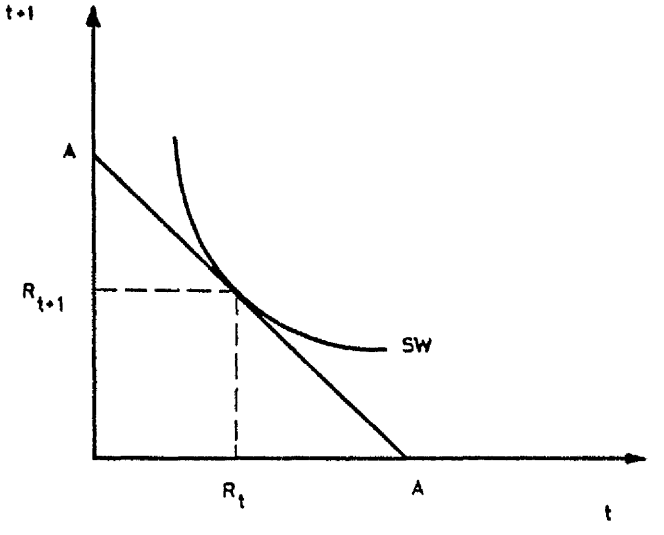
tion and both of them imply a trend towards underexploitation. If the governments of either the producer or the consumer country impose revenue-raising taxes on the use of the resource, the effect will be equivalent to increasing the degree of monopoly in the resource exploitation. If the taxation scheme is assumed applied at a constant rate over time without any discrimination on the type of activity held by the extracting firm, but over the general firm's profits, the effect would be to depress exploration and development expenditures. Obviously, more complex taxation structures taking into account these effects would smooth this bias towards underexploitation (KAY and MIRRLEES, 1975).

(iv) The rate of discount and neglect of future generations. The 'ideal' optimum depletion rate is based on the assumption that the rate used for discounting future profits (the interest rate) presents no differences whether it is privately or socially considered. It has been widely accepted however, that the private rate of interest diverges from the social one, the former being in general higher than the latter (18). Therefore, the decisions taken by accomplishing the criterion of equalizing the present value of the benefits obtained in each period untill the resource is exhausted would imply overexploitation.

Unless some criteria are accepted for discriminating between resources conservation and other kinds of investment and thus, to apply lower discount rates to the former, the argument given before is rather contradictory. If we have an across-the-board reduction in the rate of interest (so that it becomes nearer to the social rate) the rates of investment in general would be greater and consequently, the growth rates of the economy will be higher. This will have not only an effect over the rates of resource exploitation (its prices will tend to increase), but also over other ecodimensional demands (pollution would tend to be higher).

(v) Pollution and the materials balance. Insofar as perfect recycling is impossible, the consumption of a given flow of non-replenishable

(a) Non-recyclable Resource



(b) Recyclable Resource

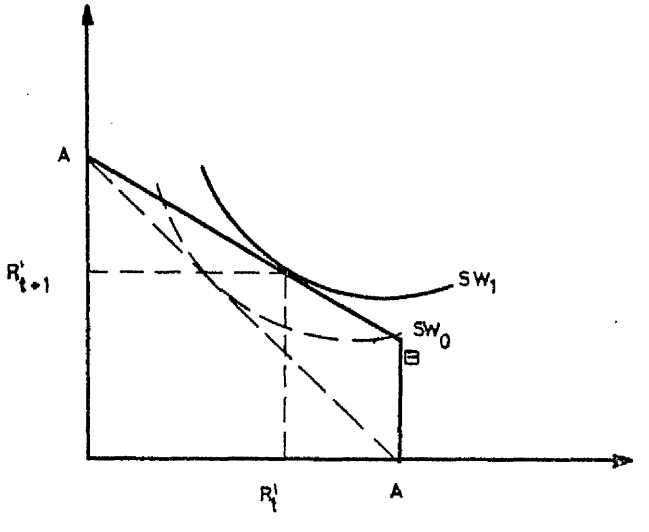


FIGURE N° 4.1: NON-REPLENISHABLE RESOURCES. INTERTEMPORAL 'OPTIMALITY'

resources will imply a positive amount of wastes and thus, the higher rates of exploitation the higher will be, ceteris paribus, the pollution rates. The external economic character of pollution, results in divergences between the private costs considered in the decision of how much of the resource to exploit and the effective social costs derived from the activity. Therefore, the neglect of pollution effects would result in overexploitation of the resource as compared with the 'ideal' optimum rates.

The high level of abstraction and globality of the former approach could imply misleading normative guidelines in the establishment of optimal depletion rates, especially when considering this problem at the national level and within the context of developing nations. Therefore, it seems convenient to discuss some of the premises and assumptions underlying the already described analysis and its applicability at the level and within the context we are interested in.

In first place, it is the relationship assumed between the resource exploitation, its consumption and the welfare levels derived from the latter. We may express the condition for optimality stated before, by means of the following figures (Figure No. 4.1).

Where 'R' corresponds to the resource levels of use and 'SW' represents the social welfare function in the form of indiference curves between actual and future consumption. Figure No. 4.1a shows the case of a non-replenishable non-recyclable resource; Figure No. 4.1b corresponds to a case where recycling is possible up to some extent. Obviously, the curves AA and ABA are the transformation functions representing the possibility frontier of the resource's use between both periods. It is easy to demonstrate that the point where 'SW' is tangent to 'AA' satisfies the condition

$$(4.2)\quad \dot{P}/P = r$$

That is to say, the rate of increase of the resource's price must be equal to the rate of interest (19).

Facing the welfare situation of the national community of a developing country (20) that exports a high proportion of the resource being extracted, the question of whom the 'SW' function represents to, arises immediately if the correspondence between the graphical and the algebraic expressions of the optimization problem is to be maintained.

If we assume that the resource owner country does not consume or use the resource at all, but sells the whole production in the international market, the price of the resource will correspond to the marginal valuation the buyer communities give to it and thus, the social welfare function will correspond to that of such communities. Unless we assume both the buyers and sellers having the same scale of preferences (21) and an equilibrated situation in all markets, operating under perfect competence, the accomplishment of the condition $\dot{P}/P = r$ will be sub-optimal from the owner's point of view.

Accepting the consumption levels as a reasonable approximation of the national community's welfare, then the optimality of any depletion rate from the latter's viewpoint must be determined by the actual and future consumption allowed by the benefits of the exploitation activity. The analysis becomes then far more complex because we must include the possibility of capital accumulation and changes in the overall economic structure, together with the trends the income terms of trade (import capacity) would experience.

The main outcome of this approach is that there is not a single optimal depletion rate for any given non-replenishable ecodimensional resource, but a variety of different rates depending on economic, social and political conditions existing in the countries where such resources are located in and on the relationships implicit in the trading movements between the producer and the consumer countries.

If we consider the optimal depletion rates as being established on the bases of each owner country's welfare considerations, we may find that in most resource-rich developing countries there is a great

variety of elements pushing up the exploitation rates considered as optimal. In general, they act by jeopardizing either the net financial returns of the resource's exploitation and/or its efficiency for securing higher and self-sustained growth rates of the community's consumption levels. The strength of these pressures is greater the more elastic the demand for the resource is, and the more weak each individual country is within the market (being the weakest position that one of the country completely acting as price-taker).

The fact of a given resource being exploited and commercialized by agents from abroad with little knowledge of national agencies about the mechanisms and possibilities existing in the international markets represents one of the strongest examples of this kind of pressure. Usually this situation implies that the resource is sold in markets characterized by very hard monopsonistic conditions and thus, implying relatively low prices as compared with those that otherwise would prevail. The quantities demanded by the country that controls the resource tend to be comparatively high insofar as it consumption involves a net transfer of real resources from the 'owner' country. The rather limited range of action the latter has for increasing the total receipts coming from the resource's exploitation, which are mainly due to taxes applied on the activity's profits, implies on the other hand, the tendency for promoting higher depletion rates by giving special tributary treatment to investments in the exploration and development of new deposits.

As we mentioned before, the maintainance of rather high (and invreasing) 'optimal' rates of depletion in developing countries also results from existing conditions in the overall structure and function of the national economies, implying low efficiency of the resource's revenues to promote increasing and self-sustained consumption levels (development in general) on a generalized distributional basis.

Worth noting in this sense are the structural conditions existing in the agrarian sector. Insofar as an increase in the levels of

per capita income is accompanied by redistributive (progressive) measures, the population pressures over renewable resources derived from relatively high rates of demographic growth will be further increased (22), generating or accelerating the depletion processes already affecting such resources (23), especially those of agricultural soils. The rigidity of the agrarian sector for responding to higher demand would imply in the short-term the need for importing the basic goods it otherwise should provide, and the mentioned depletion process affecting the ecodimensional sectoral capital would imply serious limitations in the long-term to overcome such insufficience. In order to avoid increasing balance of payment problems, the pressures pushing upwards the 'optimal' rates of depletion would increase.

Insofar as higher proportions of the resource exploitation revenues are used to finance current expenditure, the less will be the possibilities of the national economy to increase its overall productive capacity and it will become not only more dependant on investment and credits from abroad, but also its reliance on the exploitation and export of the resource in question, as raw materials, will become greater.

The former discussion places the problem of assessing the optimality of actual and foreseable rates of depletion of non-replenishable resources in a different perspective. Considering the issue of inter-temporal resource allocation and its connection with intergenerational equity, it is quite clear that, insofar as there is a significant proportion of the known reserves of non-replenishable resources within the boundaries of developing countries, it is rather irrelevant to try to evaluate actual global exploitation (depletion) rates by comparing them with global 'ideal' ones which optimality is based on benefits maximization criteria having no correspondence whatsoever with real conditions and that make dubious its usefulness even on purely academic grounds

As we mentioned before, the conventional approach states for instance, that the existence of monopolistic powers would imply depletion rates below those considered as 'ideal' and therefore, underex-

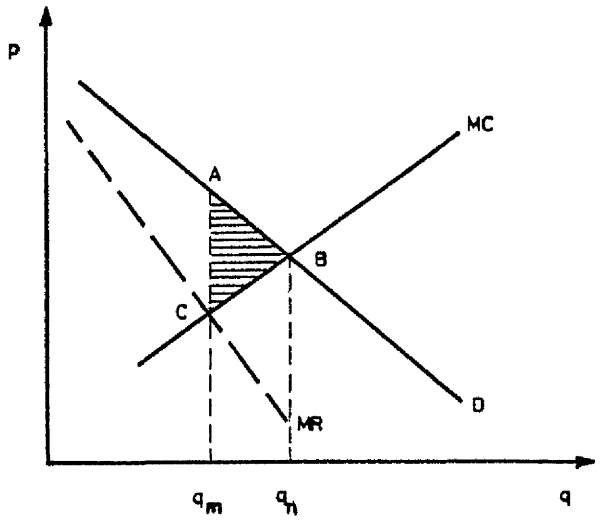


FIGURE N°4.2: NON-REPLENISHABLE RESOURCES
MONOPOLISTIC EXPLOITATION LEVEL ('SOCIAL LOSS')

ploitation of the resource. It follows that the correction of such imperfection in an otherwise competitive market would result in a more efficient resource allocation over time by approaching the actual rates of underexploitation towards the ideal ones. The overall welfare level (both present and future) will consequently increase. That this has not to be necessarily the case is possible to appreciate from our following discussion.

Let us assume that the monopolistic conditions are due to the association of developing producer-countries that jointly control (24) a significant proportion of the total current supply and known reserves of a certain non-replenishable resource. Assume also, that the world demand for this resource (mainly coming from industrialized countries) is rather inelastic with respect to its price due to technological restrictions and to the non-existence of near substitutes within a wide range of possible prices under such restrictions. Let us further assume that the monopolistic national industries (and the industry of the association as a whole) are profit maximizers having the same cost structure, that the extraprofits due to monopoly are used for capital accumulation purposes within the producer economies (25), and that the consumer countries use the resource as an input for consumption goods internally consumed.

The industry, facing a decreasing demand function, its marginal revenue will be below the marginal valuation the consumers make for the consumption of the resource and therefore, the maximization of the firms' profits will occur at an output level that is lower than the optimal one 'from the point of view of the economy as a whole'. This argument is graphically shown in Figure No. 4.2, where 'q_n' corresponds to the 'optimal' output and 'q_m' to the output that maximizes the industry's profits. The shaded area would represent the 'social loss' due to monopoly (26).

In connection with this social loss, there are at least two observations we must make. First, it assumes that the reduction of the output level from 'q_n' to 'q_m' is not compensated by an equivalent in-

crease in the production of any other good (27) and therefore, the economy as a whole is shifted from a position on to a position within its production-possibility frontier. However, even in a situation of equilibrium in the rest of the market, we may think of the governments (who are the monopolistic powers in this case) as having behavioural patterns other than those purely maximizing profits. For instance, it is reasonable to assume that the governments are interested in redistributing incomes and that they may use the resources coming from the reduction of the non-replenishable resource exploitation activity to increase the health conditions of the population, by improving or establishing free health services (28).

Apart from the gains in welfare due to the valuation of non-economic benefits derived from the absence or lower frequency of diseases, this reallocation of real resources would lead to short-term and long-term increases in the average productivity of the labour force by diminishing the absentism due to illness and thus, to an increase in the developing country's productive capacity (29). The final effect in terms of the social loss, represented by the area ABC in Figure No. 4.2, will depend then, on the productivity of the resources reallocated in the health sector as compared with that of these resources in their previous occupation, weighed by the respective valuation each community gives to the results derived from each allocation. It is reasonable to think that in this case, the gains in welfare within the developing nations could be even greater (in absolute terms) than the lost of welfare in the industrialized countries mainly due to the multiplicative effect of the resources' reallocation in the overall productivity of the former. Although it is highly difficult to evaluate and compare the changes in the welfare situation between these two groups of countries, we may state at least, that the existence of a monopolistic situation in the non-replenishable resources market under these circumstances would not necessarily imply its underexploitation in terms of the world's actual welfare achievements. It is clear however, that a redistribution of welfare from the industrialized to the developing owner countries is likely to occur.

The distributional effects of a situation like that being analyzed is not restricted only to the real income redistribution due to reallocation of productive factors. There will be also an increase in the transfer of financial resources represented by the increase of the monopolistic extraprofits derived from the reduced output in conditions of a rather inelastic demand. Such an increase is shown in Figure No. 4.3 by the shaded minus the dotted area (30).

Again, it will depend on the way governments spend or use such additional financial resources whether the actual global welfare levels will be reduced at all, and if an eventual transfer of welfare from present to future generations will or will not imply a net loss.

A similar discussion can be done with respect to the other kinds of imperfections mentioned earlier. In the case of pollution effects derived from the disposal of wastes remaining once the non-replenishable resource has been consumed, which would imply over-exploitation insofar as these external effects or diseconomies are not considered, one may also argue that the suggested intertemporal inefficiency must be concluded as effectively occurring only after a careful analysis of the specific circumstances under which the phenomenon appears. If, for instance, a reduction in the exploitation rates in order to avoid higher pollution levels in the consumer country implies that the producer country becomes unable to promote a modernization process in its agrarian sector so that the depletion process its renewable resources are subjected to cannot be reduced, the final result of the original measure in the welfare possibilities of future generations becomes much less self-evident that what the orthodox analysis of the resource depletion problem suggests.

There are two main issues in the analysis we have done so far that seem necessary to emphasize: first, there is no sucha thing like a determinable, unique, global optimal depletion rate of any resource that could serve as a normative guide, at least when the optimum is referred to as implying the highest achievable welfare levels as possible on an inter-temporal basis. This is so because there is no way

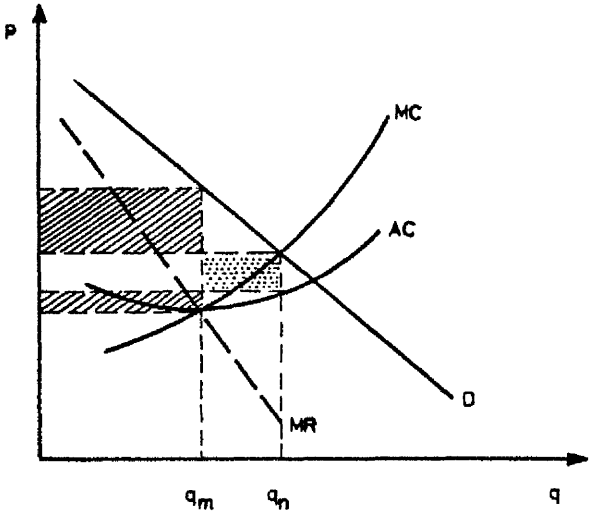


FIGURE N°4.3: NON-REPLENISHABLE RESOURCES
MONOPOLISTIC 'EXTRA PROFITS'

for even simulating conditions of perfect competence and equilibrium at a world wide level that allows the establishment of the optimal rates by means of marginal adjustements so that the conditions for optimality are fulfilled. It may be argued however, that this limitation affects the optimization problem not only at this level, but at any level of reality and thus, the theory underlying the analysis has no practical relevance at all.

That this is not the case is derived from our second issue, i.e. the function of the world's political system implies that subsystems' optimization (or satisfaction) becomes the rule (represented by national or in some cases, even lower levels of aggregation), as a result of the practical impossibility to establish a generally accepted social welfare function to be maximized (or given values of which to be satisfied) at the level of the system as a whole, and to the absence of mechanisms to impose any estimate that could be attempted in this sense, if a reasonable and unbiased estimate were feasible at all.

It is at the national level instead, where we may find the possibility to establish some sort of compromise-function (31) to which maximization (or satisfaction) we may refer the internal consistency of different actions affecting different social and ecodimensional variables, and the value of different alternative, internally consistent, sets and sequences of actions.

Insofar as the exploitation of this type of resource is controlled by the community as a whole through the political authorities, the 'optimal' rates of depletion will or must be determined as a result of and within concrete development strategies designed to satisfy given values of determined social welfare functions. Under these circumstances, such rates will depend on both endogenous and exogenous elements with respect to each nation's developing planning process.

In general, the lower the price-elasticity of the demand each producer country faces and the higher the income-elasticity of the glo-

bal demand, the greater the relative importance of endogenous factors in the determination of 'optimal' depletion rates will be and thus, each country will have more degrees of liberty to design its development strategies. Nevertheless, there are two major exogenous (32) elements that must be accounted for in the determination of both the 'optimal' depletion rates and the specific role (33) the resource plays within any development strategy, especially when a long-term perspective is adopted: the situation of the world's reserves of the resource as compared with the trends of its consumption, and the possibilities of technological changes implying the resource's substitution (34) and/or higher rates of recycling.

So far, we have discussed the depletion problem in the context of developing economies assuming that these own a significant proportion of the world's known reserves. It is unlikely however, that any single country could be self-sufficient in the provision of the non-replenishable resource requirements derived from different alternative development strategies. Even in the case of a whole region (Latin America, for instance) that may possess a wide variety of resources, the fact that the rates of exploitation are determined by each individual country's own welfare considerations, makes that the mentioned exogenous elements become highly relevant in the selection between alternative development strategies implying different roles assigned to and requirements of such resources. From this point of view, the optimization of depletion rates presents a strong case in favour of the economic integration of the regional communities.

Later on we will consider a very important issue connecting the problems of strategy-selection, of determination of 'optimal' depletion rates, and of the uncertain behaviour of the exogenous factors any single country or region must face: the relationship between non-replenishable resources' depletion and the development and protection of replenishable resources.

The Depletion of Replenishable Commodities

It is in connection with replenishable commodities where the issue of resource management in its physical context becomes a relevant factor. While in the case of non-replenishable commodities, the management problem in general can be established in terms of deciding the rates of exploitation that could be considered as 'optimal'; dealing with marketing issues; and managing the yields of such an exploitation so that the whole national community benefits on a long-term basis, in the case of replenishable commodities not only the former aspects should be considered, but also the management problem must be addressed to deal with the structure and function of those ecodimensional segments providing the respective commodities.

The exploitation of a particular resource, under certain circumstances, may affect the capability of the ecodimension to provide on a continuous and permanent basis any other resource or even the exploited one itself. Apart from the ecological difficulty to appreciate the full effects of a given action tending to use certain replenishable commodity (35), from an economic point of view, the problem may be seen as one involving trade-offs both along and across the time axis. The exact kind of the trade-offs will vary with the characteristics of the resource being exploited but in general, they will differ from that of non-replenishable resources in that in most cases such trade-offs become effective only above certain determinable possitive levels of exploitation, which in turn, are parameters that could be either enlarged or diminished by the action of man (36).

In order to analyze the general characteristics of these trade-offs and their consequences over the community's welfare achievements we have to distinguish between the concepts of ecodimensional capital and ecodimensional commodities.

By ecodimensional capital we mean in general those qualities the ecodimension has, which constitute the sources of commodities useful to man. Such qualities may be represented by structural characteris-

tics implying the possibility of different ecodimensional segments to perform certain functions or by given volumes of elements that at a certain point in time are capable of reproducing themselves at certain rates (37).

By ecodimensional commodities on the other hand, we understand the services and goods man actually uses to satisfy, directly or indirectly, his needs and that derive themselves from the existing ecodimensional capital.

While the capital concept involves the idea of stock, the concept of ecodimensional commodity constitutes a flow that in its material expression in normally transformed (physically or chemically) once it is used and thus, changes its usefulness to man.

According to this distinction we may interpret the depletion problem of replenishable commodities as being the result of depreciation processes affecting the ecodimensional capital and thus, implying a decrease in the flows derived from these assets.

The characteristics of these depreciation processes will depend on the kind of capital we deal with, being possible to aggregate them into two main categories: ecodimensional capital depletion and ecodimensional capital degradation.

The first category is referred to depreciation processes affecting the size of given populations (whether they belong to the consumer or to the producer levels of the ecosystem's structure) and thus, diminishing the capability of initial stocks to provide a sustained flow of individuals representing the economic commodity. In general, a decrease in the total population of a given commodity-species will represent a real ecodimensional problem (a depletion problem) insofar as it constitutes a secular trend so that the final situation in absence of corrective measures would imply the species' extinction. It is therefore, allowed some degree of cyclical fluctiation around rather stabilized populations without referring to this situation as an eco-

dimensional problem.

The second category represents man-induced changes in both the structure and function of ecodimensional segments so that the flow of services and/or goods they render of supply to the community suffer from permanent deterioration which could be expressed either in quantitative or in qualitative terms.

On the other hand, there are two main kinds of action through which man can generate depreciation processes over the ecodimensional capital: overexploitation and mismanagement.

Apart from what we may call straightforward consequences following rather simple cause-effect patterns, there are some cross effects appearing at each step of the sequence 'original cause - (intermediate phenomena) - capital depreciation - welfare results' that makes more complex the analysis of the depletion problem in general and the design of corrective measures. In Figure No. 4.4 we summarize the most relevant analytical lines involved in this issue.

As we mentioned before, although pollution and congestion correspond to intermediate phenomena within the chain of actions and reactions finally resulting in depletion problems, we are going to analyze them separately as an especial kind of ecodimensional phenomena (38). The rationale of this division lies in the peculiar character of the sociodimensional sources leading to overexploitation and mismanagement of the assimilative and carrying capacities of different segments of the ecodimension when performing the functions of waste-receiver and space respectively.

One of the major problems in connection with stock depletion that we can find in most countries of the region is the problem of forest devastation. As we are going to see later, its importance in not only due to the lowering effect it has over the flow this capital would be able to generate, but also because it constitutes an important factor

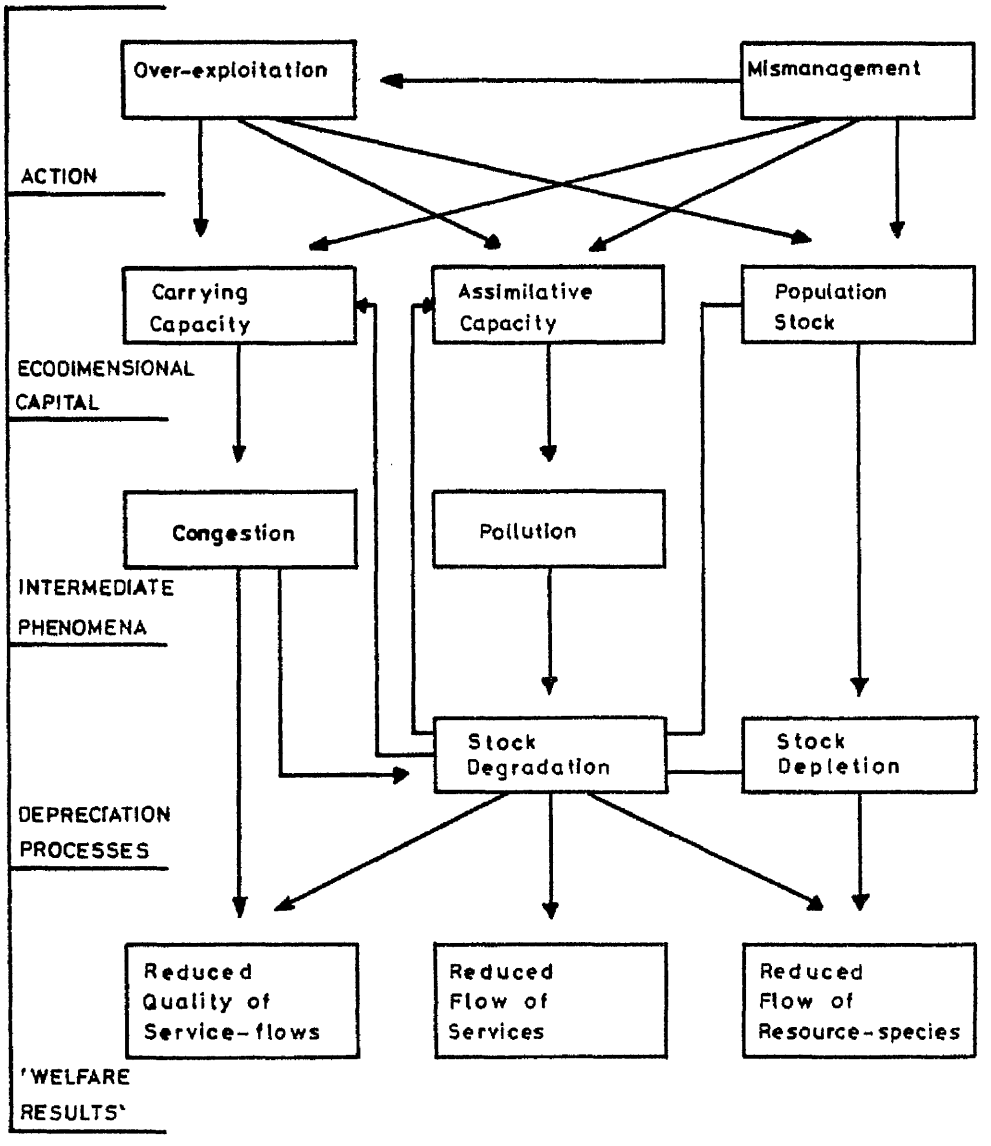


FIGURE N°4.4: REPLENISHABLE RESOURCES
DEPRECIATION OF ECODIMENSIONAL CAPITAL

in the acceleration of soil-loss rates.

In Table No. 4.1, we summarize some indicators about the problem of forest devastation that has been found in several countries.

Although the information is not organized on an homogeneous basis, and does not cover the whole region, it gives an approximate idea of the relevance of the problem.

In relation with stock degradation, on the other hand, the greatest problem registered through the whole region is that of terrestrial ecosystem's degradation represented by soil fertility losses due to erosion and other geochemical processes. In Table No. 4.2 it is contained some information that gives a general approximation to the magnitude of the problem.

As it is shown in Figure No. 4.4 before, these problems could derive from mismanagement and/or overexploitation of the ecosystems' carrying capacities. Typical examples of overexploitation of the carrying capacity are the overgrazing and overstocking of rangelands that cause soil compaction, increasing water run-off and consequently, accelerating land erosion. The capital asset represented by such rangelands is depreciated and its capability for supplying given flows of resource-species is reduced. In Figure No. 4.5 we represent this phenomenon by means of a graphic.

In it, $\overline{P}$ represents the natural or original carrying capacity of the rangelands ecodimensional capital; R, represents a function relating actual species' stocks with time; and CC corresponds to a function representing changes in the value of the carrying capacity in terms of the species' individuals. The ecological processes (erosion) occurring when the actual population maintained in these ecosystems surpasses their carrying capacity is represented by a change on this factor from its parametric condition to a variable one, showing a decreasing behaviour. If the rangelands' carrying capacity is to be stabilized in the long term, the resource-population stock must be kept

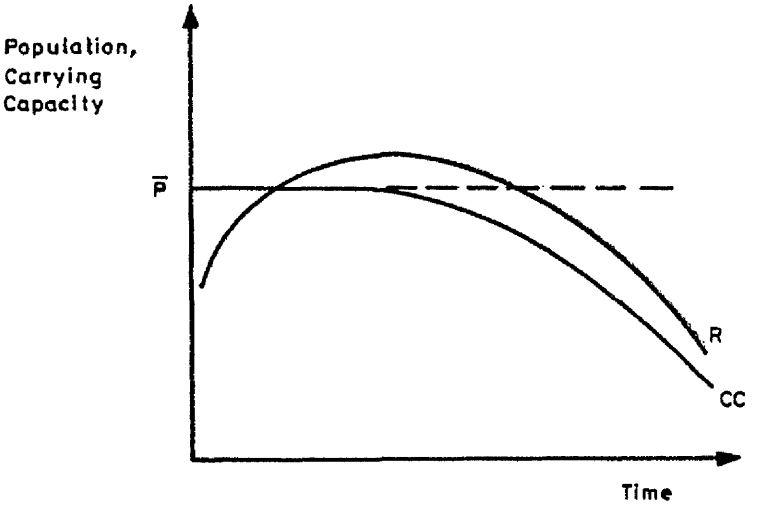


FIGURE N°4.5: OVERUSE OF ECOSYSTEMS' CARRYING CAPACITY

TABLE No. 4.1: FOREST DEVASTATION IN LATIN AMERICA

CHILE: Total Forestry Land: 32 million ha. (42% of total surface)
Devastated Area: 8 million ha. (25% of forestry surface)
Rate of Devastation: 60.000 ha. per year

COLOMBIA: Forestry Land Surveyed: 7,4 million ha.
Devastated Area: 2 million ha.
Trend: continue without interruptions
Reforestation: 1% of annual destroyed surface

ECUADOR: Devastated Area: 50.000 ha.
Rate of Devastation: 10.000 per year (during 5 years)

MEXICO: Rate of Devastation: 350.000 - 500.000 ha. per year

VENEZUELA: Devastated Area: 10 million ha.
Rate of Devastation: 1 million ha. per year (last decade)

CUBA: In 1964 only 8% of the total territory was forest-covered.
This is far below the needs for protective purposes.

Source: ECLA, 1976, based on studies for each country: Chile: CAPURRO 1970; Ecuador: SERRANO and DURANGO, 1974; Mexico: VELASCO and MOQUEL, 1973; Venezuela: LOPE-BELLO, 1974

TABLE No. 4.2: SOIL LOSSES IN LATIN AMERICA

CHILE: Eroded Area: 62% of total agriculture forestry area (25% of total territory)
Serious Erosion: about 20% of the eroded area

COLOMBIA: Eroded Area: 30% of the 'Sabana Bogotana' (best agricultural land of the country). Serious erosion
Rate of Loss: equivalent to 30 cm. of soil in an area of 160.000 ha. per year.

ECUADOR: Serious Erosion: * affecting the 'Sierra', interandean zone and its flanks, and the head of several rivers (Jubones, Portoviejo, and Guayas); also affecting in different degrees the coastal zone.
* 'Desertification' and Aridization in Palmira desert, provinces of Chimborazo and Loja.
* Laterization, areas of province Esmeralda, near to the mountains.

MEXICO: Eroded Area: 72% of the agrarian surface (100 million ha.)
Rate of Loss: 150.000 - 200.000 ha. per year

VENEZUELA: Eroded Area: 12,5 million ha.

CENTRAL AMERICA: Rate of soil degradation: about 1 cm. of soil is lost each year, affecting mainly the tropical dry belt.

Source: ECLA, 1976, based on studies for each country: Chile: PERALTA, 1974 and ELIZALDE MAC-CLURE, 1970; Colombia: MARULANDA, 1973 and QUEVEDO, 1969; Ecuador: SERRANO and DURANGO, 1974; Mexico: UNCHE, Informe Nacional, 1972; Venezuela: LOPE-BELLO, 1974; Central America: ICAITI, 1974.

correspondingly lower. This decrease in the population stock will occur as the result of a deliberate action or as the result of 'natural' checks (mainly acting through the death rates). The smooth form of the 'R' curve in Figure No. 4.5 represents in general the latter case. Deliberate actions will be represented by a discontinuity of the 'R' curve implying a jump downwards. This kind of behaviour could be present also in the case of the 'natural' checks, when the size of the reducing stocks becomes lower than the biological thresholds characterizing the reproductive capabilities of different species. The biological threshold of a species-population may be trespassed by the joint effects of the decreases (or decreasing) carrying capacity and of the kind of exploitation the population is subject to. When this situation is present, the management of the involved population becomes a key element in any strategy seeking for the conservation of the economic relevance of the resource. Later on we are going to return to the management issue; what is important to emphasize at this stage is that given practices of management and exploitation that could have been adequate may become dangerous for the resource's preservation when the ecosystem's carrying capacity is changing. A deep Knolwledge of the affected populations is required because the mentioned thresholds vary with the "genetic make-up of the species, its habitat requirements and behavioural characteristics" (DASMANN, MILTON and FREEMAN, 1973; pg. 49).

The depreciation processes affecting this type of ecodimensional capital can be considered as almost irreversible. Recuperation of eroded lands' fertility (its carrying capacity, in more general terms) constitutes extremely slow process usually involving, at the same time, huge amounts of resources to be invested. Furthermore, once erosion has started, there are certain physical vectors (rain, winds, etc.) acting as propagating factors that will induce further erosion. Therefore, even if recuperation of already eroded lands were not attempted and social activities were hold within limits that would not generate further depreciation, investments will be necessary anyway in order to check the mentioned natural propagation vectors.

In order to analyze the mechanisms by means of which this pheno-

menon affects the intertemporal welfare situation of a community, let us assume that the mentioned natural propagation vectors do not operate.

In figure No. 4.6 we have drawn a transformation curve between the values for the carrying capacity in two subsequent periods that reflects the general patterns settled in our former figure, i.e. the stock will have no effects if it is kept below the carrying capacity and will deteriorate this capacity if it surpasses its original levels.

If we assume given fixed technological conditions and thus, do not allow for changes in the volume of the commodity-flows coming from different population stocks, each point of the transformation curve will represent a feasible combination of present and future consumption flows. Therefore, we are able to overimpose social welfare functions to our stated transformation curve.

Being possible to hold stocks above that represented by the ecodimension's initial carrying capacity ($\overline{S}_0$), the stock representing a paretian optimal situation over time will be held above such level whenever the community discounts future consumption. We have represented this behaviour in our former figure by means of the SW' welfare function. It is clearly shown that the level of welfare achieved by maintaining the stock at the carrying capacity levels (SW'_0) is lower than that possible to achieve is some degree of overexploitation of this capacity is undertaken (SW'_1). It is also clear that the more heavily the community discounts future consumption, the greater will be the degree of overexploitation the ecodimensional capital capital will be subject to. Overexploitation will not occur only if the rate of discount is zero (SW_0) or negative; in these cases the stock would be maintained at the carrying capacity levels.

The former analysis involves however, a short-term point of view insofar as we are considering a two-period economy. Extending the time horizon will change the whole result due to the cummulative character of the depreciation process affecting the ecodimensional capital

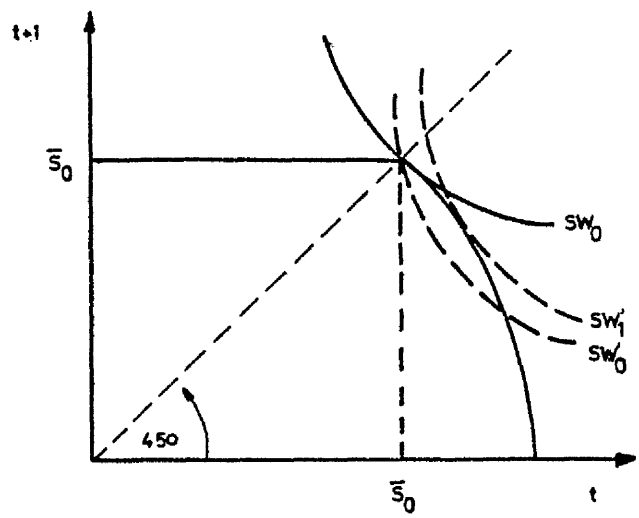


FIGURE Nº4.6: USE OF CARRYING CAPACITY. INTERTEMPORAL CHOICE

under analysis. In Figure No. 4.7 we add a third period that serves to show the trends the welfare achievements would follow.

If the utility function does not change through time, the maximum welfare level achievable between periods t+1 and t+2 will be lower than that achieved between period t and t+1 and so on.

By following the same procedure it is easy to show that whatever be the shape of the utility functions, the maximum intertemporal short-term welfare level compatible with its long-term maximization is that implying the stocking of the resource-population at the ecodimension's carrying capacity levels, even when in the short-term this could appear as a suboptimal or inefficient situation in paretian terms.

In the case of mismanagement of the ecodimension's carrying capacity, the most frequent pattern found in the countries of the region is the allocation of ecosystems in activities implying population-stocks to which their carrying capacity is particularly low. Typical examples in this area are the establishment of grazing, stocking and commercial cash-crops in forestry lands.

In these cases the analysis of its welfare consequences is complicated by the fact that not only intertemporal trade-off but also trade-off between actual flows of different commodities are involved. Furthermore, it is common that even though the ecosystem's carrying capacity presents fundamental differences from one allocation to another, the land factor has a significantly higher short-term productivity in that allocation in which the carrying capacity is the lowest.

If the ecodimensional capital is to be maintained in the long-term, the costs involved in the high short-term productivity activity will rise sharply (39) and probably will annul its comparative advantage. On the other hand, if the allocation of this capital asset is decided on the basis of short-term criteria only, the degradation affecting the involved ecosystems will imply sub-optimization in the long-term. The demonstration of this statement can be easily done by

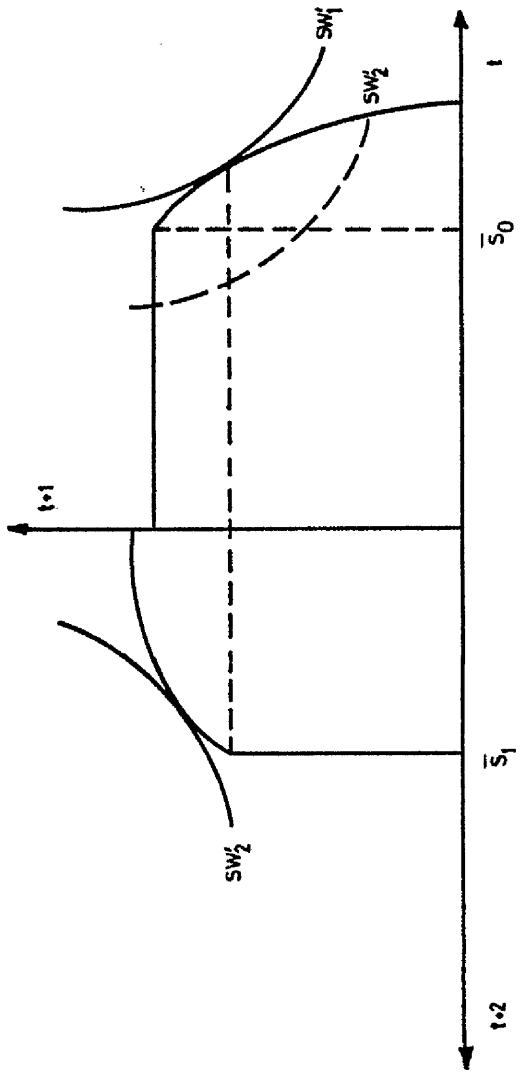


FIGURE N°4.7: OVERUSE OF CARRYING CAPACITY. INTERTEMPORAL EFFECTS

following the same procedure used before in the case of simple over-exploitation. The main difference is that in this case, the degradation process will tend to be more intensive.

Despite their initial high fertility, certain cultivation practices in humid tropical lands for instance, where the original vegetation is cut down and more commercial species are introduced, imply the continuous exposition of the soil to sunlight, rain and bacterial action that will finally result in the nutrients being removed, soil compaction and fertility losses in a relatively short period of time (40). In subhumid and semiarid environments, where in general the ecosystems are less resilient, short-cycle food crops will cause high erosion rates, accelerating the 'desertification' process (DASSMAN, MILTON and FREEMAN, 1973). Worth noting in connection with the shift of forest lands into grazing, stocking or crop-cultivation activities is the fact that not only the shifted ecosystems are liable to be affected by degradation processes but also other segments of the ecodimension will be exposed to degrading vectors insofar as the protective role of the forest is removed. In this case, apart from the internal long-term costs associated with the ecosystemic reallocation, there will be external effects as well, affecting ecologically interconnected segments and especially, water resources' supply (41).

Although the optimization approach attempted so far is useful to analyze the most general welfare-effects involved in different behavioural patterns in front of the ecodimensional capital and to derive some general normative criteria, any attempt to deal with the types of depreciation processes already mentioned, requires a structural approach, seeking for the explanation of those patterns actually present in the Latin American economies, sonstituting the roots of such ecodimensional problems.

In general terms we will say that most of the pressures over the ecodimension we have mentioned so far within the context of developing countries (mainly represented by the overexploitation and mismanagement of ecodimensional capital assets) are generated by underdevelop-

ment itself and particularly, by structural conditions existing in the agrarian sector and rural life.

It is the polarized character of the situation resulting from such structure (in terms of wealth, income and opportunities) what constitutes the principal factor leading to the final pressures exerted over the ecodimension (CENTRE INTERNATIONAL POR LE DEVELOPMENT, 1975). In Figure No. 4.8 we state in very simple terms the main general paths through which such pressures become apparent.

In it we have stated three main groups of inequalities coming from the existing agrarian overall structure that could be responsibilized, to a great extent, for the observed ecodimensional damage. In first place it is the unequal distribution of wealth, which we could identify with the land tenure system (large land tenure units are functionally related with the existence of very small units from which depend large families or associated groups in relative terms, and that are normally located within marginal areas of relatively poor soils or unfavourable general physical conditions) (42). Second, there is an unequal distribution of the income the sector generates which is derived from the former factor together with other attached characteristics most of which belong to the third kind of inequality. Third, there exists also, a profound inequality in the opportunities different groups have to take advantage of certain services, as well as an unequal access to institutional channels of social and economic communication with the rest of the national community.

The three unequality factors interact with each other reinforcing their global effects so as to conduct large number of peasants into what we may call 'survival-struggling' conditions. Figure No. 4.9 represents, in the form of a signed digraph (43), some of the most relevant interaction processes between the factors we are interested in from the point of view of those population sectors which are the less favoured. In order to simplify its construction, we have assumed that the structural characteristics represented by the land tenure system (unequality of wealth distribution) can be expresse by some kind of

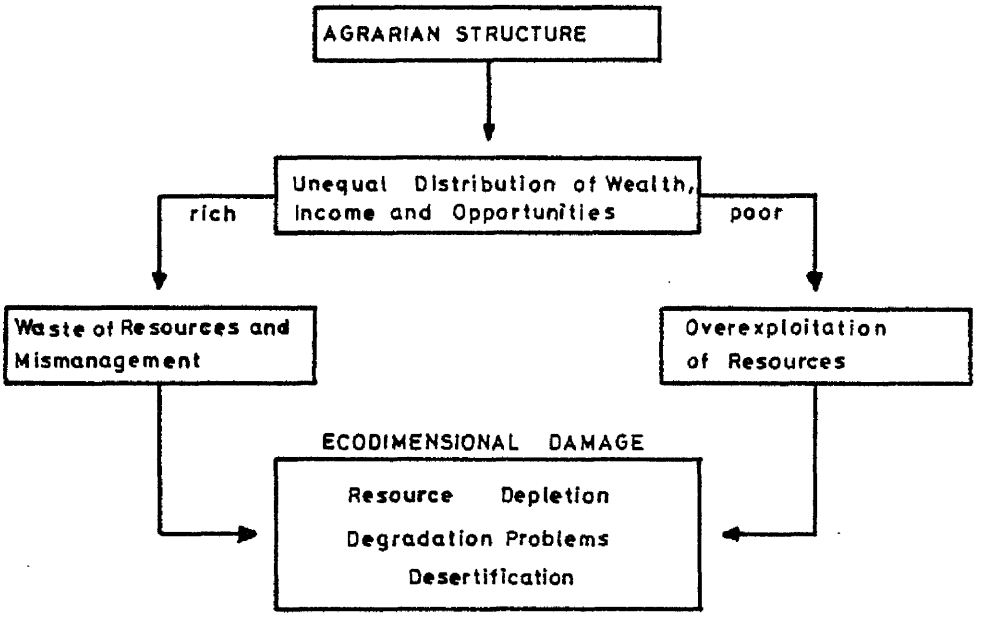


FIGURE N°4.8: AGRARIAN STRUCTURE - ECODIMENSIONAL DAMAGE

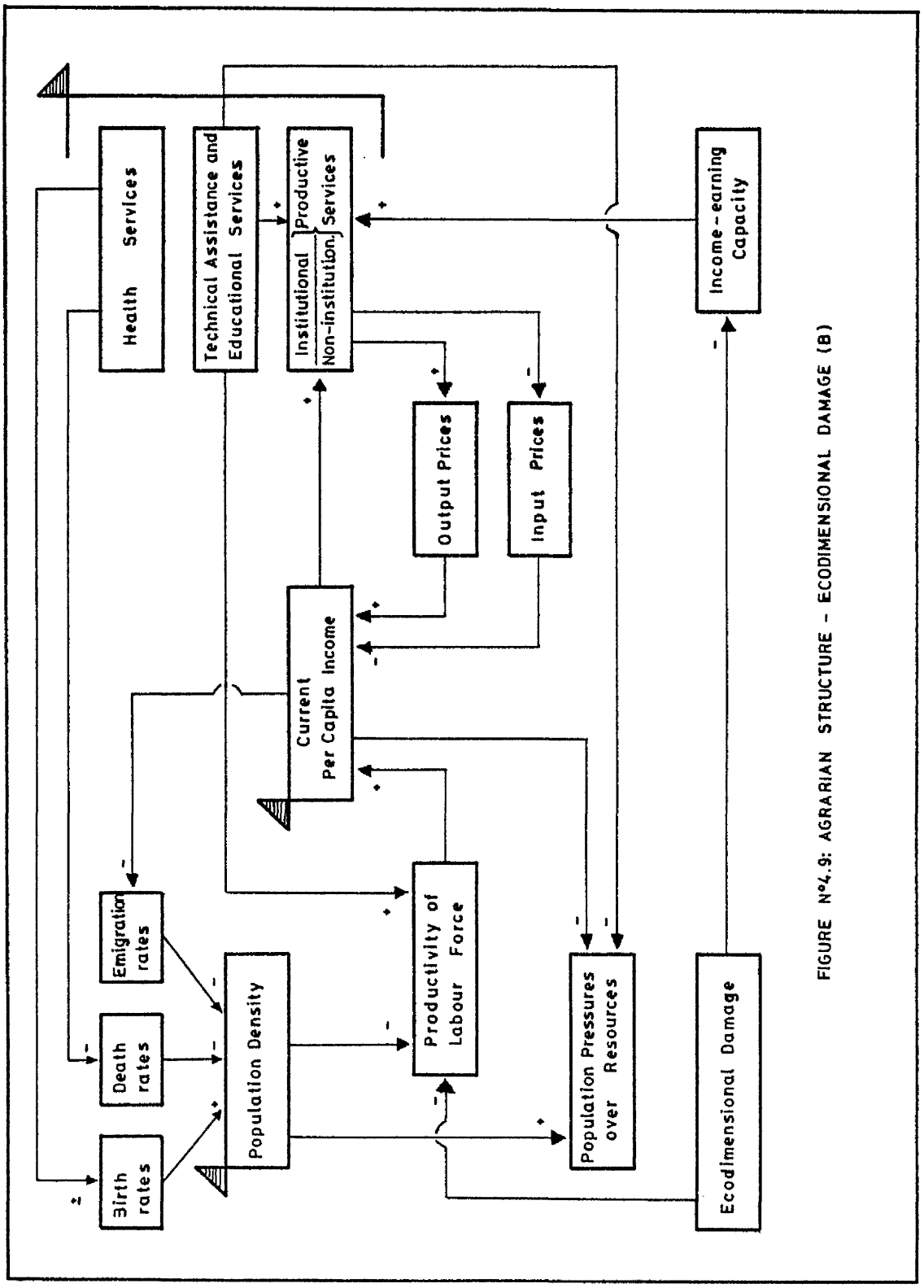


FIGURE N°4.9: AGRARIAN STRUCTURE - ECODIMENSIONAL DAMAGE (B)

relative measure of the population density per unit of land-area (44). In general, these structural conditions are represented by rather high values of the lower extreme of the interval within which the variable fluctuates. On the other hand, the unequal distribution of income is represented within this group by relative and absolute low current per capita income levels, which, again, have a limited range of variability. Finally, the unequalities in the opportunities of using certain institutional services are represented by rather low accessibility to health services; low opportunity-levels of entering to and maintaining regular attendance to educational services as well as highly insufficient flow of technical assistance; and a relatively high level of use of non-institutional channels of credit and commercial services as compared with the frequency of use of institutional ones.

From this simplified scheme we may appreciate the existence of a chain of effects originated in the rural structural situation, which result in terms of the ecodimension is an increase of the pressure the population exerts over their limited availability of ecodimensional capital. Such pressures, which we are going to name the demand for the services provided by the mentioned ecodimensional capital, imply that this capital is subjected to relatively high rates of depreciation, reinforcing the negative effects the structural conditions have over the general living conditions of this population sector.

It could also be noticed that the only mechanism that somehow alleviates the increasing trends in the demand for the land's services is represented by the migration flows towards the urban system.

Nevertheless, given the situation of the latter system within the Latin American region, the migration process cannot be considered as an efficient adjustment mechanism, nor one that helps the solution of the poverty problem.

Although the process of decay affecting the ecodimensional capital connected with the poorest segments of the rural population is

more accute than elsewhere, it does not mean that this capital is free from degrading pressures within the richer or more favoured segments. Nevertheless, the pressures existing at this level are mainly derived from inadequate answers given to the population pressures over the sector by the social system as a whole and by individual farmers in particular.

The answers the upper segments of the rural community have given to the food requirements of the growing populations, far from being sufficient in global terms, have adopted a wide range of technological characteristics. These depend, in general, on the position each group within these segments occupies in the agrarian structure and on the entrepreneurial character given to the exploitation units. We may distinguish the kind of response given to the population pressure in the frame of traditional agriculture practices from that implying come degree of modernization. Within the firs group, worth noting are those pressures coming from the shift of forestry lands into agricultural, grazing and more commercial uses, following the extensive-type of exploitation characterizing in general the largest units (latifundia). As we have mentioned before, this phenomenon usually gives rise to a process of rapid erosion and, in general, of soil losses.

On the other hand, and mainly within the group of intermediate owners and rented exploitation units, the ecodimensional damage is due to overexploitation in relative terms, adopting forms going from soil erosion to lixivation processes. Although originated in rather different sort of motivations, the latter phenomenon is,ecologically, similar to that occurring among the poorest segments of the rural community.

When the answer is given through a process of modernization, the kind of ecodimensional damage is of a quite different character. Let us consider modernization in its widest sense, as the transformation of the exploitation unit into an economic enterprise properly conscious of its social role within a given economic, social and political system. This implies the setting of rather precise targets and objecti-

ves compatible with those of the whole society (or, at least, much more precise than those traditionally implicit in the land-ownership, which usually adopted the form of being a symbol of power and social status rather than a means of social and economic development), proper consideration of the costs structure, 'industrial' relations, technological advancements and of capital investments, including within them the land and soil resources and therefore, their consideration as assets susceptible of being depreciated and revaluated.

At a macro level, modernization also includes the establishment and/or improvement of complementary services such as capital and financial markets, commercial (including transport and storage) systems, scientific and technological research and achievement-transfer channels, irrigation systems, educational facilities, etc.

The major ecodimensional problems related with agricultural modernization have appeared in any case, because of partial and wrong-adoption of different factors involved in the process as defined before, that sometimes have implied even the complete misconception of the whole concept. Generalized introduction of high-yielding new genetic varieties, indiscriminated overapplication of pesticides, ill-conceived irrigation projects, and careless use of mechanization respond for most of the ecodimensional decay experienced within this sector of the regional rural environment.

As the Founex Report (UNCHE, 1971)clearly states, even though most of the already discussed ecodimensional problems and others coming from underdevelopment should be solved by development itself, this will not occur automatically. Furthermore, a spontaneous development process without any regulation not only could aggravate such problems, but also could create new ones normally associated with high levels of industrialization.

The questions of sectoral priority and the relative importance of replenishable as compared with that of non-replenishable commodities, are two related issues the planning of economic development must

consider properly if the ecodimensional problems discussed so far are to be effectively solved and other ecodimensional problems we will discuss later on are to be avoided, especially when considering that the depreciation of the ecodimensional capital constitutes a serious limitative factor in the achievement of sustained growth rates in the community's welfare levels.

Nevertheless, the high diversity of situations we find in the sociodimension of the Latin American human environments, as well as differences existing in their ecodimensional capital endowment (both quantitatively and qualitatively), make useless any generalization intended around these questions. In any way, its importance emphasizes the need for planning methodologies and tools allowing the explicit inclusion and evaluation of alternative patterns and time-paths concerning such questions. This is valid not only at the national but also at the regional-subnational level.

4.3 : THE ECODIMENSIONAL COMMODITY-SOURCE FUNCTION, THE DEPLETION PROBLEM AND THE SPATIAL STRUCTURE

Although we have noticed the lack of consideration given to the ecodimension (and to its problems) by the two theoretical approaches on which we focussed our attention in the previous chapter, it does not mean that the same lack of concern is present in regional economic growth theory in general. It seems convenient to discuss then, the treatment this issue has been subjected to in this sense. We expect this discussion to suggest the assumptions underlying Friedmann's and Siebert's theoretical formulations and thus, to allow us an easier approach of how to include this issue more explicitly.

The role of resource endowment in the process of regional economic growth has been recognized by theories stressing both the demand and the supply sides.

From the demand-oriented theories of regional growth, the export-base approach consitutes the most relevant example. Although its pro-

ponent clearly states that the export sector does not necessarily correspond to primary (extractive) activities but it could very well be the output of secondary or even tertiary industries (NORTH, 1955; pg. 336), when referring to young regions (45), primary activities and export base tend to be the same thing. Therefore, the possibility of growth rate differentials between different regions will be strongly conditioned by the type, quality and amount of ecodimensional commodities located in each region that, at the same time, present favourable conditions in the external markets (whether national or international). The importance of the export sector as the primary income generator will determine the extent to which 'residentiary' activities (secondary and terciary activities oriented towards the regional market) would be developed. In this context, the regional multiplier of the export-generated income becomes a strategic element in the overall process of regional growth (NOURSE, 1968).

An interesting element that is worth noting in connection with this approach to the economic growth in 'young regions' is the relativeness of the concept of resource endowment.

Although the theory as such concentrates the attention on the demand structure and level as the basic growth determinant, not only these elements but also the organization and technology of production will be responsible for the definition of what, at any point in time, is contained in the resource endowment of any region as a relevant growth factor. Insofar as these variables change, there will be changes in the relative advantage of different regions supplying products for the national and/or international markets (PERLOFF and WINGO, 1961).

On the other hand, we find references to the role of ecodimensional commodities in those theoretical approaches that focuss the attention on the supply side. It has been suggested that, for an open region under modern conditions (46) it is the resource endowment and the accumulation of fixed capital what represent its most important and permanent characteristics in terms of growth possibilities (and relative advantages) insofar as it is the attractiveness of a given region

for mobile factors what will determine its medium and long term productive potential (CZAMANSKI, 1969).

The theory of productive sectors (and correspondingly, that of the 'stages of regional development') also consider the availability of ecodimensional commodities as a relevant factor, though in a different fashion. In the stages theory, replenishable ecodimensional commodities and its spatial distribution are conceived as the principal determinant of the population's location patterns in the early development stages of the national systems, when self-sufficient subsistence economies prevail as the dominant feature. As trade and some degree of local specialization increases, the population begin to concentrate in urban settlements, which spatial characteristics are still strongly conditioned by the locational patterns of primary (agricultural) activities. These activities, however, tend to experiment some changes towards more commercial, cash-providing, practices. Due to diminishing returns in the agricultural sector and to increasing populations, industrialization is conceived as a necessary step if growth is to continue. Initially the industrialization process is based on agricultural products and thus, at this stage, the role of replenishable resources is still a relevant one in determining the patterns of the overall spatial economic landscape (HOOVER, 1937). In a second stage of this process, a shift from replenishable, agricultural, commodities to non-replenishable ones (mainly mineral and energy (47) resources) is conceived as inevitable and necessary for industrialization and growth to continue on a permanent basis (HOOVER and FISHER, 1949; HOOVER, 1948). Although under this approach, the ecodimensional commodities continue playing a relevant role in the evolution of the spatial structure, their internal composition suffers significant changes (those regions having abundant mineral resources and cheap energy will gain relative and absolute advantage over regions lacking these strategic factors). Finally, a stage is reached where the region starts expanding its tertiary sector which product is also exported to less advanced regions.

Perloff and Wingo, on their side, combine elements of the economic (export) base and the economic sectors approaches (though stressing the former) and explain the inter-regional growth differentials (and indeed, the growth possibilities of any region) in terms of relative and absolute cummulative advantages. They distinguish resource-based and non-resource-based advantages and state that "where resource and non resource advantages come together are to be found the best conditions for a high level of economic development" (PERLOFF and WINGO, 1961; pg. 318). In order to get a resource-based advantage, a particular region should have a resource endowment characterized by high income-elasticity demand at both intermediate and final demand sectors of the national economy; also, the production processes of these resources should present extensive locationally associated forward and backward links as well as a high regional multiplier. Considering the fact that , as income increases, the demand structure will tend to shift towards a greater relative importance being given to manufactured goods as compared with food and other basic commodities, a 'good' resource-based advantage will be normally associated with non-replenishable (mineral and energy) commodities. Being so, and taking into consideration the increase of the market-oriented (as apposed to resource-oriented) character of the succesive manufacturing stages, for this advantage to fulfil the former requirements and become a cummulative one, the region should reach a certain 'threshold'market-size for internal production of a variety of goods and services.

In this latter sense, social overhead, human capital and living conditions in general, consitute necessary ingredients (op. cit., pg. 332)

Although in the formulation of his theory of polarized development Friedmann makes no explicit reference to the role of the ecodimension (in terms of resource endowment), from his previous work (48) it is possible to identify, to some extent, his approach to the process of regional economic growth with that of the theory of the economic base ("The initial impulse for the economic growth of a given subarea

comes usually from the outside. For this to happen, the particular resource combinations of the local area must give it a comparative advantage in supplying external demand efficiently. Its leading economic sectors will consequently be oriented to exports" (FRIEDMANN , 1966; pg. 22)). By considering, on the other hand, industrialization as an inevitable and necessary step in the development process, somehow he introduces certain elements of the development stages approach.

The consideration of both external and internal determinants of regional growth makes Siebert's approach more relevant in this sense. Also, its less compromised position in front of industrialization as a condition for development and thus, as an implicit development strategy (49), operates in the same direction. Nevertheless, as we mentioned in the former chapter, Siebert does not specify the role of the ecodimension in the degree required for our purposes.

Based on the discussion done so far in this chapter about the role played by and the problems affecting the ecodimension as a commodity source and on the global discussion of the Latin American situation we did in Chapter 2, a more explicit consideration of this ecodimensional function within the general context of the analyzed theoretical formulations, requires the following elements to be accounted for:

(i) To dissaggregate the regional economic activity into its different sectors. The separate consideration of rural and urban activities and human environments could serve as a reasonable basic distinction. This distinction does not follow the conventional analysis of primary and secondary and tertiary activities. Rather, it considers within the rural sector those activities mainly based on replenishable resources exploitation and, although funadamentally at the primary level, not necessarily excluding industrial or secondary activities. The urban sector, on the other hand, includes primary (related with non-replenishable commodities), most secondary activities, and the tertiary sector.

(ii) To incorporate the ecodimension's function of being a commodity source as an explicit element in the regional production functions in terms of a particular form of heterogeneous capital factor, which availability is strongly determined (both in quantity and in quality) by the characteristics (structure and function) of the related ecosystems. This also means that the depreciation processes this capital is or could be subjected to, must be explicitly incorpored (whether such depreciation - resulting in depletion problems - affects replenishable or non-replenishable commodities (50)).

(iii) To identify different socio-economic groups, particularly in the rural sector, which relationships (in terms of use, abuse and misuse) with the ecodimension present clearly differentiated features and generate specific patterns of ecodimensional problems which, in turn, affect differently not only the overall development path of each particular region but also the behaviour (including its spatial dimension) of each particular group. Later on, when discussing the distribution issue, we will return to this point.

(iv) To confront the trends of the demand structure as it is expressed through the market mechanisms with a normative scale so that the exact relative position of the commodity-source ecodimensional function in general, and particularly that of providing replenishable resources, can be assessed in front of desired social values (and thus, including the community in its wholeness) and not only in terms of aggregated income-elasticities of the demand for such commodities.

NOTES

(1) The length of the discussion in these two chapters obeys to two main reasons. The first is based on methodological considerations which could be expressed as the need for clarifying a kind of problem around which there is still a great deal of controverted arguments, that has been subjected to systematic economic treatment only since relatively recent date, and which connection with development and underdevelopment constitutes an area not yet consagrated by the economic tradition. Although some of the particular problems we are going to analyze has been

within the scope of the economist long before the 'environmental boom' became a noticeable academic phenomenon in the late 60s, they were not considered in the integrity of this environmental dimension. The second reason is less 'rational',and can be expressed as a specific and particular interest the author has on this issue.

(2) The mentioned list is by no means exhaustive. Its purpose is to show in general the kind of commodity, useful to man, provided by the ecodimension.

(3) When we refer ourselves to superior form of elements, we mean those living and non-living elements located on the higher levels of biological and physico-chemical organization. Because of the use we are going to make of a series of ecological concepts in this chapter, we considered it convenient to include the analysis of the most basic and general ecological features of the ecodimension in Apendix No. 1. Thus, we will not break the unity of our main discussion.

(4) Consumption can be considered as a transformation activity held by the 'human sector', from a bio-physical point of view.

(5) A fourth kind of energy is that coming from the use of animals in working activities. Nevertheless, we have included it within the physical energy because of its common feature of being a complement for human energy. One interesting feature in relation with animal energy is that it has been progresively substituted for other forms of physical energy and the ratio of animal to physical energy-use is sometimes considered as an index of a community's technological advancement.

(6) As it has occurred in most already industrialized nations and as it is occurring with most development attempts of underdeveloped ones.

(7) This statement brings about some political issues, specially related with the political representativeness of the authorities, the efficiency of the community's participation mechanisms, etc. It also implies a specific way of solving the problem of social choices.

(8) ECLA uses the concept of environment for expressing the idea we have defined in this work as the ecodimension of the human environment.

(9) The term 'irreversible' is used in a similar way of that given to the concept of non-replenishability, i.e. reposition of the depreciated proportion of the capital stock may occur, but it is likely to be so slow that becomes meaningless in human time-scale.

(10) The waste-assimilating function of the ecodimension could be considered as a relatively replenishable commodity. We will analyze it however, separately, when considering the pollution problem.

(11) This case is put forward only for stressing our argument. It must be recognized however, that perfect recyclability is prectically impossible.

(12) Perhaps the most clear example of non-replenishability at all (implying absolute non-recyclability) is represented by deposited organic materials (mainly oil and coal) used in energy-generation processes, insofar as an important part of them enters the energy flow and thus, dissappear from the materials cycling.

(13) In this case not only the flow of commodities will be permanently reduced to zero, but the capital asset represented by the genetic information contained in the species being extincted will be lost as well.

(14) This assumption includes the existence of complete certainty about the future.

(15) Kay and Mirrlees (KAY and MIRRLEES, 1975) for instance, have suggested that in general, "there is a danger that the world's resources are being used too slowly" (op. cit., pg. 171) and that the interests of future generations will be better served by leaving them production equipment rather than minerals in the ground.

(16) Forward markets, it should be said, do not eliminate uncertainty for the society as a whole. On the other hand, even under assumptions of perfect competence in these markets, the problem of uncertainty linked to technological breakthrough and the like is not reduced. Finally, the success (in terms of an active market) of futures trading, even in the case in which it were feasible, depends on conditions that are hardly met, specially when considering that trading parties would normally involve developed and developing countries at each side of the market. For a discussion of this issue, see GOSS, 1972.

(17) This trend is reinforced by the uncertainty about exploitation premises of resources located in developing countries and exploited by firms from abroad. When the resource is nationalized this trend could be reverted. However, apart from the example of oil, no certainty exists about what the behaviour of the national industries will be.

(18) Pearce (PEARCE, 1976) suggests for instance, that while private owners have to bear the whole risks involved in any decision, socially adopted decisions imply the share of such risks among the members of the whole community. Therefore, the rate used by a private decision-taker to discount future uncertain benefits will be normally higher than that used by a decision-taker representing the community. On the other hand, it has been also suggested that even socially determined discounting rates are affected by what has been named the 'society's defective telescopic faculty' and thus, present decisions tend to underestimate the importance of future generations.

Moreover, it should be also considered that discounting mainly deals with intertemporal efficiency and thus, it does not constitute a social decision rule for dealing with intertemporal equity. For a discussion of alternative criteria, specifically referred to ecodimensional problems, see PAGE, 1977.

An interesting discussion of moral issues that are involved in any decision about intertemporal distribution (especially when they

involve irreversibility problems and thus, preclude future generations from exercising options) can be found in PEARCE, 1977.

(19) Assuming constant costs of extraction so that $P(t) - \overline{C}_o$ will converge to P as 't' gets larger.

(20) Which, we will assume, owns the resource in question and therefore, the decision-making process is undertaken seeking the maximization of social variables affecting the owner-community.

(21) In which case the assumption of no internal consumption of the resource is no longer sustainable.

(22) The population sectors most favoured by the income increases present high income-elasticity (near to unity) of their demand for food and other basic primary goods.

(23) Later on, when analyzing the renewable resources we are going to discuss in detail the depletion processes they are affected by.

(24) Such a control is exerted through nationalized industries in charge of the resource exploitation in each individual country.

(25) Such capital accumulation could adopt the form of directly productive investments (increasing the productive capacity of the economy) or the form of social capital (including health, education, etc.).

(26) The area under the 'D' function is assumed to represent the consumer's maximum willingness to pay and that one under the 'MC' curve, the opportunity costs of production (social costs).

(27) Based on the assumption that all the other markets including those of capital goods and credit, are in equilibrium under conditions of perfect competence and thus, any increase in another good's output would be inconsistent with the rationality criteria.

(28) Assuming perfect factors' mobility between activities.

(29) It must be noticed that in this case we are introducing another type of imperfection in the market system, i.e. the presence of a public good. The results reached by our discussion can be interpreted as being a consequence of what we may call the 'non-additivity' of the market imperfections' effects.

(30) We are assuming that the cost structure of the monopolistic industry is such that the level of production where the marginal costs equal the marginal revenues represents also the level of minimum average costs. If such production level corresponds to the phase of decreasing average costs, the volume of additional extra-profits will be lower, but it is unlikely that such profit will be reduced to zero.

(31) Underlying this statement is the fact recognized by Arrow (ARROW, 1964) that the establishment of a social welfare function always involves

ves value-judgements. Unless we have some kind of political unity characterizing the community to which the function is defined, there is almost no way to reach a minimum consensus around such value-judgements. In this sense, we will accept the values of national political directive bodies as being valid for this purpose, and the 'technical' role of the economic planner then, is to detail and specify such value-judgements and to spell out the consequences of the different welfare functions possible to specify within the normally broad fundamentals given by political authorities (DASGUPTA, 1973).

(32) Certainly, the exogenous character of these elements is valid only at the national level, which is the level we are interested in. At a global (world) level, however, these constitute endogenous factors.

(33) When referring ourselves to the role of the resource within development strategies we are mainly thinking on the resource as being a source of financial means (through exports) and/or as an input for internal productive activities, whether it is incorpored in consumption or capital goods.

(34) Again, the concept of substitution (or substitutability) as a relevant one in the analysis of non-replenishable resources' depletion, is mainly referred to the national level. At the level of the world as a whole, substitution between non-replenishable resources certainly does not solve the depletion problem in the long-term. Here, the relevant substitution concept is that linking this kind of commodity with replenishable ones.

(35) We must recognize that such a difficulty is almost impossible to solve so that always there will be potential effects of any activity that are unforseeable and therefore, the risk element will be present in all decisions involving ecodimensional changes.

(36) It must be noticed that the recycling possibility introduces the same characteristic in the case of non-replenishable resources. However, the behaviour of the trade-off along the time axis is quite different one case from another.

(37) Such rates will depend on structural characteristics as well, so that the flows derived from the stocks will result as a combination of its initial volumes and of the existing ecodimensional structural qualities.

(38) Except those cases of congestion leading to stock degradation, that seem more convenient to include as part of the stock depletion problem or, directly, as part of the 'reduced flow of species-resources' problem.

(39) Assuming that the depreciation process derived from holding stocks above the ecosystem's carrying capacity is possible to avoid or recuperate by means of specific investments.

(40) When this process affects lateritic soils, the result will be the

transformation of the original land cover into crusts of iron and aluminium oxides which are almost impossible to recover for agricultural purposes or any other valuable use.

(41) Because of its particular characteristic of being an ecological spatial link between the rural and the urban sector and also because of the multiple functions performed by water resources systems, we will analyze some of the major problems it is affected by in the next chapter.

(42) About two thirds of the rural population and one third of the agricultural surface belong to the traditional sector which is mainly composed by 'aparceros' and 'campesinos minifundistas' (ECLA, 1976).

(43) For a brief discussion of this kind of analytical model, see Chapter 14.

(44) A good approximation could be achieved by considering the proportion of total land occupied by the lower income segments of the rural population as compared with the proportion these segments represent on the total rural population. Bell and Duloy (BELL AND DULOY, 1974), based on BARRACLOUGH and DOMIKE, 1970, have specified a representative land distribution for Latin America in which they show that submarginal and small farmers occupy about 21% of the rural land and represent more than 80% of the total rural population (op.cit., pg. 97). The existence of a great number of other kinds of institutional and structural unequalities has been neglected at this stage. Legal aspects such as the type of contract by which the relationships of land-rental are maintained (which have, obviously, economic and physical implications in the exploitation the resource is subject to) and other elements will be included in the analysis later on.

(45) We may identify with peripheral regions in general in our context and, particularly, with those constituting resource frontiers (See STOHR, 1975).

(46) Where the spatial friction does not affect significantly the inter-regional mobility of production factors (specially labour and financial capital).

(47) Availability of replenishable energy sources (hydroelectrical power) constitutes in this context a highly strategic ecodimensional capital in terms of locational advantages of any region.

(48) Particularly in his "Regional Development Policy. A Case Study of Venezuela", the MIT Press, Cambridge, Mass., 1966.

(49) Our definition of development requires a much wider options-set, insofar as it assumes an endogenous and self-reliant character of this process that "stimulates creativity and leads to a better utilization of production factors; for each product, it does not ask the question 'how much can we get through exchange' but 'how much can we produce ourselves or with others'. Thus the basis is laid for a search for new resources, for utilizing known resources in new ways and, sometimes,

for questioning the need for the product" (UNITED NATIONS, 1975; pg. 34; the underlying is mine).

(50) Obviously, the differences existing between both kinds of depletion (as an ecodimensional problem) should be properly expressed, specially in terms of the policy-implication differentials associated with them. When revisiting the questions of policy in the last chapter of this part, some connections between both types of commodity and its associated problems will be suggested.

CHAPTER 5 : THE ECODIMENSION OF THE HUMAN ENVIRONMENT AND THE ECODIMENSIONAL PROBLEMS (CONTINUED)

As we mentioned in the previous chapter, in this one we will deal with the problems of congestion and pollution.

In general, both congestion and pollution problems affecting most countries of the region are the result of the particular patterns adopted by the spatial distribution of the population, one of its main features being the high rates of urbanization and the concentration of population in only few major urban centres (generating an urban system of a primate character).

5.1 : THE CONGESTION PROBLEM

Within the kind of environmental problems generated in urban areas, congestion is one of the most frequently observable and also the one having the most accute negative effects. In order to discuss these issues we must clarify first, the scope we will give to the concept of congestion.

The effects carried out by congestion are of two kinds: those occurring exclusively through human perception and preferences, and those occurring through the impact of human activities over the associated ecosystems when such activities are run beyond the limits of their carrying capacity, leading to harmful conditions within the ecodimension (in terms of social welfare). We may consider then, that the congestion problem becomes apparent whenever the rate of use of rather fixed facilities increases beyond determinable limits or when such rates increase faster than the increases of the facility's availability (assuming initial full employment of it), whether this facility is referred to as man-made or natural and whether its use is directed towards the satisfaction of final needs or towards the fulfilment of intermediate requirements (including those of waste disposal).

The character of urbanization itself (both in terms of densities

and of spatial distribution of actual and potential users) implies that the natural existing facilities must be adapted and enlarged to properly satisfy the requirements of the urban population. Services that in an otherwise dispersed population are usually permanently supplied by the ecosystems' natural capabilities, in areas of concentration of human settlements they would be absolutely insufficient if such capabilities were not organized, managed and enlarged by social capital investments. Insofar as the rates of net investment allocated in the provision of these kind of facilities stay below those required by the rates of urbanization, such facilities will become congested bringing about deterioration of the basic supporting ecosystems and creating awful secondary conditions in the urban ecodimension of the environment (1).

In the literature on the economics of the environment, congestion has been defined as a phenomenon connected mainly with 'public commodities'. Rothenberg, for instance, states that congestion, in generic terms

> "..represents the unkind rub of human activities on one another, where there is no intermediation of a market to enable affected parties to confront their tormentors".

He also adds,

> "While some part of the 'capacity' of the public good may be natural or given by Nature as a 'free good', deliberate human action can either increase that capacity or mitigate the quality impairment stemming from any given level of socio-economic interaction"..."This composite of public good sharing, and the policy variability of medium capacity and rate of interference by-product for each unit flow of interaction is the basic characteristic of the 'generic congestion' process.." (2). (ROTHENBERG, 1970; pgs. 345-6)

Although the approach to the congestion problem as affecting public goods only, constitutes, from a theoretical point of view, a logical way for defining the scope of this phenomenon, when dealing with the reality of underdeveloped countries we may find it somewhat restric-

tive, leaving outside a set of important problems. The most relevant group of problems in this case is that connected with residential and housing services: these commodities constitute in general, goods that are subject of market transactions and therefore, it will be the market mechanism (through price changes) the responsible for adjusting demand and supply. Nevertheless, the income situation of the national communities and particularly of those urban-located segments, implies that important proportions of the population are marginated from the market and therefore, solve their basic needs by pressing the resources through non institutional mechanisms. The result, as we are going to see later, is normally the generation of a congested situation derived from rates of use largely exceeding the resources' carrying capacity (whether the latter is defined in terms of 'natural' capabilities or by applying normative criteria).

The analysis of the congestion type of ecodimensional problem as defined before, and its relationship with the characteristics and patterns of underdevelopment must obviously consider the two sides involved, which we may call the demand side (the use a given facility is subject to and the way in which such use behaves in terms of level and character) and the supply side (the factors determining its quality, its availability levels and its increases). Although we could analyze such issues in general terms, by referring ourselves to the idea of congestion in abstract, it seems more convenient to delimitate the exact characteristics of the kind of congestion we are interested in. Insofar as we are mainly concerned with the problems which expressions appear through the ecodimension of the human environment, we will not deal with that type of congestion expressed as a matter of pure preferences or tastes. We will treat and discuss those congestion problems that clearly result in ecodimensional damage or that create such a physical environment to human communities, that affect directly their quality of life, mainly through health conditions.

Considering the actual situation of the Latin American region we will consider the congestion problem as having a relative high

degree of urgency when connected with the following facilities:

(i) Housing

(ii) Residential space

(iii) Basic public services

(iv) Transport

The problems existing in connection with these facilities affect different social groups with different intensity and also their acuteness vary with the type of human settlement.

There are at least, two main issues we must discuss in connection with the 'demand' side of the congestion problem (considered in its generic interpretation): the density changes affecting human settlements, and the spatial features such changes adopt within particular urban areas and between them, considering the urban system as a whole. Underlying these issues there are some socio-economic and political qualifications that must be considered if a proper assessment of the type and intensity of the congestion problem is to be achieved. In general terms, we may establish a straightforward connection between the environmental problem under discussion and the firs issue already mentioned: other things being equal, increases in the population density will imply increasing pressures over the overall capacity of the urban ecodimension for assimilating the wastes generated by the community, as well as increasing pressures over the urban ecodimension's capacity for supplying the required water resources and over the urban-region ecodimension's capacity for supplying the food requirements of the growing populations. As we are going to see later, and considering the relatively limited natural capacities of the correspondent segments of the ecodimension, these pressures will express themselves over the technical (and economic) possibilities for enlarging such capacities and to provide a rather important set of related services and facilities.

The Latin American experience is characterized by an accelerated process of urbanization, far beyond the global rates of population

growth. While the rate of demographic growth in the region is about 3%, the rate of growth of the urban population reaches an average of about 6% (ECLA, 1976). In Table No. 5.1 it is shown the proportions that would adopt the urban growth in some centers if the observed trends are not modified.

The historical rates of growth of the urban population in the countries of the region, compared with those of the total population, constitute a strong indicator that a great proportion of such rates corresponds or is the result of a process of migration of people from rural communities.

This fact brings about the second issue mentioned before, because the special characteristics of the incoming population together with the principal features of the urbanization process considered in its global context, imply particular spatial as well as sectoral arrangements of the pressures exerted by the former over the overall urban environment. In general, the population constituting the rural-urban flows is composed by unskilled and uneducated people belonging to the active segment of the population pyramid, that enter the urban environment without economic or financial resources of their own. There, they face a labour market characterized by low rates of job-creation for this kind of labour force.

An important proportion of the migrants must therefore, remain unemployed or enter the 'murky' sector obtaining an eventual and - in any case - low income. Under these circumstances this sector of the urban population becomes almost completely marginated from the institutional housing market having also highly difficult access (if any at all) to other kind of basic services such as health services, educational facilities and general social governmental assistance.

The conditions existing in the supply side, in terms of the level and quality of the facilities required by the growing population, are mainly conditioned by the availability of space where such popula-

TABLE No. 5.1 : PROJECTION OF URBAN POPULATION IN LATIN AMERICA

(population in thousands)

year		1975	1980-90	2000
Cities with more than 8 million inhabitants		38.570 (1)	46.760 (1)	112.689 (2)
Cities with less than 8 million and more than 1 million inhabitants	*	16.890 (3)	32.400 (4)	41.300 (5)
	**	17.310 (6)	27.930 (7)	59.700 (8)

* : National Capitals
** : Regional Cities
(1) Includes: Mexico City, Sao Paulo, Buenos Aires and Rio de Janeiro
(2) Incorporates Lima and Bogota
(3) Includes: Lima Bogota, Santiago, Caracas, La Habana and Montevideo
(4) Incorporates: Santo Domingo, Brasilia, La Paz, Quito, Asuncion, Port Prince, Guatemala and Managua
(5) Incorporates Kingston, Panama, San Jose, San Salvador, and Tegucigalpa; exculdes Lima and Bogota
(6) Includes: Monterrey, Guadalajara, Medellin, Cali, Redife, Salvador, Belo Horizonte, Porto Alegre, Curitiva and Fortaleza
(7) Incorporates: Rosario, Belem, Goiania, Santos, Ciudad Juarez, Barranquilla and Maracaibo; the population of the cities included in (6) was projected assuming the same average growth rate of the national capitals with less than 8 million inhabitants.
(8) Incorporates: Campinas, Bucaramanga, Valencia, Leon and Tijuana; the population of the cities included in (7) was projected by following the same procedure mentioned above.

Source: UNITED NATIONS, 1975 (modified)

tion is able to locate. The general trend in this sense, is reflected in a lack of suitable sites for establishing proper housing units. The solution to this situation is frequently reflected in the factual occupation of marginal lands presenting poor drainage conditions and highly difficult access to water-supply facilities (3). This low natural capacity of these segments of the urban ecodimension is increased by the lack of resources (both public and private) that are located in activities and facilities oriented towards its enlargement and management.

This way of resolving the spatial pressures of the incoming population results in the creation of misery belts ('favelas', 'callampas', 'barriadas', etc.) characterizing most of the Latin American urban landscape (4) in which the socio-economic miserable conditions of the community is matched with ecodimensional characteristics in a rather cummulative circular process, ending in an overall congested human environment overloaded with psychosocial stressing elements and extremely poor sanitary conditions. We are mainly concerned with the latter implications of the interdimensional conflicts and in what follows we will focuss our attention in the analysis of its major features.

Figure No. 5.1 graphically presents the main patterns composing the mentioned circular process together eith the originating conditions. Although the interface between the sociodimensional pressures and the ecodimensional response is stated in general terms we may appreciate the augmenting character of the cycle connecting productivity, income levels, population pressures, congestion, ecodimensional deterioration, and sanitary and psychosocial conditions (5). The main structural factors that contribute to give rise to the conflicts which are finally responsible for the environmental problems are represented by hexagons.

Figure No. 5.2 represents a more detailed description of the kind of situation arising from the population pressures over the ecodimension and its technological extensions. As we can see, there is a rather complex set of interrelations connecting the particular con-

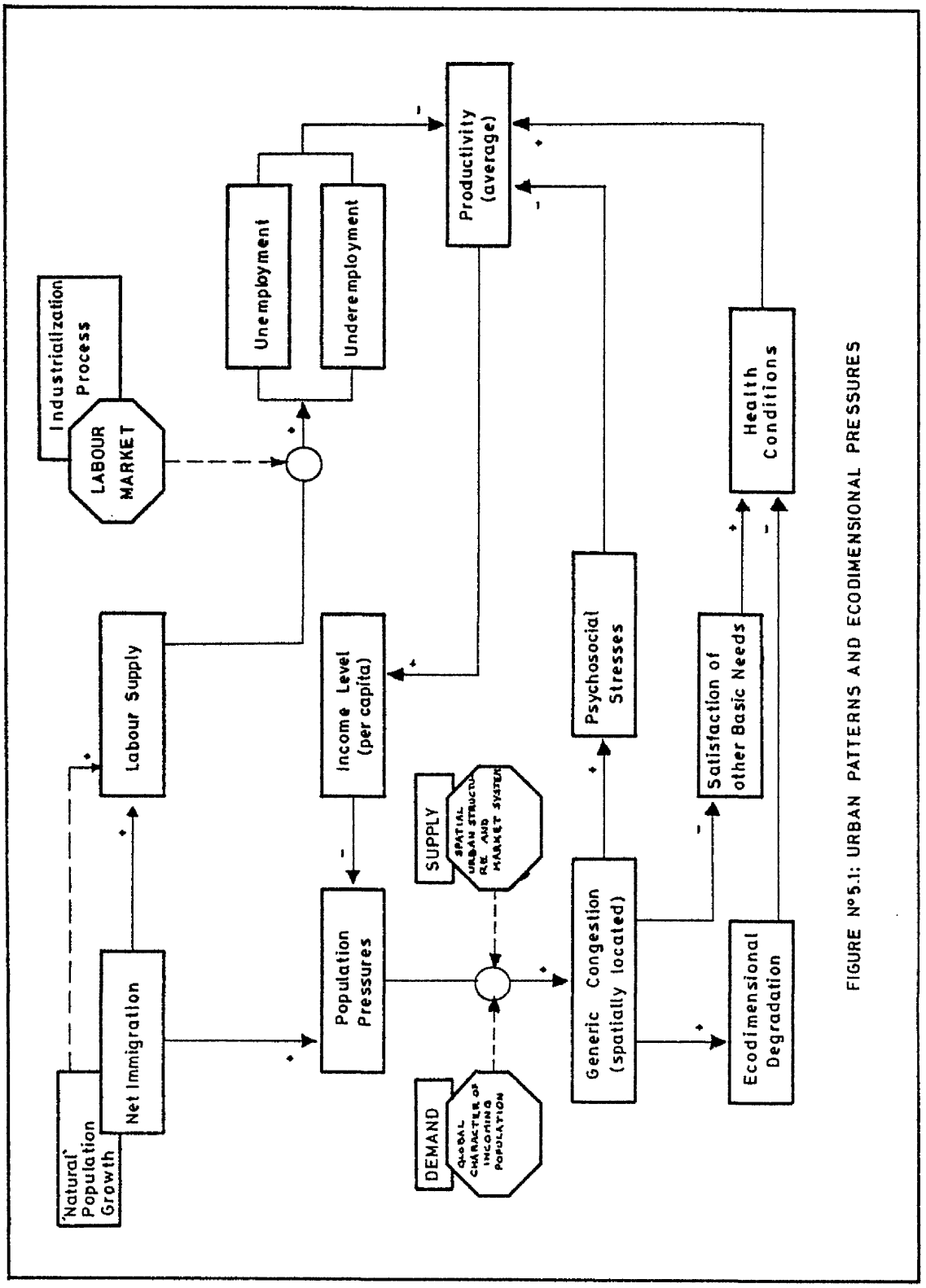


FIGURE N°5.1: URBAN PATTERNS AND ECODIMENSIONAL PRESSURES

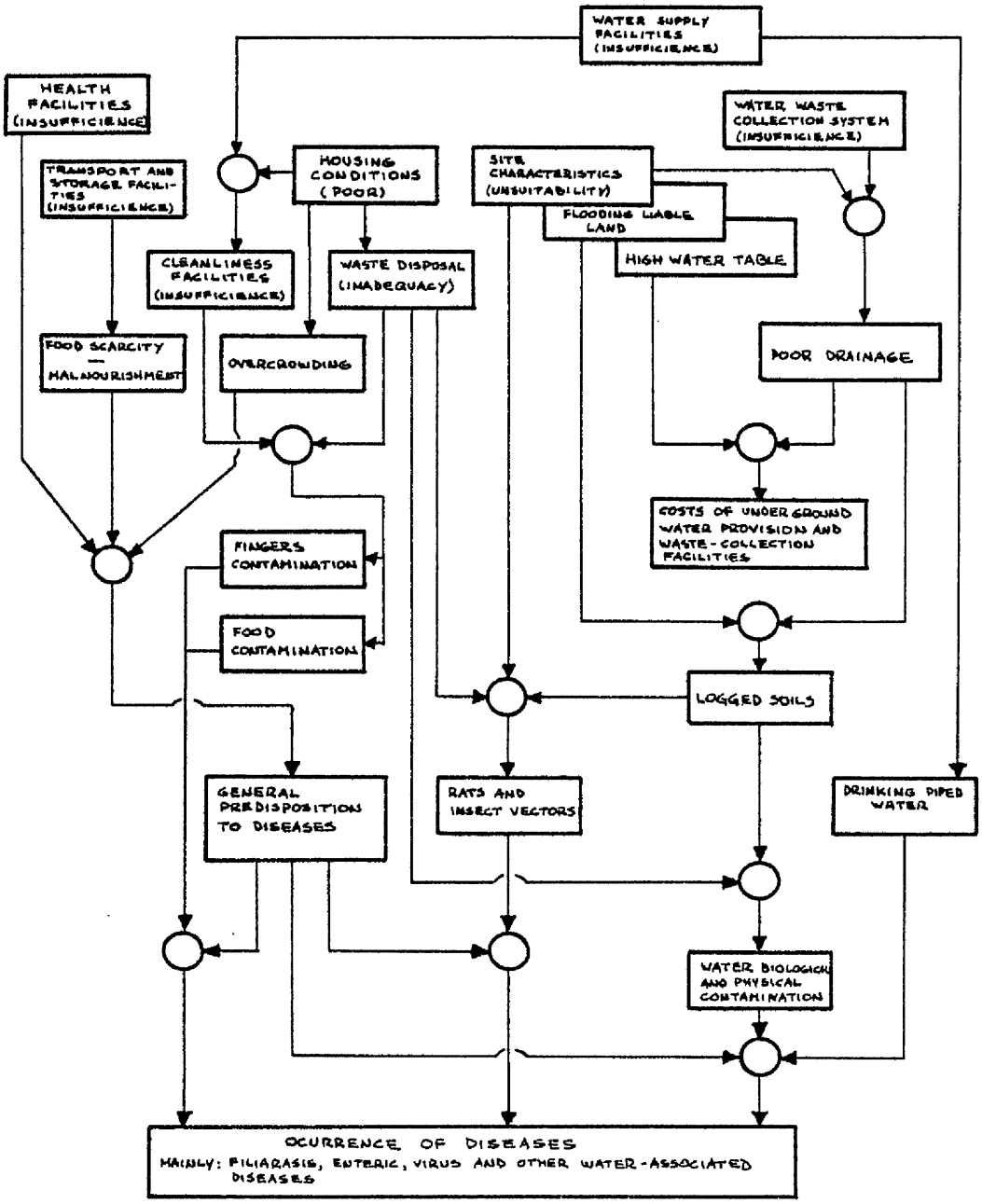


FIGURE N°5.2: URBAN PATTERNS, ECODIMENSIONAL PRESSURES AND HEALTH PROBLEMS
(based on NOVICK, 1976)

gested ecodimensional segments with the technodimensional ones, which finally express itself in actual occurrence of high rates of diseases. As it is stated in Figure No. 5.1, the situation detailed in this one represents an overall congested picture that is sectorally and spatially located. It corresponds to those segments of the urban ecodimension being specially unsuitable for supporting human settlements and also, it corresponds to those sectors of the social community that remain highly marginated - in social and economic terms - from the facilities and commodities usually associated with the urban environment.

However, the most advanced and modern segment of such urban human environment is by no means free of pressures, though of quite different character. In this sense, we must distinguish two main aspects: on one hand, those pressures over space itself and over the public capacity for providing the necessary enlargement of the urban ecodimension's natural capabilities, which 'compete' with those of the less advanced sectors establishing some sort of trade-off between the alleviation of each sector's congestion problems, the solution of which is determined politically. On the other hand, the creation of congestion problems that are inherent to the modern sector the burden of which effects are felt however, by the whole community (6). The first aspect mentioned mainly constitutes a problem of distribution of both the effects of congestion and the real resources committed to their solution.

5.2 : THE POLLUTION PROBLEM (7)

We have identified one of the functions performed by the ecodimension as being the 'sink' where man disposes of the wastes generated by almost any consumptive and productive activity. Associated with this function we defined the assimilative capacity as a form of capital, embodied in different segments of the ecodimension. Such capacity enables the ecodimension to receive the wastes discharged and to recycle them back into some kind of valuable element.

Pollution, as an ecodimensional problem, can be then defined as

the result of introducing into the ecodimension waste-materials and energy in rates that are higher than those the receiving segments are able to absorve. Such results may adopt different expressions depending on the type of waste being released and on the characteristics of the receiver. In general terms we will identify those that affect the human welfare levels directly by decreasing either the quality or the volume of other flows the affected ecodimensional segments provide as consumption commodities, and those that affect the flows provided by these segments to productive activities as intermediate commodities (including the waste assimilative function itself). In any case, it will correspond to a process of depreciation of the ecodimensional capital providing such flows that can be either temporal or permanent, global or regional.

The temporality of the depreciation process will be determined by the degree of reversibility of the ecological phenomena involved in such process once the polluting source dissappears together with the degree of persistence of the waste once discharged.

Its spatial domain on the other hand, will be determined from the emission side mainly. The waste-elements' mobility and persistence being the most relevant characteristics. In general, the higher the mobility and the higher the persistence of any discharged waste, the more global its effects as a polluting agent will be. Normally the global effects are defined as those problems affecting the ecodimension as a whole and which emission sources are spread all over the world or, at least, its identification in specific locations is impossible. The regional problems are referred to as those which spatial domain is rather limited and that could involve ecodimensional segments belonging to one or more countries (8).

From the point of view of the segments of the ecodimension receiving the pollutants regardless its spatial domain, pollution problems can be aggregated into those affecting terrestrial ecosystems, those affecting the atmospheric segment and those affecting water eco-

systems. These three groups are known as soil pollution, air pollution and water pollution respectively.

Air Pollution

We have referred to pollution as a phenomenon that becomes apparent whenever the rate of waste discharge into the ecosimension exceeds the rate at which the latter is able to absorve such wastes (assimilative capacity). Nevertheless, from the materials balance principles it is clear that, insofar as the atmospheric segment has almost no possibility to transform (physically, chemically or biologically) the wastes discharged, into valuable and thus, reusable elements, to speak of 'air assimilative capacity' seems to be ecologically mistaken. Despite our recognition of this characteristic, we will use the concept of assimilative capacity of the atmosphere, mainly to achieve certain semantic unity in our discussion of pollution in general.

In general terms ans particularly when referring to the regional kind of pollution, the assimilative capacity of the air mantle of the ecodimension corresponds to the ability of a given area to disperse and dilute the wastes discharged in it. Obviously, there are other removal processes characterizing this segment of the ecodimension. Among them we can mention the incorporation of particles into clouds and/or their removal by rain; coagulation of small particles and subsequent settlement out by gravitation; removal by contact with buildings and plants, etc. However, it seems that dispersion and dilution constitute the most important, specially when considering the reduction of the wastes' damaging effects (MASTERS, 1974).

Dilution and dispersion do not mean however, the absortion of wastes. They only imply the distribution of wastes through a greater segment of the ecodimension. Eventually, the density of such wastes will increase. In this context, more than assimilative capacity, what dilution and dispersion represent, is a delaying mechanism when consi-

dering the situation at a global level. From a regional, local, point of view, they certainly imply some sort of assimilative capacity insofar as wastes discharged in a specific area would be physically removed from that area. In this case, air 'assimilative capacity' could be identified with a 'natural' mechanism for exporting wastes outside the region.

With the former qualifications in mind we may state that the basic variables determining the atmospheric 'assimilative capacity' of a given area are the wind speed, the mixing height and the general geographical conditions characterizing such area.

The wind speed is responsible for the capacity of an area to disperse the wastes discharged into its air-mantle, showing an inverse and straightforward relation with pollution levels: the higher the wind speed through an area, the higher will be its dispersion capacity and thus, the lower will tend to be the risk of pollutants to remain within the area. This factor is obviously influenced by the topographical conditions of the area. Chains of hills surrounding a valley, for instance, will present a natural barrier for air motions to occur and thus, the wastes discharged into its air-mantle will be not dispersed.

The mixing height, on the other hand, is mainly responsible for the capacity a given area has to dilute the wastes discharged. We may interprete this factor as being analogous, to some extent, to the horizontal air motion (represented by wind speed) but this time, in a vertical sense. It will be the vertical air motion what, by allowing polluted air to mix with the clean air of higher mantles, will dilute the pollutants in a greater air volume, consequently diminishing their concentration. The mixing height is then, the range in terms of altitude , over which vertical air motions (and thus, air mixing) occur in connection with a given area.

The basic factor influencing the vertical air movements is re-

presented by differences in temperature between air parcels at different altitudes. The higher the speed at which temperature decreases with increases of altitude, the more unstable will tend to be the atmosphere and the higher will tend to be the mixing height. The lower such speed on the contrary, the more stable will be the atmosphere (the stronger will ve the inhibiting forces for vertical air mixing) and the lower will be the mixing height. When air temperature increases with altitude (inversion), the atmosphere will tend to be highly stable and therefore, the risk of pollution will be higher insofar as the dilution capacity of the atmosphere (the mixing height) will be quite low.

Apart from atmospheric reasons (due to high pressure systems) inversion may occur due to weather conditions (specially in the case of clear cold nights) and particular geographical conditions (such as those represented by coastal cities specially during summer time, and by hill-surrounded valleys).

Due to seasonal and morning-afternoon variations of the mentioned factors conditioning the 'assimilative capacity' of the air segment of the ecodimension, and also due to differences characterizing such factors in different geographical locations, it is possible to determine a spatial distribution of the probable frequency with which highly pollution-risk episodes may occur during a detemined period of time (9). In terms of environmental planning in general, the former determination constitutes a relevant factor that should be accounted for, specially when deciding the vormative guidelines for the spatial distribution of industrial location. Areas with high pollution potential (in terms of probable number of episode-days) would have by this token, locational disadvantages (both absolute and relative) which exact incidence in actual location decisions will be conditioned by the relative position of the pollution problem in the social choice scale and by the strength and efficiency of the mechanisms available for correspondingly orienting the resource allocation process.

As it is shown in Table No. 5.2, the problem of air pollution is mainly present in the major cities (megalopolis and metropolitan areas) of the region. Nevertheless, because of the character of partivular industries combined with low assimilative capacity in particular areas, problems of air pollution has been also registered is much smaller settlements like, for instance, Poza Rica, Chimbote and San Pedro Sula (ECLA, 1976).

Where information has been produced, it shows that the levels of pollutants, in monthly average terms, frequently exceed those considered as reference levels. Table No. 5.2 presents some figures that give a general idea of the magnitude of the problem under discussion.

Water Pollution

When analyzing water pollution problems it is usefull to distinguish between degradable and non-degradable residuals. The general characteristics of water pollution due to degradable emissions derive themselves from the degradation processes that occur once the residuals are discharged into a body of water. These processes will imply consumption of the dissolved oxygen contained in the water body on one hand, and the release of other organic materials on the other, which in turn, consitute basic plant-nutrients. The oxygen-depletion problem however, will tend to be offset by reoxygenation which takes place through the water-air interfaces and therefore, some degree of self-purification capability of the involved water-body must be considered. The problem of nutrient-enrichment will remain and water pollution due to degradable emissions would imply some degree of cultural eutrophication. If the amount of waste discharged is too high, the dissolved oxygen-depletion process will reach positive net values and eventually the element would become exhausted. Even in the absence of dissolved oxygen, the degradation process will continue through the action of anaerobic bacteria that use organically or inorganically bound oxygen. This time, gaseous by-products will result from the anaerobic degradation, among which the most typical are carbon-dioxide, methane and

TABLE No. 5.2 : AIR POLLUTION IN SOME MAJOR LATIN AMERICAN CITIES

Type of Pollutant	Sedimentable Particles	Suspended Particles	SO_2	CO
Reference Level	0.5 mg/cm^2	100 mcg/cc	70 mcg/cc	p.p.m.
MEXICO CITY	2.11-3.26 (1)	145,3 (1)	146,6 (1)	
SAO PAULO		169,0 (1)		
BUENOS AIRES		167,4 (1)		
CARACAS			135,6 (1)	*
SANTIAGO			81,0 (1)	**
LIMA				40 (2)

Source: ECLA, 1976, based on studies indicated in each case
(1) CEPIS, 1971
(2) VINCES, 1974 (he compares this value with the one experimented in Los Angeles, California for 8 hrs. of only 30 p.p.m.)
* It has been estimated that 68,4% of a total of 1.350 tons. of daily pollutants corresponded to CO in 1970 (PARRA, 1971)
** The concentration of CO in the city center increases in 1.5 p.p.m. per year (CASTELLA, 1974)

hydrogen sulfide. The degraded aquatic ecosystem will emit foul odors and will become aesthetically offensive, apart from the fact than any previous resource being extracted from such ecosystem will be no longer available or will become valueless.

Closely linked with pollution by degradable elements is one type of energy pollution principally affecting water streams. This is the thermal pollution mainly derived from power generation. As water temperature rises, the saturation levels of dissolved oxygen and thus, the threshold points when degradation becomes anaerobic, will be reached by relatively lower flows of effluents. This behaviour of the degradation processes in front of temperature becomes highly relevant not only in connection with thermal pollution, but also relative to waste-discharges' seasonal regulations and management. In general, the same amounts and composition of wastes will generate more serious problems of pollution in hot seasons than in cold ones, where the ratio biochemical oxygen demand (BOD) of a given amount of wastes to dissolved oxygen will be lower.

Finally, bacterio-contamination of watercourses should be considered as a relevant pollution problem in this group, insofar as it has direct implications over human populations' health. Diseases such as dysentery, gastroenteritis, typhoid and paratyphoid are frequently derived from drinking contaminated waters. Although this could be a minor problem in more industrialized countries where water supply treatment is efficiently and generally applied, in developing countries it constitutes an accuta problem,specially among deprived and overcrowded suburban settlements. This problem is not only reflected in the polluted character of drinking water, but also it becomes an important factor of food contamination through irrigation practices with polluted waters, followed by the absence of adequate sanitary and hygenic practices in food-manipulation that is frequently observed among low-income level sectors of the population.

Another kind of degradable emissions that is frequently consi-

dered as a separated group is that of 'persistent' pollutants. Although the basic elements constituting such pollutants are chemically and biologically degradable, its molecular structure is so complex that they will normally persist through rather long distances and/or long periods without being completely degraded. The most typical examples of these pollutants are the synthetic organic chemicals produced by modern chemical industries (detergents, pesticides, phenols among others) that enter the aquatic ecosystems as industrial, domestic and agricultural (10) waste residuals. The final effects of this kind of pollution are still being discussed and it seems that one of its most important characteristics in terms of human health is reflected by the fact that rather low concentrations of these elements in water-bodies are magnified within the ecosystemic food-chains and the higher levels of the ecosystem's community (which normally represent food-resources to man) would present higher concentrations of this kind of persistent pollutants. This process of biological magnification would also affect the overall ecosystemic structure and some kind of ecodimensional degradation is likely to occur.

Water pollution due to non-degradable material is in general cummulative and includes inorganic chemicals such as colloidal matter, ordinary salt and salts of heavy metals. The latter ones are relevant in human health terms, Mercury and Cadmium can, in large quantities, generate Minimata and Itai Itai diseases respectively, when ingested by human populations through the consumption of different elements of the ecosystem's structure, both from the consumer and producer levels. Also, other types of non-degradable residuals will give water resources unpleasant and corrosive characteristics.

Soil Pollution

Most soil pollution problems affecting the urban environments of the Latin American countries are due to industrial wastes and domestic garbage, the latter apparently being the most important, at least in the Andean countries (ECLA, 1976 quoting the report of the Meeting of

TABLE No. 5.3 : WATER POLLUTION PROBLEMS IN SOME LATIN AMERICAN COUNTRIES

Key to Information

COUNTRY: AFFECTED WATER BODY (ies)
GEOGRAPHICAL SOURCES
POLLUTANT SOURCES

ARGENTINA (1):
Rivers: Matanzas, Reconquista; Water Courses: Cildanez and Moron (2)
Buenos Aires (metropolitan area)
Domestic and Industrial Sewage
Water Course: Luduena
Santa Fe
Domestic and Industrial Sewage
Water Course: Pescara
Mendoza
Domestic and Industrial sewage (organic wastes from oil industry)
Rivers: Sali and Negro (3)
Chaco
Domestic and Industrial sewage (sugar industry and others)

CENTRAL AMERICA (4)
Lake of Atitlan, Lake of Amatitlan (5) and Villalobos River
Guatemala
Domestic and Industrial sewage
Rivers: Umuya and Chobutecas
Honduras
Domestic and Industrial sewage
Rivers: Tiribi and Virilla
Costa Rica
Domestic and Industrial sewage
Rivers: Suquiapa and Acelhuate
El Salvador
Domestic and Industrial sewage
Lake Manahua (6)
Nicaragua
Domestic and Industrial sewage

CHILE (7)
Rivers: Mapocho
Santiago (metropolitan area)
Domestic and Industrial sewage
Rivers: Bio-Bio
Concepcion City
Domestic and Industrial sewage
Bay of San Vicente
Area of Concepcion
Domestic and Industrial sewage (petrochemical)

TABLE No. 5.3: WATER POLLUTION PROBLEMS IN SOME LATIN AMERICAN COUNTRIES (continued)

CHILE (cont.)	Rivers: Maule	
	Area of Chillan	
		Domestic and Industrial sewage (paper mills)
COLOMBIA (8)	Rivers: Bogota (9)	
	Bogota (capital city)	
		Domestic and Industrial sewage
	Rivers: Magdalena (10)	
	Girardot	
		Industrial effluents (fenol, iron, manganesum mercury and oil)
	Bogota river (tributary)	
	Cities: La Dorada, Barrancabermeja and Barranquilla	
		Industrial and Domestic sewage
	Rivers: Medellin (11)	
	City of Medellin	
		Industrial and Domestic sewage
	Rivers: Cauca	
	City of Cali	
		Industrial and domestic sewage
MEXICO (12)	Valley of Mexico in general	
	Federal District	
		Industrial and Domestic sewage
	Estuarie of Coatzacoalos River	
	State of Veracruz	
		Industrial sewage mainly (oil refineries, petrochemical and fertilizers)
	River Blanco and Alvarado Lake	
	Cities of Mendoza, Nogales, Orizaba, Cordoba and others	
		Domestic and Industrial sewage (distilleries, cellulose, cofee and textiles)
PERU (13)	Lima (metropolitan area)	
VENEZUELA (14)	Maracaibo Lake (15)	
	Cities of Merida, Urdena and Boburas	
		Industrial sewage (sugar industry mainly)
	Cities of Maracaibo, Cabimas, Ojeda, Bachaquero, Santa Rita and Puerto de Altagracia	
		Domestic sewage mainly
	Tablazo	
		Petrochemical complex wastes
	Valencia Lake	
	Cities of Valencia, Maracay, La Victoria, Guigue and Guacara	
		Domestic and Industrial sewage (major industrial concentration of the country)

TABLE No. 5.3 : WATER POLLUTION PROBLEMS IN SOME LATIN AMERICAN COUNTRIES (continued)

VENEZUELA (cont.)	Rivers: Cabriales, Guayra, Tuy and San Pedro	Domestic and Industrial sewage

Source: ECLA, 1976, based on studies indicated in each case

(1) ROBIROSA and MORELLO, 1974
(2) These water bodies are so polluted that can be considered as open sewers.
(3) The pollution levels in this river have reached such values that kills any animal drinking his waters.
(4) Population located in the Pacific vertient, where water resources have short length and high seasonal variations. Assimilative capacity is much lower than demand (ICAITI, 1974)
(5) With rather serious problems of eutrophication due to biochemical and biological effluents.
(6) With rather serious problems of eutrophication as well.
(7) 60% of the population is located in two central river basins (Santiago and Bio-Bio).
(8) Despite its abundant water resources, most economic activity is located around the mentioned water courses (INCITEC, 1974).
(9) This river is so strongly polluted that constitutes an open sewer.
(10) Corresponds to the principal river of the country
(11) It suffers from total desoxygenation untill 40 Km. down the city of Medellin.
(12) 15% of its water resources serve 75% of national population and 70% of national industry (DE CSERNA,MOSILO and BENASSINI, 1974).
(13) The metropolitan area of Lima suffers from a deficit of water resources of 8 cubic meters per second.
(14) The Central Region, with a capacity of water generation of only 16% absorved in 1970, 41% of the national water demand (UNCHE, Informe Nacional, 1972b)
(15) HIBIAN, 1973

the Andean Countries' Health Ministers, 1974). The main problems connected with this issue are the insufficience and inefficience of collecting facilities,and the lack of adequate systems of disposar or final elimination. The result is expressed by the presence of unsafe (in sanitary terms) disposal sites on one hand and of large segments of the population being badly served or not served at all by the collecting system. This is particularly accute in the case of urban areas of spontaneous settlements an in general, of those areas occuppied by the lower socio-economic segments of the population. The acuteness of the problem in these cases is due to the joint effects of two factors: first, to the sanitary habits of the population itself; and second, to the fact that, the collection services being normally run by municipalities, the high population density of these areas and the lack of resources of the municipal bodies serving these areas, make the provision of adequate means of collection and of proper disposal mechanisms, an impossible task to accomplish.

As we mentioned before, when discussing the congestion problem, this situation contributes to the generation of vectors affecting the overall health conditions of the urban environment and particularly, those of the poorest segments of the population.

Besides, new problems derived from the more affluent segments of the Latin American urban population (specially in major cities) such as car and domestic appliances 'junks' have started to acquire increasing importance (ECLA, 1976).

The Economics of Pollution (11)

The classification we have attempted of different types of wastes according to their degradability, places the capital resource represented by the assimilative capacity of different segments of the ecodimension within a wide range of values, being zero or almost zero for non-degradable and highly persistent wastes and adopting positive values for degradable wastes.

As we have done in the cases of commodity-depletion problems, in what follows we will analyze the ways in which pollution affects the welfare possibilities of the communities using the involved eco-dimensional segments.

Due to the fact that almost any segment of the ecosimension represents more than one kind of capital asset and thus, provides more than one commodity-flow (including that of being waste-receiver), the depreciation processes generated by positive levels of pollution will not only affect the waste-assimilation services (whenever they have positive values) but also, any other commodity-flow this multifunctional capital asset provides.

The problem of the optimal allocation of ecodimensional capital under these circumstances is affected by the fact that the commodity-flows provided by such capital involve goods and services which may have no price at all due to their unmarketable character (PEARCE, 1976) (12).

Insofar as we give positive values to the costs (13) involved in ecodimensional disruptions not only from a productive viewpoint but also from the final consumer's perspective, different 'mixes' of the traditional consumption-goods and pollution levels will certainly have different results in terms of social welfare achievements.

This statement is valid in two directions as far as pollution is concerned: different mix of traditional economic goods themselves would provoke different welfare achievements not only because each good is differently valued in terms of its capacity for satisfying needs located at different positions in the priority-scale, but also because their production (and consumption) will generate different pollution flows both in quantity and quality, and therefore, the aggregate pollution flow and its internal composition will vary with the structure of the goods produced and consumed. In turn, this differences would lead to changes in the whole scale of priorities and

preferences and thus, to new levels of social aggregate welfare associated with any given mix of commodities once the effects of pollution are appreciated.

The planning problem in its more general expression, i.e. to reach pre-determined levels of welfare for the community, becomes then more complex: not only revealed individual preferences must be arranged and ordered by the planning authorities in order to reach a reasonable approximation to the social welfare function, but also unrevealed and normally very difficult to deduce and to estimate preferences about ecodimensional services and commodities at any point of and over a period of time. Moreover, this already complex situation is further complicated by the temporal interdependence of the pollution phenomenon and by some distributional effects of it we are going to analyze later on.

In other words, the ranking of alternative time-paths of consumption-flows resulting from different investment policies is further complicated by the presence of pollutants in the ecodimension (that vary from one alternative to another) which count to the levels of welfare-flows achieved and the valuation of which is almost always difficult to be done in physical terms and even more difficult to establish in monetary terms.

Having in mind the complexity of this situation and the fact that, whatever be the goal-image to be achieved, value-judgements will be always involved, let us see how economic tools are useful to gain insight on the way in which such objective could be achieved.

There are two main approaches by means of which pollution (environmental damage in general) has been considered by welfare economics, both using the basic idea underlying this theoretical body, i.e. a comparison of monetary costs and benefits of the production activity and the subsequent maximization (minimization) of the net benefits (costs).

The first approach deals with the problem by linking together

the marginal private costs of producing a given commodity, the marginal gross benefits derived from the consumption of such commodity, and the 'external' (from the firm's or industry's viewpoint) cost generated by pollution, which is viewed as a by-product of the commodity's production.

Assuming an idustry operating under perfect competence, which pollutant activity does not affect and is not affected by any other industry's activity (see BAIN, 1973, pgs. 11-20), we may represent the mentioned links by means of the graph shown in Figure No. 5.3.

Where 'X' represents volume of production of the commodity, which productive process implies the generation of the pollutant as a by-product; 'MC' corresponds to the long-term marginal and average costs, including a normal interest rate, of producing different levels of the commodity X; 'ME' is the annual monetary value of the marginal long-term environmental damage, that is assumed to increase at a constant rate for simplicity purposes, and having positive values from the level of production represented by 'J' (later on we will discuss this point); 'MGB' represents the marginal gross benefits derived from the consumption of the commodity or, from the industry's viewpoint, derived from the sale of the commodities produced; 'TMC' is the total marginal cost of producing X and corresponds to the sum of the 'ME' and 'MC' curves.

Under the situation represented by Figure No. 5.3, if the industry is allowed to fix its level of activity without any consideration of the environmental damage it generates, the long-term annual volumes of production will be decided at 'q_o'. At this level, the total private costs of producing X (represented by area AEq_oO) equals the monetary measurement of the total value paid (received) for consuming (producing) such volume of the commodity. On the other hand, the total annual environmental (ecodimensional) cost of such level of production is represented by area JBq_o (= KGE). If, on the contrary, the industry is somehow obligated to internalize the ecodimensional

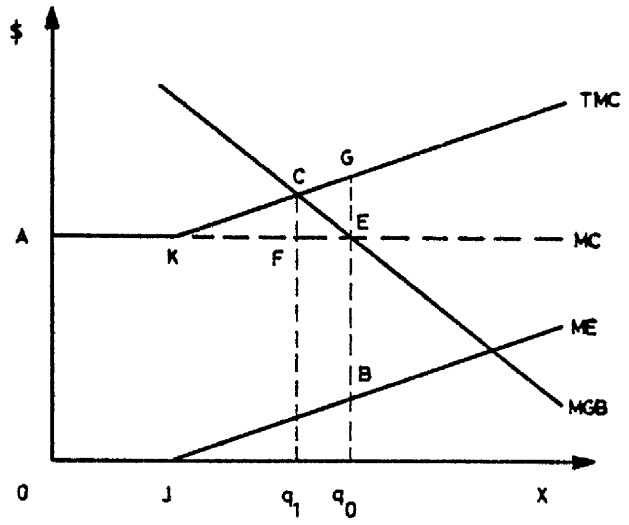


FIGURE N°5.3: 'OPTIMAL' POLLUTION LEVEL. EXTERNAL COST APPROACH (a)

damage and incorporates it into its cost structure, the optimum, from the society's point of view, will correspond to a lower level of output (q_1), where the marginal gross benefit is equal to the total marginal cost, including the monetary value of the marginal ecodimensional damage.

The second approach mentioned earlier, to incorporate the ecodimensional damage lies on the same principles, though seen from a rather different perspective. It focusses the attention on the process of pollution itself and concludes the optimal levels by comparing the benefits the community would achieve when different levels of pollution are avoided, with the monetary costs the system must accept in order to reach such levels. Graphically, this approach is represented in Figure No. 5.4.

Where 'MCC' represents the marginal cost function of achieving different levels of pollution. This variable, i.e. the control costs, represents the benefits of avoiding pollution levels (external costs) that otherwise would occur at different levels of production of the waste-generating commodity. Therefore, the interpretation of the curve in the figure requires some explanation. The point where the curve intersects the horizontal axis represents the fact that if no resources were allocated in the control of the phenomenon (zero cost of pollution control), that would be the levels of pollution reached (14).

On the other hand, to achieve zero pollution levels it would cost in the margin, what is represented by the magnitude where the function intersects the vertical axis. Looking then at the curve from right to left, it is showing that there exists increasing costs for avoiding greater levels of pollution.

'MDC' represents the marginal damage costs, which are anything else but the external costs associated with each different level of pollution. Both functions are assumed to be linear for simplicity purposes only.

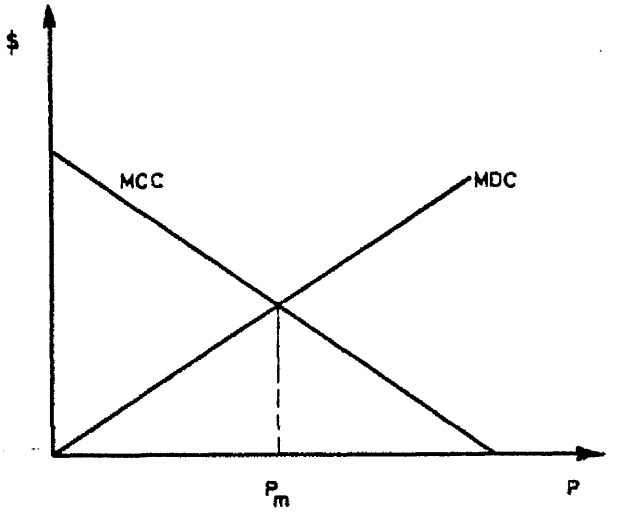


FIGURE N° 5.4: 'OPTIMAL' POLLUTION LEVEL. CONTROL COST APPROACH

In this case, the optimal level of pollution is determined where the marginal control cost equals the marginal damage cost in absolute terms, which, in other words, represents the level where the total social benefit (net) is maximized in relation to pollution control (15). However, these optimal levels coincide with those determined by the former approach only under the assumption of full employment and an equilibrated economy working in conditions of (otherwise) perfect competence.

If there were some level of unemployment and/or sectoral differences in factors' productivity (at least between the commodity production and the pollution abatement activity) such equivalence would be reached only by chance. In other words, it would be possible to maintain the 'optimal' levels of pollution determined by the equalization of the industry's MNB and ME at higher levels of the commodity's output.

The amount of pollution that remains after the ecodimensional costs are 'internalized' in the industry's decision-making process is considered as being the optimum in paretian terms. That is to say, the optimal resource allocation (including the ecodimensional waste assimilative capacity as a service provided by a multifunctional capital asset) in relation to the community's welfare implies a positive level of pollution.

Nevertheless, this optimum is so only in static terms, and therefore, it does not take into account the processes occurring within the ecodimension due to the existence of pollutants having positive flow-values and thus, somehow affecting the whole structure and function of the involved ecosystems. We have to consider then, the exact kind of waste generated, the assimilative capacity (if any) of the ecosystems receiving such wastes, and the way in which the pollution levels affect the structure and function of these ecosystems.

Let us assume the production of a commodity generating a degra-

dable waste and thus, assimilable by the natural systems into which it is disposed. As we mentioned earlier, the assimilative capacity expressed as levels of waste, corresponds to an ecological threshold characterizing the ecosystems, beyond which further volumes of matter or energy introduced through the waste-disposing activity would imply relevant structural and functional changes of the affected systems. We have also defined pollution as precisely being the situation of the ecosystems when such thresholds are trespassed by the levels of discharged wastes.

If, on the other hand, we consider that the structural and functional ecosystemic changes due to pollution imply (among other effects) a process of lessening the ecosystems' assimilative capacity to handle further volumes of waste, we may state that the solution discussed in the former analysis in terms of the 'optimal' levels of pollution (in paretian terms) would imply what Pearce denominates an 'ecological gap' (PEARCE, 1976; pg. 63-72) which meaning and effects we are going to discuss as follows.

In order to assess the implications of the 'ecological gap', in Figure No. 5.5 we will reproduce the one established in Figure No. 5.3 by expressing it, this time, in net rather than in gross terms. In this figure, 'MNB' represents the marginal benefits function net from private costs but gross in terms of the external costs due to pollution. 'q_p' in this case, represents the level of production that would maximize the private benefits and 'q_{p1}' represents the paretian optimal social level of production.

Figure No. 5.6 represents the technological situation relating the levels of waste generated (W) and different levels of production of the commodity X. For simplicity purposes we have assumed that the function linking these variables is a linear one and thus, the amount of waste relief per unit of the commodity produced, is constant and independent from the production levels. Notice that we are dealing with physical rather than with monetary measures. Also notice that we are identifying the levels of waste relief into the ecodimension with

the levels of waste generated and thus, we are assuming that neither recycling nor treatment is done.

Considering our definition of pollution, we may relate different levels of waste introduced into the ecodimension and pollution levels (in physical terms) by means of a physical waste-pollution function which is shown in Figure No. 5.7. In this figure, $\overline{W}$ corresponds to the assimilative capacity of the receiving ecosystems expressed as the amount of waste such ecosystems are able to handle without any disruption in their structure and/or function and therefore, implying zero pollution levels. The rate at which pollution increases beyond this point is assumed to be constant and depending from $\overline{W}$ in the sense that the lower the value of $\overline{W}$, the higher will be the slope of the function.

On the other hand, $\overline{W}$ has been stated as depending on the levels of pollution, in the sense that positive values of the latter would imply decreases in the former. This relationship is represented in Figure No. 5.8. Again, in this case, we are assuming a linear functional relationship for simplicity purposes. In fact, the shape of the curve will depend on the general characteristics of the ecosystems, on the external limiting factors (climate, etc.) and on the exact nature of the waste being generated and disposed.

Finally, we could establish a functional relationship between the levels of pollution affecting different segments of the ecodimension and the valuation the community makes of such disruption, in terms of monetary measurable costs. In general, this relationship will depend on the kind of ecodimensional conditions pre-existing in the area (the initial value of the ecodimensional capital) and on those created by pollution in terms of health effects, of negative effects over other ecodimensional functions played by the affected ecosystems whether they correspond to the provision of amenity resources, other economic resources' breeding, etc. (the effects of the capital depreciation due to pollution over the commodity-flows provided, other than that of waste-assimilation).

However, we may assume a rather straightforward linear dependence that would allow us to derive some general conclusions that are relevant for policy purposes. In Figure No. 5.9 we have represented such interconnection, where ME(P) represents the marginal external costs of pollution.

Although the processes occurring in the ecodimension when pollution has positive values involve a continuous dynamic change, we are going to use the static comparative scheme to analyze and discuss the validity of the optimum derived from the static paretian approach. We will consider that the relationship existing between the level of assimilative capacity in terms of the wastes being discharged and the levels of pollution is represented by the following function,

$$(5.3) \quad \overline{W}_t = \overline{w}\,(P_{t-1})$$

Which in fact corresponds to the relation allowing us to include the time variable within our former discussion. The other relationships mentioned before and represented in the previous figures can be formalized in the following way:

$$(5.4) \quad W_t = w\,(X_t)$$

$$(5.5) \quad P_t = p\,(W_t, \overline{W}_t)$$

$$(5.6) \quad ME_t = e\,(P_t)$$

$$(5.7) \quad X_t = x\,(ME_t\ ,\ MNB_t)$$

The level of X_t in each period is determined by the condition $ME_t = MNB_t$, which represents the optimal level derived from the paretian conditions.

Given the characteristics of the relation represented in equation (5.3) stated before in Figure No. 5.7, we may appreciate that the system becomes unstable insofar as the static paretian conditions are satisfied. In Figure No. 5.10 we have represented the operation of this

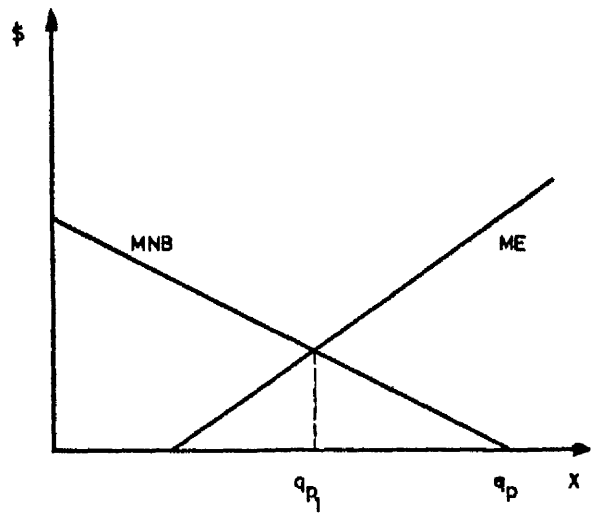


FIGURE N°5.5: 'OPTIMAL' POLLUTION LEVEL. EXTERNAL COST APPROACH (b)

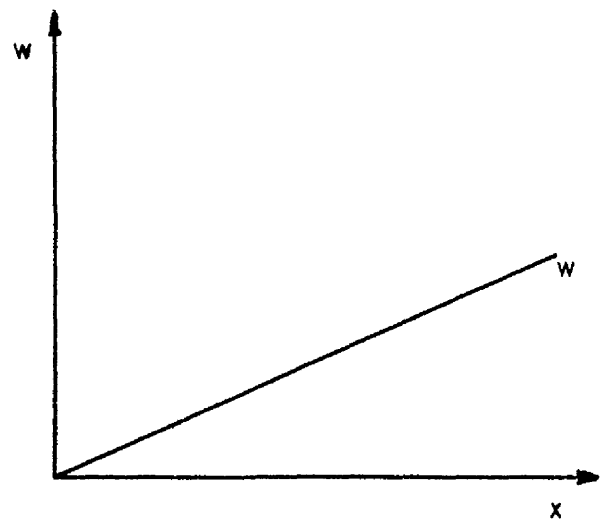


FIGURE N°5.6: PHYSICAL WASTE GENERATION FUNCTION

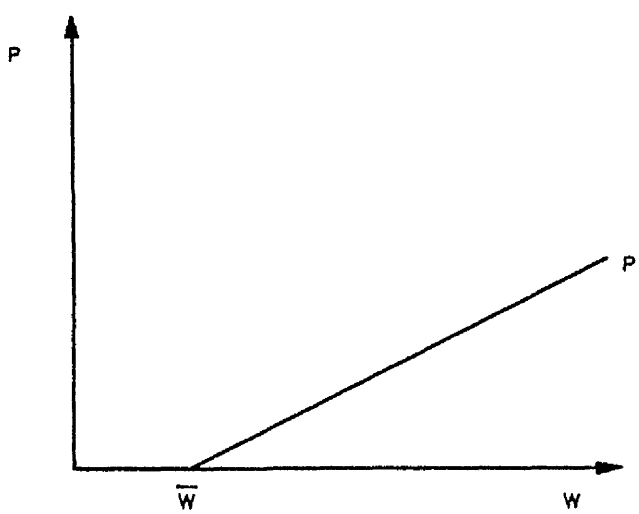


FIGURE N°5.7: WASTE- POLLUTION (PHYSICAL) FUNCTION

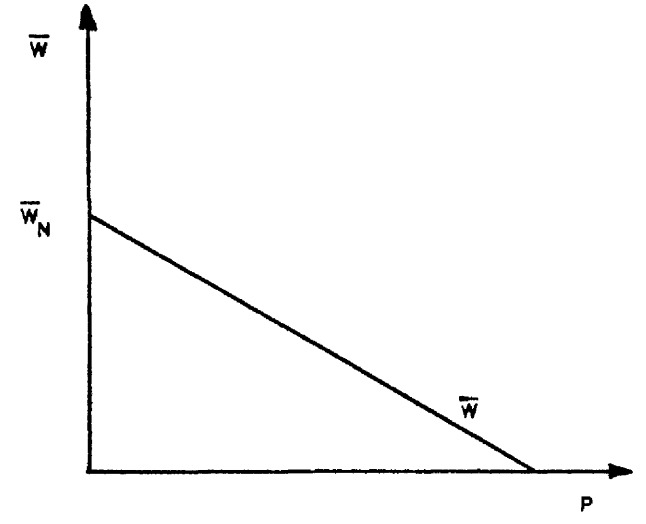


FIGURE N°5.8: POLLUTION - ASSIMILATIVE CAPACITY FUNCTION

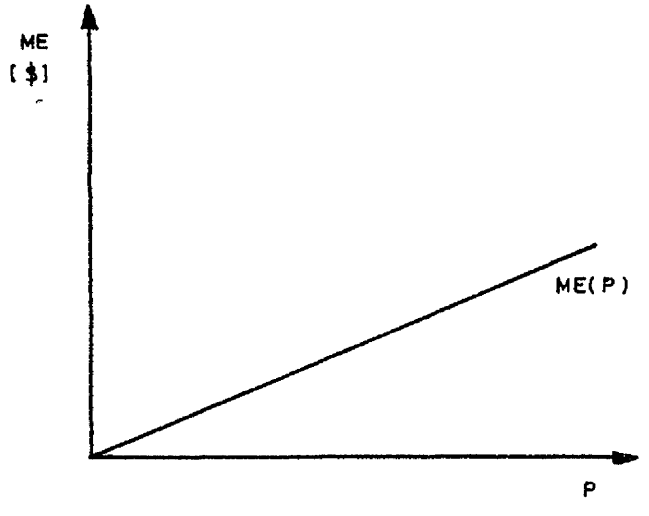


FIGURE N° 5.9: MARGINAL EXTERNAL COST OF POLLUTION

pattern, exagerating the effects occurring in each round.

From it we can conclude that, given the technological conditions, the natural capabilities of the involved ecosystems (their value as an ecodimensional multifunctional capital), and the valuation the community makes of the resulting ecodimensional degradation associated with different pollution-levels, the neglect of the dynamic ecodimensional decay process would imply a progressive and permanent increase of the pollution levels and also a permanent depreciation of the used segments of the ecodimension as a multifunctional capital resource so that in a finite period of time, the assimilative capacity of the ecosystems would be reduced to zero and the other commodity-flows such ecosystems provide, would be strongly diminished either quantitatively or qualitatively. This outcome is represented in Figure No. 5.10 by the shift of the P function upwards (equal levels of wastes discharged would imply higher levels of pollution together with the fact that the zero-pollution waste level would diminish); by the shift downwards of the $\overline{W}$ function; and by the correspondent shifts of the marginal external costs curves associated with the process of ecodimensional capital depreciation.

In our graph, we established an initial adjustement of the levels of production so that the social benefits (net from both private and social costs) are maximized at that moment. If the level of output is maintained at that initial one (X_o) in the following period, neglecting the ecodimensional change experimented, the community would incur a net welfare loss which is equal to the area BCA. If this situation is further maintained, the losses of welfare will increase at an increasing rate.

A rather obvious corolary of this analysis is represented by the fact that any increase of the levels of production would imply, ceteris paribus, greater losses and therefore, economic growth under these circumstances would be negative in terms of social welfare and thus, irrational.

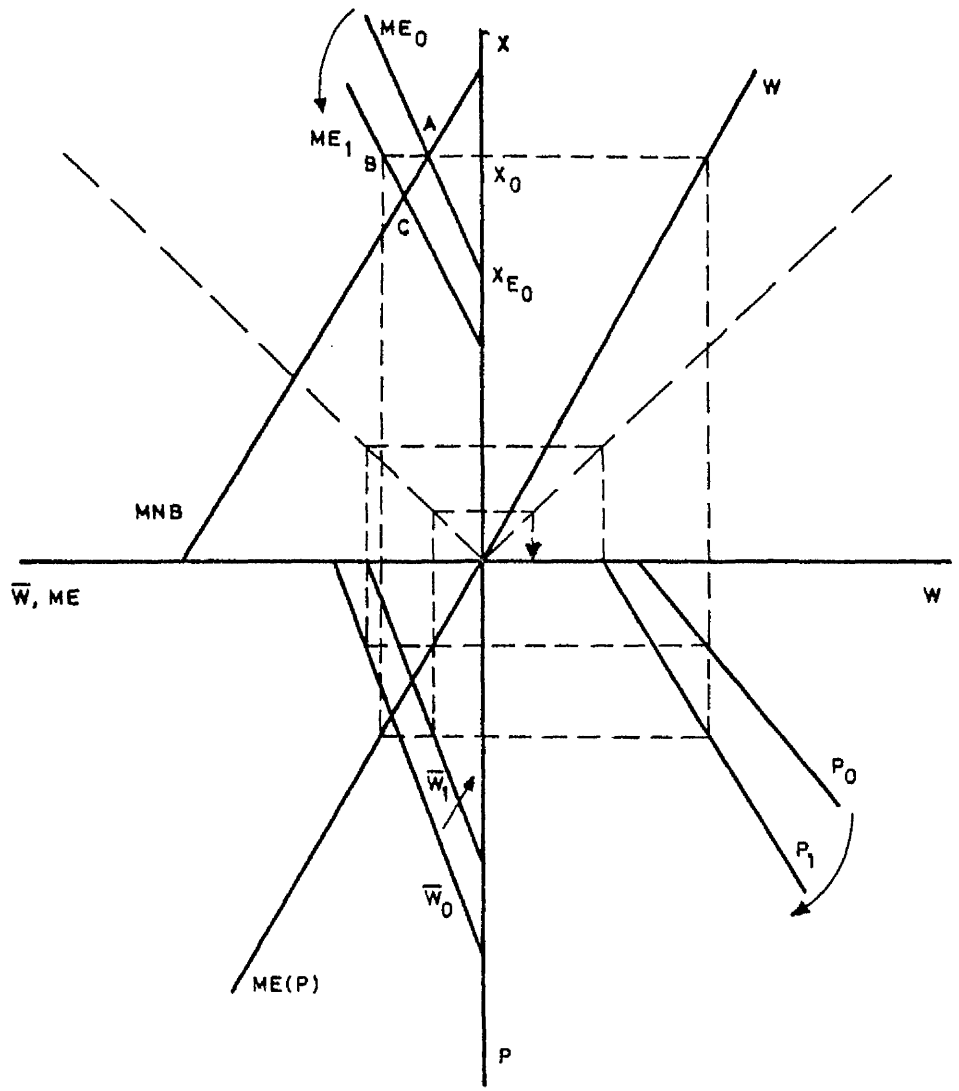


FIGURE N°5.10: THE "ECOLOGICAL GAP"

From Figure No. 5.10 it is easy to see that, other things being equal, le maximum levels of production of X that eliminate the process of diminishing the assimilative capacity of the affected ecosystems is X_{eo} , which corresponds to that level implying zero pollution; that is to say, the level of production generating a waste flow that does not exceed that representing the ecosystem's assimilative capacity. The difference between this value and that derived from the satisfaction of the paretian optimum conditions, X_o , is what Pearce has named the 'ecological gap'.

It is also possible to appreciate that even in the case of a continuous adjustment to the changing marginal external costs so that the paretian static conditions are satisfied in every period, the ecological gap will remain (and in fact, will be widening) and the final result of carrying the ecosystem's assimilative capacity to zero will be reached anyway, though probably in a later date.

Although we are going to discuss other implications of this approach, at this stage we can say that it gives an economic-ecological explanation of those stands we frequently find in the literature on the environmental crisis, which place the blame on economic growth: if we extend the former analysis to all industries comprising the economic structure, the generalized existence of waste-flows higher than the assimilative capacity of the ecosystems (satisfying the paretian conditions) would necessarily have the result of endangering sooner or later the survival possibilities of mankind or, at a national level, would imply the inhabitability of tha national territory.

However, apart from the possibility suggested by the former discussion of avoiding the eventual ecodimensional collapse due to pollution by maintaining the levels of production within those determined by the natural (or initial at a certain point in time) assimilative capacity of the ecosystems and therefore, by imposing concrete limits to economic growth, from our figure we may conclude other general strategies to cope with the problem.

(i) Increasing the ecodimensional assimilative capacity: the process of continuous lessening the assimilative capacity of the ecosystems where the waste-flows are disposed of, could be smoothed or eliminated by enlarging such capacity artificially. In terms of our figure, this is represented by a shift outwards in the curve relating levels of pollution within a given period and the ecosystemic assimilative capacity in the following period. As we have already stated, starting from period 0 in Figure No. 5.10, the production level achieving a paretian optimum which consider external costs of pollution (of the previous period), is X_o. This level of production however, implies a decrease in the assimilative capacity in the current period represented by $\overline{W}_o\overline{W}_1$, which effect is to increase, ceteris paribus, the level of pollution and thus, the associated external cost of period 1.

If we restore the former level of the assimilative capacity at the end of period 0 once and for all, the effect will be that the whole process of environmental (ecodimensional) decay will be postponed in one period. Therefore, if we want to maintain the overall value of the ecodimensional capital without diminishing the levels of production, we must allocate a continuous flow of resources in the activity of enlarging the involved ecosystems' assimilative capacity.

In other words, a flow of positive gross ecodimensional investment would be required if the productive capacity of the economy as a whole is to be maintained in the long term.

In this case however, the relationship depreciation-investment is or should be of a different character than that involving other capital goods, mainly due to the differences in the assimetry involved in the physical depreciation-reposition process. While in the case of traditional capital goods, their time of production is minimum as compared with their useful life, in the case of the ecodimensional capital represented by the assimilative capacity, this relation is almost always inverse, i.e. the time of reposition once the asset has been completely (pr nearly) depreciated, normally is much longer than that in

which the depreciation has occurred.

On the other hand, while in the case of traditional capital goods, the financial resources derived from its depreciation rates could be temporarily shifted towards other investments, in the case of ecodimensional capital, the process of replacing should occur 'pari passu' with that of effective depreciation. Otherwise, the replacement of the asset once it becomes useless (if possible at all), would be extremely costly and very mubh higher than the flow of resources involved in the former alternative, whatever be the interest rate used to discount such flow. In other words, while in the case of 'pari passu' replacement, the depreciation can be considered as being linear, in the case of reposition once the asset has been completely depreciated, the depreciation becomes exponential.

(ii) Changing the intensity of the wastes' polluting effects: given a certain quality and amount of wastes derived from the production (16) activity of the economy, the effects these wastes generate over the ecodimension in terms of pollution can be diminished by means of various alternative or complementary actions taken before discharging them, which would be reflected in our figure, in both a change of the slope and a shift of the P function downwards.

Among such possibilities are the modification of the residuals or a change in its global composition, giving to the flow different physical and/or chemical forms less harmful to the ecosystems (FORSUND and STROM, 1974). This could take the form of capturing and concentrating toxic elements, separating those like air and water which can be released back into the ecodimension with no ill-effects, or degrading the wastes into less complex forms before discharging them and thus, releasing wastes more easily assimilable by the ecosystems (STEARNS and MONTAG, 1974). There is another possibility which relates itself with the time and location of the discharges. Changing the time-paths of releasing given amounts of waste (both in seasonal and daily terms) towards paths according with moments or periods when the ecosystems

have the highest levels of assimilative capacity or changing the waste disposal activities from ecosystems with lower to ecosystems with higher assimilative capacity, would certainly imply less pollution levels (the representation of this case in our figure will correspond to a shift in the $\overline{W}$ function and subsequently, of the P function, rather than a pure change in the latter) (17).

Unless these changes imply the discharge of wastes in volumes that are lower (or equal) than those determined by the ecosystems' assimilative capacity, its effects would be only to smooth the process of ecodimensional decay, enlarging the period of an eventual collapse, but would not eliminate it.

As it is easily noticeable, within this alternative there are some types of action that may be regarded to as investments resulting in the enlargement of the ecosystem's assimilative capacity (e.g. waste treatment plants). Nevertheless, they correspond to the once-and-for-all type of investment mentioned in the former paragraph, which effect will not necessarily imply the continuous reposition of the ecodimensional asset required by the depreciation pollution generates.

(iii) Recycling and reclamation of residuals: given a certain amount and quality of wastes resulting from production or consumption activities, it is possible either to recycle them (partially or totally) and thus, to avoid its discharge into the ecodimension or to reclame them once the waste loads has been discharged.

The first case, i.e. recycling the residuals, can be expressed in terms of our figure by a shift in the W function upwards; that is to say, the same levels of production would imply less volumes of waste and therefore, less degree of pollution (18). The whole process of ecodimensional decay will be smoothed unless the recycling activity results in disposal-flows operating within the ecosystemic assimilative capacity, in which case pollution will not become apparent at all.

Reclamation is referred to as the process by means of which the residuals are exteacted from the ecosystems once the disposal action has been taken and therefore, once the pollution side-effects of such activity have been created (SPOFFORD, 1971). The final result of this measure and the concrete forms it will take depend on the ecological processes occurring after the waste has been discharged into the ecosystems. In the case of persistent and non-degradable wastes for instance, it will consist on the re-extraction of such elements implying the reduction in their rates of accumulation. In the case of degradable wastes, reclamation acts over secondary elements appearing as a result of the ecological processes involved in their degradation and therefore, will coincide in some cases with the activity of enlarging the assimilative capacity, already discussed. This time however, apart from the yields this 'investment' will have in terms of replacing totally or partially the capital asset represented by the mentioned capacity, its productivity should be enlarged by adding the benefits (both private and social) involved in the production using the reclamed wastes as an input, net from both its private and eventual polluting effects or external costs (and of course, also net from any other external cost such activity may have).

(iv) Changing the technology of production activities: given a certain amount, quality and structure of production in the economy, it would be possible to induce or impose technological changes that either reduce the waste-generation per unit of production or imply the generation of less harmful (polluting) residuals.

In terms of our former figure, such change in its first form will be represented by a shift downwards in the W function having similar effects than those of the recycling activity already discussed, except that in this case ther will be no further productive activities involving the residuals. In the second form, i.e. generation of less harmful residuals, it will be represented by a shift downwards of the P function and could be achieved either by changing the equivalent degree of polluting effects per unit of waste or by changing its

physical characteristics allowing its release into ecosystems having higher assimilative capacity. In this sense, this alternative coincide with that discussed before under the heading of changing the intensity of the wastes' polluting effects. Nevertheless, in this case, such change is assumed to result from a change in the productive technology itself, while in the former it was mainly derived from acting over the wastes once generated but before them being discharged into the ecodimension. In other words, this alternative is assumed to be non-additive in technological and economic terms while the former is conceived as being essentially of an additive type.

The productive changes would involve any of the steps and areas of the production-consumption process, i.e. extraction, generation, manufacture, transportation and delivery of goods, services, electricity, fuel, food and water and they could be undertaken consequently by either the government, commerce or industry (STEARN and MONTAG, 1974).

(v) Changing product specifications: given the level of global production, the amounts of waste generated by it can be altered (diminished) by changing the specification of the commodities so that they perform more efficiently and therefore, demand less resources (which production in turn, generates waste-flows and other ecodimensional damage as well) or reduce the residuals output whether it occurs in the process of producing or consuming them.

This more efficient performance would involve also lower replacement-frequency in the case of durables and easier reclamation once consumed in the case of both durable and non-durable commodities. The same criterion of achieving higher efficiency is applicable to the design and production of capital goods (STEARN and MONTAG, 1974).

Although the objective of reducing the flow of harmul wastes is based in this case, only on changing the products' specifications, normally it will be followed by changes in the demand structure, in the price structure and consequently, in the overall 'product-mix' of the economy. It should be expected that such a change in the pro-

duct-mix will further reduce the polluting effects of the economic activity. Nevertheless, this could ne not the case if, for instance, the specification changes imply demand-shifts towards substitutes having higher polluting effects, due to adverse changes in their relative prices. The final effects of this alternative in terms of achieving the ecodimensional objectives will depend also on the direction and level of the changes in relative prices and on the cross-price-elasticities of the commodities' demand.

(vi) Finally, based on the fact that different commodities will have different quality and level of associated waste-flows (both from its production and consumption), a given level of global product will have less harmful effects on the ecodimension if a change of the weights each commoditey has in the overall product-mix is induced or imposed, giving higher weights to those having less harmful or lower residual-flows.

The assessment of the action lines we have briefly reviewed should be done considering their contribution to the solution of the previously discussed ecodimensional problems, as well as to the solution of other problems connected with other developmental issues such as the distributional situation and the process of spatial change which are, in fact, strongly related to the ecodimension, its problems and their solution.

In the next section we will discuss the relevance of the analyzed ecodimensional functions and problems in the process of regional change. We will also discuss the general ways in which these issues should be included within a comprehensive analytical framework for dealing with regional development.

5.3 : CONGESTION AND POLLUTION AND REGIONAL ANALYSIS

In the previous chapter but one, we noticed the lack of expli-

cit consideration of the ecodimension by both Friedmann's and Siebert's approaches. This is particularly so in the case of those ecodimensional functions affected by the pollution problem and also, though to a much lesser extent, in the case of the ones we have given special attention as affected by congestion problems.

We also established, as a working hypothesis, that to attribute the concern about the 'environmental quality' (19) only to post-industrial stages of development could very well imply an inefficient long-term resource allocation and that the earlier such a concern were introduced into the scope of the decision-maker, the wider would be the options-set, in terms of development strategies, available to the planner for dealing with growth and ecodimensional goals.

Most of the policy oriented approaches to the pollution problem attempted by economics in general precisely being the result of a post-industrial concern, have been strongly focussed on those action-lines, among the set we identified before, which we could qualify as being in line with the 'marginal' analysis: facing a situation already characterized by relatively high pollution problems, the analysis of policy measures is done in terms of marginal adjustments that should be required in order to correct the inefficiencies generated by the existence of these ecodimensional external costs. Most of the discussion has been then centered around the relative advantages of direct controls and regulations versus those of using fiscal mechanisms or taxation systems.(see, for instance, FORSUND and STROM, 1974; BAIN, 1973; BOHM, 1973; EDEL, 1973; FREEMAN, HAVEMAN and KNEESE, 1973; DAVIS and KAMIEN, 1969; DALES, 1968; KNEESE and BOWER, 1968; MISHAN, 1968; and TURVEY, 1963).

Although recognized as possible courses of action, very little attention has been given to more 'radical' approaches involving, for instance, goal-oriented long term changes in the population's demand structure so that the process of development considers not only the requirements, in terms of productive structure, involved in the satis-

faction of the basic needs of both actual and future generations, but also the necessary harmony between the growth patterns and the ecodimensional potentialities and limitations.

On the other hand, the mentioned line for approaching the pollution problem completely neglects its spatial dimension in terms of geographical differentiation of the effects of the waste-disposing activity and therefore, neglects spatially oriented policy instruments and measures for either alleviating or preventing the existence of such ecodimensional problems (20).

On these grounds however, i.e. on the treatment of pollution within the framework of regional development analysis, the lack of explicit consideration of this phenomenon constitutes an insufficiency of not only the approaches we are specially interested on, but of the regional development theory as a whole.

When considered, the general trend has been to loosely establish the pollution problem as a form of agglomeration diseconomy that, with varying intensity (normally considered rather negligible) and beyond certain limits (21), would operate against clustering of both population and firms and therefore, would tend to smooth inter-regional disparities (RICHARDSON, 1973; KALDOR, 1970). Nevertheless, this way of considering this ecodimensional problem gives no attention to the dynamics of the whole process (in terms of ecosystemic structural and functional changes) induced by the waste-discharging activity within the ecodimension and thus, to a relevant extent, the latter is considered as capable of maintaining a minimum, non depreciable, capital value.

When dealing with the areas in which we focuss our attention as those presenting the most accute congestion problems, i.e. principally the provision of housing services, residential space (mainly in urban areas) and basic public services, Friedmann suggests an approach that is in line with our definition of development, specially in the case of

housing investments.

Within the context of his core-region paradigm, he considers housing policies in a sense that goes beyond the conventional approach of distinguishing social from economic infrastructure (being housing investments normally aggregated under the former). Apart from its social function of providing shelter and essential public services as well as community environments facilitating constructive social processes, he assigns to housing policy at least four direct economic functions that are highly relevant in fron to the problems (spatial and social) characterizing the Latin American process of environmental change: the mobilization of unsused resources (specially labour); the channeling of migration processes; the increasing of labour productivity; and the development of the construction industry (FRIEDMANN, 1973; pgs. 144-6).

Siebert however, is nearer to the conventional approach and focusses most of his attention on economic infrastructure, at least in his more formal treatment of regional growth determinants.

The discussion attempted so far in this chapter in connection with the problems of congestion and pollution and the associated ecodimensional functions, allows us - as we did in the previous chapter - to suggest some elements and features that should be introduced in the discussed analytical frameworks in order to gain the comprehensiveness demanded by the planning of development (as defined in Chapter 1), starting from the actual situation characterizing the Latin American human environment.

(i) To incorporate the ecodimensional function of being a waste-assimilator in the regional productive potential, giving services to both productive and consumption activities.

(ii) The former feature together with the uneven spatial distribution and heterogeneous character of the ecodimensional capital assets pro-

viding the referred services, call for a much more concrete consideration of the regional space in order to achieve a meaningful definition of such capital as a factor determining the regional productive potential.

(iii) To identify, at the most dissaggregated level as possible (both in terms of economic or productive sectors or industries and in terms of social groups) the composition and level of demand for the analyzed services of the ecodimensional capital.

(iv) To include the most relevant features of the structure and function of the ecosystems involved in the provision of the waste assimilative capacity and its basic connections with the commodity-source ecodimensional function.

(v) To further specify the technological factor so that different options in terms of both production and consumption technologies could be properly assessed in front of the ecodimensional capabilities and of the trends in the community's demand structure.

(vi) To confront the trends of the demand structure as it is expressed through the market mechanisms with a normative scale so that the exact relative position of basic 'public' services (including housing in general) could be assessed in front of desired social values. Later on, when dealing with the distributional issue we will return to this question.

NOTES

(1) Because of the necessary enlargement of the services provided by the ecodimension (in its natural capabilities) required by the urban type of human settlement, it is impossible to separate what is supplied by the ecodimension itself from what is due to the technodimension. Therefore, when referring ourselves to the ecodimension of the urban environment, we will include both dimensions as defined in Chapter 1, unless it is otherwise expressed.

(2) This definition of 'generic congestion' includes customary congestion and pollution as special cases which difference is mainly due to the special kind of relationship that is established among the generators and victims of 'interference' in each case (op.cit., pg. 346).

(3) Spontaneous settlements hve grown, in terms of their population, at rates near to 12% in some cities like Santiago, Lima, Caracas, Bogota, Mexico City, Rio de Janeiro and Panama, being even higher in certain cities of smaller size where most of their growth is due to this type of settlement (e.g. Chimbote, Barranquilla, Puerto la Cruz, etc.) (ECLA, 1976). For a detailed study of this phenomenon in Caracas, see OFICINA METROPOLITANA DE PLANEAMIENTO URBANO, 1974, where it is registered, for instance, that in 1966, 18% of the total surface of the city was constituted by this type of settlement, supporting 23% of its population.

(4) In major Latin American cities these misery belts could very well represent between 25 - 30% of their population (ECLA, 1976; pg. 47).

(5) For an explanation of the meaning of 'augmenting cycles' within this kind of models, see Chapter 14.

(6) Worth noting in this sense is the type of congestion connected with the urban transport system. Despite the fact that between 75 and 85% of the urban trips are made by collective means of transportation, 80% of the urban road system is occupied by private cars and taxis. In some major cities of the region, this has resulted in buses having reduced their average speed to only 8 Km/hr (ECLA, 1976; pg. 39).

(7) The typification done in the first part of this section in connection with pollution and pollutants is mainly based on KNEESE (1971) and RUSSELL and LANDSBERG (1971).

(8) The definition of regional in terms of administrative or political boundaries is generally avoided because the "scale of pollution resulting from the emission of materials and energy follows the patterns, pulses, and rythms of metereological and hydrological systems rather than the boundaries of political systems" (KNEESE, 1971; pg. 2).

(9) Holzworth has attempted this detemination of the U.S.A. territory in terms of potential episode-days per year, where an episode-day is

defined as occurring whenever the mixing height is less than 1500 m. and the wind speed is less than 4 m/sec for at least two consecutive days during which no significant precipitation has occurred either (HOLZWORTH, 1972).

(10) Agriculture also consitutes an important non-urban source of degradable-wastes pollution, mainly as a result of fertilizers and animal manure which is washed of by natural vectors subsequently entering the water ecosystems.

(11) Because of its particular characteristics we will analyze the treatment economics gives to pollution problems in general and particularly to that affecting water resources. Most policy implications of its analysis however, are in general applicable to the issues discussed before in this chapter.

(12) An important question, in terms of policy implications, that arises from the untraded character of the flows affected by pollution generated depreciation processes, is whether this character is derived from institutional restraints that make them unmarketable, or from characteristics of these effects themselves that make almost impossible the identification of eventual trading-parties. This distinction is relevant not only within the context of a market economy, but also in that of a centrally planned system where the assignment of some kind of valuation (shadow prices) of the different commodity-flows provided by multifunctional capital assets will be also difficulted by these characteristics, and specially by the second type.

(13) These costs correspond to the amount in which the commodity-flows provided by the depreciated capital diminish both actually and potentially.

(14) The exact position of this point will depend on the levels of pollution derived from these levels of production that maximize the private net benefits of the industry, which are the production levels where it would locate in if the external (ecodimensional) costs were completely neglected.

(15) For a demonstration of this statement, see PEARCE, 1976; pgs. 73-5.

(16) Even though we are discussing the waste-disposal derived from production activities, the actions stated are also applicable to those wastes derived from consumption activities.

(17) This change could imply only a spatial one, maintaining the kind of pollutant and releasing it into the same kind of ecosystem, and also it could imply a change of the latter. For instance, it could be possible to decrease the levels of equivalent aggregate pollution by shifting it from aquatic to atmospheric pollution if the latter involves a relatively higher 'assimilative capacity' of the affected ecodimensional segments.

(18) This would be a true-statement insofar as the recycling of the

wastes into the productive process imply a secondary waste-generating activity that involves either less amounts of equally harmful (polluting) residuals or the disposal of the same amounts of less polluting ones. When referring ourselves to less volumes of waste resulting from recycling activities we are meaning equivalent volumes in terms of their polluting marginal and average effects, rather than volumes in absolute physical magnitudes.

(19) As we noticed, environmental quality in this context is mainly referred to as connected with the intensity of pollution problems affecting the ecodimension.

(20) Obviously, the ',arginal' (control versus prices) type of approach could include the spatial variable by discriminating between localities or regions. This however, has normally not been attempted whether because of the complications it would introduce in an otherwise simple scheme, or because the location decision is considered in the same status as that of determining production techniques or output levels, and therefore, not requiring special and separate consideration (JACKMAN, 1975).

(21) Although the recognition of the existence of some kind of turning point in this sense does not necessarily mean to subscribe the 'optimum city-size' approaches, it has been in connection with the latter that the pollution (and congestion in general) problem has received more attention in regional analysis.

CHAPTER 6 : REAL INCOME DISTRIBUTION, THE ECODIMENSIONAL PROBLEMS AND REGIONAL DEVELOPMENT

We have defined development as a process of environmental change aiming at the achievement of increasing levels of real income (for both actual and future generations), that should be distributed on equitable bases among the community members.

The Latin American historic experience of environmental change implies the need for considering the distribution issue as an explicit policy area. The concern of the regional development theory about spatial income differentials should be enlarged in order to include its personal expressions as well, which, as we noticed in Chapter 3, is largely neglected in Friedmann's and Siebert's theoretical approaches.

In order to do so, we have considered convenient to start our discussion with a brief review of the theory of income distribution. Then we will take a closer look to the connections existing between the distribution issue and the ecodimensional problems discussed before. Finally, we will suggest some elements and features that should be introduced into our analytical framework in order to allow the explicit consideration of the distributional situation.

6.1 : THE THEORY OF INCOME DISTRIBUTION

Most of the theory of income distribution, since Ricardo, has been focussed on the distribution of the income generated by the economic activity between production factors, i.e. on the functional distribution of income.

Within this theoretical body, the basic problem is conceived as the determination of the levels of employment and the correspondent remuneration of the production factors. The main sources of discre-

pancy between its different lines of thought (neoclassical as compared with the marxist schools, for instance) are focussed in the assumptions made about market behaviour and the economic system's mechanisms of income appropriation among production factors (determination of factors' prices). The connection between functional and personal distribution (being the latter the relevant category for finally determining the levels of social welfare) has been drawn in a rather simplistic way by assuming that the owners of labour, capital and land are distinguishable, different, social groups. On the other hand, the connection between economic growth and personal income distribution has been conventionally treated (mainly by welfare economics' theories) as independent issues, being the central concern that of determining the optimal rates of growth and assuming that desired patterns of distribution between social groups are possible by unrestricted (politically) income transfers. In this context, no conflicts between growth and distribution are recognized.

There are at least three elements characterizing the Latin American environment that support the statement of these theoretical approaches as giving inadequate policy guidelines.

(i) There is no such clearcut correspondence between the categories in which production factors are normally aggregated, and social or income groups. In this connection, the following elements should be considered: significant numbers of landowners belong to the poorest segments of the social structure (small and marginal farmers); there is a great degree of heterogeneity within the segment of the population which basic income source is its labour force, belonging either to the middle, low or even to the high income groups; there is a relatively significant proportion of the active population of the lowest income groups which is self-employed and which income is difficult to be aggregated as resulting from the application of labour or from the ownership of some kind of capital, in terms that are relevant for policy purposes (in connection with this element, the importance of the family unit and the range of different income sources normally as-

sociated with each unit, are features that should be considered).

(ii) Normally there is a great number of political constraints for reorientating patterns of income distribution generated by specific growth strategies, if such patterns do not correspond to the goal-image of the community.

(iii) There is a significant proportion of the population living below the poverty line. This implies that both income links between socio-economic groups and income determinants in poverty groups have to be analyzed and thus, the integration of growth and distribution theory is a necessary condition for policy design (AHLUWALIA and CHENERY, 1974).

The former characteristics imply that instead of functional distribution theory, one should recourse to personal distribution approaches. Furthermore, the presence of the third characteristic, i.e. significant poverty problems, requires the consideration of not only unequality in income distribution but also of particular factors generating the poverty problem.

Within the context of a social system in which private property constitutes a relevant institution (1), personal (or family) income distribution will be mainly determined by:

(i) The distribution of the ownership of the various kinds of productive factors among the community members (or the relevant social unity for these purposes).

(ii) The degree of employment the economic system makes of each kind of productive factor.

(iii) The relative prices of such factors.

(iv) The allocation of the owners of such factors in different sectors

and activities in the economy.

(v) The accessibility of the community members to public commodities (2).

(vi) The accessibility of the factors' owners to complementary assets, inputs and productive services.

(vii) The action of the government, whether it is expressed by transfer of income from one group to another or by the allocation of resources benefiting each socio-economic group with different intensity.

While determinants aggregated in points (i), (ii) and, to some extent, (v) before, correspond to structural elements, those aggregated under points (ii), (iii) and (vi) correspond to what we may call conjunctural determinants.

The action of the government should be aggregated under the conjunctural kind of influence in the sense that his intervention will be conditioned by the combination of events or circumstances existing at the moment when the decision of intervene is taken. However, despite this conjunctural character of governmental actions as an income distribution determinant, once the policy measure is implemented it is the element of the social system (structural and/or conjunctural) this measure affects what will ultimately determine the character of its influence.

The importance of making this distinction between structural and conjunctural determinants in terms of policy lies in the fact that while the once-and-for-all change in structural ones would permanently modify the distributional pattern of the social system, the permanency of distributional changes through conjunctural determinants will prevail as far as the inducing measure is vigent (3).

On the other hand, it is frequent to find that while structural changes have a major impact in the medium and long term, conjunctural

changes are likely to have their effects in the short term (4).

Let us briefly examine the elements already mentioned.

The Distribution of Factor Ownership

The ownership of productive factors as a source of income should be considered in terms of both its quality and quantity. Any individual member (or family) of the community could appoint labour, economic capital (5) and/or ecodimensional capital to the economy's productive process. Both the quality and quantity of the available factors to be appointed are determined at any time by inheritance and investment.

In the case of labour or, mor appropriate, of human capital we find that any member of the community has a limited and approximately equal (in comparison with the rest of the community members) quantity available to contribute with. Therefore, the main source of differentials, in terms of income, coming from the ownership of this factor will derive from differences in its quality, which is in fact the characteristic susceptible of being varied by inheritance and investment.

As a productive factor, there are three major elements that give shape to the human capital's qualitative character: first, there is what we may call the general psychological characteristics of the individual (personality, intelligence, attitudes and general aptitudes are major features included in this category); second, acquired capabilities (general and specific education mainly count in this category); and third, experience (which includes those capabilities an individual acquires through his involvment in specific activities during his life).

Obviously, this aggregation is somehow atrificial because the education an individual receives, for instance, counts for his experience and for the advantage he may take of it and in turn, both education and experience will strongly condition his psychological characteristics.

On the other hand, the 'initial' psychological characteristics will condition the extent to which any individual would improve the quality of his 'human capital' by means of education and experience. However, the distinction is still useful for analytical and policy purposes.

Having in mind the interconnections between the mentioned elements, it is possible to state that, in general, the psychological characteristics of any individual are basically determined by compulsory inherited factors (both in biological and social terms). It will be the genetic content togethe with the legacy in terms of attitudes and, to some extent, of personality and general aptitudes given to him through the home and social environments in his early years what will have a decisive influence in shaping the individual's psychological characteristics.

Changes or improvements in the quality of the capital due to acquired capacities and experience should be considered as derived from a process of investment. Assuming no problems of accessibility to the means allowing human capital investments, there is still a strong connection between inheritance (mainly cultural) and investment in this sense (6).

Due to the inter-connection between psychological characteristics, acquired capabilities and experience on one hand, and to the links between inheritance and investment in human capital on the other, initial conditions of unequality generating different values of thes e determinants among socio-economic community groups will tend to perpetuate and even to widen the differences in the overall capacity of each group (and of each member within it) to generate and earn an income.

The same argument in connection with inheritance and investment is valid in the case of economic capital (7), although this time the quality differentials in human capital will tend to aggravate any ini-

tial disequilibrium existing in this sense. Assuming that each individual (or relevant socio-economic unit) has to rely on his own means for increasing a certain initial, inherited, volume of economic capital, the higher this initial availability the greater the possibilities of this individual will be to receive an income flow that, after assuring the satisfaction of his basic needs, allows him to conserve and eventually increase his initial availability (through the investment his saving capacity permits). At the other extreme, the lower the initial availability of an individual's capital stock, the more difficult will be his possibilities of accumulation, to the extent that eventually he may be unable to replace the capital losses due to depreciation. These trends derived from initial conditions in terms of availability of economic capital, could be either modified or emphasized depending on the quality of the human capital associated with the ownership of the former. A poor-quality human capital associated with relatively high volumes of initial economic capital could very well result in a process of decapitalization in the medium and long term, as well as a small volume of initial economic capital associated with a high-quality human capital could result in a situation of progressive accumulation. Although such cases are theoretically possible and have accurred in practice, they constitute the exception confirming the rule. And the latter is that normally there is a relatively high correlation between the size of inherited economic capital and the quality of the associated human capital.

The presence of positively correlated values of economic capital ownership and human capital quality tends to have multiplicative effects over income differentials insofar as high saving rates together with high finance and general management abilities constitute key factors in the accumulation process.

Considering that some evidence exists showing that normally the distribution of assets is more concentrated than the income distribution (see, for instance, FISHLOW, 1972 for the Brazilian case) it is possible to argue (though there is a great lack of data in this field) that the existence of significant middle income groups is mainly due

to the existence among these groups of relatively high human capital quality. Most Latin American countries however, show high unequality with a relatively small segment of their population located in the middle income group (8). This tends to make the whole social system much more rigid in the sense that, given the concentrated situation in the asset area, the highly polarized social structure makes extremely difficult the accessibility of the poor to the facilities allowing improvements in the quality of their human capital, and to complementary assets, inputs and productive services.

Accessibility of Factor Owners to Strategic Areas

Considering the (though scarce) evidence on the correlation existing between formal education and the share of different socio-economic groups in total income (9), and accepting the role played by the quality of human capital in shaping the distributional situation of a community (10), there is a relatively strong case for considering differentials in the accessibility of the community members to educational facilities, as a relevant factor conditioning the income distribution patterns. Such differentials should be regarded to as affecting the accessibility to education from different angles as well as derived from different causes.

Assuming all other factors determining educational availability as affecting equally any community member, quality differentials in the service constitute an important element contributing to what we have called accessibility differentials in generic terms. The presence of an heterogeneous educational system in terms of the quality of its services, presenting systematic bias towards different socio-economic groups (high-quality services normally being a 'private' commodity and thus, discriminating against the low income population segments while those services constituting a 'public' commodity are usually characterized by a comparatively poor-quality) represent an important factor shaping the distribution of the quality of human capital and consequently, affecting that of income generating capacity.

Insofar as this factor of accessibility differentials is present at each level in the formal education sequence, it contributes to reinforce the problem towards the higher levels of the educational system, even in the case where the latter constitutes a public commodity.

The unequality of income distribution itself and particularly the existence of absolute poverty problems constitute another structural characteristic making the accessibility to educational facilities to be different for each socio-economic group. Apart from the difficulties arising from the family's lack of perspective for assessing the importance of educating its young members, even in the case of complete publicness of an homogeneous quality of educational services, the lower the family's income level, the higher will be the pressure exerted on its young members to leave their condition of, dependent, students and join the active population at early stages.

Despite the importance one may attribute to differentials in the accessibility to educational services and facilities as conditioning the income distribution patterns, by no means its assessment (specially for policy purposes) could be done isolated from another feature, in terms of accessibility differentials, characterizing the social system. These are particularly important when considering the fact that in most Latin American countries the occupational structure of the lowest income groups is characterized by a relatively high incidence of non-wage income sources.

Although in this context the accessibility to and availability of high-wage jobs play an indiscutible role, one has to give as much attention to institutional characteristics limiting the access of non-wage earners to productive services like credit, commercial and general infrastructure, technical assistance, etc., and to factors like financial capital and physical capital ownership itself. Insofar as improvements of the human capital quality in general are not accompanied by increasing accessibility to these elements, the former will have little effect over the whole distributional pattern. Furthermore, when referring to the

conditions of the rural sector, an improvement in the accessibility to educational facilities that is not accompanied by improvements in the accessibility to complementary productive services and inputs (including accessibility to land ownership) will tend, in a context characterized by relatively high rates of population growth, to reinforce urbanward migration.

Accessibility to Basic Public Services

Another factor contributing to reinforce the condition of unequality, in terms of real income distribution, existing in the countries of the region is the limited access the poorest segments of the community have to basic public services such as housing, health and amenity facilities.

Apart from low monetary income caused to a great extent, by the previously discussed characteristics, the limited accessibility to these basic services affecting these segments of the population contributes to aggravate their welfare situation because of the incidence such services have in the living conditions (levels of real income) of the family unit in general.

Not only it has a direc effect over the levels of real income, but also poor housing conditions and insufficient health facilities affect the capability of the population to earn higher monetary incomes by reducing its actual productivity (short term effects) and by generating a social and physical micro-environment that does not allow the appearance of constructive social processes which, in the medium and long term, are key factors conditioning a greater degree of social mobility.

Employment, Wages Determination and Sectoral Location

Although the levels of employment, as we stated before, and the wage determination mechanisms play an undoubtedly role in shaping the distributional patterns of most underdeveloped countries, the emphasis usually given to employment and wage-pay policies as instruments for improving

the distributional situation tend to be overstated if consideration is given to the facts that a significant proportion of the unemployed (mainly in urban areas) corresponds to individuals belonging to middle and high income groups and that the bulk of the poorest members of the national communities corresponds to self-employed rural-located groups (11). Obviously, the generation of high-wage jobs and therefore the factors conditioning the employment levels and the determination of wages should be considered in any framework explicitly containing distributional issues. But this does not constitute a substitute for the consideration of the former structural conditionants which in fact correspond to equally (and in many cases, even more) relevant factors.

6.2 : SOME DISTRIBUTIONAL ISSUES CONNECTED WITH THE ECODIMENSIONAL PROBLEMS

As we mentioned when analyzing the commodity-depletion and the congestion problems, some of their most accute expressions are rooted in the highly unequal distribution of the economic activity itself (in spatial terms) and of its benefits and results (in personal terms). This pattern has been clearly emphasized in general by the Seminar on Environment and Development sponsored by the OECD and held in Paris, December 1975, which report states that,

> "One occurrence, common to all underdeveloped regions studied, is that while the wealthy sectors of the population tend to systematically waste scarce resources, the poor tend to make an excesive use of them, sometimes to the point of exhaustion".."the environment of the developing countries suffers at the same time from the consequences of extreme poverty and of extreme wealth".
>
> (CENTRE INTERNATIONAL POUR LE DEVELOPMENT, 1975; pgs. 29 and 36-7)

These ecodimensional problems may very well be attributed to underdevelopment itself one of which most noticeable characteristics being the extreme unequality of wealth, income and opportunities distribution.

Although it would be reasonable to think that the solution to

these ecodimensional problems should come about as development occurs, from our discussion of the previous chapters and from our previous analysis of the conditionants of the distributional patterns, it is fairly clear that such an outcome will strongly depend on the kind of strategy adopted for promoting higher growth rates and accelerating the whole development process. Insofar as the trend of relying on industrialization for these purposes continue, largely neglecting the rural environments and their problems we have witnessed in the past, no assurance can be given that the mentioned ecodimensional problems will be significantly alleviated, it they do not become even more accute.

Apart from this connection between the ecodimensional problems and the situation in the distribution area (which main features have been already analyzed in previous chapters), the design and selection of development strategies have to cope simultaneously with those ecodimensional problems (mainly pollution) that may occur as the result of growth itself and particularly associated with the processes of industrialization and urbanization.

Being highly probable that neither the appearance of such problems nor the measures that could be adopted for avoiding or solving them will be distributionally neutral, we will analyze the basic interconnections between these issues.

For analytical purposes we will distinguish those relationships implying distributional effects caused by ecodimensional-related elements from those implying ecodimensional consequences of redistributive actions. The first group in turn, can be subdivided in those distributional effects coming from the existence of ecodimensional problems and those derived from measures taken to avoid the appearance of and to solve already existing problems. In this latter case, the final effects must be assessed by considering the distributive consequences of both the existing problem and its solving-action, simultaneously. The reason for making such distinction, as we are going to see, lies in the fact that in general, both kinds of effects tend to

behave assimetrically.

Distributional Effects of Ecodimensional Problems

Among the ecodimensional problems related to economic growth, although not necessarily caused by growth itself, perhaps the most relevant for our purposes is that of pollution.

Insofar as the assimilative capacity services provided by the ecodimensional capital is used as a free or costless commodity from the user's point of view, there is a potential redistributive mechanism in-built in the operation of the economic system. If the activity using such such service is a consumption-oriented one, the redistributive effects will become apparent as soon as the waste generated trespass the ecodimensional assimilative capacity and provided that the pollution effects affect a different and/or larger segment of the community than that consuming the pollutant-creating commodity.

On the other hand, if the pollutant-creating activity corresponds to a production-oriented one, redistributive effects will appear whenever the unconsidered costs of using the ecodimensional capital are not reflected in the product's price and thus, inflate the industry's profits. If the pollution-affected segments of the community coincide with those consuming the industry's commodity, the redistribution will occur from the consumer towards the industry's owners and shareholders. Insofar as the produced commodity's price reflects, at least partially, the free use of the referred ecodimensional capital asset and if the pollution-affected segment of the community does not coincide with that consuming such commodity, the redistributive scheme will be much more complex. There will be some degree of redistribution from the non-consumer population towards the consumer one and still, some redistribution from the latter towards the shareholders will remain. The former will be reinforced if the community generates additional pollution effects when consuming the commodity.

In general, the redistributional effects due to consumption-created pollution will operate the same way whatever be the political-economic system (i.e. market based, centrally planned, or mixed). In the case of production-created pollution however, the redistributional effects will vary from one kind of system to another, depending on the proportion of the industry's firms (pollution-creating) state-owned and on the way the state spends the 'surpluses' generated by the avoided oportunity costs of using the involved ecodimensional capital.

Within the context of development planning however, the simple recognition of interpersonal redistributive effects of ecodimensional problems is rather meaningless, unless we are able to identify relevant community-groups 'whether such identification is made in terms of income, wealth, opportunities or welfare differentials in general) and then, to determine the direction of such distributional changes. In doing so, we must depart from the analysis of those characteristics of the ecodimensional commodity-flows having in-built redistributive mechanisms.

There are three main features in this sense that are worth noting: first, it is the already mentioned multifunctional character of most ecodimensional capital assets, which makes possible and highly probably the separation of different community-segments using its different services (12); second, it is the uneven spatial distribution of the ecodimensional capital assets providing equal or, at least, equivalent commodity-flows; and third, it is the heterogeneity of the ecodimensional commodities themselves.

It must be emphasized that the redistributive mechanisms involved in the former ecodimensional features will result in effective welfare redistribution insofar as we depart from a social situation already characterized by an uneven distribution of any welfare component in general and specially, of income and wealth. Indeed, if we were able to assume the existence of an ideal society in which perfect equality exists, any individual or group of individuals will use the same amounts and proportions of any of the commodities provided by the multifunctio-

nal capital assets than any other, all and each individual will face the same spatial friction to reach the ecodimensional commodities in the desired amount and quality, and the ordering in terms of preferences and priorities of the different kind of ecodimensional commodities will be the same to all. It will be only under these circumstances that problems affecting the volume or quality of the ecodimensional commodity-flows will be distributionally neutral. This is hardly the case of the Latin American countries where we find at least, profound income and wealth differentials not only between persons but also between regions.

In this context, the redistributive mechanisms of ecodimensional problems will act along two main ways we may call 'price-effects' and 'income- effects'.

By price-effects we understand those changes in the real price of the ecodimensional commodities due to the presence of degrading elements that change the effective availability of such commodities for one (income or other aggregative distributional criteria) community-group relative to the others.

By income-effects on the other hand, we inderstand differential changes in the income (or in the possibility of earning an income at all) of one group relative to the others, due to the presence of the ecodimensional problem.

Being essentially public goods, the way in which any individual has to avoid the consequences of deteriorating processes affecting spatially fixed ecodimensional commodities is mainly to move himself (whether temporarily or permanently) towards localities where such deterioration is absent or, at least, less intensive. Otherwise, he should somehow artificially create the conditions existing prior to the degrading process. Whatever the alternative adopted may be, each unit of the commodity will imply higher costs (price) from the consumer's viewpoint.

Disregarding other costs and the benefits derived from the acti-

vity causing pollution, it is likely that both poor and rich will suffer the negative effects of this problem. It has been often suggested however, that they will be stronger (in terms of diminishing welfare achievements) for the poorer than for the richer segmetns of the community and thus, will regressively affect the existing distributive situation. The main reason that has been adduced for this differential effect to occur is the relatively higher immobility characterizing poor people as compared with that of wealthier segments of the community (LECOMBER, 1975; FREEMAN, HAVEMAN and KNEESE, 1973; MISHAN, 1968), accompanied by the fact that, being unable to move into higher quality environments, they also have no possibility for creating (or purchasing) individual ecodimension-improving devices. Therefore, they have no other alternative except to suffer the consequences of pollution, insofar as the price of high-quality ecodimension fall outside their income-possibilities.

The multifunctional character of the ecodimensional capital assets and the heterogeneity of the commodities they render, act in general by reinforcing the stated regressive trends. While for the rich, higher quality ecodimensional characteristics from those they are willing to live in become divisible amenity and recreational commodities possible to 'purchase' in different quantities according to particular tastes and incomes, for the poor, the relatively unpolluted physical environment (compatible with minimum physical and mental health standards) constitutes an indivisible basic commodity hardly possible to get. Insofar as the income structure is embodied in the political system as well (as it is frequently found in the countries of the region) most of the public ecodimensional-improving efforts will be focussed over the recreational and amenity function which normally is shifted away from the sites inhabited by the poorest segments of the population. The amenity and recreational facilities for these segments, when available at all given their possibilities of mobilization and transport, becomes more and more scarce and therefore, increasingly congested.

Although the analyzed price effects can be interpreted as being real income effects as wll, by diminishing the living conditions of the affected population given their aggregated nominal income, we have distinguished them from those ecodimensional problems (pollution) resulting in direct relative changes of the latter variable (income effects). While in the former case the problem appears affecting the real relative availability of consumption ecodimensiona commodities, in the latter case it affects ecodimensional commodity-flows acting as productive inputs. The redistributive mechanisms operate by means of differential factor income effects involved in economic activities using such inputs and undertaken by different income groups. Again, in this case it is likely that the final results will be regressive in general. Perhaps the most clear example in this sense is represented by the income losses (relative to the effort done) of handicraft fishermen due to water pollution affecting both the amount and quality of the fish-resource of rivers, estuaries and coastal zones generated by 'up-stream' industrial activities waste-intensive.

So far we have ignored the benefits (net from costs other than the ecodimensional ones) that come from those activities disposing the wastes which generate the pollution processes. One could be tempted to reason that, insofar as the consumption of goods resulting from such activities are sold in a widely spread way among the national community at relatively low prices, reflecting the lower costs that result from the free use of the involved ecodimensional capital, the regresiveness of the redistributive effects of the related ecodimensional problems become much less clear, specially when considering that the pollution-affected community is limited by the rather concentrated spatial coverage of the pollution effects. Besides, such activities create employment that should be considered as a mechanism for smoothing income disparities when high rates of unemployment are dominant.

This argument deserves however, at least, two main critics when analyzed under the Latin American industrialization experience and

trends. First, ths highly protected internal markets, its relatively small sizes, the failures experimented by the attempts for achieving a real integration (or, at least, a common market) between the countries of the region, and their permeability to foreign multinational corporations have helped to create rather high degrees of monopolistic conditions making the lower costs of using rather freely the ecodimensional capital assets being transferred to the consumers, quite unusual. Rather, such benefits are likely to be oriented towards owners and shareholders through inflated profits.

Second, it is [illegible] accepted that as growth proceeds, at least in the western world in general and particularly in the already developed nations, "productive activities with intense environmental impacts have displaced activities with less serious environmental impacts" (COMMONER, 1971; pg. 281). As we discussed in Chapter 2, the patterns followed by the industrialization process in Latin America have been in general responsive to industrialized country-types of consumption structure and thus, minority oriented. Therefore, it should be expected that the counter-ecological character of economic growth will be also present in the countries of the region if the actual trends are maintained, though probably less generalized (precisely due to the concentrated characteristic already present in the growth process) (13).

Therefore, the argument claiming for the consideration of the benefits derived from the consumption of the pollution-generating conventional economic goods must be accounted for, realizing that a significant proportion of it is done by those income groups we may in general consider within the richer segments of the community which, as we have discussed, are able to avoid the effects of pollution to a great extent. On the other hand, much of the industrial activity has implied (and will probably imply in the future if the trends are maintained) rather los rates of job-creation due to the capital-intensive character of the technology involved in the process of consumption goods import substitution.

In this context the distributive situation is affected not only

by the fact that it is likely that certain pollution levels would have mush stronger effects over the poorest segments of the community but also by the fact that any eventual transfer of the lower costs derived from the free use of the involved ecodimensionalc capital is likely to be oriented towards the richer segments. Leaving aside the inter-temporal aspects of welfare distribution, the former situation implies in general that the pollution problem arising from the operation of non-intervened markets generates a net transfer of welfare from the poor to the rich.

Distributional Aspects of Ecodimensional-improving (protecting) Actions

If ecodimensional problems (pollution) tend to create regressive changes in the distribution of income and welfare in general, one could be tempted to think that ecodimensional improving or protecting measures should set off such trend and thus, the whole problem of ecodimensional policy-making should be centered on resource-allocation optimization criteria. In fact, most of the treatment this issue has received on grounds of conventional welfare economics precisely adopts this approach, although not necessarily implying that distributional effects of ecodimensional-improving policies are denied. However, despite the recognition of the very existence of such effects, they are usually confined to marginal comments and the core of the analysis of alternative policy measures is done seeking the least cost method for attaining conditions the closest to paretian optimal ones as possible (14).

It has been emphasized by a number of economists concerned with enviromental problems in general and pollution in particular, that this constitutes a misleading position. Baumol (BAUMOL, 1971) states, for instance, that "if we are concerned with unequality of income distribution (15)..., redistribution measures should be built right into environmental protection measures, to make certain that they do not simply serve..as another instrument to make the rich richer and the poor poorer" (op. cit.; pg. 73). Freeman, Haveman and Kneese also have a critical position to this approach. They argue that the 'willingness to pay' criterion (which we may considering as implicitly or explicit-

lyunderlying the evaluation of environmental policies made on grounds of the conventional welfare theoretical body) for deciding on resource allocation and ecodimensional management constitutes "the first instance where failure to consider the distribution of income can lead to bad choices" (FREEMAN, HAVEMAN and KNEESE, 1973; pg. 83n). Lecomber in turn, qualifies this position (that the environmental case can be developed in terms of externalities, being quite independent of distributional considerations) as unassailable. He states, on the contrary, that "one might insist that environmental policies should be considered along with other sub-optimal instruments as a method for achieving a more equitable distribution of welfare" (LECOMBER, 1975; pgs. 67-8).

As we are going to return to this question when discussing the trade-off issue, at this stage we will only deal with the most general elements involved in the distributional consequences of ecodimensional measures.

Here, the three features of ecodimensional commodity-flows mentioned before (see pgs.)as intervening in the formation of redistributive mechanisms, also have a similar role when we regard the benefits derived from measures adopted in order to protect or improve different segments of the ecodimension acting as capital assets. The issue from this point of view is however, further complicated by the fact that any measure undertaken in this sense is likely to have a cost side in terms of the conventional economic aggregates which behaviour is mainly dependent on particular elements characterizing the structure and function of the political, social and economic systems where such measures are decided and implemented.

Although it has been suggested that environmental concern corresponds to an attitude adopted by the richest segments of the population (see, for instance, BAUMOL, 1971), it is clear from our former discussion that this is far from being out of the mind of the poorest ones, unless we assume absolute lack of information or complete inability to realize even the short term consequences of a great variety

of ecodimensional problems, over health and other welfare components. Perhaps the main source of misunderstanding in this sense is the common practice of many environmentalists to consider the problem as being homogeneous or, at least, to generalize from the analysis of particular kinds of problems (mainly related with aesthetical and amenity issues) to the ecodimensional problem as a whole. Sometimes, it is the lack of understanding of the ways in which the political system functions what results in the discussed type of misleading conclusions. The inability of the poor to reach effectively the communication media together with the rather frequent impermeability of such media and of the political superstructure to the ecodimensional problems of these population sectors as compared with the highly influential position of the wealthy sectors, is interpreted as a situation where ecodimensional concern is strictly rich-centered.

Therefore, the conclusion that "considering benefits alone, an increase in environmental protection or in the supply of some other public good is likely to yield a greater net gain to the rich than to the poor" (BAUMOL, 1971) corresponds to the kind of misleading conclusion already discussed. In fact, the distributional affects of environmental (ecodimensional) protection's benefits will depend on the relative spatial location of the ecodimensional capital the protection is directed to and on the precise kind of function perofmed by such capital, which is selected as a policy-target. On the other hand, the final direction or, at least, the intensity of the distributional effects derived from improved ecodimensional conditions will be influenced by the type of secondary responses the economic system gives to the newly improved situation. The suggestion, for instance, that air quality improvements in center cities would benefit the poor more than the rich (FREEMAN III, 1972) can be partially checked by changes (increases) in land values within the improved areas which - in a situation of the poor being only dwelling tenants - would tend to transfer in the long term part of the benefits of better air quality towards the landlords, usually rich, dwelling-owners unless legal, administrative or other kind of counter-actions are implemented.

As we mentioned before, improving already existing low standards of ecodimensional quality implies almost always cost-effects that involve distributive changes. Furthermore, unless specific provisions are made, ecodimensional improvements also aiming at achieving distributional goals could result in complete failures if the costs involved in the policy (or strategy) implementation are not consider as an integral part of it.

As far as the direct real resource costs of implementing improving measures are concern and which are undertaken by the government (e.g. the costs in terms of utilization of productive factors of building and operating a sewage-treatment plant) the main redistributive mechanism is derived from the ways and methods by which the funds required to pay for the use of such resources are raised. If the way used is, for instance, by levying income taxes, the actual degree of progressiveness of the tax-structure plays an important role in determining the feasibility of making the whole ecodimensional policy a distribution-progressive one from the sides of both the benefits and the costs. If the tax-structure is already on its limits (whether these limits result from political, economic or even purely algebraic considerations), any intention of recoursing to this way will result, ceteris paribus, in a regressive situation from the cost side, insofar as the achievement of the desired target depends on the progressiveness of incremental taxation rather than on the basic existing structure. On the other hand, indirect taxation is considered as an essentially regressive raising-funds method. However, if some degree of selectivity is possible or feasible to be introduced into the consumption-taxation structure, selective increases affecting the pollution-intensive goods and services would discourage its consumption (the prices of the affected commodities will rise) and thus, will smooth the process of ecodimensional deterioration. Similar effects would have the application of the 'polluters-pay' principle in those cases in which individual firms can be clearly identified and/or iduced to apply control measures by their own.

Closely connected with the latter type of measure, there is a-

nother kind of cost we may refer to as factor income cost (FREEMAN, HAVEMAN and KNEESE, 1973). Among these the most relevant for our discussion is that of eventual increases in the unemployment rates due to induced lower production levels in those pollution-intensive industries. Nevertheless, the final result has to be analyzed considering the whole activity of ecodimensional improvements, insofar as it demands productive factors. If the technology adopted in order to repair ecodimensional damage and to decrease the pollutant-flows coming from the already existing industrial and other waste-generating activities is labour intensive, the potential regressiveness represented by the risk of higher unemployment rates could be diminished to a great extent and even reverted.

So far we have discussed the most significant distributive aspects of both the existence of ecodimensional problems and of some general action-lines aiming at their solution. We have qualified however, the pollution problem in the context of the Latin American situation more as a potential than as an actual problem, especially in the peripheric less developed national regions. Therefore, the proper consideration of distributive and ecodimensional goals within the process of global, regional and sectoral development planning acquires special relevance. Technological options, sectoral and commodity-structures of development efforts as well as its spatial composition, become key elements in the design of strategies and policies.

Ecodimensional Effects of Redistributive Policies

As we tried to demonstrate, ecodimensional improvements and protection need not to be contrary to progressive distributional objectives. Moreover, ecodimensional policies could (and should) be designed as to contribute to such objectives. Nevertheless, insofar as ecodimensional policies do not constitute the only way for achieving a more equitable distribution of income, wealth and opportunities, there is the risk of independent redistributive measures to contribute, specially in the long term, to create additional pressures over the ecodimension.

It may be argued that as far as redistributive measures are based on changes in the structure of relative prices (making relatively cheaper those goods and services considered as basic ones), on the introduction of labour-intensive and energy-non intensive technologies for producing increased flows of basic commodities,and on the implementation of progressive direct taxation schemes, it is likely that the result would imply, in the context of a growing economy, less ecodimensional pressures due to the fact that in general the environmental (ecodimensional) impact of economic growth under these circumstances would tend to be lower (COMMONER, 1971). However, it must be emphazised that although this argument is valid for the relative short term, it does not necessarily apply for the long term. From this latter point of view, the expectations created by the redistribution process in terms of desired consumption structure by the favoured population, plays a decisive role.

Insofar as these expectations include the achievement of similar positions, in terms of structure and level of consumption, than those actually being held by the wealthy sectors of the community, the long term orientation of the economic system's productive capacity would tend to be very much similar to that characterizing the already industrialized countries. The proliferation of pollution-intensive industries would spread out and increasing efforts and reosurces should be allocated away from genuine growth targets into the maintainance of ecodimensional conditions compatible with reasonable minimum standards. Given the situation of the international economic system under which such process would occur, it is unlikely that both economic growth itself and the preservation and improvement of the ecodimension of the human regional environments could be undertaken without seriously risking the achievement of significantly higher degrees of national self-reliance than those actually prevailing among the Latin American countries.

The consideration of this latter element not only emphasizes the need for designing comprehensive development strategies and policies,

but also implies the need for conceiving alternative definitions of development itself, other than those that have been historically attempted, and to find the ways for transmiting and internalizing the new concepts to the whole community (for a very good analysis of the need for "another development" concept, see the Dag Hammarskjold Report, UNITED NATIONS, 1975).

6.3 : INCOME DISTRIBUTION, ECONOMIC GROWTH AND THE SPATIAL STRUCTURE

So far we have brifly discussed the main determinants of income distribution and also the connection between the latter and those eco-dimensional problems that eventually appear as by-products of economic growth. We have not directly dealt however, with the relationships between growth and distribution, to which attention must be given in order to suggest some basic criteria allowing the introduction of the latter in the regional development analysis and planning.

The most obvious element relating distribution and growth is the savings rate. Insofar as different socio-economic (income) groups will normally present different consumption patterns and thus, different savings habits, the effect of various distributional arrangements over the global national savings which in turn, has a decisive role in the behaviour of the economy's productive capacity by allowing investment to be undertaken, will probably differ from one another.

Although the connection in these general terms is fairly clear, the problem appears when the attempt to give sense and direction to such connection is faced: will an unequal distribution of income generate higher global savings and therefore, a more accelerated process of capital accumulation than it will a more even distributiona pattern ? The lack of conclusive evidence of whether one or the other trend is the more likely to occur and indeed, the existence of different alternative theoretical interpretations of consumption behaviour in front of income variations (16) make any generalization somewhat adventurous. This is specially so if one allows the institutional setting to vary

as well.

Still, there is another line of approach to the relationship between distribution and growth, this time from the demand side and which application for the Latin American experience is mainly due to Furtado (FURTADO, 1965; 1964). His basic argument is that an unequal income distribution has a stagnating effect over the economy insofar as, within a situation in which industrialization answers to import substitution motives, low and rather constant wages, increasing capital/labour ratios and the necessary shift of the industrial activity towards more sophisticated consumer durables and capital goods, imply lack of prospective consumer demand and consequently, discouragement to invest among the receivers of the greatest proportion of the generated income. Under this interpretation then, income redistribution would have a stimulating effect on economic growth.

Finally, losses in ecodimensional capital assets (specially in rural areas) due to distributional elements we have discussed before, provide yet another link between the latter and the growth potential of the national economies which points in the same direction of the 'lack of demand' approach, i.e. smoothing income unequalities would have positive effects on the growth possibilities of the whole economy.

Depending on the approach one is more willing to accept (the selection of which is frequently based on political rather than on purely economic grounds. This is precisely due to the still highly controversial character of the whole issue), income redistribution will be either a condition for growth or a result that will come about as the economy starts growing, though initially income differentials may become wider.

This controversy about the precise kind of relationship existing between growth and income distribution can be considered as forming part of a much more complex and ample one, covering sectoral and spatial issues as well.

Though not necessarily based on the same theoretical assumptions, one could find many points of coincidence, in terms of the expected results, between those positions supporting an initial income concentration among the community-members as a necessary condition for higher growth rates and those pointing at growth in the 'modern sector' as the major conditionant of the acceleration of the economy's growth process. The same coincidence is possible to be establixhed between the former and those theoretical approaches supporting a process of initial spatial concentration of the economic activity as a key element for accelerating the growth rates of the economy as a whole.

Unfortunately however, most of the work done in this sense has been highly compartmentalized. Although cross references between personal distribution and sectoral approaches as well as between the latter and spatial ones can be found more frequently, very little - as we mentioned before - has been done to explicitly connect personal and spatial distributional issues within the context of an economy attempting to accelerate its growth and general development rates.

In this connection, we will establish as a general hypothesis, that given the spatially and socially disintegrated character of the national systems of the region, unless specific actions are taken in both fronts, the equalizing trends of growth will hardly operate and the latter process itself will be difficulted by the social, political, economic and ecodimensional situation a widening of unequalities would generate.

The consideration of distributional (in personal terms) factors when dealing with the process of regiona development must incorporate the following elements and features, in addition to those stated when discussing the inclusion of ecodimensional problems.

(i) To identify, as clear as possible, different socio-economic groups within both the rural and urban sectors of the regional system, facing internally similar conditions in terms of real income levels

and general living conditions.

(ii) Considering the differences existing between regions in terms of rural-urban balances, sectoral composition of the regional economy, ecodimensional resources and problems affecting them, and particular cultural and institutional characteristics, the former aggregation should consider a rather detailed profile of each socio-economic group in terms of the composition of their income sources for it to become useful for analytical and planning purposes. According to such composition, the role and relative importance of different income distribution determinants, among those discussed before, must be established.

(iii) Insofar as the composition of income sources, specially in the case of the poverty groups, implies a relatively high weight of non-wages sources (as it seems to be the case of many peripheral regions in the Latin American countries, specially in the rural areas and of urban metropolitan regions), special attention should be given to the structural conditionants of income distribution (mainly the accessibility of different groups to productive services and factors such as commercial services, financial markets and credit facilities, economic physical capital and ecodimensional capital - mainly land ownership).

(iv) To specify the technological patterns characterizing the productive activities of each income group, giving special emphasis to the trends in the capital/labour ratio in those areas governed by the higher income groups, to the particular technological features conditioning the trend in plent-size specially in those areas where middle income groups contribute with more intensity, and to the character of the relationships implicit in the main technical features between economic units and the ecodimension fôr each particular group. An important aspect is the identification of the mechanism through which technological innovations become apparent and diffuse within each region and among the different socio-economic groups.

(v) To introduce, based on the general characteristics (cultural, social and ecodimensional) of each local or regional community, a normative estimation of the demand structure and levels, giving special consideration to the basic needs of these groups located below the povery line and therefore, normally not expressed in the market's demand functions.

NOTES

(1) Which is the case of all Latin American countries with the only exception of Cuba.

(2) The consumption or use of such services must be considered as constituting part of the community's real income.

(3) Obviously here, one should recognize the interdependence between conjuncture and structure in the sense that if a conjunctural situation is maintained for a relatively long period, structural changes will normally occur. However, this does not diminish the importance of the distinction we have made.

(4) The most typical example in this sense is represented by agrarian reforms. They change the bases of the property relations (structural determinants) but its effects in terms of income distribution hardly become apparent except after a relatively long period of maturation. The same is valid in the case of changes in the accessibility to educational facilities.

(5) The notation of 'economic capital' is done to distinguish it from the ecodimensional capital. The latter, obviously, corresponds to an economic category as well.

(6) "Aperson from an educated family is more likely to take a long view of his decisions as regard optimal levels of education, choice of career, and management of personal finances and savings plans, than one from a family of low educational level" (JOHNSON, 1973; pg. 206).

(7) Due to the special characteristics of the ecodimensional capital assets and emphasizing the limitations of the treatment conventional eco-

nomics has normally given to it (aggregating both economic and ecodimensional capital under the same generic denomination), we will consider the links of this type of capital (and the problems affecting it) and distributional patterns in a separate section.

(8) In a cross-classification of countries by income level and equality, Ahluwalia (AHLUWALIA, 1974; pg.8) aggregates most Latin American countries to which data were available within the group where high unequality exists (the share of the lowest 40% of the population is less than 12%), with the exception of Uruguay, Chile and Argentina which are located in the group of moderate unequality (the share of the lowest 40% is between 12 and 17%). A salient feature is that while in those countries characterized by high unequality, the 40% of the population aggregated as middle income group shares in general less than 30% of the total income, the share of this group in those countries of moderate unequality is over the 30% reaching values of up to 36% as in the case of Argentine in 1970. The share of this group in countries of low unequality is systematically around the 40%. Although these trends could be considered tautological, it should be noticed that the aggregation criterion is based only on the share of the lowest 40%.

(9) In his study, Ahluwalia (op. cit., pg. 29) found a significant positive relationship between education and income equity as measured by the income shares of the lowest @0½ and the middle 40%.

(10) Although it is possible to find a significant number of pieces of work arguing against this role, it should be emphasized that they refer mainly to the situation of industrialized economies.

(11) Based on data reported in BANCO DE MEXICO, 1966 and DIRECCION DE ESTADISTICAS Y CENSOS, 1969, Ahluwalia concludes that at least 70% of the poverty group in Mexico and Chile live in rural areas (AHLUWALIA, 1974; pgs. 19-20)

(12) This does not imply, unfortunately, that the identification of such segments is an easy task. Indeed, it is very often an almost impossible one.

(13) As we noticed in Chapter 5, in many Latin American industrial and political metropolises we find air and water pollution levels that are even more accute than those affecting the industrialized country's average city.

(14) For instance, Pearce in his 'Environmental Economics' recognizes that "there is nothing sacred at all about Pareto rules" (PEARCE, 1976; pg. 11) when referring himself to the introduction of equity considerations in the evaluation of policy effects. Nevertheless, he adopts the optimization approach of paretian welfare economics leaving to the reader "to recall that these results (of the paretian analysis) can be modified along the lines of the decision rules that have just been introduced" (those allowing for the weighting of compensation variations of income in the comparisons between loossers and gainers).

(15) And this concern can be hardly discussed when dealing with developing economies in general and with the Latin American ones in particular.

(16) Here we find four main approaches: that on keynesian lines stating that the average propensity to save rises with income increases; Friedman's approach of consumption rates as a constant proportion of permanent income (FRIEDMAN, 1957); Duesenberry interpretation of savings as a function of relative income (income levels as compared with average income of society as a whole); and Modigliani and Brumberg approach of the savings rate as being a function of the individual's age (MODIGLIANI and BRUMBERG, 1954).

CHAPTER 7 : THE QUESTIONS OF POLICY REVISITED. CONCLUDING REMARKS

Based on the discussion we have done so far in this Part, we are now in a position to further specify the questions of policy stated in Chapter 2.

Before attempting this specification however, we would like to emphasize some global implications derived from our definition of development and the qualifying statements we established in Chapter 1.

(i) The general conditions imposed to the process of environmental change for it to constitute development of the involved communities, i.e. the satisfaction of the basic needs of the whole population, the increase of the community's real income on permanent and equalitarian bases, and the accomplish of harmonic interdimensional relationships, require a profound revision of the ways in which society as a whole has faced the task of achieving increasing welfare levels. This is particularly urgent in connection with the relationships existing between industrialized and underdeveloped countries, in terms of trade, technology transfers, investments, etc.

(ii) Apart from the requirements posed by the achievement of the general goals included in our definition of development at the international level, there is no doubt that within each particular nation, they also imply the need for profound transformations of the social, economic and political structures which at the present constitute perhaps the major barrier.

(iii) Finally, although the satisfaction of the basic material needs constitutes a prior goal given the actual conditions characterizing the Latin American human environment (and that of underdeveloped countries in general), it does not mean that the development effort ends there. On the contrary, we may say that it is where development begins. The Dag Hammarskjold Report, when referring to the concept of 'another

development' clearly states:

> "basic needs are much more than needs as conventionally understood. What people need to live on, they seek from others, who themselves may have to seek it in defferent conditions. Such needs are already rights.
>
> "Just as men have a right to food, they also have a social right to speak, to know, to understand the meaning of their work, to take part in public affairs and to defend their beliefs.
>
> "The right to education, to expression, to information and to the management of production are all rights which articulate the same need of socialization.
>
> "It is therefore a perversion to imagine that the discussion on development can be limited to what is called the satisfaction of basic material needs. When peasants or workers are excluded from all responsibilities in the production system, when scientific research is subjected to profit, when education patterns are imposed that make schoolchildren or students strangers to their own culture and mere instruments of the production process, when protest is reduced to silence by force and political prisoners are tortured, can it be thought that these practices do not hinder the goals of development and that they do not inflict an injury on society ?"
>
> (UNITED NATIONS, 1975; pg. 27)

Insofar as we are centering our attention at the regional (subnational) level and our basic aim is to integrate regional economic growth, distribution and the functions and problems of the ecodimension, our approach should be considered as a partial one in the context of the implications already stated.

Its globalization however, in terms of explicitly including the former elements, is possible to some extent, depending very much on the degree to which they could be specified in the configuration of the scenarios in relation to which the functional relationships we will include in our analytical framework are to be considered, and the questions of policy we state in the next section are to be answered.

7.1 : SOME BASIC QUESTIONS OF POLICY

One of the first issues that clearly appears from the discussion attempted so far and that underlies almost every decision connected with the process of development, is that of income distribution (in real terms).

Insofar as the present trends affecting the region's evolution continue unchanged, the welfare achievements will be affected not only by the direct effects maldistribution itself has over the former, but also by undermining the possibility of increasing the global levels of income. In terms of long run reorientation of the process of environmental change in this sense, ths most basic question of policy deals with structural or institutional elements and among them, particularly with the property relations prevailing in the social systems (1).

Considering the existence of explicit long-term goals in connection with the distributive situation underlying our definition of development, we may state this question as follows:

> 1: "What are the most appropriate patterns the property relations should adopt through the process of environmental change ? "

It should be noted that the statement of this question as a matter of policy implies no recognition of ideological or phylosophical status to the property issue. It is conceived strictly as a basic determinant of the patterns of income distribution and thus, it is allowed to adopt different characteristics, which 'optimality' must be qualified in terms of the distributive situation it generates within each phase or momentum of the overall process of environmental change (2). Therefore, the property issue goes beyond the rather simplistic dichotomy of public versus private property. It also includes, in the case of private property, different forms this property could adopt (e.g., family property, cooperatives, workers-property, share-holding, etc,), which have different distributional implications (3).

Important as the property relations are in determining the way in which income is distributed, there are nontheless, other institutional features that should be present if a modification of such relations is to be effectively accompanied by a corresponding change in the schemes of income appropriation (e.g. adequate accessibility to complementary productive services and inputs). This brings about a second relevant question of policy:

> 2: "What are the most relevant complementary institutional elements that should be considered and what characteristics they should adopt in order to guarantee the optimal correspondence between different patterns and forms of property relations and effective schemes of income appropriation ? "

The anser to the former questions would normally involve the nationa system as a whole, at which level corresponds the establishment of the basic game-rules determining the institutional setting within the economic activity would operate. Nevertheless, within an ample definition in this sense, it is likely that a significant room for manoeuvre will exist at the level of each particular region where the precise and concrete forms the property relations could adopt can be adapted to the local cultural tradition, to the possibilities and options allowed by the kind of ecodimensional capital characterizing the region, to the productive areas in which the region may specialize, etc. The same is valid for the decision about complementary institutional elements where the diversity of answers could be even wider, depending, apart from the peculiarities (cultural, economic and social) of each region, on the particular forms adopted by the property relations.

Besides these questions connected with the basic structural framework, the issues of growth, distribution and ecodimension together, place a set of questions in relation with technology and technological change that again, within a globally defined strategy at the national level, require specific answers that are very much likely to differ from one region to another. Among the most relevant, we may mention:

3: "What is the most convenient ('optimal') composition of the process of technological change in terms of 'native' or endogenous generation, and adoption of externally generated innovations ? "

4: "What should be the participation of the government in the process of generation and/or adoption of innovations (mainly productive) ? "

5: "What should be the most appropriate size of economic productive units at different points of achievement of the development process ? "

6: "What criteria should be applied to determine the desirability for changing from one size-type of firm to another ? "

Question 3 is particularly relevant in the case of regions having a relatively strong economic potential based on replenishable ecodimensional commodities, due to the higher probability of adopted external technologies to generate some kind of depreciation process in the capital providing such commodities. Nevertheless, this is not the only consideration that has to be done when deciding whether to make the effort of starting some kind of technology-creating capability or simply maintaining a rather passive role in this sense and rely on the availability of technological knowledge generated elsewhere. The existence of traditional productive methods susceptible to being modernized, the availability of particular characteristics and elements in the local ecodimension (in terms, for instance, of energy sources, building materials, etc.) which utilization and potential advantages call for original approaches, the existence of some kind of infrastructure (scientific and technical) that could constitute the basis for a relatively easy departure in this area, correspond to some of the elements that give relevance to the stated question as a matter of policy at the regional level.

The involvement of the government in searching for technological improvements corresponds to another matter that should be decided considering the particular characteristics of each region, specially in

the case where the need for significant endogenously generated technology is established. Closely linked with the former questions is that of the size of the economic units considered as the most appropriate. Here, it is likely that some degree of incompatibility may appear between the technological conditionants of the plant size (considering the available technology that could be eventually adopted) and that derived from distributional and ecodimensional criteria (specially when they suggest small and medium firm-sizes as the most convenient). The capability of privately generated technological improvements depends, on the other hand, on the size of each firm. The larger the latter, the higher will tend to be the former. Therefore, if significant technological improvements are to be expected within a strategy favouring the establishment of small and medium size firms, the government should play the major role in this area.

The answers to the former questions should be also considered within the context of the kind fo strategy selected for accelerating the regional growth in sectoral terms, given the distributional.and ecosimensional goals. Apart from the question of priorities between different sectors, the following issues constitute ralevant matters of policy in this area:

7: "What criteria should be applied for determining the need for changing from one sectoral pattern of economic growth to another ? "

8: "Assuming the existence of both kinds of resources within a particular region, what should be the role assigned to replenishable and non-replenishable ecodimensional commodities in the development process, both in the short and long term ? "

9: "What criteria should be applied for deciding the development (or protection) of replenishable and non-replenishable commodities whenever some kind of trade-off (direc or indirect) appear between them ?

10: "How strong the commodity-flows (actual and potential) coming from the existing ecodimensional capital should be discounted ? "

(What criteria should be applied to establish the rate of discount

in the social evaluation of different projects, specially when problematic ecodimensional by-effects are involved ? Alternatively, what intertemporal decision rule should be applied if discounting is rejected as a meaningful and proper social decision rule ?)

Closely connected with the former questions are those dealing with the characteristics that should adopt the overall spatial structure both in terms of the regions system and of each particular region. Among the most relevant questions are:

11: "What criteria should be applied for determining the degree of autonomy in decision-making of different regions through the process of spatial change ? "

12: "Within what limits, given the desired patterns of the national system's spatial structure, differences in regional growth should be accepted as constituting no matter of concern for the policy-making process ? "

13: "What is the most desirable rate of urbanization and what is the most convenient pattern the urban system (at the national and regional levels) should adopt at different points or stages of the development process ? "

14: "What are the optimal transformation paths in moving from one spatial structure to another ? "

15: "What criteria should be applied for deciding the locational patterns of economic activities (and to some extent of population itself) within and between regions, specially when potential ecodimensional hazards exist ? "

(What are the most desirable patterns of land use, given specified objectives of economic growth, income distribution and ecodimensional quality ?)

Two final questions of policy have to be stated, which answer very much depend on the decisions taken about the issues involved in the former ones. They can be stated however, as a matter of basic goals themselves, in which case, any incompatibility with the decisions taken in connection with the previous questions should be solved by re-

viewing the whole strategy. These questions deal with the situation of labour employment and long term trends in the demand structure.

> 16: "What are the maximum lavels of unemployment and underemployment (both in rural and urban areas) possible to accept given the regional development overall goal-image ? "

> 17: "What is the most desirable long term demand structure of the community under a condition of highly improved distributional situation and what criteria should be applied to determine the best transformation paths in moving from the actual structure towards the desired one ? "

Obviously the relevance of the latter question will vary with the importance given to the market, specially in the process of needs-creation that normally appears within a growing society.

7.2 : FINAL COMMENTS

Based on the discussion done so far, we will attempt in Part III, to formalize the general inter-connections surveyed in the form of a set of functional relationships constituting a comprehensive analytical framework useful to face the previously stated questions of policy in a rational way.

As we mentioned when discussing each of our main areas of concern, such an attempt should consider certain elements and features it seems convenient to recapitulate.

(i) The spatial processes and patterns must be explicitly considered. Not only specific conjunctural variables (whether they are internal or external to each particular sub-space), but also structural elements intervening in the process of shaping the overall spatial landscape, should be considered. The peculiarities of these spatial considerations and the impossibility of dealing with them in aggregated, spaceless, theoretical approaches impose the need for starting from the methodologies suggested by regional economics in particular and regio-

nal analysis in general.

Within the general framework of regional economic analysis, the problems placed by the ecodimension as a relevant category, imply the need for:

(ii) The sectoral dissaggregation of the analysis of the socio-economic system's performance (distinguishing, at least, the rural from the urban sectors).

(iii) The explicit inclusion of the ecodimension, as being a productive capital providing intermediate goods and services as well as consumption commodities. This also means that the eventual depreciation effects different human uses may induce on this capital should be explicitly considered. This latter requirement is particularly relevant due to the particular characteristics such depreciation processes (and the replacement possibilities) have.

(iv) The former requirement implies the need for including also, the most relevant features of the structure and function of the ecosystems involved in the provision of the different commodities as well as the basic connections (mainly ecological) existing between the different ecodimensional functions.

(v) The consideration of the regional space in a much more concrete way than that normally undertaken in regional growth analysis, in order to meaningfully define the concept of ecodimensional capital.

(vi) The ecodimensional capital, being a multifunctional asset, requires that the structure and level of the demand for different services provided by it should be identified at the most dissaggregated level as possible.

(vii) The specification of the technological factor in a greater degree than that normally found in regional economics, so that different op-

tions in terms of both productive and consumption technologies could be properly assessed in front of the ecodimensional capabilities.

The existence of important degrees of income unequality within the countries of the region, calls, on the other hand, for:

(viii) The identification of different socio-economic groups both within the rural and the urban environments, based on income and general living conditions considerations.

(ix) Although based on income criteria, the former identification should be further dissaggregated in order to properly cope with elements conditioning unequality and poverty problems as well as with effects coming from the latter (mainly associated with the ecodimension). Therefore, a detailed profile of each socio-economic group in terms of the composition of their income sources is necessary for assessing the role played by other institutional features (apart from the property relations themselves) in shaping the distributive situation and for determining possibilities and ways of redistributive measures. In terms of the effects of unequality and poverty, each group's profile determination should consider eventual sub-aggregations allowing the identification of sub-groups having different kind of relationships (in terms of use, abuse and misuse) with the ecodimension.

(x) The specification of the technological factor in a greater degree than that normally found in regional economics,so that technological differences between income-groups can be identified; the trend in plant sizes can be estimated and eventually modified; and the differential effect of each group's activity over the ecodimension due to technological specific factors can be properly qualified.

(xi) Finally, the introduction, at the level of each region's community, of a normative estimation of the demand level and structure, specially considering the needs of those groups located below the poverty line, which possibility to expressing them through the market are almost none.

This determination would allow a much more proper assessment of the position of basic 'public' services (including housing in general) within the social choice scale as well as that of ecodimensional commodities (specially replenishable ones, which relative importance in terms of growth potential is normally assessed on the basis of aggregated income-elasticities of demand).

NOTES

(1) Although we may find many economic areas in many countries where the state-ownership constitutes the rule, the importance of the property relations in the determination of the long term patterns of income distribution lies in the fact that private ownership is still a major institutional characteristic of the region's national systems, strongly conditioning the schemes of income appropriation.

(2) Obviously, its changes, as in the case of any structural modification, will depend on ideological elements and on the political feasibility of their implementation.

(3) The emphasis given to this issue in connection with the distribution of income does not mean that other mechanisms for orienting the patterns of the latter within given property relations are denied. Nevertheless, it must be recognized that economic and political power are interlinked in such a way that when the former becomes highly concentrated, it normally exerts a strong influence over the latter so that alternative redistributive measures become improbable or, at least, difficult to implement (on these issues see, for instance, GALBRAITH, 1973). Besides, any achievement in terms of more equitable income distribution under these circumstances has a much more degree of reversibility as compared with situations achieved through modifications in property relations themselves and therefore, is much more vulnerable to political contingences (normally answering to rather short term oriented motivations).

REGIONAL DEVELOPMENT AND THE ENVIRONMENT
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PART III : THE PROCESS OF REGIONAL DEVELOPMENT. A GENERAL ANALYTICAL FRAMEWORK

INTRODUCTION

As we stated in Part II, the objective to the present one is the formulation of a general analytical framework allowing the explicit consideration of the relationships existing between the process of regional economic growth, the way in which the results of the economic activity are distributed among the community, and the functions played and problems faced by the ecodimension of the regional human environment.

We also stated that our starting point in this attempt will be the theoretical model of regional economic growth suggested by Siebert (SIEBERT, 1969) together with the theoretical basis contained in Friedmann's polarized)core-periphery) development approach (FRIEDMANN, 1973).

In order to achieve our purpose of suggesting a comprehensive framework in the sense stated above, we will reformulate such approaches by including within them the elements and features summarized before in Chapter 7.

The discussion has been organized in five chapters. In the first one (Chapter 8) we will establish the overall frame of reference for our formulation. Two main issues are then examined: the spatial setting we are going to consider and the level at which we will concentrate ourselves, and the way in which we will consider the concept of income and the global patterns characterizing its distribution. In relation with the first issue, the relative position of Friedmann's and Siebert's approaches will be established.

Based on the functional expression determining the changes in the global regional income, in the second and third chapters (Chapters 9 and 10) we are going to deal with the determinants of that part of the income received by the regional community that is derived from the direct contribution it makes to the productive activities in terms of productive factors. The analysis for each of the socio-economic groups in which we will dissaggregate the regional community, in order to reflect the unequalities characterizing the income-distribution situation in both the rural and urban sectors, considers the particular characteristics of their behaviour. Chapter 9 deals with those conditionants coming from the supply side, i.e. availability (and its changes) for each group, of capital, labour, ecodimensional capital and technological knowledge. Chapter 10 deals with the demand side, where we also distinguish the behaviour of different relevant factors by each socio-economic group. The demand for consumption and capital commodities, as well as that for ecodimensional capital services and labour, are also analyzed.

In Chapter 11, we analyze the consumption possibilities of social services and ecodimensional commodities, as additional components of each group's real income, above the purchasing power represented by the earned-income coming from the group's direct participation in the productive process. Here we will center our attention on what we consider basic commodities: housing, health and educational services on one hand, and clean water for human consumption, water and solid waste disposal facilities, clean air and recreational commodities, in the other.

Finally, in Chapter 12, we tie up some of the loose ends remaining from the discussion of the previous chapters. We will deal with the inter-regional terms of trade and their effect over the regional income in global terms and in terms of each particular socio-economic group, with labour unemployment and with ecodimensional problems (depletion and pollution mainly). We close the discussion with a global assessment of the technological change issue, analyzing the extent to

which the suggested framework incorporates some of its complex and diverse facets.

CHAPTER 8 : THE ANALYTICAL FRAMEWORK. GENERAL METHODOLOGICAL FEATURES

Given our defintion of development, the elements characterizing the Latin American process of environmental change and the problem-areas we are basically interested in, we have to take some decisions about the method we should use for approaching our objective of formulating a comprehensive analytical framework for planning purposes. It seems that at this stage there are at least, three issues the clarification of which will contribute to give shape to the general methodological features of our attempt.

These issues are connected with, first, how to concretely consider the spatial structure of the national human environment and at what precise level - within such structure - to focuss the attention; second, how to introduce the existence of basic disparities in the way the product of the economic activity is generated and appropriated among the community members; and third, how to define meaningfully the concept of income so that it reflects, approximately, the idea of welfare and allows not only its global estimation at the selected level of the spatial structure, but also a proper approximation to the way in which it is distributed among the community members.

The discussion that follows has been then organized in two sections. In the first one we deal with the first issue mentioned before, i.e. the establishment of the way in which we are going to consider the spatial structure of the national system. Here we also state the position of the two theoretical approaches we discussed in Chapter 3, in connection with our own.

In the second section we will discuss the way in which we are going to consider income and the inequalities existing in its generation and distribution or appropriation.

8.1 : THE SPATIAL SETTING

The spatially polarized situation characterizing the countries of the region requires a methodological approach allowing for the consideration of essentially asymetric kinds of relationships between sub-spaces of the national system. This assymetry will be represented in our framework by the recognition of two main types of region which have to be defined, consequently, one in relation to the other. We will adopt then, the distinction between central (or core) and peripheral regions.

The center (core)-periphery approach includes the possibility of more than one core region within the national space, each having its own definible periphery. At the same time, this possibility implies the presence of relationships between core regions. Insofar as such core regions belong to a hierarchy, those located at lower levels will normally constitute part of the higher level core region's periphery.(FRIEDMANN, 1973). Core regions located at the same level of the spatial hierarchy will eatablish inter-relations of different kind depending on their relative location in the national territory, on the characteristics of the spatial sub-system they represent (the core-region itself and its relevant periphery) in terms of population, resource endowment, social and cultural features, etc., and on their physical connectiveness. Such inter-relationships may be of a complementary type, of competence or even of relative indiference.

Given the primate character of the urban system of most Latin American countries, where not only the economic activity is highly concentrated in the metropolitan regions but also the decision-making process presents a high degree of centralization, the center (core)-periphery type of relation will be the predominant feature of the overall spatial system we are going to consider.

On the other hand, we have stated that the explicit inclusion of ecodimensional capital assets in their multifunctional character requi-

res the consideration of physical space in a fairly concrete way so that a meaningful definition fo the ecodimensional capital as a factor conditioning the productive capacity of the regional economy and influencing the levels of real income, can be done.

This places us in a rather difficult position in practical terms: how to compatibilize the necessary consideration of the situation characterizing the regions system as a whole (1) with this latter requirement, without making the analytical exercise too cumbersome and therefore, useless for practical, planning purposes. This problem is further complicated by the requirement our definition of development implies in terms of explicitly including too, the situation of personal income distribution.

The way we have chosen for solving this problem implies the need for recoursing to a rather unconventional methodology known as the 'scenarios technique'. In what follows we will briefly analyze the basic features of this technique and then, we will discuss its adaptation for our particular purposes.

The Scenarios Methodology (2)

The basic feature of this methodology is that it constitutes, essentially, a decision aiding tool, where the representation of a given reality (the model) is oriented towards the assessment of the most probable behaviour of the system under different, alternative, assumptions about the sequence and character of certain relevant events. From this point of view, it is not a 'predictive' methodology in conventional terms.

We may describe its structure as composed of three main elements: (i) a set of scenarios, (ii) a causal model, and (iii) a decision-making model.

The scenario corresponds to a "sequence of possible events and

socio-political choices" (op.cit., pg. 34) the analysts have to specify and which corresponds to a representation of the system's basic structure at different points in time.

The causal model constitutes a representation of the system's functioning and is composed by a set of functional relationships expressing the way in which the most relevant elements of the system are inter-related. The formal expression of this model could adopt a variety of forms depending on the degree to which the system under analysis and the relationships between its basic elements have been subjected to theoretical generalizations and also, on the availability of concrete information about the behaviour of such elements (and their inter-relations) through time. Therefore, the model could be formalized into a set of regression equations (an 'econometric' kind of model) or it could be expressed in terms of theoretically determined functional relationships obeying certain assumptions made about the system's general and particular behaviour.

In general, the feasibility of the first course of action is directly dependent on the volume, quality and coverage of statistical series allowing a meaningful assessment of correlation between variables. On the other hand, the degree of specification of a theoretical model will depend on the knowledge existing about the behaviour of the system's relevant variables. In this case, the volume, quality and coverage of statistical series also play an important role in terms of allowing the empirical verification of the theoretical generalizations contained in the model.

As we are going to discuss in Part IV, the relative lack of both statistical information and theoretical explanations about many environmental phenomena at the regional (sub-national) level affecting most Latin American countries, implies the need for recoursing to 'intermediate' solutions that compromise between accuracy and comprehensiveness, if they are to be an effective support to the process of decision-making.

Finally, the decision-making model allows the representation of the processes of options-selection when the decision-maker faces different alternative courses of action. This representation includes the restraints that, in general, should be observed when deciding for any particular option. It will be this model, the one allowing the inclusion of goals and objectives within the overall planning framework. Its outcome therefore, should be the establishment of feasible and compatible sets of objectives and targets that could be formulated within different possible scenarios, together with the specification of the actions that should be taken in order to achieve the former. In this context, the concrete policies will be the result of the joint operation of the three 'models', which in turn, must consider the actions involved as relevant imputs within an iterative process.

The Scenarios Technique and the Spatial Setting

Although in the terms in which it has been stated, the scenarios technique as a planning-aid tool covers the whole range of environmental phenomena determining the parameters characterizing the behaviour of the social system at any point in time (or during any given period) and at any specified level, in what follows we will focuss our attention mainly on the spatial dimension and will discuss how this technique would allow an appropriate treatment of space itself (and therefore, allow a meaningful definition of the ecodimensional capital assets) and of the spatial relations giving the Latin American countries their particular characteristics and which we have identified in general with the center-periphery (authority-dependency) kind of relationship.

In brief terms, we may state our approach as one in which the causal model is mainly defined at the level of a particular region, which position within the national spatial system and the changes this position may experiment are issues that must be specified in terms of the scenarios this particular region would evolve in.

The former statement does not mean that, once a scenario is defined, the associated parameters of the relationships included in the causal model should be considered as given. On the contrary, even though the selected scenario will determine the basic inputs to the causal (and decision-making) model, the methodology implies an interactive or conversational mode where such inputs are applied incrementally over time. Therefore, "the analyst becomes actively involved during the system's evolution and contributes to a better representation of the adaptative characteristics of the (national) system" (op. cit.; pg. 48).

Within this methodological context we will concentrate our attention on the peripheral type of region. Therefore, one of the main features characterizing the spatial scenarios to be defined for any particular peripheral region, is the dependency relations it maintains with the central (or core) region. Such dependency should be specified in terms of the political, social and economic processes determining the exact position of the region within the overall spatial structure.

As we mentioned before (see Chapter 3), the theory of polarized development suggested by Friedmann can be used as a relevant starting point for defining the essential features of the scenarios within which the region's behaviour should be assessed.

It must be noticed however, that this theory being commited with what we may call a particular strategy of spatial development (3), the interactive mode characterizing the operation of the scenarios methodology and the presence of distributive and ecodimensional objectives (at both the national and regional levels), may generate scenarios that diverge from the paths of spatial evolution predicted by Friedmann's approach. That is why we give this approach its main relevance as a starting point, allowing the establishment of certain basic initial conditions and patterns characterizing the spatial structure and thus, the spatial scenarios for our particular region.

With this question in mind, it is possible to draw some general features that should be considered in the scenarios defined for peripheral regions.

(i) Their initial situation correspond to one of relatively low autonomy in political, social and economic decisions. In this context, the decision-making processes answer to the interests of the most influential segments of the central region's population and to the image these groups have of the most convenient spatial arrangements the national system's evolution should adopt.

(ii) Insofar as the national authorities do not intervene in order to consciously modify the general trends, the former condition of dependency will tend to generate self-reinforcing mechanisms and processes. Friedmann attributes this characteristic to six main feedback effects associated with the growth of core regions, i.e. dominance, information, psychological, modernization, linkage and production effects. Nevertheless, he also recognizes the possibility of peripheral regions to successfully challenge the core-region's authority (due to the effects of core-region's innovations introduced to and adopted by the periphery) and therefore, of a process of relative descentralization of power.

(iii) In general, the structural and behavioural characteristics of the peripheral regions themselves and those of the overall spatial system derived from the patterns adopted by the authority-dependency relationships, tend to generate a process of net transfer of people, natural resources and capital (mainly financial) from the periphery to the center.

In its more dynamic expression, the scenarios-designing activity should consider different options in terms of spatial arrangements and thus, of the relative position of each particular region within the spatial structure; the socio-political restraints each option may face; and the possible consequences each option is likely to

generate over the structure of the nationa and regional systems.

Based on the already mentioned general features, the rest of the present Part will be oriented mainly towards the formulation of what we named the 'causal model', where we are going to attempt the establishment of basic identities and functional relationships representing the major features of a 'peripheral region'. This will be done following in general, the theoretical model of regional growth established by Siebert and which basic features we discussed in Chapter 3.

8.2: REGIONAL INCOME. CONCEPT AND DISTRIBUTION

The income concept that is going to be used corresponds to an index of the capacity of any individual member of the community to satisfy his needs. In order to make it operational, we will consider real income as composed of three major elements:

(i) The monetary income earned by each member of a community as the remuneration to his contribution to the process of adding value to the resources and inputs available at the beginning of each period and which represents, on the other hand, purchasing power in terms of consumption commodities (4).

(ii) The availability and consumption of commodities constituting public goods and services, provided by the government (5). Although this group considers a wide range of goods and services including defence, legislation and justice, social infrastructure, etc., we will give special consideration - as consumption commodities - only to education, health and housing in order not to excessively complicate our analysis.

(iii) The availability and consumption of ecodimensional commodities which, although in many cases correspond to some form of public good, present certain peculiarities making convenient their separate analysis.

Despite the fact that normally their patterns are closely correlated, the distribution of each of these components among the community members obeys different laws. This makes necessary their treatment individually, even in the case where some aggregate estimate for each member were possible.

Income Distribution

We may consider the issue of income distribution at least, in three different levels. One, in terms of geographical (or administrative) units and how the income generated by the whole nation is distributed among the component units. In other words, the consideration of income distribution focussed on the differentials affecting the regions of a country. This is one of the principal issues considered by regional economics and the elimination of accute differentials, one of the most common objectives of regional planning.

Another level for analyzing the general theme of distribution is that of functional participation or share in the income generated by an economy, whether it is referred to the national or regional levels. In this case, income generated is analytically divided into that part appropriated by capital owners and that appropriated by labour-owners (wage-earners).

The third level corresponds to that of personal (or family) income distribution; that is to say, the analysis of how the income generated is distributed among the members (persons or families) of the community.

As we discussed in Chapter 6, insofar as our main interest is the welfare levels achieved by a society as a whole and by each member of it, the ways in which income is distributed among persons become the finally most relevant feature. An equitable distribution of income between regions accompanied by extreme concentration of it between persons in each region could be, for instance, worse than a

situation of spatial concentration of personally well-distributed income in each region. On the other hand, a high proportion of the income appropriated by capital owners is compatible with an equitable personal distribution insofar as such capital is evenly distributed among the population.

In our following analysis the role of spatial differentials in income distribution will be implicitly considered in the theoretical treatment given to the process of regional income growth, while the personal income distribution will be explicitly treated.

Seeking for a meaningful and practical way of introducing income differentials at the personal level, it seems that the aggregation of the community in socio-economic groups according to their participation in the total income generated corresponds to a reasonable procedure. Nevertheless, it should be borne in mind that by no means the groups so defined will correspond to socially and economically homogeneous categories. Therefore, we will use these categories in general, dissaggregating, whenever considered necessary, any of them in sub-groups in order to capture particular relevant differences within each one.

Considering, on the other hand, that the exact way of defining each socio-economic group will very much depend on the peculiarities of each community, we are going to refer our analysis to three broad categories, i.e. low, middle and high income groups, without attempting any statistical definition of them (6).

Based on our discussion of Chapter 6, we may state the income of any individual as a function of the volume and quality of the factors he contributes to the productive process and of their respective prices, as well as a function of his accessibility to public goods and services and to ecodimensional consumption commodities (7).

Starting from a situation with a given distributional pattern

of the income the community generates (in terms of income-groups rather than in terms of individuals) and assuming that such income is increasing, the initial distribution will change whenever the accessibility to public commodities (including the ecodimensional ones) varies from one group in relation to the others and whenever the rates of change in the quality and quantity of labour and capital (both economic and ecodimensional) ariginating the income increases are different from one group to the other. Even in the case of no changes in the relative accessibility to the former and of equal rate of changes in the latter, the overall distributional situation will change if there is a change in the relative prices of each kind of productive factor, insofar as each group contributes with different factor-proportions to the productive activity. Fianlly, if all the mentioned elements vary in such a way that the composite effect of such changes becomes distributionally neutral, the participation of each group in the increased income will remain the same as that prevailing prior the increase. Nevertheless, this does not mean that in personal terms the distributional pattern of the community have remained necessarily unchanged, unless we additionally assume that the population of each group has not changed or has changed in exactly the same way one from another.

If we divide the population in the three mentioned socio-economic groups for both the urban and rural (8) sectors and considering the fact that in any of these groups the earned income (monetary) comes from both wages (labour hiring) and profits (capital ownership), we are able to establish the following identities:

$$(8.1) \quad RY_1 = {}_r w_{11} \cdot RL_{11} + {}_r p_1 \cdot RQ_1 + {}_r w_{14}$$

$$(8.2) \quad RY_3 = {}_r w_{31} \cdot RL_{31} + RQ_3 + {}_r w_{34}$$

$$(8.3) \quad UY_1 = {}_u w_{11} \cdot UL_{11} + {}_u w_{14} \cdot UL_{14} + {}_u p_1 \cdot UQ_1$$

$$(8.4) \quad UY_2 = {}_u w_{21} \cdot UL_{21} + {}_u w_{22} \cdot UL_{22} + {}_u w_{24} \cdot UL_{24} + {}_u p_2 \cdot UQ_2$$

$$(8.5) \quad UY_3 = {}_u w_{31} \cdot UL_{31} + {}_u w_{32} \cdot UL_{32} + {}_u w_{34} \cdot UL_{34} + UQ_3$$

(8.6) $UY_4 = {}_uP_4 \cdot UQ_4$

where RY_i with i= 1,3 : actual income earned by rural income group i

UY_i with i= 1,2,3 : actual income earned, urban income group i

RL_{ij} : actual employment level of individuals belonging to income group i in activities undertaken by income group j, rural sector

UL_{ij} : actual employment level of induviduals belonging to income group i in activities undertaken by income group j, urban sector

UQ_j : actual level of product of urban activities undertaken by income group j

RQ_j : actual level of product of rural activities undertaken by income group j

${}_uW_{ij}$: urban wage rate (average) receivad by individuals of income group i from activities undertaken by income group j

${}_rW_{ij}$: rural wage rate (average) received by individuals of income group i from activities undertaken by income group j

${}_rP_j$ and ${}_uP_j$: participation of profits in the toatal product generated by activities undertaken by income group j, rural and urban sector respectively

${}_rW_{i4}$: rural total wage paid by the government to income group i, corresponding to activities involving the supply of public goods and services (conventional and ecodimensional) (9).

Income group 4, as an income receiver, corresponds to the government when involved in productive activities by its own. We are assuming that the activities undertaken by income group 3 do not involve labour-hiring in both urban and rural sectors.

Our interest being centered at the level of the regional community, the values of each group's monetary income determined by the former identities should be adjusted in the amount represented by the participation of factors owned by extra-regional agents in the generation

of the regional product and by the participation of factors owned by residents of the region in the product generated outside it. Such factors could be represented by financial capital (in which case the payment transfers adopt the form of interests paid or received), physical capital (the transfers being a proportion of the profits generated by the activities in which the capital is located), or labour (wages paid to or received by inter-regional commuters).

Insofar as we are interested, on the other hand, in the welfare levels achieved by the regional community in general and by each group in particular, we should additionally adjust the monetary income by considering the consumption of public and ecodimensional commodities made by each group. Identities 8.1 to 8.5 will then adopt the following expressions:

(8.1a) $${}^{I}RY_i = RY_i + {}^{II}RY_i^I + {}_{r}^{I}PUB_i + {}_{r}^{I}ECC_i \quad \text{for } i = 1,3$$

(8.3a) $${}^{I}UY_i = UY_i + {}^{II}UY_i^I + {}_{u}^{I}PUB_i + {}_{u}^{I}ECC_i \quad \text{for } i = 1,2,3$$

Where ${}^{I}RY_i$ and ${}^{I}UY_i$: actual income received by income group i, rural and urban sectors respectively, region I residents

${}^{II}RY_i^I$ and ${}^{II}UY_i^I$: net volumes of actual income received by income group i, rural and urban sectors respectively, from region II; region I residents

${}_{r}^{I}PUB_i$ and ${}_{u}^{I}PUB_i$: value of public commodities received by income group i, rural and urban sectors respectively, region I residents

${}_{r}^{I}ECC_i$ and ${}_{u}^{I}ECC_i$: value of ecodimensional consumption commodities received by income group i, rural and urban sectors respectively, Region I residents.

Notice that when considering the regional income we do not consider the participation of the government in the product of its own productive activities (profits or surpluses). The reason for this treatment it that we assume that any surplus generated is incorpored into the global public income, regardless of the location of the activities generating it.

The income increases of each group will depend on a series of factors we may summarize as follows:

(i) variations in the product generated by itself,

(ii) variations in the rates of employment (unemployment) affecting each group,

(iii) variations in the wage rates received from (payed to) other group's productive activity (wage earners belonging to other income groups),

(iv) variations in the net income received by residents of the region from outside, and

(v) variations in the availability (accessibility) of public and eco-dimensional commodities for consumption (final) purposes.

We may then establish the following functional relationships for the variations of each group's level of real income (10):

$$(8.7)\quad \Delta^{I}RY_1 = f(\Delta RQ_1, \Delta RL_1, \Delta_r w_{31}, \Delta^{II}RY^{I}_1, \Delta^{I}_r PUB_1, \Delta^{I}_r ECC_1)$$

$$(3.8)\quad \Delta^{I}RY_3 = f(\Delta RQ_3, \Delta RL_3, \Delta_r w_{31}, \Delta^{II}RY^{I}_3, \Delta^{I}_r PUB_3, \Delta^{I}_r ECC_3)$$

$$(8.9)\quad \Delta^{I}UY_1 = f(\Delta UQ_1, \Delta UL_1, \Delta_u w_{31}, \Delta_u w_{21}, \Delta_u w_{14}, \Delta^{II}UY^{I}_1, \Delta^{I}_u PUB_1, \Delta^{I}_u ECC_1)$$

$$(8.10)\quad \Delta^{I}UY_2 = f(\Delta UQ_2, \Delta UL_2, \Delta_u w_{32}, \Delta_u w_{21}, \Delta_u w_{24}, \Delta^{II}UY^{I}_2, \Delta^{I}_u PUB_2, \Delta^{I}_u ECC_2)$$

$$(8.11)\quad \Delta^{I}UY_3 = f(\Delta UQ_3, \Delta UL_3, \Delta_u w_{31}, \Delta_u w_{32}, \Delta_u w_{34}, \Delta^{II}UY^{I}_3, \Delta^{I}_u PUB_3, \Delta^{I}_u ECC_3)$$

The Regional Income

Although we are essentially concerned with the process of regional environmental change in terms of its effects on each particular socio-economic group, there are certain elements related to the evaluation of the regions system's performance that require the consideration of some global index of each region's economic growth.

Starting from the real income levels achieved by each socio-economic group, represented by identities 8.1a and 8.3a, we may reach a congruent concept of regional global real income, variations of which

can be used to represent the economic performance of each region.

Assuming that,

(8.12) $p_j = 1 - \sum_{i=1}^{3} w'_{ij}$

where $w'_{ij} = w_{ij} \cdot UL_{ij}/UQ_j$, the total value obtained by adding the monetary income earned by each group as determined by identities 8.1 to 8.5 will correspond to an approximation of the regional (geographical) product (11). This value will differ from that of the regional monetary income (the monetary income effectively received by the regional residents) in the amounts represented by the net movements of income between regions (second term of the right hand side of identities 8.1a and 8.3a).

The consideration of the consumption of public commodities provided by the government as part of the regional income presents some, mainly statistical, difficulties. Although when analyzing each individual's or group's real income the value of such commodities should be added to that of the purchasing capacity represented by its earned monetary income (12) in order to properly estimate the group's level of consumption possibilities, the aggregation of the latter will overvalue the global regional consumption levels in the amount represented by the wages paid and the purchases of locally produced commodities made by the governmental activities supplying such public commodities.

If we value these commodities by means of the costs involved in their generation (we will assume equal to the current expenditure of the government, excluding its productive activities and including both the depreciation of the physical capital involved in the provision of such commodities and the interest of the capital invested, the latter considered either as an effective or as an opportunity cost), in order to achieve an approximate valuation we should add, to the total monetary income, the government's current expenditure minus the wages paid (13) and the purchases of locally produced goods.

On the other hand, insofar as the availability of (public) ecodimensional consumption commodities is due in part to the action of the government, the addition of the latter (whatever be the way in which they are valued) should be done net of the associated governmental expenditure, which is already included in the estimate of the 'public' commodities discussed above. In Chapter 10 we will discuss other questions related to the availability of ecodimensional commodities and specially those connected with the eventual existence of what we may call public 'ecodimensional bads' and their effect on the level of real regional income.

Without considering many statistical problems associated with the definition and estimation of regional social accounts (14), we could express the regional income as follows:

$$(8.13)\ \sum_{i=1}^{m} {}^{I}Y = \sum_{i=1}^{m} {}^{I}RY_i + \sum_{i=1}^{m} {}^{I}UY_i - \left(\sum_{i=1}^{m} {}_{r}W_i + \sum_{i=1}^{m} {}_{u}W_i + {}^{I}GOVP^{I} \right)$$

where ${}_{r}W_i$ and ${}_{u}W_i$: total wages paid by the government to income group i, rural and urban sectors respectively, corresponding to activities involving the supply of public commodities (including ecodimensional ones)

${}^{I}GOVP^{I}$: governmental purchases of regionally produced commodities, used in the supply of regional public commodities (including ecodimensional consumption ones).

Being the first component mentioned at the beginning of this chapter a highly significant part of the total real income any particular region is able to generate, we will define the global functional context for our analysis of the determinants of each socio-economic group's income variations, in terms of the basic conditionants of the global regional earned-income growth.

Along this line, we will adopt Siebert's argument that actual increases in real income are determined by the minimum increase of supply or demand, assuming an initial situation of equilibrium between potential and actual output (SIEBERT, 1969; pg. 94).

$$(8.14)\quad \Delta^{I}Y = \min\left[(\Delta^{I}Q + \Delta^{I}M),\ (\Delta^{I}D + \Delta^{I}X)\right]$$

where $\Delta^{I}Q$: increases in regional productive capacity

$\Delta^{I}M$: variations in the level of regional imports

$\Delta^{I}D$: increases in the level of internal aggregate demand

$\Delta^{I}X$: variations in the level of regional exports

Within the framework given by the former relationship, in the next chapters we will analyze the supply side of earned-income growth determinants focussing the attention on the peculiarities characterizing each socio-economic group; the demand conditionants of such growth; and the elements determining both the demand and supply of social services and ecodimensional consumption commodities in order to complete the analysis of the income determinants for each socio-economic group stated in relationships 8.7 to 8.11 before.

NOTES

(1) The authority-dependency relaions implicit in the center (core)-periphery approach implies that the analysis and planning of regional development become irrelevant if such relations (and their variations) are neglected and thus, if the situation of the regions system as a whole is not included.

(2) The discussion of this sub-section is based on MESAROVIC and PESTEL, 1975; pgs. 32-55.

(3) Based on the concentration of economic activities in a relatively small number of areas having a high potential for economic growth, and leaving the structuration of the overall spatial landscape to the conflicts that eventually would rise between core and periphery as the latter becomes aware of its dependent, subsidiary, condition.

(4) This component also includes payments in kind that - although do not correspond to monetary income - can be considered as retribution for the receiver's participation in the productive activity.

(5) As we are going to discuss later on in this chapter, this income component is relevant at the level of individuals or particular social groups, being somehow included in the former component when considered at a global (national or regional) level.

(6) The most common way of defining these groups is in terms of percentiles of the population and the respective share each group has of the total income generated by the community during each period.

(7) Notice that, although we are considering the accessibility to public goods as a determinant of the income distribution, at this stage we are neglecting the influence of the way in which the government finances his expenditure in order to provide such commodities. We will discuss this aspect in Part IV when analyzing the policy instruments governments have to induce desired behaviour in those variables connected with social goals and objectives.

(8) Because of the structural conditions existing in the rural sector of most countries of the region, we will assume that in this sector only the high and low income groups are relevant. Insofar as the scenarios defined for the region imply significant changes in the rural structure so that important redistribution can be expected, the inclusion of the middle income group in this sector would be necessary.

(9) The wages paid by the government due to his activities of public commodities supplier in the urban sector has been aggregated with those paid by his direct productive activities. We are assuming that the government is not involved in rural direct productive activities.

(10) Notice that the relationships stated assume, implicitly, a condition of full employment of the labour force of each group, by making the increases of income a function of the increases in labour supply (RL_i and UL_i) rather than of the changes of the employment levels. In Chapter 12 we discuss this issue, when analyzing the unemployment problem.

(11) As we mentioned before, we will assume that the government's income as an agent involved in direct productive activities is transferred to the global public income independently from the location of its generating source. Therefore, it will be not considered as composing the regional income.

(12) Notice that such capacity will differ whether we consider earned of available income when taxation is explicitly included. Insofar as we are neglecting the latter element at this stage, earned and available income will be considered as equivalent.

(13) We are assuming that the government's current expenditure is due only to the costs involved in the supply of public commodities.

(14) Given the fact that we are going to formulate our framework in terms of unspecified functional relationships, we will not discuss the statistical issues connected with the definition of relevant analytical categories.

CHAPTER 9 : EARNED-INCOME GROWTH DETERMINANTS BY SOCIO-ECONOMIC GROUP. THE SUPPLY SIDE

Although we have recognized that, in terms of earned income, the participation of each socio-economic group depends on its productive capacity in terms of production generating economic units and on the labour it is able to hire in the labour market, we will use the former as a frame of reference for organizing the analysis of the supply-determinants of each group's income-earning possibilities.

Therefore, considering the productive activities undertaken by each group, we may state their productive capacity as following the general functional relationship stated below:

$$(9.1) \quad \Delta Q = f\left[\Delta h, \min\left(\Delta K, \Delta L, \Delta E\right)\right]$$

where ΔK : variations in capital stock
ΔL : variations in labour supply (quantity and/or quality)
ΔE : variations in ecodimensional capital stocks (effective availability)
Δh : technological changes available to the group.

Underlying the former relationship is the assumption that the initial situation is characterized by full employment. Otherwise, the condition of the minimum increase of K, L or E determining (together with technological changes) the increases of productive capacity should consider only these factors being fully employed. On the other hand, a minimum increase of the availability of ecodimensional capital's productive services as an effective restraint of actual increases in each group's productive capacity, has to be carefully considered. Although in the case of some forms of these capital assets this condition will hold unequivocally, in the case of others, the possibility of overusing them, at least in the short and medium term, will give to it a relative character the final assessment of which will depend on the willingness of the community to accept the consequences of the overuse and on the mechanisms available to the community for inducing or imposing such will.

In term of relevant analytical concept for analyzing the productive capacity associated with each income-group, we will make, in general, the following identifications:

(i) The productive capacity associated with rural income group 3 will be identified with the submarginal holdings and with the exploitation units aggregated under the label of 'small farmers' (see, for instance, BELL and DULOY, 1974).

(ii) The productive capacity associated with rural income group 1 will be identified with those exploitation units not belonging to the former category.

(iii) The productive activities undertaken independently by urban income group 3 will be identified with the category of 'self-employed' (1) labour associated with the 'murky sector'.

(iv) The middle income group's productive activities, with small and medium enterprises in the service and industrial sectors, and

(v) The high income group's activities, with large and corporate services and industrial enterprises.

Based on the functional relationship stated above, we will start our analysis by discussing the determinants of the physical capital stock's variations for each income group's productive activities. We will then analyze the elements conditioning the labour supply associated with each income group. Due to the fact that the consideration of this element as a limiting factor of the productive capacity of different socio-economic groups should be done together with the demand (in quantity and quality) for labour derived from each group's productive activity, we will discuss it in terms of the capability for earning an income it represents from the point of view of the owners-group, productive activity this labour supply is oriented to.

The fifth section is dedicated to the analysis of the variations in the regional supply of non-replenishable resources. Although we will not refer it to any particular income-group, the role the exploitation of this kind of resource plays (or should play) in the determination of the regional income growth possibilities, make necessary its inclusion at this stage.

Finally, we end the chapter with a brief analysis of the availability of technological change as a relevant input determining the productive capacity, centering the attention on the mechanisms through which this factor becomes available to each socio-economic group's productive activity.

9.1: VARIATIONS IN PHYSICAL CAPITAL STOCKS

In general we may consider the variations in the regional stock of physical capital as composed of the internal (regional) production of capital goods, and of the movements of capital goods produced outside the region. In turns, the latter is compsed of those capital goods entering the region as net transfers without any transaction being effected. The purchases of capital goods (imports) can be done to other regions of the country or the other countries. Distinguishing between income-groups and between productive sectors (urban and rural), we may establish the following identities:

$$(9.2)\quad \Delta {}^{I}RK_1 = {}^{I}(pKR_1)^{I} + {}^{II}(pKR_1)^{I} + {}^{I}(MKR_1)$$

$$(9.3)\quad \Delta {}^{I}RK_3 = {}^{I}(pKR_3)^{I} + {}^{II}(pKR_3)^{I} + {}^{I}(MKR_3)$$

$$(9.4)\quad \Delta {}^{I}UK_1 = {}^{I}(pKU_1)^{I} + {}^{II}(pKU_1)^{I} + {}^{I}(MKU_1) + {}^{II}(tKU_1)^{I}$$

$$(9.5)\quad \Delta {}^{I}UK_2 = {}^{I}(pKU_2)^{I} + {}^{II}(pKU_2)^{I} + {}^{I}(MKU_2) + {}^{II}(tKU_2)^{I}$$

$$(9.6)\quad \Delta {}^{I}UK_3 = {}^{II}(pKU_3)^{I} + {}^{II}(tKU_3)^{I}$$

$$(9.7)\quad \Delta {}^{I}UK_4 = {}^{I}(pKU_4)^{I} + {}^{II}(pKU_4)^{I} + {}^{I}(MKU_4)$$

$$(9.8)\quad \Delta {}^{I}K = {}^{I}(\Delta K)^{I} + {}^{II}(pK)^{I} + {}^{I}(MK) + {}^{II}(tK)^{I}$$

where $\Delta^{I}RK_i$: increases in capital stock of rural income group i

$\Delta^{I}UK_i$: increases in capital stock of urban income group i

$^{I}(pKR_i)^{I}$: purchases of capital goods of rural income group i which are regionally produced

$^{I}(pKU_i)^{I}$: purchases of regionally produced capital goods of income group i, urban sector

$^{II}(pKR_i)^{I}$: imports of capital goods by rural income group i, region I

$^{II}(pKU_i)^{I}$: imports of capital goods by urban income group i, region I

$^{I}(MKR_i)$: imports of capital goods produced abroad, by income group i, rural sector, region I

$^{I}(MKU_i)$: imports of capital goods produced abroad, by income group i, urban sector, region I

$^{II}(tKU_i)^{I}$: net transfers of physical capital from region II, involving income group i

The following assumptions underly the former identities:

(i) The rural sector is considered as one in which the entry of new agents is not possible (mainly due to the structural conditions existing in the Latin American countries' rural environment). It is also assumed that there is no mobility of physical capital from the rural to the urban sector. Therefore, transfers of capital goods motivated by rates of return differentials are ruled out.

(ii) Most capital goods generated inside region I correspond to output of the construction industry. This assumption is based on the fact that in general the modern sector is mainly concentrated in the metropolitan region (Region II) with a rather low development of capital goods producing industries. Therefore, it is unlike to find this type of production in peripheral regions in general.

(iii) Capital goods used by income group 3 correspond to working tools and minor capital assets nationally produced (in Region II). Therefore, this group makes no purchases of capital goods generated inside Region I.

(iv) Physical capital transfers between regions I and II involve the

same income group. Therefore, no allowance is made for capital transfers between income groups.

The Rural Sector

The increases in rural capital stock being mainly derived from purchases of capital goods, its level will be determined by the conditions existing in the markets of capital goods. In the case of rural rich groups, we may consider that they face a rather competitive market from their own point of view and thus, the capital stock increase will be basically determined by the demand these groups make. The exact composition of the purchases will be determined however, by the productive capacity of the capital goods industry both inside the region and in Region II. At this stage we will assume that any gap occurring between the damand of capital goods of these groups and the supply derived from the national industry, will be covered by imports from abroad, unless such a gap is referred to the construction industry. We may express then:

$$(9.9) \quad {}^{I}(pKR_1)^{I} = f\,({}^{I}KQ\,,\ {}^{I}DKR_1)$$

$$(9.10) \quad {}^{II}(pKR_1)^{I} = f\,({}^{II}KQ\,,\ {}^{I}DKR_1)$$

$$(9.11) \quad {}^{I}(MKR_1) = {}^{I}DKR_1 - {}^{II}(pKR_1)^{I} - {}^{I}(pKR_1)^{I}$$

$$(9.12) \quad {}^{I}RK_1 = f\,({}^{I}DKR_1)$$

where ${}^{I}KQ$: productive capacity of capital industry, region I

${}^{II}KQ$: productive capacity of capital industry, region II

${}^{I}DKR_1$: demand for capital goods, rural income group 1, region I

In the case of the rural poor almost the same considerations are valid, except that for this group it will be the accessibility to the capital goods market rather than the industry's productive capacity, what will determine the effective supply of these goods. In each case, it will be the minimum value the determinant factor.

$$(9.13) \quad {}^{I}(pKR_3)^{I} = f\left[\min\left({}^{I}DKR_3 , {}^{I}ACCK_3\right) , {}^{I}SELFCON_3\right]$$

$$(9.14) \quad {}^{II}(pKR_3)^{I} = \min\left({}^{I}DKR_3 , {}^{II}ACCK_3\right)$$

$$(9.15) \quad {}^{I}(MKR_3) = \min\left({}^{I}DKR_3 , {}^{M}ACCK_3\right)$$

where ${}^{I}ACCK_3$, ${}^{II}ACCK_3$ and ${}^{M}ACCK_3$: access of rural income group 3, region I, to capital goods markets of the region, of region II and of imports respectively

${}^{I}SELFCON_3$: self-construction capacity of rural income group 3, region I.

Notice that, insofar as the capital goods generated within the region correspond to the construction industry, the 'purchases' of regionally produced capital of this income group will be partially determined by its capacity to undertake investments implying some sort of construction by itself, through the application of its own labour effort as the main imput.

In any case, the accessibility of this group to the capital goods market is determined by structural elements characterizing the rural sector in general and the mentioned market in particular. Therefore, the scenarios defined for the region must consider such structural elements and their possible variations.

Figure No. 9.1 graphically shows the former relationships determining the increases of the physical capital stock for the rural sector in Region I.

The Urban Sector

In the case of the urban sector, the determinants of the three first elements of the right hand side of identities 9.4 , 9.5 and 9.7 , are the same from those analyzed for the rural rich. Therefore, we may express:

$$(9.16) \quad {}^{I}(pKU_i)^{I} = f\left({}^{I}KQ , {}^{I}DKU_i\right) \text{ for } i = 1,2 \text{ and } 4$$

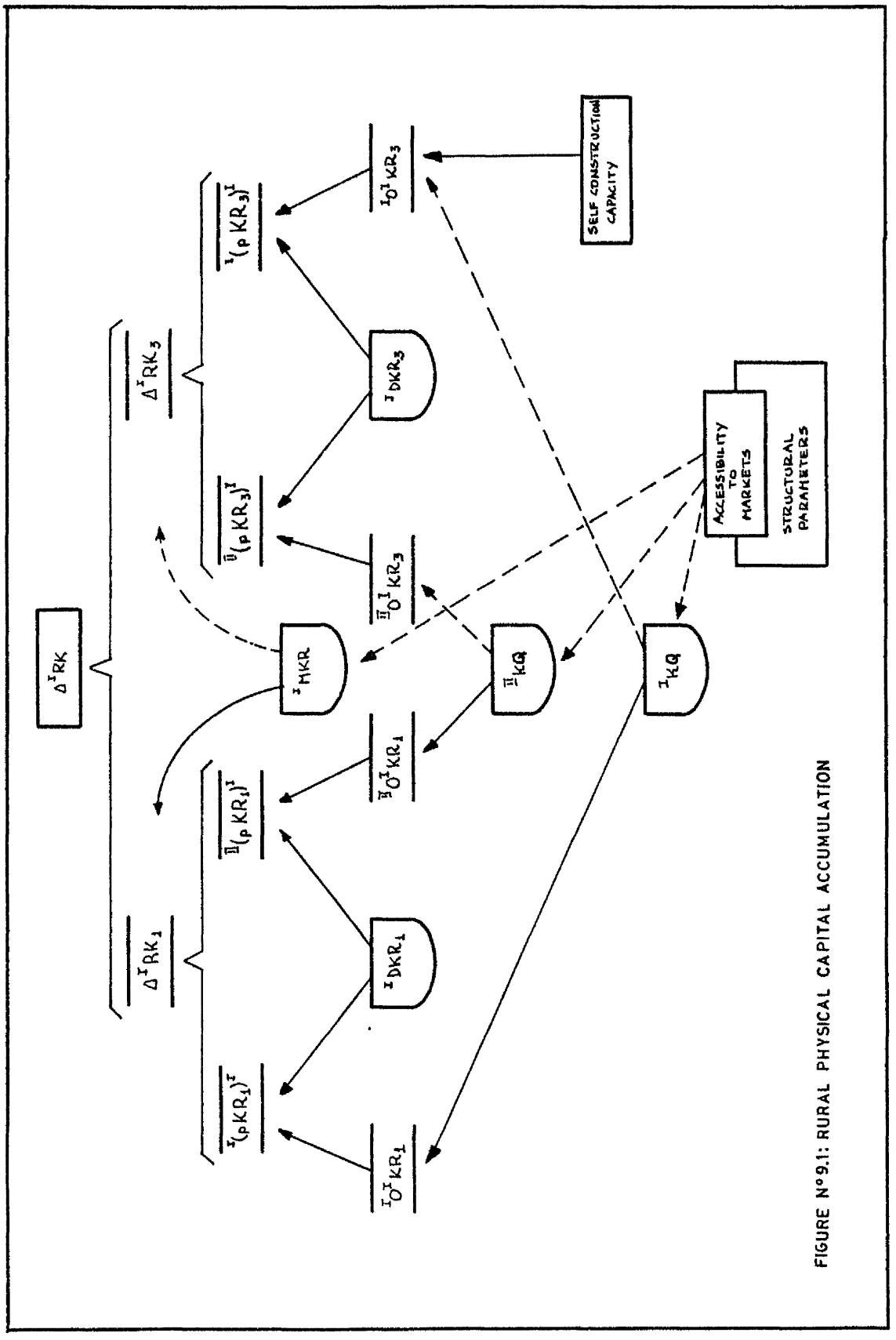

FIGURE N°9.1: RURAL PHYSICAL CAPITAL ACCUMULATION

$$(9.17) \quad {}^{II}(pKU_i)^{I} = f\left({}^{II}KQ\ ,\ {}^{I}DKU_i\right) \text{ for } i = 1,\ 2 \text{ and } 4$$

$$(9.18) \quad {}^{I}(MKU_i) = {}^{I}DKU_i - {}^{II}(pKU_i)^{I} - {}^{I}(pKU_i)^{I} \text{ for } i = 1,2,4$$

$$(9.19) \quad {}^{I}UK_i = f\left({}^{I}DKU_i\right) \text{ for } i = 1,\ 2 \text{ and } 4$$

where ${}^{I}DKU_i$: demand for capital goods coming from income group i, urban sector, Region I

Given the characteristics of the capital goods used by income group 3 (see assumption iii before), the increases due to purchases of these goods will depend mainly on the demand this group is able to make effective.

$$(9.20) \quad {}^{II}(pKU_3)^{I} = f\left({}^{I}DKU_3\right)$$

The net transfers of capital goods coming into region I will depend on the relative volumes of the inflows as compared with the outflows. These movements, on the other hand, could affect existing capital and/or be constituted by newly created capital goods. Although it is theoretically possible that both kinds of capital may move in space, the degree of mobility of already existing capital is very low (and, in general, it is achieved at very high costs) and thus, we are able to neglect this type of movement without the risk of gross misleading conclusions.

Those transfers involving income groups 1 and 2 will be then determined by the inter-regional differences of rates of return of those investments each group has access to; on the increases of capital stock due to newly created capital; and on the degree of mobility from one region to the other of this new capital has.

$$(9.21) \quad {}^{II}(tKU_i)^{I} = {}^{II}(tKU_i^{!})^{I} - {}^{I}(tKU_i^{!})^{II} \text{ for } i = 1,\ 2 \text{ and } 3$$

$$(9.22) \quad {}^{II}(tKU_i^{!})^{I} = f\left[{}^{I}r_i,\ {}^{II}r_i,\ {}^{II}\gamma_i^{I},\ {}^{II}(\Delta K)^{II}\right] \text{ for } i = 1 \text{ and } 2$$

$$(9.23) \quad {}^{I}(tKU_i^{!})^{II} = f\left[{}^{I}r_i,\ {}^{II}r_i,\ {}^{I}\gamma_i^{II},\ {}^{I}(\Delta K)^{I}\right] \text{ for } i = 1 \text{ and } 2$$

where ${}^{II}(tKU_i')^{I}$ and ${}^{I}(tKU_i')^{II}$: gross transfers of capital goods involving income group i, from region II to region I and from region I to region II, respectively

${}^{I}r_i$ and ${}^{II}r_i$: internal rates of return of investments available to income group i in region I and region II respectively

${}^{II}\gamma_i^{I}$ and ${}^{I}\gamma_i^{II}$: coefficient of physical capital (newly created) mobility characterizing income group i, from region II to region I and from region I to region II, respectively

It should be noted that, insofar as we are assuming that the capital generated within the region I corresponds to assets strongly connected to land, the value of ${}^{I}\gamma^{II}$ will be almost zero and therefore, there will be no outflowing physical capital from this region (2).

Given that the use of own capital assets by income group 3 is almost inseparable from the labour force of the owners, any inter-regional transfer of such capital goods will be determined by the migration movements characterizing this income group, mainly because it is likely that capital owners that decide to migrate will do so carrying with them their working assets (3).

Therefore, for this income group, the gross transfers of capital goods from one region to the other can be expressed in the following terms:

(9.24) $${}^{II}(tKU_3')^{I} = f\left[{}^{II}(UL_3)^{I}\right]$$

(9.25) $${}^{I}(tKU_3')^{II} = f\left[{}^{I}(UL_3)^{II}\right]$$

where ${}^{II}(UL_3)^{I}$ and ${}^{I}(UL_3)^{II}$: urban income group 3 labour force migrating from region II to region I and from region I to region II, respectively

The former relationships are graphically shown in Figure No. 9.2.

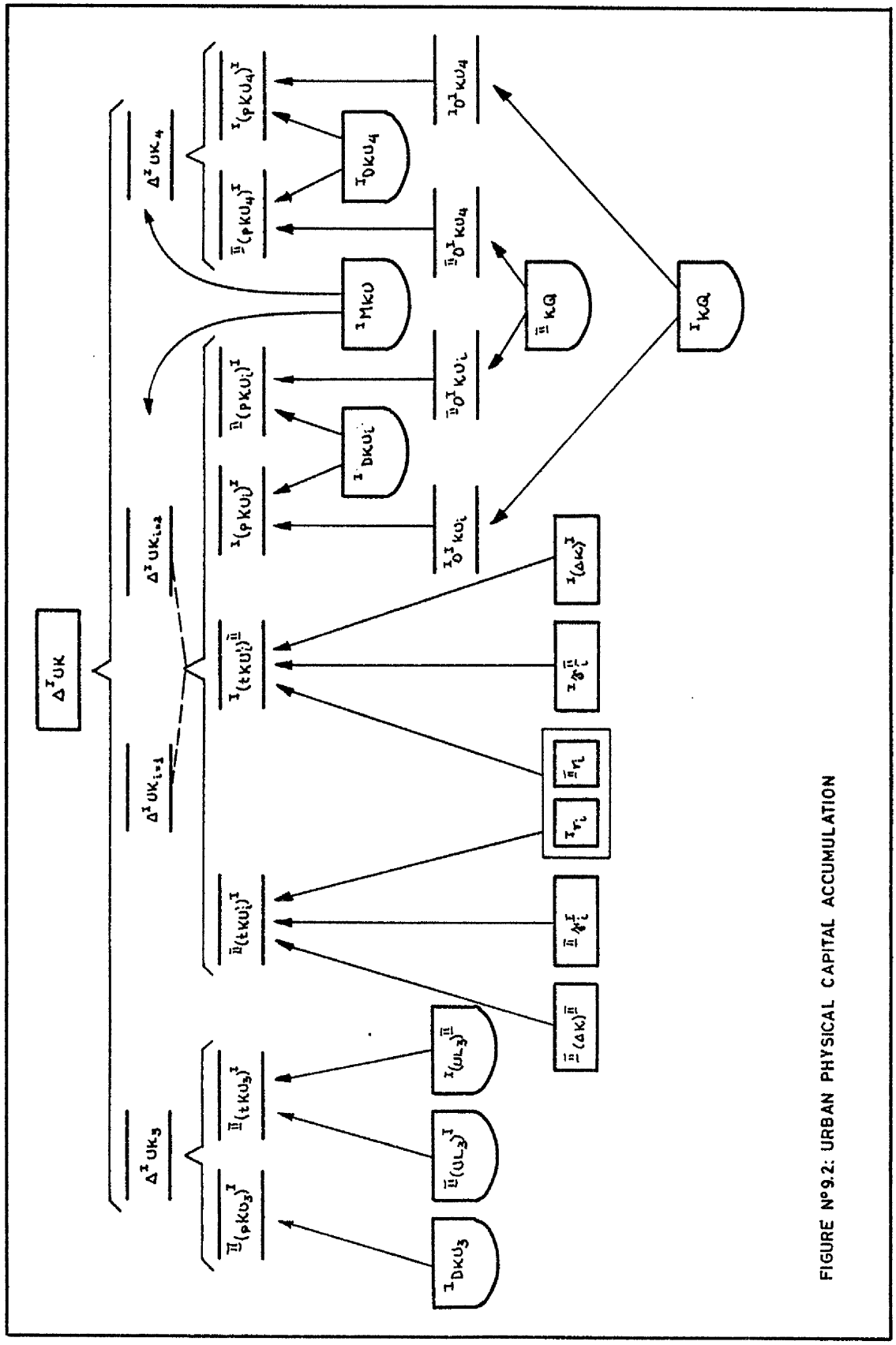

FIGURE N°9.2: URBAN PHYSICAL CAPITAL ACCUMULATION

9.2 : LABOUR SUPPLY AND DEMOGRAPHIC VARIATIONS

Due to the fact that the regional productive activity will require different qualities of labour inputs (whether it implies differences in general education level requirements or different compositions of skills and professions), the analysis of labour supply must be done considering that the labour force is heterogeneous in this sense and thus, the elements conditioning the qualitative profile of the population must be explicitly included.

We will start however our discussion with some quantitative demographic aspects, namely, the factors determining the size and its variations of the regional population distinguishing between sectors and income groups.

There are two main factors we must analyze in order to estimate the relative (and absolute) importance of each group in terms of their population: the internal demographic growth rates and the movements of population from one group to another. In connection with the second factor we have to distinguish at least three types of movement that imply a change in the overall situation and position of the individuals in the social system. Those movements from the rural to the urban sector (rural-urban migration); those movements from one region to another (inter-regional migration) which may or may not imply a change from one sector to the other (4); and those movements of individuals from one income group to another (social movementa). These three kinds of movement are closely linked in the sense that, for an individual, any of them is almost always accompanied of conditioned by the other (s).

Except for isolated cases (which confirm the rule) the situation of the whole population in the Latin American countries is characterized by an extremely rigid social system that makes almost impossible relatively large movements of people from one income group to another. Therefore, our analysis will be centered on the processes of migration

from one region to another and from the rural to the urban sector. The issue of social mobility will be considered later on, mainly as an objective of the process of development itself.

The Rural Sector

In the case of the rural sector we may write then:

$$(9.26) \quad \Delta {}^{I}RN_i = n\,\Delta {}^{I}RN_i - {}^{Ir}RN_i^{u}$$

where $\Delta {}^{I}RN_i$: variations in rural population, income group i, region I

$n\,\Delta {}^{I}RN_i$: natural growth of rural population, income group i, region I

${}^{Ir}RN_i^{u}$: rural-urban migration, income group i, region I

The natural growth of both income groups in this sector is determined by the initial number of people and by the rates of birth and death. Due mainly to living conditions and cultural reasons, the rates of birth and death characterizing each income group are quite different, in general those of the income group 3 being greater than those of income group 1.

$$(9.27) \quad n\,\Delta {}^{I}RN_i = f\,(\,{}^{I}RN_{i,o}\,,\, rb_i\,,\, rd_i)$$

where ${}^{I}RN_{i,o}$: initial size of rural population, income group i

rb_i : birth rate of rural population, income group i

rd_i : death rate of rural population, income group i

Although it is commonly argued that the rural-urban migration movement constitutes a characteristic affecting mainly the landless and in general the poorest segments of the rural population, there is evidence that many of the members of rich rural families are dispatched (due to a variety of reasons, education being not the least one) to cities (BELL and DULOY, 1974). In any case, the influence of this group's movements in the overall migration process from the rural to the urban environment should be assessed considering the fact that the group does not represent more than the 10% of the rural population in

Latin America (5) and corresponds to those farmers associated with holdings with sizes over 30 hectares.

Even though at this stage we are assuming that the income group 3 of the rural sector is rather homogeneous, it must be said that some important differences are to be found within it, specially in connection with their poverty levels, their degree of social mobility within the sector and their porpensities to migrate. Conscious of the problems that this assumption could bring, in Part IV we will discuss the need for making some differentiation within this group (specially between the landless and the small and marginal farmers operating their own land). In the following discussion we will consider these differences only in general terms.

The migration movement towards urban settlements characterizing this group is influenced by both the situation and conditions of living existing within the sector itself (push factors) and the situation existing in the urban areas (pull factors).

The most relevant push factors are represented by the degree of employment (that affects more directly the group of landless) and by the expectations of income increases allowing real possibilities of moving from the condition of extreme poverty towards better general living conditions. The ways in which these expectations are formed follow very complex patterns, We will simplify them however, by stating that such expectations are a function of the depreciation processes the ecodimensional capital owned by this group is subjected to, of the trends shown by the increases in the real wage rates, and of the degree of social mobility characterizing this income group. The higher the depreciation rates affecting the ecodimensional capital connected to this group,the lower will be its future productive capacity and thus, the lower will be the group's expectations of income increases. The same is valid in connection with the flexibility of real wages to rise and with the degree of social mobility. Access to land and other complementary assets like skills, credit and commercial ser-

vices, being the most relevant conditionants of the degree of social mobility within the sector, the expectations held by this income group in this sense will mainly depend on structural factors and on the way such factors are changing (if any change is occurring at all). Governmental efforts in implementing land reform schemes, for instance, will increase such expectations and the migration flows will tend, ceteris paribus, to decrease (6).

Obviously, the relevance of the push factors already analyzed acquire meaning only when it is compared with the income increases the rural population expects to achieve by migrating (HARRIS and TODARO, 1970). Therefore, we will represent the 'pull factors' by means of the expected income the rural migrants have once they become urban settlers.

The former differentials (allowing for the existence of other, non-economic, pull factors) must be large enough as to outweigh some economic and non-economic costs involved in the decision to migrate, like the economic costs of travelling, the cultural costs of detachment from the local community, etc. We amy represent these limiting factors by means of a mobility coefficient.

$$(9.28)\quad {}^{I}r_{RN_3^u} = f\left[{}^{I}REMP_3,\ {}^{I}E(RY)_3,\ {}^{I}E(UY)_3,\ rm_3\right]$$

$$(9.29)\quad {}^{I}E(RY)_3 = f\left[{}^{I}dRE_3,\ {}_{r}w_{31},\ {}^{I}E(RS)_3\right]$$

$$(9.30)\quad {}^{I}E(RS)_3 = f\ (\text{STRUCTURAL PARAMETERS})$$

where ${}^{I}REMP_3$: degree of employment affecting rural income group 3, region I

${}^{I}E(RY)_3$: income expectations of rural income group 3 within the rural sector, region I

${}^{I}E(UY)_3$: income expectations of rural income group 3 when decision to migrate to the urban sector is faced, region I

${}^{I}E(RS)_3$: expectations of social mobility within the sector of rural income group 3, region I

rm_3 : mobility coefficient characterizing income group 3, rural sector

I_{dRE_3} : depreciation affecting the rural ecodimensional capital connected with income group 3, region I

The income expectations of rural income group 3 when facing the decision to migrate and the differentials between these expectations and those it faces within the rural sector must be qualified considering the fact that in most Latin American countries the flows of migrants from the rural to the urban environments is very high (and increasing), despite that extreme urban poverty frequently presents even worse characteristics than those existing in rural settlements (7). Although it must be recognized that non-economic factors (such as the attraction that the 'brightness' (8) of urban centers exerts over rural populations, accompanied by rather irrational behaviour patterns from the economic point of view) could be partially responsible for such a phenomenon, a closest look at this apparent paradox enables us to give an explanation in which the mentioned economic elements play a significant and decisive role.

There is some evidence that in general the poor tend to be somehow employed (9) and therefore, it suggests a rather weak relationship between poverty and unemployment (RAO, 1974). From this point of view then, the rural potential migrant faces a situation in which the probability of being unemployed once arriving in the urban environment is likely to be low. At least for the rural unemployed or temporarily employed there is a significant difference in this sense, pushing him to migrate. One of the factors explaining this phenomenon in the urban environment is the existence of what has been named the 'murky' sector which in general is characterized by an easy and relatively unlimited entry.

Nevertheless, the presence of this sector does not guarantee an effective differential in terms of income and thus, the very existence of increasing levels of urban poverty should offset the effect over migration of employment differentials.

That this is not the case is explained by the fact that, even when

there could be an initial negative income differential eventually preventing at least the rural underemployed from migrating, the operation of the urban labour markets implies a relatively higher expected rate of social mobility from the individual migrant's point of view as compared with the one he faces by staying in the rural environment.

Fields (FIELDS, 1975) explains this relatively higher expected rate of social mobility in terms of the relative job-search parameter (10). He states that "a priori consideration suggest that the murky sector relative job-search parameter...would be fairly large"... "This would seem so for two reasons: First, the nature of the murky-sector is such that self-employment, flexible hours, and part-time work are common. Thus, it is often possible to adapt one's work weak and the specific work hours so as to be relatively free to search for modern-sector jobs. Second, many modern-sector jobs are obtained by contacts from employed friends and relatives. Consequently, workers would have relatively little to gain by searching full time and they would be likely to take up employment in the murky sector in order to earn a cash income" (op. cit., pg. 176).

It is this higher expected social mobility (as compared with that prevailing in the rural sector which, given its political, social and economic structure, is very near to zero) which makes that, being the actual nominal wage rates in the agriculture or the general per capita income levels in this sector higher than that of the murky sector, the differentials in expected income will be reversed and therefore rural-urban migration, still significant. Fields (op. cit.) states this situation as being an additional reason for the existence of an impoverished urban class.

$$(9.31) \quad {}^{I}E(UY)_{3} = f\left[{}^{I}UEMP_{3},\ {}^{I}E(US)_{3}\right]$$

$$(9.32) \quad {}^{I}E(US)_{3} = f\ (\text{STRUCTURAL PARAMETERS})$$

where ${}^{I}UEMP_{3}$: degree of employment affecting urban-income group 3, region I

$^{I}E(US)_{3}$: expectations of social mobility of income group 3 in the urban sector, region I

In Figure No. 9.3 are graphically shown the former relationships explaining the variations in the rural population.

The Urban Sector

Considering the Latin American situation and the nature of human behaviour, it is reasonable to assume that the inter-sectoral migration flows are unidirectional and thus, the urban population as a whole will increase due to the natural growth rates and due to the rural-urban migration. Insofar as we are considering the demographic situation for a specific region, we have to allow for inter-regional movements in order to determine the growth of the regional urban population. Therefore, we must analyze the inter-regional movements affecting the urban sector itself and also we have to analyze the proportion of the rural-urban migration flows that remains inside the region. In the following definitional identities we are neglecting, for simplicity purposes, the rural-urban migration flow due to movements of rural income group 1.

$$(9.33) \quad \Delta\, {}^{I}UN = n\Delta\, {}^{I}UN + {}^{I}({}^{r}RN_{3}^{u})^{I} + {}^{II}({}^{r}RN_{3}^{u})^{I} - {}^{I}UN^{II}$$

$$(9.34) \quad {}^{I}{}^{r}RN_{3}^{u} = {}^{I}({}^{r}RN_{3}^{u})^{I} + {}^{I}({}^{r}RN_{3}^{u})^{II}$$

$$(9.35) \quad {}^{II}{}^{r}RN_{3}^{u} = {}^{II}({}^{r}RN^{u})^{II} + {}^{II}({}^{r}RN_{3}^{u})^{I}$$

where $\Delta\, {}^{I}UN$: increases in urban population, region I

$n\Delta\, {}^{I}UN$: natural increases in urban population, region I

$^{I}({}^{r}RN_{3}^{u})^{I}$, $^{I}({}^{r}RN_{3}^{u})^{II}$: flow of rural-urban migrants of region I remaining in region I and moving to region II, respectively, income group 3

$^{II}({}^{r}RN_{3}^{u})^{II}$, $^{II}({}^{r}RN_{3}^{u})^{I}$: flow of rural-urban migrants from region II remaining in region II and moving to region I, respectively, income group 3

$^{I}UN^{II}$: flow of urban migrants from region I to region II

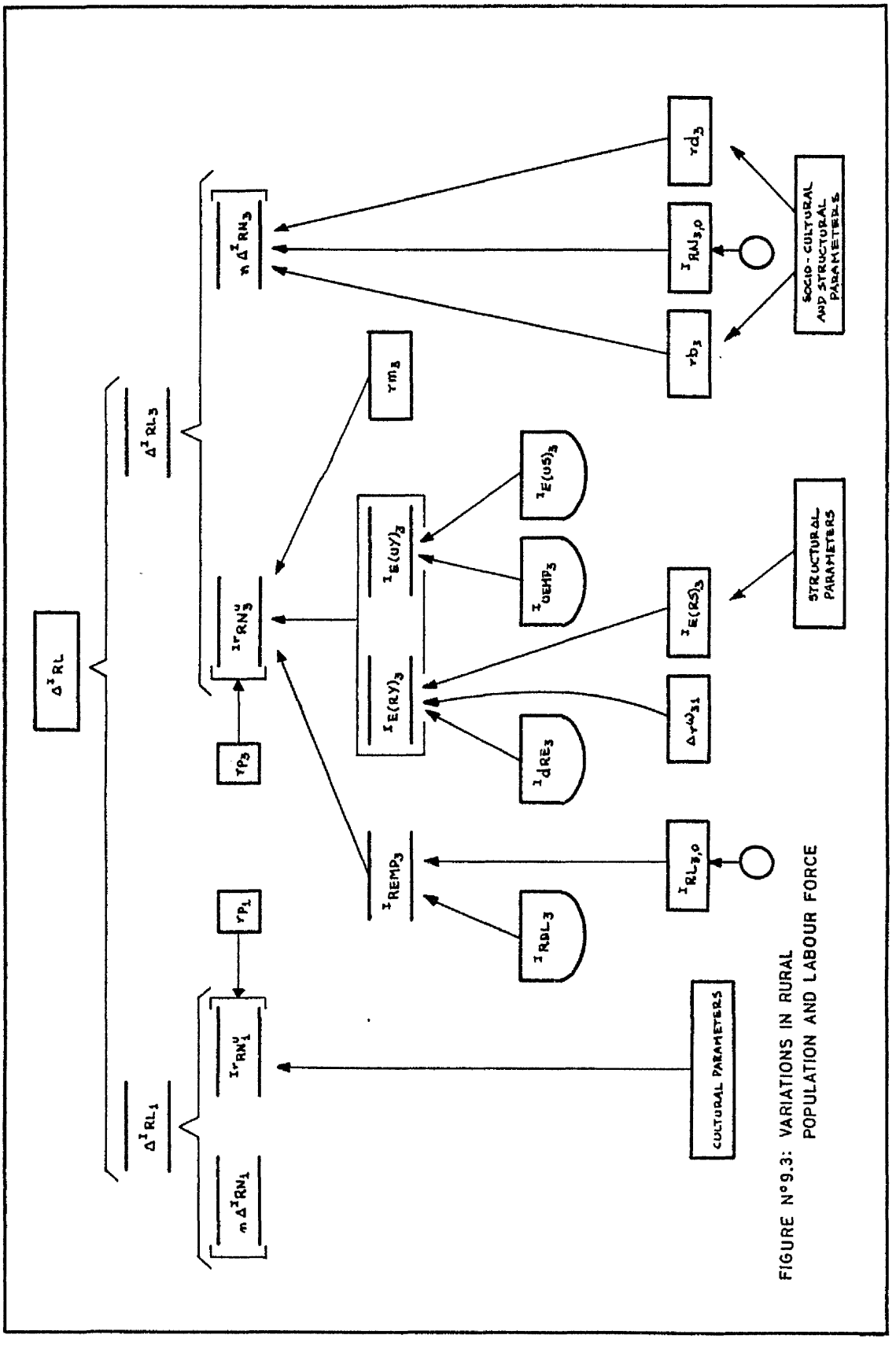

FIGURE N°9.3: VARIATIONS IN RURAL POPULATION AND LABOUR FORCE

The natural growth of the regional urban population is determined by the initial size of such population and by its growth rates, Evidence suggests that the lower the per capita income of a community or of a group within it, the higher will be the rates of growth of its population (11).

$$(9.36) \quad n \Delta {}^{I}UN = f({}^{I}UN_{1,o}, {}^{I}UN_{2,o}, {}^{I}UN_{3,o}, un_1, un_2, un_3)$$

where ${}^{I}UN_{i,o}$: initial urban population, income group i, region I

un_i : rate of growth of population of income group i

Although it has been often suggested that the migration process between regions affecting the periphery of underdeveloped or developing countries is of a selective type, involving those sectors of the population whose potential is higher, there is a great lack of knowledge about the exact characteristics of the migrants in terms of skills, actual income levels, general education levels, etc.

A convenient approach however, to the analysis to the urban interregional migration is the consideration of at least two different categories of peripheral urban centers. In the first place, the flows linking what ECLA has defined as regional metropolises and some kind of transitional urban centers (provincial cultures with over 100,000 inhabitants) with the national metropolises and megalopolises. Second, the minor cities (between 20,000 and 100,000 inhabitants) "in which it is found perhaps, more than in rural areas, the main sources of migratory flows towards metropolises and megalopolises" (ECLA, 1976).

The first type of link has to be assessed considering the fact that the regional metropolises are experiencing high rates of growth of their populations (12), offering increasing optative opportunities for development mainly based on a relative functional specialization. This situation suggests that, in the first place, the overall migration from these centers towards the national metropolises is comparatively low and, in the second place, affects mainly middle income and, to some extent, upper income groups.

The mechanisms underlying the latter hypothesis are mainly based on employment and educational considerations.

From the point of view of employment we may recourse to three pieces of evidence: a significant proportion of the urban unemployed belongs to the mentioned income groups (see note 9); the growth of the modern sector is characterized by a low employment elasticity, feature that should be considered together with the fact that the services sector has a high weight within the total urban employment as compared with industrial employment in general and specially with that of the modern sector (13); and the already highly concentrated character of the population in one or two central cities together with an even more centralized character of the decision-making process. This element together with the former (14), induce one to think that those individuals belonging to the group of unemployed who aspire to high-income jobs will have greater expectations to become employed under the desired conditions, if they migrate towards the center region.

This trend is reinforced by the special features characterizing the educational system of most Latin American countries, which orient the school-leavers mainly to white-collar job-searching, the service subsector and particularly the burocracy, being the ones that offer the highest possibilities of success.

Not only in terms of vocational orientation is where the educational system reinforces this migratory trend, but also in terms of its own spatial and regional location. The higher and further education establishments being highly concentrated in the national metropolitan centers, the possibilities of effective access to them by students belonging to the periphery implies their temporal migration to such centers. Obviously, this possibility becomes a real one only to middle and high income families. Due to multiple reasons (cultural, economic and social) the probability of both the graduates and the ones who fail, to return to their original regions is fairly low and thus, temporal migration becomes rather permanent.