

Development Pole Theory and the Brazilian Amazon

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RESUMO

A Amazônia brasileira, principalmente a sua parte oriental, sofreu uma significativa transformação em decorrência das políticas de desenvolvimento regional implementadas a partir do golpe militar de 1964. De fato, estas políticas de desenvolvimento, que foram profundamente influenciadas pela teoria dos pólos de desenvolvimento, geraram impactos sociais e ambientais adversos. Este artigo mostra como a teoria dos pólos de desenvolvimento, elaborada pelo economista francês François Perroux, moldou tanto a formulação quanto a aplicação das políticas regionais de desenvolvimento. O argumento central é que esta teoria veio a ser uma justificativa teórica conveniente para os objetivos geopolíticos específicos (integração nacional e ocupação da Amazônia) e econômicos do regime militar.

PALAVRAS-CHAVE

pólos de desenvolvimento, políticas de desenvolvimento regional, Perroux, Amazônia

ABSTRACT

The Brazilian Amazon, especially the Eastern region, has undergone a deep transformation due to the implementation of regional development policies by post-1964 military-backed governments. In fact, these development policies, which were influenced by development pole theory, have had negative social and environmental consequences. This article shows how development pole theory, elaborated by the French economist, François Perroux, shaped policy formulation and application. The central argument is that development pole theory showed to be a convenient theoretical justification for the specific geopolitical (national integration and occupation of Amazonia) and economic objectives of the military regime.

KEY WORDS

development poles, regional development policies, Perroux, Amazonia

JEL Classification

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INTRODUCTION

The Brazilian development policies were heavily influenced by Perroux's development pole theory, as its presence in most national plans testifies. The main reason for its wide acceptance lies in the fact that the theory's underlying idea suggested that economic growth, interregional equilibrium and integration of backward regions could be achieved through a strategy of decentralised development. This idea showed to be a convenient theoretical justification not only for the geopolitical (national integration and occupation of Amazonia) but also for economic (accelerated economic growth) objectives of the military regime. In relation to Amazonia, this region, with its great potential of natural resources and vast areas of unpopulated land, was regarded by the military governments as a means of rapidly tackling those objectives. In this regard, development pole strategies were vigorously implemented by the Federal government through the PND II¹ (1975-79) and they continued with the advent of the PGC² in the 1980s.

This article aims to analyse the development pole strategies implemented in the Amazon region, but focusing on the assumptions behind this theory with respect to the beneficial spread effects, which were supposed to be generated by such induced poles to their peripheral areas. According to this general objective, the article is divided into five sections organised as follow. An historical background of Perroux's work is provided in the first section with the clear purpose of understanding his theory. In the second section, the concept of development pole is examined in order to show some inconsistencies and contributions of Perroux's theory. The main objective of the third section is to show the influence of Perroux's

1 PND II - The Second National Development Plan (Segundo Plano Nacional de Desenvolvimento).

2 PGC - The Greater Carajás Programme. The PGC was the largest and most ambitious "integrated" development plan ever devised and implemented for an area of tropical rainforest. This programme comprised four main projects: an iron-ore mine (the Carajás Project), which was the PGC's centerpiece; two aluminium plants; the ALBRAS-ALUNORTE complex and ALUMAR; and the Tucuruí hydroelectric scheme. In addition, the PGC involved investments in infrastructure such as roads and rail transport and also in agriculture, cattle-breeding, fisheries, agroindustry, forestation, reforestation, lumbering and utilisation of energy sources. In this respect, see HALL (1987; 1991).

development theory in Brazil. The implementation of development poles in the Brazilian Amazon is analysed in the fourth section, which prepares the way for making some remarks on the supposed positive effects generated by development poles in that region in the subsequent section.

HISTORICAL BACKGROUND

François Perroux was an important source of ideas and his development pole theory, whose influence on Latin American countries, principally Brazil, was significant, has a remarkable place, allied to other theories and strategies of development, in economic development theory. In order better to understand Perroux's theory, it is important to set his work in historical context.

The term “pole” was first introduced by Perroux in his 1950 article “Economic space: theory and applications”, which was a product of his lecture at Harvard University in 1947. (PERROUX, 1988b) In this article, Perroux discussed “economic spaces”, which were categorised into three types: as a plan; as a field of forces and as a homogeneous aggregate. This discussion served as a basis for his explaining that the firm was the core of the problem and not the region itself, and even the use of the term “pole”, mentioned as synonymous with “centre” (this reference is important because it marks the origin in the economic literature of the conceptual confusion caused by Perroux, who never made a clear distinction between growth pole and growth centre), emphasised this belief, as Perroux stressed:

“As a field of forces, economic spaces consist of centres (or poles or foci) from which centrifugal forces emanate and to which centripetal forces are attracted. Each centre being a centre of attraction and repulsion, has its proper field, which is set in the fields of other centres. Any banal space whatever, in this respect, is a collection of centres and a place of passage for forces.”

The firm, considered as centre releases centrifugal and centripetal forces. It attracts men and objects (personal and material aggregations around the firm) into its banal space, or it removes them (diverting tourist activities, land reserved for further expansion, etc.). It attracts economic elements, supplies and demands, into the space of its plan, or it removes them.

Through this process, the economic zone of influence, whether or not it is linked to the topographical one, is determined. The topographical zone of influence of Michelin in France is inscribed in a region, but its economic zone of influence, like that of all large firms, defies cartography.” (1950, p. 95-96)

This article, based on his lectures at Harvard at the end of 1940s, was relevant because Perroux provided some insights into his views on the development of capitalist economies and, at the same time, he paved the way for the construction of his own theory. Despite Perroux's first mention of pole, he only discussed the concept of pole in his 1955 article *La Notion de Pôle de Croissance*, which can be considered his most important and influential work.

Some important factors contributed to Perroux's conclusions about growth poles in particular, and also his views on economic development in general. The first factor was related to post-war problems of economic reconstruction and co-operation in western Europe where the Marshall Plan, whose main objective was to contain the progress of communism, was implemented and a large amount of money was invested in disrupted economies such as those of France, Italy, etc. in order to tackle serious problems. The success of this Plan generated confidence in the role of economic aid.

The second and more important factor was the controversy between two distinct doctrines of economic development: the then prevailing view of “balanced growth” and the insurgent “unbalanced growth”. Perroux was well-informed about the current economic development literature in the late 1940s and 1950s and in his 1961 book *L'Économie du XXe Siècle*, he

made references to the writings of now eminent development economists, such as Hirschman, Myrdal, Nurkse, Rosenstein-Rodan, Tinbergen, Rostow, Harod, Domar, etc. Perroux was influenced by, and in turn influenced, many of them and also future generations of development economists.

The third factor was the great influence of Schumpeter's writings on Perroux's ideas. In fact, Schumpeter's innovation concept was essential for Perroux's explanation of the growth and development of capitalist economies because Perroux believed that entrepreneurial innovation was primarily responsible for the development process which, therefore, would encompass a sequence of poles, considered as dynamic centres, over time. It is important to stress here that Perroux's growth pole gained prominence in the context of the controversy between the balanced growth, and unbalanced growth, theory.

When the concept of "growth poles" was elaborated, Perroux, despite his emphasis on the interactions among industrial branches, focused his attention principally on economic activities and also on the geographical location of population rather than spatial development processes. Boudeville, who was Perroux's disciple, was mainly responsible for transforming the economic phenomenon that was observed in an abstract space into a concept applicable to a geographical space. Thus, the transformation of Perroux's concept into an operational tool for regional planning was an important factor for its widespread use in several countries. In fact, growth pole strategy was implemented in different nations such as the United States, Spain, Italy, Brazil, Venezuela, Kenya, Nigeria, Japan etc., whose contexts were completely distinct.

DEVELOPMENT POLE THEORY

Development pole theory has its origins in Perroux's observation of the notion that:

“growth does not appear everywhere and all at once; it appears in points or growth poles with variable intensities; it spreads along diverse channels and has varying terminal effects for the whole of the economy.” (PERROUX, 1955, p 308)

This understanding of the process of economic development contrasted clearly with the balanced growth approach and led Perroux to consider development itself as fundamentally polarised, because the propulsive effects intrinsic to a development process tended to be generated by a cluster of economic activities and also tended to engender the growth of the economic whole. Although Perroux was not primarily concerned with the spatial implications of development in geographical terms, his concept of the growth pole, which was elaborated in order to describe and explain the process of economic development in an abstract economic space, attracted the attention of regional planners, geographers, economists and many other professionals involved with problems of regional development. As a consequence, the concept of growth poles, together with similar concepts such as growth centres, growing points, core areas, etc., which were conceptual tools developed to solve problems of regional inequalities, became a catchphrase. The wide acceptance of these concepts, principally of the growth poles, is centred on their underlying idea, whose appeal was very strong, that it was possible to achieve economic growth, interregional equilibrium and integration of backward regions by means of a strategy of decentralised development. However, the use of these concepts as slogans in the political discussion of regional problems and, especially, the necessity of applying Perroux's theory as a basis for regional planning, contributed to the generalised confusion of the concepts and also to his theory losing much of its original content and meaning.

In relation to Perroux's theory, Paelinck stressed that:

“the growth pole concept has often been misunderstood. It has been confused with the notions of key industry, basic industry, and industrial ensemble; from this follows the erroneous conception according to which the growth pole would be an industrial monument raised to the glory of future regional

industrialisation, a guarantee of certain economic growth. Or again, to make this scarcely rigorous concept more precise some would have as a growth pole any important implantation of firms, preferably industrial, which would exercise salutary effects on the geographic area where it is introduced.” (1965, p. 10-11)

More recently, Higgins stated that:

“as initially presented by Perroux, the theory was too complex, too abstract, and too nonoperational to be used as a basis for planning. Indeed to apply the pure theory of Perroux would require global planning, if we take into account Perroux’s more recent insistence on planning transmission lines and receptors as well as generators of growth. Perroux’s economic space, in which spread effects are felt, is global. He argues, for example, that Latin America’s true growth poles still lie in Europe and, to some degree, in the United States. Such a concept is useless for regional planning which is confined to a single country. As a consequence, economists who found themselves involved in practical regional planning simply discarded the pure theory of Perroux. They converted it into a totally different theory which treated growth poles as urban centres, and spread effects as being generated in a particular geographic space, namely the region adjacent to the urban centre itself. Once this happy doctrine is accepted, it is possible to imagine that by pushing and pulling new enterprises (mostly industrial enterprises) into urban centres of retarded regions, it is possible to reduce regional disparities, decentralise urbanisation and industrialisation, and accelerate national development all at once. It did not take long for this pleasant version of the growth pole doctrine to spread to developing countries and to be applied there as well.” (1988, p. 44)

Both statements suggest that Perroux's theory was misunderstood. Nevertheless, an important question remains: why did development pole theory generate so many bewildering concepts? In order to answer this essential question, certain inconsistencies in his theory will be analysed and, thereby, clarified.

The basis for such confusion is centred on Perroux himself, who, despite being an important source of fruitful ideas, was far from clear in his conceptualisation. A good example is the term pole, which Perroux never defined exactly and which was interpreted as a cluster in geographical space or as a set of linkages in economic space within a general equilibrium system. This kind of impreciseness and ambiguity in Perroux's writings contributed enormously to the generalised misinterpretation and also to the use of his concepts in vague, unclear and oversimplified ways.

These confusions do not invalidate Perroux's concepts at all. His theory that growth neither appears simultaneously, nor regularly throughout an economy and that it tends to be polarised are unquestionably important. These convictions led Perroux to develop other significant arguments, such as: that growth industries (*industries de la croissance*), also termed propulsive industries (*industries motrices*), tend to be clustered in geographical space and moreover, tend to generate spread effects (*effets d'entraînement*) on their environments; and that these propulsive industries tend to grow faster than and, as a consequence, dominate, other industries that are linked with them. Thus, owing to its perceived theoretical potential, Perroux's ideas became the focus of interest of several professionals, who were seeking a tool for solving problems of national and regional development both in industrialised and underdeveloped countries. However, difficulties arose when these ideas, which were conceived in an economic space (abstract space), were applied to geographical space (banal space). As a consequence, Perroux's theory was considerably broadened by other important contributions to his work and, as will be seen, some of these contributions differed from the original ideas.

Before examining some of these contributions to Perroux's theory, it is important to analyse certain aspects of his own theory. The first aspect is

his understanding of the development process, an understanding which is essential for perceiving the difference between growth poles and development poles. According to Perroux, although growth and development can occur jointly in the same place, they are far from synonymous. In this regard, he stressed that:

“growth means a sustained increase in the dimension index for an economic entity (for example, gross product). (...) Development is the sum of the changes in social patterns and mentalities through which the production device is coupled with the population: the latter acquires the capacity to utilise the production device to achieve what is considered to be a satisfactory growth rate, and the production device supplies a product that serves the population instead of being “alien” to it.” (1968, p. 248; 1988a, p. 70)

This difference between growth and development is fundamental for pinpointing the distinction between the development pole and the growth pole. In this regard, Perroux pointed out that:

“the growth pole is a set that has the capacity to induce the growth of another set (“growth” being defined as a lasting increase in the dimensional indicator); the development pole is a set that has the capacity to engender a dialectic of economic and social structures whose effect is to increase the complexity of the whole and to expand its multidimensional return.” (1968, p. 247-8; 1988a, p. 49)

In order to understand Perroux's scheme, it is fundamental to recognise that propulsive industries play a key role in the development process. These industries are highly innovative and, according to Perroux, innovation or technological progress is the pillar of economic development. The propulsive industries tend to be clustered in particular areas, which can be centres for the extraction of raw materials, for production and distribution of power generation and for technological research, or also agro-industrial centres. Owing to their nature, the propulsive industries tend to generate

spread effects, such as the increase in income and employment, to their environment and some of them can be internal to the industry itself. These beneficial diffusion effects are stimulated by geographical clustering of these propulsive enterprises and any concentration of them is necessarily considered a growth pole or development pole.

The growth or development poles will certainly produce spread effects, but Perroux never indicated where these effects would be felt and moreover, there was no guarantee that they would be felt in the immediate surrounding region. The main reason for this lies in the fact that Perroux's theory was elaborated for an economic space, which was extremely abstract, and, therefore, the creation of growth poles and development poles and their performance were problems considered on a theoretical plane.

As was mentioned above, transfer of the concept from abstract space (economic) into geographical space was carried out by Perroux's disciples, principally by Boudeville, who transformed it into useful and important concept for regional development theory. According to Boudeville:

“a regional growth pole is a set of expanding industries located in an urban area and inducing further development of economic activity throughout its zone of influence.” (1966, p. 11)

Besides his emphasis that a set of dynamic industries should be geographically clustered, he also widened the definition beyond this point by arguing that there were three types of space: homogeneous; polarised; and planning, or programme, space. A homogeneous region can be characterised by its relative uniformity; a polarised region is a heterogeneous space, which comprises a set of units, or economic poles (*pôles économiques*), which have more exchanges (goods and services) or linkages (interdependencies) with a dominant pole than with other poles of the same type. The notion of polarisation involves the notion of a hierarchy of poles, which are classified according to the activities they perform; and the planning region is *“a continuous space, a technical and geographic instrument to attain a goal localised in the region itself in the most economic way.”*

(BOUDEVILLE, 1968, p. 35) In fact, Boudeville, with his new concepts, made Perroux's theory more operational, especially in the context of underdeveloped countries.

Nevertheless, it is important to stress here that some basic ideas of the unbalanced growth theory, principally those advocated by Hirschman, such as the importance of induced investment decisions for the promotion of development, and also the belief that infrastructure investments could be essential for the development of backward regions - although the most important aim was the provision of regularly inducing activities in industry, agriculture and services, provided significant parameters for development pole policies implemented throughout the 1960s. During this decade, most of these policies were designed to promote the development of backward regions by concentrating investment in order to obtain scale and agglomeration economies. Despite this favourable context, structural problems persisted and a good example, especially in developing countries, is the constant population growth of large urban areas and the concomitant decline of some peripheral regions. Although such large urban areas continued to grow because new entrants benefited from the economics of agglomeration, the marginal social costs prevailed over the marginal social benefits. In this regard, a plausible alternative for overcrowded urban areas as for the country itself would be centred in the intermediate (medium-size) centres (or development poles), whose accelerated economic and population growth could be induced by government policies in relation to infrastructure, capital subsidies and other types of incentives.

This development pole strategy stressed the advantages of agglomeration economies and at the same time these induced, medium-size development poles were conceived as truly poles of attraction for migrants who would otherwise go to large congested urban centres, which were considered spontaneous development poles. In addition, these induced development poles, according to the theory, would generate beneficial spread effects to their immediate peripheral regions, so that in the long-run an "equilibrium growth" throughout a country would be expected. An excellent example of this strategy was the French spatial development policy of the 1960s, which designated eight metropolitan areas whose concentrated investments would

stimulate economic and population growth and, therefore, would, it was hoped, counterbalance the growth of the Paris region. (HANSEN, 1967, 1968; DARWENT, 1975)

An important contribution to the understanding of the incidence of economic growth in spatial terms and the problems of regional allocation of investments was Friedmann's core-periphery, or centre-periphery, model, which, in certain aspects, was related to the notions of growth poles (development poles) and also growth centres. According to Friedmann and Weaver (1979), core regions were major centres of innovative change and as a consequence the places where development occurred, whereas all other territory consisted of peripheral regions. However, the main point is that innovations generated in these dominant centres spread to their peripheral regions, whose development is completely dependent on the core regions. Although it is beyond the scope of this chapter to analyse the theoretical weakness or validity of Friedmann's propositions, it is interesting to note, as Darwent (1975, p. 548) had pointed out, that French regional planning could be thought of in Friedmann's terms because this was "*a policy of encouraging spatial integration between core and periphery, at the intra-regional scale - the level of polarised region - while correcting the imbalance evident between Paris (as a core) and the rest of France (as a periphery) at the inter-regional scale.*"

It is necessary to highlight the terminological confusion generated by the use of "growth pole" (development pole) and "growth centre". In its origins, both terms were used synonymously, but the lack of a precise definition by Perroux allied to the searching for conceptual tools in order to overcome regional inequalities led many professionals to employ these terms interchangeably as well as definitively. In this regard, a useful distinction was made by Kuklinski:

"the promotion of growth pole policies is a phenomenon on the national scale, changing not only the structure of a given region where the pole is located but also the interregional proportions in the distribution of population and economic activities of a given country. The promotion of growth centres

policies is a phenomenon on the regional scale, transforming the pattern of urban and rural settlement inside the different regions.” (1975, p. 9)

However, this distinction was not entirely acceptable and the semantic confusion persisted in the regional development literature. It will be recalled that this sort of ambiguity found in Perroux's theory generated extensive misunderstandings which, in some cases, could have been incidental but also deliberate.

The development pole strategies implemented in the 1960s are closely related to the model of hierarchical diffusion of innovation which prevailed at that time. According to Hansen (1981, p. 21), “*this urban-oriented framework of economic activities in space has two major elements: a system of cities arranged in a functional hierarchy, and corresponding areas of urban influence surrounding each of the cities in the system.*” Within this framework, development-inducing innovations were disseminated from higher to lower centres in the urban hierarchy and also from urban centres to their immediate peripheral regions. In addition, the magnitude of development, in spatial terms, was determined by the size and functions of the urban centre. The hierarchical diffusion of innovation model stressed the importance of continuing innovation in large centres as the crucial factor for the development of the whole urban-economic system.

This general background showed the connection between the hierarchical diffusion of innovation model and the induced development poles that were implemented in order to “*link lagging regions more closely with the national system of hierarchical filtering and spread effects from urban centres to their hinterlands.*” (HANSEN, 1981, p. 22)

Despite its great acceptance and implementation in many countries, the results of development pole policies were highly questionable. However, it is difficult to evaluate them concretely because it is not a simple task to find a genuine example of a development pole policy that was effectively implemented in practice. Problems are manifold. One of them is that in many countries development pole strategies were elaborated but were not

implemented for various reasons according to their context. The serious problem identified is related to the political difficulty of selecting geographical development poles because many policies that had begun by concentrating investments in a few urban centres were attenuated by political pressures to include more centres, thus impeding the inducement of extensive agglomeration economies elsewhere. Nevertheless, the foremost problem is the implementation of development pole policies in completely different contexts, such as developed countries and developing countries.

In the context of developed countries, it was verified, for example, that development-inducing linkages (through innovations) were not only transmitted from larger to smaller centres but also in the reverse order, as well as between centres of similar size. Another important point was that industrial sources of innovation were increasingly widely dispersed, which meant that linkages between these industries involved relatively large distances. This evidence undermined the idea that induced development poles could generate development in their own peripheral regions. The above evidence contributed to the generalised pessimism in relation to the promotion of induced development poles in developed countries.

Developing countries, in general, have manifold problems, which vary from high unemployment rates to sharp regional inequalities. Planners and policy makers believed that, in order to overcome social and economic disparities between regions and also between larger urban centres and their peripheral areas, it would be necessary to implement development pole strategies. In the understanding of these professionals, *“if the developed countries appear to have an orderly hierarchy of central places through which development-inducing innovations filter and spread, then this spatial structure must also be created in the developing countries.”* (HANSEN, 1981, p. 32)

Owing to scarce resources in these countries, development pole policies focused on a few urban centres selected where investments would be allocated in order to obtain scale and agglomeration economies. The argument was that the induced poles would generate beneficial spread

effects to their hinterlands, which would necessarily be underdeveloped areas.

Development pole policies took a number of forms, particularly in developing countries such as Brazil. Some focused on infrastructure, aiming at supplying a basic level of power, water, transport and other public facilities. Others were based on intermediate or heavy manufacturing industries (generally public enterprises), these projects being commonly associated with industrial complexes organised around such sectors as iron and steel, aluminium, petrochemicals and heavy engineering. The common factor in all these projects was the importance of the direct use of large-scale investment resources to produce structural changes through accelerated economic growth.

Nevertheless, there were many criticisms related to development pole policies. Some of them stressed the fact that that spread effects claimed by the theory were smaller than expected and limited in geographical extent, so that peripheral regions were benefited in a minimal scale. Others, such as Coraggio argued that development pole theory was:

“really designed for the development of the poles and their associated social groups and that any clever attempt to “extract” from it the ideological elements, so as to remain with a set of technical relationships, is a contribution to the advance of dominating ideology.” (1972, p. 39, quoted by HILHORST, 1981, p. 161)

Higgins, in turn, pointed out that:

“the strategy applied was seldom the one that Perroux favoured. Far from strengthening and encouraging existing growth poles, the strategy has been one of trying to create growth [development] poles in retarded, disadvantaged regions, hoping for spread effects from the chosen pole to its own geographical regions...In my view, it is very important to make it clear that “the failure of the growth-pole [development

pole] strategy” was not the failure of the Perroux`s theory, but failure of a distorted version applied by his disciples, mainly Boudeville.” (HIGGINS, quoted by POLENSKE, 1988, p. 105)

In fact, many development pole strategies implemented over the world had just one point in common with Perroux's theory: the name. However, Higgins argument that the failure cannot be attributed to Perroux's theory but is due to a version that had been misinterpreted and applied by his followers - especially by Boudeville - is highly questionable because Perroux himself recognise the significance and also the validity of contributions made by Boudeville and other disciples to his theory. This suggests that Perroux was completely aware of this “distorted version” and agreed with the new viewpoints implied by his concept of growth (development) poles.

Although development pole theory had been criticised in many of its aspects, some authors, despite difficulties, believed in its potential, principally in the context of Latin America. In this regard, Richardson and Richardson (1975, p.169) stressed that:

“the practical objections to growth [development] pole strategies such as the selection of growth centres, the identification of propulsive industries, and the choice of effective instruments arise wherever growth [development] centre strategies are adopted, and are in no sense peculiar to Latin America. Moreover, the existence of these difficulties does not provide an argument for rejecting the growth [development] centre approach, but may instead suggest the need for perseverance and improvement. The disenchantment with growth [development] centre policies in many countries is not evidence that the principle of polarisation is wrong. On the contrary, it reflects the over-optimism and short-run time horizon of regional policy-makers, the failure of sustained political will, the use of deficient investment criteria, bad locational choices, and lack of imagination in devising appropriate policy instruments.”

After more than three decades of many experiments with development pole policies in Latin America, especially Brazil, some significant factors contributed to Perroux's theory having been unsuccessful, and thus it is important to comment on them here. The main problem is centred on the selection of development pole locations, which was commonly based on criteria such as national sectoral projections and urban population growth projections instead of being based on the development potential or demand of the peripheral regions. As a result, development poles generated a limited impact on their immediate hinterland areas and the reasons for this are: the linkages involved in the development process were largely with distant suppliers and markets, and also the derived demand for labour and for agricultural outputs frequently encouraged an intense flow of migration and supplies from outside the regions where development poles were located. In addition to the foregoing problems, employment was not generated to the degree expected in view of the considerable resources invested. What boomed instead was informally organised work, and mostly on a subsistence basis, and a main reason for both these developments is associated with the highly capital-intensive nature of development pole activities.

Nevertheless, the most important criticism that was addressed to development pole strategies implemented in developing countries was that these strategies were unable to improve the social and economic well-being of populations who live in peripheral regions and who belong, to a large extent, to the poorest social stratum of society. It is important to stress here that development pole policy is one form of the top-down development paradigm, which is in fact a development paradigm "from above". This paradigm placed its emphasis on urban, industrial and capital-intensive, technology (innovation), and also on the use of external and scale economies.

According to Hansen (1981), the prevalent attitudes toward development pole strategies have passed from a period of optimism in relation to the generation of spread effects by the creation of induced poles, to one of pessimism when these expectations were not realised, and subsequently to

a broader understanding that induced development poles would be just one aspect of more comprehensive development planning.

THE DIFFUSION OF THE DEVELOPMENT POLE THEORY IN BRAZIL

In retrospect, the influence of Perroux's development pole theory in Brazil can be traced to the end of 1950s when his disciple Boudeville, who lived in Brazil for three years, published an important study in 1957 about the State of Minas Gerais. This study, *Contribution à l'étude des Pôles de Croissance Brésiliens - Une industrie motrice - La Sidérurgie du Minas Gerais*, focused on the development of the metallurgical industry in Minas Gerais and also on the possibilities of transforming the city of Belo Horizonte, which is the capital of the State of Minas Gerais, into a powerful development pole. In 1964, Boudeville published another significant study, *Croissance Polarisée du Rio Grande do Sul*, whose main focus was on the economic polarisation in the state of Rio Grande do Sul and he highlighted its capital, the city of Porto Alegre, as the main pole of the State and at the same time defined other smaller poles.

The presence of the French geographer, Michel Rochefort, who taught in some Brazilian universities, supervised academic studies, fieldwork, etc., in Brazil contributed to the consolidation of Perroux's ideas in this country. Although Rochefort had used the terminology of his French geographer colleague, Chardonnet, and not that of Perroux, Andrade (1977) stressed that it was not significant because the two terminologies were similar.

These presences and studies marked the deep influence of Perroux's ideas on Brazilian economists, geographers and other professionals involved with regional problems. In this regard, private enterprises such as SAGMACS - *Economia e Humanismo* (Economics and Humanism) and EPEA - *Escritório de Pesquisas Econômicas Aplicadas* (Office for Applied Economic Researches)

as well as governmental agencies, such as CNG,³ BNH,⁴ SUDENE⁵ and the Ministry of Planning adopted the development pole theory in their plans.

Andrade (1977) pointed out that SUDENE began to adopt development pole theory definitively in 1966, when this agency decided to use Perroux's concepts in its III Master Plan (*Plano Diretor*) for Economic and Social Development of Northeast for the 1966-68 period. In that same year, SUDENE promoted the First Seminar on Development Poles, which was an important event because by congregating several professionals with different backgrounds in order to discuss Perroux's theory and Brazilian regional problems, it served to diffuse the theory itself even more and also to consolidate the prestige of Perroux's ideas in the national territory.

Despite the importance of Perroux's ideas in Brazil, this fact does not mean that SUDENE, in its Masters Plan, had understood and, more importantly, applied his development pole theory correctly. According to Richardson and Richardson (1975, p.174):

“although Brazil has had a long experience with regional policies, particularly with the ambitious SUDENE programme for the Northeast, its programmes have been too diffuse to be described as a growth [development] pole approach.”

The National Housing Bank (BNH) also illustrates very well the influence of Perroux's ideas in Brazil. This Bank was created in 1964 and one of its objectives, clearly stated in its report for the 1969 period, was the *“creation of development poles and a consequent improvement of living condition in rural*

3 CNG - National Council for Geography (Conselho Nacional de Geografia).

4 BNH - National Housing Bank (Banco Nacional de Habitação).

5 SUDENE - Superintendency for Development of the Northeast (Superintendência para o Desenvolvimento do Nordeste).

areas” (quoted by BOLAFFI, 1982, p. 51). In addition, famous economists, such as Celso Furtado and Roberto Campos, and other professionals were familiarised with Perroux's concept. For instance, Roberto Campos (1962, p. 27) stressed that “*a controversy, which only occurs when economic development programmes are formulated, is between the supporters of “integrated development” and those who support the selection of “growing points”*” (as seen above, this term, coined by Hirschman, is synonymous with “growth poles”). Furtado in his book *Teoria e Política do Desenvolvimento Econômico* discussed the main ideas of Myrdal (spread and backwash effects), Hirschman (backward and forward linkages), Rosenstein-Rodan (Big Push) and also Perroux (growth poles). In relation to Perroux's theory, Furtado (1967, p. 278) stressed that “*as the starting point for the formulation of a development strategy for underdeveloped countries, the idea of poles shows clearly the importance of the connection of [development] projects and this gets closer to the doctrine of balanced development.*”

Perroux's theory was also discussed by other professional in several articles. In this regard, Tolosa and Reiner (1972, p. 75-76) stressed that “*our conceptualisation of planned poles as public instruments for achieving national goals of regional development implies a policy of urban development co-ordinated at national level (by a central planning agency) and implemented at regional level (by a regional planning agency).*” In another article, Tolosa (1974, p. 214) emphasised that “*growth poles may emerge as a result of the performance of market forces or may service as an instrument of governmental economic policy in order to achieve a set of national goals of regional development.*” The geographer Milton Santos (1974, p. 274) points out that “*the application of the growth pole theory in underdeveloped countries raises the problem of knowing if the space can be indifferently defined in developed countries and in underdeveloped countries. The majority of those who dedicate to the analysis and planning of the space behave as if theories elaborated in developed countries and directed to their realities could be transplanted to underdeveloped countries.*”

Nevertheless, the most important point is that Perroux's theory had been accepted by most Brazilian professionals involved with regional inequality problems, who would apply the concepts to national plans, such as the

PND I,⁶ PND II, etc., as well as to regional plans, such as those elaborated by SUDAM,⁷ especially PDA II. (SUDAM, 1976c) The fact that there were some misunderstandings in relation to Perroux's theory is no novelty, because Perroux himself, as was seen above, generated this sort of confusion and Brazil was no exception to the rule. Another substantial point is that these misunderstandings verified in SUDENE's plans do not mean that they have constantly appeared in other Brazilian plans.

It is important to recapitulate some chief points in relation to spatial aspects of the national development plans in order to understand and also verify the extent of Perroux's ideas. Regional disparities were a constant and serious preoccupation of several Brazilian governments, which formulated a number of national development plans in order to tackle these problems. In fact, these policies were intensified when Brazil had already created one of the most advanced and diversified industrial structures amongst developing countries, after the consolidation of the import-substitution process at the beginning of the 1960s. However, this industrial structure was practically limited to the Southeast region, principally to the two Brazilian states Rio de Janeiro and São Paulo. The military regime established in 1964 emphasised these inequalities between Brazilian regions and also the unequal relations existing between production structures. Each military government tackled these problems in a different way, but each of them had some common characteristics, which can be exemplified by the fact that their spatial development policies were uniform in certain respects, such as centralised decisions at Federal government level, adoption of a polarised development model from the expansion of economic activities in industrial areas, etc.

During the military regime, spatial planning was considered a cornerstone in the development process. The policy instruments adopted by these governments varied from the isolated use of fiscal incentives in order to

6 PND I - The First National Development Plan (Primeiro Plano Nacional de Desenvolvimento).

7 SUDAM - Superintendency for Development of Amazonia (Superintendência para o Desenvolvimento da Amazônia).

attract private investments for areas lagging behind to more integrated development programmes to exploit natural resources in vital areas of Amazonia.

With respect to Perroux's theory, the national development plans after the Decennial Plan, which was formulated for the 1967-78 period, adopted the terminologies of the French economist. In this regard, the Decennial Plan, although it had not passed the stage of being only on paper, established in its second chapter the basis for the formulation of a national policy of urban development through the characterisation and study of "programme regions" (it must be mentioned here that this concept was created by Boudeville in order to make Perroux's theory more operational) and also through the definition of development poles. In parallel, some studies based on professor Rochefort's methodology were undertaken with the purpose of establishing a hierarchy of the urban net and there were three levels of development poles: development poles of national interest, poles of interest of micro-regional development and poles of equilibrium (LOEB, 1987); the PED⁸ (1968-70) referred to the creation of regional poles (HADDAD, 1981); the PND I (1972-74) mentioned the creation of development poles:

"the economic occupation and the development process will be effected through: 1) occupation, basically by means of: (...); 2) development programmes, based especially upon fiscal incentives and exemptions administered by SUDAM and SUFRAMA, along the following lines: selection of development and integration poles (priority areas and border zones) to achieve regional priorities, via the concentration of investments; (...)." (BRAZIL, 1971, p. 29)

The Second National Development Plan - PND II (1975-79) suggested the creation of growth (development) poles, which were called agro-mine-

8 PED The Strategic Development Plan (Plano Estratégico de Desenvolvimento).

ral growth (development) poles (BRAZIL, 1974). In addition, the PDA II⁹ also mentioned the establishment of development poles:

“the spatial strategy of the Federal government will be completed with a special project, which is being planned by SUDAM and was included in the Second National Development Plan (PND II), concerning to the establishment of development poles in the region [Amazonia].” (SUDAM, 1976a, p. 46)

This evidence clearly shows the popularity of Perroux's ideas among Brazilian professionals involved with regional inequality problems. However, this acceptance of his ideas does not mean that they were strictly implemented, because it is hard to find any example of a development pole policy that was vigorously implemented in practice and most of these Brazilian national plans cannot be described as examples of development pole approach. Nevertheless, the PND II can be considered the one exception because its main policy instrument was the development pole strategy and moreover, the directives established in this plan were in fact implemented by the Brazilian government.

Before discussing development strategies adopted by the PND II in the next section, it is important to stress that one of the principal objectives stated in this national development plan was to consolidate Brazil as a modern industrial economy and in order to achieve this objective it was necessary to incorporate the vast “empty spaces” into the market economy. Thus, national integration was an essential part of the geopolitical objectives of the Federal government for modernising the country. Although there were several criticisms of modernisation theories, modernisation remained a prevalent strategy in a number of development plans, and in Brazil the development model adopted by the Brazilian government was intrinsically

9 PDA II - The Second Development Plan for Amazonia (Segundo Plano de Desenvolvimento da Amazônia).

associated with the precepts of modernisation theory and also with the development pole theory, the latter being used as a regional planning strategy.

Although the economic modernisation theories and development pole theory have divergence of perspective and analysis, there are some parallels between them. Modernisation theories understood development as an economic problem, being economic growth a suitable measure for it. In fact, economic growth was practically synonymous with development. In this regard, growth meant the reduction in inequalities (both within and between countries), unemployment levels, and poverty. Such development would occur because the essential technologies were already available.

After this generalisation, it is important to highlight some basic points of modernisation theories, which were impregnated with a profound dualism (traditional-modern) and ethnocentricity. First of all, industrialisation was considered the key element for achieving economic development, which would transform the stagnant economy of backward countries and regions into a modern and dynamic capitalist economy that would provide, in the long term, an increase in income levels. However, the main question was the way in which underdeveloped countries could best achieve the economic prosperity and social development of advanced industrial economies. In this regard, an essential element was the entrepreneurial class, which should be psychologically and technically prepared for introducing new production functions into the economy, and at the same time they had a high propensity to save and invest out of their profit income. It is interesting to note that this emphasis on the key role played by entrepreneurship in economic development was based on Schumpeter's idea. Allied to the role played by the entrepreneurial class was the capacity of developing countries to absorb modern technologies. Another significant point was related to the labour force. There was an acceptance of the existence of unemployment and underemployment, especially in the agriculture sector, in developing countries and as a consequence, the mobilisation of this labour force into more productive activities was considered an essential part of economic development.

The most influential modernisation theorist was Rostow (1960), whose preoccupation with the process of economic growth led him to develop a mechanism that catapulted a backward economy into take-off. The propulsive mechanism was supplied by the leading sectors (could be one or more), but all sectors remain in a continual change as production functions, modern technologies become available, and new linkages reach out into the economy. The leading sectors were a key element in Rostow's work because the vital energies were accumulated there, although they derived from different sources, such as: new inventions or the absorption of available technology; the emergence of an entrepreneurial class who invested in and exploited the market possibilities; a productive agriculture; etc. It is interesting to note here that there are some similarities between Rostow's "leading sector" and Perroux's "propulsive industry", which were concepts used for describing the dynamic of industrialisation.

In relation to the development pole theory, it is important to note that Perroux was influenced by Schumpeter's ideas, especially his innovation concept. In fact, Perroux believed that entrepreneurial innovation was primarily responsible for the development process in which the propulsive industries played a key role because they were highly innovative and according to him, innovation or technological progress was the pillar of economic development. Second, industrialisation was an important aspect of economic development. Third, the most important objective was to generate the spread effects, such as the increase in income and employment and at the same time produce structural change through economic growth. Obviously, the implementation of development poles was the essential vehicle for achieving these objectives.

Summarising, the basic idea that permeated these theories and the development model itself adopted by the Brazilian government was that the necessity of having an accelerated economic growth, principally in terms of GDP, in order to favour the poorest stratum of society, which meant that the social development was a consequence of economic growth. In other words, problems such as poverty and underemployment were regarded as temporary obstacles, which would be overcome through the beneficial spread effects generated from dynamic centres, generally richer

areas, to the periphery, generally backward regions, leading in the long run to a more egalitarian and principally prosperous society.

THE AMAZON REGION

As was seen above, few countries adopted Perroux's ideas to the extent that Brazil did and his influence can be attested by various national development plans that adopted his concepts. Although most of these plans implemented his theory partially or in different ways, the PND II was the only Brazilian plan whose spatial planning approach was based on Perroux's development pole theory and was strictly implemented according to the directives previously established. Thus, this national plan is an excellent example for analysing the beneficial spread effects generated by development poles to their surrounding hinterland areas.

The main objectives of the PND II were economic. Thus, in order to maintain the accelerated growth rates of the "miracle years" (1968-73), to contain inflation and to keep the balance of payments in relative equilibrium industrial, agricultural, urban and geopolitical strategies were designed. The industrial strategy was based on a "new phase" of import-substitution, whose emphasis was on basic sectors, especially in chemical and metallurgical industries. With respect to agricultural strategy, it was hoped that Brazil would become a world supplier of food, agricultural raw materials and industrialised agricultural products principally because of the vast "empty spaces" at its disposal. The Federal government encouraged diversification and regional specialisation of agriculture with the purpose of taking advantage of the productive potential of each region.

One of the most important objectives of the Federal government was national integration, which was related to geopolitical and economic preoccupations. In fact, the occupation of "empty spaces", especially in Amazonia and the Centre-west, had implications of security and sovereignty for the military regime. At the same time, the incorporation of these vast

spaces into the market economy was fundamental for the PND II economic strategy, in which decentralisation of economic activity was a key factor.

The Federal government hoped that these new areas would contribute substantially to the growth of GDP, especially through a number of projects (agricultural, mining, livestock, forestry, etc.) to be implemented, and at the same time, considered the best way of integrating and occupying the regions was by means of the highways system, which was already constructed to a large extent (Trans-Amazon highway, BR-230 and the *Cuiabá-Santarém* highway, BR-165). The foremost point in the national integration strategy was the “integrated areas” concept, which made concentrated efforts of the Federal government and the private sector possible, and moreover allowed external savings and scale and agglomeration economies to be taken advantage of. The objective was to create blocks of integrated investments in these areas (which was development poles) which would, it was hoped, permit the adoption of clear priorities and the physical control of the results by selected areas. Several programmes were based on this concept, such as: POLAMAZONIA,¹⁰ the Programme for Integrated Areas in the Northeast, the Special Programme for the Development of the Pantanal and the Special Programme for the Development of the Geoeconomic Region of Brasília. It is important to stress here that colonisation and agricultural enterprises were important elements of national integration strategy.

The strategy of economic occupation of Amazonia (and also the Centrewest) was based on (Brazil, 1974; CDE, 1974):

- Utilisation of the natural axes of penetration for Amazonia and the Centre-west and principally of the important influxes of people which occurred: the first started in the state of Paraná and the state of São Paulo, passed through the state of Mato Grosso and continued to

10 POLAMAZONIA - The Programme of Agro-Livestock and Agro-Mineral Poles for Amazonia (Programa de Pólos Agropecuários e Agrominerais da Amazônia).

Rondônia; the second started in the same area, ran toward the North of the state of Goiás and southern Pará; and the third started in the Northeast, passed through the state of Piauí and the state of Maranhão and continued to the Central Plateau or the South of Pará;

- Promotion by the government of the occupation of the most fertile land of selected areas (and therefore geographically separated), and of the development of comparative advantages;
- The orientation of export activities, associated with export corridors, aiming at clear comparative advantages and dynamic sectors of the international market (beef, mineral deposits, lumber, cellulose). Export activities were expected to grow at a rate of 25% annually.

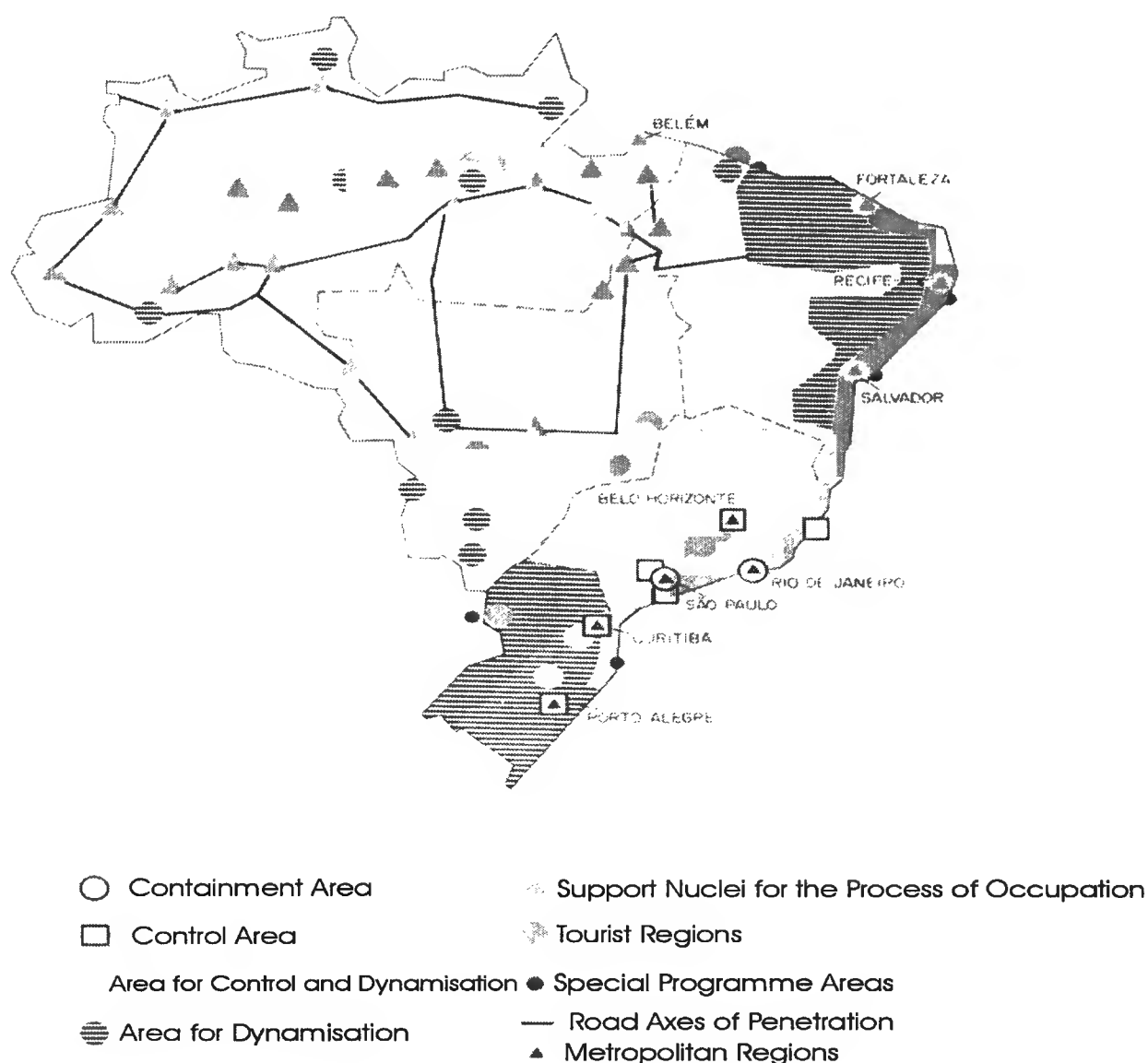
According to these guidelines, the PND II established the following points in order to occupy Amazonia productively: the creation of the POLAMAZONIA, which comprised fifteen development poles and whose investments were estimated at Cr\$ 4 billion (equivalent to US\$ 2.121.001.472,648¹¹ in 2001); the setting up of the mineral-metallurgical complex of Eastern Amazonia, which embraced the integrated Carajás - Itaquí scheme (iron-ore mining and steel mills), the bauxite-aluminium complex (Trombetas - Belém) and a large number of other undertakings associated with exploiting the hydroelectric potential of the Araguaia - Tocantins region (São Félix and Tucuruí); lumber exploitation in a planned way; and conclusion of the industrial district of the Free Zone of Manaus and the establishment of its agricultural district.

In connection with all these points above, there was a policy of urbanisation (see Figure 1) that served as a basis for both national development and the occupation strategy advocated by the PND II. The main points of the urban development strategy were: the implementation of nine metropolitan regions that were already created: São Paulo, Rio de Janeiro, Belo Horizonte, Fortaleza, Porto Alegre, Recife, Salvador, Curitiba and Belém; the

11 This number was computed by means of the inflation calculator of the Bureau of Labor Statistics.

identification of the functions that were to be performed by the national metropolitan centres and also by the regional metropolitan centres, especially in areas of greatest demographic and economic concentration; and decentralisation, through the definition of medium-sized centres (poles), on national and regional scale. The principal objective was to take advantage of the existing agglomerations in economic, social and political terms. With respect to Amazonia, the setting up of urban poles was fundamental for the occupation of the region.

FIGURE 1 - NATIONAL URBAN DEVELOPMENT POLICY



Source: Brazil (1974).

The urban development strategy for Amazonia and the Centre-west was based on: the development of the cities of Manaus and Santarém and also

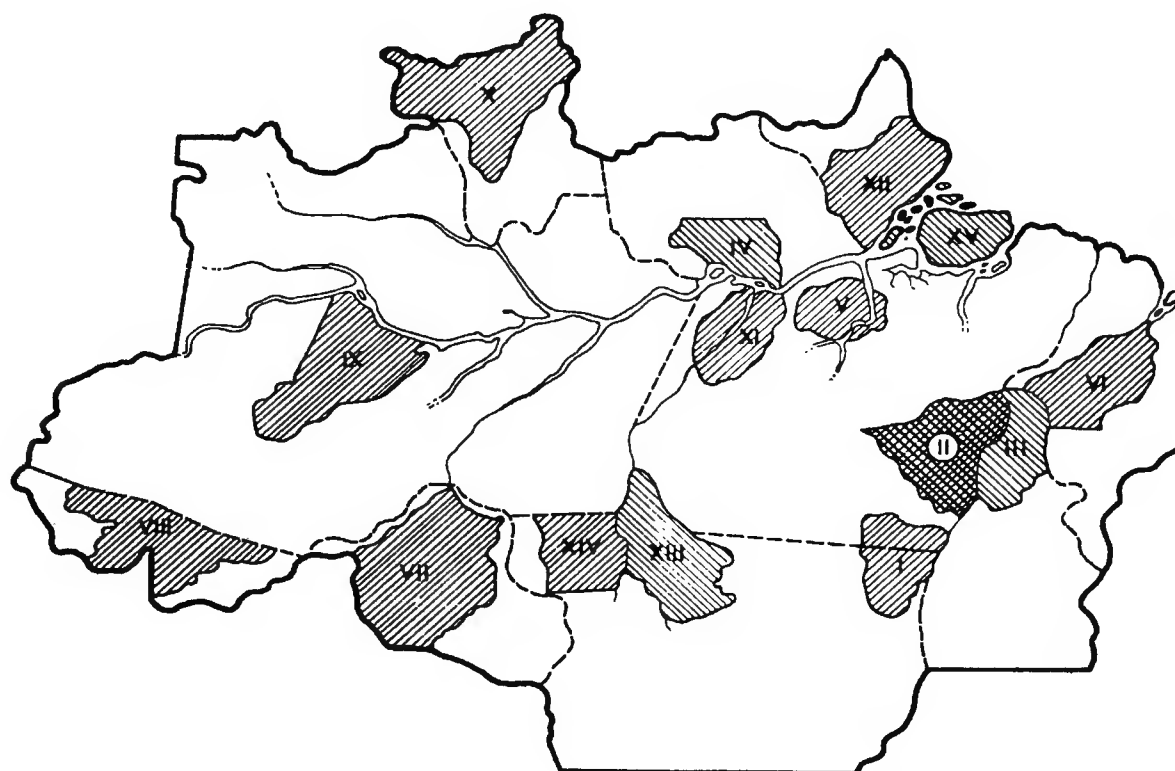
of the metropolitan region of Belém. The aim was to complement their urban infrastructure and support their productive secondary and tertiary activities; the implementation of the development guidelines for the geoeconomic region of Brasília, especially the occupation along the road axes which led to the Brazilian capital (principally the Brasília-Anápolis-Goiânia axis); the development of the following cities: Cuiabá, Campo Grande, Corumbá, Dourados, Macapá, Boa Vista and Rio Branco; and the establishment of selected urban poles along the main highways (the Trans-Amazon, the Cuiabá- Santarém, the Belém- Brasília, etc.) and also in the hinterlands. The objective was to occupy and to promote the agricultural and agro-industrial development of the region. It is important to stress here that all these strategies were intrinsically connected with urban development strategy based on Perroux's theory and served as a basis for the national development and occupation strategy advocated in the PND II. Urban poles identified as centres of regional development would be strengthened by productive activities and investments in infrastructure and social apparatus. It was hoped that these poles would contain migration and support industrial activities.

The spatial development strategy of the PND II was formalised in the POLAMAZONIA programme (see Figure 2), which was set up by Decree-Law n° 74,607 on September 25, 1974. This programme aimed to establish fifteen development poles in selected areas throughout "Legal Amazonia" according to their potentialities, which were: mineral, forestry, agro-livestock and agro-industrial. In this regard, infrastructure, capital subsidies, taxation and other countless similar incentives were provided by the Federal government in order to accelerate economic growth and also create the necessary conditions for these poles to generate the hoped-for spread effects to their peripheral areas. The selected development poles were: Xingu-Araguaia; Carajás; Araguaia-Tocantins; Trombetas; Altamira; Pré-Amazônia Maranhense; Rondônia; Acre; Juruá-Solimões; Roraima; Tapajós; Amapá; Juruena; Aripuanã; and Marajó.

Carajás, pole 2, was a priority area under the POLAMAZONIA programme because of its huge iron-ore deposits (estimated at 18 billion tons) principally in the valleys between the Xingu and the Tocantins rivers and

the Carajás mountain chain. In order to exploit these vast deposits, mining was programmed to start in 1978/79 and the feasibility studies recommended that the ore should be carried by rail from the mine to the port of Itaqui, which was located 940 kilometres away from the Carajás mine and close to São Luís, the capital of the State of Maranhão. The Carajás pole also had reserves of manganese, cassiterite, diamond and tin and a survey was started to determine how best to use the natural resources of the region. Moreover, to the west of the iron-ore deposits there was land with a high potential for agro-livestock and also forestry resources, both of which were to be exploited by private enterprises. In fact, agro-livestock, and especially mineral undertakings, were the main activities of this pole and it is interesting to note that six years before the PGC had been established, the potential and strategic importance of iron-ore, manganese, bauxite and other mineral deposits in eastern Amazonia was completely understood and stated.

FIGURE 2 - DEVELOPMENT POLES SELECTED BY POLAMAZONIA



I) Xingu-Araguaia; II) Carajás; III) Araguaia-Tocantins; IV) Trombetas; V) Altamira; VI) Pré-Amazônia Maranhense; VII) Rondônia; VIII) Acre; IX) Juruá-Solimões; X) Roraima; XI) Tapajós; XII) Amapá; XIII) Juruena; XIV) Aripuanã; and XV) Marajó.

Source: SUDAM (1976b).

According to POLAMAZONIA, the actions of the Federal government, of the State governments, and also of private initiative would be coordinated in these fifteen development poles and the plans for the development of each pole would be part of an integrated development plan. Obviously, the specific objective of massive investments in infrastructure allied to countless types of fiscal incentives provided by the Brazilian government was to attract private industries and consequently to set in motion a dynamic process of economic growth, but in addition to this objective there was a general one: to occupy "the empty spaces". (SUDAM, 1976a; 1976b)

With the coming to power of the Figueiredo government, the development of Eastern Amazonia gained a new impetus and as a consequence the POLAMAZONIA programme was maintained, the PGC was set up and infinite additional incentives were created in order to accelerate economic growth, solve the foreign debt problem and also consolidate geopolitical objectives, such as the occupation of empty spaces, which had been established by previous military governments. However, it is important to highlight here that with the advent of PGC in 1980, seven development poles were established along the Carajás railway corridor at Parauapebas, Marabá, Açailândia, Buriticupu, Santa Inês, Rosário and São Luís. The logic was the same as for previous development poles: the stimulus to mineral, agro-livestock, lumbering and infrastructural undertakings would attract industrial and agribusiness ventures, and would thereby accelerate the development of the region.

Although massive investments of regional infrastructure have contributed to reducing the isolation between distant regions of the country and have shown alternatives for investment and for extraction of the economic surplus, they have also accelerated spatial occupation, which has resulted in predatory exploitation of natural resources, and has aggravated social disparities, reproducing and intensifying situations of poverty which occur in other Brazilian regions.

Brazilian development policies, based on Perroux's development pole theory, have been responsible for generating negative social and environmental

impacts in urban and rural areas. In relation to impacts on urban development, it is clear that towns and cities in Amazonia, principally its Eastern part, have benefited, to some extent, from industrial undertakings implemented in this region. For instance, the Carajás railway has transported a considerable number of passengers and has carried large quantities of products, varying from pig-iron to food. For instance, the number of persons transported by the Carajás railway increased from 571,000 in 1990 to 836,000 in 1995. (MAYRINK, 1996) Moreover, the road and sanitation infrastructure was improved and schools and hospitals were constructed in several towns and cities, which previously lacked such facilities. The indirect employment and income effects produced by industrial activities have partly contributed to the development of local economies.

Industrial projects, such as the Carajás project,¹² associated with other public interventions in Eastern Amazonia have attracted, directly or indirectly, a substantial flow of migrants, which has aggravated the already insufficient infrastructure and service-provision capabilities of local urban nuclei. Municipal governments have endeavoured to tackle a number of problems, with very limited assistance from the CVRD, of the towns and cities along the Carajás corridor, improving some facilities, but these attempts have been totally inadequate. In fact, the local authorities have been unable to meet the growing needs, and some political changes, such as dismemberment of districts, have exacerbated this situation.

12 The Carajás Iron-Ore Project was the centrepiece of the PGC programme and comprises the mine, the railway, a deep-water port and also the town sites. The iron-ore mine is located at the Serra dos Carajás and its eighteen billion tonnes of high-grade iron-ore are the largest reserves in the world. In addition to the iron-ore, the Serra dos Carajás also contains other minerals such as: manganese (sixty five million tonnes, which is the second largest manganese reserve in Brazil), copper, nickel, chrome, cassiterite, tungsten and gold. The port of Ponta da Madeira was built in the São Marcos Bay, which is located nine kilometres southwest of the island of São Luís. The Carajás railway is a single track, has a total length of 890 kilometres, and connects the mine site in Carajás to the Ponta da Madeira terminal in São Luís. It was designed with the purpose of transporting the high grade iron-ore economically. An important component of the Carajás Project is the company town - CVRD - built for approximately 6,000 inhabitants and which has a relatively advanced infrastructure. Strongly contrasting with the Carajás town, which was well planned and equipped with modern facilities, the nearby town of Parauapebas was planned to accommodate a population of up to 10,000 by 1988, including principally CVRD contract service workers.

All cities and towns along the Carajás corridor have problems of infrastructural deficiency. Water supplies are commonly untreated, sewage and trash collection and storm drainage systems are usually restricted to higher income neighbourhoods, while sewage treatment and adequate solid waste disposal are scarce. The inadequacy of urban services and facilities directly affects the health and education sectors. The impacts on the health sector are aggravated by widespread urban poverty, which is caused by the intense flood of migrants attracted to the region in search of economic opportunities. In general, the towns and cities in the Carajás region present high incidences of a number of diseases, which vary from malaria to sexually transmitted diseases, and also high indices of infant and foetal mortality. (COELHO, 1991; WORLD BANK, 1992) With regard to the education sector, schools are frequently lacking or greatly overcrowded in most of the region and these problems connected with the need to supplement family incomes contribute to making the situation more problematic. (IDESP, 1990)

Manifold impacts have been generated in Amazonia, principally its Eastern part, by industrial projects (and the Carajás project is an excellent example) and one of them is related to urban displacement and involuntary resettlement. In fact, industrial activities have affected small communities by displacing their populations without any type of compensation. The villages were demolished and the only alternative for most of displaced people was to live in squatter settlements. There are several examples of displacement caused by these projects, such as the ALUMAR plant, which displaced 20,000 small farmers and fishermen; the Tucuruí dam and reservoir, which displaced approximately 35,000 people and demolished six small towns; and CVRD which expropriated families from small villages, such as Santo Antônio, Boqueirão, Itaqui, etc., to “Morro Pelado” in order to construct its rail and port facilities. (HALL, 1991; WORLD BANK, 1992).

Brazilian development policies, principally for Eastern Amazonia, adopted a clear *latifúndio*-based model, which favoured large landowners with generous subsidies to the detriment of the vast majority of small farmers. In this regard, these policies have directly affected the rural sector, which

have undergone many and interconnected impacts, namely land conflicts, land concentration, rural violence, and food insecurity. The implementation of both the PGC and the Carajás project, by increasing land values in Eastern Amazonia, exacerbated land concentration and rural violence, and moreover, stimulated a considerable flow of migrants into the region.

Amazonia development policies were responsible for excluding a large part of the peasant population from access to land. However, the persistence of rural violence in Brazil is intrinsically related to the police and the judiciary, whose local and state structures are slow and corrupt. In addition, the Federal government, which is also responsible for formulating and implementing these policies, could use its powers to ensure that the law is better enforced instead of being negligent and even conniving with this situation. The confrontation between the police of the state of Pará and approximately 1500 landless workers at Eldorado do Carajás in April 1996 not only illustrates the whole problem, but also indicates that rural violence is far from coming to an end in Brazil. These landless occupied the highway PA-150 with the clear purpose of protesting against the Federal government, which had postponed the resettlement of their families, and the governor of the state of Pará's immediate reaction was to send in the military police to expel them rapidly. As a result, nineteen landless workers were killed while fifty-one were seriously wounded. (BERGAMO & CAMAROTTI, 1996)

Rural violence also embraces the indigenous question insofar as Indian people have been directly affected by development policies implemented by the Federal government. In fact, Indian lands have been correct because of their valuable natural resources and the pressure from mining companies became more intense with Decree N° 88,895 of 1983 which legitimised mechanised mineral extraction on all Indian lands, CVRD being one of the companies that has made many applications to prospect in tribal territories. These policies associated with the authorities' slowness in assuring land demarcation and assistance to the indigenous population have been responsible for a number of violations, such as invasions by

agricultural, mining and lumbering enterprises, assassinations, death threats and outbreaks of disease, in tribal territories under PGC's area of influence.¹³

Intrinsically connected to rural violence is the problem of land concentration and speculation, problems which have been severely aggravated by development policies. Although polarisation of land ownership in the region had already reached an advanced stage before 1980, the implementation of the PGC, including the Carajás project, exacerbated this process through generous subsidies provided to large farmers and also through the indirect stimulus given by development poles and land values. These factors made Eastern Amazonia an area extremely attractive for purely speculative investment in land during a period of high inflation. In this regard, the World Bank (1992) pointed out that following the creation the municipality of Parauapebas (the town of Parauapebas was one of the PGC's seven development poles) in late 1988, rural property values in some areas rose by nearly 3000%. Another important impact caused by development policies is on food security, which directly affects the nutritional levels of the population in the region. The reasons for the impact on food security lie in a number of factors, such as: great stimulus given by the Federal government to livestock, lumbering and the production of cash crops for export instead of food staples; the total control over agricultural lands of largely unproductive properties; the increase in landless small farmers due to the process of expulsion from land allied to the impediment to access to new lands; and the rise in temporary wage labour on larger rural properties. Food insecurity is a common phenomenon in Eastern Amazonia, whose urban areas, from the state capitals to towns along the Carajás corridor, have problems in maintaining supplies of food stuffs, which have to be imported from the Centre-South.

With regard to environmental impacts, it is important to bear in mind the fact that the forest cover of Amazonia remained practically untouched until the military coup. Amazonian development policies stimulated a number

13 In relation to adverse impacts generated by development projects on Indian tribes, see ALMEIDA (1994); FERRAZ & LADEIRA (1991); MAGALHÃES (1991).

of undertakings, such as the construction of highways and secondary roads; cattle-ranching; lumbering; official and “spontaneous” colonisation; mining together with associated infrastructural projects (rail and port facilities and hydroelectric power); and pig iron smelters. All these initiatives are interconnected and have contributed to worsening deforestation and environmental degradation in Eastern Amazonia. Alterations in soil and water quality are associated with rapid deforestation. In relation to soils, clearing the forest for pasture on crops results in erosion, leaching, loss of fertility, and an increase in soil densities by means of compaction, principally when land is used for grazing or heavy machinery is utilised in connection with agricultural activity. In relation to water quality, its contamination is the result of a number of factors, such as: soil erosion, the use of herbicides and fertilisers, increasing urbanisation, and mineral activities. Mercury pollution as a result of gold prospecting is a serious problem in the Carajás region.

Despite the importance of both the POLAMAZONIA and the PGC programme, one basic question remains: why did the Federal government adopt the development pole theory? In order to answer this question, it is important to recapitulate the chief points mentioned beforehand. On the one hand, Perroux's theory had a very strong appeal because its underlying ideas suggested that economic growth, interregional equilibrium and integration of backward regions could be achieved through a strategy of decentralised development. On the other hand, the military regime was acutely aware of the sharp regional inequalities in Brazil and this problem was introduced in its geopolitical and economic objectives.

Becker and Egler stressed that:

“the ideology of development poles showed itself to be the most adequate model for territorial organisation proposed by the authoritarian state, since it involved the creation of privileged locations, from the perspective of capitalist accumulation, capable of interlinking the national and international circuits of financial and mercantile flows.” (1992, p. 100)

Unquestionably, the main focus of the Federal government was economic, but at the same time the implementation of development poles associated with infrastructural undertakings, which meant the completion of the axes of penetration (see Figure 1 above) and principally the construction of a network of vicinal roads, were essential for the strategic occupation and also for the integration of Amazonia. In addition to the geopolitical and economic objectives, the Brazilian government hoped that development poles would act like efficient counter-magnets to the large and congested metropolitan areas by attracting populations in search of employment. Thus, the military government saw the development pole theory as a convenient theoretical tool which served to justify its distinct objectives.

CONCLUDING REMARKS

The concept of development pole, which was elaborated in order to describe and explain the process of economic development, was based on the following argument: the propulsive effects intrinsic to a development process tended to be generated by a cluster of economic activities and also tended to engender the broader economic growth. Owing to its perceived potential, this concept attracted the attention of many professionals involved with problems of regional development. However, Perroux's concept was conceived in an economic space, which was too abstract and non-operational to be applied as a basis for planning. Boudeville, who was Perroux's disciple, was the main responsible for transforming this concept into an operational tool for regional planning and this fact was essential for its widespread use in several countries.

According to the theory, development poles could be induced and the logic was that these induced poles would act such as efficient counter-magnets to the large and congested metropolitan areas; would produce scale and agglomeration economies; and would generate beneficial spread effects to their immediate hinterlands, so that in the long-term an "equilibrium growth" throughout a country would be expected. In addition, the accelerated economic and population growth would be encouraged by

government policies in relation to infrastructure and several types of incentives.

These ideas advocated by development pole theory fitted in well with the specific geopolitical (national integration and occupation of Amazonia) and economic objectives of the military regime. In this regard, the POLAMAZONIA programme was established and massive investments were channelled into infrastructure undertakings, capital subsidies, taxation and thousands of other incentives with the clear purpose of producing structural changes through accelerated economic growth.

In pushing forward with a development strategy that was associated with the development pole theory and also with the basic precepts of economic modernisation theory, the military government opted for a policy which would be responsible for negative social and environmental impacts.

BIBLIOGRAPHY

- ALMEIDA, A. W. B. de. *Carajás: a guerra dos mapas*. Belém: Falangola, 1994.
- ANDRADE, M.; CORRÊA, C. M. Mataram a pobreza: condições de vida de famílias de trabalhadores rurais expropriadas pela Companhia Vale do Rio Doce e assentadas no "Morro Pelado", em São Luís, Maranhão. *Pará Desenvolvimento*, n. 20-21, 1986/87.
- ANDRADE, Manuel. C. de. *Espaço, polarização e desenvolvimento*. São Paulo: Editorial Grijalbo, 1977.
- BECKER, Berta. K.; EGLER, Cláudio. A. G. *Brazil: a new regional power in the world economy*. Cambridge: Cambridge University Press, 1992.
- BOLAFFI, G. Habitação e urbanismo: o problema e o falso problema. In: MARICATO, E. (ed.), *A produção capitalista da casa (e da cidade) no Brasil industrial*. São Paulo: Alfa-Omega, 1982.
- BOUDEVILLE, Jacques R. *Contribution à l'étude des pôles de croissance brésiliens: une industrie motrice - la siderurgie du Minas Gerais*. Cahiers de l'I.S.E.A., Série F, n° 10, 1957.
- _____. *Problems of regional economic planning*. Edinburgh: Edinburgh University Press, 1966.

- _____. *L'espace et les pôles de croissance*. Paris: Presses Universitaires de France, 1968.
- BRAZIL, REPÚBLICA FEDERATIVA DO. *I Plano Nacional de Desenvolvimento (1970-74)*. Rio de Janeiro: IBGE, 1971.
- _____. *II Plano Nacional de Desenvolvimento (1975-79)*. Rio de Janeiro: IBGE, 1974.
- CAMPOS, Roberto de O. *Planejamento do desenvolvimento econômico de países subdesenvolvidos*. Rio de Janeiro: Fundação Getúlio Vargas, 1962.
- CDE - CONSELHO DE DESENVOLVIMENTO ECONÔMICO. *Polamazônia: Programa de Pólos Agropecuários e Agrominerais da Amazônia*. Brasília: CDE, 1974.
- COELHO, Maria Célia N. *Socio-economic impacts of the Carajas railroad in Maranhão, Brazil*. 1991. Ph.D. Thesis, Syracuse University.
- CORAGGIO, José. L. Polarization, development, and integration. In: KUKLINSKI, A. (ed.), *Regional development planning: international perspectives*. The Netherlands: Sijthoff-Leyden, 1974.
- DARWENT, D. F. Growth poles and growth centers in regional planning: a review. In: FRIEDMANN, J.; ALONSO, W. (eds.), *Regional policy: readings in theory and applications*. Cambridge, Massachusetts: MIT Press, 1975.
- FERRAZ, I.; LADEIRA, M. E. Os povos indígenas da amazônia oriental e o programa Grande Carajás: avaliação e perspectivas. In: HÉBETTE, J. (org.), *O cerco está se fechando*. Petrópolis, Rio de Janeiro: Vozes, 1991.
- FRIEDMANN, J.; WEAVER, C. *Territory and function: the evolution of regional planning*. London: Edward Arnold, 1979.
- FURTADO, C. *Teoria e política do desenvolvimento econômico*. São Paulo: Companhia Editora Nacional, 1967.
- GISTELINCK, F. *Carajás, usinas e favelas*. São Luís, 1988.
- HADDAD, Paulo R. Brazil: economic efficiency and the disintegration of peripheral regions. In: STÖHR, W. B. and TAYLOR, D. R. F. (eds.), *Development from above or below? The dialects of regional planning in developing countries*. London: John Wiley & Sons, 1981, p. 379-400.
- HALL, Anthony L. Agrarian crisis in Brazilian Amazonia: the grande Carajás Programme. *Journal of Development Studies*, v. XXIII, n. 4, July, 1987, p. 522-52.
- _____. *Developing amazonia: deforestation and social conflict in Brazil's Carajas programme*. Manchester: Manchester University Press, 1991.
- HANSEN, N. M. Development pole theory in a regional context. *Kyklos*, v. XX, 1967.

- _____. *French regional planning*. Edinburgh: Edinburgh University Press, 1968.
- _____. Development from above: the centre-down development paradigm. In: STÖHR, W. B.; TAYLOR, D. R. F. (eds.), *Development from above or below? The dialectics of regional planning in developing countries*. London: John Wiley, 1981.
- HERMANSEN, T. Development poles and development centres in national and regional development. In: KUKLINSKI, A. (ed.), *Growth poles and growth centres in regional planning*. Paris and The Hague: Mouton, 1972.
- HIGGINS, B. François Perroux. In: HIGGINS, B.; SAVOIE, D. J. (eds.), *Regional economic development: essays in honour of François Perroux*. London: Unwin Hyman, 1988.
- IDESP (Instituto de Desenvolvimento Econômico-Social do Pará). *Municípios paraenses: Parauapebas*. Belém: IDESP, 1990.
- KUKLINSKI, A. Regional development, regional policies, and regional planning. In: KUKLINSKI, A. (ed.), *Regional disaggregation of national policies and plans*. Paris and The Hague: Mouton, 1975.
- LOEB, R. Aspectos do planejamento territorial urbano no Brasil. In: LAFER, B. M. (ed.), *Planejamento no Brasil*. São Paulo: Editora Perspectiva, 1987.
- MAGALHÃES, A. C. As nações indígenas e os projetos econômicos do estado: a política de ocupação de espaço na amazônia. In: HÉBETTE, J. (org.), *O cerco está se fechando*. Petrópolis, Rio de Janeiro: Vozes, 1991.
- MARTINE, G.; TORRES, H. Criança, problemática sócio-ambiental e desenvolvimento na amazônia. *ISPN*, documento de trabalho n° 4.
- MAYRINCK, G. Apito na floresta: o maior trem do país leva gente do mar através da selva e civiliza uma terra carente. *Veja*, 14 de fevereiro, 1996.
- MIRAD (Ministério da Reforma Agrária e do Desenvolvimento). *Conflitos de terra*. Brasília: MIRAD/INCRA, 1987.
- PAELINCK, J. La théorie du développement régional polarisé. *Cahiers de l'ISEA*, Série L, n. 15, Mars 1965.
- PERROUX, F. Economic space: theory and applications. *Quarterly Journal of Economics*, 64, 1950.
- _____. Note sur la notion de pôle de croissance. *Economie Appliquée*. January-June 1955.

- _____. *L'economie du XX^e siècle*. Paris: Presses Universitaires de France, 1961.
- _____. Les investissements multinationaux et l'analyse des poles de développement et des poles d'intégration. *Revue Tiers-Monde*, tome IX, n. 34, Avril-Juin 1968.
- _____. The pole of development's new place in a general theory of economic activity. In: HIGGINS, B.; SAVOIE, D. J. (eds.), *Regional economic development: essays in honour of François Perroux*. London: Unwin Hyman, 1988a.
- _____. Peregrinations of an economist and the choice of his route. In: HIGGINS, B.; SAVOIE, D. J. (eds.), *Regional economic development: essays in honour of François Perroux*. London: Unwin Hyman, 1988b.
- POLENSKE, K. R. Growth pole theory and strategy reconsidered: domination, linkages, and distribution. In: HIGGINS, B.; SAVOIE, D. J. (eds.), *Regional economic development: essays in honour of François Perroux*. London: Unwin Hyman, 1988.
- RICHARDSON, H. W.; RICHARDSON, M. The relevance of growth center strategies to Latin America. *Economic Geography*, v. 51, n. 2, April 1965.
- ROSTOW, W. W. *The stages of economic growth: a non-Communist Manifesto*. Cambridge Cambridge University Press, 1960.
- SANTOS, M. Sous-développement et poles de croissance économique et sociale. *Revue Tiers-Monde*, tome XV, n. 58, Avril-Juin 1974.
- SEPLAN/PGC. *Plano diretor da estrada de ferro do corredor de Carajás*. Relatório síntese, dezembro, 1989.
- SUDAM. *II Plano Nacional de Desenvolvimento da Amazônia: detalhamento do II Plano Nacional de Desenvolvimento (1975-79)*. Belém: SUDAM, 1976a.
- _____. *POLAMAZÓNIA - Carajás*. Belém: SUDAM, 1976b.
- _____. *I Plano de Desenvolvimento da Amazônia, Nova República: 1986-89*. Belém: SUDAM, 1976c.
- TOLOSA, H.; REINER, T. A. Programação econômica de um sistema de pólos planejados. *Revista Brasileira de Economia*, v. 28, n. 2, abril/junho 1967.
- TOLOSA, H. Pólos de crescimento: teoria e política econômica. In: HADDAD, P. R. (ed.), *Planejamento regional: métodos e aplicação ao caso brasileiro*. Rio de Janeiro: IPEA/INPES, 1972.

WORLD BANK. *World Bank approaches to the environment in Brazil: a review of selected projects - The Carajás Iron Ore Project*. Washington D. C.: The World Bank, 1992.

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