

MEDIUM-SIZED CITIES AND THE EXPRESSIONS OF HIERARCHY-HETARARCHY IN THE BRAZILIAN URBAN SYSTEM

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Abstract

Amid the complex web of contemporary interurban relations, there is an urgent need for analytical perspectives that advance the understanding of spatial interactions beyond the traditional hierarchical pattern. To this end, the proposal of urban heterarchy contributes to a reading of the movement and the leap of scales in the urban network's structure within a context of strong spatial restructuring promoted by capitalism in the light of globalization. In this work, the roles and functions of medium-sized cities are favored, to recognize the expressions of urban heterarchy in the territory. Namely, the economic sectors through which these cities establish flows and interact with other urban centers at multiple spatial scales. To this end, the trade balance (exports and imports), air network, and shopping malls were selected as analytical dimensions, whose economic logic reveals the changes in the ongoing urban structuring.

Keywords: Medium-sized Cities, Urban Hierarchy-Hetararchy, Exports and Imports, Airports, Shopping Malls.

Resumo / Résumé

CIDADES MÉDIAS E AS EXPRESSÕES DA HIERARQUIA-HETERARQUIA NO SISTEMA URBANO BRASILEIRO

No bojo da complexa trama das relações interurbanas contemporâneas urge a necessidade de perspectivas analíticas que avancem na compreensão das interações espaciais para além do tradicional padrão hierárquico. Nesta direção, a proposta da heterarquia urbana contribui para uma leitura do movimento e do salto de escalas na estrutura da rede urbana em meio a um contexto de forte reestruturação espacial promovida pelo capitalismo à luz da globalização. Neste trabalho, privilegamos os papéis e funções das chamadas cidades médias, buscando reconhecer as expressões da heterarquia urbana no território, isto é, por meio de quais setores econômicos estas cidades estabelecem fluxos e interação com outros centros urbanos em múltiplas escalas espaciais. Para tanto, elegemos como dimensões analíticas a balança comercial (exportações e importações), a rede aeroviária e os shopping centers, cujas lógicas econômicas revelam as mudanças da estruturação urbana em curso.

Palavras-chave: Cidades Médias, Hierarquia-Hetararquia Urbana, Exportações e Importações, Aeroportos, Shopping Centers.

VILLES MOYENNES ET LES EXPRESSIONS DE LA HIÉRARCHIE-HÉTÉRARCHIE DANS LE SYSTÈME URBAIN BRÉSILIEN

Au milieu du tissu complexe des relations interurbaines contemporaines, le besoin de perspectives analytiques est nécessaire de toute urgence pour faire progresser la compréhension des interactions spatiales au-delà du modèle hiérarchique traditionnel. En ce sens, la proposition d'hétéarchie urbaine contribue à une lecture du mouvement et du saut d'échelles dans la structuration du réseau urbain au sein d'un contexte de forte restructuration spatiale promue par le capitalisme à la lumière de la mondialisation. Dans ce travail, nous privilégions les rôles et les fonctions des villes dites moyennes, en cherchant à reconnaître les expressions de l'hétéarchie urbaine dans le territoire, c'est-à-dire à travers quels secteurs ces villes établissent des flux et interagissent avec d'autres centres urbains à de multiples échelles spatiales. Pour cela, nous avons choisi comme dimensions d'analyse la balance commerciale (exportations et importations), le réseau aéroportuaire et les galeries marchandes, dont les logiques économiques révèlent les mutations de la structuration urbaine en cours.

Mots-clés: Villes Moyennes, Hiérarchie-Hétéarchie Urbaine, Exportations et Importations, Aeroports, Centres Commerciaux

INTRODUCTION

We live in a period identifiable as a crisis, wrote Santos (1993) when dealing with the speed of social, economic, and spatial transformations at the end of the twentieth century. For the author, the recent acceleration is expressed by ruptures in the spatial structures and the economic logic that have reached cities of different strata of the urban network. From the big metropolitan center to the local city, urbanization has relied heavily on interscalar spatial interactions.

In this context, some analytical traditions in the epistemological field that define spatial patterns are gaining new contours. Examples are how the center-periphery pair and the urban hierarchy aid in understanding the structuring of cities and urban networks. Therefore, reading the complexity of urbanization ever more requires an analytical effort aimed at the articulations in and between urban centers. Medium-sized cities, defined as those that play regional roles with a strong influence of multiscalar logics in the urban network, constitute privileged contexts of analysis of ongoing urban changes.

Given the above, a decade after the publication of the debate around Catelan's (2012; 2013a) theoretical-methodological proposal of the urban heterarchy, we resume the discussion of medium-sized cities and interscalar spatial interactions in the urban network. At that time, the author brought a concern to the univocal reading in the Brazilian urban system, guided by the Christallerian pattern that strongly influenced official studies of institutions such as the Brazilian Institute of Geography and Statistics (IBGE).

Considering the broadening of contexts¹ within the scope of economic Globalization (SANTOS, 1996), a question arises: how are the spatial interactions articulated by and from medium-sized cities identified to unveil the hierarchy-heterarchy in the urban network? Our efforts focus on the search for elements that highlight these new dynamics in Brazilian territory.

At the outset, it is notable that heterarchy is not found in the dictionary, being an adaptation from the Greek expression *heteros* (difference and diversity). The American neurologist Warren Sturgis McCulloch (1965) was the first to use the term heterarchy when he observed that despite forming a reasonably ordered system, neuronal networks are not organized hierarchically. Authors such as Kontopolos (1993) and Dreifuss (2001) take heterarchy to refer to processes linked to geopolitics and social relations whose elements do not necessarily obey verticalized logic. Catelan (2012; 2013a) proposed relying on the idea of heterarchy as a methodological standard in the light of the expression "urban" as a qualitative of the processes studied herein.

On the other hand, the word hierarchy is widely known in common sense and the scientific field. According to the Houaiss [Portuguese] Dictionary, hierarchy means an "organization founded on order of priority among the elements of a set or on relations of subordination between the members of a group" (HOUAISS, 2022). When applied to the urban network, this definition is, at the very least, insufficient to explain contemporary urban dynamics.

Many studies, as already highlighted in Catelan (2012; 2013a), focused on the theme of spatial interactions, such as Ullman (1980), Cheptulin (1982), Camagni (2005), and Corrêa (1997, 2005). These works contributed significantly to the analysis of spatial complexity. However, from a theoretical-methodological point of view, there is a latent need to qualify better what is "non-hierarchical" in the urban network and system. After all, it encompasses everything and explains little in the modern world.

We start by recognizing that the hierarchical structure is still a vital characteristic of the urban system since the metropolis is a concentrator of capital, flows, people, and information. However, with the technical uniqueness and the diffusion of the technical-scientific-informational environment in the territory (SANTOS, 1996), medium-sized cities and local cities have been participating, at different levels and intensities, in the spatial interactions that take place in the capitalist system in the light of global logics. Thus, the need to complement what is hierarchical. For this reason, heterarchy must be understood as a complement to the notion of hierarchy and not its opposition. This proposal of the hierarchy-heterarchy dialectical pair conceives the relational movement of space as a fundamental analytical dimension in understanding the complexity of the contemporary urban network (CATELAN, 2013a; SPOSITO and CATELAN, 2014).

The urban heterarchy in the Brazilian territory was highlighted through an analytical focus on the trade balance (exports and imports), Brazilian air network, and shopping malls in medium-sized cities, whose economic logic reveals urban restructuring processes. To this end, first, there was bibliographic research on topics such as urban networks, urban restructuring, and medium-sized cities. Data was also collected from IBGE, especially the study Region of Influence of Cities (REGIC), the Secretariat of Foreign Trade (SECEX) of the Ministry of Economy, the National Civil Aviation Agency (ANAC), and the Brazilian Association of Shopping Malls (ABRASCE). The data collected were represented on maps prepared using the QGIS 3.22 software.

The article is organized as follows: it begins with a discussion of the importance of medium-sized cities in the context of urban restructuring; next, we present urban heterarchy as an analytical perspective for understanding the structure of the urban network, and finally, the empirical expressions of hierarchy-heterarchy in the Brazilian urban system are emphasized.

URBAN RESTRUCTURING AND MEDIUM-SIZED CITIES

We know that there is nothing modern about the fact that, in geographic space, there are scalar articulations that materialize in different ways and rhythms. Since the depletion of the feudal system, several economic agents have sought to establish interactions with cities and regions in different parts of the globe, a moment that characterized the internationalization of the economy under the capitalist system of production. However, the current historical period, marked by the speed of transformations dictated by an advanced capitalism, invites us to think about how these articulations are realized in the territory.

With the transition from the Fordist system to the flexible accumulation regime in the last quarter of the 20th century (HARVEY, 1996), the new locational logics of companies began to redefine spatial interactions. The city and the urban network become objects of determinations created on different scales and through social, economic and political agents. Globalization and the expansion of the technical-scientific-information environment (SANTOS, 1996) have altered the rhythms and directions of material and immaterial flows, shaping spatial structures that escape a hierarchical pattern.

Faced with the intensification of relationships on a global level, new contents and meanings are attributed to medium-sized cities, and old paradigms and traditions of urban research become insufficient to explain the economic and spatial contexts that are revealed. In this context, restructuring has been gaining investigative strength in the search for understanding the relationships between continuities and ruptures in space.

Soja (1993), when analyzing the structural transformations in the capitalist system after the 1970s, defines restructuring as a sequential combination of collapse and reconstruction, of deconstruction and attempts at reconstitution. Thus, it is constituted as the expression of modern capitalism, inducing social and territorial transformations in the midst of “[...] a complex and unresolved mix of continuity and change” (SOJA, 1993, p.194).

Sposito and Sposito (2012, p. 05), in this perspective, emphasize that “[...] as the dynamics that consubstantiate an economic restructuring are constituted, we observe, *pari passu*, an urban restructuring that is its basis and reveals it”. Within the scope of urban studies, this theme was largely approached with the metropolitan perspective of the production of space. In recent years, however, much research has dedicated special attention to medium-sized cities, as these urban centers have taken on important roles in the restructuring process, resulting in changes in their urban structures, in the logic of centralities, in the use of urban land and in space relations. -time (BESSA, 2005; FERNANDES, 2022).

Among the economic and spatial transformations that cross medium-sized cities in recent decades, we can highlight: a) deconcentration of industrial production accompanied by economic and spatial centralization in metropolises; b) expansion of access to consumption by the population with lower purchasing power and the emergence of a new middle and upper class, which justifies the implementation and/or modernization of urban equipment such as shopping malls, exclusive bank branches, airports, networks of franchises, gated residential condominiums, etc.; c) extension of urban

fabrics (continuous and discontinuous), composing, in many cases, urban-regional arrangements with neighboring cities; d) expansion of roles and functions in the interurban division at work, a fact that enables the strengthening of its regional influence and the establishment of increasingly distant spatial interactions, thus breaking with the hierarchical structure of the urban network; e) deepening the forms of differentiation and inequality that, in certain cities, can lead to socio-spatial fragmentation².

These facts point to a reality highlighted by Sposito (2007), that is, that there is an urban restructuring and a restructuring of the city. The first process deals with regional changes and/or within the scope of urban networks due to the redefinition of the urban roles of cities in the interurban division of labor. The second, in turn, refers to changes in the structure of urban spaces, that is, on an intra-urban scale, taking the perspective of urban morphology to understand the economic and social division of the territory.

Therefore, the increase in technical possibilities in medium-sized cities has made the social, economic and spatial relations that develop in and from them more intense and complex. Urban restructuring and the new roles of medium-sized cities resulted in the rupture of old patterns of socio-spatial organization. Corrêa (2006) reminds us that the Brazilian urban network was characterized, until the 1970s, by a small functional complexity of its urban centers, with a low degree of articulation and predominantly regional flows. There was, therefore, a large concentration of the main urban centers in the central-southern portion of the country and on the coastline of northeastern Brazil.

As one of the trends in the urbanization process is the intensification of scalar articulations based on the new logic and economic and spatial strategies of companies (SPOSITO and SPOSITO, 2017), medium-sized cities have had their roles redefined in the urban network, a fact that makes more complex relations between the local and the global. These cities have always played mediating roles in the urban system. The novelty, however, is in the density of spatial interactions, in the spatial reach (reaching an international scale) and in the depth of the ongoing changes, marking a context of restructuring. Hence the need to move forward in the search for new analytical perspectives.

HETERARCHY IN THE UNVEILING OF THE URBAN NETWORK

A starting point of our proposal is to understand that the urban network is "[...] a social product, historically contextualized, whose crucial role is to, through spatialized social interactions, articulate the whole society in a given portion of space, ensuring its existence and reproduction" (CORRÊA, 1997, p. 93). In this sense, the urban network gains new content and meanings over time.

Classical studies of spatial location, such as those by von Thünen in 1826 (Agricultural Location Theory), Alfred Weber in 1909 (Industrial Location Theory), and August Lösch in 1940 (Theory of Location Economics), have long formed the theoretical and methodological basis for analyses of economic and spatial organization. Their merit was the representation of spatial structure in their historical contexts and the revelation of the strength of the hierarchical pattern in spatial interactions.

However, Walter Christaller's Theory of Central Locations is the genesis of a more in-depth theoretical reflection on the subject. In 1933, the author published *Die Zentralen Orte in Süddeutschland*, founding a theory on the location of goods and services, the number of urban centers, their dimensions, and spatial distribution. The German geographer's propositions refer to the analysis of various urban centers, understood as central places, in which central functions of distribution of goods and services take place for a population located in its region of influence (hinterland).

Christaller's theories permit the inference that the hierarchical level of urban centers is determined by their centrality, resulting from the capacity to offer goods and services and the attraction of consumers from regions near and far. Expressions such as regional metropolis, regional capital, zone center, and local center reflect the hierarchical nature of the urban network centers. Christaller's theory has been widely disseminated and was investigated by several urban network scholars, from those who supported it, to those who rethought it critically or observed some possible applications.

Another great scholar of the urban and regional question in the twentieth century was the French geographer Michel Rochefort. In his work *L'Organization Urbaine de l'Alsace*, published in 1960, a

classic of Urban and Regional Geography, the author discusses the city and its relationship with the region. For Rochefort, cities are centers that command and direct productive activities. Analyzing the region of Alsace, he sought to understand the formation of a network of cities and the urban hierarchy based on economic flows. Thus, cities that play the role of coordination and direction are called poles and, according to their relevance and position in the network, can be classified as regional, national, or international poles.

Authors such as Christaller and Rochefort inspired studies by several researchers (geographers and others) and institutions dedicated to urban and regional planning, such as the IBGE's REGIC studies, published in five versions in 1972, 1987, 2000, 2008, and 2020. These studies have used different methodologies over the last decades to classify Brazilian cities as metropolises, regional capitals, subregional centers, and local centers. Thus, the strength of the paradigm of the urban hierarchy is evident in the analysis of the urban network. However, although robust and still needed to explain the structuring of the network, such a paradigm is no longer sufficient to understand the complex web of spatial interactions in the urban network. With the intensification of economic globalization and the complex geometry of networks, authors such as Camagni's (2005) have sought to offer perspectives on the subject. The Italian author takes a critical look at the urban network and highlights the progressive decrease in hierarchical relationships between cities and the trend of a spatial organization of cooperation and competitiveness between urban centers of different types.

For Camagni (2005, p. 79):

All activity located in the physical space, be it a production unit, a demographic unit, or a city, develops a complex network of bidirectional relationships with the surrounding environment at multiple levels. On the one hand, a complex field of forces of attraction, radiation, repulsion, and cooperation materializes around this activity, supplying, so to speak, the basic energy for the functioning (and the very existence) of the territorial system. On the other hand, all the activities located in the environment exert an influence on the first center, through the most diverse channels: commercial relations of import and export of goods and especially services; movements of factors of production and, in particular, daily movements home-work or migratory population; dissemination of know-how and information; interaction through communication and transport networks; relationships that can be established in the territory between more or less complex entities.

Given Camagni's statements, the urban heterarchy proposal seeks to answer the following question: what is the "non-hierarchical" in the urban network? Therefore, it is not the construction of another geographical neologism but instead, an attempt to recognize and name contemporary urbanization processes.

Observing the current capital reproduction and territorial structuring stage, which promotes the complexity of interscalar spatial interactions, Sposito and Catelan (2014) adopt the urban hierarchy-heterarchy pair, proposing methodological reflection from Catelan (2012; 2013a). In this way, urban heterarchy consists of a theoretical and methodical perspective, where medium-sized cities are seen for their functions and roles without committing to their classification at some level and/or baseline of the urban hierarchy. Thus, we propose a reading of spatial interactions in an interscalar manner. For this, the inseparability between space, time, and movement must be recognized as categories of analysis since:

The urban network is dynamic and complex; therefore, its hierarchical structure must be recognized due to the existence of cities with functional differences. However, it must also be recognized that any of them can participate in interscalar spatial interactions, depending on the interests articulated between local and regional economic agents and of broader scales, especially the global [...] this condition of articulations that go beyond the limits of hierarchical structuring, we prefer to call Urban Heterarchy, to understand, not only the medium-sized cities but articulations in the urban network in general, having as an analytical proposal the complex movement of spatial-temporal interactions and the interrelationship of geographical scales (CATELAN, 2013b, p. 13).

This proposition considers the relational movement of space as a key analytical dimension in understanding the complexity of the contemporary urban network since "[...] horizontalities and verticalities are found in these cities, causing their functions and roles to be recognized, both in the consolidation of a regional network, and the interaction with the logics of the national and, mainly, the global scales." (CATELAN, 2012, p. 13). Therefore, the proposal of urban heterarchy is not based on the city's classification in the urban network but on its scalar movement.

As emphasized by Perlo, Costa, Romorini, and Riestra (2017, p. 101), who apply heterarchy in the field of learning organization, "[...] heterarchical systems are open, flexible and multidimensional, characteristics today recognized, from complex systems, as essential for stability, conservation, and transcendence." This understanding aligns with what we call urban heterarchy, which seeks to value the functions and roles of each city in the urban network, according to the scale and spatial interactions in the network where the cities are inserted.

Hence, geographical scales, centrality, concentration, economic/spatial centralization, and global logic are listed as constitutive elements of urban heterarchy, thus permitting a methodological reading of the urban network and the spatial interactions that intensify movement and complexity in space-time.

The IBGE itself highlights the contribution of the hierarchy-heterarchy pair to the reading of the complexity of the urban network by considering that:

Cities articulate with each other, composing a hierarchical and heterarchical system (of complementarity) of functions (SPOSITO and CATELAN, 2014). Thus, they are hubs of one or more city networks that articulate to enable the flow of goods, information, and orders (IBGE, 2017, p. 10, emphasis added).

By considering the movement of capitalism in its globalized, neoliberal, and flexible accumulation model (HARVEY, 1996), the urban heterarchy gains strength as an analytical reference for the reading of urbanization. In the current cycle of capital accumulation, where there is a constant need to reduce the time between production and consumption, the urban, transport, and communications networks allow the connection between places near and far, drawing attention to the leap from the geographical scales expressed by Smith (2002).

Based on the debate generated by the urban hierarchy-heterarchy binomial, we propose a way of organizing thought based on contemporary spatial transformations in their multiple geographical scales. The following section explains how this process occurs empirically by privileging the roles and functions of medium-sized cities in the interurban division of labor.

HIERARCHY-HETARARCHY EXPRESSIONS OF IN THE BRAZILIAN URBAN SYSTEM

In a globalized world, space is increasingly characterized as a relational space. Thus, medium-sized cities are characterized as nodes of complex networks, acting as the intersection points of various scales. Let us take the case of flows resulting from exports and imports as a reference.

A survey of SECEX/Ministry of Economy³ data on the trade balance (exports and imports) of Ribeirão Preto, an important middle-sized city in the northeast of the state of São Paulo, whose urbanization process was strongly influenced by the coffee economy in the twentieth century, offers the empirical evidence of the jump of spatial scales (Figure 1).

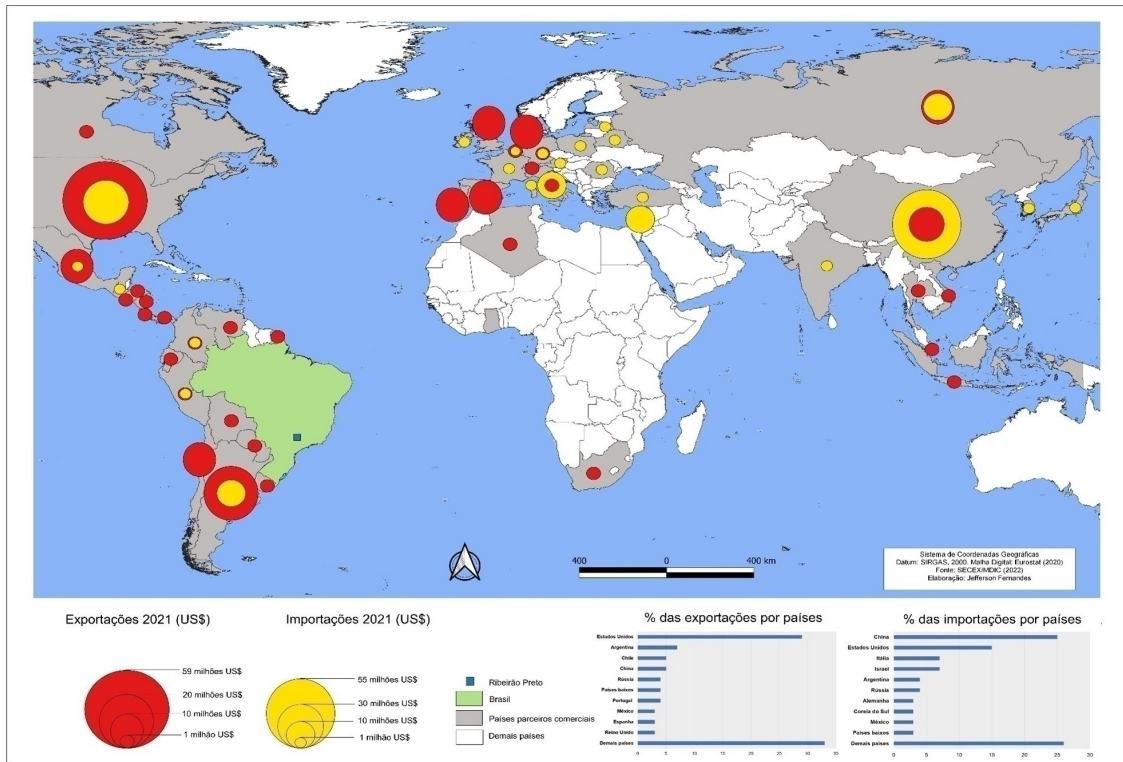


Figure 1 – Ribeirão Preto: exports and imports (2021). Source: SECEX/Ministry of Economy (2022). Prepared by: Jefferson Fernandes

The map above shows how at the beginning of the present decade, the city of Ribeirão Preto had strong economic interactions on a global scale, with flows starting from and going to it. With the deconcentration movement of industrial production from the metropolis of São Paulo towards the interior in the last quarter of the twentieth century, intermediate-level cities modified their roles in the urban network at different scales.

Due to the substantial amount of information, only those countries whose trade balance reached at least US\$1,000,000 were selected. Overall, 34 countries were represented in Figure 1 (129 were trading partners for exports in 2021). The data reveal that the volume of exported resources in negotiations with countries such as the United States, Argentina, Chile, China, Russia, the Netherlands, Portugal, Mexico, Spain, and the United Kingdom stands out. The total value of exports to these countries from Ribeirão Preto reached US\$301,172,637.

Regarding imports, 28 trade partner countries are represented on the map (there were 82 trade partner countries for imports in 2021). Countries such as China, the United States, Italy, Israel, Argentina, and Russia are prominent in the negotiations; Ribeirão Preto imported a total of US\$222,000,906. Therefore, export values exceeded those of imports. Notably, commercial partners with this medium-sized city in São Paulo are found on all continents.

The following table presents the ten main sections of products exported to and imported from Ribeirão Preto in 2021.

Export	Values (US\$)	Import	Values (US\$)
Common metals and metalwork	134,998,868	Machinery and apparatus, electrical equipment and parts; Audio recording or reproducing apparatus; Television picture or sound recording or reproducing apparatus, parts, and accessories	53,068,231
Food industry products; beverages, alcoholic liquids, and kinds of vinegar; Tobacco and manufactured substitutes	39,918,828	Plastics and plastic articles; Rubber and rubber articles	40,669,946
Machinery and apparatus, electrical equipment and parts; Audio recording or reproducing apparatus; Television picture or sound recording or reproducing apparatus, parts, and accessories	38,428,406	Products of the chemical or allied industries	34,210,522
Products of the plant kingdom	32,904,977	Optical, photographic, cinematographic, measuring, controlling, or precision instruments and apparatus; Medical-surgical instruments and apparatus; Clocks and similar apparatus; Musical instruments	33,958,057
Plastics and plastic articles; Rubber and rubber articles	23,555,831	Common metals and metalwork	26,313,491
Optical, photographic, cinematographic, measuring, controlling, or precision instruments and apparatus; Medical-surgical instruments and apparatus; Clocks and similar apparatus; Musical instruments	16,989,633	Wood pulp of or other fibrous cellulose materials; Recycling paper or paperboard (waste and scrap); Paper and paper articles	7,441,263
Mineral products	5,635,367	Transportation materials;	6,683,385
Miscellaneous goods and products	4,411,932	Mineral products	5,271,130
Products of the chemical or allied industries	2,174,302	Textile materials and textile articles	3,513,367
Transportation material;	1,159,421	Products of the plant kingdom	3,169,120

Table 1 - The main sections of exported and imported products - Ribeirão Preto, 2021. Source: SECEX/Ministry of Economy (2022). Prepared by: Jefferson Fernandes.

Information on production circulation reveals interscalar spatial interactions. It reinforces the urban heterarchy as an analytical perspective for the contemporary urban network, resulting from the performance of national and international companies in medium-sized cities that are inserted in global production and marketing networks. According to Santos and Silveira (2001, p. 290) "[...] each company, each activity needs points and areas that constitute the territorial basis of its existence, as production and circulation and consumption data: the respective division of labor will have this geographical manifestation".

Faced with a global order increasingly associated with networks of connections, another important vector of interscalar spatial interactions is the dynamics of the air sector, a perspective highlighted in Teixeira and Catelan (2017). Thus, the IBGE's last REGIC survey pointed out that:

Passenger air transport is an important marker of the urban network, the way cities interconnect. It indicates the displacement of businesspeople, state apparatus operatives, tourists, and consumers between urban centers, showing which cities are more accessible and which are more remote. Transportation goes beyond the traditional hierarchical manner, from the smaller centers to the larger ones. Cross-cutting connections are also common between cities of the same hierarchy belonging to different networks (IBGE, 2020, p. 131, emphasis added).

By highlighting that the flows resulting from air connections are not only hierarchical, the IBGE reinforces the urban heterarchy perspective, highlighting the importance of non-metropolitan urban centers. Airports are essential fixed articulators of flows, and in recent decades there has been a process of internalizing air infrastructure in Brazil, making medium-sized cities important nodes in the urban system (Figure 2).

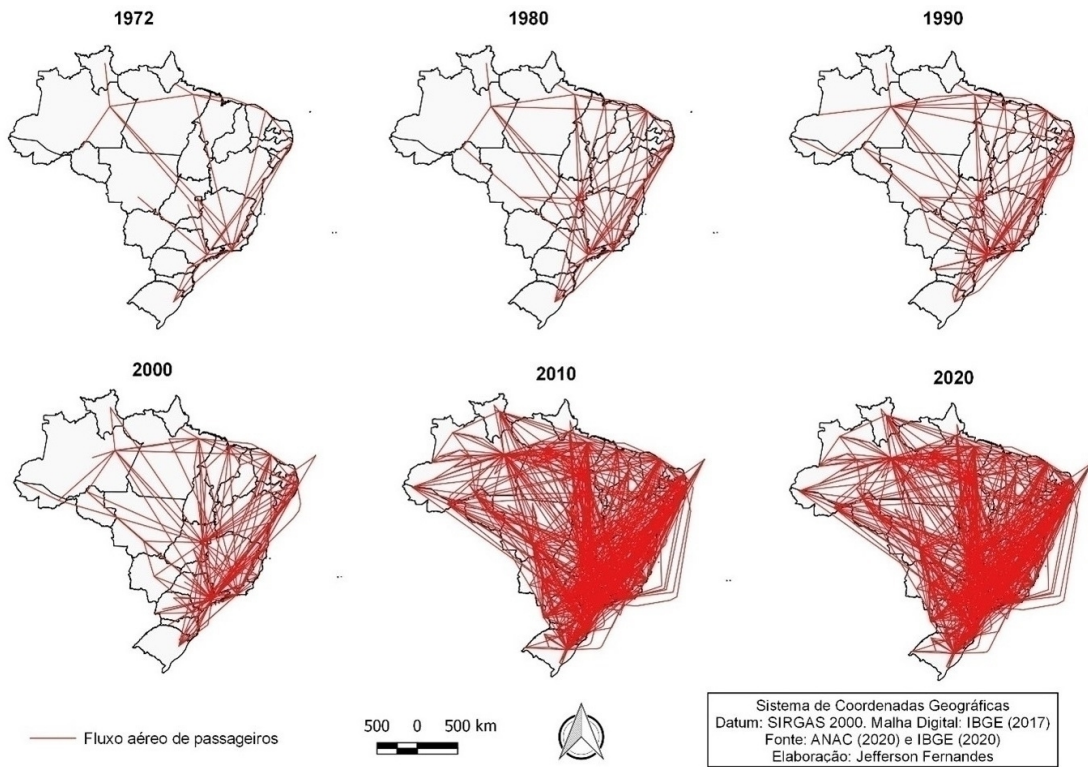


Figure 2 – Spatio-temporal evolution of passenger airflow in Brazil. Source: ANAC (2020) and IBGE (2020). Prepared by: Jefferson Fernandes

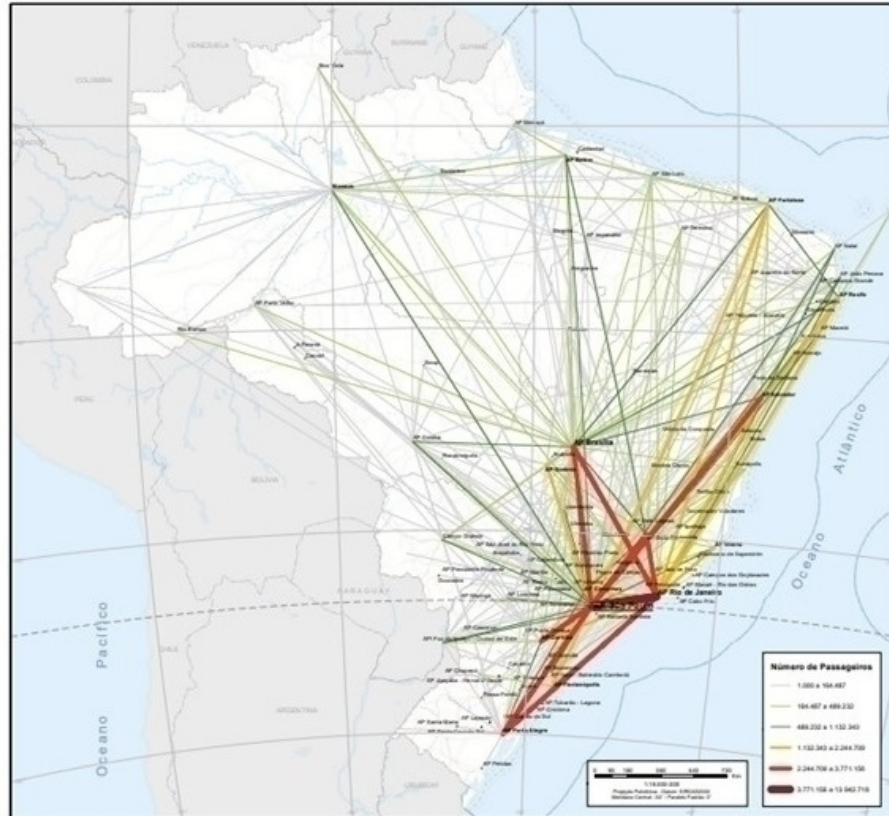


Figure 3 – Air connections, Brazil – 2018. Source: IBGE (2020).

The ANAC and IBGE survey of information on the spatiotemporal evolution of passenger flow in Brazil (origin-destination) indicates greater densification of air connections within the country since the 1970s, a decade that marked the creation of the Brazilian Airport Infrastructure Company (INFRAERO). Initially concentrated in the southeastern and southern regions and the northeastern coast, the air network has advanced to the central-western and northern regions, with connections made by non-metropolitan urban centers and/or state capitals.

According to IBGE evidence in the last REGIC survey, Brazil currently has a densely articulated air network throughout the national territory (Figure 3).

First, there is a concentration of air connections from and towards the metropolises, especially São Paulo, Rio de Janeiro, and Brasília. This spatial configuration reveals an urban network with a still strongly hierarchical structure since these metropolitan centers are home to the country's largest airports and have a greater demand for business trips, events, and tourism, among others. Together, these network flows reflect the spatial and productive differentiation of the Brazilian territory.

However, second and no less important, the Brazilian air network has a dense network of flows in intermediate urban centers in the country's interior. The new centralities in the airflow network accompany the changes in the Brazilian urban network in recent decades, with a more significant role for medium-sized and local cities. Therefore, there is a deconcentration movement of the technical and productive density previously only found between the metropolises.

From the 1990s, the Brazilian aviation sector gained a greater volume of investments for the implementation and expansion of airports in the interior of the country, mainly due to the intensification of the "war of locations," with the opening of the territory to globalization, supported at the political level by the federative pact promulgated by the Federal Constitution of 1988. In the 2000s, this process of internalizing the economy was strengthened, especially with resources from the Growth Acceleration Program (CAP). In the last decade, however, there has been no significant increase in cities served with airports (Figure 2), but the number of airlines operating between urban centers has increased (Figure 3).

According to ANAC data for 2022, there are 86 non-metropolitan urban centers and/or state capitals in Brazil with airports that have regular flights. Emphasis should be given to medium-sized cities, with significant examples being centers such as Juazeiro do Norte/CE, Ribeirão Preto/SP, Marabá/PA, and Chapecó/SC.

As asserted by Teixeira and Catelan (2017, p. 13-14):

The fact that a city is served by an airport characterizes its centrality since the actual establishment of goods and services of an airport-fixed infrastructure transmits variable quantities of flows to the city that also form a repositioning in the hierarchy, consolidating a complex and heterarchical movement, a new condition in the urban network. In the context of the increasing popularization of commercial aviation, air links represent an indicator of the relationship between urban centers, providing, in an increasingly accessible way, fast transport over long distances [...] The complexity of the airway movement encourages the appreciation of the perspective of urban heterarchies, especially through the airport connections made in medium-sized cities from the second half of the 1970s.

Thus, the air transport system's flows reveal that, at the same time as the urban hierarchy is reinforced, there is an overlap of heterarchical logics, jumping from the local to the national scale, and connections can also be established with foreign cities through international airports in an increasingly interconnected air system. This is mainly the case in medium-sized cities with export activities such as agribusiness, industrial goods, and specialized services. Therefore, the hierarchy-heterarchy constitutes a fundamental pair for understanding these articulations in the air network.

Likewise, another noteworthy transformation vector in the urban network is the shopping mall, understood as large modern commercial and service equipment, whose production in the urban space contemplates land and real estate interests related to large projects, generating impacts on the structuring of urban space (SILVA, 2013).

Variations in the definition and size of shopping malls point to subjectivity in their classification. Here, we will use ABRASCE's definition, according to which shopping malls are enterprises with a Gross Leasable Area (GLA), usually greater than 5,000 m², formed by several commercial units, with a single and centralized administration, which practices fixed rent and percentages. In addition, they are urban equipment with anchor stores and parking spaces.

According to information from the ABRASCE website, in 2022, Brazil had 620 shopping malls operating in the national territory, with 112,738 stores, 17 million m² of GLA, and a total of 397 million visitors per month, in addition to the expected opening of another 13 shopping malls by the end of the year. According to Silva (2013), Brazil had 268 shopping malls in 2013, while Pintaudi (1989) points out that in 1989, Brazil only had 64 shopping malls.

It is a fact that the number of shopping malls in Brazil has grown rapidly, with a greater exponential increase in metropolises and state capitals; nevertheless, it is worth highlighting an "internalization" movement of this modern urban development, whose location logic points to a more significant presence in medium-sized cities. A survey by Silva (2013) highlighted that in Brazil, until 1990, there were only seven non-metropolitan cities (interior) with shopping malls. In 2022, according to ABRASCE, this number had leaped to 91 cities (Figure 4).



Figure 4 - Medium-sized cities with shopping malls in Brazil. Source: ABRASCE (2022). Prepared by: Jefferson Fernandes

Therefore, the spatial configuration of the distribution of shopping malls in the interior of Brazil reveals the imbalance existing in the Brazilian urban network, with a greater concentration of medium-sized cities in the southeastern and southern regions of the country, especially in the state of São Paulo. On the other hand, in the northern region, no shopping malls are located in the interior of the states of Roraima, Amazonas, Rondônia, Acre, and Amapá.

The first shopping mall installation in an average Brazilian city occurred in Ribeirão Preto in 1981 (Figure 5). Nowadays, this city in the interior of São Paulo has four shopping malls, namely: Ribeirão Shopping (1981), Shopping Santa Úrsula (1999), Novo Shopping Mall (1999), and Shopping Iguatemi (2013).



Figure 5 – Ribeirão Shopping, opened in 1981. Source: Jefferson Fernandes (2022).

In recent decades, however, the expansion of these enterprises throughout the country has marked the urban restructuring process, with new roles for medium-sized cities in the urban network and changes in cities' internal structures, processes previously seen only on the metropolitan scale. Examples such as the Tenco Group, which specializes in the construction and/or modernization of shopping malls in the country's interior, reveal an urban network articulated between cities outside the metropolitan orbit. This network has eight shopping malls in the following cities: Bragança Paulista/SP, Itaquaquecetuba/SP, Taubaté/SP, Varginha/MG, Boa Vista/RR, Juazeiro/BA, Macapá/AP, and Lages/SC.

Thus, reading spatial interactions from the hierarchical perspective does not fully explain the existing interstices in the urban network. There may be interactions between cities of the same size and roles in the network that are not necessarily mediated and controlled by the metropolis.

It should be noted that in many cases, the business groups that manage the shopping malls in Brazil operate powerfully on the stock exchange, with intense trade in international capital, thus making the economic hierarchy of the territories more complex. This is the case for Aliansce Sonae, Iguatemi, and Multiplan, the three principal administrators of these projects in Brazil and who operate in medium-sized cities such as Juazeiro do Norte/CE and Feira de Santana/BA (Aliansce Sonae), São José do Rio Preto/SP and São Carlos/SP (Iguatemi) and Ribeirão Preto/SP and Canoas/RS (Multiplan).

Silva (2013, p. 14) considers shopping malls the nodes of nodes in the urban network, at the same time as they generate profound transformations in cities' internal structures. According to the author,

[...] there are important changes in the existing spatial interactions between the city scales and the urban network, so that the shopping malls allow the composition of nodes that constitute centers of convergence of people, capitals, goods, etc., which redefine the expression of urban centrality in cities and the urban network so that the locational choices of these enterprises are guided by accessibility, on main roads and, in the case of medium-sized cities, on highways with regional reach.

Accordingly, shopping malls are new expressions of centrality resulting from the vertical imposition of capital on the territory at different scales and modifying the urban structure, directing the growth and strategies for revaluing urban land, and modifying the way of living, thinking, and appropriating the city.

With the arrival of this type of enterprise in medium-sized cities in recent decades, resulting from economic forces at different scales, some changes in the structure of cities are observable, such as the new commercial and service centralities and new forms of differentiation and inequality associated with consumption.

Shopping malls thus form closed territorial enclaves appropriated by the portion of the population that can consume their products, images, and symbols, representing a point in space that fragments urban life (DAL POZZO, 2015) while economically connecting with other nodes of the network, from local to global. So, the production of urban space must be understood from a double perspective because "at the same time that a movement takes place constituting the process of globalization of urban society [...], the process of fragmentation of both space and the individual is produced and accentuated"

(CARLOS, 1994, p. 194). In these terms, "we are facing today a dialectic of the territory [...], of the geographies of inequality produced by the world-system, which allow us to see the territory as a historical dimension of the process of globalization and fragmentation" (SANTOS, SOUZA and SILVEIRA, 1994, p. 11).

Given the above, the reorganization of systems of objects and actions undergoes profound changes to propel the rapid and dense boost of flows in a context in which the geography of flows increasingly depends on the geography of fixed (SANTOS, 1996). Therefore, by housing large business groups and chains of stores with national and international capitals and promoting new consumption habits for the city, attracting a vast local and regional audience, shopping malls provoke a change in centrality in the interurban and intraurban scales.

In a period of intensification of economic relations under the aegis of globalization, understanding territories has become more complex. The expansion of the technical-scientific-informational environment (SANTOS, 1996) with modern infrastructures in medium-sized cities ensures the maintenance and consolidation of interscalar spatial interactions. Focusing on these scalar articulations is an important challenge for researchers in the city and the contemporary urban.

CONCLUSION

The proposal of an urban heterarchy does not oppose the classic studies of the urban network developed by several authors and institutions. Its objective is to offer explanatory complementation since the paradigm of hierarchy is insufficient to understand the vertical, horizontal, and transversal interactions that materialize in the urban network.

The insertion of medium-sized cities in the new global economic logic has pointed to restructuring the urban network with hierarchical and heterarchical movements in the territory. These cities have increased their importance in the interurban division of labor, assuming a particular role in regional economic development and redefining old spatial patterns with exclusive control of the metropolis.

In this work, the trade balance data (exports and imports) and the presence of airports and shopping malls are analytical dimensions that express the urban hierarchy and heterarchy. This selection was based on these sectors' capacity to establish flows of goods, people, capital, information, ideas, and values. Industrial sector data express the interactions that medium-sized cities can establish in the international urban network. The presence of airports endows medium-sized cities with a greater technical density, with flows that overlap at various scales. Finally, internalizing shopping malls with networks of stores and franchises linked to national and international economic groups brings new consumption logics and establishes new capital flows.

Such technical objects and their actions (SANTOS, 1996) accelerate previously undynamic processes and create spatial practices aligned with hegemonic interests expressed in urban life through differentiation and inequality. Moreover, they drive territorial expansion and the emergence of new centralities, thus modifying the structure of cities, often generating the fragmentation of the urban fabric.

These economic and spatial logics (SPOSITO and SPOSITO, 2017) arise from urban and city restructuring processes (SPOSITO, 2007) and are established from the locational strategies of capital to augment urban space to capitalist accumulation. Analyzing these processes is essential in comprehending Brazilian urbanization's new contents.

We do not adopt a generalizing and homogenizing perspective of the territory, as there are significant differences in the current pace and intensity of urban transformations. Consequently, it is crucial to consider the geographical situation and socio-spatial formation of medium-sized cities to assess their potential to establish spatial interactions in the urban network with other cities at multiple scales. As Santos (1978, p. 122) reminds us, "space is a true force field whose formation is unequal. Therefore, spatial evolution does not present itself in the same way everywhere."

The discursive production of signs and icons of modernity in medium-sized cities, the need for more public and private investments in infrastructure, and new spatial practices contribute to a context

of the expansion of interscalar spatial interactions. This interpenetration of scales reinforces urban heterarchy as an analytical perspective that can contribute to a reading of differentiation and socio-spatial inequality in the network and the urban system.

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NOTES

1- For Santos (1996, p. 254), the extension of contexts expresses “[...] the new possibilities of fluidity that are at the base of this formidable expansion of exchange. It exponentially increases the number of exchanges, occupying a superlative number of places on all continents by multiplying the number and complexity of connections.”

2- Socio-spatial fragmentation has been widely analyzed within the scope of the thematic project “Socio-spatial fragmentation and Brazilian urbanization: scales, vectors, rhythms, forms and contents” (FRAGURB), which has the support of the Research Support Foundation of the State of São Paulo (FAPESP). For readers interested in the subject, see Sposito and Sposito (2020) and Góes and Melazzo (2022).

3- From 2018 to 2022, SECEX was linked to the Ministry of Economy. From January 2023, this secretariat became part of the Ministry of Development, Industry, Trade and Services.

4- For a deeper understanding of the roles of shopping centers in urban restructuring, see the works of Nascimento (2003), Silva (2013) and Dal Pozzo (2015).

REFERENCES

AGÊNCIA NACIONAL DE AVIAÇÃO CIVIL – ANAC. Base de dados estatísticos do transporte aéreo 2021. Brasília, DF, 2021. Disponível em: <https://www.gov.br/anac/ptbr/assuntos/dados-e-estatisticas/dados-estatisticos/dados-estatisticos>. Acesso em: 10 abr. 2022.

ASSOCIAÇÃO BRASILEIRA DE SHOPPING CENTERS - ABRASCE. Site institucional. Disponível em: <https://abrasce.com.br/>. Acesso em: 11 abr. 2022

BESSA, Kelly Critine. Reestruturação da rede urbana brasileira e cidades médias: o exemplo de Uberlândia (MG). *Caminhos de Geografia*, v. 6, n. 16, p. 268-288, 2005.

CAMAGNI, Roberto. *Economía urbana*. Barcelona: Editorial Antoni Bosch, 2005.

CARLOS, Ana Fani Alessandri. A natureza do espaço fragmentado. In: SANTOS, Milton; SOUZA, Maria Adélia Aparecida de; SILVEIRA, Maria Laura. *Território: globalização e fragmentação*. São Paulo: Hucitec, 1994. p. 191-197.

CATELAN, Márcio José. *Heterarquia Urbana: interações espaciais interescolares e cidades médias*. 2012. 227 f. Tese (Doutorado em Geografia) - Universidade Estadual Paulista, Presidente Prudente, 2012.

CATELAN, Márcio José. *Heterarquia Urbana: Interações espaciais interescolares e cidades médias*. 1. ed. São Paulo: Editora UNESP, 2013a. v. 1. p. 291

CATELAN, Márcio José. *Heterarquia Urbana e interações espaciais interescolares: proposta analítica para estudos na rede urbana*. In: *Anais do XIII Simpósio Nacional de Geografia Urbana, 2013*, Rio de Janeiro. *Ciência e Ação Política: por uma abordagem crítica*, 2013b. v. 13.

- CORRÊA, Roberto Lobato. Estudos sobre a rede urbana. Rio de Janeiro: Bertrand Brasil, 2006.
- DAL POZZO, Clayton Ferreira. Fragmentação socioespacial em cidades médias paulistas: os territórios do consumo segmentado de Ribeirão Preto e Presidente Prudente. 2015. 400 f. Tese (Doutorado) - Universidade Estadual Paulista, Faculdade de Ciências e Tecnologia, 2015.
- DREIFUSS, René Armand. A época das perplexidades: mundialização, globalização e planetarização – novos desafios. Petrópolis: Editora Vozes, 2001.
- FERNANDES, Jefferson Santos. Cidades médias e reestruturação urbana no Nordeste brasileiro. Terra Livre, [S. l.], v. 2, n. 57, p. 526–552, 2022.
- GÓES, Eda Maria; MELAZZO, Everaldo Santos (Org.) Metodologia de pesquisa em estudos urbanos: procedimentos, instrumentos e operacionalização. 1. ed. Rio de Janeiro: Consequência Editora, 2022. v. 1. 452p.
- HARVEY, David. Condição pós-moderna: uma pesquisa sobre as origens da mudança cultural. 6ª ed. São Paulo: Loyola, 1996.
- HOUAISS, Antônio. Dicionário Houaiss da Língua Portuguesa. Disponível em: https://houaiss.uol.com.br/corporativo/apps/uol_www/v6-0/html/index.php#1. Acesso em: 02 jun. 2022
- INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA – IBGE. Regiões de Influência de Cidades - 2018. Rio de Janeiro. IBGE, 2020.
- INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA – IBGE. Tipologia intraurbana. Espaços de diferenciação socioeconômica nas concentrações urbanas do Brasil. Rio de Janeiro: IBGE, 2017.
- KONTOPOLOS, Kyriacos. The logics of social structure. Londres: Routledge, 1993.
- MCCULLOCH, Warren Stutgis. A heterarchy of values determined by the topology of nervous nets, embodiments of mind. Cambridge: MIT Press, 1965.
- MINISTÉRIO DA ECONOMIA. Secretaria de Comércio Exterior. Exportação e Importação Municípios. Brasília, DF, 2022. Disponível em: <http://comexstat.mdic.gov.br/pt/municipio>. Acesso em: 15 jul. 2022.
- NASCIMENTO, Gerson Gomes do. Shopping centers: elementos de (re)produção urbana na Zona de Sul de Natal-RN. 2003. 178 f. Dissertação (Mestrado em Dinâmica e Reestruturação do Território) - Universidade Federal do Rio Grande do Norte, Natal, 2003.
- PERLO, Cláudia Liliana; COSTA, Letícia Del Carmen; ROMORINI, Maria Verônica Lopez; Riestra, María Del Rosario De La. Aprendizagem organizacional e poder: hierarquia, heterarquia, holarquias e redes. Nova Perspectiva Sistêmica, [S. l.], v. 21, n. 43, p. 99–112, 2017. Disponível em: <https://www.revistanps.com.br/nps/article/view/266>. Acesso em: 22 abr. 2022.
- PINTAUDI, Silvana Maria. Templo da Mercadoria. Estudo sobre os shopping centers do estado de São Paulo. 156 f. (Tese de Doutorado em Geografia). Universidade de São Paulo, 1989.
- SANTOS, Milton. A natureza do espaço: técnica e tempo, razão e emoção. São Paulo: Hucitec, 1996.
- SANTOS, Milton. Por uma Geografia Nova. São Paulo: Hucitec, 1978.
- SANTOS, Milton; SOUZA, Maria Adélia; SILVEIRA, Maria Laura. Prefácio. In: SANTOS, Milton; SOUZA, Maria Adélia Aparecida de; SILVEIRA, Maria Laura. Território: globalização e fragmentação. São Paulo: Hucitec, 1994. p. 11-13.
- SILVA, William Ribeiro. Reestruturação urbana e shopping centers: os nós dos nós da rede urbana. In: Anais do Encontro de Geógrafos da América Latina, 2013, Lima. 14 EGAL, 2013. v. 1. p. 1-20.
- SMITH, Neil. Geografia, diferencia y políticas de escalas. Terra Livre, São Paulo, v. 18 n. 19, p.127-146, dez. 2002.

SPOSITO, Eliseu Savério; SPOSITO, Maria Encarnação Beltrão. Fragmentação Socioespacial. Mercator, Fortaleza, v. 19, jun. 2020. ISSN 1984-2201.

SPOSITO, Maria Encarnação Beltrão; CATELAN, Márcio José. Hierarchy and Heterarchy in Brazil's urban network. Brazilian Geographical Journal: Geosciences and Humanities research medium, Ituiutaba, v. 5, n.2, pp. 556-54, jul.-dez. 2014.

SPOSITO, Maria Encarnação Beltrão. Cidades médias: reestruturação da cidade e reestruturação urbana. In: SPOSITO, Maria Encarnação Beltrão (org.). Cidades médias: espaços em transição. São Paulo: Expressão Popular, 2007, p. 233-253.

SPOSITO, Maria Encarnação Beltrão; SPOSITO, Eliseu Savério. Articulação entre múltiplas escalas geográficas: lógicas e estratégias espaciais de empresas. Geosp – Espaço e Tempo (Online), v. 21, n. 2, p. 462-479, agosto. 2017.

TEIXEIRA, Sérgio Henrique de Oliveira; CATELAN, Márcio José Verissimo. Novas articulações da rede de cidades no Brasil: uma análise das heterarquias por meio do sistema de movimento aeroviário. Sociedade & Natureza, v. 31, p. 1-23, 2017

ULLMAN, Edward Louis. Geography as Spatial Interaction. Seattle and London: University of Washington Press, 1980.

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