E-commerce and logistical urbanization in last-mile delivery

Comércio eletrônico e urbanização logística na última milha da entrega

Diogo David de MATOS [I]

Abstract

E-commerce integrates two central pillars of contemporary capitalism: digital platforms and logistics. While the construction of large fulfillment centers in metropolitan peripheries has garnered attention for its role in shaping logistical urbanization, we argue that e-commerce logistics goes beyond these structures, integrating small facilities into the urban fabric to meet the growing demand for fast deliveries. Through case studies, we analyzed the logistical programs of Amazon and Mercado Livre and mapped their operations in the São Paulo Metropolitan Region. We concluded that last-mile logistics dissolves the boundaries between logistical spaces and urban centers, consolidating an urban fabric increasingly shaped by logistical imperatives.

Keywords*:* e-commerce; logistical urbanization; last-mile delivery; platform urbanism.

Resumo

O comércio eletrônico integra dois pilares centrais do capitalismo contemporâneo: as plataformas digitais e a logística. Embora a construção de grandes centros de distribuição nas periferias metropolitanas venha recebendo atenção pelo papel na conformação de uma urbanização logística, argumentamos que a logística do comércio eletrônico vai além dessas estruturas, integrando instalações menores ao tecido urbano para atender à demanda por entregas rápidas. Por meio de estudos de caso da Amazon e do Mercado Livre, analisamos seus programas logísticos e mapeamos suas operações na Região Metropolitana de São Paulo. Concluímos que a logística de última milha dissolve as fronteiras entre espaços logísticos e núcleos urbanos, consolidando um tecido urbano cada vez mais orientado por imperativos logísticos.

Palavras-chave: *comércio eletrônico; urbanização logística; última milha da entrega; urbanismo de plataforma.*

Introduction

E-commerce integrates two central pillars to contemporary capitalism: digital platforms and logistics. In the city of São Paulo, a single click is all it takes to purchase a product on a major online platform and have it delivered to your home within a few hours. In other Brazilian metropolises, such as Belo Horizonte, Porto Alegre and Recife, delivery times of less than 24 hours have also become common. Behind apparently simple commercial transactions mediated by information technologies lies a complex logistics chain, carefully designed and controlled by major electronic retailers to ensure that products reach consumers as quickly as possible.

Since the Covid-19 pandemic, the logistical expansion of e-commerce has drawn attention due to the production of new spatial forms resulting from the construction of large distribution centers by major online retailers. Indeed, the scale of these structures and their rapid proliferation in recent years are impressive. The North American e-tailer Amazon, for instance, expanded its presence in Brazil by inaugurating nine fulfillment centers between 2020 and 2022, increasing its total from three to twelve units. Similarly, the Argentinian Mercado Livre, which previously operated only two centers, opened ten more during the same period. One of the outcomes of this expansion has been the emergence of so-called warehouse cities and specialized logistical centralities focused on e-commerce, such as the municipalities of Cajamar (SP) and Extrema (MG), which have already become the subject of relevant academic research (Diniz & Gonçalves, 2022; Yassu, 2022; Jesus, 2023; Venceslau, 2023).

In this article, we argue that the materiality of e-commerce logistics extends beyond large-scale structures and logistical centralities. In the pursuit of ever-faster deliveries, in addition to the multiplication of major distribution centers on the outskirts of Brazilian metropolises, e-commerce introduces a new layer of distribution equipped with its own logistical infrastructure: the so-called "last-mile delivery" (Winkenbach & Janjevic, 2018). This term refers to the final stage of the delivery process, connecting the fulfillment center to the end consumer. By combining the logic of large-scale retail with that of express parcel services, e-commerce logistics operations become increasingly embedded throughout the urban fabric.

Throughout the paper, we examine the facilities and logistical programs of two of the leading e-commerce retailers operating in Brazil: Amazon and Mercado Livre. In the first section, we situate e-commerce within the broader context of logistical transformations. We then reflect on the role of e-commerce in shaping logistical urbanization and in the development of large-scale storage centers. In the subsequent sections, we explore the transportation services and distribution networks involved in last-mile delivery, highlighting logistical programs and mapping last-mile infrastructures operated by Amazon, Mercado Livre, and third-party logistics providers in the São Paulo Metropolitan Region.

E-commerce, logistics and capital

A long logistics chain, composed of various flows and fixed infrastructures, is activated when a product is purchased online. This logistical dimension of e-commerce can be understood as the latest development of a long process of transformation in the way commodities circulate under contemporary capitalism. Since the second half of the twentieth century, transportation and distribution processes have been entirely reshaped by the emergence of logistics as a new global economic sector. Beginning in the 1960s, logistical technologies originally developed for military purposes began to be incorporated into the economic sphere, and the distribution of goods became a key basis for competition among companies. This transformation – marked by the rise of logistics as a specialized managerial science requiring its own body of experts – is referred to by many authors as the 'logistics revolution' (Allen, 1997; Bonacich & Wilson, 2008; Cowen, 2014).

Alongside the rescaling of production, the 1970s and 1980s witnessed the introduction of an increasingly integrated management of distribution systems (Cowen, 2014). As supply chains expanded on a global scale and the production process became segmented into spatially dispersed components, the transportation of raw materials and intermediate products between manufacturing plants became an integral part of the production process itself. This marked a reconfiguration of the relationship between production and distribution, in which the boundary between them becomes blurred. (Hesse & Rodrigue, 2004).

In addition to the introduction of transportation and information technologies that enabled the integration of supply chains – among which the container and the barcode stand out (Levinson, 2006; Dicken, 2011) – and the establishment of a demand-driven production regime characterized by inventory minimization, the logistics revolution is marked by a few features. First, Bonacich and Wilson (2008) highlight a shift in the balance of power between manufacturers and retailers. In the demand-driven model, consumer behavior is tracked by retailers and transmitted to producers, who in turn attempt to coordinate production based on actual sales, thereby minimizing inventories throughout the supply chain. As a result, power shifts toward large retailers, who hold information about consumer behavior and exert influence over their supply networks.

Secondly, another operational development that situates the logistics revolution within the broader context of the flexible accumulation regime (Harvey, 1992) can be observed: the emergence of a specialized logistics industry, necessary to manage the increasingly complex flows of goods, to which correspondent flows of information are associated (Dicken, 2011). As distribution systems became more complex, a process of vertical disintegration unfolded, characterized by the outsourcing and subcontracting of logistics services to so-called 3PLs (Third-Party Logistics providers) (Rodrigue, 2020a).

Underlying the rise of logistics are the imperatives intrinsic to capital accumulation. On the one hand, logistical activities play a crucial role in maintaining the continuous flow of the capital cycle by minimizing frictions in the circulation process and ensuring the reliability of value realization (Marx, 2015). On the other hand, the main driving force behind logistical developments is the reduction of the turnover time of capital by shortening the period the commodity remains within the sphere of circulation. In this sense, the speed of circulation plays an indirect role in the creation of value, simply by bringing capital back into the sphere of production (Marx, 2011).

The recent development of e-commerce, driven by competition for increasingly rapid deliveries, situates it within the long process of the logistics evolution, while simultaneously updating and transforming it. Emerging in the 1990s, electronic retail initially struggled following the burst of the dot-com speculative bubble, which led to the collapse of many internet-based businesses. In the wake of the failed narrative of the 'death of distance' that prevailed at the time (Anderson et al., 2003; Zook, 2006; Malecki & Moriset, 2008), e-commerce remained a residual phenomenon throughout the 2000s, having only a marginal impact on retail as a whole (Malecki & Moriset, 2008; Hesse, 2008). This situation, however, would begin to shift in the 2010s and especially in the 2020s, as e-commerce became a systemic and transformative force within contemporary retail.

Firstly, this transformation was partly driven by the emergence and consolidation of a new business model, made possible by innovations in information and communication technologies: the digital platform (Srnicek, 2017). Platforms are digital infrastructures that enable communication between different users to facilitate transactions, interactions, and exchanges. As intermediaries that concentrate online transactions, their main product lies in the extraction of user data. In the context of retail, e-commerce platforms – unlike physical retail – can leverage accumulated data to recommend products to users based on their purchase and browsing history, as well as on consumption patterns from other users. In this sense, they are part of what has been termed surveillance capitalism – that is, a new economic order in which platforms use data extracted from users not only to predict their behavior, but to steer it as well (Zuboff, 2018).

Moreover, the platform economy is characterized by network effects – that is, the greater the number of users, the greater the value of the platform –, which drives market concentration (Kenney & Zysman, 2016). Although retail is a more competitive sector in which network effects are not as evident as in other services, this phenomenon can be observed through the rise of marketplaces. By opening their platforms to third-party sellers, e-tailers position themselves as intermediaries between small suppliers or retailers and the final consumer. In doing so, they can expand the range of products offered while freeing themselves from the task of purchasing and reselling goods, shifting a significant portion of their profits to transactions made by third parties on their platform (Venceslau, 2023). This mechanism is made possible by the

platforms' power of concentration of users, as well as their recommendation algorithms and logistics capacities.

Secondly, a decisive factor in the growth of e-commerce was the development of its material infrastructure, which had been largely neglected in its early years. The reduction in shipping costs and, above all, in delivery times – longstanding obstacles to the widespread adoption of online retail (Malecki & Moriset, 2008) – was achieved through massive investments in order distribution logistics. Currently, the speed of delivery is one of the main factors of competition between e-tailers. Globally, Amazon has become the paradigmatic case having built – especially since the 2010s – one of the most robust logistical infrastructures in the world (Moody, 2020).

Even under the marketplace model, in which they act merely as intermediaries in commercial transactions, platforms are increasingly positioning themselves as providers of logistical services, deploying their own infrastructure and managerial capabilities not only for the sale of their own products but also for those sold by third-party vendors. This is the case of Mercado Livre, which, through its Mercado Envios Full program, takes full responsibility for the storage and delivery logistics (the so-called fulfillment) of goods sold by third-party sellers. Similarly, Amazon, in addition to selling its own products, has been operating the Fulfillment by Amazon (FBA) program in Brazil since 2022, offering logistics services to sellers on the platform.

Undoubtedly, the outbreak of the Covid-19 pandemic marked a turning point in the history of e-commerce worldwide, including in countries that had previously recorded low volumes of online sales. The public health measures adopted to contain the spread of the virus – such as social distancing and mobility restrictions – had a profound impact on economic activity, especially on physical retail. Despite the overall downturn in retail, caused both by widespread uncertainty and by declining household income, a sharp increase in online sales volumes and in the share of e-commerce within total retail was observed globally (UNCTAD, 2021). In Brazil, according to data from the National E-commerce Observatory (Brasil, 2023), the gross value of e-commerce sales jumped from R$57.4 billion in 2019 to R$107.24 billion in 2020 and R$155.76 billion in 2021. It is therefore clear that the pandemic structurally elevated e-commerce in Brazil to a new stage.

It can be argued, however, that the pandemic merely accelerated ongoing investments in the logistics chain of e-commerce. The development of this chain, on the one hand, reveals and intensifies the role of logistics in contemporary capitalism. After all, through the direct transportation of goods from storage facilities to the point of consumption and the continual reduction of delivery times, the turnover time of capital is further shortened. On the other hand, these new developments impose non-trivial transformations on logistical systems, as they operate according

to a specific logic of distribution. Rather than responding to the aggregate demand of a local market, e-commerce logistics responds to the individualized demand of a regional or national market (Rodrigue, 2020b). The supply chain is transformed by redefining its endpoint, which is no longer the physical retail store but the consumer's home (Alimahomed-Wilson, 2022).

In this way, e-commerce introduces greater flexibility into the processes of circulation and capital accumulation, as it significantly expands the pool of potential buyers for a given product, thereby contributing to the resolution of a chronic problem of capitalism – one that is inherently geographical in nature: the gap between supply and demand (Bonacich & Wilson, 2008). Through the reconfiguration of spatial flows of goods and the formation of more flexible supply chains, e-commerce can be understood as a method for creating opportunities for the realization of value (Danyluk, 2018).

To achieve this, however, the logistics chains of large e-commerce retailers must have sufficient territorial capillarity to allow for such flexibility. In this regard, these companies have increasingly sought to expand their control over transportation and distribution tasks by integrating certain stages of the delivery process and strengthening their territorial presence. In a certain sense, delivery itself has become a commodity, just as much as the goods being delivered (Loewen, 2018). By gaining more control over distribution chains to ensure faster deliveries, e-commerce platforms are, more than selling goods, selling their logistical services.

Logistical urbanization and e-commerce

The centrality acquired by logistics in contemporary capitalism takes on a specific spatial expression. Logistical imperatives shape the production of space in ways that optimize the circulation of goods – a phenomenon that has been described by terms such as "logistical urbanism" (Altenried, 2019), "logistical urbanization" (Diniz & Gonçalves, 2022; Fernandes et al, 2023), and "supply chain urbanism" (Danyluk, 2021). According to Diniz and Gonçalves (2022, p. 9), "logistical urbanization corresponds to the production, management and connection of spaces whose high technol-scientific-informational density facilitates and promotes the fluidity of capital, especially in the commodity form" (author's translation).

On the one hand, certain cities and hubs, through the concentration of flows in ports, inland cargo terminals and airports, begin to emerge as major nodes in global or national logistics. This may result from their position within the globalized economy, state investment strategies, or private strategies by large logistics companies that choose specific locations as operational bases (Dicken, 2011). This gives rise to forms such as "logistics cities" (Sengpiehl, 2008; Cowen, 2014) or "distributive world cities" (Negrey et al, 2011), i.e., cities where logistics becomes a driving force and that function as major circulation platforms, either by providing infrastructure or by exerting command over distribution activities.

On the other hand, as Cuppini (2018) points out, the logistical face of contemporary urbanization is not limited to large logistical hubs. In fact, under the paradigm of diffuse urbanization, it is possible to think of every city as a node in the circulation of goods. In this sense, the entire urban fabric presents itself as a logistical web, embedded with infrastructures that serve global flows.

Logistics operations are, in fact, ubiquitous (Altenried, 2018). The imperative of speed extends beyond logistics cities or large warehouses, reaching into the central areas of major metropolises and permeating the entire urban fabric:

> "While 'logistical cities', understood as logistics parks, ports or special economic zones and their particular form of spatial and urban planning are most of the time situated at the margins of urban agglomerations (Cowen, 2014; Rossiter, 2016), this imperative of speed tends to further merge the space of logistical operations with city centres" (Altenried, 2019, p. 118)

The logistics of e-commerce retail is an expression of both features of logistical urbanization, that is, the production of spaces dedicated to logistics activities on the one hand, and the formation of a "logistified" urban fabric on the other. This is because the logistics of e-commerce is structured around two layers of distribution, each with its own distinct spatial organization: one originating from large-scale retail, characterized by extensive storage infrastructures, and another related to express delivery services, commonly referred to as "last mile delivery". In what follows, we will examine some aspects of the first layer, while the next sections will delve more deeply into the second layer.

Before the emergence of electronic retail, one of the main consequences of the logistics revolution and of modern supply chain management was the concentration of storage functions into a single unit rather than multiple ones (Rodrigue, 2020a). This transformation stems from the fact that storage was removed from production sites and centralized in distribution hubs operated by large retailers, freight carriers, or logistics providers, which operate with economies of scale and serve multiple companies through investments in specialized fixed assets (Huertas, 2013). Traditional warehouses were replaced by the modern warehouse, the Distribution Center, whose main purpose is to ensure the fastest possible flow of goods. This shift has led to changes in the layout of these facilities, such as the preference for single-story buildings that stretch over thousands of square meters (Cidell, 2010). The main feature of the resulting geography of distribution is the so-called logistics sprawl (Dablanc & Rakotonarivo, 2010), that is, the relocation of logistics facilities to the suburbs and fringes of metropolitan areas. This trend is driven not only by the sheer size of such facilities but also by the need for connectivity to major road networks and by the formation of logistics clusters within new real estate formats, such as logistics parks and condominiums (Zioni, 2009; Finatti, 2011).

On the one hand, e-commerce logistics reinforces and updates this trend. Instead of traditional Distribution Centers (DCs), which supply physical stores in bulk, the anchors of the system have become the so-called fulfillment centers – facilities where individual orders are assembled and processed according to consumer demand. These centers store both first-party (1P) goods – products purchased by

the retailer from suppliers – and third-party (3P) goods – products sold by external vendors whose delivery logistics are handled by the platform. Although their operations differ, the geographical characteristics of fulfillment centers are similar to those of distribution centers: they occupy large plots of land and store goods on high shelving racks. Due to their size and the need for fast outbound delivery, fulfillment centers tend to be located on the outskirts of major metropolitan areas, close to high-speed roadways.

In order to examine these trends within the Brazilian context, we analyzed the case of two of the largest e-commerce platforms in the country: Amazon and Mercado Livre. The information presented in this and the following sections is based on research conducted using a variety of sources, including press articles, reports from the international consultancy MWPVL, and, most importantly, data from company registration records filed with the Junta Comercial de São Paulo (JUCESP), which were cross verified through satellite imagery.

Until 2019, the two companies operated only five fulfillment centers in total. By 2023, there were twenty-four – twelve operated by each company. Amazon primarily uses its centers for storing its own products, although it has already launched its third-party fulfillment program, Fulfillment by Amazon (FBA). Mercado Livre, on the other hand, stores almost exclusively products from third-party sellers participating in the Mercado Envios Full program.

We observed that the aforementioned spatial location pattern of storage facilities holds true. The fulfillment centers of both companies are located in large-scale warehouses – averaging 47,000 square meters in the case of Amazon, and 77,000 square meters in the case of Mercado Livre – generally built outside urban areas and within large logistics parks, either through leasing modular units or entire warehouses built under built-to-suit conditions. Due to these characteristics, large distribution centers imprint a pattern of discontinuity on the urban fabric – a pattern that was already observed before the logistical development of e-commerce (Zioni, 2007), and which has been intensified by it, given the proliferation of such facilities over the past five years.

Although there is a significant concentration around the Metropolitan Region of São Paulo – the largest consumer market and command center for Brazilian e-commerce – since the outbreak of the pandemic, a process of decentralization of fulfillment centers by both companies has been observed. These companies are seeking to establish themselves in the outskirts of metropolitan areas in the Northeast and South regions – such as Porto Alegre, Recife, Salvador, and Fortaleza – in order to ensure faster deliveries in these regions. It is important to highlight that the location of fulfillment centers by these companies has also been influenced by State policies, in the form of institutional support and tax incentives. A fierce competition has been taking place between states and even municipalities to attract these investments, as evidenced by the imbroglio related to the establishment of a Mercado Livre fulfillment center in the South region. Although Mercado Livre had already started adapting a pavilion in a logistics condominium from GLP in Gravataí (RS), the company

abandoned the project after it was unable to secure a modification to the state legislation, and a few months later, it announced the installation of a fulfillment center in Governador Celso Ramos, in the state of Santa Catarina, which granted the special tax regime required by the company (Comunello, 2020).[1] In this sense, the phenomena of tax wars and urban competition emerge as mechanisms activated by these global actors to obtain benefits in their occupation of the territory (Yassu, 2021).

In the intersection of land availability, territorial fluidity conditions, the role of specialized real estate, and state incentives, some cities have emerged as hubs for Brazilian e-commerce storage activities, effectively becoming "warehouse cities" (Diniz and Gonçalves, 2022). The textbook case is the municipality of Cajamar, located in the São Paulo Metropolitan Area, which is intersected by the Anhanguera and Bandeirantes highways. Thanks to its location, the availability of land with easy negotiation, and fiscal incentives, it has attracted investments from global logistics real estate actors such as Prologis and GLP, becoming the epicenter of Brazilian e-commerce (Yassu, 2022). Amazon operates five fulfillment centers in the municipality, while Mercado Livre operates three.

Warehouse-cities and large-scale distribution centers are the clearest material expression of e-commerce platforms. On the other hand, the pressure for time and the need for proximity to the consumer have led to the introduction of a new distribution layer (Aljohani & Thompson, 2016), with smaller structures such as consolidation centers or last-mile hubs, located closer to inner city centers or medium-sized cities. Their function is to channel large shipments from major distribution centers to their urban destinations. In this sense, as we will see, large metropolises are teeming with e-commerce sorting centers located in small warehouses, scattered across the territory, from where delivery drivers depart in vans, cars, or motorcycles for their daily delivery routes. These smaller structures allow large e-commerce retailers to have an ever-increasing reach and are evidence of an increasingly "logistified" urban fabric.

The last-mile delivery service

From the moment a product is purchased through a platform, a series of logistical processes unfold until the order is finally delivered to the consumer, usually at their home. Last mile logistics operations – which take place between the storage facility and the place of delivery – involve more than the mere transportation of packages to their destinations. To optimize the delivery process, packages often go through consolidation and sorting stages at intermediate logistics centers, where loads are transferred between vehicles or between modes of transportation.

There are multiple models of operation on the last mile. Distribution networks can vary in complexity and in the degree to which they are outsourced by companies (Janjevic & Winkenbach, 2020). The design of Amazon and Mercado Livre's distribution networks in Brazil also involves different delivery models. Some deliveries are handled directly by the retailers

themselves, while others are outsourced to carriers or to the national postal service (Correios). Some shipments are dispatched directly from fulfillment centers to the delivery point, while others pass through intermediate facilities.

While public postal services continue to be used in Brazil and around the world by major electronic retailers, especially to reach remote and less densely populated regions, there has been a deliberate effort by these companies to become less dependent on national postal services (Salomão, 2020). This effort involves both the development of their own logistics network and the outsourcing of deliveries to private carriers.

In recent decades, there has been significant growth in the number of logistics service providers across the board, as well as in the specific segment of urban parcel deliveries, which includes e-commerce. Until the 1990s, these activities were carried out almost exclusively by the national postal service (Cruz, W., 2021). However, e-commerce has driven the expansion of private sector involvement in this segment, which now includes both small and medium-sized carriers operating in regional and local markets, and large logistics operators that, in addition to transportation, also provide integrated logistics services such as cargo management and warehousing.

Although there are major logistics operators in last-mile delivery, the urban express delivery market is far more competitive than that of e-commerce retail, being made up of a large number of companies. Road freight transport, when considered as a whole, is composed of an upper circuit – formed by logistics operators and large carriers – and a lower circuit – formed by small transportations companies and independent drivers (Huertas, 2013). In this sense, also in urban delivery services, large logistics operators may establish partnerships with local and regional carriers, as well as with independent drivers, to carry out deliveries. That is, in order to increase their territorial reach, platforms activate both upper and lower circuits of the urban transportation sector.

Major e-commerce retailers work in partnership with a wide range of transport companies and logistics operators. Among them, we highlight three that operate on a national scale and are among the most frequently used in Brazilian e-commerce: Total Express, Jadlog, and Loggi (ABComm, 2019). According to information made available by the companies themselves on their official websites, all three operate their own logistics networks through which deliveries are carried out. When Amazon or Mercado Livre selects one of these companies to handle a delivery, the orders are forwarded to the carrier, which receives the goods at its own logistics centers, where they are processed and prepared for shipment – a process that may involve passing through additional sorting centers before final delivery.

On the other hand, the need for greater control over delivery times and the reduction of shipping costs have led Amazon to develop its own delivery service, gradually taking over

a growing share of the logistics management of the goods sold on its platform. In Brazil, the company launched Amazon Logistics in 2021, beginning to handle part of its deliveries directly, in competition with the partner carriers it had traditionally worked with (Ventura, 2020).

Amazon deliveries, however, are not carried out by the company itself, but rather by a network of small carriers that deliver on its behalf. For this, the company relies on so-called Delivery Service Partners (DSPs). This program encourages the creation of small partner businesses to manage a team of delivery drivers. Each DSP is expected to oversee between 20 and 40 motorcycles and vans, and between 40 and 100 affiliated delivery workers. None of these drivers are directly employed by Amazon; instead, they are contracted by the Amazon partner company. Under this model, Amazon performs its deliveries through a subcontracting system, delegating the execution of logistics operations to these commercial partners (Amazon Brasil..., 2023).

Mercado Livre, in turn, manages its deliveries through its logistics arm, Mercado Envios. Initially, the service was limited to generating shipping labels for deliveries via national postal service. Over time, it was expanded to include private carriers. In its most comprehensive version, Mercado Envios takes over the entire delivery process, issuing the shipping label for the seller and, depending on the logistics model adopted, automatically selecting the carrier based on origin and destination, shipping cost, and delivery time (Developers Mercado Libre, 2020). In these cases, Mercado Livre relies on its network of partner carriers, both for transportation between logistics centers and for last-mile deliveries.

In addition to its network of partner carriers, since 2021 Mercado Livre has also started hiring independent drivers for express deliveries, following a model similar to ride--hailing or food delivery platforms like Uber and iFood. This service is called Mercado Envios Extra – an app that allows autonomous drivers to sign up and deliver packages (Góis, 2021). In the app, orders are grouped into routes that are made available to drivers, who can choose whether or not to accept them. However, these couriers are not guaranteed a minimum number of routes, working solely on a demand-driven basis.

This method of mobilizing a large number of workers for last-mile delivery has become increasingly common in e-commerce. Mercado Envios Extra is inspired by Amazon Flex – a program that has been operating in the United States since 2015 but has yet to be launched in Brazil. Other carriers active in e-commerce, such as Loggi, also use the on-demand service model with freelance drivers. This model inserts last-mile delivery work into broader processes of uberization and platformization of labor, through which formal employment contracts are replaced by voluntary adhesion agreements, in which drivers are regarded merely as platform users who agree to its terms and conditions[2] (Abílio et al., 2021; Fernandes et al., 2023).

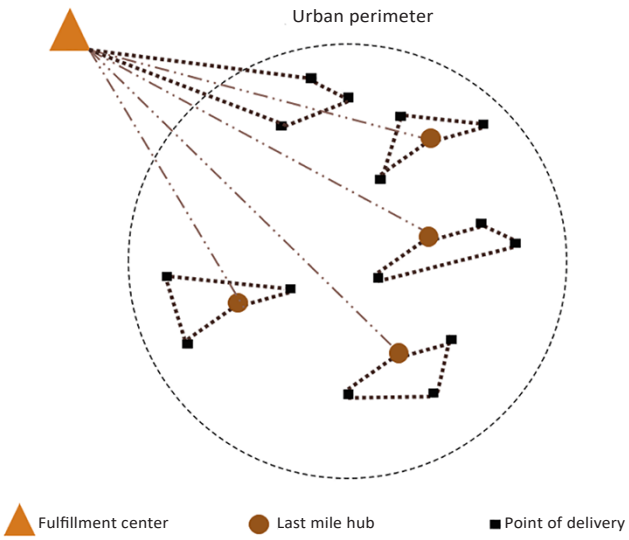
On-demand labor hiring, as well as the subcontracting of small transport companies to carry out deliveries on behalf of Amazon, illustrates what Mark Graham (2020) calls the "conjunctural geographies" of platform urbanism. According to the author, platforms are simultaneously embedded in and disembedded from the territory: while they mediate spatial interactions with material manifestations, they can also evade local responsibilities by operating at different scales. Although e-commerce platforms have a much more evident material presence and are more deeply embedded in the territory than other platforms – especially regarding the operation of large-scale storage facilities – the execution of last-mile deliveries reflects a detachment from the local workforce mobilized for such operations. In this sense, even as major e-commerce platforms increasingly control all stages of their logistics chain, reaching down to the last mile, they do so through the subcontracting of a lower circuit, which allows them to avoid directly engaging in the exploitation of labor.

Distribution networks on the last mile

Regardless of the governance model of transportation services or the labor regime adopted in last-mile delivery, the processing of orders involves different physical structures with specific spatial configurations. The architecture of the distribution systems of major e-commerce retailers – as well as that of their third-party logistics providers – follows a multi-level model. That is, in addition to storage infrastructures, intermediate layers are added between fulfillment centers and the final destinations of orders. In most cases, the delivery route now includes facilities closer to customers, where packages are sorted and dispatched for last-mile delivery.

There is no uniform terminology in the literature – or even among e-commerce retailers – for these facilities, which may be referred to as urban logistics spaces, urban consolidation centers, delivery stations, micro-distribution centers, last-mile hubs, among others (Cruz, L., 2021). These centers serve the purpose of optimizing product circulation by reducing delivery routes and centralizing delivery itineraries within a specific area. These last-mile hubs act as transshipment platforms that receive packages from larger logistics centers via cargo trucks and consolidate them into smaller shipments to be picked up by drivers of lighter vehicles, who then complete deliveries in urban areas (Flores & Silva, 2017). Because they aren't storage infrastructures and serve smaller areas, last-mile hubs do not require the same operational specifications as fulfillment centers – that is, they do not need to be housed in large warehouses with high ceilings. They are typically located in small warehouses or in smaller modules of larger warehouses and can be situated in denser areas

Figure 1 - Diagram of the last-mile distribution process



Source: adapted from Flores e Silva (2017).

within the urban perimeter. Figure 1 illustrates the last-mile distribution process, in which urban logistics centers constitute a second layer.

Amazon refers to these intermediate facilities as delivery stations. The company's first delivery station in Brazil was established in the Vila Anastácio neighborhood, in the Lapa district, located in the western zone of the city of São Paulo. The facility is located within the Espace Center logistics condominium, which lies along the Marginal Tietê and near the bridges that provide access to the Anhanguera and Bandeirantes highways. This location ensures good connectivity with Amazon's fulfillment centers in Cajamar. The Espace Center covers a total area of 54,000 square meters, divided into 29 warehouse modules. According to the international consulting firm MWPVL, Amazon's delivery station occupies approximately 5,800 square meters of this space.

The flow of goods for delivery in São Paulo works as follows, according to a report by Valor based on statements by Amazon's country manager in Brazil, Daniel Mazini:

> With the delivery stations, a truck carrying parcels destined for the city of São Paulo, for example, transports the items from the company's fulfillment center in Cajamar (SP) to a delivery station in the Lapa neighborhood, in the western part of the capital. "From Lapa, I can deliver to the entire East and North zones much faster, instead of waiting for the carrier or our logistics to pick up the parcels in Cajamar." explains Mazini (Braun, 2023, author's translation).

Amazon maintains at least two other delivery stations in the São Paulo Metropolitan Region, in addition to several others in metropolitan areas such as Belo Horizonte, Rio de Janeiro, Brasília, Recife, Salvador, João Pessoa, Curitiba, Goiânia, and Vitória. The company's locational strategy aims to bring operations closer to consumers, especially in large metropolitan areas, by adding an intermediate distribution layer. In cities where Amazon has storage facilities, the intermediate logistics centers are usually located closer to the urban core, often within the host municipality itself, though frequently positioned on the edge of the urbanized area. In metropolitan areas where the company does not have storage infrastructure, the installation of delivery stations increases the reach and capillarity of its operations.

Mercado Livre, in turn, has a larger and more complex logistics network. In addition to its fulfillment centers, the company operates three different types of facilities that are part of the last mile delivery: the so-called cross-docking centers, various service centers (or delivery centers), and a sortation center. The cross-docking centers occupy large areas and serve as major hubs for processing and preparing parcels from third-party sellers whose goods are not stored by Mercado Livre. The sortation center, opened in 2022 in the municipality of Cajamar, is responsible for consolidating shipments from storage facilities and sorting them by destination, dispatching them to other logistics facilities rather than directly to final delivery.

The delivery centers, in turn, are effectively the company's last-mile hubs – logistics facilities that receive parcels from fulfillment centers as well as from cross-docking centers, having passed through the sortation center or not, and then break them down into smaller shipments to be picked up by drivers for delivery along predefined routes. Mercado Livre operates over 100 delivery centers, all managed in partnership with third-party logistics providers such as CEVA Logistics and DHL Supply Chain. Unlike Amazon's logistics network, which is concentrated in major metropolitan areas, Mercado Livre's network is much more widespread and dispersed across the national territory, although nearly half of its delivery centers are located in the state of São Paulo, according to data we collected from the registration records of both companies at Jucesp.

The partner carriers of both companies also operate their own logistics networks, distributed throughout Brazil. Total Express operates 16 hubs and regional networks, in addition to more than 120 last-mile delivery bases. Loggi, in turn, operates 9 distribution centers and at least 84 agencies across the country. Jadlog has a network of at least 354 operational centers throughout the national territory, organized under a franchise model.

In general, the location of delivery stations, last-mile hubs, and agencies closely follows the distribution of the Brazilian population. Regions with higher population density tend to concentrate a greater number of these logistics facilities. A significant portion

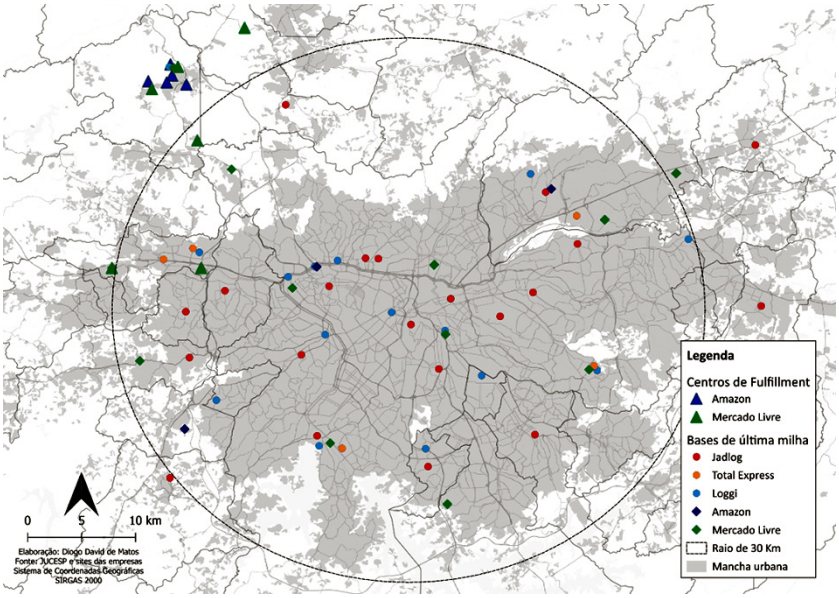
of last-mile infrastructure is located in large metropolitan areas. Based on information from MWPVL, Amazon's Delivery Stations average 5,644 square meters, roughly one-tenth the size of its fulfillment centers. Due to their smaller scale, these facilities are often found in more central areas of cities, facilitating consumer access and reducing delivery times.

In the case of the São Paulo Metropolitan Region, the 30-kilometer radius around the city center is the most valued area by the logistics real estate market, precisely because of the competitive advantages it offers to e-commerce, due to the possibility of making faster deliveries. According to Revista Buildings, the rental price per square meter within the 30-kilometer radius was R$ 24.48 in 2022, while in the 30 to 60-kilometer radius it was R$ 21.44, and in areas beyond 60 kilometers, R$ 19.81 (Quanto..., 2022). The 30-kilometer radius is the most coveted area for the installation of last-mile hubs, considering that these facilities can occupy smaller spaces.

We mapped the distribution of e-commerce logistics facilities in the São Paulo Metropolitan Region (RMSP), considering those operated by Amazon, Mercado Livre, and the three logistics service providers mentioned earlier. We observed that the main storage facilities, i.e., fulfillment centers, are mostly located outside the 30-kilometer radius and outside the urbanized area of the São Paulo metropolis, toward the northwest corridor, specifically in the municipalities of Cajamar and Franco da Rocha. In contrast, the vast majority of last-mile hubs are located within the 30-kilometer radius and are dispersed either within or at the edge of the urbanized area. In the case of Amazon, whose fulfillment centers are all located in the municipality of Cajamar, the company's delivery stations are located in the municipality of Guarulhos – on the northeastern axis of the capital –, in Embu das Artes – on the western axis –, and in the Lapa district – closer to the central area of São Paulo. In addition to these, there are also Amazon delivery stations operated by other companies in central urban areas.

Mercado Livre, in turn, also operates last-mile hubs in municipalities that form the immediate periphery of São Paulo, such as Guarulhos, São Bernardo do Campo, and Cotia, along the northeastern, southern, and western corridors of the city. However, the company also maintains five last-mile hubs within the municipality of São Paulo itself, some of which are located less than five kilometers from Praça da Sé, the city's geographic center. Although these facilities are located in more central areas of the metropolis, they are not situated in residential or commercial districts, but primarily in traditional freight and distribution zones, including former industrial areas or designated industrial parks. Examples include Mercado Livre's last-mile hub in Vila Leopoldina – home to the Ceagesp wholesale market (Companhia de Entrepostos e Armazéns Gerais de São Paulo), the base located in the Mooca district – a historically industrial part of the city –, and the one in the São Lourenço Industrial Park, in the city's eastern zone.

Figure 2 – Spatial Distribution of E-commerce Logistics Facilities in the São Paulo Metropolitan Region – 2023



Source: own elaboration using data from IBGE, Jucesp, and company websites.

The last mile bases of Total Express, the agencies of Loggi, and the operation centers of Jadlog have distinct characteristics from the delivery stations of Amazon and Mercado Livre. Being smaller companies with a lower daily volume of shipments, these facilities can occupy smaller warehouses, often located in more central areas and, in some cases, even in residential neighborhoods. The distribution of their facilities follows a more dispersed and homogeneous pattern within the urbanized area of the metropolis, although there are some clusters of warehouses at certain points, such as the São Lourenço Industrial Park and near the Santo Amaro neighborhood in the South Zone.

Concluding remarks

According to Altenried (2019), last-mile delivery lies at the intersection of the expansion of logistics as the rationale for managing flows and the rise of digital platforms, which are reshaping patterns of production, work, and consumption. E-commerce platforms aim to expand their control over the flow of goods by investing in the development of their own distribution networks and offering logistics services. In the case of transportation services, however, these companies maintain a stance of detachment from the local context and the exploitation of labor, resorting to the subcontracting of small logistics operators and autonomous drivers for delivery operations.

When discussing distribution activities before the invention of the container, Levinson (2006) describes freight transportation as an urban industry, composed of swarms of workers who would carry or drag cargo through the streets and ports, often on their own backs. Despite the immense technological advances, both in transportation and in information and communication technologies, which now allow the coordination of multiple and complex transfers and routes of goods, the e-commerce delivery industry today still shares similarities with Levinson's description from the 1950s. It is an urban industry, whose most visible face consists of crowds of vans, cars and motorcycles loaded with packages, crossing large cities daily, following delivery routes designed by algorithms to be completed in the shortest time possible.

Anchored in large fulfillment centers located in vast logistics condominiums on the outskirts of metropolitan areas and along major roadways, the e-commerce logistics network extends through smaller facilities strategically located closer to consumers and, by extension, to the central areas of cities. As e-commerce grows, the demand for cargo spaces within the metropolis increases, and the logistics real estate – in the form of large developers and investment funds – starts to compete with other urban space uses. Similarly, the volume of commodity flows increases, and the roads of major cities are being overtaken by delivery vehicles, which circulate and park throughout the city.

Last-mile delivery logistics blurs the distinction between logistical spaces and urban centers: the entire city becomes a 'logistical system' (Cuppini, 2018). An increasingly logistics-oriented urban fabric takes shape, one that provides greater fluidity and flexibility for capital and creates opportunities for an ever-faster realization of value. The intensification of e-commerce and the spread of its infrastructures throughout the city are part of the development of a logistical urbanism driven by the interests of capital under the dominance of large digital platforms. However, this phenomenon is still very recent and is still unfolding, presenting extensive opportunities for further research. We hope this paper helps shed light on the last-mile logistics infrastructure of e-commerce and its densification within contemporary cities – an issue that has received little attention in Brazilian scholarship

[I] https://orcid.org/0009-0001-0493-9483
Pesquisador autônomo. Rio de Janeiro, RJ/Brasil.
diogo.matos3@gmail.com

Notes

(1) The state legislation required that sellers who sold products on the platform have branches in the state of Rio Grande do Sul, which would pose an obstacle to the operation of Mercado Livre's marketplace. The Secretariat of Finance of Santa Catarina allowed sellers from the entire South region to store and ship their goods from the Santa Catarina fulfillment center without the need to open a branch in the state.

(2) Delivery workers have some degree of autonomy over their schedules and strategies, but they bear all the costs and risks associated with their work and with maintaining their own means of production, appearing as “entrepreneurs of themselves.” At the same time, however, they are subject to the management of platform algorithms, which centralize control over route distribution, number of deliveries, and fare rates. This creates a form of subordinated self-management (Abílio, 2020), which seems to contribute to the processes of labor informalization and precarization.

References

ABCOMM (2019). *Pesquisa: Logística no E-commerce Brasileiro 2019.* Disponível em: https://abcomm.org/noticias/pesquisa-logistica-no-e-commerce-2019/. Acesso em: 10 nov. 2023.

ABÍLIO, L. C. (2020) Plataformas digitais e uberização: a globalização de um Sul administrado? *Revista Contracampo*, v. 39, n. 1.

ABÍLIO, L. C.; AMORIM, H.; GROHMANN, R. (2021). Uberização e plataformização do trabalho no Brasil: conceitos, processos e formas. *Sociologias,* v. 23, pp. 26-56.

ALIMAHOMED-WILSON, J. (2022). "The E-Logistics Revolution Amazon, Labor, and the Future of Logistics Work". In: NESS, I. (ed.). *Platform labour and global logistics: a research companion.* Londres, Routledge.

ALJOHANI, K.; THOMPSON, R. G. (2016). Impacts of logistics sprawl on the urban environment and logistics: Taxonomy and review of literature. *Journal of Transport Geography*, v. 57, pp. 255-263.

ALLEN, W. B. (1997). The Logistics Revolution and Transportation. The *Annals* of the American Academy of Political and Social Science, v. 553, pp. 106-116.

ALTENRIED, M. (2019). On the last mile: logistical urbanism and the transformation of labour. *Work Organisation, Labour & Globalisation,* v. 13, n. 1, pp. 114-129.

ANDERSON, W. P.; CHATTERJEE, L.; LAKSHMANAN, T. R. (2003). E-commerce, Transportation, and Economic Geography. *Growth and Change*, v. 34, n. 4, pp. 415-432.

AMAZON BRASIL expande programa de logística de última milha e desenvolvimento de empreendedores de entrega em Indaiatuba, SP (2023). *Logweb*, 4 ago. Disponível em: https://www.logweb.com.br/amazon-brasil-expande-programa-de-logistica-de-ultima-milha- e-desenvolvimento-de-empreendedores-de-entrega-em-indaiatuba-sp/. Acesso em: 23 nov 2023.

BONACICH, E.; WILSON, J. B. (2008). *Getting the goods: Ports, labor and the logistics revolution*. Ithaca, Cornell University Press.

BRASIL (2023). Ministério do Desenvolvimento, Indústria, Comércio e Serviços. Observatório do Comércio Eletrônico Nacional. [Brasília]: MDIC. Disponível em: https://www.gov.br/mdic/pt-br/assuntos/observatorio-do-comercio-eletronico. Acesso em: 13 nov 2023.

BRAUN, D. (2023). Amazon amplia logística e prevê fim de ano mais forte. *Valor Econômico*. Disponível em: https://valor.globo.com/empresas/noticia/2023/11/08/amazon-amplia-logistica-e-preve-fim-de-ano-mais-forte.ghtml. Acesso em: 13 nov 2023.

CIDELL, J. (2010). Concentration and decentralization: The new geography of freight distribution in US metropolitan areas. *Journal of Transport Geography, Tourism and climate change,* v. 18, n. 3, pp. 363-371.

COMUNELLO, P. (2020). Mercado Livre adia operação de centro de distribuição no Rio Grande do Sul. *Jornal do Comércio*. Disponível em: https://www.jornaldocomercio.com/_conteudo/economia/2020/02/726992-mercado-livre-suspende-obras-do-centro-de-distribuicao-no-rio-grande-do-sul.html. Acesso em: 4 dez 2024.

COWEN, D. (2014). *The deadly life of logistics: mapping violence in global trade*. Minneapolis, University of Minnesota Press.

CRUZ, L. T. K. S. (2021). *Entre o físico e o virtual: transformações do varejo na era do e-commerce*. Trabalho final de graduação. São Paulo, Universidade de São Paulo.

CRUZ, W. L. DE M. (2021). Crescimento do e-commerce no Brasil: desenvolvimento, serviços logísticos e o impulso da pandemia de Covid-19. *GeoTextos*, v. 17, n. 110, pp. 67-88.

CUPPINI, N. (2018). A cidade enquanto sistema logístico. *Lugar Comum – Estudos de mídia, cultura e democracia*, n. 52, pp. 299-310.

DABLANC, L.; RAKOTONARIVO, D. (2010). The impacts of logistics sprawl: How does the location of parcel transport terminals affect the energy efficiency of goods' movements in Paris and what can we do about it? *Procedia - Social and Behavioral Sciences, The Sixth International Conference on City Logistics,* v. 2, n. 3, pp. 6087-6096.

DANYLUK, M. (2018). Capital's logistical fix: Accumulation, globalization, and the survival of capitalism. *Environment and Planning D: Society and Space,* v. 36, n. 4, pp. 630-647.

_____(2021). Supply-Chain urbanism: constructing and contesting the logistics city. *Annals* of the American Association of Geographers, v. 111, n. 7, pp. 2149-2164.

DEVELOPERS MERCADO LIBRE (2020). Webinar de Logísticas de Mercado Libre. *YouTube*, 17 dez. Disponível em: https://www.youtube.com/watch?v=t5Ob9Zaw1yw&t=1s&ab_channel=DevelopersMercadoLibre. Acesso em: nov 2023.

DICKEN, P. (2011). *Global shift: mapping the changing contours of the world economy.* Nova York, The Guilford Press.

DINIZ, N.; GONÇALVES, P. P. (2022). As cidades dos galpões: dinâmicas e contradições da urbanização. *e-Metropolis*, v. 13, n. 48.

FERNANDES, B. S.; PEREGALLI, A.; CANETTIERI, T. (2023). Costurando a cidade: crise do capital, urbanização logística e entregadores de aplicativo. *Cadernos Metrópole,* v. 26, pp. 97-121.

FINATTI, R. (2011). *Condomínios empresariais nas áreas metropolitanas do Estado de São Paulo: produção imobiliária e localização da indústria*. Dissertação de mestrado. São Paulo, Universidade de São Paulo.

FLORES E SILVA, C. (2017). *Last Mile Delivery em Favelas: um estudo explicativo com empresas brasileiras*. Dissertação de mestrado. São Paulo, Insper.

GÓIS, A. C. (2021). Veja como se cadastrar e utilizar o Mercado Envios Extra. *TecMundo*, 11 nov. Disponível em: https://www.tecmundo.com.br/mercado/228554-veja-cadastrar-utilizar-mercado-envios-extra.htm. Acesso em: nov 2023.

GRAHAM, M. (2020). Regulate, replicate, and resist – the conjunctural geographies of platform urbanism. *Urban Geography*, v. 41, n. 3, pp. 453-457.

HARVEY, D. (1992). *Condição pós-moderna*. São Paulo, Loyola.

HESSE, M. (2008). *The City as a Terminal: the urban context of logistics and freight transport.* Burlington, Ashgate.

HESSE, M.; RODRIGUE, J. P. (2004). The transport geography of logistics and freight distribution. *Journal of Transport Geography*, v. 12, n. 3, pp. 171-184.

HUERTAS, D. M. (2013). *Território e circulação: transporte rodoviário de carga no Brasil.* Tese de doutorado. São Paulo, Universidade de São Paulo.

JANJEVIC, M.; WINKENBACH, M. (2020). Characterizing urban last-mile distribution strategies in mature and emerging e-commerce markets. *Transportation Research Part A: Policy and Practice,* v. 133, p. 164-196.

JESUS, F. S. (2023). *As firmas globais e nacionais no comércio eletrônico brasileiro: concorrência, estratégias territoriais e disputas*. Dissertação de mestrado. Florianópolis, Universidade Federal de Santa Catarina.

KENNEY, M.; ZYSMAN, J. (2016). The Rise of the Platform Economy. *Issues in Science and Technology*, v. 32

LEVINSON, M. (2006). *The Box: how the shipping container made the world smaller and the world economy bigger*. United Kingdom, Princeton University Press.

LOEWEN, K. (2018). Reproducing disposability: unsettled labor strategies in the construction of e-commerce markets. *Environment and Planning D: Society and Space*, v. 36, n. 4, pp. 701-718.

MALECKI, E. J.; MORISET, B. (2008). *The digital economy: business organization, production processes and regional developments.* Nova York, Routledge.

MARX, K. (2011). *Grundrisse: manuscritos econômicos de 1857-1858: esboços da crítica da economia política*. São Paulo, Boitempo.

_____ (2015). *O Capital - Crítica da economia política* [Livro II]. São Paulo, Boitempo.

MOODY, K. (2020). "Amazon: Context, Structure and Vulnerability". In: ALIMAHOMED-WILSON, J.; REESE, E. (ed.). *The Cost of Free Shipping: Amazon in the Global Economy.* Londres, Pluto Press.

NEGREY, C.; OSGOOD, J. L.; GOETZKE, F. (2011). One package at a time: the distributive world city. *International Journal of Urban and Regional Research,* v. 35, n. 4, pp. 812-831.

QUANTO mais perto de São Paulo, mais caro; performance por raios do mercado logístico. (2022). Revista *Buildings.* Disponível em: https://revista.buildings.com.br/quanto-mais-perto-de-sao-paulo-mais-caro-performance-por-raios-do-mercado-logistico/. Acesso em: 21 dez 2023.

RODRIGUE, J.-P. (2020a). *The geography of transport systems*. Nova York, Routledge.

_____ (2020b). The distribution network of Amazon and the footprint of freight digitalization. *Journal of Transport Geography,* v. 88, p. 102825.

SALOMÃO, K. (2020). Gigantes como Mercado Livre e Magalu driblam a dependência dos Correios*. Exame*. Disponível em: https://exame.com/negocios/gigantes-como-mercado-livre-e-magalu-driblam-a-dependencia-dos-correios/. Acesso em: 15 jan 2024.

SENGPIEHL, C. et al. (2008). The emergence of logistics cities: Conceptual model. *Journal of Transport and Supply Chain Management,* v. 2.

SRNICEK, N. (2017). *Platform Capitalism*. Cambridge, Polity Press.

UNCTAD (2021). Estimates Of Global E-Commerce 2019 And Preliminary Assessment Of Covid-19 Impact On Online Retail 2020. Disponível em: https://unctad.org/system/files/official-document/tn_unctad_ict4d18_en.pdf. Acesso em: 15 jan 2024.

VENCESLAU, I. (2023). *Espaço geográfico e economia digital: usos do território brasileiro para o comércio eletrônico*. Tese de Doutorado. São Paulo, Universidade de São Paulo.

VENTURA, F. (2020). Exclusivo: Amazon vai lançar serviço próprio de entregas no Brasil. *Tecnoblog.* Disponível em: https://tecnoblog.net/noticias/2020/12/09/exclusivo-amazon-prepara-servico-proprio-de-entregas-no-brasil/. Acesso em: 14 nov 2023.

WINKENBACH, M.; JANJEVIC, M. (2018). "Classification of Last-Mile Delivery Models for e-Commerce Distribution: a global perspective". In: TANIGUCHI, E.; THOMPSON, R. G. (ed.). *City Logistics 1: New Opportunities and Challenges.* Londres, John Wiley & Sons.

YASSU, A. M. DA S. (2021). *A reestruturação imobiliária e os arranjos escalares na (re)produção da metrópole: o caso de Cajamar-SP*. Rio de Janeiro, Letra Capital.

_____ (2022). O galpão logístico e a financeirização urbana: da flexibilidade produtiva ao imobiliário. *Cadernos Metrópole*, v. 24, n. 53, pp. 257-281.

ZIONI, S. M. (2009). *Espaços de carga na Região Metropolitana de São Paulo.* Tese de doutorado. São Paulo, Universidade de São Paulo.

ZOOK, M. (2006). "The New Old Thing: e-commerce geographies after the dot.com boom". In: DANIELS, P. W. et al. (ed.). *Geographies of the new economy*. Nova York, Routledge.

ZUBOFF, S. (2018). "Big other: capitalismo de vigilância e perspectivas para uma civilização de informação". In: BRUNO, F.; CARDOSO, B.; KANASHIRO, M.; GUILHON, L.; MELGAÇO, L. (org.). *Tecnopolíticas da vigilância: perspectivas da margem*. São Paulo, Boitempo.

Authorship contribution
Diogo David de Matos: investigation/research; data curation; writing-original draft; review and editing.

Editors: Lucia Bógus e Luiz César de Queiroz Ribeiro
Dossier organizers: Luiz César de Queiroz Ribeiro e Nelson Diniz

Translation: this article was translated from Portuguese to English by the author himself.

Received: December 9, 2024
Approved: February 7, 2025