

# Urban delivery, the Covid-19 pandemic and changes in land use: evidence of the territorial dynamics of the non-residential real estate sector in Belo Horizonte





*Entrega urbana, pandemia de Covid-19 e mudanças no uso do solo: evidências da dinâmica territorial do setor imobiliário não residencial em Belo Horizonte*

Isabela Kopperschmidt de Oliveira<sup>1</sup>, Leise Kelli de Oliveira<sup>1,2</sup>, Maria Leonor Alves Maia<sup>1</sup>, Jorge Luiz dos Santos Júnior<sup>3</sup>

<sup>1</sup>Universidade Federal de Pernambuco, Recife, Pernambuco – Brasil

<sup>2</sup>Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais – Brasil

<sup>3</sup>Patrus Transportes, Contagem, Minas Gerais – Brasil

**contato:** isabela.iko@ufpe.br,  (IKO); leise@etg.ufmg.br,  (LKO); nonamaia@gmail.com,  (MLAM); jorgelsjunior@gmail.com,  (JLSJ)

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**ABSTRACT**

In addition to the observed impacts on urban mobility, urban deliveries have changed the territorial dynamics of the non-residential real estate sector. This paper analyses land-use changes in the non-residential real estate sector caused by urban deliveries in 2020 in the context of the COVID-19 pandemic in Belo Horizonte. Therefore, we used a spatial-temporal approach based on Local Indicators of Spatial Association and the estimation of a geographically weighted regression model. The results showed that the decentralisation of new businesses occurred, and an inverse relationship exists between traditional retail deliveries and online retail deliveries concerning the location of new businesses. Furthermore, the results indicated a change in the territorial dynamics of the non-residential real estate sector, encouraged by urban deliveries. Thus, the master plans must consider urban deliveries as a driving component in urban and transport planning.

**RESUMO**

As entregas urbanas têm alterado a dinâmica territorial do setor imobiliário não residencial, além dos impactos observados na mobilidade urbana. Este artigo analisa as mudanças no uso do solo do setor imobiliário não residencial relacionadas com as entregas urbanas em 2020, no contexto da pandemia da COVID-19, em Belo Horizonte. Para tanto, foi utilizada uma abordagem espacial-temporal baseada nos Indicadores Locais de Associação Espacial e na estimativa de um modelo de regressão geograficamente ponderada. Os resultados permitiram confirmar as hipóteses de que houve descentralização dos novos negócios e que existe uma relação inversa entre as entregas do varejo tradicional e do varejo online para a localização de novos negócios. Ainda, os resultados indicaram evidências da alteração da dinâmica territorial do setor imobiliário não residencial estimulado pelas entregas urbanas. Desta forma, a elaboração/revisão de planos diretores precisa considerar as entregas urbanas como um componente indutor no planejamento urbano e de transporte.



## 1. INTRODUCTION

The COVID-19 pandemic has changed people's lifestyles and interactions with the city. In 2020, working from home became a reality, especially in developed countries (Chernick, Copeland and Reschovsky, 2020), bringing a pattern also observed in Brazil (Filardi, Schmitz and Leal, 2020). According to Hensher, Beck and Wei (2021), working from home is the most effective transport policy since World War II. This change in the working routine made people reconsider their living places (Hart, 2020) and reduced home-work displacements (Hensher et al., 2022). However, the temporary situation due to the COVID-19 pandemic has become permanent for many workers since working from home has been recognised as a viable choice for some fields (Hensher et al., 2022). As a result, the demand for office spaces tend to reduce, and business building tend to change to mix-uses facilities, including housing, shopping, and office units in the same building (Chernick, Copeland and Reschovsky, 2020). The expected consequence is changing the housing pattern location to less-density areas with lower living costs (Carson et al., 2021). Moreover, one possible outcome of this movement is the increase of small businesses in the suburbs and the reduction of the traditional big retailers' operations (ONS, 2020; Carson et al., 2021). In this manner, the effects of the COVID-19 pandemic are not only sanitary and economic but also changed land use.

The COVID-19 pandemic also caused a supply chain disruption (UNCTAD, 2020). E-commerce was the leading solution the companies found to avoid their revenue downfall. The business owners started a campaign to encourage people to use digital channels to improve health security and keep attending to their regular customers as they make new ones (UNCTAD, 2021). According to the OECD (2020), the COVID-19 pandemic consolidated online shops worldwide for various products and services. For example, online retail shops in Brazil increased by 40% between 2019 and 2020 (E-bit, 2022) and 27% between 2020 and 2021 (E-bit, 2022). The rising online retail transactions increased door-to-door deliveries and, consequently, the negative externalities associated with the delivery mode, such as air pollution; noise; congestion; and infrastructural damage in the city (Van Lier, 2014).

Several authors have analysed consumer behaviour regarding shopping habits over the years (Verhallen and Robben, 1994; Shah, Shafir and Mullainathan, 2015; Hamilton et al., 2019). They all observed a positive perception of the product value facing different situations and changes in their shopping priorities. Kumar (2005) analysed consumer habits in crisis periods, like those experienced in the COVID-19 pandemic, and concluded that people's practices change according to their reality. Some people may lean towards impulse shopping and grocery accumulation (Huang et al., 2017; Pantano et al., 2020), while others may count towards purchasing only essential items (Kumar, 2005; Pantano et al., 2020). During the COVID-19 pandemic, these behaviour patterns were observed due to the closing of non-essential shops.

Studies investigating the relationship between traditional retail and online retail are not new in academia, given the importance of understanding consumer behaviour. Burt and Sparks (2003) observed a trend towards the disappearance of physical stores due to changes in the real estate sector related to traditional retail. However, customer

experience and product differentiation were central to consolidating physical stores (Zhang, Zhu and Ye, 2016). However, the COVID-19 pandemic accelerated or modified trends pointed out by these studies, mainly due to restrictive circulation measures. Nanda, Xu and Zhang (2021) showed the importance of new omnichannel practices (marketing strategies used by traditional retail that integrate and explore all the possibilities of interaction between physical stores, virtual stores, and consumers) and new relationships between tenants and property owners. These strategies could keep the physical stores in urban centres with higher land prices.

Therefore, traditional retail finds an opportunity for growth with the increase in working from home, which has caused a change in real estate dynamics as people move their homes to less densely packed locations with less diversity of services. These localities, in turn, require diversification of commerce and services and represent an opportunity to increase online sales supply by traditional retailers.

Based on the above, this paper analyses the changes in land use in the non-residential real estate sector related to the urban deliveries made during 2020 in Belo Horizonte (Brazil). In this study, real estate transactions of a non-residential nature correspond to properties purchased, classified as non-residential, and registered at the Real Estate Registry Office in 2020, provided by Belo Horizonte (2022b). This data was used as a proxy for the location of new businesses in Belo Horizonte. Moreover, urban deliveries are those delivered to traditional retail (business to business - B2B - deliveries) and final customers from e-commerce (business to consumer - B2C- deliveries). The research question we intend to answer is, "to what extent has the increase in urban deliveries contributed to the decentralisation of non-residential real estate transactions?" The research hypotheses are: (i) there was the decentralisation of new businesses caused by urban deliveries; (ii) there is an inverse relationship between B2B deliveries and B2C deliveries for the location of new business. We used spatial-temporal techniques to prove the hypotheses.

The contribution of this article is threefold. First, we identified the spatial pattern of urban deliveries, showing differences between B2B and B2C deliveries. Second, we showed the spatial dependence between non-residential transactions and urban deliveries. Third, we evidenced the importance of considering the freight landscape in urban planning.

This paper has five sections. After this introductory section, section 2 presents the literature concerning freight transport and the real estate sector. Section 3 describes the data regarding urban deliveries and non-residential real estate transactions carried out in 2020 in Belo Horizonte. Section 3 presents the research approach, and the results are presented and discussed in section 4. Finally, section 5 concludes, including suggestions for further research.

## **2. FREIGHT LANDSCAPE AND REAL ESTATE SECTOR**

The real estate sector has influenced freight activities by decentralising logistics facilities (Sakai, Kawamura and Hyodo, 2016; Guerin et al., 2021). In general, the real estate cost has influenced the location decision of the companies (Sakai, Kawamura and Hyodo, 2016; Aljohani and Thompson, 2020; Heitz et al., 2020; Guerin et al., 2021). For

example, In São Paulo Metropolitan Region, Guerin et al. (2021) showed the warehouses are in areas with the lowest real estate cost. Nonetheless, the freight landscape goes beyond the location of warehouses and real estate values.

Rodrigue, Dablanc and Giuliano (2017) defined the spatial patterns of freight activities by freight landscape. According to the authors, freight activities influence the urban landscape due to the location of freight facilities (e.g., warehouses and parking areas). Moreover, the urban landscape affects the freight flows (Rodrigue, Dablanc and Giuliano, 2017) due to the spatial pattern of employment and population (Giuliano, Kang and Yuan, 2018).

Some scholars have analysed the freight landscape. Rodrigue, Dablanc and Giuliano, (2017) identified convergence and divergence from estimating the freight landscape in New York, Los Angeles, Paris and Seoul. Giuliano, Kang and Yuan (2018) detail the freight landscape in Los Angeles, while Sakai et al. (2018) analysed the case of Paris. Rodrigue (2020) extended the concept to e-commerce and investigated the case study of Amazon. Therefore, little is known about the relationship between freight activities and the real estate sector (Giuliano, Kang and Yuan, 2018; Sakai et al., 2018).

E-commerce is changing the traditional retail landscape (Rodrigue, 2020). According to Rodrigue (2020), from the 1980s and 1990s, traditional retail in the U.S. anchored megastores in shopping malls. However, e-commerce is creating a new freight landscape (called the freight landscape of e-commerce) due to the demand and delivery characteristics (Rodrigue, Dablanc and Giuliano, 2017; Rodrigue, 2020);

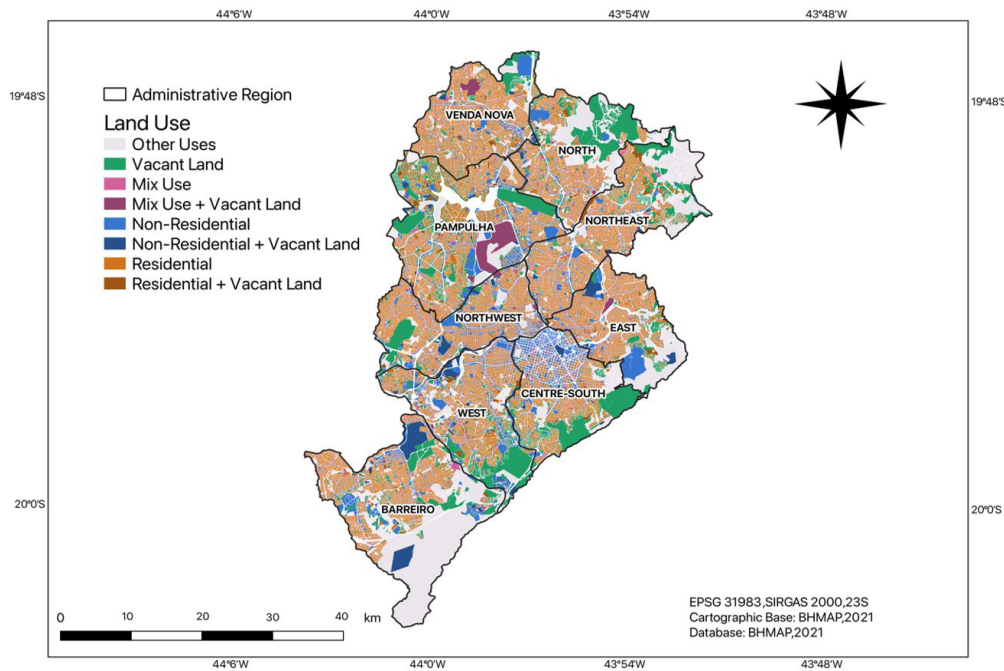
The freight landscape of e-commerce modified the distribution pattern, the real state footprint, and the logistics facilities' location, accelerating vertical integration (Rodrigue, 2020). Moreover, the retail store has become a showroom and a pickup point from e-commerce in this new freight landscape (Rodrigue, 2020).

Thus, e-commerce requires a new real estate footprint (Rodrigue, 2020). Recognising this unique real estate footprint, we analysed the relationship between the spatial pattern of urban deliveries and non-residential real estate transactions in Belo Horizonte.

### 3. DATA DESCRIPTION

This paper focuses on the urban deliveries and non-residential real estate transactions made in Belo Horizonte in 2020. Belo Horizonte is the capital of Minas Gerais and the metropolis of the Belo Horizonte Metropolitan Region. This municipality has the 4th GDP among Brazilian capitals, and the service sector is the one that contributes most to its value (IBGE, 2022). The entire municipality territory is urban, and the commercial activity is intense, constituting an important regional commercial hub and a fashion hub (wholesale and retail) with national projection. Belo Horizonte was planned from a highly functional specialised zoning that was reproduced in its territorial expansion, shown in Figure 1. Most of the territory is designed for residential use (38% of the territory) to house its 2.5 million inhabitants (IBGE, 2022). The non-residential land use (14% of the territory) is concentrated in specific areas, especially north of the central-south region, corresponding to the planned city limits. The mixed-use is even more restricted (7% of the territory), and most of its totality corresponds to the region of the Campus of the Federal University of Minas Gerais and its immediate surroundings. A few of the 487

neighbourhoods have activities and services that go beyond the needs of their population. This spatial configuration is evidence of the function of zoning still inherited by the city's original planning and adopted today in Belo Horizonte.

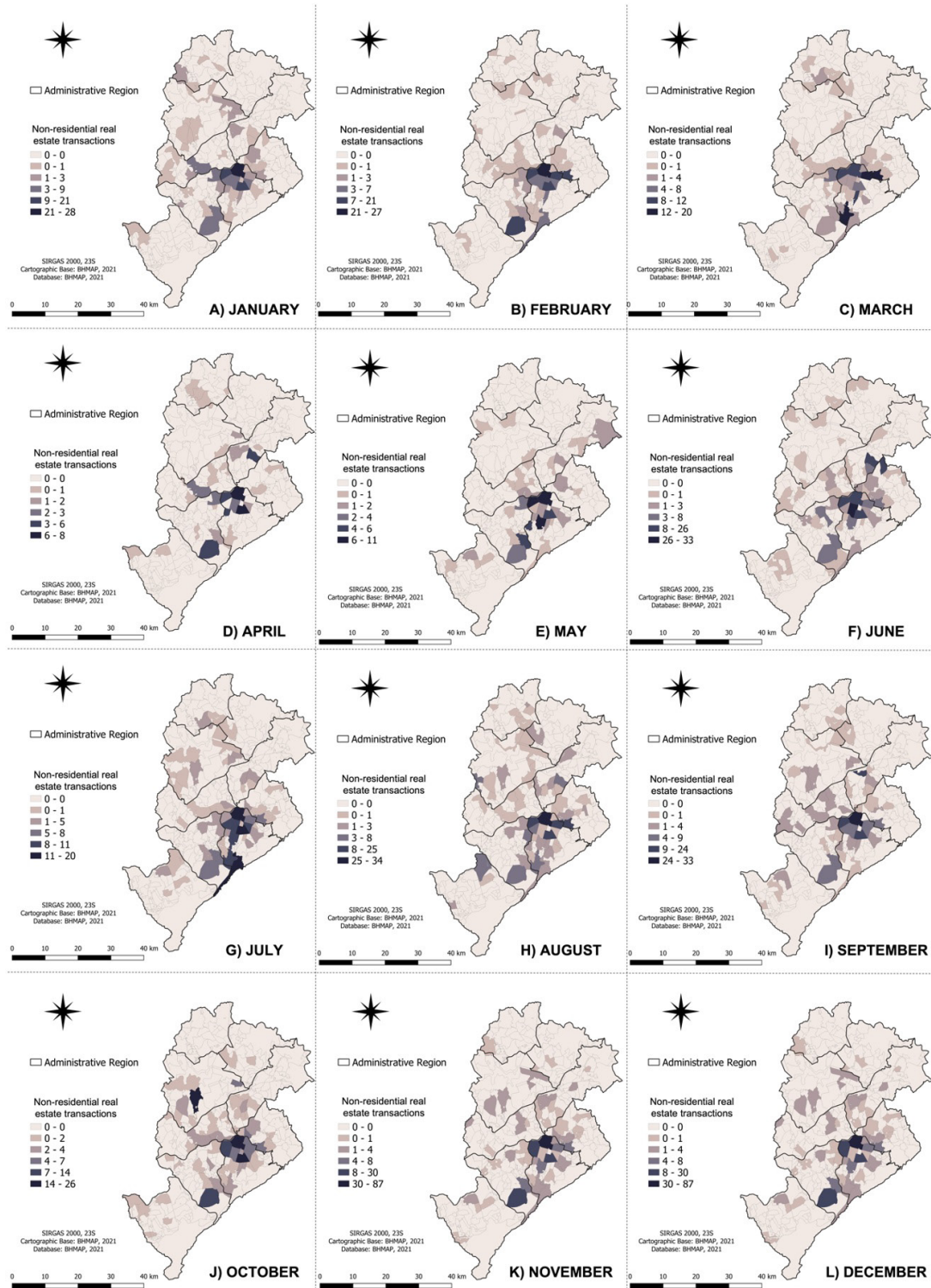


**Figure 1.** Belo Horizonte Land Use [Based on data from BH Map (2022)].

Regarding the COVID-19 pandemic in Brazil, the first case was confirmed on February 28, 2020, and in Belo Horizonte on March 30, 2020. However, the municipality declared community transmission in Belo Horizonte on March 18, 2020, and the lockdown measures adopted on March 19, 2020, suspended all non-essential activities.

With the improvement of the monitored index (transmission index, occupancy of ICU beds, and occupancy of infirmary beds), the municipality reduced the restrictive measures on 25/05/2020 (e.g., return of non-essential shops and services, but with reduced opening hours) and in on 08/06/2020 (expansion the opening hours of non-essential shops and services). However, a new total lockdown was decreed from June 29, 2020, to August 06, 2020, due to the high occupancy of the health system. After August 06, 2020, the non-essential activities were gradually reassumed (Belo Horizonte, 2022a). As a result, Belo Horizonte had one of the most prolonged periods of social isolation among Brazilian cities.

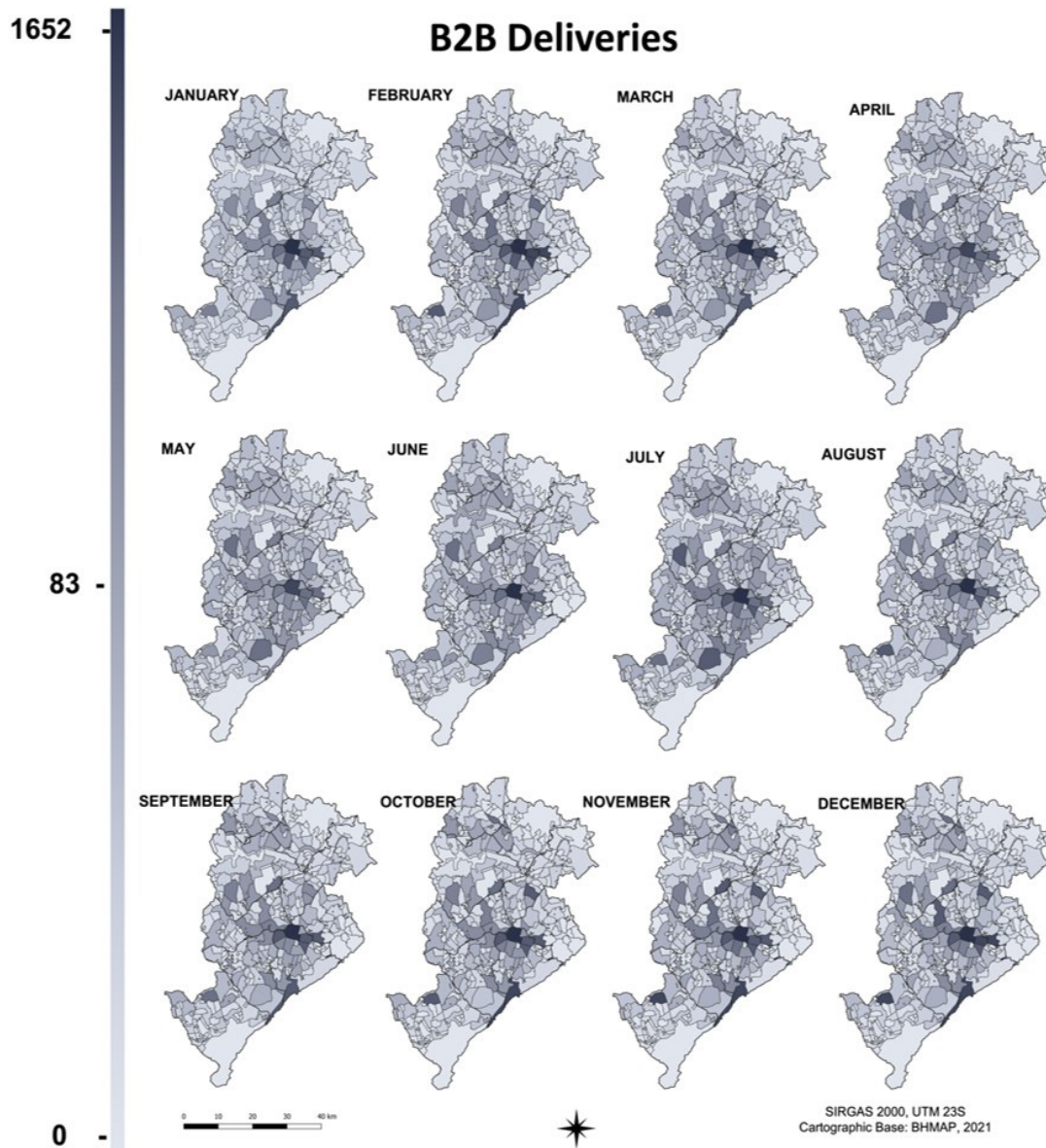
The restrictive measures impacted many businesses, including non-commercial real estate transactions. Figure 2 shows the spatial-temporal evolution of these in Belo Horizonte during 2020. The central area has the highest concentration of these transactions, where non-residential land use is predominant and with greater accessibility to products and services. However, we also observe an increase in these transactions in other regions, especially in the West, East, Northeast, and Centre-South regions. The spatial-temporal evolution allows us to infer that the COVID-19 pandemic impacted the non-residential real estate sector. Moreover, we observed a decentralisation of non-residential transactions to regions other than the central area, where the non-residential activity was historically centralised.



**Figure 2.** Non-residential transactions spatial-temporal evolution during 2020 in Belo Horizonte

Urban delivery data were obtained from a carrier that performed 652,872 deliveries in Belo Horizonte during 2020, with 122,808 B2B deliveries (19%) and 530,064 B2C deliveries (81%). Concerning the B2B deliveries (Figure 3), the spatial-temporal evolution indicates variances in the neighbourhoods over the months, with a concentration in the high-income areas of the Centre-South region. Also, 2% of the districts (10) concentrated

33% of the B2B deliveries; moreover, these ten districts concentrated 40% and 42% of deliveries in November and December, respectively.



**Figure 3.** B2B deliveries spatial-temporal evolution during 2020 in Belo Horizonte

Additionally, 16% of the neighbourhoods received 80% of B2B deliveries, evidencing the concentration of the traditional retail sector, mainly in the central area. The spatial-temporal evolution showed a reduction of B2B deliveries in the first months of the COVID-19 pandemic (March and April). Thus, the retail sector resumed its activities and recovered with the gradual resumption of non-essential activities.

Regarding B2C deliveries (Figure 4), these occurred more frequently, especially between May and August. Also, 15% of B2C deliveries occurred in 10 neighbourhoods (2%); 170 neighbourhoods (35%) received 80% in 2020, demonstrating that B2C deliveries were more territorially diffused than B2B.

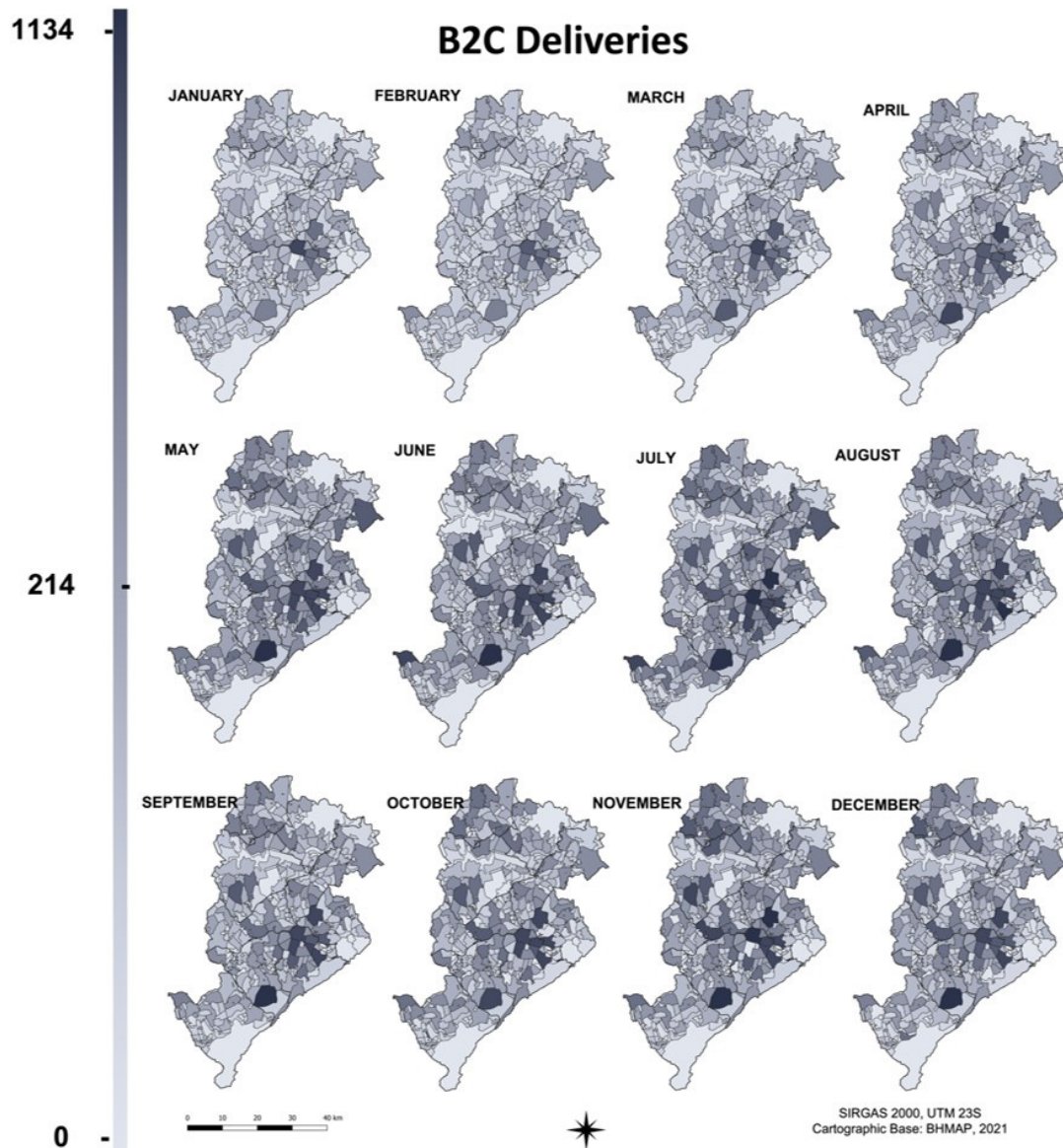


Figure 4. B2C deliveries spatial-temporal evolution during 2020 in Belo Horizonte

The spatial-temporal evolution indicated that B2B and B2C deliveries had different spatial distributions throughout 2020. While B2B deliveries had their peak values between January and March, B2C deliveries increased from April onwards. These data were used for the analysis of this paper, whose method is explained in the next section. It should be noted that obtaining information on establishments closed in 2020 or new businesses opened under rental contracts was impossible. Therefore, the analysis considered only non-residential real estate transactions registered in a property registry office in Belo Horizonte.

#### 4. RESEARCH METHOD

The research method had two steps to analyse the changes in land use related to urban deliveries in the non-residential real estate sector. The first step analysed the spatial



correlation between urban deliveries and non-residential real estate transactions, using Local Indicators of Spatial Association based on the Moran Bivariate Index. In step 2, a geographically weighted regression model was estimated to identify the spatial relationship between urban deliveries and non-residential real estate transactions. These methods are briefly described in the sections below.

#### **4.1. Identifying centralisation/decentralisation patterns with Local Indicators of Spatial Association**

To identify the centralisation/decentralisation of non-residential real estate transactions motivated by urban deliveries, we find clusters based on Local Indicators of Spatial Association (LISA) based on the Bivariate Moran Index. The Moran Bivariate Index measures the degree of correlation between a variable ( $x_i$ ) in a locality  $i$  and the mean value of another variable in its surroundings ( $y_j$ ) (spatial lagged -  $\sum_j w_{ij}y_j$ ) (Anselin, 2022). The LISA identifies patterns in the study area (Anselin, 1995). A typical use of the Bivariate Moran Index is to describe the linear spatial association between two distinct variables and to make spatial-temporal comparisons (Grekousis, 2020). A spatial matrix ( $w_{ij}$ ) describes the spatial attribute and a constant that estimates the variance between the relation of the analysed variable and the average value of the other variable ( $c$ ). This study obtains the spatial matrix from the contiguity of the queen using the municipality neighbourhoods as spatial units.

Another application of the LISA is the identification of local clusters and spatial outliers (Anselin, 1995). The clusters obtained from LISA have five levels: High-High, High-Low, Low-Low, and Low-High are not significant. These levels are based on a previously established significance interval and the relationship between the value obtained by the Moran Bivariate Index in the analysed region and its surroundings. High-High clusters indicate that the examined geographic unit has a high value for the indicator, and its neighbours have a high value. The High-Low clusters suggest that the analysed geographic unit has a high value for the indicator, and its neighbours have a low value. Low-Low clusters indicate that the examined geographic unit and its neighbours have a low value for the indicator. Low-High clusters suggest that the analysed geographic unit has a low value for the indicator, and its neighbours have a high value. Non-significant clusters are those in which the relationship is not within the previously established significance interval of 95%. The Geoda software obtained the clusters (Anselin, Syabri and Kho, 2006).

Identifying the cluster, we examined the hypothesis that there was the decentralisation of new businesses in Belo Horizonte throughout 2020 induced by urban deliveries. Therefore, two situations were analysed: (i) the spatial correlation between non-residential real estate transactions and the lagged B2B deliveries; and (ii) the spatial correlation between non-residential real estate transactions and the lagged B2C deliveries. Data were grouped at the neighbourhood level and temporally grouped by month.

## 4.2. Identifying tendency with Geographically Weighted Regression

A Geographically Weighted Regression (GWR) model was estimated to demonstrate the inverse relationship between B2B deliveries and B2C deliveries for the location of new business. A GWR calculates coefficients for each spatial unit weighted by the spatial fit of the database parameters (Fortheringham, Brunson and Charlton, 2002). From the estimated GWR coefficients, observing patterns and exceptions throughout space is possible. Equation 1 illustrates the general form of the model, where  $(u_i, v_i)$  are the coordinates,  $\beta_k(u_i, v_i)$  is the realisation of the continuous function at point  $i$ ,  $\varepsilon_i$  is the error function,  $x_{ik}$  is the parameter value at the point  $i$ , and  $\beta_0(u_i, v_i)$  is the intercept function (Fortheringham, Brunson and Charlton, 2002)

$$y_i = \beta_0(u_i, v_i) + \sum_k \beta_k(u_i, v_i)x_{ik} + \varepsilon_i \quad (1)$$

Therefore, to investigate the spatial relationship between non-residential real estate transactions (dependent variable) and urban deliveries (B2B and B2C) (independent variables), the data were grouped annually, and each neighbourhood was used as spatial units. The model was estimated using a generalised geographically weighted regression, considering the Gaussian error distribution. Cross-validation was used to find the bandwidth fit for model estimation. The Kernel function generated images with smoother transitions of the estimated coefficients. The “spgwr” package (Bivand, 2022) in the R environment (R-Core Team, 2013) was used to estimate the GWR model, and further information about the model can be found in Fortheringham, Brunson and Charlton (2002).

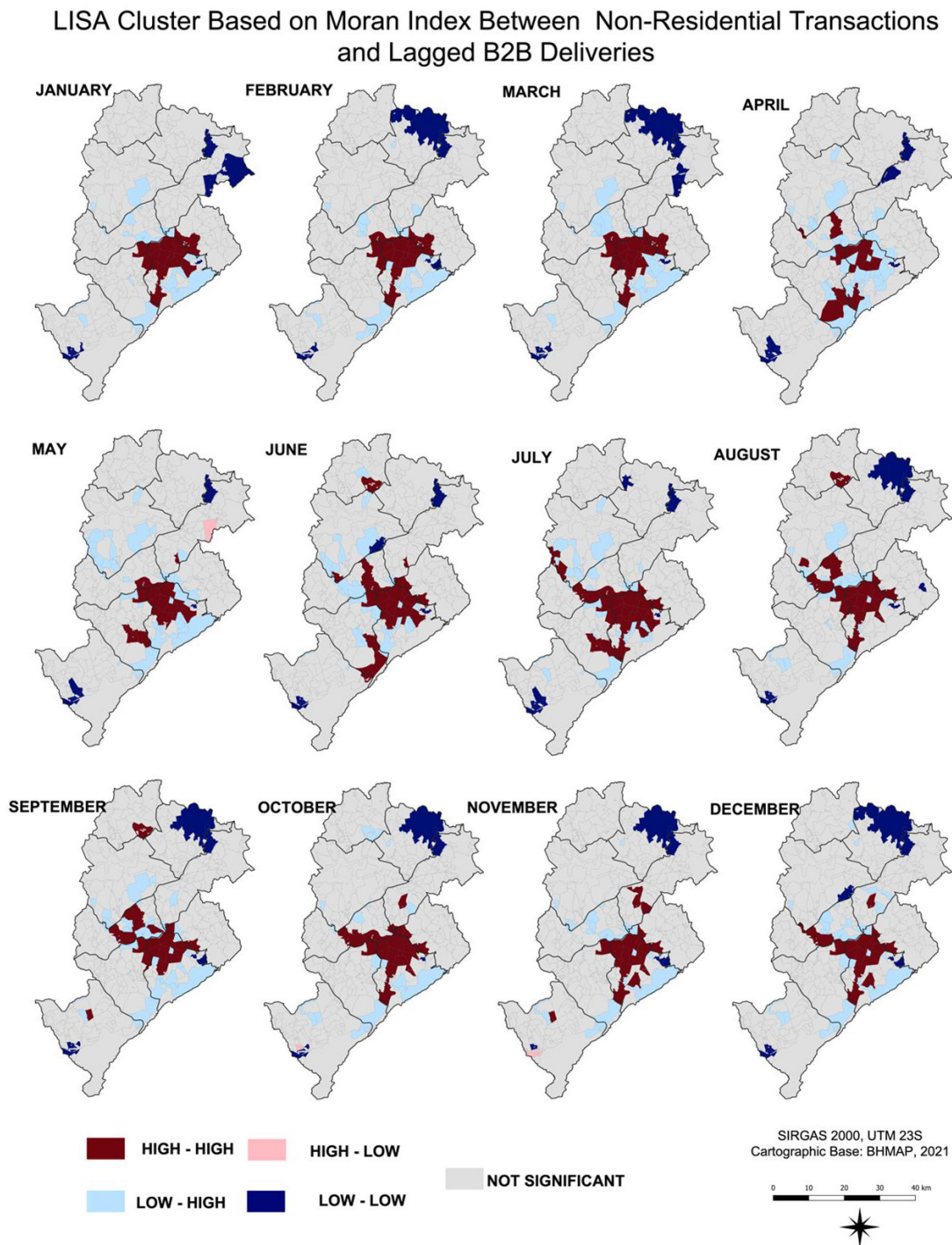
## 5. RESULTS AND DISCUSSIONS

### 5.1. Spatial correlation between urban deliveries and non-residential real estate transactions

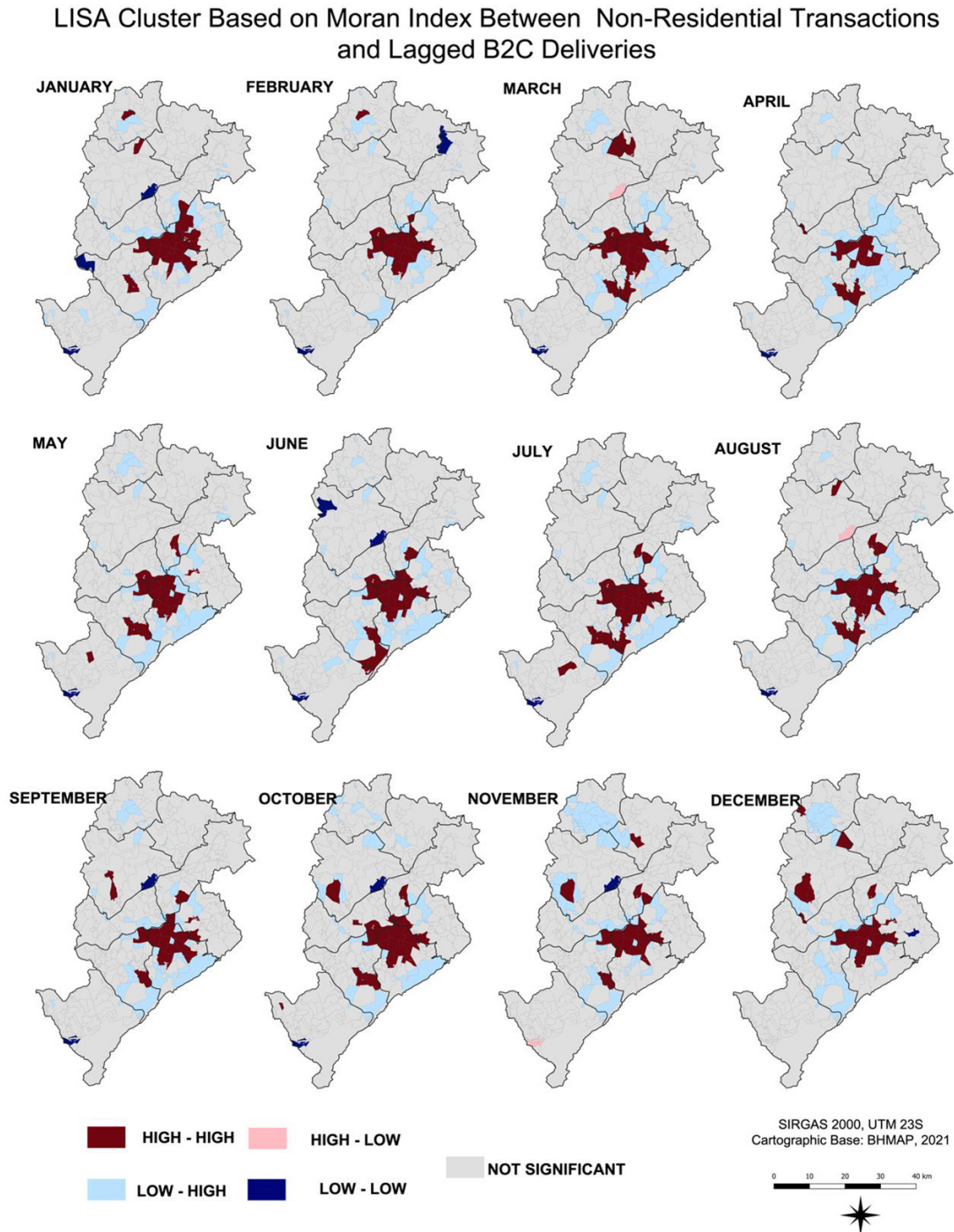
Figure 5 shows the spatial clusters obtained from Moran's Bivariate spatial correlation index between non-residential real estate transactions and B2B deliveries. The high-high clusters (in red) indicate new businesses location due to a high spatial concentration of non-residential real estate transactions and urban deliveries. The clusters reduced in April when the lockdown measures restricted the functioning of non-essential commerce. After this month, we observe the clusters spread across the municipality's territory. In addition, the low-high outliers (in light blue) indicate neighbourhoods with the potential to attract new business since the increasing B2B deliveries suggest a growing local economy.

Figure 6 shows the spatial clusters of B2C deliveries. High-high clusters for B2C deliveries occur due to the high number of new businesses and B2C deliveries in the neighbourhoods and around them. However, the number of high-high clusters decreases in April and increases again in smaller numbers than B2B deliveries. The low-high clusters indicate potential neighbourhoods for new businesses since they are areas with a high volume of B2C deliveries, probably due to the lack of accessibility to more diverse goods.

Comparing the clusters from B2B and B2C deliveries, we observe more high-high or low-low clusters for B2B deliveries. This result reveals that online purchases, especially those delivered directly to the consumer, have the potential to meet the consumers' demands more efficiently in terms of diversity and product specialisation.



**Figure 5.** LISA cluster between non-residential transactions and B2B deliveries temporal evolution



**Figure 6.** LISA cluster between non-residential transactions and B2C deliveries temporal evolution

Additionally, in both cases, a similarity is observed between the high-high clusters in the central region, which corresponded to the initial layout of the municipality – the planned area. An expansion of the cluster was also observed throughout 2020, indicating a decentralisation of new businesses in Belo Horizonte. From the perspective of B2B deliveries, this decentralisation takes place towards the West and Centre-South regions. From the standpoint of B2C deliveries, it occurs more intensely towards the Northeast, East and Centre-South regions. Therefore, we prove the hypothesis of decentralising new businesses motivated by urban deliveries throughout 2020 based on the proxy of non-

residential real estate transactions. Moreover, we can say that traditional retail is reinventing itself to address the growth of e-commerce, changing its location and adopting online selling strategies to keep active, as pointed out by Zhang, Zhu and Ye (2016).

## 5.2. Relationship between urban deliveries and new business

Figure 7 presents the estimated spatial coefficients for the GWR model using non-residential real estate transactions as the dependent variable and total deliveries as the independent variable. The determination coefficient obtained was greater than 0.90 for the entire territory, which makes it statistically valid. Furthermore, the positive values for the estimated coefficients of B2B deliveries are more intense in the East, Centre-South and Northeast regions, which indicates the positive spatial effect of this type of delivery on the location of new businesses. On the other hand, negative values of the estimated coefficients for B2B deliveries are observed in Pampulha and the north of the Northeast region, indicating a negative effect of these deliveries on the opening of new businesses in these locations.

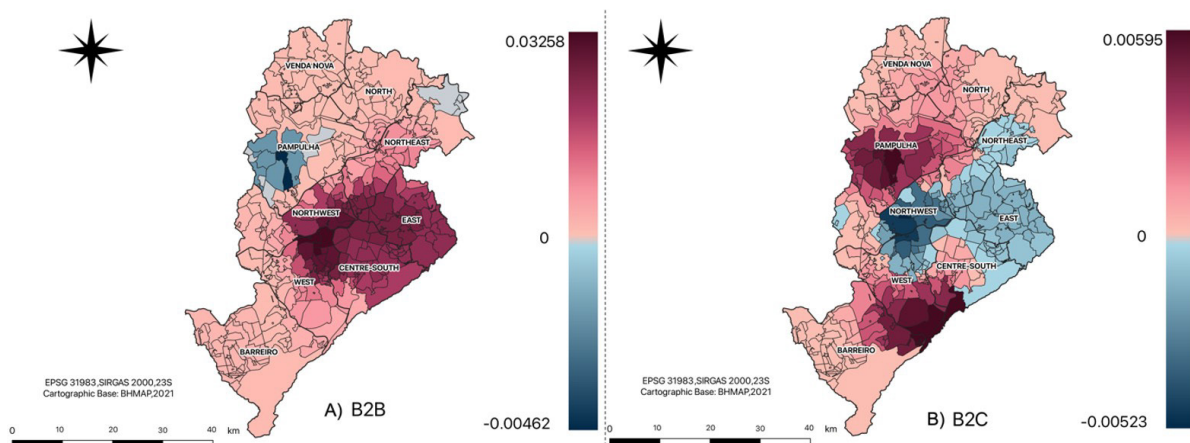


Figure 7. Estimated spatial coefficients of the GWR model

Concerning B2C deliveries, the estimated coefficients are opposite to those for B2B deliveries: Pampulha, Oeste, and Barreiro had positive coefficients on the installation of new businesses, while in the north of the Centre-South, Northeast, East, and Northwest had negative coefficients. Signal inversion shows that the places where B2C deliveries are more intense indicate locations with opportunities for the installation of new businesses, possibly due to the lack of certain products and services in these regions and/or difficult access, especially during the pandemic with measures to restrict the operation of non-essential businesses and services. Moreover, findings show that B2C deliveries occurred in the places with the highest number of new non-residential real estate transactions in 2020. Thus, the GWR model confirms the second hypothesis of this research, that urban deliveries have an inverse relationship with the location of new business, most likely driven by the COVID-19 pandemic.

The results presented also allow us to answer the central question of this research: “to what extent has the increase in urban deliveries contributed to the dynamism of non-residential real estate transactions?” We verified a decentralisation of non-residential real

estate transactions in 2020 related to urban deliveries. Also, B2B and B2C deliveries present different dynamics in the territory. We observed that B2C deliveries are concentrated in neighbourhoods with lower B2B deliveries and where the dynamics of non-residential real estate transactions were more intense. Also, B2C deliveries previously concentrated in the central region of Belo Horizonte started to become more distributed in the municipal territory. Despite this, no spatial-temporal pattern may result from lockdown measures aimed at reducing COVID-19 cases. The lockdown measures may have contributed to the increase in B2C deliveries, especially between April and July. On the other hand, these same lockdown measures may have harmed the opening of new businesses, as activities were suspended and were gradually resumed until the end of 2020.

Our findings complement those of Wang et al. (2021) in the United States. The authors considered four types of e-commerce consumers (prior consumers, temporary consumers, permanent and new consumers, and non-consumers) with four categories of products (grocery, food, home goods, and other packages). They concluded that e-commerce would gradually reduce after the COVID-19 pandemic. However, a different interesting result is the increasing essential goods market in residential areas, highlighting the opportunity for new businesses in residential areas.

## 6. CONCLUSION

The COVID-19 pandemic is changing urban mobility patterns. Similarly, the lockdown measures contributed to accelerating the growth of B2C deliveries in urban areas. Still, working from home and the need for goods and services in new areas could also have contributed to the territorial dynamics of the non-residential real estate sector. Therefore, this paper analysed the change in the dynamics of non-residential land use related to traditional retail (B2B) and online retail (B2C) deliveries in Belo Horizonte during the year 2020.

The results indicated that B2B and B2C deliveries had a dynamic spatial-temporal pattern in 2020. Moreover, a spatial correlation was identified between urban deliveries and non-residential real estate transactions in 2020. Analysing the spatial-temporal evolution of non-residential real estate transactions in 2020, we observed a tendency of migration from a highly specialised land use pattern to a more mixed-use pattern due to the neighbourhoods with the highest urban deliveries are potential places for new businesses to meet the needs of the consumer market.

The spatial clusters obtained from the LISA technique based on the bivariate Moran Index confirmed the decentralisation of new businesses when the high-high clusters expanded in 2020. The clusters composed of the outliers of this technique (high-low and low-high) indicated potential locations for setting up new businesses distributed throughout the municipal territory. Considering the function-based planning model adopted in Belo Horizonte, this new distribution dynamic of non-residential activities throughout the territory changes the current land use pattern. The estimated coefficients of the GWR model corroborate that new businesses tend to become more dispersed, serving peripheral regions of the city.

Furthermore, the estimated coefficients of the GWR model show an inverse relationship to the decentralisation potential of new businesses from the perspective of urban deliveries. With this, it is possible to conclude that the growth of urban deliveries has changed the patterns of land use, represented by the changes in the non-residential real estate sector, being driven by the unique context experienced in 2020 by the COVID-19 pandemic, which is permanently changing society's behaviour.

The non-residential real estate market is not homogeneous in Belo Horizonte territory. This dynamic can be different within the same administrative region and may indicate greater and/or less potential for new business. In this way, the public administration must observe the goods movements since it can potentially change land use in the medium-long term, and the COVID-19 pandemic accelerates this process.

Thus, the master plans must consider urban deliveries as an inducing component of non-residential territorial dynamics and accessibility and mobility issues. In addition, urban deliveries have the potential to change land use characteristics. These results align with Holguin-Veras et al. (2021), who pointed out that technology and economics should be considered in land use planning.

For future studies, we suggest: (i) expanding the analysis to the ex-post COVID-19 pandemic period to identify the dynamics of land-use changes in non-residential real estate transactions and urban deliveries; (ii) assessing the dynamics of the residential real estate sector and urban deliveries; and (iii) analyse the relationship between income, the intensification of urban deliveries and the value of real estate transactions.

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