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The 15-minute city and real estate capital: contributions from Chile's major cities

The COVID-19 pandemic has spurred discussions on reimagining cities based on principles of public health and reducing spatially expressed inequalities. In this context, the concept of the 15-minute city has emerged as a priority for municipal authorities in the case of Chile. However, the implementation of this model faces challenges, including the dominant presence of the market in the production and capitalisation of urban life in Chilean cities.

Keywords: 15-minute city, urbanism, walkable city, real estate

Introduction

The coronavirus pandemic has prompted a profound contemplation of a new urban landscape, one that is meticulously designed according to public health principles and prioritises the reduction of spatially manifested inequities (Chang et al., 2020; Vial et al., 2022). As cities are being reconfigured, particularly in preparation for the post-pandemic challenges and in acknowledgement of the effects of the climate crisis (McCarthy et al., 2010), the concept of the '15-minute city' has emerged as a paramount objective for municipal authorities.

Their aim is to establish urban neighbourhoods that encompass all essential amenities, thereby minimising the need for residents to commute to other areas for their daily activities (Moreno et al., 2021). However, the international expert community has not unanimously embraced this idea, as some scholars argue that the 15-minute city, as proposed by Carlos Moreno, fails to acknowledge the existence of less conspicuous networks within daily life and risks repeating the errors of the modernist movement's tabula rasa approach, which disrupted social relationships at the neighbourhood level through top-down planning (Casarin et al., 2023).

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The critique focuses not so much on the concept of the 15-minute city itself but rather on the oversimplification of urban complexity in its promotion as a method of urban transformation. According to Allam et al. (2022), the 15-minute city can be enhanced by incorporating localised information systems that facilitate the exchange of data between urban life and decision makers. Nevertheless, the fundamental question lies in how this urban model can be applied in the Global south. Marchigiani and Bonfantini (2022) argue that the 15-minute city model can be desirable, provided it can be integrated into the urban fabric by embracing the intricacies and distinctiveness of individual neighbourhoods.

At the moment, particular experiences, driven by local governments, have been registered in Latin America for the cities of Buenos Aires, Santiago and Bogotá as a way to generate a political agenda towards the reduction of the gap in access to urban goods in these cities. However, data from the platform ‘whatif.sonymcsl.it/15mincity’, developed by Bruno (2024), shows that cities in the Global South (whether in Latin America, Africa or Oceania) have much longer travel times than just 15 minutes to access the various facilities and services available in cities. This clearly evidences the strong spatial inequality that has shaped Third World cities, as an effect of the precarious policies of territorial planning (Watson, 2009) that have given rise to unequal and segregated cities, where, in addition to the city, housing has also become another factor of exclusion and harm (Cociña, 2021).

This study endeavours to explore the relationship between the potential implementation of a 15-minute city and the underlying market structures, with a particular focus on major Chilean cities. The hypothesis posits that, given the predominant influence of the market in the production and financialisation of urban life in Chilean cities (Cattaneo Pineda, 2011; Santana-Rivas, 2020), the chances of achieving a 15-minute city are greatly reduced owing to the strong socio-spatial inequalities generated by the private housing market and the lack of regulatory mechanisms in real estate market development that prioritise the reduction of gentrification, segregation and speculation. Therefore, the emergence and consolidation of neighbourhoods of the 15-minute city run the risk of merely augmenting the value of private investments without comprehensively improving the social conditions of the entire society affected by these urban transformations.

This hypothesis is supported by the work of Mikelbank (2004), who suggests a statistically significant correlation between neighbourhood infrastructure improvements and increased housing prices in the area, Cordera et al. (2019), who establish that access to public transportation also influences property value appreciation, and Li et al. (2019), who indicate that the relationship between public infrastructure, private accessibility and services genuinely impacts property values in Shanghai.

In the case of Chile, it has been observed that the presence of private amenities exerts a greater influence on property value appreciation than that of public amenities (Cortés and Iturra, 2019). In other words, there is a clear trend that, in view of the

improvement of urban and architectural conditions, the price of land and housing tends to increase several negative processes for the population, such as eviction and gentrification (Polanco, 2023).

The case of Chile is paradigmatic as it constitutes a nation where the state handed over the prioritisation and formalisation of urban space to the market (CNDU, 2014; Vergara-Perucich et al., 2023). The role of the market in the urban production of Chilean cities has been crucial in creating unequal urban spaces (Daher, 1991; Fuster-Farfan, 2019; Cociña, 2021); this has also had an impact on the mobility of inhabitants access the different goods and services offered by the city, consolidating the socio-spatial gap between the various groups living there (Vecchio et al., 2020; Tiznado-Aitken et al., 2021).

This is especially evident in the city of Santiago, where a strong residential segregation is observed (Sabatini, 2000) that is based on a polycentric city but with a strong concentration of facilities and jobs in the higher-income area (Truffello and Hidalgo, 2015; Niehaus et al., 2016), generating a travel matrix with a strong dependence on car use and public transport that reinforces these inequalities, which in turn are reinforced by real estate development for the elite on the periphery of the city (Muñoz and Gschwender, 2008; Cox and Hurtubia, 2020) but also by the peripheral location of social housing complexes (Hidalgo, 2007).

The organisation of urban space, particularly in Chile, is generated from the tensions of supply and demand, framed within legislative and regulatory elements regulated by the Ministry of Housing and Urban Development, which by constitutional mandate cannot interfere in the market, other than by subsidising those aspects where the market cannot participate, such as financing for social housing and public infrastructure financing (Inzulza and Cárdenas, 2017; Hidalgo et al., 2018, 2021; Contreras Orrego et al., 2021; Vergara-Perucich, 2023). As an exceptional case, Chile offers scarce opportunities worldwide to review the social effects of an urban production led almost exclusively by ideological frameworks from a free-market state project.

Additionally, in major Chilean cities, municipal financial autonomy, housing demand and the financial profitability of real estate companies play significant roles in shaping housing prices (Vergara-Perucich, 2021; 2022). Consequently, integrating the 15-minute city model into cultural, social, political and economic contexts necessitates an acknowledgement of preexisting conditions that could either support endeavours towards social justice or contribute to the exacerbation of socio-spatial inequalities, contingent on the applied urban planning criteria.

Recent research proposes that Chilean cities tend to have good provision of public services in terms of availability but a poor distribution of private services (Correa-Parra et al., 2020; Ulloa-Leon et al., 2023); the existence of a 15-minute city in neoliberal nations like Chile could be highly exposed to appropriation by the market (Boano and Vergara-Perucich, 2017), especially through the real estate market.

In line with the above, this research analyses the relationship between the 15-minute city and the processes of financialisation and verticalisation, the first understood as ‘the increasing dominance of financial actors, markets, practices, measurements and narratives, at various scales, resulting in a structural transformation of economies, firms, states and households’ (Aalbers, 2017) and the second defined as the process of transformation of the urban morphology, tending to verticality and densification of the residential offer oriented to middle-class and investor groups (Vergara-Perucich, 2021) as a way of appropriating and maximising land rents through housing production.

For this purpose, we provide evidence on this spatial relationship between the socio-spatial inequalities of the cities, private market forces and the idea of a 15-minute city model, trying to demonstrate that the most consolidated sectors of the city (in terms of access to the 15-minute city) are fully exploited by private real estate market forces, which could translate into an exclusionary process, reflected in less accessibility (in terms of housing access) for the most vulnerable groups, due to potential purchase and rental price increases, relegating these groups to the peripheries of the city, where accessibility to urban goods is much more precarious than in the central areas.

Methods

Considering the hypothesis developed above, the main objective of this research is measuring the levels of accessibility to the 15-minute city and their relationship with real estate development, through the process of financialisation and verticalisation, and evidence of the potential exclusion of the most vulnerable groups from housing and the city.

Based on the work of Moreno et al. (2021) and the methodological experience of Correa-Parra et al. (2020) and Ulloa-Leon et al. (2023), it is proposed to continue the analytical approach to estimate the levels of accessibility to the 15-minute city. The analysis progresses based on the connectivity levels of city spaces with different urban functions that account for access to various opportunities and services. This also allows for an understanding of the consolidation of subcentres with good accessibility conditions in the city (Berry and Garrison, 1958).

For this reason, the authors have decided to use the methodology proposed by Correa-Parra et al. (2020), based on measuring the levels of accessibility of each census block to each of the 24 urban functions (Table 1) proposed by Correa-Parra et al. (2020) and Ulloa-Leon et al. (2023) to determine the population’s accessibility levels to the 15-minute city. These urban functions encompass public facilities provided by the government (such as educational establishments and healthcare centres) and private services like banks and bookstores.

Table 1 Urban functions for a 15-minute city index

Hierarchy of functions		
Primary (600m)	Secondary (1,200m)	Tertiary (2,400m)
Elementary school	Secondary school	Hospital
General doctor practice	Medical centres	Police
Pharmacy	Parks	Firefighters
Green areas	Courts	Museum
Bus stops	Sport facilities	Cinema and theatre
Book stores	Library	Cultural centres
Places of worship	Administrative services	
Banks	Supermarket	
	Street markets	
	Hardware store	

It is worth noting that Correa-Parra et al. (2020) define hierarchical access levels to these urban functions, which are expressed in distance thresholds (600, 1,200 and 2,400 metres), based on the availability and intensity of use of these facilities, as well as the mobility or means of transportation that could be used to access these facilities (Both et al., 2022).

This methodology also incorporates a more inclusive perspective on travel speeds and times, which are measured based on primary hierarchy facilities that should be within a real distance (through the Network Analyst module of ArcGis 10.8) of 600 metres, corresponding to a 15-minute walk at a speed of 2.4 kilometres per hour. This approach is much more realistic and inclusive than other studies, which use speeds of up to 4.5 kilometres per hour and fail to fully incorporate the mobility of other population groups such as older adults, children, women, and people with disabilities (Rojas et al., 2020).

Secondary hierarchy facilities are analysed at 1,200 metres, which could be reached either by walking (30 minutes) or within 15 minutes using active modes such as cycling (Ruiz-Apilánez and Solís, 2021). The same applies to tertiary hierarchy facilities, measured within a range of 2,400 metres, which can be reached in less than 15 minutes but using public transportation.

The aim of the above is to represent that the concept of the 15-minute city should not be restricted solely to walking but should also consider active mobility through other means such as cycling and, especially, public transportation (Both et al., 2022). It must be considered that not all opportunities and services have a homogeneous distribution across the territory that affects their accessibility but, like any model, it

also does not consider context-specific constraints such as climate or local topography.

Considering the above, to determine the level of accessibility to the 15-minute city, for each census block (INE, 2017) we estimate the distance to each of the 24 facilities (Table 1). Considering the threshold distances, a dichotomous indicator (0 and 1) is created to determine whether a particular census block is connected to each urban function or not. In this way, the total number of facilities accessible to each census block is determined, which is subsequently classified into five levels of accessibility to the 15-minute city (Table 2):

Table 2 Levels of accessibility to the 15-minute city index according to score

Level of accessibility to 15 minutes index	Minimum score (accessible urban functions)	Maximum score (accessible urban functions)
Very low	0	5
Low	6	10
Medium	11	15
High	16	20
Very high	21	24

On the other hand, to determine the relationship between the 15-minute city and the processes of verticalisation and financialisation, official records from the National Institute of Statistics (INE, 2021) were used. These records include all building permits for residential and mixed-use purposes requested between 2010 and 2021 for projects of six or more floors, which are geolocated. Based on this, the aim was to determine how many projects and how many housing units would be in the areas with better accessibility to the 15-minute city.

Finally, to understand the potential exclusionary process, owing to the combination of real estate development in the most accessible areas, we use the records of housing tax valuations from the Servicio de Impuestos Internos of Chile (SII, 2018), determining the fiscal assessment and building surface of each housing unit per census block, to estimate the average fiscal value by square metre, for each census block, as a proxy of land value and socio-economic status. The idea behind this is to show that the most accessible areas of the city tend to concentrate the real estate development and are the most valuable areas. This has a significant impact on land and housing prices, leading to a widening gap in access to housing, as evidenced by Vergara-Perucich and Aguirre-Nuñez (2019), Cortés and Iturra (2019) and Vergara-Perucich et al. (2023).

This methodology was applied in the Chilean case, focusing on the country's six main cities (Table 3), which together account for approximately 60 per cent of the country's population (9,297,585 inhabitants). These cities include consolidated metropolitan areas (such as Santiago, the capital), emerging metropolitan areas (Concepción

and Valparaíso) and intermediate cities or conurbations like Coquimbo–La Serena, Temuco and Antofagasta.

Table 3 Characterisation of the study area

City	Population (2017)	Urban surface (hectares)	Density (inhabitants per hectare)	Percentage of national population
Antofagasta	348,517	6,715	51.90	2.30%
Coquimbo–La Serena	403,912	14,286	28.27	2.60%
Metropolitan area of Valparaíso	939,558	36,654	25.63	6.10%
Metropolitan area of Santiago	6,350,912	116,977	54.29	41.40%
Metropolitan area of Concepción	944,696	39,069	24.18	6.20%
Temuco	309,990	9,250	33.51	2.00%
Total	9,297,585	222,951	43.32	60.60%

For each of these cities, population data and census blocks from the 2017 Housing and Population Census (INE, 2017) were used, focusing solely on urban areas. The location of these cities is detailed in Figure 1.

As seen in Figure 1, of these six cities, four (Antofagasta, Coquimbo–La Serena, Valparaíso and Concepción) are in coastal areas, while the other two (Santiago and Temuco) are in the central valley, no more than 150 kilometres away from the coast.

In terms of population, surface area and density (Table 3) we can observe that the main city analysed, Santiago, has more than six million inhabitants, while Valparaíso and Concepción have close to one million people each; on the other hand, the other three cities have around 350,000 inhabitants on average. A similar trend can also be seen in terms of surface area, where the largest city is Santiago, with 116,977 hectares, followed by the rest of the cities, which have much smaller surface areas.

Nevertheless, if we look in detail at Figure 1, we can see that the distribution of population density is not homogeneous in the territories analysed, with a tendency in all cities to concentrate both in the historic centre and also towards the peripheries. This is a fundamental factor in understanding the socio-territorial inequities of Chilean cities, a product of the public housing policies of the last 40 years (Hidalgo, 2007; 2008) that have generated cities with high levels of segregation (Sabatini and Brain, 2008), where the most vulnerable members of the population tend to concentrate in their peripheries, far from the opportunities and services offered by the city (Ducci, 1997).

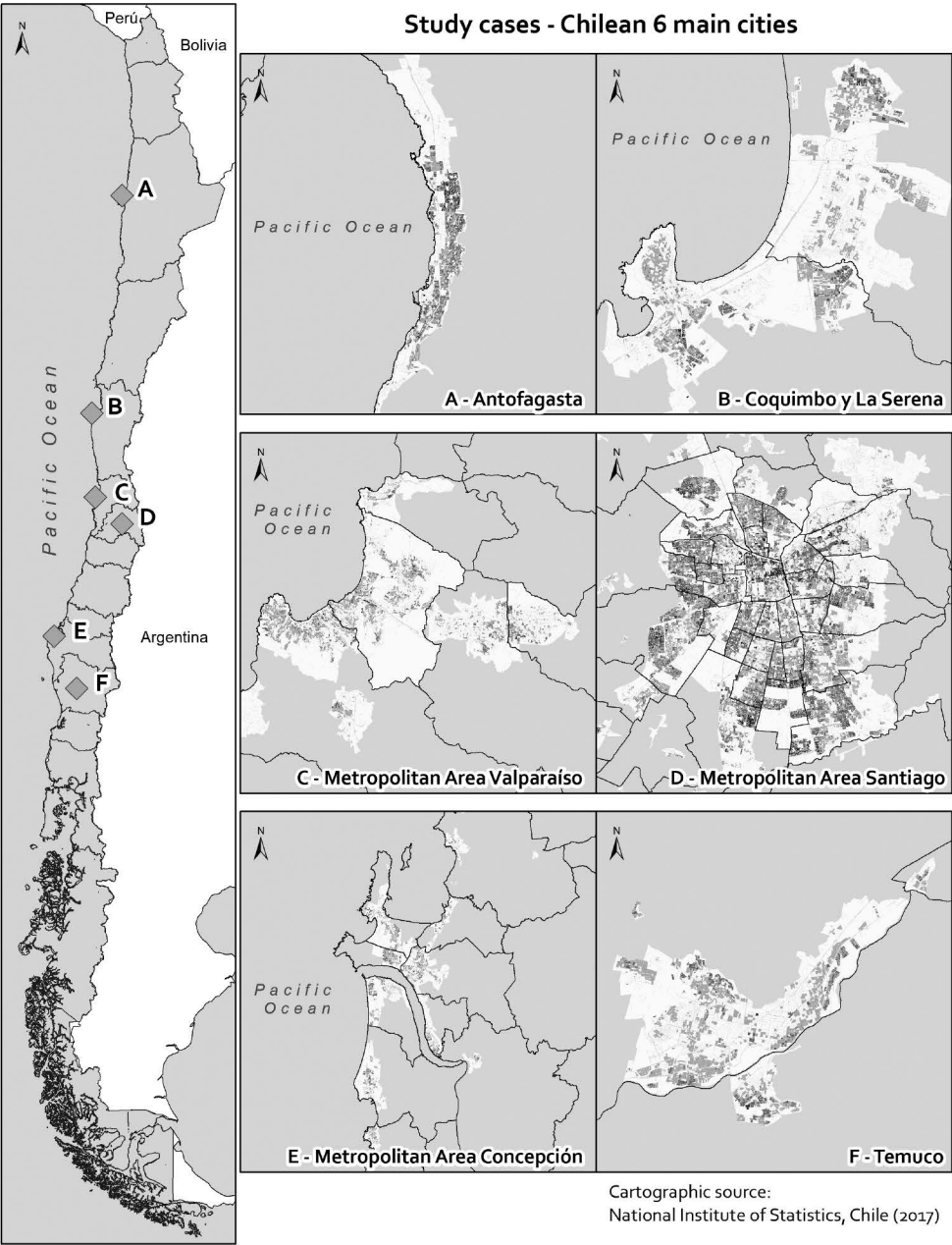


Figure 1 Study area, location of analysed cities

Considering these aspects, their urban morphology and the effects of housing policies, it is important to analyse the similarities and differences in these cities, between the thesis of the 15-minute city regarding real estate development and its effects on urban inequality, in terms of access to opportunities and housing itself, despite the notorious differences in size and surface area of the cities analysed.

Results

After analysing the connectivity levels of 24 elementary urban functions in the six cities, it can be observed that there is no balanced distribution of areas with better accessibility in each city (Figure 2), indicating a quite unequal distribution in all cities, where only small portions of the city could be a 15-minute city neighbourhood.

At first sight, a relationship between the size of the city and its accessibility levels can be observed, as in the case of the city of Antofagasta, where only a single major central area exists, where the zone with the highest levels of accessibility to elementary urban functions concentrates. On the other hand, in the Coquimbo–La Serena conurbation and in Temuco, the other two middle cities, the formation of two subcentres can be observed. Finally, in the case of metropolitan areas, a greater number of zones or subcentres with significant access to urban functions are observed, in the line of the most populated and extended cities, which also implies an increased demand for these urban goods.

In all the analysed cases, the areas with the highest accessibility correspond to the historical and commercial centres of the cities, while in the metropolitan areas of Santiago, Valparaíso and Santiago other subcentres can be seen around municipalities or districts that are large or have a significant presence in the city's job market (Truffello and Hidalgo, 2015).

Another common element in the six analysed cities is a centrifugal pattern in accessibility levels, indicating that the further away from the city centre, the lower the access to the 15-minute city. This is problematic considering that cities grow both vertically (through densification) and horizontally (through sprawling), which affects the form and sustainability of cities (Artmann et al., 2019; Haaland and Van den Bosch, 2015). To better understand the effects of territorial inequities in the distribution of the 15-minute city, Table 4 presents the total population and percentage living within each level of access to the 15-minute city.

Only 8.2 per cent of the analysed population lives in areas with very high accessibility to the 15-minute city, with higher levels of accessibility observed in the cities of Temuco (11.8 per cent) and Santiago (9.3 per cent), contrasting with low levels of access in the case of Coquimbo–La Serena (2.7 per cent) and Concepción (3.5 per cent). This is followed by 32.6 per cent of the population living in areas of high accessibility, particularly in Santiago (39.8 per cent) and Temuco (33.4 per cent); in this level we

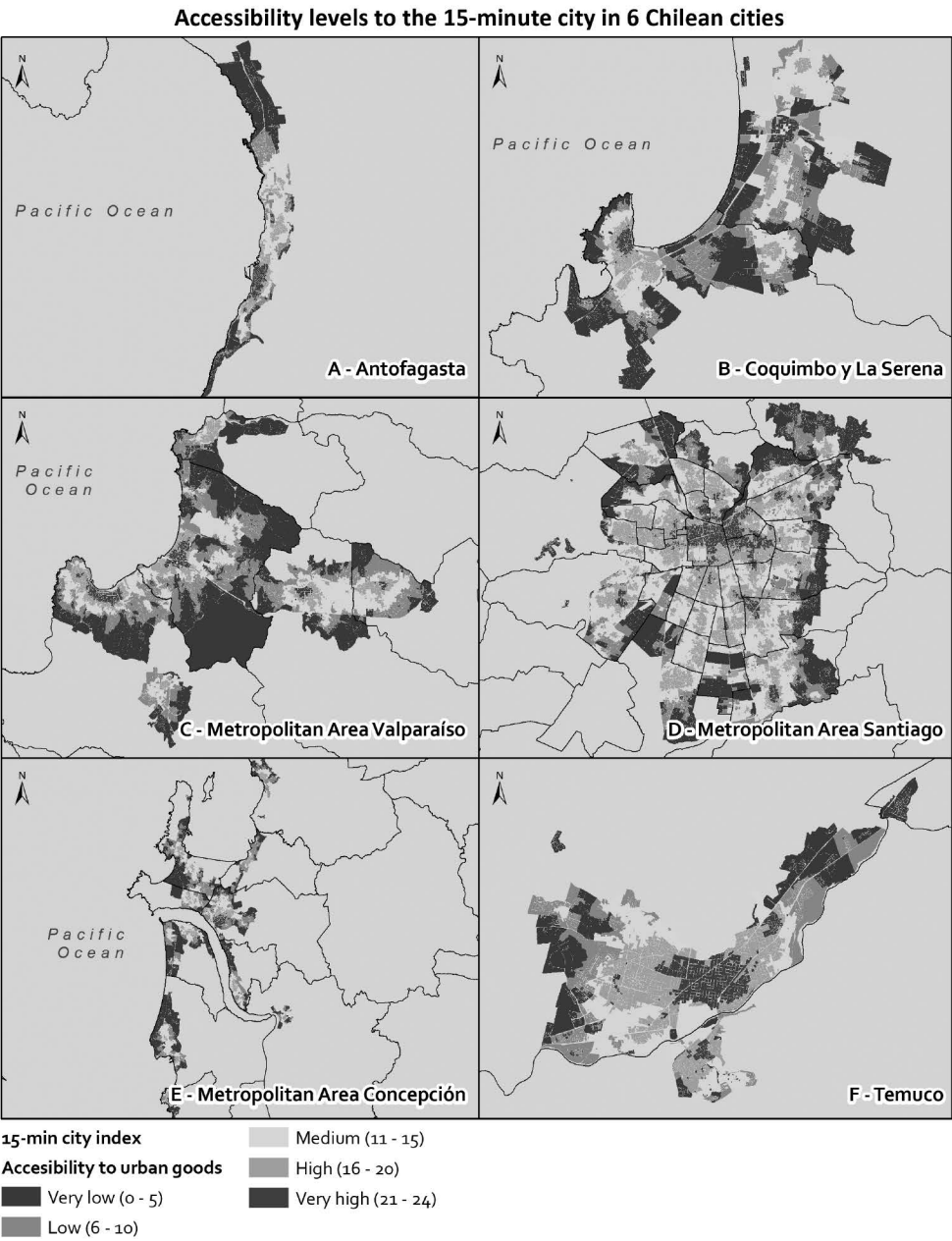


Figure 2 Accessibility levels to the 15-minute city in six Chilean cities

can observe that some services are not available, especially cultural or leisure activities, which are relatively scarce, but allowing for well-developed areas in terms of job opportunities and services.

Table 4 Population per city according to level of accessibility to the 15-minute city

City	15 minutes city accessibility level					Total population
	Very low	Low	Middle	High	Very high	
Antofagasta	9.10%	19.50%	43.70%	20.00%	7.70%	347,605
Coquimbo–La Serena	11.40%	28.10%	42.90%	14.90%	2.70%	403,574
Valparaíso	9.90%	34.30%	34.40%	14.90%	6.50%	935,872
Santiago	3.50%	8.10%	39.20%	39.80%	9.30%	6,081,881
Concepción	13.00%	26.90%	41.00%	15.60%	3.50%	938,040
Temuco	9.70%	16.80%	28.30%	33.40%	11.80%	284,844
Total	5.90%	14.40%	38.90%	32.60%	8.20%	8,991,816

Second, a significant portion of the studied population is in areas of moderate (middle) accessibility (38.9 per cent), which according to previous studies (Correa-Parra et al., 2020; 2022) mainly corresponds to areas with good provision of public services but with a significant absence of private services like banks, supermarkets and theatres. This generates a greater need for long-distance travel by both public and private transportation, resulting in various externalities for the city, especially in terms of pollution (Banister, 2008; Rodriguez-Urrego, 2020).

In contrast, 20.3 per cent of the population lives in areas of low or very low accessibility, which tends to concentrate in peripheral sectors with medium to high population density. This poses a significant problem, as in the case of Santiago, Valparaíso and Antofagasta these are areas where low-income households prevail, especially in social housing complexes provided by the government or in informal settlements (Ducci, 1997; Hidalgo et al., 2016).

Finally, if we analyse each city compared to the study group average, the city with the highest accessibility in terms of population is Santiago, where 49.1 per cent of its population lives in areas of high or very high accessibility to the 15-minute city, with only 11.6 per cent residing in areas of very low or low accessibility. The same trend is observed in Temuco, where 45.2 per cent of the population lives in areas of high or very high accessibility, while only 26.5 per cent reside in areas of low or very low accessibility.

In Antofagasta, there is a significant concentration of the population in areas of moderate accessibility, with 43.7 per cent of the population, mainly corresponding to areas with medium to lower-middle-income levels. However, the cities with the

greatest gaps in accessibility are Valparaíso, Concepción and Coquimbo–La Serena, with 44.2 per cent, 39.9 per cent and 39.5 per cent of the population, respectively, in areas of low or very low accessibility.

Regarding the second objective of this study, concerning the relationship between the 15-minute city and housing real estate investment processes, observed by various authors in Chilean cities (Cattaneo Pineda, 2011; Santana-Rivas, 2020; Hidalgo et al., 2022; Vergara-Perucich et al., 2023), in Table 5 we can see that a total of 2,416 building permits for residential or mixed-use destinations with a height equal to or greater than six floors were identified, containing (Table 6) a total of 440,504 housing units. Of these 2,416 building permits, 69 per cent are concentrated in the city of Santiago, which in turn accounts for 75.8 per cent of the analysed housing units, highlighting the high intensity of real estate activity in the Chilean capital.

Table 5 Total building permits by city by level of accessibility to the 15-minute city

City	15 minutes city accessibility level					Total permits
	Very low	Low	Middle	High	Very high	
Antofagasta	19.60%	12.70%	20.60%	11.80%	35.30%	102
Coquimbo– La Serena	37.10%	37.10%	10.10%	15.70%	0.00%	89
Valparaíso	22.30%	38.40%	16.70%	14.10%	8.50%	305
Santiago	1.20%	4.00%	20.50%	48.10%	26.20%	1,690
Concepción	19.10%	23.50%	15.40%	17.90%	24.10%	162
Temuco	7.40%	2.90%	13.20%	29.40%	47.10%	68
Total	7.40%	11.20%	19.10%	38.50%	23.80%	2,416

A preliminary analysis at a general level reveals that, out of the 2,416 building permits issued between 2010 and 2021 in the cities, 23.8 per cent are in areas of very high accessibility, while another 38.5 per cent are in areas of high accessibility. This result shows that 62.3 per cent of the permits are well located, contrasting with only 18.6 per cent of other permits that are situated in areas of low or very low accessibility to the 15-minute city (Figure 3).

Out of these 1,505 building permits in well-located areas, the majority were concentrated in the cities of Santiago and Temuco, which have better distribution of access to the 15-minute city, with over 60 per cent of the permits in these cities being in areas of high accessibility. In contrast, in Valparaíso and Coquimbo, the permits in well-connected areas fluctuate between approximately 15 per cent and 20 per cent.

The above analysis is corroborated by examining the number of new housing units linked to these building permits and their location in relation to accessibility levels (Table 6). This also responds, to some extent, to processes of public space privatisation

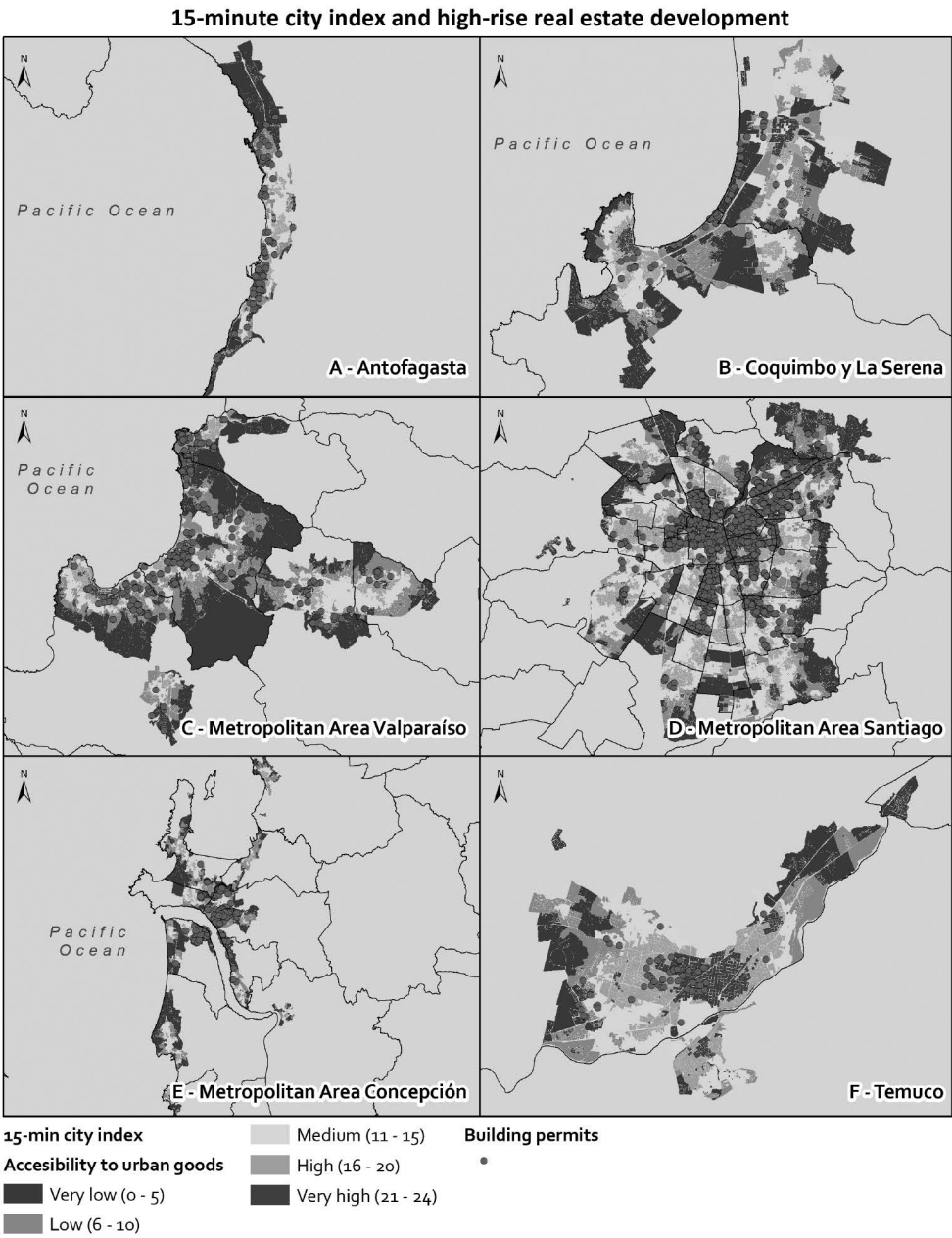


Figure 3 Accessibility levels to the 15-minute city and real estate development

through the capture of the city’s best-connected sectors to enhance the real estate business (Vergara-Perucich et al., 2023), as will be discussed below.

It can be observed that, out of the 440,504 authorised housing units to be constructed, 22.6 per cent of them are in areas with very high accessibility to the 15-minute city, while another 40.6 per cent are in areas of high accessibility. This accounts for a total of 63.2 per cent of the potential supply being concentrated in areas with the best accessibility, especially in the central areas of the cities, but also with the highest market values, as shown in Figure 4; this is a fundamental detail in understanding the dynamics behind Chilean households’ access to such areas with good accessibility.

Table 6 Total new housing units by city by level of accessibility to the 15-minute city

City	15 minutes city accessibility level					Total new housing units
	Very low	Low	Middle	High	Very high	
Antofagasta	20.90%	15.70%	37.30%	5.50%	20.60%	19,083
Coquimbo–La Serena	30.00%	45.40%	11.10%	13.40%	0.00%	14,646
Valparaíso	25.70%	41.40%	17.90%	8.70%	6.20%	41,358
Santiago	1.20%	5.40%	19.70%	49.20%	24.50%	334,081
Concepción	13.00%	17.90%	15.10%	23.30%	30.60%	21,754
Temuco	4.40%	0.90%	20.00%	28.00%	46.60%	9,582
Total	6.00%	11.10%	19.80%	40.60%	22.60%	440,504

Referring to the details for each case of study, if we look at Figure 3, we can observe that 246,218 housing units, equivalent to 73.7 per cent of the authorised housing units, are in areas of high and very high accessibility, which in turn represent 55.9 per cent of the total housing units in the six cities analysed (Table 6). Regarding the few building permits issued in areas of low or very low accessibility (6.6 per cent for 22,049 housing units), most of them correspond to real estate projects targeting middle or high-income families in urban expansion areas through the development of gated communities (Rasse Figueroa et al., 2021).

In the case of Temuco, the situation is quite similar to Santiago, as 76.5 per cent of the high-rise housing units authorised to be constructed are located in areas of high and very high accessibility (Table 6), which correspond to the historical centre of the city, where various public and private services are concentrated, resulting in a strong concentration of employment and educational opportunities in that area. The other 23.5 per cent of housing is primarily located in areas of medium or low accessibility, corresponding to middle- or upper-middle-income sectors, where the trend has been

the development of gated communities for these groups, where city accessibility is compensated for by car ownership, like in Santiago (Cox and Hurtubia, 2020).

Concepción follows the same tendency as Santiago and Temuco, where a significant percentage of new housing (42 per cent) is concentrated in areas with better accessibility (Table 6). However, looking at Table 3, we notice that only 19.1 per cent of the population lives in areas with better accessibility, showing the potential gap between the resident population and the real estate market. Indeed, when looking at Figure 5, it can be observed that building permits for high-rise constructions are highly concentrated in the few areas with high and very high accessibility, which correspond to the historic centre of Concepción and the subcentre of the San Pedro de la Paz district. In the first case, this zone concentrates practically all the city's services and urban amenities (regional government, banks, universities, hospitals etc.), which also creates a strong dependence from the rest of the city in terms of employment or educational access.

In the case of Valparaíso, it happens that only 22.6 per cent of the building permits, accounting for 6,162 housing units, are in areas with better accessibility, while 67.1 per cent of the authorised housing units (13,876) are found in areas with low or very low accessibility.

This is because a significant percentage (30.2 per cent) of the building permits are located in the northern zone of the city, in the area known as Reñaca, one of the most famous coastal residential areas, where a strong process of verticalisation has been observed of various coastal spaces, creating a new cluster of upscale neighbourhoods (Hidalgo et al., 2022), where the main asset that adds value to housing is the attractive view of the sea; it is notable that, in this type of real estate development, accessibility is a secondary issue, being more important to capitalise on the natural asset of the coastal proximity (Valdebenito et al., 2020).

This dynamic of verticalisation and overexploitation of the coastal landscape is also observed in the cities of Coquimbo–La Serena and Antofagasta. In the first case, 74.2 per cent of the analysed high-rise housing units are in areas with low or very low accessibility to the 15-minute city, but more than 90 per cent of these units are located within 600 metres of the coastal line, indicating that proximity to this element is of greater importance than accessibility to city services.

In the second case, Antofagasta, a similar dynamic is observed, with over 40 per cent of new high-rise housing being located within 600 metres of the coastline, 36.6 per cent of new housing units are in zones with low and very low accessibility areas, and 47 per cent in zones with high accessibility, forming two concentration zones, one in the historic centre of the city and the other to the north, but both always close to the sea.

Furthermore, when we ask how accessible the new supply of well-located housing is (with respect to the 15-minute city) for Chilean households, the data in Table 7 and

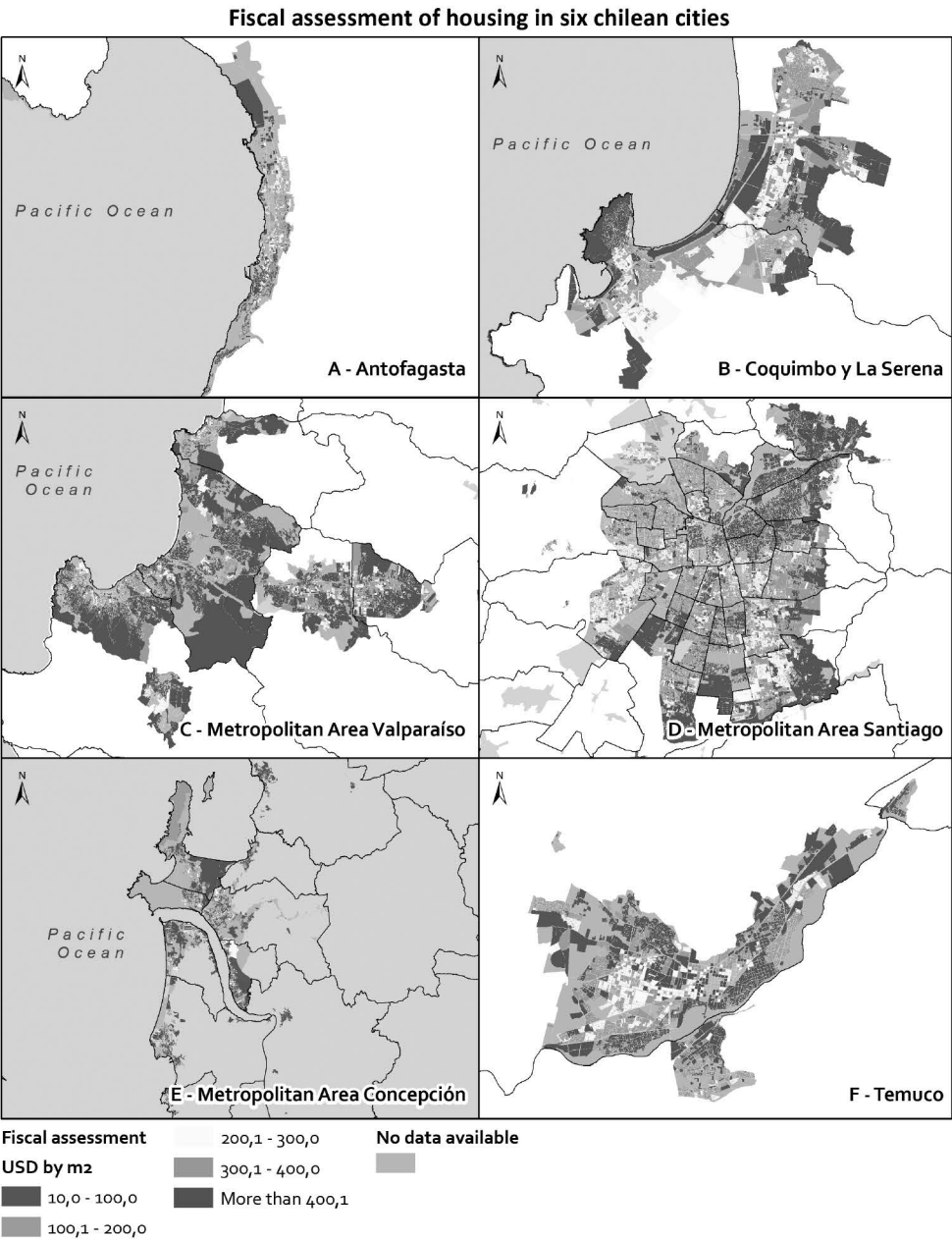


Figure 4 Fiscal assessment of housing in six Chilean cities

Figure 4 shows the relationship between urban accessibility and housing fiscal values for the six cities analysed.

Figure 4 shows the spatial relationship between the real estate development, through the processes of verticalisation and financialisation, the well provisioned areas of the city observed via the 15-minute city index and housing value enhancement, expressed in the fiscal assessment of the houses, which is closely related to higher-income households.

Table 7 New housing units by level of accessibility and fiscal assessment of housing

15 minutes city accessi- bility level	Fiscal assessment of housing (USD per m ²)					Total new housing units
	0-100	100-200	200-300	300-400	>400	
Very low	2.91%	0.39%	0.33%	0.53%	1.78%	5.95%
Low	3.20%	2.99%	0.90%	0.60%	3.36%	11.06%
Middle	3.71%	4.97%	2.62%	1.52%	6.97%	19.79%
High	4.04%	6.18%	5.24%	4.19%	20.97%	40.61%
Very high	2.23%	0.32%	1.45%	1.38%	17.20%	22.58%
Total	16.09%	14.85%	10.54%	8.23%	50.29%	100.00%

Table 7 indicates that 50.3 per cent of the new dwellings analysed are in areas with the highest valuations, with a value above USD 400 per m², and, specifically, 43.7 per cent of the dwellings are in areas of high or very high accessibility, with valuations above USD 300 per m². Only 16 per cent are in areas with a valuation of less than USD 100 per m², of which only 6.2 per cent are in areas with good accessibility to the 15-minute city.

This is fundamental to understanding how the real estate development, focused on providing housing for investors rather than on the housing shortage (Correa-Parra et al., 2023), has occupied the prime spaces of the 15-minute city, predominantly excluding low-income families, who are unable to afford such high housing prices and the most affected by processes of segregation and lack of urban integration (Sabatini et al., 2017).

This situation is prevalent across all six analysed cities, although with certain nuances that respond to specific local factors, like the proximity to the seashore or the consolidation of subcentres linked to major transport routes. In the first case, these developments correspond to capitalisation of the natural asset of the coastal proximity, meanwhile, in the second case, they correspond to the capture of the most valuable areas of the city, where public and private services and employment sources are concentrated.

On the other hand, areas with lower accessibility have seen more recent real estate development, which has been strongly driven by the mining boom of the last decade.

This boom has resulted not only in a sharp increase in housing prices in Antofagasta but also in a significant rise in the number of families living in informal settlements, particularly among migrant populations (CES Techo-Chile, 2021).

Discussion

The above-mentioned findings provide support for the hypothesis proposed at the outset of the study, drawing upon insights from Correa-Parra et al.'s (2020) research, regarding the potential co-optation of a significant proportion of areas with favourable accessibility to the 15-minute city by real estate development.

The evidence shows that more than 60 per cent of the new buildings permits and housing units in the six cities analysed are in areas with high or very high accessibility levels to the 15-minute city; at the same time, nearly 50 per cent of these new housing units are in the areas with the highest fiscal housing value, generating a gap in terms of access to affordable housing for an important portion of the Chilean households, as discussed by Vergara-Perucich (2021; 2022; 2023).

This problematic could be interpreted as a form of privatisation of the 15-minute city, through the capitalisation of the urban space, via real estate development and urban amenities, which have an important role in determining housing prices with a significant spatial heterogeneity (Cortés, 2021). Consequently, access to these neighbourhoods is hindered by the exorbitant housing prices currently prevailing, as has been demonstrated by Knoll et al. (2014) and Vergara-Perucich et al. (2023).

Nonetheless, this situation is predominantly observed in three out of the six analysed cities (Santiago, Temuco and Concepción), while coastal cities present an opposing scenario.

In the cases of Antofagasta, Coquimbo–La Serena and Valparaíso, over 60 per cent of the new housing units are in areas with limited accessibility to the 15-minute city. In these cities, real estate development directly targets the exploitation of the coastal edge as an environmental asset, particularly focusing on the tourism industry during the summer season, especially in cities with a high presence of tourism, such as Valparaíso (Cáceres-Seguel, 2023a), where the verticalisation and investification process are closely linked to the arrival of rental platforms such as Airbnb and processes of tourisification and displacement (Cáceres-Seguel, 2023b).

Moreover, the concept of the 15-minute city is an urban proposition aimed at bringing essential services and activities closer to residents, thereby promoting an improved quality of life and reduced reliance on private vehicles. However, in the Chilean context, there are several crucial considerations that arise when critically evaluating the feasibility of implementing this model. These factors must be considered when endeavouring to adopt this urban framework.

First, there is the issue of the urban impact of a 15-minute city in a context of extreme inequality. Chile is a country with marked socio-economic and territorial disparities (Sabatini and Brain, 2008; Cociña, 2021, Mena et al., 2021); with that in mind, the idea of a 15-minute city could keep or exacerbate these inequalities, especially if we consider the relationship between real estate, urban amenities and housing prices as a barrier to housing affordability.

Linked to this, is important to consider the role of the state on distribution of resources and services in all communities, avoiding excessive concentration in certain areas, and creating regulatory mechanisms capable of regulating the process of investment or the entry of more private services like banks or supermarkets.

This is reflected by looking at the results of Tables 3 and 4, where we can appreciate that around 60 per cent of the population in these six cities does not live in the best-connected or consolidated areas of the cities; meanwhile, the rest of the population lives in the most provided areas, but in most cases in areas with high housing values, which is a major barrier to entry for the other 60 per cent of the population.

A second point is to recognise that the prevailing neoliberal bias in Chile's urban planning model necessitates the establishment of regulations to prevent potential increases in inequality and to avoid decisions driven solely by investment returns. Vicuña and Urbina (2023) argue that verticalisation processes have posed strong challenges for urban planning, as evidenced by the urban crisis of unbalanced densification in urban areas, transforming cityscapes in a notorious way. Evidence of this is that around 50 per cent of the new building permits are heavily concentrated in the central areas of the cities of Santiago, Concepción and Antofagasta, showing the precarious territorial planning capacity of local governments against private market forces (Bustamante and Varela, 2007; Boano and Vergara-Perucich, 2017; Fuentes and Pezoa, 2018).

On the other hand, the processes of coastal verticalisation observed in Antofagasta, Valparaíso and Coquimbo-La Serena, where an important percentage of the new housing units are closely to the coastal line, reflect the precarious and conflictive planning around the coastal edge, where the problem involves other processes such as touristification and capitalisation of the natural resources (Cáceres-Seguel, 2023a; Valdebenito et al., 2020). In these coastal areas, access to the 15-minute city may not be a priority but the concentration of private housing investment is likely to attract more public and private investment in the public goods, affecting housing and land prices, reinforcing the spatial inequalities in these cities.

Overall, owing to the institutional design of the Chilean state and the market itself, simultaneous and comprehensive addressing of these points in urban transformation initiatives is challenging. Often, these initiatives tend to focus solely on housing development. Therefore, it is vital to undertake further analysis and reflection on the

concept of 15-minute cities. Without the necessary regulatory, normative and ethical transformations, the benefits of this urban model could primarily accrue to private companies, failing to effectively improve the well-being of the population.

Conclusions

This research raises a series of pertinent questions that warrant further discussion and exploration within the academic sphere. In particular, it delves into the process of urban development and the viability of achieving true 15-minute cities. Beyond assessing feasibility, the crucial issue at hand is determining who would benefit and how from such interventions. Presently, the evidence presented in this article suggests that real estate developers are already reaping the rewards. Thus, the challenge lies in ensuring feasibility while promoting the collective well-being.

The results of this study corroborate the initial hypothesis of the spatial relationship between the real estate development and the 15-minute city neighbourhood in the Chilean cities, and how this relationship evidences the advance of the private housing market forces inside the urban spaces, where the area with the most urban public goods is occupied by the new private urban development. The evidence shows that 60 per cent of the new housing units in the six cities analysed are in the best accessibility areas of the city, but we know that these housing units are not accessible for the majority of the citizens, when we look at the value of the housing in these neighbourhoods, because of the strong house price increases, which make both housing and the city difficult assets to access.

This situation is also intertwined with the particularity of the coastal cities like Antofagasta, Coquimbo and Valparaíso, where the benefit of the proximity to the sea generates a new form of capitalisation of the coastline, generating new process of verticalisation in the kind of natural spaces, reinforcing the process of touristification and potential displacement of the habitants in these areas.

The evidence presented in this study shows how private real estate market forces, underpinned by weak and precarious urban planning, are driving the development of the city, not only generating greater inequality gaps in access to the city itself but also reinforcing them through potential increases in land and housing prices, leading to a vicious cycle of socio-spatial inequality and segregation. In this case, the 15-minute city would not be the path to greater urban integration but a new mechanism of inequality and segregation.

The findings of this study present various avenues for further research. First and foremost, it is crucial to conduct studies that assess the tangible impact of implementing a 15-minute city in terms of quality of life, mobility, equity, health and sustainability. Such investigations can deepen our understanding of the benefits and challenges

associated with this approach and help identify potential avenues for improvement. Modelling the implementation using statistical analysis of future scenarios is a viable method for achieving this.

Second, it is important to continue with the review of the concept of the ‘15-minute city’, which involves substantial transformations in infrastructure and transportation, particularly aimed at preparing neighbourhoods for the influx of people and activities in the context of climate change. Its proposal seeks to promote sustainability and minimise environmental impact.

On the other hand, if we look at the relationship between the 15-minute city, real estate development and urban planning, is mandatory to think in inclusive and participatory urban plans. The planning process for a 15-minute city should actively involve citizens and local communities, thus fostering a bottom-up approach in a time when the democratisation of the city is paramount.

It is crucial to attentively listen to and consider the needs and opinions of residents to ensure that services align with their demands. Citizen participation can aid in identifying priority areas for the placement of services and foster a sense of belonging and ownership within the urban environment. Conversely, an opposing question arises: can private entities be motivated to invest in areas that require improvements to transform into 15-minute neighbourhoods?

As mentioned earlier, while the state in Chile typically allocates functions evenly, market-driven functions tend to concentrate in specific sectors. Consequently, achieving the 15-minute city ideal for all could become an impossibility. In this regard, it seems that the only viable solution lies in coordinated regulation of the city, governing the market’s involvement in spatial production processes, and guiding these enterprises towards the common good without jeopardising potential commercial relationships.

Technology and digitalisation can play a pivotal role in implementing the 15-minute city concept, particularly in light of the accelerated digitalisation brought about by the coronavirus pandemic lockdown. Future research could analyse how technological innovations such as shared mobility, smart planning and data management can facilitate and optimise the implementation of this approach. These investigations can help identify key factors that contribute to the success of this approach and inform policies and strategies on a global scale.

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