

Relationships Between Walkable Urban Environments and the Creative and Knowledge Economies


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Relationships Between Walkable Urban Environments and the Creative and Knowledge Economies

A review regarding impacts on contemporary city development

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Abstract: Currently, many urban planning projects have sought to apply sustainable strategies, with a special dedication to mobility. International guidelines indicate a focus on pedestrians and their integration with other active and collective transport modes, discouraging car use. Conceptions of transit-oriented development (TOD) see cities strengthen walkable environments around public transport stations, which provide several benefits. Around the world, there has also been a shift from a commodity-based industrial economy to a knowledge-based economy. TOD environments are seen as having the potential to attract young workers, generating jobs in creative and knowledge economies. However, criticism arises regarding the possibility of real estate valuation and consequent gentrification with the consummation of these planning practices. Considering positive and negative aspects, the objective of this paper is to provide a brief literature review of the impacts of urban transformations dedicated to stimulating pedestrian mobility, with an emphasis on their interplay with the knowledge-based economy. There is no focus on methods, rather on concepts and interpretations regarding how processes occur in spatial dynamics. Reviewing case studies from the USA, Australia and China indicates correlation between the amenities characteristic of walkable environments and the creative and knowledge sectors. Negative effects for start-ups or smaller capital companies are apparently related to the cost of real estate. With the understanding that gentrification tends to be inherent to the dynamics of urban requalification, public policies and planning actions are suggested to manage gentrification and minimise its problems.

1. INTRODUCTION

Over the past few decades, many proposals for the construction and/or requalification of cities have sought to apply sustainable strategies, with a special dedication to the topic of mobility. Several countries have adopted urban mobility policies in line with international guidelines, such as the New Urban Agenda ([UN Habitat, 2017](#)) and the Sustainable Development Goals (SDGs) of the [United Nations \(2016, 2021\)](#). These serve as guidelines whose spatial representation is a city designed to encourage pedestrians' co-presence and integration with other sustainable and active transport modes



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for smaller routes and collective transport for greater distances. The use of individual motorised transport is thus discouraged. In this sense, the walking mode appears as an important structuring element of contemporary urban design, and walkability becomes a frequent object of investigations about the city.

Studies dedicated to walkability integrate various areas of knowledge beyond the traditional approaches to transport engineering and urban design. They incorporate multidisciplinary contributions from fields such as social sciences, public health and environmental psychology, among others ([Moura, Cambra et al., 2017](#)). Many current studies apply a public health approach to the relationship between walkability and the built environment. Such studies are motivated by diseases caused by physical inactivity ([Sallis, Cerin et al., 2016](#)), and there is an understanding that the environment (built, natural and/or social) directly affects the physical and mental health of the population (with positive effects against obesity, osteoporosis, diabetes and cardiovascular problems as well as for self-esteem and the reduction of stress and depression) ([Creatore, Glazier et al., 2016](#); [Frank, Giles-Corti et al., 2016](#); [Moura, Cambra et al., 2017](#); [Smith, Hosking et al., 2017](#)). Other recent works take an economic perspective to investigate how the amenities of the sustainable (and walkable) built environment attract young workers by generating jobs in the creative and knowledge economy and enhancing robustness in high technology/high added-value sectors ([Esmailpoorabi, Yigitcanlar et al., 2018](#); [Fang and Rao, 2021](#); [Kelly, Ruther et al., 2017](#); [Zandiatashbar and Hamidi, 2018, 2021](#); [Zandiatashbar, Hamidi et al., 2019a](#)).

Another concept that has been proposed, studied and adapted to the new ideals of urban mobility is transit-oriented development (TOD). TOD is an urban model that integrates land use and transport planning, locating the highest residential density and other diversified uses (density of companies and jobs) within short distances of public transport stations ([Ibraeva, de Almeida Correia et al., 2020](#); [Maheshwari, Grigolon et al., 2022](#); [Thomas and Bertolini, 2017](#); [Zandiatashbar, Hamidi et al., 2019b](#)). Creating walkable environments around public transport stations improves accessibility and reduces dependence on car use and also sustains an economically attractive environment for the agglomeration of companies ([Padeiro, Louro et al., 2019](#); [Zandiatashbar, Hamidi et al., 2019b](#)).

Many studies point to the positive consequences of adopting strategies for walkability and TOD, although there are also criticisms. One that is frequently highlighted is the possibility of increasing the cost of land (for housing and the installation of companies), leading to gentrification as a consequence of these new planning practices ([Anguelovski, Connolly et al., 2019](#); [Ibraeva, de Almeida Correia et al., 2020](#); [Immergluck and Balan, 2018](#); [Janoschka and Sequera, 2016](#); [Moos, Revington et al., 2019](#); [Morisson and Bevilacqua, 2019](#); [Tulumello and Allegretti, 2021](#); [Yao and Hu, 2020](#); [Zandiatashbar and Hamidi, 2018](#); [Zandiatashbar and Kayanan, 2020](#)). Considering positive and negative aspects, the objective of this article is to provide a brief literature review of the impacts of urban transformations dedicated to stimulating pedestrian mobility in the dynamics of the contemporary city, with emphasis on their interplay with the knowledge-based economy.

The article is organised into five sections. The Introduction is followed by a brief description of the method adopted for the review. Then, the literature review conceptualises and summarises contemporary understandings of walkability, TOD, knowledge economies and

agglomeration. The Literature Review concludes with the relationship between walkable built environment characteristics and workers and companies in the creative and knowledge sectors, exemplified by the summary of the results of some articles that assess their correlation through case studies. Finally, considering that these results concern the risk of gentrification, this theme is briefly approached in the Discussion and finally the Conclusion.

2. RESEARCH METHOD

As stated in the Introduction, this is a literature review. Articles indexed in databases were consulted (such as Web of Science, Science Direct and Google Scholar). Searches were conducted by combining main keywords (*walkability*, *TOD - transit-oriented development*) with complementary ones (*knowledge economy*, *creative economy*, *amenities*, *gentrification*). Articles written in English and primarily published in the last five years were selected; those whose titles or abstracts were not connected with this review proposal were rejected. Beyond this method, other articles were added by snowballing, mainly for conceptual purposes.

Analyses of the articles reviewed focus not on methods but rather on concepts and interpretations of how processes occur in spatial dynamics. To better understand the correlations between the amenities characteristic of walkable environments and the creative/knowledge sector, some additional case studies carried out by other authors were selected for several reasons. These included a more expanded description of results, a different focus (on workers and/or companies) and different country contexts and city sizes. In other words, the selection of studies sought to verify the relationships between walkable built environments and the creative economy under different approaches. The proposal here is not intended to systematically cover the total production of these themes but rather to provide an overview of recent discussions in TOD.

3. LITERATURE REVIEW

3.1 Walkability and TOD

When conceptualising the term ‘walkability’ in the early 1990s, Canadian planner [Bradshaw \(1993\)](#) listed four qualifying characteristics of urban built environments ([de Cambra, 2012](#)): (i) diversity of uses close and accessible on foot; (ii) adequate infrastructure for walking; (iii) ability to moderate climatic variations and noise and air pollution; and (iv) local culture for contact and with conditions for social and economic activities. Over the past few decades, the concept of walkability has been reinterpreted and expanded. New indicators have been added, such as the 7D by [Ewing and Cervero \(2010\)](#) (density, diversity, design, distance to transit, destination accessibility, demand management and demographics) or the 7C by [Moura, Cambra et al. \(2017\)](#) (connectivity, comfort, convenience, conviviality, conspicuousness, coexistence and commitment).

Relationships between pedestrian behaviour and the characteristics of the built environment can be observed and measured at different geographical scales, each providing different levels of understanding. Smaller scales are

usually apprehended at street level, are easier to change and are more readily perceived by pedestrians, such as comfort, safety, architectural morphology, sidewalks and their aesthetics, and other amenities ([Cain, Geremia et al., 2018](#); [de Cambra, 2012](#)). At larger scales, the structure that shapes the urban form is abstracted, barely perceptible to users, and hardest or slowest to be modified, such as the size of blocks and road connectivity ([Cain, Geremia et al., 2018](#); [de Cambra, 2012](#)).

Many morphological aspects of already consolidated cities can be large, dispersed, fragmented or monocentric, with spatial incompatibilities between housing and work or study places ([Cervero, 2013](#)). Urban sprawl contributes to these morphologies and is discussed as a phenomenon of significant concern for the sustainability of cities today ([Hellberg, Guaralda et al., 2021](#)). Thus, public transport complementary to the walking mode gains importance, which meets the guidelines of the New Urban Agenda ([UN-Habitat, 2017](#)) and the SDGs of the [United-Nations \(2016, 2021\)](#). Therefore, road structure and motorised modes have an important relationship with pedestrians' propensity to walk.

The concept of TOD also emerged in the early 1990s, coined by urban planner Peter Calthorpe ([Renne, Tolford et al., 2016](#)). As already mentioned, TOD is related to a city model with higher densities for diversified uses (homes, businesses and workplaces) located in the immediate vicinity (i.e. accessible on foot) of public transport stations (e.g. trains, metro, buses, modal integration) ([Ibraeva, de Almeida Correia et al., 2020](#); [Maheshwari, Grigolon et al., 2022](#); [Thomas and Bertolini, 2017](#); [Zandiatashbar, Hamidi et al., 2019b](#)). In other words, TOD brings about the positive characteristics of walkable environments, but with the public transport station as the structuring element of urban development at the local scale. The objective is to minimise spatial incompatibilities at the city scale, bringing housing and jobs closer both for those who live near the stations and for those who rely on public transportation. It is understood that this model tends to discourage individual motorised transport ([Park, Deakin et al., 2015](#)), enabling transit ridership and maximising the efficiency of public transport structures ([Thomas and Bertolini, 2017](#)).

The last decades have seen, in several places, the shift from a commodity-based industrial economy to a knowledge-based economy, generating a new model of urbanisation for planners and policymakers ([Scott, 2006](#); [Zandiatashbar, Hamidi et al., 2019a](#)). In this type of urbanisation, the locational advantages surrounding public transport stations (as characteristics of TOD) seem to attract clusters of knowledge-based and creative companies ([Zandiatashbar, Hamidi et al., 2019a](#); [Zandiatashbar, Hamidi et al., 2019b](#)). Public transport can lead to significant densification, which tends to facilitate knowledge sharing not only between companies but also between people during their social and networking activities. Public transport can also decrease the time and cost spent looking for jobs ([Chatman and Noland, 2011](#)).

Accordingly, these locational advantages have been described as attractive to workers with higher education belonging to the creative and knowledge class, especially Millennials ([Zandiatashbar and Hamidi, 2018](#)). Regarding knowledge class, there is no consensus regarding the fields where these professionals congregate, but [Florida \(2014\)](#) indicates some areas: computer science and mathematics; architecture and engineering; design, entertainment, and media; artists (actors/actresses, musicians, dancers, novelists, poets, etc.); education (university professors and researchers); life, physical and social sciences; pharmacy; management; finance; and law. Data

indicate that this group tends to have lower car ownership than the previous generation ([Klein and Smart, 2017](#); [Lucchesi, Larranaga et al., 2021](#); [Zandiatashbar and Hamidi, 2018](#)), which is in line with the decrease in licences for driving observed in the last decade in European countries, the USA, Australia and Japan ([Delbosc and Currie, 2013](#); [Kuhnimhof, Armoogum et al., 2012](#)). Millennials prefer to live in places that suit the characteristics of micro- and macro- scales for walking. They prefer places with daily activities accessible at walkable distances. They also prefer third places (such as restaurants, cafes, gyms, shops, cultural institutions, etc.), places that are economically functional and aesthetically desirable (around the urban centre, along public transport routes, close to universities and waterfronts or other natural amenities), and places that are favourable to higher diversity (ethnic-racial, linguistic, gender and sexuality, marriage status, etc.) ([Esmailpoorarabi, Yigitcanlar et al., 2018](#); [Florida, 2002, 2014](#); [Florida and Adler, 2018](#); [Kelly, Ruther et al., 2017](#); [Rao and Dai, 2017](#); [Zandiatashbar and Hamidi, 2018](#); [Zandiatashbar, Hamidi et al., 2019b](#)). That is, the conditions that support quality of life in these places can be determinants of the creative class's location decisions ([Rao and Dai, 2017](#)). Despite the abundance of jobs being a strong decisive factor for talented workers, according to [Florida \(2014\)](#), there is still a correlation between these professionals and creative companies (attracting each other) and the qualifying amenities of the walkable built environment, which function as essential elements to motivate them to stay in these places.

Concerning the general decrease in the number of new driving licences, [Kuhnimhof, Armoogum et al. \(2012\)](#) found an increase in the use of automobiles by women, with greater availability of vehicles in households in Japan and greater mileage per capita when traveling in Japan and France. [Delbosc and Currie \(2013\)](#) find the opposite in Israel, Finland, Latvia, Spain, Switzerland and the Netherlands, where the number of new licences has recently increased for both genders. No similar surveys have been conducted by gender or age group for the Global South, but many of these countries have seen a growth in the vehicle fleet in recent decades ([Cervero, 2013](#)).

On average, Millennials own about 12% or 13% fewer cars than previous generations ([Klein and Smart, 2017](#); [Zandiatashbar and Hamidi, 2018](#)), and 11% of them are carless ([Ralph and Delbosc, 2017](#)). However, when those results are disaggregated by economic dependence and independence, financially independent young adults show a 3% increase in vehicle ownership compared to that of older generations when they were the same age ([Klein and Smart, 2017](#)). These results (in the USA context) may suggest this is not a change in generational behavior but a decline caused by economic factors.

Following are examples of some studies that tested the relationship between walkability/TOD and the attraction/presence and agglomeration of companies and workers in the creative/knowledge economy. However, before proceeding, it is necessary to further explain this type of economy.

3.2 Knowledge economy and agglomeration

The industry or creative occupation is a productive sector related to management workers and consultants in STEM (Science, Technology, Engineering and Mathematics) and the occupations of the cultural goods and social services development industry ([Dursun, 2018](#); [Zandiatashbar and Hamidi, 2018](#)). It fits the concept of the knowledge economy because it depends on a population with a high level of education (with education being

a determinant for income) and has information access as an asset for success ([Moos, Revington et al., 2019](#)). In this sense, the presence and expansion of post-high school institutions (technical, higher education and postgraduate study) are highly relevant and can be understood as developers in this scenario ([Moos, Revington et al., 2019](#)), with extensions of university campuses and incubation/innovation districts showing potential for ‘innovation ignited urban developments – IIUD’ ([Zandiatashbar and Kayanan, 2020](#)).

In this new economy, the potential emergence of an economically creative urban environment depends on policies that focus on places at the neighbourhood scale and aim to concentrate knowledge in the city ([Zandiatashbar and Kayanan, 2020](#)). There is a marked tendency to assume geographical expression in the form of specialised locational clusters ([Scott, 2006](#)). Clusters in the proximity of central areas (central business districts, or CBDs) and amenities enhance the built environment and attract the creative class and high-skill workers ([Zandiatashbar and Hamidi, 2018](#)).

A basic principle for economics is that companies tend to be located where they can minimise production, labour and transportation costs ([Zandiatashbar and Hamidi, 2018](#)). Even with that primary objective, the explanation for the logic of business agglomeration is generally attributed to two opposing approaches: the Marshallian (developed by Alfred Marshall, in 1890) and the Jacobsian (by Jane Jacobs, in 1969). In summary ([Chatman and Noland, 2011](#); [Van der Panne, 2004](#)): (i) the Marshallian model emphasises the need to capitalise on geographical proximity (e.g. sharing suppliers to reduce transportation costs) and the transmission of knowledge that can arise between companies within the same sector, generating ‘location’ externalities or ‘specialisation’; (ii) on the other hand, in Jacobs' model, knowledge can overflow between different but complementary sectors and increase productivity and innovation through competition in a diversified local production structure that gives rise to ‘urbanisation’ or ‘diversification’ externalities. According to [Fang and Rao \(2021\)](#), the Jacobs agglomeration model has a more explicit focus on walkability and, consequently, on urban sustainability. In both models, agglomeration works through sharing mechanisms (of facilities or suppliers; distributing risks), correspondence (between buyers and sellers; between contractors and labour); and stimulates competition and learning (generation, diffusion and accumulation of knowledge; enhanced by networking) ([Chatman and Noland, 2011](#)). However, according to [Fang and Rao \(2021\)](#), the Jacobs agglomeration model focuses more on walkability and, consequently, on urban sustainability.

Knowledge-based or creative companies located in urban centres generally operate with immaterial services; their agglomerations are influenced by easy access to information, with spillovers of knowledge and innovation made possible through greater networking opportunities ([Dursun, 2018](#); [Zandiatashbar and Hamidi, 2018](#); [Zandiatashbar, Hamidi et al., 2019a](#); [Zandiatashbar, Hamidi et al., 2019b](#)). This takes advantage of what [Florida \(2014\)](#) called externalities of human capital. The benefits of this externality, with its overflow of knowledge, would increase when there is cognitive proximity, i.e. when there is a similarity of knowledge necessary for intra- and inter-firm exchanges (related to specialised labour according to the level and type of workers' training) ([Zandiatashbar and Hamidi, 2018](#); [Zandiatashbar and Kayanan, 2020](#)). This would suggest a Marshallian approach. However, on the other hand, [Yao and Hu \(2020\)](#) suggest that the dynamics provided by TOD are more relevant to Jacobsian economies.

Since agglomeration is implicitly a function of accessibility ([Chatman and Noland, 2011](#)), transport infrastructures play an important role in enhancing a cluster's development, reducing travel times and expanding the coverage area of companies, thus contributing to the robustness of the economy at the local scale ([Zandiatashbar and Hamidi, 2018](#)). There is a spatial mitigation effect (space-decay) regarding the impact of public transport on the establishment of companies (except for the manufacturing industry), mainly for start-ups, which tend to follow the pattern of reducing in quantity as they move away from the stations ([Yao and Hu, 2020](#)). Accordingly, creative companies tend to seek proximity to transport hubs (train, metro or bus stations, or even airports) ([Zandiatashbar and Hamidi, 2018](#)). Cluster formation around such hubs reinforces the idea that TOD can catalyse the dynamics of agglomeration, attracting companies as well as their workers with abundant job opportunities and the local amenities of the walkable environment ([Zandiatashbar, Hamidi et al., 2019b](#)).

According to [Scott \(2006\)](#), in cities with many groups of creative/knowledge workers, the emergence of a balance between the production system and the urban cultural environment is perceived and expressed through urban environmental renewal programmes with placemaking and place promotion activities. These are strategies for reformulating the image of places that, in addition to fostering the knowledge economy, also serve as tools for attracting tourism based on the same amenities ([Scott, 2006](#)).

3.3 Do walkability and TOD matter for the creative and knowledge economy?

As seen in this review, several authors make assumptions that walkable and/or TOD environments can attract and gather creative companies and knowledge professionals. However, according to [Esmailpoorarabi, Yigitcanlar et al. \(2018\)](#), the understanding of the role of the urban environment and its characteristics in cluster dynamics is still limited. The few recent case studies that assess the validity of this relationship were found and summarised below. All these studies (*Table 1 and Figure 1*) relate characteristics of the built environment with the location/concentration of workers ([Esmailpoorarabi, Yigitcanlar et al., 2018](#); [Kelly, Ruther et al., 2017](#)), companies ([Fang and Rao, 2021](#); [Yao and Hu, 2020](#)) or both ([Zandiatashbar and Hamidi, 2018](#)).

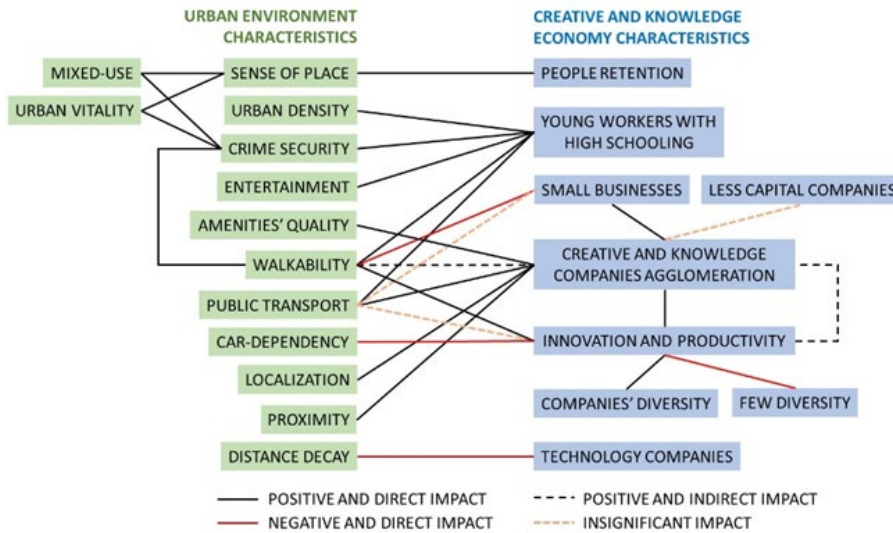


Figure 1. Flowchart summarising the relationships between attributes of the urban built environment and characteristics of the creative and knowledge economy

Table 1. Synthesis of revised case studies

Reference	Objective	Case study	Main results
Kelly, Ruther et al. (2017)	to test the hypothesis of correlation between the proportion of knowledge workers and the presence of placemaking amenities	small and medium-sized cities (up to 500,000 inhabitants) in the USA	Positive relationships between young people with high schooling and factors of density and crime/security for medium-sized cities; and positive results for entertainment in both types of city size. Insignificant relationships for small towns.
Esmailpoorarabi, Yigitcanlar et al. (2018)	to identify place characteristics that support better performance of the knowledge economy	Brisbane (Australia)	Mixed uses, dynamic street life and walkability provide a greater sense of security and sense of place. Sense of place keeps people living in innovation districts localisation has a direct positive effect on the amount of KIBS and innovation productivity. Agglomeration contributes indirectly to innovation the quality of local amenities had the greatest direct positive impact on KIBS and creative companies.
Zandiatashbar and Hamidi (2018)	to verify the local determinants for innovation	USA (nationwide)	Walkability had a direct positive impact on the creative class and an indirect impact on the emergence of KIBS. Public transport had a direct and positive effect on both the creative class and the presence of KIBS, but was insignificant for innovation. For small businesses, there was a negative impact regarding walkability and the

Reference	Objective	Case study	Main results
			insignificance of public transport.
Yao and Hu (2020)	to ascertain the push-out (expulsion/repulsion) and pull-in (attraction) factors of creative industries from the opening of public transport structures (i.e. TOD environments)	Hangzhou (China)	The agglomeration effect is more intense in the vicinity up to 1000 meters. Technology companies are the most affected by spatial attenuation. The agglomeration around the stations had a positive result for small firms in the construction sector, but not for large companies. Insignificant impact of agglomeration was found for companies with less registered capital.

Table 2. Synthesis of revised case studies (continuation)

REFERENCE	OBJECTIVE	CASE STUDY	MAIN RESULTS
Fang and Rao (2021)	To qualitatively evaluate the relationships between innovation, industrial diversity and walkability	Baltimore (USA)	Coupling companies' diversity and walkability expands the potential for innovation, which also has a positive relationship with agglomeration and public transportation. Car-dependency networks and domination by a few industries negatively correlate with innovation.
		Melbourne (Australia)	Companies' diversity and walkability are related to innovation, but young and high-skill workers have a more significant and positive impact.

The study of [Kelly, Ruther et al. \(2017\)](#) addressed placemaking amenities using locational quality indicators (crime/security, entertainment, density, diversity, housing). In this study, the insignificant results for small towns stand out. According to the authors, small towns may report lower crime rates, may not influence location decisions, and may not have sufficient demand for public transportation to justify density. They may also exhibit less diversity. In this sense, the positive effects of placemaking seem to be obstructed in the context of small cities, but they do tend to be effective in medium-sized ones.

[Esmailpoorarabi, Yigitcanlar et al. \(2018\)](#) used the method of expert and user interviews in three innovation districts, together with data from previous studies. Four dimensions were measured: the form (location, urban

morphology, design, amenities), the function (services, land use, companies' profile, working conditions), the ambience (public and cultural spaces, public engagement, diversity, creativity), and the image (buzz, sense of safety, sense of place, place identity). As seen in *Table 1*, some of these factors appeared to be more successful in generating a sense of security and belonging to place, which in turn contributed to the retention of workers.

[Zandiatashbar and Hamidi \(2018\)](#) applied Structural Equation Modelling from census data and other available databases in modelling walking trips, with support in geotechnologies. The positive effects (direct or indirect) of the amenities for walking in Knowledge-Intensive Business Services (KIBS) are highlighted. However, this study found a negative impact on walkability for small businesses. The authors explain that this may be related to the high cost of real estate in these areas. In addition to variables related to location, amenities and mobility, positive direct and indirect effects were also found in the presence of the creative class and innovation with indicators of tolerance, racial diversity and the number of bohemians. In this case, bohemians' refers to the artistically creative class composed of authors, designers, musicians, composers, actors, directors, painters, sculptors, artistic printers, photographers, dancers and performers ([Zandiatashbar and Hamidi, 2018](#)).

The study by [Yao and Hu \(2020\)](#) found that the agglomeration effect is stronger in the vicinity of station areas, up to 1000 meters. More new companies open within this vicinity (i.e. within TOD environments), compared to other parts of the city. As for the sectors, technology companies (also start-ups of various specialities) are the most directly affected by the spatial attenuation, possibly because they depend more on the knowledge exchanges and spillovers provided by cluster agglomeration. According to the authors, the insignificant impact for companies with less registered capital may also be related to higher real estate costs.

[Fang and Rao \(2021\)](#) assessed the relationships between innovation (based on the number of patents), industrial diversity (measured by the Gini coefficient and entropy), and walkability (based on road connectivity). The results for Baltimore and Melbourne were similar, although to a lesser extent in the Australian city. The relationship between innovation and public transport was contradictory. It had a positive correlation with train stops and a negative correlation with bus stops, indicating the need for further studies to find an explanation. Nonetheless, the authors emphasise that the results align with the ideal of planning based on place and people.

[Yu and Liu \(2021\)](#) reinforce the notion that externalities related to agglomeration economies may vary according to different sectors. Among other results, [Zandiatashbar and Hamidi \(2021\)](#) point out that the walkability and accessibility of public transport increase the probability of locating professional services (architecture, engineering, design, education, etc.) but reduce it for the IT, aerospace and biopharmaceutical sectors. They also suggest that remote work initiatives accelerated by the COVID-19 pandemic may change the relationships between business location and mobility, suggesting the need for more studies in the future.

4. DISCUSSION: THE RISK OF GENTRIFICATION

Proposals for sustainable urban development integrating active mobility and public transport solutions are seen as aggregators of several benefits, mainly in terms of environmental sustainability and economic growth.

However, critics point out that this development model is not entirely sustainable, as it ignores social equity ([Immergluck and Balan, 2018](#)) and can bring about gentrification processes as a consequence. Gentrification can be defined as a process of improvement in the urban environment. It is a process that also causes more intense and rapid changes in the socioeconomic composition of a given neighbourhood, compared to other parts of the city, by increasing the proportion of the wealthy to the poorest in urban housing ([Padeiro, Louro et al., 2019](#)).

There are derivations of the gentrification process that may appear in the literature under other names, due to specific characteristics of the motivating agents of social change: (i) touristification, with a demographic trend of depopulation instead of replacement and the conversion of residential units into units of short-term rentals (e.g. Airbnb rentals, hotels, hostels) to attract tourists ([Tulumello and Allegretti, 2021](#)), or even the displacement of local residents due to housing price increases or conflicts with the tourist-commercial overexploitation of revitalised historic areas ([Zhang, Zhang et al., 2017](#)); (ii) studentification, which is associated with the influx of students in the vicinity of university campuses, with the possibility of converting residential units into short-term rental units for student accommodation ([Moos, Revington et al., 2019](#)); (iii) youthification, characterised by the influx of young adult workers, regardless of income, in neighbourhoods rich in amenities that combine aspects of the labour market and housing offers (greater offers, smaller units or more cohabitation) ([Moos, Revington et al., 2019](#)); and (iv) eco-gentrification (or green gentrification), in which inequalities are produced or intensified by urban greening interventions (greenways, parks, gardens, ecological corridors, trails) ([Anguelovski, Connolly et al., 2019](#); [Immergluck and Balan, 2018](#)). According to [Moos, Revington et al. \(2019\)](#), studentification and youthification can easily co-occur. These subclassifications of gentrification either directly relate to creative and knowledge economies/workers or they relate to amenities that may meet this profile of economies.

Walkability is important for tax calculation, the valuation of property values by real estate agents, and purchase decisions by customers ([de Cambra, 2012](#)). In this way, it has already been suggested that a built-in walkable environment integrated with mass transportation and rich in amenities (higher in density social diversity and land use; aesthetically pleasing; safe, etc.), would tend to cause an increase in the price of properties (for purchase or rent) in the real estate market. Such valuation is caused not only by urban improvements and mobility but also by the increase in demand, especially when demand exceeds the supply of real estate. This creates a lack of harmony and can make it difficult to open new business, or it can cause the expulsion of start-ups and/or smaller companies with limited financial resources that are more sensitive to costs ([Yao and Hu, 2020](#); [Zandiatashbar and Hamidi, 2018](#)). The same increase in property prices also affects people with lower incomes, restricting their access to new housing and their ability to maintain their current housing, which can cause social filtering and the displacement of families from better-structured areas to peripheral ones ([Lucchesi, Larranaga et al., 2021](#); [Padeiro, Louro et al., 2019](#)).

This reduced sustainability of access to real estate (for business or housing), and consequent displacement, is not the only negative consequence of the gentrification process related to an IIUD. Admittedly, these are types of recent urban developments with little evidence of their repercussions, but [Zandiatashbar and Kayanan \(2020\)](#) empirically suggest three other

consequences: (i) polarised labour division with a higher focus on highly qualified professionals, which deepens the social division of work caused by inequities in the distribution of opportunity; (ii) unequal access to opportunity, because, with the increase in real estate values, many workers are located further away from employment centres and are dependent on flawed transport systems, which increases congestion; and (iii) socio-spatial polarisation, because with inequality in urban economic development, low-skilled and low-paid workers (who are sometimes also ethnically or racially disadvantaged) tend to cluster in poor peripheries in high-tech regions.

The causal chain of gentrification and displacement processes as a consequence of investments in urban improvements, such as TOD and walkability (which lead to the agglomeration of companies and wealthier people from the creative and knowledge classes), is quite frequent in the literature. However, this causal chain does not fit all situations. [Maloutas \(2018\)](#) argues that gentrification is a concept highly dependent on contextual causality, i.e., on specific parameters of each location, with the intertwining of the economic, state and social spheres, as well as the socio-spatial dynamics and realities. [Maloutas \(2018\)](#) criticism mainly targets the gentrification parameters adopted in the English-speaking scientific literature (i.e. for the USA, Canada, and the United Kingdom), as they tend to ignore the differences that can be observed in urban renewal processes in the specific contexts of other countries.

[Janoschka and Sequera \(2016\)](#) see internationally common characteristics in basic aspects of gentrification, such as real estate investment and exclusions of urban transformation. However, these authors also question whether it is possible to use the same term (or the same concept) for cities with different histories and social, urban, political and administrative structures. For example, in Latin America, gentrification rarely happens organically due to the active role of newly arrived, wealthy elites. Instead, gentrification arises from the displacement of populations following some motivating patterns, such as ([Janoschka and Sequera, 2016](#)): (i) heritage accumulation: through public policies of reinvestment and social cleansing to attract tourism; (ii) cultural dispossession: similar to the previous item, although with a greater focus on intangible heritage; (iii) militarisation and states of exception: motivated by pacification actions or great events that generate opportunities for expansion of the real estate market; and (iv) ground rent dispossession: similar to the process reported in English-speaking countries, but more violent. All of these operations occur according to public-private persuasion and can inflict different types of symbolic violence (hyper-security, touristic, cultural, architectural or urbanist; in addition to cases of ethnic-racial and physical violence), consciously or not, as an instrument of gentrification ([Janoschka and Sequera, 2016](#)).

Despite its negative aspects, some authors understand that the gentrification process tends to be inherent to the urban requalification dynamic and that is also capable of bringing about positive impacts. For example, contact with families in a higher socioeconomic class has been associated with improved educational results for low-income children or the improvement in the quality of life of families, due to the availability of new goods and services ([Padeiro, Louro et al., 2019](#)) or the increase in tax revenues for municipalities ([Dong, 2017](#); [Immergluck and Balan, 2018](#)), which can be fundamental for investments in new infrastructure. Thus, the current trend is not to combat gentrification, but to manage it politically ([Ghaffari, Klein et al., 2018](#)).

With the understanding that gentrification tends to be inherent to urban requalification dynamics, it is possible to manage it to enhance its positive aspects and minimise its negative ones. To that end, some public policies and planning actions have been proposed:

- [Zandiatashbar, Hamidi et al. \(2019b\)](#) suggest that TOD can be planned to act as an innovation hub in a network with other specialisation types of TOD, through strategic zoning and land use policies. This could take the form of coworking spaces, accelerators or incubators for creative start-ups, in addition to incentives for educational anchors and training centres for workers, thus forming a more resilient economy. Training spaces (and continuous learning) become relevant for local residents, enabling greater social equality and participation in the high-tech job market ([Zandiatashbar and Kayanan, 2020](#)).
- [Yao and Hu \(2020\)](#) propose government subsidies for small and medium-sized companies.
- [Ghaffari, Klein et al. \(2018\)](#) point out three strategies for controlling displacement induced by gentrification: (i) community empowerment (with social movements, local jobs, education, legal assistance, etc.); (ii) controlling ownership and development (greater municipal control, inclusionary zoning, stricter tax policy controlling speculation, formation of housing cooperatives, etc.); and (iii) tenants protections (with relocation assistance, tax exemption or relief, laws against harassment, rent subsidies, etc.).
- Based on strategies proposed for the city of Chattanooga (USA), [Morisson and Bevilacqua \(2019\)](#) also indicate the promotion of empowerment through programmes and training that favour entrepreneurship for the social groups most vulnerable to gentrification. These authors emphasise creating a sense of belonging through events aimed at disadvantaged populations. In addition, they suggest incentives for affordable housing near innovation districts.
- [Immergluck and Balan \(2018\)](#) indicate the importance of controlling taxes based on income, limiting tax increases for poorer owners as well as reserving a percentage of new affordable housing units in new developments in urban restructuring areas for low-income residents.
- [Zhang, Zhang et al. \(2017\)](#), in the specific case of touristification, suggest: (i) a state subsidy supported by tourism taxes so that local residents can enjoy the environments created for tourist-commercial exploration; (ii) maintaining or providing traditional facilities (schools, health centres, etc.) in the revitalised area; (iii) creating community spaces to develop relationships between traditional residents and thereby promote cultural authenticity; and (iv) promoting tourism projects with aspects of local culture (architecture, music, celebrity artists, etc.) to generate employment and income opportunities for the resident population.

Finally, regardless of other incentives that may appear in public policies, [Scott \(2006\)](#) notes that the most important element is that these places must provide a job system capable of sustaining an adequate and durable income so that people can secure permanent housing. With these in mind, people with diverse incomes can coexist and enjoy the high quality of life provided by more sustainable, diversified, creative, accessible and walkable urban environments.

5. CONCLUSION

From this brief literature review, it is possible to glimpse the scope of theorising about the impacts of urban transformations dedicated to stimulating pedestrian mobility (and discouraging car dependency) on contemporary city dynamics. Several benefits of walking are widely reported: reduction of energy consumption, of polluting gases emission and of noise pollution from motorised modes; contribution to the sense of security, spatial perception and places appropriation by communities; and gains in physical and mental health ([Creatore, Glazier et al., 2016](#); [de Cambra, 2012](#); [Frank, Giles-Corti et al., 2016](#); [Moura, Cambra et al., 2017](#); [Sallis, Cerin et al., 2016](#)). However, there are still methodological challenges and gaps in the literature ([Moura, Cambra et al., 2017](#)). At the same time, although agglomeration economies have been studied for several decades, more recent studies seek to verify the suggested positive contributions of TOD (integrating walkability and public transport) to local economic development through the attraction of knowledge workers and the cluster formation of creative companies and high value-added services.

In the practical experiments analysed here ([Esmailpoorarabi, Yigitcanlar et al., 2018](#); [Fang and Rao, 2021](#); [Kelly, Ruther et al., 2017](#); [Yao and Hu, 2020](#); [Zandiatashbar and Hamidi, 2018](#)), the results indicate strong correlations between proximity (and other characteristic amenities of walkable environments) and the creative/knowledge sector. However, some of these effects can be insignificant in small cities, or even negative for start-ups or small companies with less capital.

This negative effect of walkable environments and TOD on economic and social inclusion is apparently related to the rise in property prices and the consequent gentrification process resulting from urban transformations in innovative and creative environments. Beyond the impact on entrepreneurship, TOD also tends to restrict access to housing, which can cause displacement of the poorest to peripheral areas ([Lucchesi, Larranaga et al., 2021](#); [Padeiro, Louro et al., 2019](#)) and increase spatial inequalities of opportunity and income ([Zandiatashbar and Kayanan, 2020](#)). Although gentrification can be understood as a process dependent on contextual causality ([Moura, Cambra et al., 2017](#)) and with local specificities, it is a phenomenon that has been observed and studied in different places on the planet. Context dependence is an important part of gentrification studies, but it presents a challenge for studies in several areas, as well as for walkability itself ([Moura, Cambra et al., 2017](#)). This is in line with the differences, e.g. in the results of the study by [Kelly, Ruther et al. \(2017\)](#), in the impact of place-making on the knowledge economy among small and medium-sized cities.

One of the limitations of this review is its lesser focus on the methods adopted by the analysed studies, whether for data collection or for the respective analyses. Therefore, reviewing the methods becomes a suggestion for future study. Furthermore, the focus on pedestrian transportation could also be understood as a limitation. Other non-motorised transport modes, such as bicycles and scooters (and their public sharing strategies), are also essential as sustainable urban mobility options. However, understanding that walking is part of all mobility systems, this literature review revolves around walkability and TOD. Even for other non-motorised options, there tends to be a common requirement for accessibility by foot between places of origin/destinations and parked vehicles. Still, new literature reviews that address the relationship between the knowledge-based economy and other

non-motorised modes are essential, either individually or in aggregate with pedestrians. In addition to new reviews, future research may apply qualitative data analysis methods, such as the triangulation method, to validate factors arising from the convergence of information among different sources or through interviews with experts to capture contextual empirical insights. Alternatively, future studies could apply quantitative (or qualitative) methods from field data collection and experimental results, which can be compared and thereby strengthen the results from literature reviews.

Perhaps the greatest limitation of this article is the small number of reviewed case studies. This is due to the modest number of studies found using the keywords research method (although flexibility for the snowball method could achieve further studies). It is understood that this is not only a limitation for this review but also an investigation gap. Therefore, further studies are needed to investigate the relationship between sustainable strategies for urban mobility and economic development appropriate to the contemporary scenario in different contexts, capable of reinforcing planners' understanding of spatial dynamics and their consequences. Thus, such research would not only seek to enhance scientific knowledge, but it would also strengthen the basis for making planning and political decisions that seek to manage and minimise the negative impacts of TOD and adapt positively to the practices indicated, for example, by the New Urban Agenda and the SDGs of the [UN Habitat \(2017\)](#); [United Nations \(2016, 2021\)](#).

AUTHOR CONTRIBUTIONS

C.P.T.: conceptualization; methodology; literature review; writing—original draft preparation, review and editing. The author has read and agreed to the published version of the manuscript.

ETHICS DECLARATION

The authors declare that they have no conflicts of interest regarding the publication of the paper.

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