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Analysis of the concept of a “15-minute city” connected by pedestrian green zones: A theoretical review

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Abstract: This study examines the theoretical foundations, historical development, key structural elements, advantages, and critical aspects of the increasingly prominent 15-minute city concept in contemporary urbanism. Integrating principles such as proximity, mixed-use development, pedestrian-friendly environments, and green infrastructure, the model assigns a central role to pedestrian green corridors as ecological and mobility connectors. The analysis indicates that the integration of walkable green networks enhances accessibility in urban public spaces, improves environmental sustainability, and strengthens social cohesion and public health. However, factors such as equity concerns, gentrification processes, and accessibility challenges faced by vulnerable groups present significant obstacles to practical implementation. The findings emphasize that the effective adoption of the 15-minute city model requires a comprehensive, equity-driven, and inclusive planning approach.

Keywords: 15-minute city; pedestrian green corridors; sustainable urbanism; walkability; mixed-use development; green infrastructure; urban mobility; environmental sustainability; urban resilience; accessibility; social equity; proximity-based planning; public health; ecological connectivity; neighborhood-scale planning; climate adaptation; urban design

1. Introduction

The 15-minute city has emerged as a transformative model for sustainable urban development, promoting compact neighborhoods in which essential services—such as healthcare, education, commerce, and recreation—are accessible within a 15-minute walk or bicycle ride [1, 2]. Prioritizing active mobility and environmental quality, this approach seeks to reduce automobile dependency, improve public health, and enhance the climate resilience of cities [3, 4].

Growing interest in this concept is driven by global challenges such as climate change, traffic congestion, air pollution, and rising social fragmentation. Pedestrian-oriented green spaces—including parks, greenways, and ecological corridors—occupy a central role within this model by linking neighborhoods, improving environmental performance, and supporting walkability.

2. Research methodology

Historical foundations of the 15-minute city

Although the “15-minute city” concept has gained widespread popularity in recent years, its origins can be traced back to centuries of urban design traditions. Early precedents include the orderly street grids characteristic of Roman cities, the compact settlements of the medieval period, and Renaissance ideals emphasizing accessible public spaces [1, 3, 5]. During the Baroque era, street networks became more formalized and expansive, while by the 19th century, the cities of Paris and London exhibited markedly different approaches to urban expansion [1, 3].

In the 20th century, Clarence Perry’s neighborhood unit theory and the subsequent New Urbanism movement placed strong emphasis on proximity, community interaction, and pedestrian-friendly environments—principles that form the foundation of today’s 15-minute city model [3, 7]. The contemporary model synthesizes these historical traditions with planning frameworks oriented toward sustainability and social equity [4, 14].

3. Key components of the 15-minute city

3.1. Green Infrastructure as Urban Connectivity

Green infrastructure (GI) is one of the fundamental components of contemporary urban planning, supporting not only environmental sustainability but also social engagement and physical activity. GI encompasses parks, green spaces, community gardens, tree-lined streets, water corridors, green pathways, and ecological corridors that connect different parts of the city. These elements strengthen the balance between natural and anthropogenic components of the urban environment, help preserve biodiversity, and create accessible spaces for recreation and social interaction [15, 24].

Furthermore, green infrastructure significantly influences urban microclimates: tree cover and vegetated surfaces mitigate the urban heat island effect, purify the air, and filter dust and harmful pollutants. This process constitutes an essential aspect of environmental justice. Research indicates that residents living near green spaces exhibit improved mental and physical health; reduced stress levels; increased social engagement; and higher levels of physical activity [15, 24, 35].

However, the actual effectiveness of GI is closely linked to its equitable distribution across urban areas. A lack of green spaces in low-income or historically underserved neighborhoods contributes to environmental inequality. Therefore, green infrastructure must be planned as a social resource that provides equal benefits to all residents [15, 17].

3.2. Pedestrian Networks and Walkability

Pedestrian networks—systems of walkways and public spaces designed for pedestrian movement—constitute one of the key structural elements of the 15-minute city concept.

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These networks are regarded not merely as pathways for walking, but as systems that integrate the city socially, economically, and environmentally. Well-designed pedestrian infrastructure must incorporate essential indicators such as continuity, safety, comfort, universal design principles, and spatial attractiveness. In addition, pedestrian routes are required to be seamlessly integrated with green spaces, public transport stops, neighborhood centers, and residential areas [18].

International practice shows that the degree of integration within pedestrian networks (high, medium, or low) reflects how effectively people can move through these pathways. The quality of urban streets—including wide pedestrian walkways, shaded tree canopies, bicycle lanes, safety measures, night-time lighting, tactile guidance, and other features—serves as a primary determinant of walkability. The Pedestrian Environment guide developed by VTA clearly defines these quality indicators and confirms their importance for the successful implementation of the 15-minute city model [16, 18,36].

3.3. Mixed-Use and Proximity-Based Planning

Mixed-use development—integrating residential, commercial, service, educational, and healthcare functions at the neighborhood scale—is a central component of the 15-minute city concept. Such multifunctional areas stimulate local economic activity, reduce the need for long-distance travel, and strengthen social interactions [20]. Analyses provided by Stellarix emphasize the role of mixed-use environments in enhancing economic resilience and reducing costs by increasing proximity to essential services [13].

This approach becomes most effective when implemented alongside safe pedestrian routes, bicycle lanes, and accessible public transportation. Local businesses, marketplaces, and community spaces play an important role in reinforcing both the economic vitality and the social fabric of the neighborhood.

3.4. Equity and Universal Accessibility

The 15-minute city model must be understood not only as a framework for convenience, but also as an approach aimed at ensuring social equity. Every population group—including youth, the elderly, persons with disabilities, and low-income households—must have equal opportunities to benefit from the city. An equitable urban model is grounded in the principles of universal design: low-gradient ramps, step-free access, tactile pathways, signage for individuals with visual or hearing impairments, accessible public transport, and safe intersections constitute its essential components [9, 10, 19].

Proximity-based planning often implies that residents should be able to reach key services by walking; however, not everyone has the physical capacity to do so. Therefore, accessible public transportation and inclusive street design are mandatory elements of the 15-minute city. Without these features, the model may become inconvenient or exclusionary for persons with disabilities, older adults, or parents with small children.

The economic dimension of social equity is also critical: services, green spaces, and transportation infrastructure must be available in low-income neighborhoods as well. Otherwise, high-quality urban environments risk serving only higher-income groups, thereby intensifying gentrification processes—such as rising housing prices and the displacement of long-term residents [12]. Thus, the 15-minute city must be built not only on the principle of proximity, but also on ensuring real, physical, and economic accessibility for all.

4. Benefits of the 15-minute city

The 15-minute city model is widely recognized in scientific literature not only as a framework for optimizing urban transportation systems, but also as a comprehensive approach that strengthens the ecological, economic, and social sustainability of cities. This section provides a detailed examination of the model's key benefits:

4.1. Environmental Benefits

Positive environmental impact is one of the most significant attributes of the 15-minute city concept. By reducing automobile dependency, the 15-minute city lowers emissions of CO_2, NOx, and PM2.5, thereby decreasing the burden on public health systems and improving overall air quality [8, 21, 22]. The expansion of pedestrian and cycling infrastructure further reduces the ecological footprint of transportation. Enhanced efficiency in public transit also decreases fuel consumption and reduces greenhouse gas emissions.

Green infrastructure—particularly pedestrian green corridors—mitigates the urban heat island effect, stabilizes soil moisture, and supports water resource management through mechanisms such as bioswales and natural filtration systems. At the neighborhood scale, these functions contribute to improved microclimate regulation and strengthen adaptation to climate change [6, 24, 28].

4.2. Health and Well-Being

The 15-minute city concept offers substantial advantages in the field of public health. First and foremost, increased physical activity—resulting from expanded opportunities for walking and cycling—encourages residents to adopt healthier lifestyles. Regular physical activity reduces the risk of cardiovascular diseases, diabetes, obesity, depression, and other chronic conditions [22, 23, 24].

Green spaces and parks also exert a significant positive influence on population health. Research shows that regular interaction with nature lowers stress hormone levels, improves mood, strengthens the immune system, and contributes positively to the psychological development of children. The presence of green corridors makes short daily walks more appealing, leading individuals to spend more time outdoors.

Another major health benefit stems from improved air quality. A decrease in automobile use reduces the prevalence of respiratory diseases such as asthma, bronchitis, and allergies. Children and the elderly, in particular, experience notable improvements as a result of cleaner air.

Mental well-being is likewise a core benefit of the 15-minute city model. Public open spaces, green corridors, and recreational areas enhance social interaction, reduce feelings of loneliness, and improve overall quality of life. Walking itself has antidepressant effects and supports cognitive functioning.

Consequently, the 15-minute city model lessens the burden on healthcare systems, strengthens preventive health measures, and significantly improves the general well-being of the population.

4.3. Socio-Economic Benefits

Services located within the neighborhood generate direct benefits for the local economy: small businesses, cafes, service centers, and markets expand, thereby creating

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employment opportunities and sustaining monetary circulation at the neighborhood level [25, 26]. Compact cities also reduce infrastructure-related expenses—such as road maintenance and the upkeep of extensive utility networks—and enable more efficient use of available resources [8, 27]. During the pandemic, areas that relied on localized economic activity demonstrated greater resilience to external shocks, highlighting an additional economic advantage of the 15-minute city model.

5. Criticisms and limitations

Although the 15-minute city concept is widely supported by urbanists, policymakers, and the public, its implementation can give rise to a number of complex challenges. The following section provides a detailed analysis of the concept's limitations, critical viewpoints, and strategies for addressing them.

5.1. Risk of Gentrification and Inequality

Improvements in urban infrastructure, the expansion of green spaces, the enhancement of public areas, and the upgrading of service quality significantly increase the risk of gentrification. Studies indicate that in areas where a high-quality environment is created, property values tend to rise sharply, which may lead to the displacement of low-income residents [2, 12].

Another negative aspect of the gentrification process is the reduction of social diversity. That is, neighborhoods that once accommodated residents of various cultural, ethnic, and socioeconomic backgrounds gradually transform into more "homogeneous" areas dominated by middle- and high-income groups. This, in turn, diminishes social capital, erodes cultural diversity, and forces local small businesses to close due to rising rental costs.

Moreover, if the 15-minute city model is implemented only in selected central districts while peripheral or underdeveloped neighborhoods are neglected, new forms of social inequality may emerge within the city. As a result, the model may inadvertently create a "two-tier city" characterized by:

– one area with full access to amenities, environmentally clean spaces, and walkable infrastructure;

– and another where services are insufficient, transportation connections are weak, and green spaces are scarce.

Therefore, mechanisms such as affordable housing policies, rent control measures, the expansion of social housing stock, subsidies, and support for local businesses must be integrated into the 15-minute city strategy. Without these safeguards, the model cannot effectively serve the principles of social equity.

5.2. Accessibility Challenges

The 15-minute city model often relies on the mobility capacities of individuals who are able to walk. Consequently, not all services are equally accessible for persons with disabilities, older adults with limited mobility, mothers with young children, or individuals experiencing temporary physical impairments [10, 11].

As numerous researchers have emphasized, the notion of a "walkable distance" is not universal, which presents a significant challenge. For example:

– a 15-minute walking distance may be convenient for younger individuals but overly demanding for the elderly;

– for wheelchair users, poorly designed pathways, high curbs, or narrow sidewalks create serious barriers;

– the absence of tactile guidance reduces safety for people with visual impairments;

– and in cities where the public transport system is underdeveloped, walking alone cannot ensure adequate access to essential services.

Furthermore, in the context of the 15-minute city, what matters is not merely the physical presence of services but the actual accessibility of those services from the user's perspective. In other words, even if services are geographically close, the proximity becomes meaningless if:

– elevators are out of service,

– ramps are unavailable,

– pathways are difficult to navigate, or

– the transport system is not adapted for diverse users.

For these reasons, universal design, ramps, wide sidewalks, low curbs, tactile pathways, pedestrian safety measures, wheelchair-accessible buses, and inclusive light-rail systems must constitute integral components of the 15-minute city model.

5.3. Structural Barriers

Some scholars view the 15-minute city as a model constrained by solutions that operate primarily at the individual level. In their view, systemic challenges—such as environmental degradation, social inequality, migration pressure, or energy crises—cannot be resolved solely by creating walkable urban environments [30, 31, 29]. For example, environmental critics argue that:

– establishing green zones does not halt global ecological problems;

– planting trees within the city is insufficient if industrial pollution continues;

– and although local green spaces may be well-developed, they cannot influence large-scale issues such as widespread deforestation or the depletion of water resources.

Another important criticism is that the effective implementation of the 15-minute city is heavily dependent on political will. Because the model requires comprehensive infrastructure, transportation, and housing policies, it can be extremely difficult to implement in cities facing poor governance, financial constraints, or political conflict.

Furthermore, some experts contend that the concept is overly romanticized and fails to account for the complex socio-economic nature of contemporary cities. In reality, individuals' workplaces, incomes, travel behaviors, cultural preferences, and spatial choices are influenced by geographically intricate dynamics that cannot be simplified into a uniform proximity-based model [30, 31].

The 15-minute city model may also pose the risk of "territorial isolation." If residents live, work, and spend their leisure time exclusively within their own neighborhoods, social interaction across different demographic groups may diminish, thereby intensifying urban social segmentation—an issue widely noted by many urban sociologists.

6. Pedestrian green corridors: A structural connector

Pedestrian green corridors are regarded as one of the most critical connecting elements between the ecological and social systems of contemporary cities. They function not merely as walkways for pedestrians, but as multifunctional spatial infrastructures that support the sustainable

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development of the urban environment. By providing continuous, safe, and attractive movement routes throughout the city, green corridors deliver high-quality ecological services: they moderate microclimates, purify the air, support biodiversity, and strengthen human–nature interactions [9, 2].

These ecological corridors also serve as fully integrated mobility networks for pedestrians. Walkways shaded by tree canopies facilitate comfortable movement and create cooler environments during hot weather—an especially important feature for mitigating the urban heat island effect under conditions of global warming. Furthermore, green corridors connect communal spaces, parks, water channels, sports areas, cultural centers, and neighborhood functional nodes, thereby acting as the social spine of the city.

One of the most significant functions of pedestrian green corridors is the reduction of ecological fragmentation. In urban areas, natural habitats become divided due to residential blocks, road infrastructure, and industrial zones. Green corridors reconnect these fragmented landscapes and provide migratory pathways for birds, insects, and small animals. As such, they represent one of the most effective means of enhancing ecological resilience, creating continuous green networks, and preserving biodiversity [15, 24].

Green corridors offer not only environmental benefits but also psychological and social advantages for urban residents. Research shows that exposure to natural environments reduces stress, improves mood, lowers levels of depression, and increases physical activity—all of which alleviate pressure on public health systems. Seating areas, communal play spaces, and outdoor activity zones located along these corridors strengthen social interaction and community cohesion. The Green Belt project in Vitoria-Gasteiz clearly illustrates the effectiveness of this model: the creation of a surrounding green belt and central pedestrian routes significantly enhanced ecological connectivity, increased physical activity among residents, and improved the overall harmony of the urban environment. As a result, Vitoria-Gasteiz was awarded the European “Green Capital Award” in 2012 [9, 2]. Thus, pedestrian green corridors serve not only as walkable mobility infrastructure but also as the “green backbone” that ecologically, socially, and functionally integrates the city.

7. Global case studies

Global cities are implementing the 15-minute city model at varying scales, developing context-specific strategic approaches informed by local conditions. The following cases illustrate how this model operates in practice and how it is adapted across diverse geographical, political, and cultural contexts.

7.1. Paris

Paris is a leading example of the “15-minute city” concept, implemented under the leadership of Mayor Anne Hidalgo. The city has been restructured to ensure that essential services — such as work, healthcare, education, and shopping — are accessible within a 15-minute walk or bike ride. This decentralized urban model promotes self-sufficient neighborhoods, combining residential, commercial, and public spaces to reduce reliance on cars and long commutes. To facilitate this transformation, Paris has developed over 1,000 kilometers of cycling paths and allocated a budget of 75 million euros for community-selected projects. Notable initiatives, such as the conversion of Rue de Rivoli for pedestrian and bike use, exemplify the city's commitment to creating a connected and resilient urban environment that fosters community engagement and sustainability [32, 23, 6].

7.2. Vitoria-Gasteiz

The city of Vitoria-Gasteiz, Spain, has gained international recognition for its commitment to sustainable development, earning accolades like the 2012 European Green Capital and the 2019 Global Green Capital. Central to its strategy is the establishment of a green belt, which serves as the backbone of the city’s green infrastructure (GI) network. This green belt aims to connect various green areas within the city, the surrounding agricultural lands, and potential ecological corridors linking peripheral natural spaces. Furthermore, the city has implemented a comprehensive analysis of its pedestrian network, categorizing elements based on their global integration to enhance walkability and promote community interaction [2, 9].

7.3. Barcelona

Barcelona has embraced the 15-minute city concept through its “super blocks” initiative. This innovative urban design strategy modifies existing city layouts to create pedestrian-friendly areas with restricted vehicle access. By transforming traditional street grids into clusters where cars are limited, each super block fosters local neighborhoods complete with courtyards, green spaces, and community gathering areas. This approach enhances walkability and promotes a vibrant urban life while reducing air pollution and traffic congestion [23].

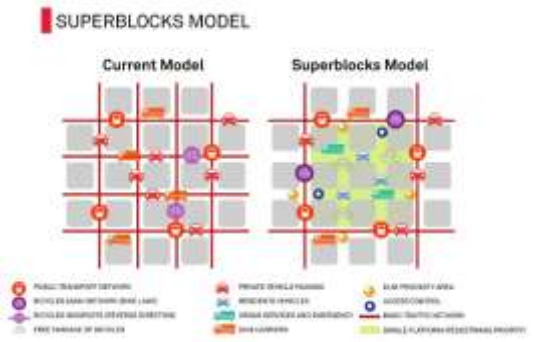

Fig. 1. Barcelona Superblocks Model: Comparison Between the Current Street Grid and the Superblocks Configuration

7.4. Portland

In the United States, Portland, Oregon, serves as an example of a successful 20-minute neighborhood model. This approach aligns with the principles of the 15-minute city by prioritizing pedestrian access to essential services within a short walking distance. Portland's urban planning focuses on enhancing neighborhood livability, encouraging cycling, and integrating green spaces to foster community ties. This model has shown promising outcomes in terms of public engagement and urban sustainability, making Portland a significant case study in the evolution of urban living [32, 33].

7.5. Global Implications

While the 15-minute city framework aims to enhance urban life by making essential services more accessible, it also faces challenges such as potential gentrification and the

risk of displacing less affluent residents. The model's effectiveness can be limited in areas with low population densities or inadequate transportation infrastructures. Despite these obstacles, cities that implement the 15-minute city principles, like Paris and Vitoria-Gasteiz, demonstrate the potential for fostering social cohesion, improving public health, and promoting environmental sustainability within urban environments [33, 34].

3. Conclusion

The findings of the study indicate that the 15-minute city model holds significant potential for improving transportation efficiency, environmental sustainability, public health, and social equity. Pedestrian green corridors emerge as a key driver in the practical implementation of this model, contributing to the creation of a human-centered and sustainable urban environment. However, realizing the full effectiveness of the model requires adherence to principles of equity and inclusiveness, alongside affordable housing policies, institutional support, and strategic governance.

Accordingly, future research should focus on expanding GIS-based assessment methods, examining access to pedestrian and green infrastructure across different demographic groups, developing adaptation strategies in the context of climate change, and exploring differentiated approaches to implementing the model in various urban morphologies.

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