

Review

Age-inclusive urban design: A review of sustainable retrofit strategies for elderly well-being

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Abstract: As urban populations age, creating cities that cater to the needs of elderly residents becomes increasingly vital. This paper addresses the imperative to develop urban environments supporting the well-being of the elderly against a backdrop of changing demographics. With the proportion of elderly individuals steadily rising, the demand for age-inclusive urban design is more pressing than ever. The research question driving this study is: How can sustainable retrofit strategies contribute to age-inclusive urban design, considering the physiological and psychological characteristics of the elderly? Begins with examining the theoretical foundations of sustainable retrofit practices, shedding light on their significance and common objectives. Shortcomings in current urban retrofit practices are scrutinized, highlighting the gaps that need addressing. Integrating research on the physiological and psychological characteristics of the elderly, along with their distinct needs in outdoor environments, the review contributes to a nuanced understanding of age-specific urban requirements. A bespoke sustainable urban retrofit strategy for the elderly is conceptualized, rooted in the principles of urban design. Finally, acknowledging the challenges faced in achieving age-inclusive urban spaces and provides forward-looking recommendations.

Keywords: sustainable retrofit strategies; elderly well-being; population aging

1. Introduction

The demographic landscape of contemporary societies is undergoing a notable shift, characterized by a substantial increase in the aging population. As urban environments grapple with the challenges posed by this demographic transformation, the imperative to foster age-inclusive urban design has become increasingly apparent. Since the industrial revolution, urban renewal has become a popular method for dealing with the changing urban environment, and addressing the issue of urban deterioration (Alma Pobric and Robinson, 2019; Bo et al., 2022; Zhou et al., 2022). However, many completed repair projects are harshly condemned since they were poorly managed and resulted in a variety of environmental and social issues. So, in order to construct sustainable communities, academia and local governments recently launched a new strategy in which the idea of sustainability is incorporated into urban regeneration initiatives (Cheng et al., 2022; Lin et al., 2022; Pan and Du, 2021).

Retrofit urban design for the elderly refers to the process of modifying or renovating existing urban areas and structures to make them more accessible and user-friendly for elderly people (Jaafar Younes et al., 2023). The purpose of retrofitting urban design is to improve the quality of life for the elderly and provide them with greater independence in their daily activities. The retrofitting process involves various

design considerations, including the layout of sidewalks and streets, lighting and signage, accessibility to public transportation, and the design of public spaces such as parks and plazas. Retrofitting may also involve modifying existing buildings to make them more accessible, such as installing ramps, elevators, and wider doorways. One important aspect of retrofitting urban design for the elderly is the concept of universal design. This approach aims to create environments that are accessible and usable by everyone, regardless of age or ability. Universal design principles include features such as step-free entrances, clear signage, and wide doorways. Another important consideration in retrofitting urban design for the people is safety (Nguyen et al., 2019). This includes ensuring that sidewalks and streets are well-lit and free of obstacles, providing easy access to emergency services, and designing buildings and public spaces with safety features such as handrails and non-slip flooring. Modern cities must feature spaces that improve people's chances to contact with one another and provide them greater room to express their feelings or engage in daily activity (Lin et al., 2022). An accessible location promotes more indoor and outdoor activities, which increases the likelihood that social cohesion will develop there (Cui et al., 2021). The level of physical layout design, environmental quality, or other aspects of the built environment that encourage people to engage in outdoor or indoor activities like walking, sitting in one place, people-watching, chit-chatting, and other types of activities may be related to accessibility in the public space. These social events can improve the standard of the public area (İpek et al., 2023). Retrofit urban design for the elderly involves modifying existing urban areas and structures to make them more accessible and user-friendly for older individuals (Jaafar Younes et al., 2023). The purpose is to enhance their quality of life and provide greater independence in daily activities. However, the retrofitting process involves various design considerations, such as sidewalk and street layout, lighting, signage, accessibility to public transportation, and the design of public spaces like parks and plazas. Therefore, this paper addresses a theoretical gap by focusing on the specific niche of retrofit urban design for the elderly. While urban retrofit has been widely explored, there is a dearth of comprehensive reviews specifically examining the retrofitting process targeted at the aging population. The research motivation stems from the critical need to understand how existing urban structures can be modified to better cater to the unique needs of the elderly.

The organizational structure delineated in this discourse orchestrates a systematic and thorough exploration of Urban Retrofit (UR) with a specific emphasis on its sustainable application for the elderly demographic as shown in **Figure 1**. Commencing with a meticulously crafted introduction, subsequent sections unfold in a logical and coherent sequence. Urban Retrofit (Section 2) initiates the narrative by introducing the central theme, paving the way for Section 3, which delves deeply into the Theoretical Foundations. Section 4 rigorously examines the Global Significance of Urban Retrofit Practices, offering a nuanced analysis of both Common Objectives and Current Shortcomings. The discourse seamlessly transitions into Sustainable Development (Section 5), wherein the initiation and imperative of Social Equity are rigorously explored. The Sustainable Urban Retrofit Approach (Section 6) undergoes meticulous dissection, encompassing its Formation, Popularity, and specific Tactics. The focus then shifts to the elderly demographic in Section 7, meticulously probing

their Physiological and Psychological Characteristics, Outdoor Needs, and Retrofit Requirements. Section 8 formulates a bespoke Sustainable Urban Retrofit Strategy tailored for the elderly, encapsulating the Concept of Urban Design and Key Principles. Anticipating challenges and providing Future Recommendations (Section 9), the discourse culminates in Section 10, offering a conclusive synthesis where key findings intricately coalesce, weaving a cohesive and insightful tapestry of sustainable urban retrofit strategies finely attuned to the needs of the elderly demographic.

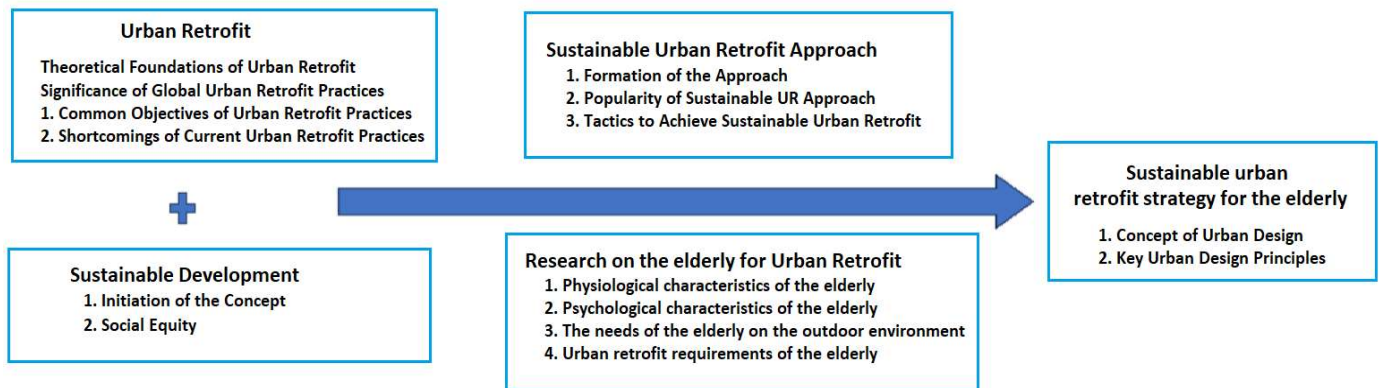


Figure 1. The paper organizational structure.

2. Definition important term

The following terms—urban regeneration, urban renewal, urban revival, urban redevelopment, and related concepts—pertain to distinct aspects within the field of urban development. Each term encapsulates specific approaches and focuses, contributing to the comprehensive understanding of strategies aimed at revitalizing and enhancing urban spaces.

Urban Regeneration:

- Definition: Urban regeneration refers to the comprehensive and integrated planning and redevelopment of a specific urban area to address economic, social, and environmental challenges. It often involves revitalizing existing infrastructure, improving amenities, and fostering community development.
- Focus: Emphasizes a holistic approach to revive and enhance an urban area, considering economic, social, and environmental aspects.

Urban Renewal:

- Definition: Urban renewal involves the redevelopment of an area, typically focusing on the clearance of blighted or deteriorated structures and the construction of new infrastructure. It aims to modernize and improve urban spaces.
- Focus: Primarily focuses on physical aspects, often involving the demolition of outdated structures and the creation of new developments.

Urban Revival:

- Definition: Urban revival refers to the renewal or improvement of an urban area, often driven by an increase in economic activity, cultural developments, and improvements in infrastructure. It signifies a positive transformation of an urban space.

- Focus: Highlights the positive and often organic transformation of an urban area, often associated with increased economic vitality.
Urban Redevelopment:
- Definition: Urban redevelopment involves the redevelopment or restructuring of a specific area, with a focus on both physical and economic improvements. It may include the rehabilitation of existing structures and the creation of new developments.
- Focus: Encompasses a broad range of improvements, including physical redevelopment and economic revitalization.

3. Urban retrofit

Several phrases and concepts that are often used yet have varying definitions can be found in the literature on urban retrofit. The definitions of words like urban retrofit (UR), urban regeneration (UREG), and urban redevelopment (URED) should first be clarified in order to prevent misunderstandings. Although the researcher has looked at the literature on UR in a variety of nations, the review of UR in this section mainly referred to the literature from develop counties such as US and UK because those countries' contexts were discussed in more detail and were more pertinent to studying the UR process in Chongqing (Barnett, 1982; Blackman, 1995; Berke and Manta Conroy, 2000; etc.). The similarities in Urban Development Challenges in both the US and the UK, as developed nations, share commonalities with Chongqing, China, in facing challenges associated with rapid urbanization, population growth, and evolving infrastructure needs. By examining the experiences of the US and UK, which have addressed such challenges, we aim to draw parallels that could inform effective strategies for Chongqing. In addition, the methodologies employed in the US and UK urban renewal processes may offer valuable insights applicable to Chongqing. By examining specific methodologies that have demonstrated success, we seek to identify transferable practices that align with the goals of Chongqing's urban development.

Urban retrofit for elderly people refers to making urban environments more age-friendly and accessible to meet the needs of older adults. As the global population ages, creating environments that support the aging population becomes increasingly important (Alipour and Galal Ahmed, 2021; Mercader-Moyano et al., 2020). They are some key considerations for urban retrofitting to benefit elderly people such as:

- Accessibility: Ensure that public spaces, buildings, and transportation systems are designed with universal accessibility, incorporating features like ramps, elevators, and clear signage to assist those with mobility challenges.
- Pedestrian-Friendly Infrastructure: Create walkable neighborhoods with well-maintained sidewalks, benches, and adequate lighting to promote safe and convenient mobility for older pedestrians.
- Public Transportation: Improve public transportation options, making them accessible and user-friendly for older adults. This may include features like low-floor buses, priority seating, and clear route information.
- Age-Friendly Housing: Retrofit existing housing or build new age-friendly housing with features like step-free entrances, grab bars, wider doorways, and adaptable designs to accommodate changing needs as individuals age.

- **Safety and Security:** Enhance safety measures in public spaces, parks, and neighborhoods to reduce the risk of accidents and ensure elderly residents feel secure in their environment.
- **Social Spaces:** Create communal spaces, such as parks, community centers, and senior centers, where older adults can engage in social activities and maintain connections with their communities.
- **Health Services and Facilities:** Ensure proximity to healthcare facilities and make them easily accessible for elderly residents who may require regular medical attention.
- **Technology Integration:** Implement age-friendly technology solutions, such as smart home features and telemedicine options, to support independent living and improve the overall quality of life.
- **Community Engagement:** Involve older adults in the planning and design process to gain insights into their needs and preferences, ensuring that retrofitting initiatives address their specific concerns.
- **Age-Friendly Urban Planning:** Integrate age-friendly principles into urban planning and zoning regulations to promote mixed-use developments, reduce sprawl, and enhance the overall livability of urban areas for all age groups.

4. Theoretical foundations of urban retrofit

The idea of UR first emerged in the years following World War II (O’Flaherty, 1994; Yang et al., 2022). However, it is feasible to see a significant amount of UR efforts in reaction to post-Industrial Revolution economic and social change (Lorenzo et al., 2022). At the time, evidence of UR could be found in the altered land and building uses as well as the rise in development density (Couch, 1990). O’Flaherty (1994) also stated that programs for UR were approved in a number of states both before and after World War II.

According to Rothenberg (1969), the United States government actively engaged in urban renewal (UR) legislation during the late 1940s and early 1950s, responding to the heightened importance of UR at that time. The Housing Act of 1949 introduced the UR concept, and subsequent developments occurred with the Housing Act of 1954, which solidified UR’s role in preserving, restoring, and enhancing the societal function and structure. UR initiatives during this period encompassed substandard housing repair, conservation programs, slum removal, Urban Redevelopment (URED), and the provision of public housing for low-income groups.

In response to evolving political, economic, and social landscapes, the legislation governing UR underwent multiple revisions to ensure smooth, efficient, and successful implementation. The Housing Act of 1956 introduced the concept of a general Neighborhood Retrofit Plan, aiming to coordinate UR activities for larger areas by dividing them into separate projects to be completed over several years (Tang et al., 2022). Subsequently, Community Retrofit Programs were introduced to prioritize UR demand in different locations based on the financial and social resources required and available for retrofit projects (Lucchi, 2022). Lucchi (2022) highlighted that while the idea and methods of UR in the US evolved over time, the primary goal of enhancing the urban environment and overall quality of life remained constant.

The theoretical foundations of urban retrofit for elderly people draw from various disciplines and concepts that emphasize creating age-friendly environments and promoting active aging. The main key theoretical frameworks include:

- 1) **Age-Friendly Cities:** The World Health Organization (WHO) introduced the concept of age-friendly cities and communities, which emphasizes creating urban environments that are inclusive, accessible, and supportive of older adults' needs and preferences. This framework identifies eight domains for action, including outdoor spaces and buildings, transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication, and community support and health services as shown in **Figure 2**.

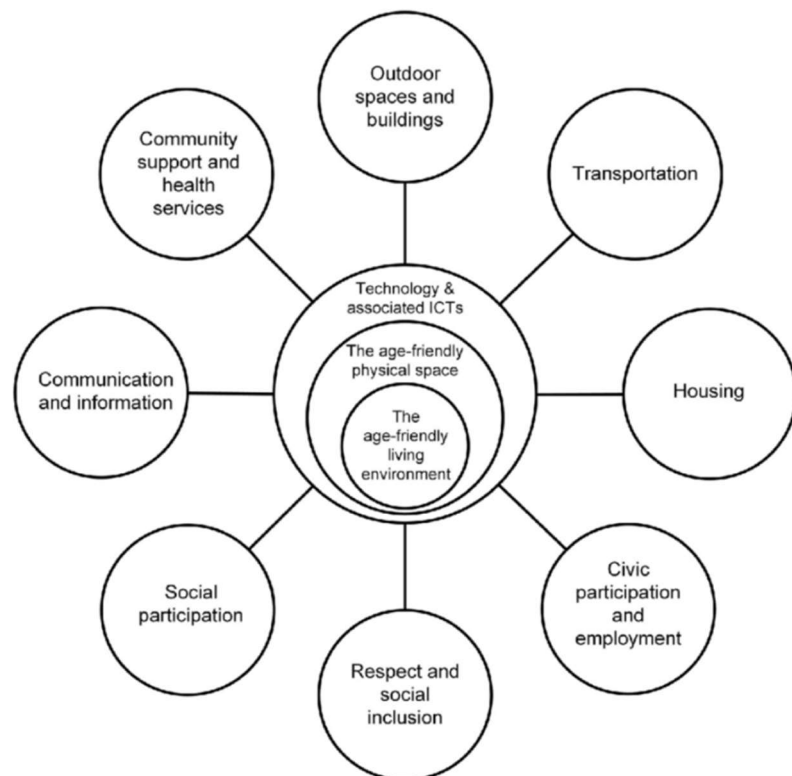


Figure 2. The age-friendly ecosystem framework by Marston & van Hoof (2020).

- 2) **Social-Ecological Model:** The social-ecological model provides a comprehensive framework that takes into account the intricate interactions among individuals, their social connections, the built environment, and broader societal influences. When applied to the context of urban retrofitting for elderly individuals, this model underscores the significance of examining various levels of influence. In the specific realm of urban retrofit for the elderly, the model emphasizes the need to consider multiple factors. These include personal mobility, acknowledging the challenges and facilitators affecting an individual's ability to move within their environment. Social support networks play a crucial role, recognizing the impact of relationships and community connections on the well-being of elderly residents. Access to healthcare is another vital component within the social-ecological model. This involves understanding the availability and proximity of healthcare services, ensuring that elderly individuals have convenient access to

medical support. Additionally, neighborhood characteristics play a key role, encompassing factors such as safety, infrastructure, and amenities that collectively contribute to the overall livability of an area. **Figure 3** visually represents how these various levels of influence intersect and contribute to the social-ecological dynamics of urban retrofit for elderly individuals. By adopting this model, planners and stakeholders can develop more holistic strategies that address the multifaceted needs of the aging population within urban environments.

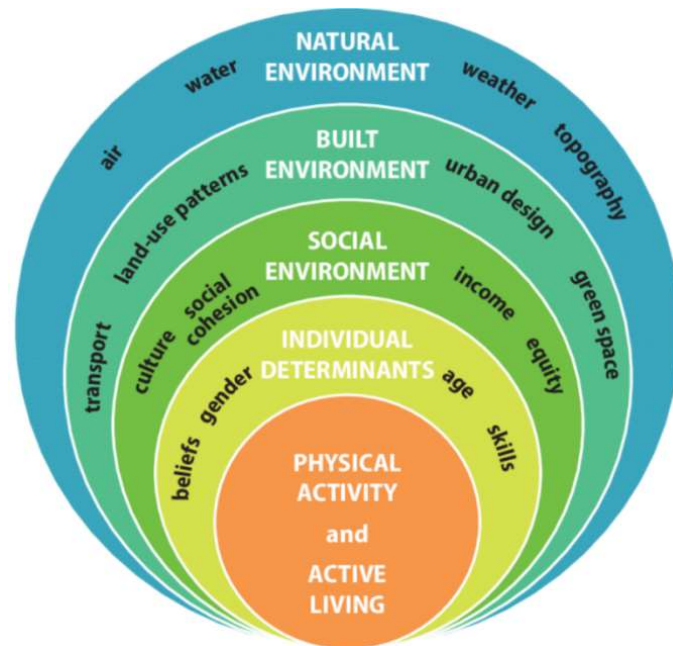


Figure 3. Social-ecological model adapted by Bornstein (2014).

- 3) **Active Aging:** The concept of active aging places a strong emphasis on preserving and enhancing physical, mental, and social well-being as individuals progress through the aging process. In the context of urban retrofit initiatives for elderly populations, the goal is to actively facilitate opportunities for active aging by creating environments that cater to social engagement, physical activity, and convenient access to healthcare services. To operationalize the concept of active aging in urban retrofit projects, it is essential to focus on various dimensions. Firstly, urban spaces should be designed to encourage social interaction among elderly residents. This involves creating communal areas, public gathering spots, and community centers that foster connections and a sense of belonging. The incorporation of green spaces and recreational areas further promotes social engagement and physical activity. Physical well-being is a central component of active aging, and urban retrofit initiatives should prioritize the creation of spaces that facilitate regular exercise and movement. This includes the development of pedestrian-friendly environments, accessible pathways, and age-friendly infrastructure to ensure that elderly individuals can navigate their surroundings safely and comfortably. Access to healthcare services is a critical consideration within the framework of active aging. Urban retrofit projects should strategically plan for the inclusion of healthcare facilities within proximity to residential areas.

This ensures that elderly residents have convenient access to medical services, contributing to their overall health and well-being. The principles of active aging outlined above serve as a foundational guide for organizations and agencies involved in urban planning. By adopting and implementing these principles, stakeholders can contribute to the cultivation of a culture that promotes and supports active aging. This, in turn, enables individuals of all age groups to lead fulfilling lives throughout their lifespan, as depicted in **Figure 4**, illustrating the interconnected elements that contribute to the realization of active and engaged living.



Figure 4. Nine principles of active aging by the International Council on Active Aging (ICAA).

- 4) **Age-Inclusive Planning:** Age-inclusive planning entails a comprehensive consideration of the specific needs and requirements of older adults throughout every stage of urban planning and design. This approach is designed to create a built environment that actively supports the social, physical, and emotional well-being of elderly individuals, with the overarching goal of making the city accessible and enjoyable for people of all ages. In the context of age-inclusive planning, various facets come into play. The physical aspects of the built environment should be designed with the understanding that older adults may have unique mobility challenges. This involves creating infrastructure that is wheelchair-friendly, providing well-maintained sidewalks, ramps, and elevators to ensure accessibility for individuals with varying degrees of mobility. Social well-being is a crucial consideration within age-inclusive planning. This entails the development of communal spaces, public amenities, and recreational areas that encourage social interaction and engagement among older adults. Incorporating age-friendly features in parks, community centers, and public gathering spots fosters a sense of community and belonging. Emotional well-being is addressed by ensuring that the urban environment is conducive to a

positive and supportive atmosphere. This may involve thoughtful design elements such as ample lighting, comfortable seating areas, and green spaces that contribute to a sense of tranquility and connection with nature. Age-inclusive planning goes beyond physical infrastructure to consider policies and services that support the elderly population. This includes access to healthcare facilities, transportation options that accommodate different mobility needs, and community programs tailored to the interests and well-being of older adults. **Figure 5** illustrates how the principles of age-inclusive planning interconnect to create an urban environment that not only meets the diverse needs of older adults but also enhances the overall livability of the city for people of all ages. By embracing age-inclusive planning, cities can strive towards becoming more inclusive, accessible, and enjoyable places for everyone.

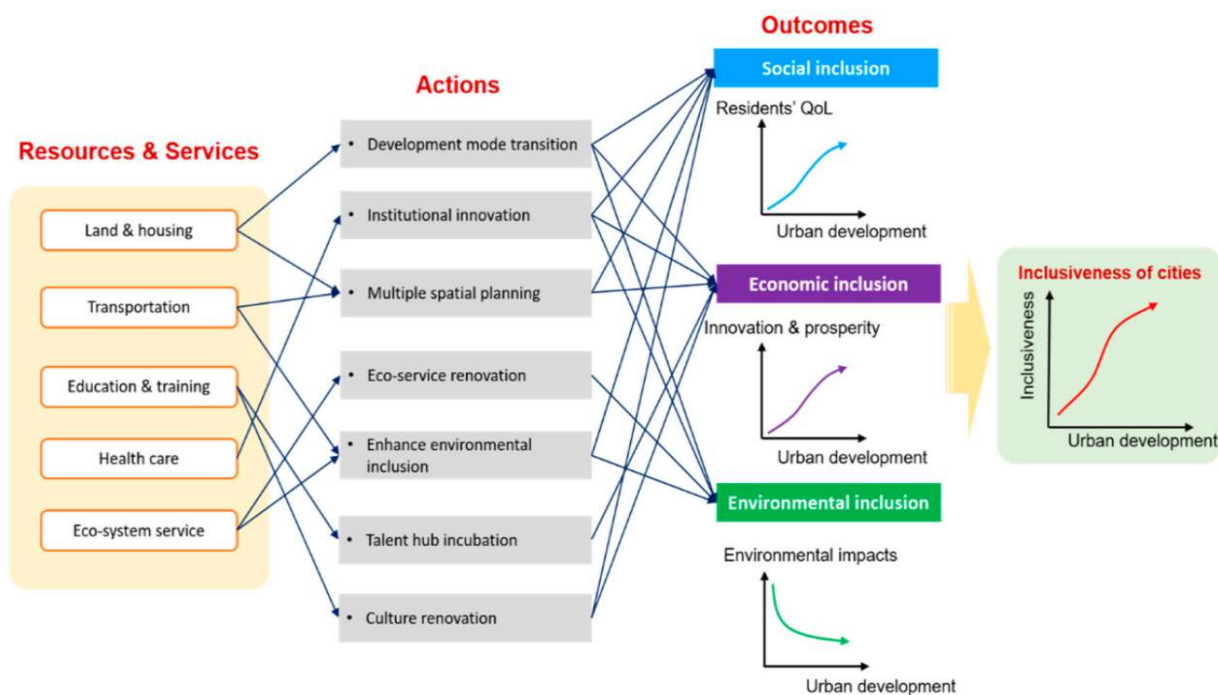


Figure 5. New model for inclusive cities Liu (2020).

- 5) **Universal Design:** Universal design is a comprehensive approach aimed at developing products and environments that are accessible and usable by people of all ages and abilities. In the context of urban retrofit projects, the application of universal design principles becomes pivotal, enabling cities to craft spaces that cater to the diverse needs of older adults while simultaneously addressing the requirements of various age groups, as depicted in **Figure 6**. The core tenets of universal design involve creating environments that are inclusive and considerate of the broad spectrum of human abilities. This encompasses the physical, sensory, and cognitive aspects of accessibility. In urban retrofit initiatives, universal design principles guide the planning and execution of infrastructure to ensure that it is navigable and beneficial for individuals with varying mobility levels, sensory perceptions, and cognitive capacities. Key considerations within universal design for urban retrofit include the development of infrastructure that is wheelchair accessible, the provision of clear and visible signage, and the incorporation of

tactile elements to aid those with visual impairments. Additionally, universal design principles emphasize the creation of open spaces, pathways, and public facilities that are easily adaptable to the needs of individuals with diverse abilities. Beyond physical structures, universal design extends to information dissemination, communication, and technology. This involves implementing communication methods that are inclusive and easily understandable, using universal design principles in the development of digital interfaces, and ensuring that information is accessible to individuals with different learning styles and preferences. **Figure 6** illustrates the interconnected elements of universal design that contribute to the creation of urban spaces that are not only age-friendly but universally accessible to people of all ages and abilities. By embracing universal design in urban retrofit projects, cities can foster environments that prioritize inclusivity, usability, and a high quality of life for everyone within the community.

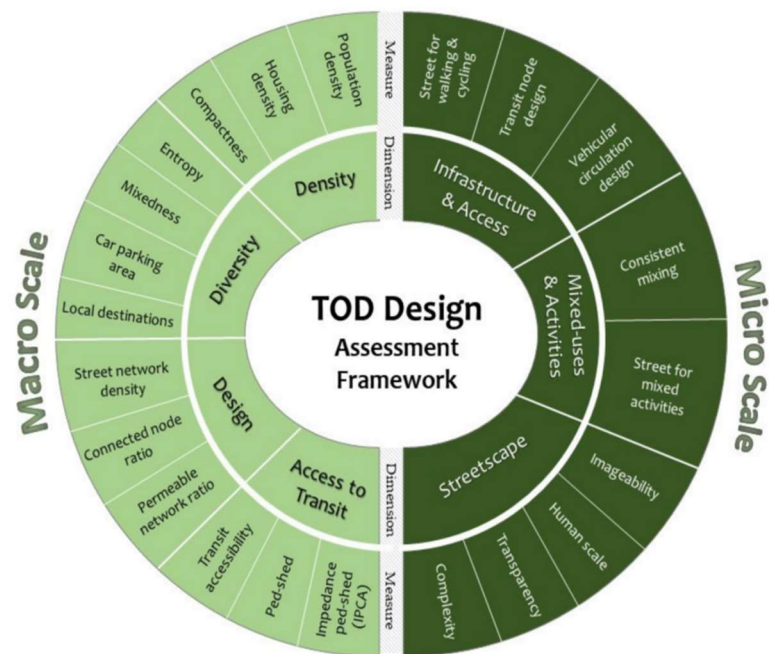


Figure 6. Transit-oriented urban design (Abdi, 2022).

5. Significance of global urban retrofit practices

In order to accomplish a number of objectives, slum clearance is a primary focus of UR (Chan, 2000; Lii, 1997; Cuthbert and Dimitriou, 1992; etc.). According to Wang et al. (2022), defective arrangement or design, lack of ventilation, light, or sanitation facilities, or any combination of these factors, are detrimental to safety, health, or morals. According to Sun et al. (2022), a building or area that is deteriorating, hazardous, unsanitary, or lacking in standard conveniences” as well as “the squalid, crowded, or unsanitary conditions under which people live irrespective of the physical state of the building or area. Wang et al., (2022) represented usage of social costs, such as crime, health risks, and fire hazards. Slum clearance is the act of removing and rebuilding unfit and inefficiently used areas in order to provide every resident with a sufficient and comfortable living space (Choo, 1988). Numerous cities carry out UR

in addition to restoring the urban districts to acceptable standards to further other goals.

1) Provision of Accommodation for Various Social Groups

When an urban region flourishes, its economy expands quickly, and land values rise as a result of the intense rivalry for the lucrative spaces. As a result, the poor are unable to afford such high land prices and are forced to either live in overcrowded, subpar housing in metropolitan centers to save on transportation costs or in the outskirts of cities to save on housing expenditures (Astrid et al., 2022). In order to help them, some governments renovate metropolitan areas and offer them subsidized public housing that is affordable and of acceptable quality. The demand for different types of housing is significantly impacted by demographic trends as well (Magnus et al., 2019). When the population of lower income groups was high in the past, the need for cheap, low-cost housing predominated in the property markets of developing civilizations. Subsequently, as the economy experienced growth, there emerged a robust demand for medium- and high-end homes. Despite the significant population size, the number of households has witnessed growth in recent decades, leading to an increased demand for smaller-sized dwellings (Sara Barron et al., 2023). However, the provision of affordable housing or housing tailored for specific needs, such as the elderly or disabled, in urban areas may prove insufficient without government intervention to address housing shortages. Developers, driven by a desire to maximize net profits, are often more inclined to cater to middle- and higher-income groups. Consequently, it becomes imperative for urban renewal (UR) projects to incorporate a diverse range of housing options that cater to the needs of various social groups. Additionally, by relocating people to the city's periphery and properly designing both private and public areas, housing policy under the UR programme can lower population density and the sensation of suffocation (Lucchi, 2022; Adams and Hastings, 2001; Fung, 2001b).

2) Reform of Population Mix

Single-status population concentration in an urban region, especially among the impoverished, is harmful. The distance from the lower classes, the middle and upper classes contribute to the widening gap between the rich and the impoverished. Population mix should be encouraged to prevent this issue. By providing housing or communal facilities for different groups within the same location, it is possible to actively redistribute individuals among different social classes and it can be done in an indirect way. According to Jacobson (1999), following the renovation of urban environments, there is a tendency for younger individuals, those with higher socioeconomic status, and those with advanced education levels to be attracted, forming a more affluent sector within the existing population. The U.S. Department of Housing and Urban Development, in implementing its urban renewal (UR) policy, has similarly embraced the diversity within the population. In some nations, neighborhoods host a mix of various races, leading to occasional conflicts due to diverse traditions, customs, faiths, and needs (Couch, 1990). In the development of UR concepts, it becomes essential to allocate specific spaces and amenities for different racial groups to accommodate their unique needs.

3) Stimulation of Productivity and Economic Growth

Property prices frequently rise when buildings are in better physical condition and the neighborhood has a better reputation. UR projects are carried out to enhance

the aesthetic appeal of the urban areas in order to earn economic benefit. Cheng et al. (2023) also noted that the government's retrofit of a portion of an urban area might serve as a spark for the reconstruction of surrounding areas by other private developers. As a result, an urban area's property prices as a whole increase. According to Michal et al. (2023), some UR projects aimed to increase land use intensity by swapping out low-rise blocks for high-density homes in order to boost overall profitability. In addition to high-quality housing options, greater areas are set aside for industrial and commercial uses under the retrofit programs in exchange for increased financial rewards (Lucchi, 2022; Lii, 1997). A portion of the current structures and land uses are no longer able to contribute to overall productivity and economic growth as a result of the economy's reorganization and the public's changing needs. Some businesses' declining revenues cause them to lay off a large number of employees. Many people lose their current work or find themselves in underemployment. Their declining salaries and diminished purchasing power damage the economy (Couch, 1990). Therefore, the process of UR must start in order to turn urban properties into uses that are more lucrative. By creating more local employment opportunities, the local economy can be enhanced (Cuthbert and Dimitriou, 1992; Queensland government, 2004). Following that, it will be possible to achieve better land use relocation and a more effective distribution of fixed assets, financial resources, and human resources (Peng et al., 2023).

4) Efficient and Compatible Land Use

UR projects are typically carried out to improve how urban areas are used (Adams and Hastings, 2001). Cuthbert and Dimitriou (1992) claim that the maximal development potential of sites was underutilized in the past and that many low-density structures were constructed. In order to maximize the economic benefits, UR to cover urban land with a more efficient use is likely to be considered because their property prices are typically lower than the site redevelopment values (Zhang et al., 2022). According UR activities would be promoted and low-value or decaying buildings would be removed from the well-located lands (Lucchi, 2022), when the potential earnings from renovating or replacing buildings outweighed current returns. In situations where the idea of comprehensive land use planning is not well developed, pencil or piecemeal redevelopments are fairly popular. Incompatible land uses are one of several issues caused by the lack of a holistic approach to redevelopment (Cuthbert and Dimitriou, 1992; Fung, 2001). For instance, environmental hazard-producing companies are located next to residential or commercial areas, while low-rent public housing is located next to expensive homes. UR projects with thorough planning and re-zoning should be implemented to solve these issues.

5) Rectification of Construction Deficiencies

Buildings that are built or maintained throughout time deteriorate at an accelerated rate (Lucchi, 2022; Jones, 2002). Obsolescence is inevitable and requires UR work to be done to alter the physical conditions of the properties when the building structures are beyond repair and their remaining useful life are projected to be brief (Couch, 1990; O'Flaherty, 1994). UR has a good effect on the cityscape's aesthetics in addition to the physical environment, which serves to produce aesthetically pleasing and attractive living and working environments for the general public (Queensland government, 2004). As time goes on, construction standards improve and building

technologies advance. In terms of design, construction method, and quality level, many existing homes fall short of the standards set today. Therefore, they must be updated to address outdated building designs, fire safety designs, and building services installations in order to offer residents with safe and healthy built environments (HPLB, 2005).

6) Enhancement of Neighborhood

The lives, property, and future generations of the inhabitants are likely in danger due to social issues and an undesirable neighborhood environment. UR is a strategy used in some developing nations, like Israel, to try and achieve social objectives including lowering social gaps and enhancing people’s quality of life. Urban locations frequently have unfavorable characteristics such as air pollution, noise, and traffic congestion (Astrid et al., 2022). Some cities undertake UR projects to improve the transportation systems and the circumstances of the surrounds since poor environmental quality can have a significant impact on social well-being (Estes, 1993). Urban neighborhoods are occasionally renovated in an effort to combat crime (Jacobson, 1999). Indirectly reducing vandalism and juvenile delinquency is the provision of community facilities, public amenities, and venues for recreational and cultural activities through UR programs. The essential requirements of society are met by provisions like schools, hospitals, and other institutional facilities, while amenities like parks and community centers encourage social interaction (Cuthbert and Dimitriou, 1992; Chui, 2003). **Table 1** lists a few prevalent causes of UR that have been cited by researchers from around the world.

Table 1. Common reasons for UR.

Item	Description	Reference
Provision of Accommodation for Various Social Groups	To reduce population density	Zeng et al., 2019
	To provide affordable housings	
	To provide high price dwellings	
Reform of Population Mix	To provide housings for people with special needs	Li et al., 2023
	To attract people with higher socioeconomic status	
	To segregate/integrate different racial groups	
Stimulation of Productivity and Economic Growth	To improve physical condition	Cheng et al., 2023; Yang et al., 2022
	To relocate different land uses	
	To increase jobs opportunities	
Efficient and Compatible Land Use	To avoid incompatible land use	Feng and Wang, 2022
	To achieve better utilization of urban lands	
	To rectify out of date design & installation	
Rectification of Construction Deficiencies	To remove structures beyond repair condition	Hong et al., 2022
	To reduce poorly built structures	
	To replace structures having short remaining economic life	
	To reduce crime	
Enhancement of Neighborhood	To solve traffic problems	Aparicio Uribe et al., 2022
	To control pollution	
	To provide open space/community facilities	

Most of the time, it is impossible to accomplish all the goals listed above since some of them are contradictory and incompatible (Lucchi, 2022). The availability of affordable homes for the poor is constantly reduced by slum clearance. Building different kinds of homes, installing industrial and commercial facilities, and installing open spaces and other public services all compete for land use. Better land use may result in dense urban development, which is counter to the objective of lowering population density. Several academics argue that urban renovation may actually exacerbate urban problems for the community rather than resolving them (O’Flaherty, 1994; Yang et al., 2022).

6. Sustainable development

6.1. Initiation of the concept

Figure 7 illustrates the most important factors and considerations regarding age-friendly cities and communities and their relationship with the built environment. In this comprehensive diagram, a range of critical elements are highlighted to guide policymakers, urban planners, and stakeholders in their efforts to create age-friendly urban spaces that cater to the needs and preferences of older adults. The figure presents crucial factors that need to be addressed to create urban spaces that cater to the needs of older adults, promoting inclusivity, accessibility, and well-being. By understanding and implementing these important elements, cities and communities can work towards becoming more age-friendly, enabling older individuals to thrive and actively participate in their urban environments.

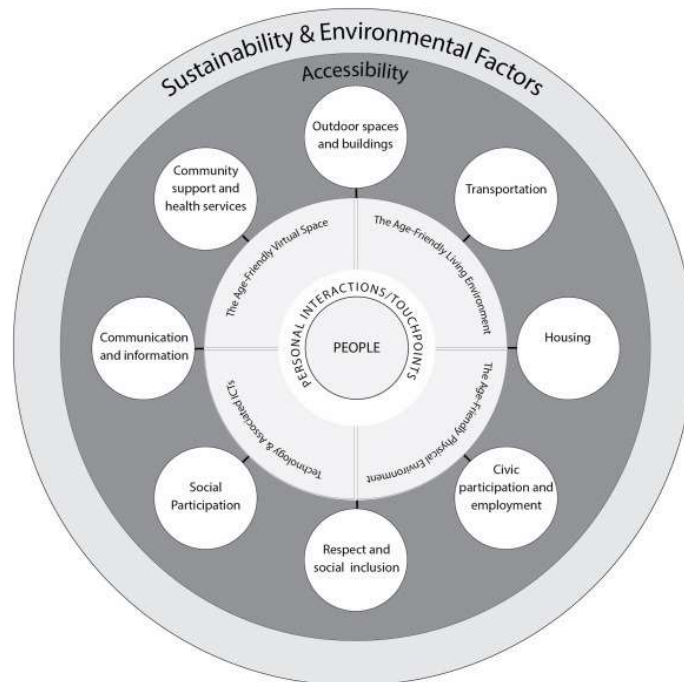


Figure 7. Most important concerning age-friendly cities and communities and the built environment by van Hoof (2021).

Table 2 lists a few common and well-known definitions of this subject in order to give readers a thorough understanding of it. Based on the definitions of urban

sustainability from various sources, it can be concluded that urban sustainability refers to the ability of a city or urban area to function in a way that supports long-term social, economic, and environmental well-being. This involves promoting sustainable practices at the local level to promote economic, social, and environmental well-being, while meeting the needs of current and future generations.

Table 2. Definition of urban sustainability.

Definition	Source
Urban sustainability is the capacity of cities and urban areas to maintain, improve and manage their socio-economic, environmental and cultural assets, while reducing inequalities and vulnerabilities, and promoting inclusive and participatory decision-making.	United Nations
Urban sustainability is the study of how cities can provide a high quality of life for their inhabitants while simultaneously protecting the natural and cultural systems on which the city depends.	Academic definition
In the United States, urban sustainability is often defined as the ability of a city or urban area to meet the needs of its residents in a way that promotes economic growth, protects public health, and preserves the environment for future generations.	US Environmental Protection Agency (EPA)
In Canada, urban sustainability is defined as the ability of a city or urban area to support a high quality of life for its residents while minimizing its impact on the environment and preserving natural resources.	Federation of Canadian Municipalities
In the United Kingdom, urban sustainability is defined as the ability of a city or urban area to provide a high quality of life for its residents while promoting economic prosperity, protecting the environment, and addressing social inequalities.	UK Department for Environment, Food and Rural Affairs (DEFRA)
In China, urban sustainability is defined as the ability of cities to balance economic growth with environmental protection and social development, while improving the quality of life for urban residents. This involves promoting sustainable transportation, green buildings, and renewable energy, among other measures.	China Urban Development and Planning Association
In India, urban sustainability is defined as the ability of a city or urban area to provide a good quality of life for its residents in a way that is environmentally sustainable, socially inclusive, and economically viable. This involves promoting sustainable urban planning, transportation, water management, and waste management, among other measures.	Ministry of Housing and Urban Affairs, Government of India
In Malaysia, urban sustainability is defined as the ability of a city or urban area to meet the needs of its current and future residents while maintaining the natural environment, social well-being, and economic development. This involves promoting sustainable urban planning, transportation, energy efficiency, waste management, and green spaces, among other measures.	Ministry of Housing and Local Government, Government of Malaysia

Source: Arun Pallathadka et al., 2023; Zhou et al., 2022.

The United Nations defines urban sustainability as the capacity of cities and urban areas to maintain, improve, and manage their socio-economic, environmental, and cultural assets, while reducing inequalities and vulnerabilities and promoting inclusive and participatory decision-making. The US Environmental Protection Agency defines urban sustainability as the ability of a city or urban area to meet the needs of its residents in a way that promotes economic growth, protects public health, and preserves the environment for future generations. The Federation of Canadian Municipalities defines urban sustainability as the ability of a city or urban area to support a high quality of life for its residents while minimizing its impact on the environment and preserving natural resources. The UK Department for Environment, Food and Rural Affairs defines urban sustainability as the ability of a city or urban area to provide a high quality of life for its residents while promoting economic prosperity, protecting the environment, and addressing social inequalities.

In China, urban sustainability involves balancing economic growth with environmental protection and social development while improving the quality of life for urban residents. In India, urban sustainability involves providing a good quality of

life for urban residents in a way that is environmentally sustainable, socially inclusive, and economically viable. In Malaysia, urban sustainability involves meeting the needs of current and future residents while maintaining the natural environment, social well-being, and economic development through sustainable urban planning, transportation, energy efficiency, waste management, and green spaces.

It is clear from the definitions that the three main components of the sustainability idea that is widely accepted worldwide are social equality, environmental quality, and economic progress. As a result, this research also limits the concept of “sustainability” to these three environmental issues, which must be addressed in order to prevent further climatic change and global warming (Shearlock et al., 2000). A few more examples of green design used to restore the health of the ecosystems are the creation of open spaces, tree planting, and landscape gardening (Zhang, et al., 2019).

6.2. Social equity

According to Chiu (2002), equity is a crucial component of social sustainability. As each person has unique needs and capacities, equity does not imply that everyone can enjoy an equal distribution of resources. According to Pincetl (2001), social equity primarily entails taking into account the social, cultural, and spiritual requirements of diverse socioeconomic groups in order to provide a more effective and equitable distribution of scarce resources. Additionally, it means that public advantages and liabilities be distributed fairly and that differences in wealth accumulation and standard of living between groups are kept to a minimal. Another example of how to achieve social justice is to provide housing, public amenities, and improvements to health, security, cohesion, diversity, and quality of life for all parties, regardless of their socioeconomic standing and income. Community involvement is urged to ensure that the public’s opinions are heard by those who will make decisions about sustainable urban development (Pincetl, 2001; Berke, 2002).

Although there are several definitions of “sustainable development” and intense disputes regarding the relative importance of the three components, it is generally agreed that taking into account economic, environmental, and social factors is advantageous to the well-being of both present and future generations. Thus, the idea of sustainability is seen in this context as the integration and harmony of the three primary spheres of economic development, environmental quality, and social equality through a continuous process of change and adaptation, in order to meet the demands of both the present and future generations. The most efficient way to accomplish sustainability, according to Berke and Conroy (2000) and Shearlock et al. (2000), is to reach the overlapping areas of three circles representing various factors (**Figure 8**). However, balancing those features is not a simple operation.

The challenge of balancing economic, social, and environmental interests becomes evident when the balancing mechanism malfunctions (Campbell, 1996). Campbell (1996) posits that the economic growth of an urban region often occurs at the expense of depleting Earth’s resources and degrading the natural environment. This degradation includes the loss of green spaces and the flattening of hills. The utilization of lands and assets, whether as private commodities to maximize profits or as public goods such as affordable housing and facilities meeting societal needs,

contributes to this complex dynamic. As residents enjoy comfortable and convenient living, there is a risk of deteriorating the quality of the environment through excessive waste production and the utilization of excessive energy, water, and other natural resources (Hamphill et al., 2002). Achieving a balance between economic development, social well-being, and environmental sustainability requires careful consideration and effective mechanisms to ensure that the interests of all aspects are harmonized and that urban growth occurs in a responsible and sustainable manner.

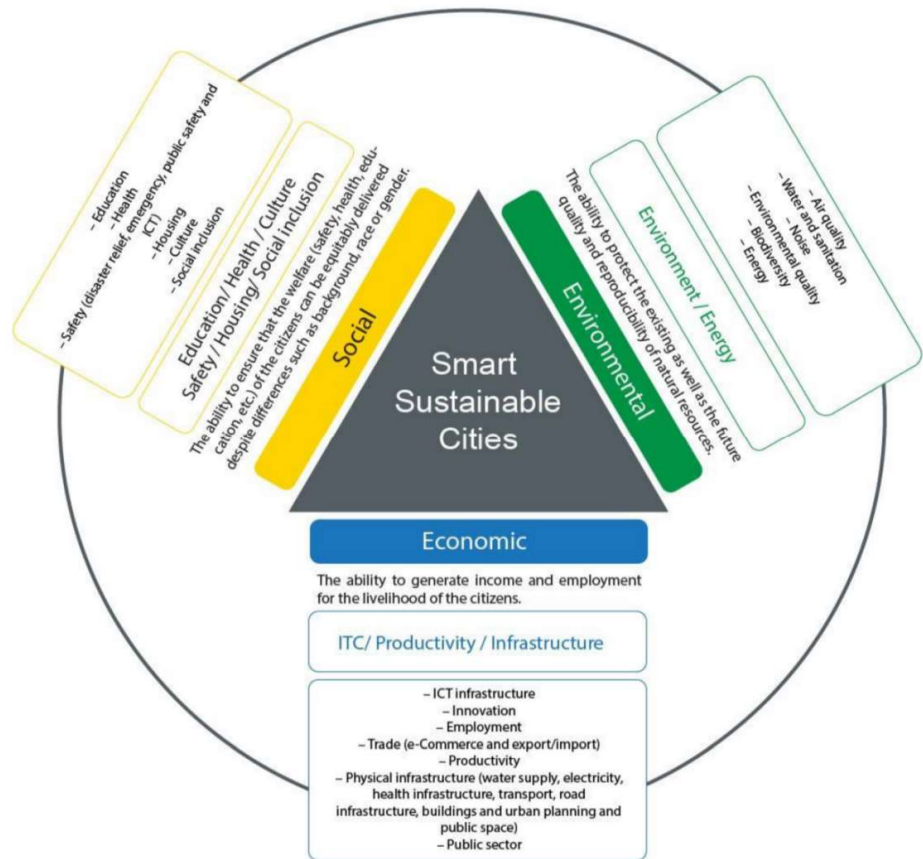


Figure 8. Relationships of sustainable development objectives (Schiavo, 2022).

Unsurprisingly, sustainable development is a worthwhile goal, and as a result, this term is used frequently across all industries. Among the terms frequently used by planners, designers, and builders in their areas are “sustainable zoning”, “sustainable design”, “sustainable construction”, “sustainable building”, etc. (Campbell, 1996; Curwell and Deakin, 2002). The term “sustainable” appears to be overused, according to some academics, who question whether those involved understand its meaning, what should be sustained, and how it can be done (Tang, 1994; Berke and Conroy, 2000; Bentivegna et al., 2002; Berke, 2002; Lai, 2002; Yang et al., 2022).

Numerous international gatherings and conferences have recently been convened to talk about the future course of urban development worldwide. To make the concept of sustainability a reality, numerous treaties, declarations, and conventions were created (Lai, 2002; Mottershead, 2004). Additionally, states and cities in industrialized and developing regions attempt to incorporate this idea into their planning efforts using various techniques. For instance, the idea of “new urbanism”—which

emphasizes the development of small urban forms—was formerly well-liked in the US (Berke, 2002). However, when it first started, it paid little regard to social fairness, environmental conservation, or economic progress. Since then, the concept of sustainable development has received a lot of attention as a means of overcoming the drawbacks of such a design strategy.

Since 1995, Canada has actively implemented sustainable development policies at both the federal and provincial levels (UNDESA, 2002). Belgium, as another industrialized nation, has committed to establishing national sustainable development policies aimed at combating poverty, addressing social injustice, and preserving the environment. Prior to commencing urban development, the Bequest European Union (EU) Network endeavors to tackle environmental and other sustainability challenges (Deakin et al., 2002). Leeming (2000) highlights that the urban strategy of the United Kingdom emphasizes the necessity for sustainable urban growth to foster the creation of stable communities. In the case of Tarija, a significant city in Bolivia, it serves as a successful model for other towns implementing the Bolivia Sustainable Urban Development Project to meet the demands of their residents, with support from Canadian specialists (Marcondes, 1999). Chongqing has undergone sustainable development research, leading to the establishment of the Sustainable Development Unit (SDU) and Council for Sustainable Development, which actively promote and implement the concept of sustainability (PD, 2000). These instances showcase the global commitment to sustainable development, with nations and cities adopting policies and initiatives to ensure a balanced and environmentally conscious approach to urban growth and community development. Developing nations embracing sustainable development techniques include the Philippines, Africa, Brazil, Colombia, China, India, Indonesia, and Thailand (Jenks, 2000). In comparison to developed counties, they might face greater challenges, such as a lack of institutional support, restricted resources and control, and a low level of public involvement in the development of the plans (UNDESA, 2002). However, they have not given up on their efforts to encourage sustainable development because early adoption of the concept can help avoid long-term negative effects like social exclusion and excessive resource depletion on the development of those regions. Sustainability is not just an international problem (Liang, 2021). Devuyt When choosing between many local development possibilities, “Think globally, act locally” has become a catchphrase that embraces the sustainability notion (Alexander, 2000; Berke, 2002). The outlines the significance of achieving sustainable development at the local level to establish sustainable communities (Simona et al., 2023; Lafferty, 2001). In order to design, plan, build, and manage a city or community more sustainably (Shearlock et al., 2000; Yang et al., 2022); to resolve conflicts between ecological, economic, and social interests (Xiao et al., 2022); and to maximize benefits for both current and future generations (PD, 2003), sustainable development at the local level is important. Local scale sustainable development, entails social fairness, economic growth, employment, wealth equality, and environmental preservation.

7. Sustainable urban retrofit approach

7.1. Formation of the approach

Urban retrofit initiatives, as previously noted, can somewhat enhance the built environment and the quality of life for residents. They may, however, have a negative impact on the communities’ social, economic, and environmental domains if they are unable to find a balance between them (O’Flaherty, 1994; Bentivegna et al., 2002; McLaughlin, 2003). Tang (2002), the property-led UREG method, which aims exclusively to improve the city’s physical state, prevents the community’s sustainable growth. A sustainable strategy is required to reduce the shortcomings in UR projects. Such a strategy is meant to be established by applying the idea of sustainability to UR, a significant local problem that receives a lot of public attention. This is why. The terms “sustainable UR” or “UREG” can be used to describe the idea of integrating sustainability concept into UR process to ensure long-term economic, environmental, and social well-being of the public. To improve the coherence of this study, “sustainable UR” would be the preferred term for that strategy. Economic Retrofit, Environmental Retrofit, and Social Retrofit are the three aspects that a true sustainable UR must address (**Figure 9**). Economic retrofit strives to raise the local economy’s attractiveness and competitiveness in order to spur growth. It comprises initiatives for modernizing outdated or historic industries, keeping workers in the local area, and luring outside investment. Physical improvement, the preservation of local landmarks, and the conservation of the natural environment are the three main subcategories of environmental retrofit. It emphasizes striking a balance between new construction and the preservation of existing infrastructure.

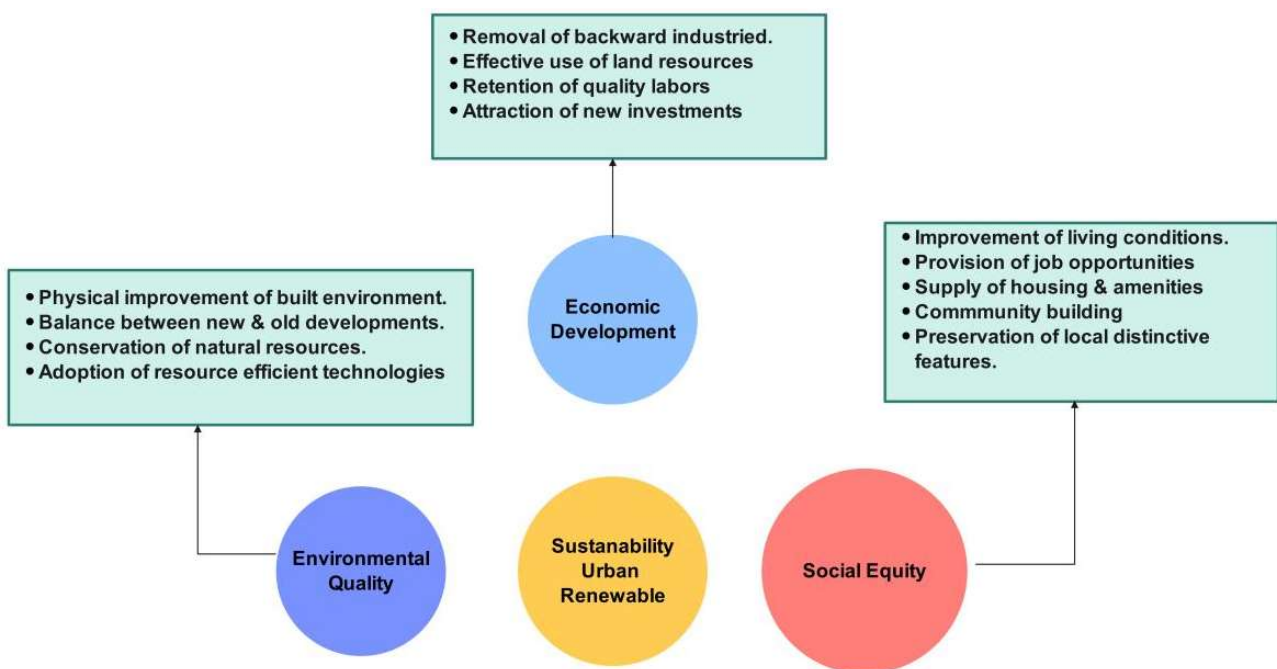


Figure 9. Urban retrofit process based sustainable development objectives.

Source: Zheng et al., 2021.

Social retrofit endeavors to enhance social conditions for individuals and the community at large while maintaining connections to the past and respecting local characteristics. Initiatives encompass various programs such as establishing local employment opportunities, offering affordable housing and amenities, promoting community development, preserving regional customs and cultures, and restoring

historic and repairable buildings. These efforts collectively aim to uplift the social fabric, fostering a sense of community identity and well-being without disregarding the importance of historical elements and local distinctiveness.

7.2. Popularity of sustainable UR approach

The academic community has explored the idea of sustainable UR over the years in their research in various ways (Blackman, 1995; Peng, 1999; Couch and Dennemann, 2000; Alker and McDonald, 2003). Shifa Ma et al. (2023) suggested a sustainable UREG strategy proposed eight important aspects, such as transportation, form of development, and public space facilities that should be taken into consideration for urban improvement. These eight major factors fall under five principles: participation, community, equity, environment, and economy. Walker (2002) said that sustainable development and UR are two issues that must be addressed in order to correct the shortcomings of earlier developments and to maintain future economic well-being, ecological wellbeing, and social advantages. Therefore, before UR begins, social, economic, and environmental factors that are important to achieving sustainable development should be evaluated (Alker and McDonald, 2003). Furthermore, Priemus (2004) noted that effective UR should be “demand-driven” and that this did not just apply to the founding of businesses, the creation of jobs, the provision of housing, the availability of facilities, the construction of greenery and open spaces, or environmental-related issues. Even if most of the time not all of their needs can be met, the demands of all parties involved should be taken into account and the final UR plans should be approved by most of the parties involved (Priemus, 2004). The concept of mutual understanding is comparable to the sustainability concept’s balancing approach, which is essential to creating a successful UR strategy.

Furthermore, numerous nations have used this methodology while creating recommendations for urban reconstruction (Alexander, 2000; Kexin Cao et al., 2023). Urban renewal and sustainable development have been identified as two of the main pillars of sehzen urban by Cao et al., (2023) Couch and Dennemann (2000) and Hemphill et al. (2004). According to Couch and Dennemann (2000), Liverpool City Council’s Unitary Development Plan (UDP) seeks to simultaneously advance social equity, environmental betterment, and economic revitalization. Following the UR process, Liverpool City’s economy recovered, the quality of its housing was enhanced, and additional open spaces, shops, and transportation options were made available. Scottish Executive reviews current planning policies, particularly those for urban renewal, with a strong emphasis on social inclusion and environmental concerns in addition to economic goals (Lloyd, 2002). For instance, Scotland established national parks to balance the demands of the community and the environment, and several pollution controls were put in place to enhance both the quality of the environment and human health. Famous American city Vancouver has experienced significant urban blight issues. Sustainable development ideas were included into UREG programs, which resulted in the construction of an energy-efficient community, the establishment of an efficient network connecting resident homes and workplaces, and the development of a lively, green city. In order to ensure that elements of sustainable development are taken into account, the Californian government also evaluates URED

proposals. In order to revitalize urban districts that are in disrepair, the Community Redevelopment Agency of the City of Los Angeles employs sustainable development principles (Pincetl, 2001). The sustainable UR process resulted in the removal of many neglected areas in Los Angeles, the creation of numerous open spaces, a decrease in the consumption of natural resources like soil, fuel, and water, an improvement in resource efficiency, and a considerable decrease in the costs associated with those resources. While Colorado has started a sustainable downtown redevelopment strategy, San Francisco has likewise committed to include sustainability criteria into UR policies (Yang et al., 2022).

7.3. Tactics to achieve sustainable urban retrofit

It appears that experts, professionals, and government officials all around the world are strongly in favor of the sustainable UR method. UR is a process that can be used to achieve sustainable development goals, so it is important to find a suitable way to translate this approach's abstract sustainability concept into a sound retrofit strategy. Sustainable development goals can be met through urban design. The broad concepts of the sustainability idea can be translated into useful design strategies through urban design (Cookson Smith, 2000). The Urban reconstruction Authority's China Square reconstruction project in Singapore is an excellent illustration of how incorporating urban design ideas into UR projects can rejuvenate run-down urban districts to the delight of people impacted. Choy and Chan (1998), the China Square reconstruction project not only addresses the issue of urban deterioration, but also produces a lively atmosphere with noteworthy architectural features and historical figures. Its physical environment and aesthetic appeal are improved, and the quality of life of the residents is raised by combining new developments for commercial and residential purposes with traditional Chinese architecture and connecting those developments with open spaces, amenities, and pedestrian walkways. Another great illustration of how urban design supports UR in achieving sustainable development goals is the rehabilitation of the Hulme neighborhood in the City of Manchester. The UK Central Government and the Manchester City Council made an effort to integrate economic, environmental, and social considerations when preparing a regeneration program for Hulme (Symes and Pauwels, 1999). In order to create a harmonious, vibrant, sustainable community, it is necessary to provide social provisions, renovate dilapidated buildings, mix different land uses, re-plan the layout of buildings and streets, adopt energy-saving and recycling initiatives, and connect the developments with outdoor spaces and secure pedestrian walkways. By doing this, the living conditions of the residents are significantly raised.

This study advocates for the incorporation of urban design approaches in the formulation of urban renewal (UR) plans to ensure the creation of a sustainable community upon project completion. The emphasis is on adopting a design-led approach for successful Urban Renewal and Environmental Governance (UREG) or sustainable UR. **Figure 10** illustrates the intricate interplay between various components, serving as a visual aid to enhance comprehension of the conceptual framework underpinning the sustainable UR strategy employed in this research.



Figure 10. Conceptual framework of sustainable UR approach.

Source: Author, 2023 (Adapted from UREG).

8. Research on the elderly for urban retrofit

After entering the old age, the physiological function of the elderly obviously declines, the change of body shape, the reduction of adaptability to the external environment, and the decline of resistance to varying degrees bring inconvenience to the daily life of the elderly. Not only has the physical condition changed, but the structure of life time has also changed. After retirement, the elderly are no longer busy with work every day, but suddenly have a lot of leisure time, discomfort, and psychological changes. Therefore, physiological and psychological changes have changed the needs of the elderly for the living environment (see **Figure 11**).

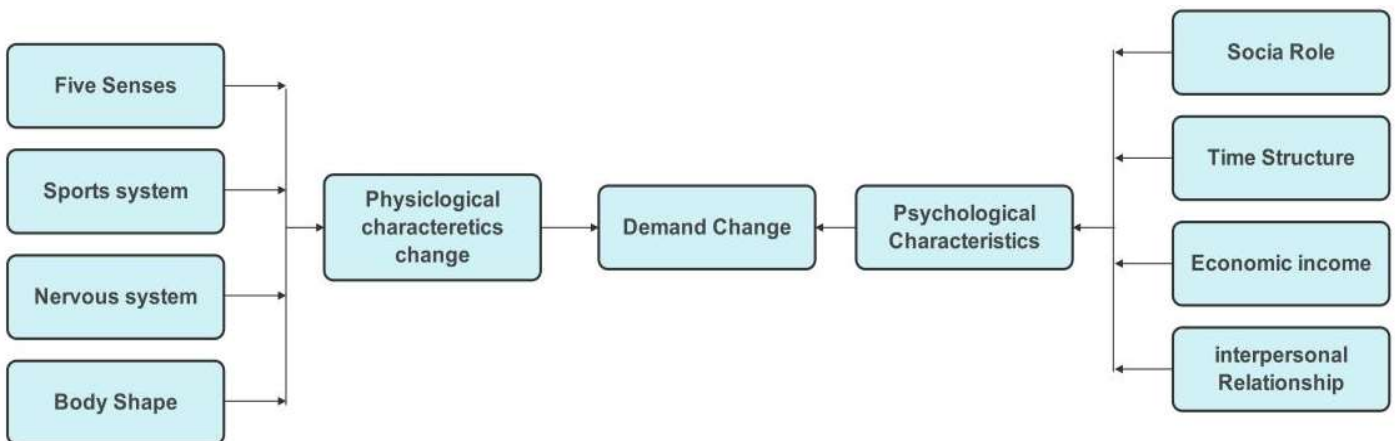


Figure 11. Factors influencing changes in the needs of the elderly.

8.1. Physiological characteristics of the elderly

1) Five senses decline

The five senses are the main media for people to perceive the surrounding environment and receive information, including vision, hearing, touch, taste and smell. The first five senses of the elderly to decline are vision and hearing. Presbyopia and

cataracts are common eye diseases in the elderly. Due to changes in the eye structure, the elderly cannot quickly adapt to changes in light and shade, and it is difficult to see the surrounding things clearly in an environment with low light penetration (Chiang et al., 2023). At the same time, the ability to recognize colors and visual adjustment is gradually weakened. Due to the reduction of cochlear hair cells, the ability of the elderly to distinguish sounds in different ranges gradually decreases. Therefore, the elderly will shorten the distance with others during the conversation to compensate for the degeneration of hearing (Yoshiyuki Kaneko et al., 2021). A decline in the senses of touch, taste, and smell can lead to slower responses to environmental hazards in older adults.

2) Movement decline

A person's bone and muscle strength peaks around the age of 30, and then begins to decline to varying degrees. After entering old age, their strength is less than half. Therefore, the elderly often suffer from backaches and leg pains, physical fatigue, reduced grip strength, and reduced endurance, which cause them to be unable to exercise for a long time. Due to muscle atrophy, the balance and coordination ability of the elderly are weakened, the flexibility of movement is reduced, and accidents such as falls are prone to occur. At the same time, due to the loss of calcium and collagen in the bones, the recovery ability after injury becomes poor, and long-term training is required (Ren et al., 2021).

3) Nervous system decline

As the age increases, the nervous system degenerates in the elderly due to factors such as reduced cerebral cortical surface area, increased brain sulcus width, and reduced brain weight. Mainly manifested as memory loss, often unable to recall what has happened recently. At the same time, the response is slow, the learning ability and cognitive ability are reduced, so the adaptability to the environment is reduced, unable to respond to emergencies in time, more afraid of unfamiliar environments, and severe cases cannot distinguish the direction and easily get lost (Okumura et al., 2023).

4) Body shape decline

As individuals age, there are noticeable changes in the body shape and appearance of the elderly. These changes include the graying and reduction of hair, the development of loose skin with decreased elasticity and an increase in folds. Additionally, due to the atrophy of bones and muscles, there is a variation in height between male and female elderly individuals. The extent of this reduction in height is often accompanied by signs of hunching, as indicated by Xiong et al. (2022).

8.2. Psychological characteristics of the elderly

The psychological characteristics of the elderly will also change with age, mainly due to the degradation of their physical functions and the transformation of social roles.

- Depression and inferiority complex: Due to the weakening of some body functions, the elderly have decreased physical mobility, decreased immunity, and decreased ability to respond to external stimuli. Susceptible to illness and inconvenient mobility, needing care from others, prone to depression and low self-esteem for a long time (Josephine et al., 2022).
- Sense of emptiness and loneliness: After the elderly retire, their roles in society

have also changed. They suddenly have a lot of free time and are no longer in a busy working environment. Such a sudden change makes the elderly feel at a loss, feeling empty and because of the status quo of the family structure in contemporary China, most of the children of the elderly cannot accompany them for a long time.

- Lack of social skills: With the change of social roles, the scope of communication of the elderly is gradually reduced, and the ability and willingness to communicate with others are also reduced. At the same time, the decline of physical function leads to the weakening of auditory and visual functions, which makes the elderly unwilling to communicate with the outside world.

8.3. The needs of the elderly on the outdoor environment

Outdoor activities for the elderly can not only improve physical and mental health, but also promote social interaction, but in real life, the elderly cannot actively participate in outdoor activities (Li et al., 2023; Ebru Akgun-Citak, 2020). The outdoor environment should not only provide a comfortable and pleasant environment, but also a place that provides opportunities for social interaction, while attracting the elderly to engage in a variety of outdoor activities. Create a safe, comfortable, and functional outdoor space through reasonable planning and design, and combine rich and ornamental plant landscapes, complete service facilities and landscape sketches to improve the quality of the outdoor environment. Transform the nature of activities of the elderly from passive attraction to active spontaneity. Based on the above research on the characteristics and needs of the elderly, it can summarize the six needs of the elderly for outdoor environmental landscapes:

- Safety: The outdoor environmental landscape suitable for the elderly must first satisfy safety. Safety includes physical safety and psychological safety. Physiological safety is not only reflected in the barrier-free space, but also in the safety design of landscape elements. Psychological safety refers to the sense of psychological safety that the atmosphere of the outdoor space brings to the elderly and the sense of safety generated by the barrier-free information exchange.
- Attractiveness: The outdoor space should create environmental landscapes, landscape sketches and activities that can attract or arouse the interest of the elderly, so as to enhance the subjective willingness of the elderly to do outdoor activities.
- Harmony: The outdoor space should not clearly divide the users, but should provide opportunities for people of different ages to use it together, so that the elderly can feel accepted by the society, accommodated by the environment and harmoniously integrated with the environment.
- Accessibility: Due to the decline in physical function of the elderly, the scope of daily activities is reduced. Outdoor spaces with a high utilization rate in residential areas are generally gathered around the buildings where the elderly live, and a 5-minute walk is within the range that most elderly people can bear due to their physical condition and physical strength.
- Comfort: Natural conditions such as the light environment and thermal environment of the outdoor space will affect the comfort of the space. In addition

to considering natural conditions, space and service facilities suitable for the ergonomics of the elderly are also key considerations for designers (Yi et al., 2022).

- Recognition: The memory of the elderly has declined significantly. If you want to strengthen the cognition and recognition of outdoor spaces for the elderly, you need to artificially increase the design with guiding signs. You can use plants, service facilities, landscape sketches and other landscapes.

8.4. Urban retrofit requirements of the elderly

The renowned American social psychologist Abraham H. Maslow introduced the “Human Motivation Theory”, which outlines five levels of needs arranged in a progressive manner. These levels include physiological, safety, social, esteem, and self-actualization (refer to **Figure 12**). Physiological needs, positioned at the lowest level, represent the most fundamental and basic requirements. It is emphasized that the pursuit of higher-level needs becomes feasible only after the fulfillment of these foundational physiological needs.

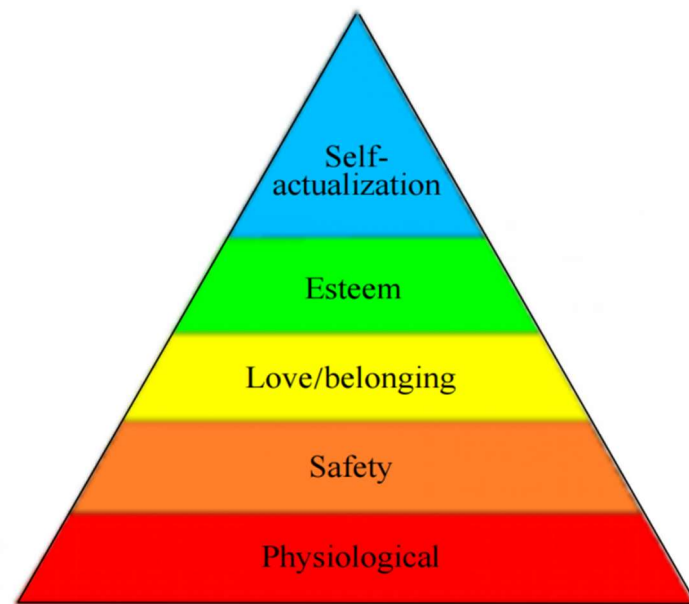


Figure 12. Maslow’s Hierarchy of needs (Zhang et al., 2022).

1) Barrier-free ring requirements

The barrier-free environment aims to create an ideal environment for unimpeded, safe and convenient passage for vulnerable groups such as the elderly, the disabled, and people with disabilities. China has promulgated corresponding design specifications for barrier-free environment construction, that is, “Barrier-free Design Specifications” (GB50763-2012), the seventh of which is for roads, residential green spaces, supporting public facilities, and residential buildings in residential areas standards are defined accordingly. The barrier-free design of the outdoor environment of the residential area should also include barrier-free information exchange. The sign system and lighting system design in the outdoor environment should also fully consider the physiological characteristics of the elderly, so as to help the elderly with different physical characteristics to obtain information and provide assistance.

2) Ergonomic ring requirements

Over time, the body shape of the elderly undergoes changes, resulting in a significant decrease in height. The requirements for service facilities and spatial dimensions suitable for the elderly differ from those designed for ordinary adults. When creating aging-friendly outdoor environments, careful consideration should be given to the body shape and size of elderly users, as highlighted by Hao Fan et al. in 2019. In line with this, China has established a national standard pertaining to ergonomics known as “Chinese Adult Body Size” (CB1000-88).

3) Halo Block Requirements

Due to the aging of the elderly, the decline of the visual system is particularly obvious. Due to the decrease of the pupil luminous flux capacity, the quality of light is demanding. In areas with relatively insufficient light, it is difficult for the elderly to see the surrounding environment (Kaneko et al., 2021). The visual ability of the elderly to adapt to light is reduced, which leads to the elderly needing more time than normal people to adapt to changes in light and darkness. If the light change is relatively strong, the elderly are extremely prone to transient blindness in the process of adapting to the change of light and dark, which will bring danger to the activities of the elderly. Therefore, the appropriate light intensity has a great influence on the comfort and safety of the daily activities of the elderly. In addition, sufficient sunshine can promote the supplementation and absorption of calcium in bones, prevent osteoporosis, and has the effect of sterilization and disinfection, enhancing the body’s immunity and resistance. Basking in the sun every day can prevent the elderly from forming negative emotions due to long-term exposure to the dark environment, which is beneficial to the mental health of the elderly.

To sum up, appropriate activities such as outdoor fitness, communication, entertainment and leisure not only have a positive effect on the physical and mental health of the elderly, but also can improve their happiness and quality of life in the elderly. Most of the elderly have a strong willingness to participate in outdoor activities, so it is necessary to design the outdoor environmental landscape in residential areas suitable for aging. The aging design research of the outdoor environmental landscape in the residential area should start from the perspective of the elderly who are the main users. Due to the decline of physical functions, changes in body shape, and changes in social roles, the elderly have higher requirements for outdoor environmental landscapes.

9. Sustainable urban retrofit strategy for the elderly

9.1. Concept of urban design

The American Institute of Architecture established a Committee on Urban Design and hired a researcher to research the subject in the late 1950s, which is when the phrase “urban design” was first used in North America. Academic studies and clarifications of the meaning and application of urban design have been extensive over the years. Although there is broad agreement that urban design exists, no definitive definition of what urban design is or how to define it has been established. Urban design tries to develop a vision for a location before utilizing the abilities and resources necessary to make that vision a reality. It is viewed as a collaborative,

multidisciplinary process that aims to shape the physical environment of an urban area while also providing specific physical design directions for urban growth, conservation, and transformation. Zhuang et al. (2019), noted that politicians, a wide range of stakeholders, and various professionals, including architects and planners, are all involved in the process of urban design, and that the success of this collaboration greatly affects the quality of the final product. Some people confuse the terms “urban design” and “urban planning” or “architecture” because they all deal with the physical setting of a region. They aren’t the same, actually. According to Arida (2002), study Urban design is the meeting point between urban planning and architecture. While urban planning deals with the design of the built environment from a macro perspective at a less detailed level and incorporates zoning to manage land-use distribution and growth management to control pace of development, architecture focuses on the physical design of buildings and the areas nearby. Urban design involves both disciplines, but focuses on physical features of the built environment that goes beyond a single building or individual parcel of land. Urban design emphasizes on the relationships between urban spaces like interface between public and private realms, areas between buildings and streets, and spaces beneath buildings or within buildings (Barnett, 1982). Given this, urban design might be referred to as “large-scale architecture” or the “physical aspect of urban planning”.

Urban design, as defined by the Department of the Environment, Transport and the Regions (DETR) in 2000, can also be referred to as “the art of making places for people”, where “places” refers to a particular area where individuals can organize or engage in a variety of activities and enjoy daily life. All of the films aim to improve the quality of human life rather than just the quality of the urban form, and common motivations for “making places” include economic growth, environmental conservation, community development, preservation of local character, expression of cultural and heritage values, and visual enhancement. As a result, consideration should be given to how the locations operate and interact with one another as well as how they seem (DETR, 2000; Raymond, 2000; Inam, 2002). As a result, several academics considered urban design to be a method to improve aesthetic value and satisfy functional criteria. In addition to planning and architecture, urban design also addresses intangible factors like relationships between people, expectations, cultures, behaviors, and perceptions of places, all of which are crucial in the development of cities (Arida, 2002). Consequently, urban design may be viewed as a process that also cares about addressing social and emotional demands.

Urban design is a powerful instrument for obtaining a higher quality of life, greater economic vitality, and a more efficient use of resources. It is also essential for creating attractive, useable, durable, and adaptive environments. Montgomery (1998) described Urban design aids in forming urban environments and transforming various facets of urban life into tangible, useable city forms. The promotion of sustainable lifestyles for the general public as well as the facilitation of future economic, environmental, and social growth are both achieved by taking into account the many characteristics of the city and the concerns of the residents in the design of the physical environment (Oktay, 2004). According to earlier research, good urban planning can also increase property prices, the quality of the environment, and inhabitants’ quality of life (Berke, 2002; Yang et al., 2022; Longmire, 2003). Barnett (1982) asserts that

urban design may address issues with resource misallocation, inefficient land use, and the needless demolition of buildings and other structures with distinctive architectural elements or historical significance. Previously, an economic model was used to assess the advantages of urban planning. A group of 102 commercial buildings in the US were subjected to a design analysis, and the researchers discovered that while good design did not always result in higher costs, the rental value grew with time. Good urban design is likely to have a favorable impact on economic, social, and environmental facets of life, according to an investigation conducted in 2001 by DETR. As investment prospects, productivity, return from enterprises, and employment offers expand, environmental quality improves, and a variety of easily accessible amenities are offered, investors, developers, and users benefit. Yang et al. (2022) examined the design elements of 7 urban rehabilitation projects in Seoul and came to the conclusion that superior urban design increased citizen happiness.

In summary, effective urban design not only benefits specific parties but also advances the economy, environment, and society—three key pillars of sustainable development. DETR (2000)'s view that urban design is a fundamental to achieving sustainable development is not surprising. Maroochy Shire Council (2005) supports the notion that effective urban design can enhance or facilitate social fairness, economic vibrancy, and environmental responsibility, all of which are factors in urban sustainability. Since urban design has been shown to be a successful tool for achieving sustainability, many researchers and professionals are working to develop a high-quality and sustainable built environment for the public using this method (Yang et al., 2022).

After examining the idea and importance of urban design and how it relates to sustainability, it is thought that urban design can achieve sustainable UR by altering the existing built environment while giving the economic, social, and environmental goals due consideration at the outset of the planning process. The term “urban design” in this study refers to the art of re-shaping the physical urban environment, preserving nature and the built environment with distinctive features, satisfying social and emotional needs of the elderly people, and connecting the elderly people and three-dimensional spaces in a process that sustains the old communities.

9.2. Key urban design principles

Based on the concept of urban design as discussed above, the key principles of urban design or the so-called the sustainable urban retrofit strategy for the elderly in the study, are identified as follows.

- **Social equity:** Urban design should promote inclusive communities that meet the needs of all residents, regardless of age, income, or ability and considering access to services, transportation, and public facilities.
- **Sustainability:** Urban design should create sustainable communities that can withstand environmental, social, and economic challenges and promoting sustainable transportation, and green infrastructure.
- **Health and well-being:** Urban design should consider the impact of the built environment on residents' health and active lifestyles, access to healthy food options, and safe and accessible public spaces.

- Safety and security: Urban design should promote safety and security in public spaces through proper lighting, clear sightlines, and secure entrances and exits.
- Aging in place: Urban design should support aging in place by designing communities that allow elderly individuals to remain in their homes and communities as they age. This involves services, transportation options, and public facilities.

By considering these principles in urban design, designers and planners can create communities that are safe, comfortable, and accessible for all residents particularly inclusive of the elderly population, regardless of income or ability (Eva Vaništa Lazarević et al., 2018, Lorenzo and Aliaksandra, 2021).

Four major design considerations are highlighted for each of these principles, as seen in **Table 3**, along with literature support. Some of the ideas have previously been demonstrated and described above, while the remaining ones are similarly taken from earlier studies. Urban design elements are then narrowed down in the next section.

Table 3. Urban design considerations linking to urban design principles.

Urban Design Considerations	Urban Design Principles	References
Community infrastructure security	Safety and security	Roma and Agnieszka Deja, 2022
Elderly comfort of community public facilities	Health and well-being; Aging in place	Li and Li, 2023
Completeness and convenience of surrounding living services	Social equity; Health and well-being	Pratt et al., 2023
Security and convenience of elderly care and services	Social equity; Health and well-being; Aging in place; Sustainability	Zhou et al., 2023

Community infrastructure security is an essential consideration for urban design because it ensures that the community is safe and secure for all residents. This includes designing communities that are equipped with proper lighting, clear sightlines, and secure entrances and exits to prevent crime and enhance safety. In short, urban design should ensure that the community’s infrastructure is secure to promote safety and security for all residents.

Elderly comfort of community public facilities is important for promoting aging in place and ensuring that elderly individuals are able to live comfortably and independently in their homes and communities. This includes designing public facilities that are easily accessible, comfortable, and accommodating for elderly individuals. In short, urban design should take into account the needs and comfort of elderly individuals when designing community public facilities.

Completeness and convenience of surrounding living services are crucial for promoting a high quality of life for residents. This involves designing communities that provide easy access to a full range of services and amenities, including transportation options, healthcare facilities, recreational facilities, and retail establishments. In short, urban design should ensure that the community has access to a full range of services and amenities that are easily accessible and convenient for residents.

Security and convenience of elderly care and elderly care services are also essential for ensuring that elderly individuals have access to necessary healthcare and

other services that support their needs. This involves designing communities that provide safe and convenient access to healthcare facilities and other elderly care services. In short, urban design should provide safe and convenient access to elderly care services, such as healthcare facilities and other services that support the elderly population.

9.3. Elements of urban design considerations

After identifying the key principles of urban design followed by the four major considerations, the elements of each consideration are specified and presented, so that the sustainable urban retrofit strategy could be further enriched and the goals of the strategy to improve old community's economic, environmental, and/or social sustainability for the elderly, could be achieved under more effective implementation.

9.3.1. Community infrastructure security

The community infrastructure security is an essential aspect of urban design. It encompasses a range of elements that affect the safety and security of residents and visitors in urban areas, including road safety, firefighting facilities, anti-theft facilities, electrical safety, public lighting facilities, and intelligent security systems. The provision of adequate infrastructure security in urban areas is crucial for maintaining social order, promoting economic development, and improving the overall quality of life for residents.

Adel et al. (2016) explored the relationship between urban design and public safety to preventing crime and enhancing community infrastructure security using various design principles and strategies that can be employed to improve public safety in urban areas. Su et al. (2023) measured a framework for designing urban areas that are resilient to security challenges taking into account the potential for security threats and incorporating measures to mitigate these risks. In addition, they provided a comprehensive overview of the factors that contribute to community infrastructure security and proposed design strategies to improve resilience to security challenges. Michele Grimaldi et al. (2023) provided an overview of recent research on the relationship between urban design and crime. The urban design can significantly impact crime rates by influencing the way people use and perceive public spaces.

Community infrastructure security involves a range of elements that contribute to the safety and security of the community's physical assets and infrastructure (Piroozfar et al., 2019). These elements include:

- Road safety: to ensure that the community's roadways are safe for motorists, cyclists, and pedestrians. These measures can include traffic calming measures, speed limits, road markings, and signage.
- Firefighting facilities: adequate firefighting facilities such as fire stations, fire hydrants, and fire extinguishers are essential for ensuring that the community is prepared to respond to fires and other emergencies.
- Monitoring facilities: surveillance cameras, security alarms, and other measures that are implemented to deter crime and ensure the safety of the community's assets and infrastructure.
- Anti-theft facilities: to prevent theft and vandalism, such as security gates, fences, and locks, are important for protecting the community's assets.

- Electrical safety: to ensure that the community's electrical infrastructure is safe and reliable, such as circuit breakers, surge protectors, and grounding systems.
- Completeness of public lighting facilities: adequate lighting is essential for ensuring that public spaces are safe and secure, and that pedestrians and motorists can see and be seen.
- Provision of intelligent security systems: use of advanced technology such as CCTV cameras, motion sensors, and other systems that can help to detect and prevent security breaches.

9.3.2. Elderly comfort of community public facilities

The comfort of elderly people is an essential aspect of urban design as the world's population is aging rapidly. Many researchers have explored the relationship between urban design and the comfort of the elderly, particularly in public spaces (Akinci et al., 2022; Chen et al., 2023; Ravi et al., 2021; Liu et al., 2021). Azadeh Lak et al. (2020) explored the importance of outdoor spaces for the elderly and presented evidence-based design guidelines for creating comfortable outdoor spaces including accessibility, safety, and comfort in outdoor spaces to encourage seniors to spend time outside and engage in physical activity. Wang (2014) investigated the role of public spaces in meeting the needs of older adults. The author highlighted the importance of public spaces in promoting social engagement, physical activity, and mental well-being among seniors.

The elderly comfort of community public facilities refers to the design of public spaces and facilities that cater to the needs and preferences of older adults. This includes:

- Safety of sports facilities: ensuring that sports facilities are designed with safety features to reduce the risk of injury to elderly users.
- Convenience of sports and entertainment facilities: making sure that sports and entertainment facilities are easily accessible and convenient for elderly residents.
- Provision of activity equipment: providing suitable activity equipment that is accessible and safe for older adults.
- Completeness of sports and entertainment facilities: ensuring that the community has a wide range of sports and entertainment facilities available for use by older adults.
- Facility Provision for Wheelchair Accessibility: making sure that all public facilities are accessible to elderly people who use wheelchairs or mobility aids.
- Personalization of community style: designing public spaces and facilities that reflect the cultural preferences of the elderly population.
- Comfort of public facilities: ensuring that public facilities such as benches, restrooms, and drinking fountains are comfortable and accessible for older adults.
- Comfort of leisure square: designing leisure squares that are comfortable, safe, and provide opportunities for social interaction for older adults.
- Comfort of public green space: providing well-maintained and accessible green spaces that are comfortable for elderly residents to use.
- Personalization of sports and entertainment facilities: designing sports and entertainment facilities that reflect the preferences and needs of older adults.
- Leisure square Personalization: designing leisure squares that reflect the cultural

preferences and needs of older adults.

- Community greening rate: increasing the amount of green space in the community to promote health and well-being among older adults.
- Configuration of plant varieties: designing green spaces with a variety of plant species that are suitable for older adults and promote biodiversity.

9.3.3. Completeness and convenience of surrounding living services

The completeness and convenience of surrounding living services are critical considerations for urban design. A well-designed urban environment must provide easy access to essential services such as transportation, medical care, shopping, and public amenities to meet the needs of its residents (Zheng et al., 2023; Bobylev et al., 2022). Convenience and completeness of surrounding living services have a significant impact on the quality of life, health, and wellbeing of urban residents. Wang and Qu (2023) studied the impact of public transportation on urban living convenience by conducting a survey of residents in a Chinese city. The study found that the convenience of public transportation significantly influenced residents' satisfaction with urban living, and an efficient public transportation system can enhance the convenience and completeness of surrounding living services. Gaglione et al. (2023) focused on the walkability and accessibility such as improving street connectivity which can increase the completeness and convenience of surrounding living services and enhance the quality of life of urban residents. Mayaud et al. (2019) focused on the impact of healthcare facilities on urban living convenience by analyzing the spatial distribution of healthcare facilities in a Cascadia city. Thus, it is crucial to consider these factors when designing urban environments.

The key aspects of the completeness and convenience of surrounding living services include:

Public Transport Convenience:

- Proximity to bus stops and train stations.
- Frequency of service.

Medical Facilities Convenience:

- Availability of hospitals, clinics, and pharmacies.

Commercial Facilities Convenience:

- Presence of supermarkets, convenience stores, and shopping centers.

Completeness of Public Transport:

- Coverage of the entire community.
- Accessibility for individuals with disabilities.

Completeness of Commercial Facilities:

- Diverse range of options.
- Adequate quantity to meet community needs.

Completeness of Service Facilities:

- Availability of post offices, banks, and community centers.

Completeness of Medical Facilities:

- Range of medical specialties.
- Adequate quantity to meet community needs.

Completeness of Sanitary Facilities:

- Presence of clean and well-maintained public restrooms.

- Adequate waste disposal facilities.
Convenience of Service Facilities:
- Availability of online services.
- Delivery options for goods and services.
Convenience of Sanitary Facilities:
- Access to clean and well-maintained public restrooms.
- Proper waste disposal facilities.

9.3.4. Secure and convenience of elderly care and services

The issue of providing secure and convenient elderly care services is becoming increasingly important in urban design, especially with the aging of the population in many countries. As a result, many researchers have studied this topic and proposed various solutions (Zhou et al., 2023; Cheng et al., 2022). Emanuele Garda (2021) cared facilities in residential districts in Lombardy and emphasized the importance of considering during COVID and needs of elderly residents when designing such facilities, including factors such as accessibility, security, and comfort. Lee et al. (2020) studied the impact of the built environment on the well-being of elderly care facility residents and focused on creating environments that promote social interaction, provide opportunities for physical activity, and offer a sense of privacy and control for residents. Kazuto Sumita et al. (2021) empirically analyzed on the design of elderly care facilities and provided case studies of successful design solutions and emphasized the importance of considering the needs and preferences of elderly residents when designing such facilities, and suggested that designers should focus on creating environments that promote independence, choice, and dignity.

To provided information about the security and convenience aspects of elderly care and services:

- On-Site Medical Delivery Service:
 - Availability of medical care services within the community for easy access by the elderly.
- On-Site Maintenance Safety:
 - Ensuring the safety and security of maintenance services provided to the elderly in their homes or within the community.
- Housekeeping Service Security:
 - Ensuring the safety and security of housekeeping services for the elderly, including the protection of personal belongings and privacy.
- Safety of Meal Delivery Service:
 - Ensuring the safety and hygiene of meals delivered to the elderly in their homes or within the community.
- Convenience of Housekeeping Service:
 - Ensuring the convenience and accessibility of housekeeping services for the elderly.
- Convenience of Meal Delivery Service:
 - Ensuring the convenience and accessibility of meal delivery services for the elderly.
- Convenience of On-Site Maintenance:
 - Ensuring the convenience and accessibility of maintenance services for the

elderly.

Agent Purchasing Goods:

- Assistance with purchasing necessary goods for the elderly, such as groceries or medications.

Accompanying to See Doctor:

- Assistance with transportation and accompanying the elderly to see a doctor or receive medical treatment.

Assistance for Traveling:

- Providing assistance and guidance for the elderly who wish to travel.

Convenience of Elderly Care Facilities:

- Ensuring the convenience and accessibility of elderly care facilities.

Completeness of Elderly Care Facilities:

- Ensuring the completeness and availability of a wide range of elderly care services and facilities.

Security Services:

- Providing security services within the community to ensure the safety and protection of the elderly.

Emergency Treatment Service:

- Ensuring the availability of emergency treatment services for the elderly.

Mental Health Counseling:

- Providing mental health counseling services for the elderly.

Address Confidentiality:

- Ensuring the confidentiality and protection of the personal information of the elderly.

Confidentiality of Personal Information:

- Ensuring the confidentiality and protection of the personal information of the elderly.

Ambulance Accessibility:

- Ensuring the accessibility of ambulance services within the community.

Accessibility of Convenient Services:

- Ensuring the accessibility of convenient services for the elderly, such as banking and postal services.

10. Challenge and future recommendation

The backdrop of age-inclusive urban design is set against the evolving dynamics of urbanization and demographic shifts. As urban environments grapple with the challenges posed by an aging population, the imperative to create spaces that enhance the well-being of the elderly has become increasingly apparent. Historically, urban renewal initiatives, while addressing broader aspects of development, have often overlooked the nuanced needs of the aging demographic (Pobric and Robinson, 2019; Bo et al., 2022; Zhou et al., 2022). Completed projects have faced criticism for inadequately accommodating the distinctive requirements of the elderly, resulting in unintended environmental and social consequences.

In response to these challenges, recent initiatives from academia and local governments have ushered in a new era wherein sustainability is integrated into urban

regeneration strategies (Cheng et al., 2022; Lin et al., 2022; Pan and Du, 2021). The concept of sustainable retrofit for the elderly aims to modify or renovate existing urban structures and spaces, seeking to render them more accessible, accommodating, and conducive to the overall well-being of the aging demographic (Younes et al., 2023).

As we navigate this terrain of age-inclusive urban design, it becomes imperative to address the challenges that arise in the pursuit of sustainable retrofit strategies. This section delineates these challenges, providing a comprehensive understanding of the intricacies involved. Subsequently, we outline future recommendations, envisioning a trajectory for research endeavors and practical interventions that can transcend these challenges and contribute to the advancement of age-inclusive urban design.

Challenges and Future Recommendations can be summarised as follows:

Integration of Universal Design Principles:

- Challenge: Achieving a seamless integration of universal design principles within existing urban structures, balancing accessibility against aesthetic and functional considerations.
- Recommendation: Conduct in-depth studies to identify best practices and strategies for incorporating universal design principles, providing a roadmap for architects, urban planners, and policymakers.

Interdisciplinary Collaboration:

- Challenge: Navigating the complexities of interdisciplinary collaboration among fields such as urban planning, architecture, gerontology, and social sciences to ensure a holistic approach to age-inclusive urban design.
- Recommendation: Foster collaborative research initiatives and educational programs to bridge disciplinary gaps, fostering a shared understanding of the diverse facets involved in the creation of age-inclusive urban spaces.

Financial Implications:

- Challenge: Balancing the economic feasibility of retrofitting initiatives against the substantial financial investments required for effective age-inclusive urban design.
- Recommendation: Explore innovative funding models, leveraging public-private partnerships and advocating for financial incentives to encourage widespread adoption of sustainable retrofit strategies.

Policy Development:

- Challenge: Advocating for the integration of age-inclusive urban design principles within municipal planning regulations and policies.
- Recommendation: Engage in targeted research to inform policy development, providing evidence-based recommendations for the incorporation of age-inclusive urban design principles at the municipal and regional levels.

Public Engagement:

- Challenge: Effectively engaging the public, including the elderly population and other stakeholders, in the process of age-inclusive urban design.
- Recommendation: Conduct research to identify and implement strategies for inclusive decision-making, involving the elderly and other stakeholders in the planning and design processes.

To sum up the above, it appears that in order to create a sustainable town or city, all objects under each of the four considerations must be taken into consideration. In

the real world, it is not the case where people place varied emphasis on various components of an urban development, and different places own different amounts of limited resources like lands and money. As a result, from time to time and from one location to another, the importance of the design concerns changes so as to ensure that the resources available in urban spaces are used effectively and to reach the satisfaction of as many parties as possible. Making a decision on which design elements should be taken into account in the designs in advance is a difficult work since UR projects have more site constraints than new developments and execution of these activities has an impact on many nearby inhabitants with varying requirements and expectations. The proposed sustainable urban retrofit strategy for the elderly shall be viewed and implemented in a dynamic or adjustable way. **Figure 13** displays the core ideas of the proposed sustainable urban retrofit strategy.

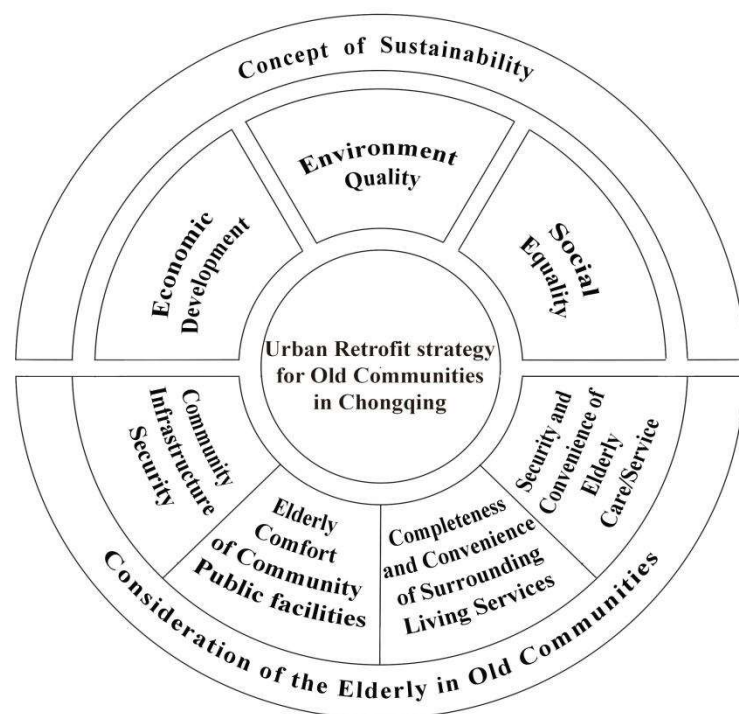


Figure 13. The future framework for sustainable urban retrofit strategy.

11. Conclusion

In the pursuit of age-inclusive urban design, this review has undertaken a comprehensive examination of sustainable retrofit strategies tailored to enhance the well-being of the elderly population. The focal point of this exploration was to critically assess existing practices, synthesize relevant theories, and propose a framework that aligns with the principles of sustainability and age-friendly urban environments. Commencing with a thorough analysis of global urban retrofit practices, this review unveiled both commendable achievements and notable shortcomings. By scrutinizing common objectives and identifying weaknesses in current approaches, a foundation was laid for proposing strategic interventions that prioritize the specific needs of the elderly within urban landscapes. The integration of sustainability principles formed a crucial component of this review, emphasizing the imperative of

age-friendly environments within the broader discourse of sustainable urban development. The synthesis of sustainable urban retrofit approaches underscored the need to intertwine sustainability concepts with the practicalities of retrofitting urban spaces for the elderly. Distinguishing the elderly population's unique physiological and psychological characteristics, the review delved into their specific needs within outdoor environments. This understanding, coupled with an exploration of urban retrofit requirements tailored to the elderly, provided a nuanced perspective crucial for fostering age-inclusive urban spaces. The conceptualization of an age-inclusive urban design strategy, rooted in the principles of urban design, marked the pinnacle of this review. By elucidating key principles, considerations, and elements, a sustainable retrofit strategy emerged as a comprehensive response to the challenges and aspirations associated with the elderly demographic.

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