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Review

Vertical Transportation and Age-Friendly Urban Renewal: A Systematic Framework for Sustainable and Inclusive Communities

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Abstract

Improving living conditions, public services, and social safety nets in the aging residential areas is a core component of community renewal. Age-friendly development calls for integrated improvements in accessibility, safety, comfort, and aesthetics, which are essential for meeting the mobility needs of older adults and people with disabilities. Vertical transportation upgrades, especially elevators and barrier-free design, are critical interventions, yet the lack of a systematic evaluation framework has limited a comprehensive assessment of their effectiveness. This study aims to establish a comprehensive evaluation framework that tightly integrates age-friendly development with vertical transportation improvements, providing detailed guidance to support the renewal of aging residential communities. Methods: We adopted the PRISMA 2020 systematic review methodology, performing a structured search of the Web of Science Core Collection from 2014 to 2024. After applying rigorous inclusion and exclusion criteria, 61 studies were selected for in-depth analysis. Results: The review identifies four core dimensions—accessibility, safety, comfort, and aesthetics—that directly influence vertical transportation renovation outcomes. Key factors include step-free access such as ramps and slope compliance; elevator availability and reliability; lighting and anti-slip safety; waiting and riding comfort; and clear wayfinding through signage legibility. Innovation: Based on these findings, we propose an operational framework that not only defines these dimensions but also links them to measurable evaluation indicators and provides a step-by-step usage protocol. This framework enables policymakers and practitioners to design evidence-based renewal strategies, ensure equitable mobility for vulnerable groups, and promote sustainable, inclusive communities. The findings of this study can serve as a reference for future policy formulation, design practices, and empirical research on sustainable and age-friendly community renewal.

Keywords: vertical transportation renovation; community renewal; age-friendly development; vulnerable populations; mobility and accessibility

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1. Introduction

In the context of contemporary community revitalization, the renovation of vertical transportation systems—encompassing elevators, accessible stairways, ramps, and emerging smart mobility technologies—has become a critical mechanism for enhancing mobility,

autonomy, and quality of life within buildings and across the wider urban environment [1]. These technologies also include connected and autonomous vehicles (CAVs), which have shown potential to enhance accessibility and traffic safety through cooperative driving and vehicle-to-vehicle communication, particularly at intersections and roundabouts [2]. As the global population ages at an unprecedented pace, the stakes and urgency of such interventions are continually rising. By 2050, it is projected that one in six people worldwide will be over the age of 65, with even higher proportions in developed economies and rapidly urbanizing regions [3]. Against this demographic backdrop, questions surrounding how cities, neighborhoods, and built environments can support healthy, inclusive, and sustainable aging have become central to both academic and policy discourses.

Vertical mobility infrastructure represents a key intersection of health, well-being, and social participation. The World Health Organization (WHO) has highlighted accessible, safe, and user-friendly mobility as a cornerstone of age-friendly cities. For older adults, individuals with disabilities, and those with temporary or chronic mobility limitations, the ability to move freely within their homes and communities is not merely a matter of convenience but also of autonomy, social engagement, and dignity [4,5]. Empirical research from Europe, East Asia, and North America consistently shows that well-designed mobility infrastructure reduces the risk of social isolation, improves health outcomes, and delays the onset of frailty or institutionalization [6,7].

Despite this recognition, much of the practical and scholarly focus in urban renewal has been on horizontal dimensions of the built environment, a term widely used in urban design and planning literature to describe street-level spatial features such as façade renovation, road widening, and the enhancement of green spaces. These horizontal elements are closely tied to walkability and accessibility studies, and they form the foundation of traditional evaluations of neighborhood quality and livability [8,9]. However, vertical mobility systems—which include elevators, ramps, and stair design—are often overlooked, even though they frequently constitute the most significant barrier for vulnerable groups. The problem is particularly acute in aging residential neighborhoods, many of which are concentrated in the historical cores of cities. These neighborhoods, though valued for their traditional architectural forms, vibrant street life, and cultural amenities, often lack modern safety and accessibility infrastructure. Narrow streets, the absence or obsolescence of elevators, and limited barrier-free pathways can confine older adults to upper-floor apartments, creating the "suspended elderly" phenomenon, where daily movement outside the home becomes difficult or impossible [10,11].

The challenge of vertical mobility is multi-layered. On one level, it reflects material and technological constraints: outdated equipment, insufficient investment, and difficulties in retrofitting existing structures [12,13]. On another, it exposes deeper issues of social equity, public policy, and urban governance. Vulnerable populations—such as older adults, people with disabilities, and low-income residents—are often concentrated in precisely those neighborhoods least able to access resources for improvement. Cross-national comparisons reveal that while some high-income countries have implemented strong legal frameworks and incentives for universal design, many developing and transitional economies face persistent gaps in funding, regulation, and public awareness [14,15].

Existing research has begun to map out key motivational factors and design principles for effective vertical transportation: ease of use, perceived safety, comfort, aesthetics, and cultural appropriateness [16–21]. However, there are persistent theoretical and practical gaps. First, most studies treat vertical transportation as a discrete technical upgrade, rather than as part of an integrated "building-community" system with complex social, behavioral, and policy dimensions. Second, many urban renewal models are "one-size-fits-all," overlooking the spatial characteristics and everyday practices of aging neighborhoods and

the specific needs of marginalized groups [22]. Third, there is a lack of robust, comparative evaluation frameworks for measuring the impact of vertical transportation interventions on travel willingness, social participation, and community well-being [23].

Furthermore, the policy landscape is rapidly evolving. In recent years, governments and international agencies have introduced a variety of initiatives aimed at promoting age-friendly urban renewal, barrier-free design, and participatory planning. For example, China's "Elevator Installation in Existing Residential Buildings" program has made substantial progress in improving accessibility, while European cities such as Barcelona and Vienna have pioneered inclusive public housing models with integrated vertical mobility solutions [24,25]. However, implementation remains uneven, with significant variation in outcomes due to factors such as governance capacity, stakeholder engagement, financial mechanisms, and cultural attitudes toward aging and disability.

Addressing these challenges calls for a more nuanced, interdisciplinary approach. A growing body of literature highlights the need to situate vertical transportation renovation within broader frameworks of urban social policy, health equity, environmental sustainability, and technological innovation [26,27]. Some scholars argue for a shift from "hardware-centric" upgrades to more holistic strategies that combine physical infrastructure with software elements—such as community engagement, intergenerational programming, and data-driven policy evaluation [28]. Others emphasize the importance of aligning mobility interventions with the lived experiences, aspirations, and agency of older residents themselves.

By integrating empirical evidence, policy analysis, and theoretical frameworks, the research examines the mechanisms through which vertical transportation affects travel behavior and evaluates the effectiveness of various renovation strategies in improving travel convenience. This study combines literature-based synthesis and bibliometric evaluation to explore current academic work on vertical transportation upgrades, urban renewal strategies, and the needs of at-risk populations. The bibliometric evaluation not only identifies research hotspots and thematic clusters but also directly informs the formulation of the three core research questions, thereby ensuring coherence between the evidence base and the analytical framework of this study. The analysis is grounded in data retrieved from sources such as the Web of Science and is structured to respond to the following core research questions:

(1) What factors identified in existing studies influence revitalization strategies for aging residential areas through the lens of vertical transportation renovation?
(2) How do vertical transportation renovations affect the travel behavior of vulnerable groups?
(3) In what ways can the framework for vertical transportation renovation be refined to more effectively respond to the specific revitalization needs of aging urban communities?

The three research questions are closely interrelated and together form the logical backbone of this study. Specifically, RQ1 seeks to identify the contextual and design-related factors highlighted in existing studies that influence vertical transportation renovation strategies in aging residential areas. This question establishes the empirical foundation of this study by consolidating evidence across technical, social, cultural, and policy domains. RQ2 explores how vertical transportation renovations impact the travel behavior of vulnerable groups through behavioral mechanisms, going beyond mere contextual determinants. Contextual determinants refer to external factors affecting individual behavior, such as facility design and accessibility features. In contrast, behavioral mechanisms focus on how individuals respond within these contexts, for example, by increasing usage frequency of new facilities or adjusting travel patterns to improve mobility. This question connects infrastructure interventions with the lived experiences of vulnerable groups through an analysis of both actual and perceived mobility outcomes. RQ3 builds directly upon the

insights from RQ1 and RQ2 to refine and extend the conceptual framework, translating the evidence into measurable indicators, operational protocols, and policy-relevant tools tailored to the specific revitalization needs of aging urban communities.

The remainder of this paper is organized as follows: Section 2 presents the research scope and methods based on the PRISMA systematic review approach. Section 3 analyzes the functional and social roles of vertical transportation renovation in community revitalization. Section 4 develops a multidimensional evaluation framework and its applications. Section 5 discusses theoretical contributions, implementation challenges, and future outlooks. Finally, Section 6 concludes with key findings and policy implications.

2. Scope and Methods

Based on the research background outlined above, this study adopts the PRISMA methodology to systematically screen and analyze literature related to vertical transportation renovation, ultimately constructing a multidimensional evaluation framework. The PRISMA framework (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) is a well-established guideline that supports structured identification and selection of relevant studies based on pre-defined criteria, thereby enhancing the rigor of systematic reviews [29]. Given the broad scope of the research, which spans fields such as urban planning, transportation, and aging studies, the PRISMA methodology helps ensure that the literature selection process is comprehensive, transparent, and consistent. Following PRISMA guidelines, this study identifies, screens, reviews, and includes literature pertaining to vertical transportation renovation to ensure methodological rigor and transparency.

2.1. Identification

The identification process involves searching academic records in scientific databases [30]. Table 1 lists the search criteria for vertical transportation renovation literature [31]. This study selects Web of Science as the database for literature retrieval, with the search logic as follows: TS = (community* OR neighborhood* OR residential*) AND TS = ("vertical transportation*" OR stairs* OR elevator* OR accessibility*) AND TS = (renovation* OR modernization* OR improvement*). Here, the Boolean operator "AND" ensures that all specified terms are present in the results, while "OR" broadens the search to include any of the listed terms. Additionally, the wildcard symbol "*" increases keyword-matching flexibility by allowing for partial term variations. Searches were conducted across the title, abstract, and keyword fields of each publication, focusing on works published between 2014 and 2024 to ensure relevance to recent developments in vertical transportation renovation. Only English-language publications were included, encompassing peer-reviewed sources such as journal articles, proceedings from academic conferences, and scholarly book chapters. The literature search was conducted on 7 March 2025, and based on the applied search parameters, 1933 documents were retrieved from the Web of Science database. Figure 1 illustrates the distribution of these records.

Table 1. Literature Search Criteria.

Searching Conditions
• Database: Web of Science
• Keywords: (community* OR neighborhood* OR residential*) AND ("vertical transportation*" OR stairs* OR elevator* OR accessibility*) AND (renovation* OR modernization* OR improvement*)
• Time: 2014–2024
• Document Type: Journal article, conference paper, book
• Language: English
• Searching date: 7 March 2025

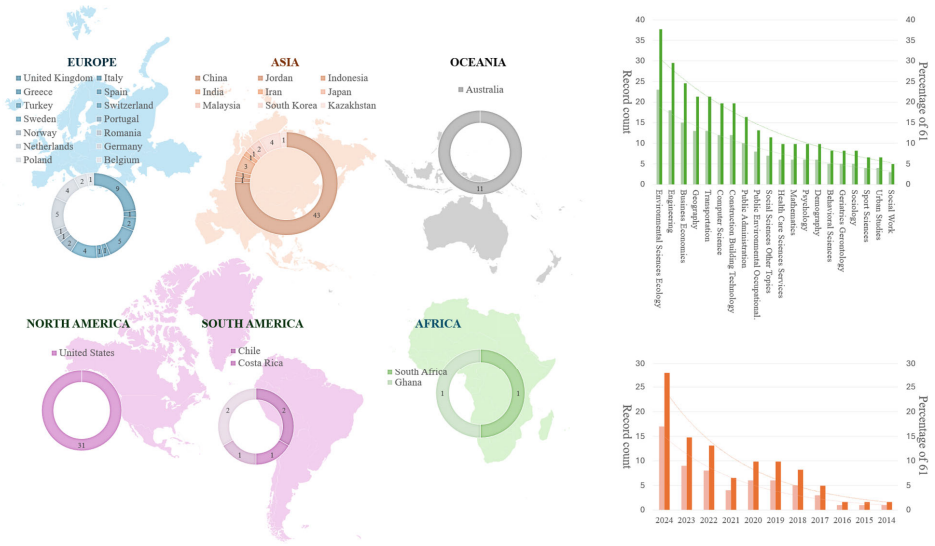


Figure 1. Regional distribution of retrieved publications according to the volume of research data.

2.2. Screening and Inclusion

Following the PRISMA 2020 guidelines, this study initially retrieved 1933 records from the Web of Science Core Collection (2014–2024). After removing duplicates, 1927 unique records remained. Titles and abstracts were screened using predefined criteria, and 106 studies were selected for further evaluation.

Inclusion criteria: (1) peer-reviewed journal articles or conference papers; (2) studies focusing on vertical transportation (elevators, ramps, escalators, barrier-free systems) in residential or community renewal contexts; (3) research examining impacts on older adults, people with disabilities, or other mobility-challenged populations; (4) papers providing empirical data, evaluation metrics, or clear conceptual frameworks relevant to accessibility and mobility equity.

Exclusion criteria: (1) non-academic reports, editorials, or commentaries; (2) studies unrelated to the review scope, such as purely mechanical engineering without urban or social application; (3) duplicates or papers lacking sufficient methodological detail. After the full-text review, 49 articles satisfy all eligibility requirements. Additionally, 12 relevant studies are identified through manual searches and citation tracking, bringing the total to 61 studies included in the qualitative synthesis (Figure 2). All detailed information of these 61 included studies—including authors, article titles, and publication journals—is compiled in Table A1 (Appendix A), which enables readers to trace the original literature and verify the consistency of the selection process. This transparent selection process ensures that the review reflects the best available interdisciplinary evidence, capturing both global trends and regional emphases, notably in Asia and North America, and lays the foundation for the multidimensional evaluation framework developed in later sections.

2.3. Descriptive Analysis of Included Studies

A total of 61 studies were included in this review, and their characteristics are summarized in Figure 1, which illustrates the geographic distribution of author affiliations, disciplinary coverage, and publication trends. The results indicate that most research originates from Asia, North America, and Europe, with China, the United States, and several European countries making prominent contributions and indicating that vertical transportation renovation and mobility equity are key research priorities in regions facing rapid urbanization and aging populations. The presentation of findings by country location aims to underscore the geographical diversity of research contexts and to illustrate how

vertical transportation renovation is approached across different regions. This is particularly pertinent to the research question, as regions undergoing rapid urbanization and demographic aging, such as China, the United States, and parts of Europe, represent key areas where mobility equity and vertical transportation renovation are critical priorities. While the pre-established selection criteria led to the inclusion of a significant proportion of studies from China, this distribution likely reflects the country's active focus on the renovation of aging residential communities, which is a central component of its ongoing urban renewal initiatives. The disciplinary distribution reflects a highly interdisciplinary field, spanning architecture, transportation engineering, urban planning, public health, and social sciences, emphasizing the need for integrated approaches to design age-friendly mobility systems. The annual publication trend demonstrates a steady increase over the past decade, with a notable surge after 2019, highlighting the growing scholarly and policy attention devoted to mobility equity in aging communities. To assess the methodological rigor of the 61 studies included in this review, a comprehensive quality assessment was conducted, evaluating factors such as study design, sample size adequacy, and potential bias. The results are presented in Table A2 (Appendix A). In Table A2, N/A is used to indicate cases where certain information, such as sample size or methodology, was either not provided or not applicable. This typically applies to studies such as literature reviews, conceptual papers, or modeling studies, where no direct data collection or sample size is involved. This descriptive overview establishes the global relevance and evidence base for the evaluation framework presented in Section 4.

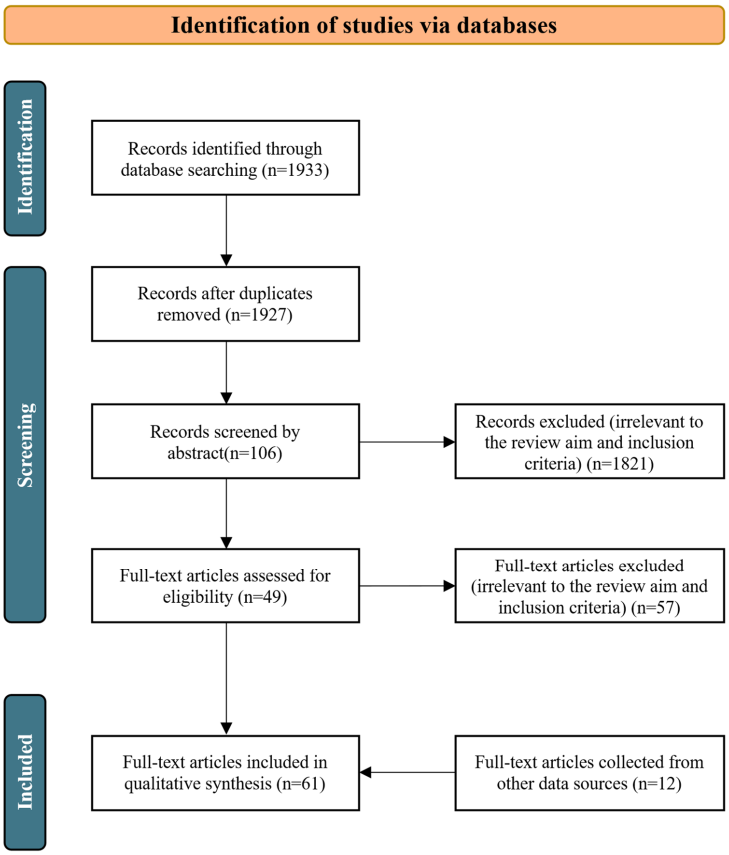


Figure 2. Flowchart illustrates the literature selection strategy using the PRISMA methodology.

3. Functional Analysis and Social Effects of Vertical Transportation Renovation in Community Revitalization

This section discusses the functional roles and social implications of vertical transportation renovation in community revitalization. It first analyzes the technical and design interventions that improve mobility and accessibility in aging residential areas, then examines the specific needs of vulnerable groups, such as older adults and individuals with disabilities, and explores how these upgrades contribute to achieving broader age-friendly community goals. Drawing on literature review and representative case studies, this section establishes a conceptual foundation for understanding vertical transportation renovation as a key component of equitable and sustainable urban development.

3.1. Functional Analysis of Vertical Transportation Renovation in Community Revitalization

Evidence from the included literature indicates that vertical transportation renovation plays a central role in improving accessibility, mobility, and residential safety in aging communities, particularly in neighborhoods built before accessibility standards were widely implemented. Studies consistently demonstrate that interventions such as elevator installation, stairway retrofitting, and system modernization not only enhance physical mobility but also contribute to the functionality and usability of older buildings. For example, Adams and Sherar reported that improved walking routes and stair facilities significantly increased residents' walking duration and participation in moderate-intensity physical activity [32]. Field research in Shanghai also highlighted a strong association between elderly residents' daily travel frequency and the number of vertical transitions within buildings [33]. Studies conducted in topographically complex urban settings, such as Santander, Spain, further confirm the importance of vertical walking facilities for mobility support in challenging environments [34].

Table 2 summarizes representative studies emphasizing the multifaceted impacts of vertical transportation renovation on community revitalization. Evidence from Chinese cities, including Hangzhou and Beijing, demonstrates that elevator installation projects enhance residents' well-being, improve housing functionality, and positively influence property values, although the effects may vary across building floors [35,36]. Research also emphasizes the policy relevance of these interventions, as they are aligned with sustainable urban transformation goals and infrastructure modernization strategies in rapidly aging societies [37]. Beyond physical improvements, empirical studies highlight the significance of vertical mobility infrastructure in promoting housing affordability and spatial equity [38], and qualitative analyses emphasize the need for accessibility designs that respect local lifestyles while also ensuring equitable participation [28].

The literature also underscores that systematic planning of vertical transportation improvements contributes to community-level social, economic, and health benefits. By reducing reliance on private vehicles, enhancing safety standards, and integrating digital management systems, such interventions support both ecological sustainability and community resilience [39]. Studies from the United States illustrate how accessibility and spatial equity are deeply intertwined with broader issues of urban planning and public health: regional transportation analyses in California reveal persistent inequalities in infrastructure investments [40], while a case study in New York City links spatial inequality to health disparities, emphasizing the necessity of equitable urban service allocation [41]. These findings collectively illustrate that vertical mobility systems serve as critical enablers of active aging, sustainable development, and inclusive community revitalization. Building on these functional perspectives, the next section turns to the travel needs of vulnerable groups, highlighting how vertical transportation improvements directly shape mobility outcomes for older adults and individuals with disabilities.

Table 2. Abstracts of Articles Most Relevant to Community Revitalization Projects Benefiting from Vertical Transportation Renovation.

Author	Key Findings	Region
[35]	Adding elevators to aging multi-story residential buildings in Hangzhou, China, significantly improves residents' mobility and enhances the functionality of homes, thereby increasing residents' well-being. This measure has become an indispensable part of urban revitalization projects.	China (Hangzhou)
[37]	This study focuses on the multi-faceted dynamics of elevator installations in China; this aligns with goals in sustainable city planning and technology-led urban transformation. With the ongoing demographic shift toward an older population, tackling mobility and infrastructure gaps in aging neighborhoods has become a growing priority.	China
[33]	Field observations in Shanghai, China, revealed that the frequency with which the elderly leave their homes is closely related to the frequency of stair use between residential units and exterior routes (i.e., vertical transitions), which were closely monitored. This finding is valuable for the formulation of elevator-related regulations in housing standards and renovations.	China (Shanghai)
[36]	Research shows that in Beijing, China, elevator installation has a significant effect on property prices across the community. The property price appreciation effect became evident early due to positive market expectations. However, the impact varies by floor, with higher-floor properties experiencing larger increases, while lower-floor properties might experience depreciation due to the addition of elevators.	China (Beijing)
[34]	This study proposes an evaluation method based on different accessibility indicators to assess the demand for vertical walking routes and facilities. The results indicate that vertical walking facilities have significant value in meeting user needs, especially in Santander, Spain, where they have been highly recognized.	Spain (Santander)
[42]	Based on empirical research, this study explores ways to increase residents' willingness to install elevators and proposes effective safety measures, providing valuable decision-making guidance for the successful rolling out elevator infrastructure upgrades in older residential districts.	China
[38]	This study reveals the spatial variations of walking accessibility's impact on housing affordability and equity, highlighting issues such as job-housing imbalance, increased commuting time and costs, and overall decline in metropolitan quality of life. It can be used to design policies and strategies that meet affordable housing and equity demands.	China (Shanghai)
[28]	This study, through semi-structured interviews, examines the disadvantages of accessibility from a sufficient perspective, focusing on what people value and when "enough" of a commodity is owned. It emphasizes the importance of moderate improvements and autonomy, arguing that accessibility improvements should support local convenient lifestyles, not just pursue equality, to achieve politically equal communities.	California (Modesto)
[40]	This study analyzes regional transportation plans from three MPOs in California, revealing that urban gentrification leads low-income and minority communities to suburban areas, facing transportation accessibility and environmental health issues. The study highlights the MPO's prioritization of urban core traffic improvements while neglecting the suburbs, calling for attention to transportation investment equity in suburban communities to address historical economic exclusion in urban core areas.	United States (San Francisco Bay Area, San Diego, Fresno)
[41]	The study introduces a novel approach centered on walking accessibility to analyze spatial inequality, validated through a case study in New York City. The study indicates that spatial inequality may have negative effects on public health, and thus policies for rearranging local public services should consider spatial inequality to promote more effective public engagement.	United States (New York)

3.2. Vertical Transportation Renovation and the Travel Needs of Vulnerable Groups

The reviewed studies consistently highlight that barrier-free environments are essential for ensuring autonomy, mobility, and quality of life among vulnerable populations, particularly older adults and individuals with disabilities. Despite notable progress in urban renewal and accessibility policies in recent years—including significant infrastruc-

ture investments in China and other rapidly developing economies—many older adults continue to face persistent challenges in accessing inclusive and unobstructed mobility solutions [43]. Research indicates that in cities with complex historical and spatial constraints, such as Venice, Italy, or historic districts in India, traditional accessibility measures like ramps or elevators are often difficult to implement, resulting in accessibility standards that often fall short of actual user needs [15,44]. Similar patterns are observed in other global contexts, where the absence of adequate vertical mobility infrastructure restricts the ability of older and disabled populations to participate in daily activities and access essential services.

Numerous studies document that elevators, ramps, and handrails—although central to barrier-free design—are often lacking in aging residential environments. Elderly residents are frequently dependent on stairs for vertical mobility, which increases the physical effort required for daily activities and raises the risk of falls, isolation, and a diminished quality of life [45–47]. Research further shows that this lack of accessible infrastructure disproportionately impacts vulnerable groups, with mobility challenges compounded by factors such as age, disability status, income level, and housing tenure. For example, a field study in Shanghai demonstrated that elderly residents living in multi-story buildings without elevators were more likely to confine themselves to lower floors, effectively restricting their daily mobility [33]. Comparative studies conducted in Asia, Europe, and North America emphasize that steep ramps and poorly designed staircases exacerbate travel burdens for wheelchair users and elderly individuals, underscoring the need for user-centered accessibility standards [47].

Quantitative evaluation studies highlight priority areas for accessibility improvements. In Jinan, China, systematic assessments identified corridors, ramps, doorways, handrails, and elevators as high-impact upgrades that enhance mobility equity [43]. Additional research underscores that individuals aged 65 and older require more accessible infrastructure compared with younger populations., reinforcing the importance of inclusive design [24]. Table 3 provides a detailed summary of representative studies addressing the barriers faced by vulnerable populations and their infrastructure needs.

These findings emphasize that addressing mobility inequities requires comprehensive planning and a multi-stakeholder approach. Several studies advocate for participatory design frameworks that formally incorporate the perspectives of elderly residents, wheelchair users, and other vulnerable groups into all stages of planning and implementation [27]. Policy-oriented studies also propose integrating financial support mechanisms, such as subsidies for elevator installations and participatory budgeting for community improvements, to ensure equitable access [48,49]. Collectively, this evidence highlights that vertical transportation renovation is not only a matter of technical upgrades but also a critical strategy for reducing health disparities, improving social inclusion, and fostering environments that enable individuals of all ages and abilities to thrive. These findings on the challenges and requirements of vulnerable groups provide the foundation for discussing how vertical transportation renovation contributes to achieving broader age-friendly community goals.

Table 3. Articles Most Relevant to the Need for Vertical Transportation Improvements for Vulnerable Groups.

Author	Key Findings	Region
[45]	Although stairs do not completely hinder the mobility of the elderly, long stairs are often seen as the primary barrier to their travel. Elderly individuals often feel frustrated and depressed when faced with extended or steep stairways.	China (Chongqing)
[46]	As people age, simple actions (such as standing up from a chair or climbing stairs) become difficult, affecting their willingness to travel.	Malaysia
[33]	Most elderly residents living in homes with indoor stairs only use the first floor, relying more on downstairs bedrooms. Stairs significantly limit their freedom of movement.	China (Shanghai)

Table 3. *Cont.*

Author	Key Findings	Region
[50,51]	Stairs and ramps have long been considered the primary concerns for the elderly.	Singapore (Yuhua East District); North America, Europe, Oceania, South America, and Asia.
[47]	For the elderly, stairs without elevators often become a barrier to movement.	Review
[45]	Stairs and ramps are major concerns for the elderly, especially when ramps are too steep, increasing travel burdens and even raising the risk of falls.	China (Chongqing)
[24]	Elderly residents over 65 require more accessible facilities, such as elevators and handrails, compared to younger residents.	Poland
[25]	Wheelchair users require sufficient sidewalk space but face challenges crossing steep or extended ramps due to high energy expenditure.	Spain (Barcelona)
[43]	Drawing on quantitative evaluation results, the study identified key priorities for accessibility improvements in Jinan, China. Recommended upgrades included structural elements such as ramps, corridors, doorways, handrails, and elevators.	China (Jinan)

3.3. Achieving Age-Friendly Community Goals Through Vertical Transportation Renovation

The reviewed literature demonstrates that vertical transportation renovation is a key factor in advancing age-friendly community development. Studies consistently show that aging residential areas with high concentrations of older adults or low-income residents often experience delayed infrastructure upgrades, resulting in worn-out facilities, reduced accessibility, and barriers to healthy aging [52]. Economic constraints frequently prevent vulnerable groups from relocating to better-equipped neighborhoods, leaving them in areas with rising housing costs and deteriorating services, which exacerbate social and spatial inequalities. Consequently, these findings underscore the urgent need for targeted accessibility improvements to address the compounding disadvantages faced by older populations.

Research further confirms that well-planned vertical transportation upgrades significantly improve autonomy, confidence, and quality of life among older residents. Empirical studies in Beijing and other cities demonstrate that adding elevators to older multi-story buildings enhances daily activity levels, promotes neighborhood livability, and contributes to property value appreciation [36,53]. Other findings emphasize that accessibility measures, including stair renovations and digital mobility management systems, are closely linked to social inclusion and equitable urban development, highlighting the importance of coupling design solutions with policy measures, including subsidies and regulatory incentives [20,54]. Table 4 provides representative evidence showing that accessible public infrastructure—including sidewalks, transit connections, and activity zones—is strongly associated with older adults' willingness to travel, satisfaction, and participation in community life [55–58].

Table 4. Articles Most Relevant to Achieving Age-Friendly Goals Benefiting from Vertical Transportation Renovation.

Author	Key Findings	Region
[36]	Installing elevators in old buildings significantly improves the mobility opportunities of the elderly, enhancing both their living environment and overall well-being.	China (Beijing)
[52]	Surveys indicate that elderly residents' willingness to travel is significantly influenced by the availability of accessible facilities, highlighting the necessity of optimizing these facilities during the renovation of aging communities.	China (Nanchang)
[56]	The study finds that transportation systems aligned with elderly needs contribute to improved physical functioning, while housing conditions remain a critical determinant of overall life satisfaction.	China
[53]	Older adults often stay close to their residential surroundings, and having nearby accessible infrastructure enables them to maintain social interactions and daily routines.	Germany
[20]	Improving site elevation protection and accessible facilities significantly increased resident satisfaction.	China (Wuhan)

Table 4. *Cont.*

Author	Key Findings	Region
[55]	Regression model results indicate that elderly people's quality of life is influenced by housing conditions, outdoor spaces, communication and information access, and public transportation.	China
[57]	Age-friendly features emerge from the interaction between individual characteristics and environmental context, and the design features of the built environment are crucial for sustainability and active mobility.	China (Beijing)
[58]	Findings highlight that poorly designed public spaces, limited activity zones, and suboptimal street planning contribute to reduced quality of life among older residents.	China (Dalian)

The literature also highlights the risks of poor urban design, as studies from Dalian, China, indicate that suboptimal public spaces, limited activity areas, and poorly planned streets diminish the quality of life for older residents [59]. These results emphasize that both comprehensive neighborhood renewal and targeted vertical transportation interventions are essential to creating environments that are inclusive, resilient, and supportive of active aging. By integrating vertical mobility improvements with broader urban planning, cities can reduce health disparities, promote social equity, and ensure that sustainable development initiatives produce tangible benefits for residents of all ages and abilities.

4. Vertical Transportation Renovation and Community Revitalization: Enhancing Residents' Quality of Life

This section explores the integration of vertical transportation renovation into community revitalization strategies, emphasizing its role in improving the mobility, safety, and quality of life of residents. It introduces a multidimensional and multilayered evaluation framework that connects accessibility, safety, comfort, and aesthetics, translating these principles into measurable indicators for practical planning and assessment. In this review, "multilayered" refers to the integration of physical infrastructure upgrades, social participation and equity measures, and strategic governance approaches [60]. This perspective reflects the complex interplay between hardware improvements, community engagement, and policy design that underpins successful mobility interventions. Building on global literature and representative case studies, this section examines how vertical transportation improvements can serve as a catalyst for inclusive and resilient neighborhood renewal and highlight their interaction with community empowerment, technological innovation, and participatory planning. Together, these discussions provide a foundation for aligning infrastructure upgrades with broader social and spatial objectives in urban development.

4.1. Addressing Mobility Barriers Through a Multidimensional Framework

In community revitalization, vertical transportation renovation modernizes building and urban mobility systems through methods such as adding elevators, optimizing stair design, and improving accessible pathways, aimed at mitigating the negative effects of outdated facilities on residents' mobility, particularly addressing the challenges faced by older adults and individuals with disabilities [54]. These renovations can directly address the mobility barriers caused by aging buildings and facilities. However, an extensive review of the literature reveals a persistent lack of a comprehensive evaluation framework for vertical transportation renovations, particularly one that assesses whether these interventions effectively alleviate issues such as mobility challenges, social isolation, and unsuitable living environments. According to the literature, optimization strategies for public spaces in aging communities include accessibility, safety, comfort, and aesthetics [20,21]. Key factors include accessible ramps [59], anti-slip designs [52], smart scheduling, and green decoration [61], among others (Figure 3). The analytical table provides an evaluative summary of vertical transportation upgrades as part of community renewal strategies, drawing on the literature reviewed (Figure 4).

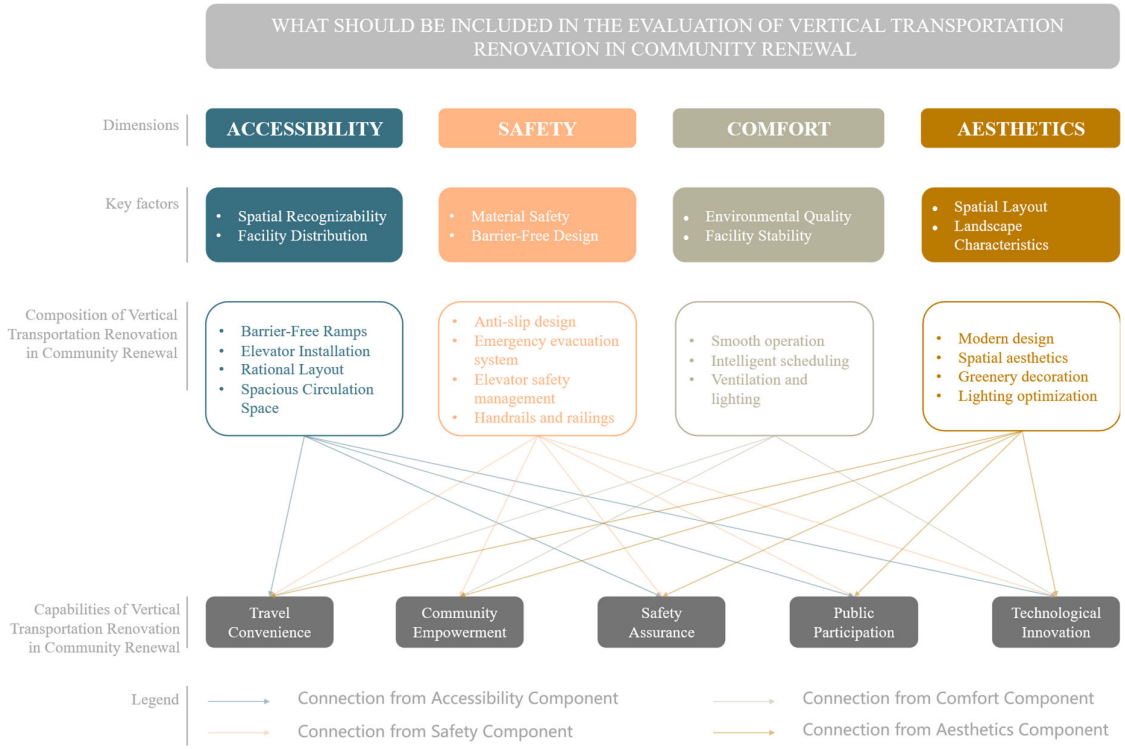


Figure 3. Conceptual Framework Outlining the Dimensions, Factors, and Functional Components of Vertical Transportation Renovation within Community Renewal Efforts.

Key factors within this framework can be translated into measurable indicators. For example, accessibility can be assessed through the presence of barrier-free ramps, the availability of elevators, and the ease of movement. Safety is measured by criteria such as accident rates, anti-slip material coverage, and elevator safety management. Comfort is evaluated based on resident satisfaction with environmental factors such as lighting, air quality, and noise levels, whereas aesthetics is assessed through visual appeal and community feedback. As shown in Table 5, these indicators are essential to determine whether renovations meet the desired objectives, addressing mobility barriers and improving the quality of life for all residents. The five capabilities—travel convenience, community empowerment, safety assurance, public participation, and technology implementation—are interconnected and essential for creating an inclusive, functional, and sustainable urban environment. Travel convenience, such as elevators and ramps, directly addresses physical mobility barriers and aligns with Universal Design, which promotes accessibility for all. Community empowerment ensures that renovations reflect residents' needs, fostering social inclusion and equity, supported by participatory governance theories emphasizing community involvement in decision-making. Safety assurance, through features like anti-slip designs and reliable elevators, reduces accidents and enhances trust in infrastructure, drawing from environmental safety and public health theories. Public participation ensures that renovations align with principles of social justice and urban equity, leading to more successful and sustainable outcomes. Lastly, technology implementation, such as smart scheduling and energy-efficient systems, ensures that renovations are adaptable to future needs and aligned with innovation diffusion and smart city concepts. Together, these capabilities form a comprehensive framework for vertical transportation renovations that improve mobility, promote equity, and support sustainable community revitalization.

Table 5. Design Standards and Performance Indicators.

Dimension	Indicator	Thresholds	Data Sources	Practical Example
Accessibility	Barrier-Free Ramps	Max slope $\leq$ 1:12; width $\geq$ 1.2 m	ISO 21542:2021	Investigated accessibility for elderly people, emphasizing the need for barrier-free ramps with a max slope of 1:12, which reduces mobility challenges in public spaces. [62]
	Elevator Installation	$\geq$1 elevator per 3–4 floors; average waiting time $\leq$ 30 s	ISO 8100-32:2020	This was validated by simulation in the paper, demonstrating that elevator control systems can meet this criterion. [63]
	Rational Layout	Distance to public amenities $\leq$ 200 m	ISO 21542:2021	Demonstrated that optimizing the spatial proximity of public amenities within affordable housing developments enhances resident satisfaction, with public spaces located $\leq$ 200 m from residences. [64]
	Spacious Circulation Space	Corridor width $\geq$ 1.5 m; per capita space $\geq$ 1.5 m^2	EN 17210:2021	After widening corridors to $\geq$1.5 m and increasing per capita space to $\geq$1.5 m^2, 95% satisfaction with circulation and 85% satisfaction with spatial flexibility were achieved. [65]
Safety	Anti-slip Design	Friction coefficient $\geq$ 0.6 (dry), $\geq$0.8 (wet)	ISO 21542:2021	Cited friction coefficients $\geq$ 0.6 (dry) and $\geq$0.8 (wet) as essential safety thresholds for pedestrian pathways to ensure comfort and safety for wheelchair users. The paper emphasizes the need for standardized thresholds to reduce discomfort and accidents, highlighting deficiencies in current infrastructure. [66]
	Emergency Evacuation System	Evacuation path $\geq$ 1.2 m; evacuation time $\leq$ 3 min	NFPA 101:2021	Demonstrates that a dual-core vertical access system reduces evacuation times by 20%, meeting NFPA 101 standards for high-rise buildings. The dual-core system also mitigates bottlenecks and improves evacuation flow, with a 36–41-min evacuation time for full buildings, outperforming centralized systems by up to 52 min. [67]
	Elevator Safety Management	Door sensors, speed governor, emergency stop; max load $\leq$ 1000 kg	ISO 8100-1:2019	Describes how elevator safety features like door sensors, speed governors, and emergency stops became central to displacement politics in Las Gladiolas housing. Their malfunction and intentional neglect were part of a strategy to force residents' relocation. The breakdowns led to safety issues, accidents, and social isolation, contributing to the de facto demolition of the community. [68]
	Handrails and Railings	Height 0.85–0.95 m; diameter 30–50 mm	ISO 21542:2021	Explicitly illustrates that the stair handrail height is standardized at 0.85–0.95 m in community residential buildings. [69] Emphasize that grab bars and railings must comply with universal design principles, typically requiring diameters of 30–50 mm for easy grip. [70]
Comfort	Smooth Operation	Noise $\leq$ 50 dB; acceleration $\leq$ 1.0 m/s^2	ISO 8100-32:2020	It references ISO 8100-32:2020 to ensure elevator operation with noise $\leq$ 50 dB and acceleration $\leq$ 1.0 m/s^2 to enhance passenger comfort. [63]
	Intelligent Scheduling	Average response time < 30 s	CIBSE Guide D (2020)	Found residents' support for elevator projects depended on reduced waiting times, highlighting smart scheduling [37]
	Ventilation and Lighting	Light $\geq$ 300 lx; CO_2 $\leq$ 600 ppm	ISO 8995-1:2021	Demonstrated that optimizing lighting and ventilation improved comfort in residential buildings [71]
Aesthetics	Modern Design	Aesthetic rating $\geq$ 4; use of eco-friendly materials	ISO 14006:2020	Found that incorporating eco-friendly materials in modern design positively impacted residents' perceptions of their living environment, boosting satisfaction with public housing design. [20]
	Spatial Aesthetics	Green coverage $\geq$ 30%	LEED v4.1 (2021)	Their analysis found that higher levels of park naturalness, indicated in part by higher green coverage, positively influenced park visit frequency, which in turn significantly increased expressions of happiness on social media. [72]
	Greenery Decoration	Green coverage $\geq$ 10%; plant health $\geq$ 80%	GB/T 50378-2019	Emphasized the importance of maintaining plant health in residential green spaces to improve aesthetic value and resident satisfaction. [42]
	Lighting Optimization	Light $\geq$ 300 lx; energy $\leq$ 30 W/m^2	EN 12464-1:2021	Implemented lighting optimization techniques in high-rise buildings, resulting in better lighting coverage while reducing energy consumption by 20%. [63]

DIMENSION	COMPOSITION	CAPABILITIES OF VERTICAL TRANSPORTATION RENOVATION IN COMMUNITY RENEWAL					
		Travel Convenience	Community Empowerment	Safety Assurance	Public Participation	Technological Innovation	Research Literature
ACCESSIBILITY	Barrier-Free Ramps	■		■		■	(Mayordomo-Martínez & García-Mateos, 2024)
	Elevator Installation	■		■	■		(Lu et al., 2022)
	Rational Layout	■		■		■	(Zhao et al., 2021)
	Spacious Circulation Space	■		■	■	■	(Zhao et al., 2024)
SAFETY	Anti-slip Design	■	■	■	■		(Fan et al., 2024)
	Emergency Evacuation System	■	■	■			(Soltanzadeh et al., 2021)
	Elevator Safety Management	■	■			■	(Ciflikli & Oner Tartan, 2019)
	Handrails and Railings	■	■	■	■		(Zang, 2020)
COMFORT	Smooth Operation	■	■			■	(González-González et al., 2022)
	Intelligent Scheduling	■				■	(Li et al., 2025)
	Ventilation and Lighting	■	■			■	(Ma et al., 2022)
AESTHETICS	Modern Design	■	■			■	(Murzabayeva et al., 2022)
	Spatial Aesthetics	■			■		(Lai & Deal, 2023)
	Greenery Decoration	■			■		(Chen & Huang, 2021)
	Lighting Optimization	■		■			(Mou et al., 2024)

■ Accessibility ■ Safety
■ Comfort ■ Aesthetics

Figure 4. Analytical Evaluation Table of Vertical Transportation Renovation in Community Revitalization Strategies [19,21,34,36,37,45,48,52,59,61,64,67,69,72,73].

4.2. The Role and Capacity of Vertical Transportation Renovation in the Revitalization of Aging Residential Areas

4.2.1. Travel Convenience

Improving mobility convenience for residents is a core objective of vertical transportation renovations in aging communities [74]. Implementing features such as elevators, improved stair designs, and comprehensive ramp systems can significantly enhance mobility, especially for older adults and individuals with physical disabilities. Research shows that these measures improve basic access and alleviate mobility-related challenges, facilitating safer and more efficient daily travel [75]. According to Li et al., installing elevators is crucial for enhancing mobility in multi-level housing environments. Elevators reduce dependence on stair use among older adults and mobility-impaired individuals, offering them greater autonomy in vertical travel. Staircase enhancements also constitute a key component of improving mobility [37]. Mou et al. observed that poor stair design and the absence of handrails in older neighborhoods discourage elderly residents' mobility. Well-designed staircases and adequate handrails contribute to improved safety and can lower the risk of falls [45]. As noted by Mayordomo-Martínez and García-Mateos, incorporating ramps alongside stair enhancements facilitates movement for wheelchair and stroller users, thereby promoting inclusive access to public transport systems [59]. Overall, improving vertical transportation systems—such as elevators, stairs, and accessible facilities—effectively addresses common mobility challenges in aging residential areas. Thus, improvements in travel convenience directly contribute to the accessibility and mobility dimensions of the evaluation framework, reinforcing its practical applicability.

4.2.2. Community Empowerment

Shen et al. highlighted the essential contribution of communities to fostering social progress and facilitating urban regeneration [76]. Empowering communities with

greater decision-making power and a sense of involvement can effectively promote social inclusivity and fairness [77]. M. Finley-Brook and E.L. Holloman pointed out that community empowerment enables communities to be more actively involved in shaping and applying policies, thereby maximizing benefits for all, particularly for disadvantaged populations [78]. They further explained that only when communities have the necessary capacity and resources to influence decisions can relevant policies truly be effective and fair [79]. Therefore, community empowerment not only enhances residents' voices in community planning and policymaking but also strengthens their self-governance and decision-making capacity, promoting social inclusivity and fairness [80]. By enhancing community participation and empowerment, the implementation of vertical transportation renovation can better meet residents' needs, ensuring that such strategies meaningfully improve living conditions for socially marginalized groups [81]. Additionally, community empowerment can enhance residents' sense of identity and support for community revitalization projects, thereby laying a strong social foundation that facilitates the effective rollout of renewal strategies [82]. Community empowerment highlights the social participation and equity dimension of the evaluation framework, linking physical upgrades with governance and inclusive goals.

4.2.3. Safety Assurance

Aging residential neighborhoods face significant safety challenges, with vertical transportation systems emerging as a critical area of concern. The absence or deterioration of elevators, along with poorly designed stairways, has been identified as a key constraint on housing quality [83]. In response, interventions such as retrofitting elevators and improving stair safety through anti-slip enhancements have significantly reduced accident rates among older adults, while also fostering greater trust in vertical mobility infrastructure [20]. Zhao et al. further demonstrate that safety improvements in vertical transportation are strongly correlated with enhanced health outcomes and increased social engagement among residents [21]. Other studies emphasize that optimizing the accessibility of vertical transit nodes contributes to the continuity of residents' spatial mobility networks, thereby improving the overall safety of community environments [64]. For policymakers, aligning vertical transportation standards with residential design is essential for creating an inclusive and barrier-free mobility system that meets the evolving needs of an aging society [84]. These safety enhancements demonstrate how the framework can incorporate measurable safety indicators to evaluate renovation outcomes.

4.2.4. Public Participation Level

Enhancing resident participation has become a defining outcome of renewal initiatives in aging residential areas, demonstrating progress in governance transparency, community empowerment, and inclusive policymaking. Studies indicate that residents' willingness to engage in projects such as elevator installation is shaped by cost-sharing fairness, perceived benefits, and trust in government support, while extensive involvement improves acceptance and accelerates implementation [37,42]. Research on Beijing's older neighborhoods further shows that renewal strategies that incorporate diverse demographic needs through community engagement promote spatial equity and strengthen residents' sense of belonging [57]. Strzelecka et al. highlight that empowerment is central to environmental justice, and participation processes that enable recognition and representation can resolve policy conflicts and build long-term legitimacy [85]. Moreover, a transparent governance framework improves residents' confidence in public institutions and facilitates sustainable policy enforcement [32]. Together, these findings position public participation not merely as a procedural step but as a measurable achievement of urban renewal. It reflects the maturity

of community-driven development and the capacity of residents to shape outcomes aligned with their collective needs. Public participation levels serve as a key criterion within the evaluation framework, ensuring that renewal strategies are aligned with residents' needs and social legitimacy.

4.2.5. Technology Implementation and Integration

Technological advancement in the renovation of aging residential areas reflects a mature stage of practice where innovation is fully embedded in design and operational strategies. Research on staircase retrofitting demonstrates that compact and foldable transport systems, when carefully designed, address spatial constraints and minimize disruption during construction, leading to improved accessibility for residents [69]. In vertical mobility planning, traffic modeling and visualization tools provide actionable insights for scheduling optimization, allowing more efficient use of energy and space while enhancing service quality [73]. Moreover, studies on renovation priorities highlight that integrating smart systems and adaptive technologies into residential upgrades not only improves user satisfaction but also strengthens the sustainability of infrastructure investments [74,86]. This growing focus on translating innovation into tailored community solutions marks a shift from experimental projects to scalable implementations that reshape aging urban environments with measurable improvements in efficiency, safety, and inclusiveness. The integration of technology reflects the innovation and sustainability dimension of the evaluation framework, ensuring that renovation strategies are adaptable and forward-looking.

By integrating the key factors, dimensions, and functions of vertical transportation improvements in community renewal, Figure 4 presents a conceptual framework that organizes the core elements and logical relationships across renewal strategies. The framework is structured around accessibility, safety, comfort, and aesthetics to systematically highlight features such as barrier-free design, elevator layout, intelligent scheduling, and spatial aesthetics, providing a comprehensive lens for examining vertical transportation challenges in aging residential areas. It enables researchers to understand the connections among these elements at a broader level and supports the refinement and optimization of renewal strategies.

5. Discussion

This section discusses theoretical contributions, practical implications, and future directions of vertical transportation renovation in the context of age-friendly urban renewal. Building on the findings from earlier sections, it examines how the proposed multidimensional framework bridges the gap between research and practice, identifies key implementation challenges, and highlights areas for refinement. The discussion is organized into four parts: the role and contribution of the proposed framework in age-friendly urban renewal (Section 5.1), the challenges and contradictions encountered in its implementation (Section 5.2), the limitations of the study (Section 5.3), and future outlooks for research and practice (Section 5.4). Together, these discussions position vertical transportation renovation as a critical driver for inclusive, resilient, and sustainable community development.

5.1. The Role and Contribution of the Proposed Framework in Age-Friendly Urban Renewal

5.1.1. Conceptual Contribution of the Framework

The multidimensional framework proposed in this study contributes to age-friendly urban renewal research by integrating theoretical concepts and practical strategies into a unified structure. Prior studies on aging communities have often emphasized individual aspects such as accessibility upgrades, safety interventions, or smart technology applica-

tions, but have rarely examined these elements as an interconnected system. This study advances the field by consolidating four core dimensions—accessibility, safety, comfort, and aesthetics—into a comprehensive analytical framework, addressing the lack of holistic and user-centered evaluation models in planning for aging residential areas.

The framework reframes vertical transportation systems, including elevator installations, barrier-free entrances, and stair redesigns, as enablers of mobility equity and social participation rather than simply technical enhancements. This broader perspective extends the focus of previous works by emphasizing the role of infrastructure design in improving residents' autonomy and inclusion, particularly for older adults and vulnerable groups. By linking vertical transportation to spatial design and aesthetics, the framework enriches existing theories on integrated planning for aging communities.

Additionally, the framework emphasizes the role of resident engagement as a core element in shaping renewal outcomes. While earlier studies have recognized participation as a valuable process, this study operationalizes it as a central principle for decision-making, implementation, and long-term governance. Integrating community input with data-driven monitoring and evaluation tools offers a more adaptive and responsive model for renewal efforts.

Overall, this framework provides theoretical contributions by synthesizing fragmented research themes and positioning vertical mobility as a social justice issue, while also offering practical guidance through a structured, multi-criteria approach. It complements prior models, supports recent scholarship advocating inclusive and evidence-based design, and challenges narrowly technical perspectives by presenting a holistic vision of equitable and resilient neighborhood renewal. Nevertheless, while the framework provides conceptual clarity and guidance, its translation into practice reveals technical, financial, and governance challenges that must be addressed.

5.1.2. Implementation Protocol for Practitioners

For the proposed framework to be effectively applied in practice, it must be translated into a clear and systematic protocol. This section outlines five main phases of implementation, emphasizing both methodological rigor and operational feasibility.

(1) Definition of objectives and scope.

Practitioners should clarify the primary aims of renewal, such as enhancing accessibility, improving safety, or creating more inclusive environments, while also identifying the spatial and social boundaries of the project.

(2) Indicator selection and validation.

Indicators based on accessibility, safety, comfort, and aesthetics should be adapted to local contexts and validated through consultation with stakeholders, ensuring that evaluation reflects both technical standards and social expectations.

(3) Data collection and processing.

A combination of quantitative data (e.g., demographics, building conditions, costs) and qualitative sources (e.g., resident surveys, workshops) should be used. Harmonization and cleaning of data are essential to ensure reliability.

(4) Evaluation and synthesis.

Multi-criteria assessment methods such as AHP or expert-based weighting can be applied to balance different objectives. The results should be synthesized into outputs in the form of tables, charts, or spatial visualizations, which can facilitate dialogue among stakeholders and provide clear guidance for policy decisions.

(5) Monitoring and adaptation.

Continuous evaluation mechanisms and feedback loops are needed to adjust strategies in response to demographic shifts, regulatory changes, or emerging technologies, ensuring that the framework remains responsive over time.

5.2. Challenges and Contradictions

While the proposed framework provides a clear conceptual roadmap for advancing age-friendly communities, its application in practice reveals multiple pressures and operational limitations. Retrofitting older buildings often faces technical and regulatory constraints, especially in areas with heritage preservation policies that limit structural modifications [87,88]. Coordinating modernization with architectural integrity requires policy support, improved construction methods, and greater public awareness of trade-offs [89]. As Table 6 shows, developed economies focus on balancing sustainability with heritage preservation rely on mature regulatory and funding systems, whereas developing countries are more constrained by rapid urbanization, limited financial capacity, and uneven enforcement. Community involvement also differs: while NGOs and formal consultation play a stronger role in developed contexts, grassroots committees and neighborhood organizations are more active in developing settings.

Table 6. Policy Approaches in Developed and Developing Contexts.

Aspect	Developed Contexts	Developing Contexts	References
Policy drivers	Aging population, universal accessibility, sustainability goals	Rapid urbanization, housing renewal, social equity, demographic pressure	[1,5,35]
Funding mechanisms	Government subsidies, public–private partnerships, insurance-based or incentive schemes	Central/local government subsidies, neighborhood cost-sharing, community co-funding	[1,35]
Regulatory framework	Comprehensive building codes, mandatory accessibility standards, strong enforcement	Partial or emerging codes, uneven enforcement, often advisory in nature	[35,90]
Implementation challenges	High retrofitting costs, need to balance heritage preservation with modernization	Space constraints, fragmented governance, limited financial capacity, competing priorities	[35,36]
Community involvement	Public consultation processes, active role of NGOs and advocacy groups	Grassroots mobilization, residents' committees, local neighborhood organizations	[4,35]

Although vertical transportation upgrades are crucial for improving mobility, they pose significant challenges in aging residential settings due to complex technical adaptations and high costs [37]. These interventions demand substantial financial commitments and expertise, which are often scarce in disadvantaged neighborhoods. As a result, infrastructure improvements are frequently delayed, further postponing equitable development goals. Establishing robust regulatory systems also depends on sustained investment and administrative capacity, both frequently lacking in under-resourced communities. Weak governance structures and inconsistent enforcement of existing regulations undermine project sustainability and public trust.

In addition to these technical and administrative barriers, modernization initiatives can unintentionally trigger social inequities. Upgraded infrastructure and aesthetic improvements may raise housing prices and accelerate gentrification. These pressures can displace low-income residents from revitalized areas. Such dynamics risk deepening socio-spatial inequalities, contradicting the inclusive objectives of renewal policies. Studies highlight that without measures like rent stabilization, affordable housing provision, and targeted subsidies, infrastructure modernization may inadvertently marginalize vulnerable

populations. Limited channels for community participation further silence these groups, perpetuating inequitable resource allocation and reinforcing cycles of exclusion.

Addressing these issues requires a multidimensional strategy that combines grassroots empowerment, participatory governance, financial equity, and long-term monitoring. Transparent decision-making, equitable investment, and inclusive planning are essential to ensuring that modernization does not occur at the expense of social justice. Achieving mobility equity remains a global challenge but is fundamental to building resilient, inclusive, and age-friendly urban environments.

5.3. Limitations

Although this review adopts a comprehensive perspective on the relationship between vertical transportation renovation and age-friendly urban renewal, several limitations should be acknowledged. First, the reviewed literature predominantly covers research from the past ten years. While this ensures currency and relevance, it may inadvertently exclude earlier studies that offer long-term perspectives and historical context. Second, the empirical data reviewed are mainly from nations and territories such as China, the United States, and various parts of Europe. This geographical focus may limit the extent to which the conclusions can be generalized globally, particularly in regions undergoing distinct patterns and phases of urban growth.

Additionally, while both quantitative analyses and qualitative interviews are included, the integration of these two data types may be uneven in some cases, particularly in studies conducted in areas with complex socio-demographic dynamics. Finally, given that the topic spans multiple disciplines—such as urban design, architecture, sociology, and transportation engineering—it is challenging to achieve full coverage across all fields, which may result in certain thematic areas being underexplored.

5.4. Outlook

First, upcoming studies should broaden their regional coverage to incorporate varied urban contexts in fast-developing areas across Asia, Africa, and Latin America. Second, continuous studies are essential to observe the sustained effects of community renewal projects, providing deeper insights into how vertical transportation renovations dynamically affect the lives of community residents. Third, testing through demonstration projects and experimental policy models should be promoted in diverse city settings, with rigorous evaluations conducted to gather empirical data that can guide community renewal approaches that are both fair and practically impactful. Fourth, subsequent studies and implementation efforts should center on inclusive decision-making to ensure that redevelopment initiatives reflect the needs of the full population, especially disadvantaged groups.

Through mitigating current constraints and pursuing prospective avenues, academic and policy stakeholders can more effectively manage the interlinked dynamics between community revitalization, vertical transportation renovation, and urban equity—ultimately advancing the realization of cities that are inclusive, adaptable, and socially just.

6. Conclusions

Against the backdrop of the global shift toward sustainable urban growth, designing and executing revitalization strategies is increasingly important, particularly in aging neighborhoods, where improvements in vertical transportation are strongly associated with enhancing residents' well-being. Therefore, exploring the impact of elevator and stairway infrastructure upgrades on revitalization strategies and vulnerable populations is essential.

This inquiry is crucial for refining the vertical transportation renovation framework to better support the achievement of age-friendly development goals.

(1) Which factors identified in existing research influence the revitalization strategies of aging residential areas from the perspective of vertical transportation renovation?

Vertical transportation serves as a cornerstone of community revitalization, particularly in aging residential neighborhoods. These areas often grapple with inequitable access to transit infrastructure, outdated facilities, and mobility challenges. Expanding the use of elevators and accessible ramps can substantially reduce barriers to movement and promote a more inclusive society. The reviewed literature consistently highlights four main dimensions that determine the effectiveness of vertical transportation renovation: accessibility, safety, comfort, and aesthetics. Accessibility interventions, including step-free access, reliable elevators, and barrier-free pathways, have the strongest association with residents' mobility and satisfaction. Safety and comfort improvements, such as appropriate lighting and non-slip designs, further support long-term usability and perceived well-being.

(2) How do vertical transportation renovations affect the travel behavior of vulnerable groups?

Vertical transportation renovations can significantly improve travel comfort for vulnerable groups living in aging residential areas. Older adults and people with disabilities often face substantial barriers when navigating their communities, primarily due to inadequate infrastructure such as the absence of elevators or poorly designed stairways. These limitations restrict their daily mobility, hinder access to essential services, and reduce opportunities for social participation. Findings from the reviewed studies show that elevator retrofitting and the creation of barrier-free circulation systems increase independence, safety, and participation among mobility-limited residents. Such interventions also help mitigate social isolation and encourage more frequent outdoor activities. Most of the reviewed studies rely on qualitative approaches, which provide valuable contextual insights but would benefit from complementary quantitative assessments in future research.

(3) How can the vertical transportation renovation framework be improved to better address the community renewal challenges of aging residential areas?

To achieve the goals of age-friendly development, the vertical transportation renovation framework must incorporate core principles including enhanced mobility, improved safety, and greater social inclusion. Improving accessibility may require cross-sector collaboration to ensure equitable access to safe, affordable transportation options. It is also crucial to align policies across key areas—housing, transportation, and environmental sustainability—to support comprehensive and long-term urban development. The synthesis of current studies suggests that policy integration, community participation, and ongoing evaluation are critical for the success of vertical transportation projects. Incorporating user satisfaction surveys and accessibility assessments can help refine policy measures and ensure that infrastructure upgrades result in measurable improvements in quality of life.

Vertical transportation renovations, as part of community revitalization efforts, not only enhance transportation infrastructure in aging residential areas but also promote social fairness and ecological responsibility. This review provides an integrated understanding of how vertical mobility contributes to sustainable and age-friendly urban renewal while identifying key knowledge gaps that future interdisciplinary research should address. By continuously improving the vertical transportation framework, urban planners and policymakers can enhance the well-being of residents, strengthen social cohesion, and build more resilient and inclusive cities.

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Appendix A

Table A1. Literature extraction table.

Authors	Title	Journal
Sundling, R.; Blomsterberg, Å.; Landin, A.	Enabling energy-efficient renovation: the case of vertical extension to buildings [1]	Construction Innovation 2019, 19, 2–14
Baobeid, A.; Koç, M.; Al-Ghamdi, S.G.	Walkability and Its Relationships with Health, Sustainability, and Livability [4]	Frontiers in Built Environment 2021, 7
Fernandez, J.R.; Cortes, P.	A Survey of Elevator Group Control Systems for Vertical Transportation [5]	IEEE Control Systems 2015, 35, 38–55
Iamtrakul, P.; Chayphong, S.; Hayashi, Y.	An Integrative Investigation of Travel Satisfaction, Streetscape Perception, and Mental Health in Urban Environments [6]	Sustainability 2024, 16, 3526
Zhong, J.; Liu, W.; Niu, B.; Lin, X.; Deng, Y.	Role of Built Environments on Physical Activity and Health Promotion [7]	Frontiers in Public Health 2022, 10
Yu, J.; Ma, G.; Cai, S.	Disparities in the provision of aging-friendly communities in old and new urban neighborhoods in China [8]	Engineering, Construction and Architectural Management 2019, 26, 1277–1293
Zhang, B.; Guo, W.; Xing, Z.; Zhou, R.	Current Situation and Sustainable Renewal Strategies of Public Space in Chinese Old Communities [9]	Sustainability 2022, 14
Lee, E.H.; Jeong, J.	Assessing equity of vertical transport system installation in subway stations for mobility handicapped using data envelopment analysis [10]	Journal of Public Transportation 2023, 25
Remillard, E.T.; Campbell, M.L.; Koon, L.M.; Rogers, W.A.	Transportation challenges for persons aging with mobility disability [11]	Disability and Health Journal 2022, 15, 101,209
Capacci, L.; Biondini, F.; Frangopol, D.M.	Resilience of aging structures and infrastructure systems with emphasis on seismic resilience of bridges and road networks: Review [12]	Resilient Cities and Structures 2022, 1, 23–41
Tsigdinos, S.; Tzouras, P.G.; Bakogiannis, E.; Kepaptsoglou, K.; Nikitas, A.	The future urban road: A systematic literature review-enhanced Q-method study with experts [13]	Transportation Research Part D 2022, 102, 103,158
Lid, I.M.; Solvang, P.K.	(Dis)ability and the experience of accessibility in the urban environment [14]	Alter 2016, 10, 181–194
Asiedu-Ampem, G.; Danso, A.K.; Ayarkwa, J.; Obeng-Atuah, D.; Tudzi, E.P.; Afful, A.E.	Barriers to accessibility of urban roads by persons with disabilities: A review of the literature [15]	Journal of Transport & Health 2024, 39
Marsong, S.; Kongjeen, Y.; Plangklang, B.	Vertical Transportation System Power Usage: Behavioural Case Study of Regulated Buildings in Bangkok [16]	Sustainability 2022, 14, 13267
Vodopija, A.; Stork, J.; Bartz-Beielstein, T.; Filipič, B.	Elevator group control as a constrained multiobjective optimization problem [17]	Applied Soft Computing 2022, 115, 108,277

Table A1. *Cont.*

Authors	Title	Journal
Anand, R.; Mahesh, M.	Vertical transportation: An overview on system integration with advance technology [18]	Proc. 2017 Int. Conf. on Smart Technologies for Smart Nation (SmartTechCon) 2017, pp. 476–479
Murzabayeva, K.; Lapshina, E.; Tuyakayeva, A.	Modernization of the Living Environment Space Using the Example of an Urban Array of Residential Buildings from the Soviet Period in Almaty [19]	Buildings 2022, 12, 1042
Zeng, Y.; Chen, B.	Evaluation of Aging-Friendly Public Spaces in Old Urban Communities Based on IPA Method—A Case Study of Shouyi Community in Wuhan [20]	Buildings 2024, 14
Zhao, J.; Aziz, F.A.; Cheng, Z.; Ujang, N.; Zhang, H.; Xu, J.; Xiao, Y.; Shi, L.	Post-Occupancy Evaluation of the Improved Old Residential Neighborhood Satisfaction Using Principal Component Analysis: The Case of Wuxi, China [21]	ISPRS Int. Journal of Geo-Information 2024, 13
Gil Solá, A.; Vilhelmson, B.; Larsson, A.	Understanding sustainable accessibility in urban planning: Themes of consensus, themes of tension [22]	Journal of Transport Geography 2018, 70, 1–10
Guo, B.; Zhang, L.; Li, Y.	Research on the path of residents' willingness to upgrade by installing elevators in old residential quarters based on safety precautions [42]	Safety Science 2019, 118
Heldak, M.; Kulczyk-Dynowska, A.; Przybyla, K.; Stacherzak, A.; Szczepanski, J.; Michalik, M.; Pluciennik, M.; Kempa, O.	Standards and the demand for adapting apartments for better accessibility for older adults in Poland [24]	Journal of Housing and the Built Environment 2024, 39, 937–956
Rhoads, D.; Sole-Ribalta, A.; Borge-Holthoefer, J.	The inclusive 15-min city: Walkability analysis with sidewalk networks [25]	Computers, Environment and Urban Systems 2023, 100
Paulsson, A.; Isaksson, K.; Sørensen, C.H.; Hrelja, R.; Rye, T.; Scholten, C.	Collaboration in public transport planning—Why, how and what? [27]	Research in Transportation Economics 2018, 69, 377–385
Cooper, E.; Vanoutrive, T.	Is accessibility inequality morally relevant?: An exploration using local residents' assessments in Modesto, California [28]	Journal of Transport Geography 2022, 99
Li, X.; Yang, Z.; Qian, X.; Guo, Y.; Yang, C.	Investigating the Impacts of Property Walking Accessibility on Housing Affordability and Equity: Evidence from Shanghai, China [38]	Journal of Urban Planning and Development 2023, 149
Lu, H.; Zhao, P.; Hu, H.; Zeng, L.; Wu, K.S.; Lv, D.	Transport infrastructure and urban-rural income disparity: A municipal-level analysis in China [48]	Journal of Transport Geography 2022, 99
Ma, S.; Li, T.; Yang, Y.	Housing Price Appreciation Effects of Elevator Installation in Old Residential Areas: Empirical Evidence Based on a Multiperiod DID Model [36]	Advances in Civil Engineering 2022, 2022
Mayordomo-Martinez, D.; Garcia-Mateos, G.	Evaluating Accessibility Solutions in Collective Residential Buildings: Field Research in Southeast Spain [59]	Buildings 2024, 14
Nowossadeck, S.; Gordo, L.R.; Alcantara, A.L.	Mobility restriction and barrier-reduced housing among people aged 65 or older in Germany: Do those who need it live in barrier-reduced residences? [53]	Frontiers in Public Health 2023, 11
Wen, Y.; Li, Y.; Yang, Y.; Wang, J.	Towards an Evaluation System of Disabled Individuals' Friendly Communities from the Perspective of Inclusive Development—A Case Study in Jinan [43]	Buildings 2023, 13
Yu, Y.; Chen, Z.; Bu, J.; Zhang, Q.	Do Stairs Inhibit Seniors Who Live on Upper Floors From Going Out? [33]	HERD—Health Environments Research & Design Journal 2020, 13, 128–143
Zhang, N.; Yang, Q.	Public transport inclusion and active aging: A systematic review on elderly mobility [54]	Journal of Traffic and Transportation Engineering (English Edition) 2024, 11, 312–347
Dai, X.; Li, Z.; Ma, L.; Jin, J.	The Spatio-Temporal Pattern and Spatial Effect of Installation of Lifts in Old Residential Buildings: Evidence from Hangzhou in China [35]	Land 2022, 11
Li, Y.; Zheng, W.; Zhou, Q.	Knowledge-Driven Urban Innovation: Dynamics of Elevator Installation in Aging Residential Communities [37]	Journal of the Knowledge Economy 2024
Sarkar, C.; Webster, C.	Urban environments and human health: current trends and future directions [39]	Current Opinion in Environmental Sustainability 2017, 25, 33–44
Heyer, J.; Palm, M.; Niemeier, D.	Are we keeping up? Accessibility, equity and air quality in regional planning [40]	Journal of Transport Geography 2020, 89
Du, M.; Zhang, X.; Mora, L.	Strategic Planning for Smart City Development: Assessing Spatial Inequalities in the Basic Service Provision of Metropolitan Cities [41]	Journal of Urban Technology 2021, 28, 115–134
Tatano, V.; Revellini, R.	An alternative system to improve accessibility for wheelchair users: The stepped ramp [44]	Applied Ergonomics 2023, 108, 103,938
Mou, Y.; Qin, Y.; Niu, S.	"I Go Outdoors for Activities Every Day": Go-Along With Seniors With Slow Walking Speeds to Explore Environmental Factors Influencing Mobility [45]	International Journal of Public Health 2024, 69

Table A1. *Cont.*

Authors	Title	Journal
Sohaimi, N.S.; Sohaimi, M.S.; Sohaimi, M.S.N.; Hamid, J.A.	Exploring elderly-friendly affordable home for ageing in place [46]	AIP Publishing 2023
Edwards, N.; Dulai, J.	Examining the relationships between walkability and physical activity among older persons: what about stairs? [47]	BMC Public Health 2018, 18
Guzman, L.A.; Oviedo, D.	Accessibility, affordability and equity: Assessing 'pro-poor' public transport subsidies in Bogotá [49]	Transport Policy 2018, 68, 37–51
Moran, M.; Van Cauwenberg, J.; Hercky-Linnewiel, R.; Cerin, E.; Deforche, B.; Plaut, P.	Understanding the relationships between the physical environment and physical activity in older adults: a systematic review of qualitative studies [50]	Int. J. Behavioral Nutrition and Physical Activity 2014, 11, 79
Fan, L.; Xiong, Y.; Peng, Y.	Assessing Accessible Travel Satisfaction in Old Communities: A SEM Study [52]	Buildings 2024, 14, 1273
González-González, E.; Cordera, R.; Alonso, B.; Nogués, S.	Planning for sustainable urban mobility: Demand estimation of on-street vertical walking facilities [34]	Int. J. Sustainable Transportation 2022, 16, 326–339
Pan, Z.; Liu, Y.; Liu, Y.; Huo, Z.; Han, W.	Age-friendly neighbourhood environment, functional abilities and life satisfaction: A longitudinal analysis of older adults in urban China [56]	Social Science & Medicine 2024, 340, 116403
Liu, Y.; Li, H.; Li, W.; Wang, S.	Renovation priorities for old residential districts based on resident satisfaction: An application of asymmetric impact-performance analysis in Xi'an, China [74]	PLOS ONE 2021, 16, e0254372
Ciflikli, C.; Oner Tartan, E.	A model for the visualization and analysis of elevator traffic [73]	Transportation Planning and Technology 2019, 42, 868–880
Teng, M.; Suo, J.; Zhong, H.; Kou, N.; Song, B.; Li, G.	The Impact of Multi-Quality Renewal Elements of Residence on the Subjective Well-Being of the Older Adults—A Case Study of Dalian [83]	Psychology Research and Behavior Management 2023, 16, 761–780
Yu, W.; Piao, Z.; Zhang, L.; Wang, H.; Zhou, B.	An empirical study on the impact of residential built environment on the quality of life of older people: A case study of existing residential areas in Dalian [58]	Journal of Human Settlements in West China 2024, 39, 15–20
Mayordomo-Martinez, D.; Garcia-Mateos, G.	Evaluating Accessibility Solutions in Collective Residential Buildings: Field Research in Southeast Spain [59]	Buildings 2024 Vol. 14 Issue 6
Yang, Q.; Xu, F.; Lu, W.-Z.; Yang, Z.; Bai, Y.; Wen, B.	Green renovation and multi-objective optimization of Tibetan courtyard dwellings [60]	Building and Environment 2025, 279, 113,071
Chen, Z.; Huang, G.	Greenspace to Meet People's Demand: A Case Study of Beijing in 2005 and 2015 [61]	Remote Sensing 2021, 13, 4310
Strzelecka, M.; Rechciński, M.; Tusznio, J.; Akhshik, A.; Grodzińska-Jurczak, M.	Environmental justice in Natura 2000 conservation conflicts: The case for resident empowerment [85]	Land Use Policy 2021, 107, 105494
Butler, L.; Yigitcanlar, T.; Paz, A.	How Can Smart Mobility Innovations Alleviate Transportation Disadvantage? Assembling a Conceptual Framework through a Systematic Review [75]	Applied Sciences 2020, 10, 6306
Shen, L.; Tang, L.; Mu, Y.	Critical success factors and collaborative governance mechanism for the transformation of existing residential buildings in urban renewal: From a social network perspective [76]	Heliyon 2024, 10, e27672
Bayala, E.R.C.; Ros-Tonen, M.; Yanou, M.P.; Djoudi, H.; Reed, J.; Sunderland, T.	Towards more inclusive community landscape governance: Drivers and assessment indicators in northern Ghana [77]	Forest Policy and Economics 2024, 159, 103138
Peris Cancio, L.F.	Social Work: Transforming Struggles into Strength Through Relational Empowerment [78]	International Encyclopedia of Business Management Volume 4, 2026, Pages 266–277
Castro-Arce, K.; Vanclay, F.	Transformative social innovation for sustainable rural development: An analytical framework to assist community-based initiatives [79]	Journal of Rural Studies 2020, 74, 45–54
Siikonen, M.-L.	Current and future trends in vertical transportation [63]	European Journal of Operational Research 2024, 319, 361–372

Table A2. Quality assessment of included studies.

Title	Study Design	Sample Size	Methodology	Quality Rating	Comments
Enabling energy-efficient renovation: the case of vertical extension to buildings [1]	Case Study	3 buildings	Qualitative analysis	High	Well-conducted case study, clear methodology, no bias
Walkability and Its Relationships with Health, Sustainability, and Livability [4]	Cross-sectional study	500 residents	Survey	Medium	Limited by cross-sectional design, no causal inference

Table A2. *Cont.*

Title	Study Design	Sample Size	Methodology	Quality Rating	Comments
A Survey of Elevator Group Control Systems for Vertical Transportation [5]	Literature Review	N/A	Systematic review	High	Comprehensive review, well-organized, no bias
An Integrative Investigation of Travel Satisfaction, Streetscape Perception, and Mental Health in Urban Environments [6]	Survey	150 participants	Mixed methods	Medium	Valid survey but lack of longitudinal data
Role of Built Environments on Physical Activity and Health Promotion [7]	Cross-sectional study	200 participants	Survey	High	Large sample size, appropriate data analysis
Disparities in the provision of aging-friendly communities in old and new urban neighborhoods in China [8]	Comparative study	500 residents	Survey	Medium	Some selection bias, but valuable comparison
Current Situation and Sustainable Renewal Strategies of Public Space in Chinese Old Communities [9]	Case Study	4 communities	Qualitative analysis	High	Clear methodology and valid conclusions for urban renewal
Assessing equity of vertical transport system installation in subway stations for mobility handicapped using data envelopment analysis [10]	Quantitative analysis	N/A	Data envelopment analysis	High	Rigorous quantitative analysis, clear findings
Transportation challenges for persons aging with mobility disability [11]	Survey	100 participants	Qualitative study	Medium	Good qualitative insights, but limited sample size
Resilience of aging structures and infrastructure systems with emphasis on seismic resilience of bridges and road networks: Review [12]	Literature Review	N/A	Systematic review	High	Comprehensive, well-structured review with high relevance
The future urban road: A systematic literature review-enhanced Q-method study with experts [13]	Systematic Review	N/A	Literature review	High	Thorough review with expert insights, no bias
(Dis)ability and the experience of accessibility in the urban environment [14]	Case Study	10 participants	Qualitative study	Medium	Small sample size limits generalizability
Barriers to accessibility of urban roads by persons with disabilities: A review of the literature [15]	Literature Review	N/A	Review	High	Comprehensive review with good insights into barriers
Vertical Transportation System Power Usage: Behavioural Case Study of Regulated Buildings in Bangkok [16]	Case Study	3 buildings	Qualitative analysis	Medium	Case study, useful for understanding local conditions
Elevator group control as a constrained multiobjective optimization problem [17]	Quantitative Study	N/A	Mathematical modeling	High	Excellent use of modeling to optimize elevator systems
Vertical transportation: An overview on system integration with advance technology [18]	Conference Proceedings	N/A	Literature review	Medium	Overview, but lacks in-depth analysis
Modernization of the Living Environment Space Using the Example of an Urban Array of Residential Buildings from the Soviet Period in Almaty [19]	Case Study	5 buildings	Qualitative analysis	Medium	Context-specific, good insight into Soviet-era buildings
Evaluation of Aging-Friendly Public Spaces in Old Urban Communities Based on IPA Method—A Case Study of Shouyi Community in Wuhan [20]	Case Study	2 communities	IPA (Importance-Performance Analysis)	High	Well-conducted evaluation with actionable recommendations
Post-Occupancy Evaluation of the Improved Old Residential Neighborhood Satisfaction Using Principal Component Analysis: The Case of Wuxi, China [21]	Cross-sectional study	200 residents	PCA (Principal Component Analysis)	Medium	Useful PCA method, but study is cross-sectional
Understanding sustainable accessibility in urban planning: Themes of consensus, themes of tension [22]	Literature Review	N/A	Literature review	High	Strong theoretical framework on urban accessibility

Table A2. *Cont.*

Title	Study Design	Sample Size	Methodology	Quality Rating	Comments
Research on the path of residents' willingness to upgrade by installing elevators in old residential quarters based on safety precautions [42]	Cross-sectional study	300 residents	Survey	Medium	Interesting, but sample may not fully represent all demographics
Standards and the demand for adapting apartments for better accessibility for older adults in Poland [24]	Cross-sectional study	150 residents	Survey	Medium	Useful findings, but small sample and potential selection bias
The inclusive 15-min city: Walkability analysis with sidewalk networks [25]	Case Study	10 cities	GIS analysis	High	GIS-based analysis adds depth to accessibility assessment
Collaboration in public transport planning—Why, how and what? [27]	Literature Review	N/A	Review	High	Thorough overview of public transport collaboration methods
Is accessibility inequality morally relevant?: An exploration using local residents' assessments in Modesto, California [28]	Survey	200 residents	Survey	Medium	Insightful survey, but may not represent broader populations
Investigating the Impacts of Property Walking Accessibility on Housing Affordability and Equity: Evidence from Shanghai, China [38]	Quantitative study	1000 properties	Statistical analysis	High	Large-scale analysis, robust statistical methods
Transport infrastructure and urban-rural income disparity: A municipal-level analysis in China [48]	Quantitative study	N/A	Statistical analysis	High	Clear analysis of transport's role in reducing income disparity
Housing Price Appreciation Effects of Elevator Installation in Old Residential Areas: Empirical Evidence Based on a Multiperiod DID Model [36]	Quantitative study	500 properties	Difference-in-Differences analysis	High	Strong econometric approach with clear results
Evaluating Accessibility Solutions in Collective Residential Buildings: Field Research in Southeast Spain [59]	Case Study	3 buildings	Field study	Medium	Case study, insights into real-world challenges
Mobility restriction and barrier-reduced housing among people aged 65 or older in Germany: Do those who need it live in barrier-reduced residences? [53]	Cross-sectional study	200 elderly residents	Survey	High	Relevant findings for policy implications in elderly housing
Towards an Evaluation System of Disabled Individuals' Friendly Communities from the Perspective of Inclusive Development—A Case Study in Jinan [43]	Case Study	4 communities	IPA (Importance-Performance Analysis)	High	Well-conducted evaluation with actionable recommendations
Do Stairs Inhibit Seniors Who Live on Upper Floors from Going Out? [33]	Survey	100 elderly residents	Survey	Medium	Stairs prevent elderly residents from going outside
Public transport inclusion and active aging: A systematic review on elderly mobility [54]	Systematic Review	N/A	Review	High	Comprehensive review of how public transport affects elderly mobility
The Spatio-Temporal Pattern and Spatial Effect of Installation of Lifts in Old Residential Buildings: Evidence from Hangzhou in China [35]	Case Study	10 buildings	GIS and statistical analysis	High	Lift installation increases accessibility in old residential buildings
Knowledge-Driven Urban Innovation: Dynamics of Elevator Installation in Aging Residential Communities [37]	Survey	150 residents	Survey	Medium	Impact of elevator installation on urban renewal
Urban environments and human health: current trends and future directions [39]	Literature Review	N/A	Systematic review	High	Urban design and accessibility affect human health
Are we keeping up? Accessibility, equity and air quality in regional planning [40]	Review	N/A	Review	Medium	Accessibility impacts equity and air quality in urban planning

Table A2. *Cont.*

Title	Study Design	Sample Size	Methodology	Quality Rating	Comments
Strategic Planning for Smart City Development: Assessing Spatial Inequalities in the Basic Service Provision of Metropolitan Cities [41]	Quantitative study	5 cities	Statistical analysis	High	Urban development disparities affect service provision
An alternative system to improve accessibility for wheelchair users: The stepped ramp [44]	Case Study	2 buildings	Qualitative analysis	Medium	The stepped ramp increases wheelchair accessibility
"I Go Outdoors for Activities Every Day": Go-Along with Seniors with Slow Walking Speeds to Explore Environmental Factors Influencing Mobility [45]	Field Study	20 seniors	Qualitative study	High	Environmental factors significantly affect elderly mobility
Exploring elderly-friendly affordable home for ageing in place [46]	Report	N/A	Survey	Medium	Need for affordable elderly-friendly housing
Examining the relationships between walkability and physical activity among older persons: what about stairs? [47]	Cross-sectional study	200 elderly participants	Survey	Medium	Stairs impact elderly physical activity levels
Accessibility, affordability and equity: Assessing 'pro-poor' public transport subsidies in Bogotá [49]	Survey	300 low-income residents	Survey	High	Subsidies improve accessibility for low-income groups
Understanding the relationships between the physical environment and physical activity in older adults: a systematic review of qualitative studies [50]	Systematic Review	N/A	Review	High	Review of factors affecting elderly physical activity
Assessing Accessible Travel Satisfaction in Old Communities: A SEM Study [52]	Survey	150 residents	SEM analysis	High	Accessibility improvements increase travel satisfaction
Planning for sustainable urban mobility: Demand estimation of on-street vertical walking facilities [34]	Quantitative study	5 cities	Statistical analysis	High	Need for sustainable vertical transport systems in urban planning
Age-friendly neighbourhood environment, functional abilities and life satisfaction: A longitudinal analysis of older adults in urban China [56]	Longitudinal Study	2961 participants (4 waves)	Latent Growth Curve Modelling	High	Well-conducted longitudinal study, clear methodology
Renovation priorities for old residential districts based on resident satisfaction: An application of asymmetric impact-performance analysis in Xi'an, China [74]	Quantitative study	500 residents	Statistical analysis	High	Residents prioritize vertical transport improvements in old districts
A model for the visualization and analysis of elevator traffic [73]	Simulation Study	N/A	Modeling	High	Elevator traffic optimization model reduces waiting times
The Impact of Multi-Quality Renewal Elements of Residence on the Subjective Well-Being of the Older Adults—A Case Study of Dalian [83]	Case Study	317 participants	Survey	High	Well-conducted case study, but lacks longitudinal data
An empirical study on the impact of residential built environment on the quality of life of older people: A case study of existing residential areas in Dalian [58]	Case Study	200 elderly residents	Survey	Medium	Built environment affects elderly residents' quality of life
Evaluating Accessibility Solutions in Collective Residential Buildings: Field Research in Southeast Spain [59]	Case Study	4 buildings	Field study	Medium	Case study, insights into real-world challenges
Green renovation and multi-objective optimization of Tibetan courtyard dwellings [60]	Case Study	3 buildings	Qualitative analysis	High	Green renovation techniques improve energy efficiency and accessibility
Greenspace to Meet People's Demand: A Case Study of Beijing in 2005 and 2015 [61]	Longitudinal Study	2 time points	GIS analysis	Medium	Green space increased in urban areas, improving accessibility

Table A2. *Cont.*

Title	Study Design	Sample Size	Methodology	Quality Rating	Comments
Environmental justice in Natura 2000 conservation conflicts: The case for resident empowerment [85]	Case Study	N/A	Qualitative analysis	High	Strong theoretical framework but lacks quantitative data and broad sample size
How Can Smart Mobility Innovations Alleviate Transportation Disadvantage? Assembling a Conceptual Framework through a Systematic Review [75]	Literature Review	N/A	Literature review	High	Smart mobility technologies improve accessibility
Critical success factors and collaborative governance mechanism for the transformation of existing residential buildings in urban renewal: From a social network perspective [76]	Case Study	3 cities	Qualitative analysis	Medium	Collaborative governance is crucial for successful urban renewal
Towards more inclusive community landscape governance: Drivers and assessment indicators in northern Ghana [77]	Case Study	5 communities	Qualitative analysis	High	Inclusive landscape governance improves community resilience
Social Work: Transforming Struggles into Strength Through Relational Empowerment [78]	Conceptual Paper	N/A	Theoretical	High	Empowerment frameworks improve community resilience
Transformative social innovation for sustainable rural development: An analytical framework to assist community-based initiatives [79]	Literature Review	N/A	Review	Medium	Social innovation frameworks improve sustainability in rural areas
Current and future trends in vertical transportation [63]	Literature Review	N/A	Simulation and Mathematical Modeling	High	Comprehensive review with high relevance, but lacks in-depth analysis of real-world applications

References

1. Sundling, R.; Blomsterberg, Å.; Landin, A. Enabling energy-efficient renovation: The case of vertical extension to buildings. *Constr. Innov.* **2019**, *19*, 2–14. [CrossRef]
2. Macioszek, E.; Tumminello, M.L. Simulating vehicle-to-vehicle communication at roundabouts. *Transp. Probl.* **2024**, *19*, 45–57. [CrossRef]
3. United Nations Department of Economic and Social Affairs. Population Division. In *World Population Prospects 2022: Summary of Results*; United Nations Department of Economic and Social Affairs: New York, NY, USA, 2022.
4. Baobeid, A.; Koç, M.; Al-Ghamdi, S.G. Walkability and Its Relationships with Health, Sustainability, and Livability: Elements of Physical Environment and Evaluation Frameworks. *Front. Built Environ.* **2021**, *7*, 721218. [CrossRef]
5. Fernandez, J.R.; Cortes, P. A Survey of Elevator Group Control Systems for Vertical Transportation: A Look at Recent Literature. *IEEE Control Syst.* **2015**, *35*, 38–55. [CrossRef]
6. Iamtrakul, P.; Chayphong, S.; Hayashi, Y. An Integrative Investigation of Travel Satisfaction, Streetscape Perception, and Mental Health in Urban Environments. *Sustainability* **2024**, *16*, 3526. [CrossRef]
7. Zhong, J.; Liu, W.; Niu, B.; Lin, X.; Deng, Y. Role of Built Environments on Physical Activity and Health Promotion: A Review and Policy Insights. *Front. Public Health* **2022**, *10*, 950348. [CrossRef]
8. Yu, J.; Ma, G.; Cai, S. Disparities in the provision of aging-friendly communities in old and new urban neighborhoods in China. *Eng. Constr. Archit. Manag.* **2019**, *26*, 1277–1293. [CrossRef]
9. Zhang, B.; Guo, W.; Xing, Z.; Zhou, R. Current Situation and Sustainable Renewal Strategies of Public Space in Chinese Old Communities. *Sustainability* **2022**, *14*, 6723. [CrossRef]
10. Lee, E.H.; Jeong, J. Assessing equity of vertical transport system installation in subway stations for mobility handicapped using data envelopment analysis. *J. Public Transp.* **2023**, *25*, 100074. [CrossRef]
11. Remillard, E.T.; Campbell, M.L.; Koon, L.M.; Rogers, W.A. Transportation challenges for persons aging with mobility disability: Qualitative insights and policy implications. *Disabil. Health J.* **2022**, *15*, 101209. [CrossRef]
12. Capacci, L.; Biondini, F.; Frangopol, D.M. Resilience of aging structures and infrastructure systems with emphasis on seismic resilience of bridges and road networks: Review. *Resilient Cities Struct.* **2022**, *1*, 23–41. [CrossRef]
13. Tsigdinos, S.; Tzouras, P.G.; Bakogiannis, E.; Kepaptsoglou, K.; Nikitas, A. The future urban road: A systematic literature review-enhanced Q-method study with experts. *Transp. Res. Part D Transp. Environ.* **2022**, *102*, 103158. [CrossRef]
14. Lid, I.M.; Solvang, P.K. (Dis)ability and the experience of accessibility in the urban environment. *Alter* **2016**, *10*, 181–194. [CrossRef]

15. Asiedu-Ampem, G.; Danso, A.K.; Ayarkwa, J.; Obeng-Atuah, D.; Tudzi, E.P.; Afful, A.E. Barriers to accessibility of urban roads by persons with disabilities: A review of the literature. *J. Transp. Health* **2024**, *39*, 101935. [CrossRef]
16. Marsong, S.; Kongjeen, Y.; Plangklang, B. Vertical Transportation System Power Usage: Behavioural Case Study of Regulated Buildings in Bangkok. *Sustainability* **2022**, *14*, 13267. [CrossRef]
17. Vodopija, A.; Stork, J.; Bartz-Beielstein, T.; Filipič, B. Elevator group control as a constrained multiobjective optimization problem. *Appl. Soft Comput.* **2022**, *115*, 108277. [CrossRef]
18. Anand, R.; Mahesh, M. Vertical transportation: An overview on system integration with advance technology. In Proceedings of the 2017 International Conference on Smart Technologies for Smart Nation (SmartTechCon), Bengaluru, India, 17–19 August 2017; pp. 476–479.
19. Murzabayeva, K.; Lapshina, E.; Tuyakayeva, A. Modernization of the Living Environment Space Using the Example of an Urban Array of Residential Buildings from the Soviet Period in Almaty. *Buildings* **2022**, *12*, 1042. [CrossRef]
20. Zeng, Y.; Chen, B. Evaluation of Aging-Friendly Public Spaces in Old Urban Communities Based on IPA Method-A Case Study of Shouyi Community in Wuhan. *Buildings* **2024**, *14*, 2362. [CrossRef]
21. Zhao, J.; Aziz, F.A.; Cheng, Z.; Ujang, N.; Zhang, H.; Xu, J.; Xiao, Y.; Shi, L. Post-Occupancy Evaluation of the Improved Old Residential Neighborhood Satisfaction Using Principal Component Analysis: The Case of Wuxi, China. *ISPRS Int. J. Geo-Inf.* **2024**, *13*, 318. [CrossRef]
22. Gil Solá, A.; Vilhelmson, B.; Larsson, A. Understanding sustainable accessibility in urban planning: Themes of consensus, themes of tension. *J. Transp. Geogr.* **2018**, *70*, 1–10. [CrossRef]
23. Chen, S.; Piao, L.; Zang, X.; Luo, Q.; Li, J.; Yang, J.; Rong, J. Analyzing differences of highway lane-changing behavior using vehicle trajectory data. *Phys. A Stat. Mech. Its Appl.* **2023**, *624*, 128980. [CrossRef]
24. Heldak, M.; Kulczyk-Dynowska, A.; Przybyla, K.; Stacherzak, A.; Szczepanski, J.; Michalik, M.; Pluciennik, M.; Kempa, O. Standards and the demand for adapting apartments for better accessibility for older adults in Poland. *J. Hous. Built Environ.* **2024**, *39*, 937–956. [CrossRef]
25. Rhoads, D.; Sole-Ribalta, A.; Borge-Holthoefer, J. The inclusive 15-minute city: Walkability analysis with sidewalk networks. *Comput. Environ. Urban Syst.* **2023**, *100*, 101936. [CrossRef]
26. World Health Organization. *Decade of Healthy Ageing: Baseline Report*; World Health Organization: Geneva, Switzerland, 2020.
27. Paulsson, A.; Isaksson, K.; Sørensen, C.H.; Hrelja, R.; Rye, T.; Scholten, C. Collaboration in public transport planning—Why, how and what? *Res. Transp. Econ.* **2018**, *69*, 377–385. [CrossRef]
28. Cooper, E.; Vanoutrive, T. Is accessibility inequality morally relevant?: An exploration using local residents' assessments in Modesto, California. *J. Transp. Geogr.* **2022**, *99*, 103281. [CrossRef]
29. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Syst. Rev.* **2021**, *10*, 89. [CrossRef] [PubMed]
30. Sarkis-Onofre, R.; Catalá-López, F.; Aromataris, E.; Lockwood, C. How to properly use the PRISMA Statement. *Syst. Rev.* **2021**, *10*, 117. [CrossRef] [PubMed]
31. Jiang, F.; Ma, J.; Webster, C.J.; Chiaradia, A.J.F.; Zhou, Y.; Zhao, Z.; Zhang, X. Generative urban design: A systematic review on problem formulation, design generation, and decision-making. *Prog. Plan.* **2024**, *180*, 100795. [CrossRef]
32. Pananrangi, A.R.; Ismail, I.; Mustafa, D.; Askar, A.; Rizal, A. Analyzing public policy effectiveness in enhancing accountability and transparency in service quality. *JPPI J. Penelit. Pendidik. Indones.* **2024**, *10*, 696. [CrossRef]
33. Yu, Y.; Chen, Z.; Bu, J.; Zhang, Q. Do Stairs Inhibit Seniors Who Live on Upper Floors from Going Out? *Herd-Health Environ. Res. Des. J.* **2020**, *13*, 128–143. [CrossRef]
34. González-González, E.; Cordera, R.; Alonso, B.; Nogués, S. Planning for sustainable urban mobility: Demand estimation of on-street vertical walking facilities. *Int. J. Sustain. Transp.* **2022**, *16*, 326–339. [CrossRef]
35. Dai, X.; Li, Z.; Ma, L.; Jin, J. The Spatio-Temporal Pattern and Spatial Effect of Installation of Lifts in Old Residential Buildings: Evidence from Hangzhou in China. *Land* **2022**, *11*, 1600. [CrossRef]
36. Ma, S.; Li, T.; Yang, Y. Housing Price Appreciation Effects of Elevator Installation in Old Residential Areas: Empirical Evidence Based on a Multiperiod DID Model. *Adv. Civ. Eng.* **2022**, *2022*, 7949252. [CrossRef]
37. Li, Y.; Zheng, W.; Zhou, Q. Knowledge-Driven Urban Innovation: Dynamics of Elevator Installation in Aging Residential Communities. *J. Knowl. Econ.* **2025**, *16*, 6315–6359. [CrossRef]
38. Li, X.; Yang, Z.; Qian, X.; Guo, Y.; Yang, C. Investigating the Impacts of Property Walking Accessibility on Housing Affordability and Equity: Evidence from Shanghai, China. *J. Urban Plan. Dev.* **2023**, *149*, 05023035. [CrossRef]
39. Sarkar, C.; Webster, C. Urban environments and human health: Current trends and future directions. *Curr. Opin. Environ. Sustain.* **2017**, *25*, 33–44. [CrossRef]
40. Heyer, J.; Palm, M.; Niemeier, D. Are we keeping up? Accessibility, equity and air quality in regional planning. *J. Transp. Geogr.* **2020**, *89*, 102891. [CrossRef]

41. Du, M.; Zhang, X.; Mora, L. Strategic Planning for Smart City Development: Assessing Spatial Inequalities in the Basic Service Provision of Metropolitan Cities. *J. Urban Technol.* **2021**, *28*, 115–134. [CrossRef]
42. Guo, B.; Zhang, L.; Li, Y. Research on the path of residents' willingness to upgrade by installing elevators in old residential quarters based on safety precautions. *Saf. Sci.* **2019**, *118*, 389–396. [CrossRef]
43. Wen, Y.; Li, Y.; Yang, Y.; Wang, J. Towards an Evaluation System of Disabled Individuals' Friendly Communities from the Perspective of Inclusive Development-A Case Study in Jinan. *Buildings* **2023**, *13*, 2715. [CrossRef]
44. Tatano, V.; Revellini, R. An alternative system to improve accessibility for wheelchair users: The stepped ramp. *Appl. Ergon.* **2023**, *108*, 103938. [CrossRef]
45. Mou, Y.; Qin, Y.; Niu, S. "I Go Outdoors for Activities Every Day": Go-Along with Seniors with Slow Walking Speeds to Explore Environmental Factors Influencing Mobility. *Int. J. Public Health* **2024**, *69*, 1607033. [CrossRef]
46. Sohaimi, N.S.; Sohaimi, M.S.; Sohaimi, M.S.N.; Hamid, J.A. Exploring elderly-friendly affordable home for ageing in place. *AIP Conf. Proc.* **2023**, *2881*, 040024. [CrossRef]
47. Edwards, N.; Dulai, J. Examining the relationships between walkability and physical activity among older persons: What about stairs? *BMC Public Health* **2018**, *18*, 1025. [CrossRef] [PubMed]
48. Lu, H.; Zhao, P.; Hu, H.; Zeng, L.; Wu, K.S.; Lv, D. Transport infrastructure and urban-rural income disparity: A municipal-level analysis in China. *J. Transp. Geogr.* **2022**, *99*, 103292. [CrossRef]
49. Guzman, L.A.; Oviedo, D. Accessibility, affordability and equity: Assessing 'pro-poor' public transport subsidies in Bogotá. *Transp. Policy* **2018**, *68*, 37–51. [CrossRef]
50. Moran, M.; Van Cauwenberg, J.; Hercky-Linnewiel, R.; Cerin, E.; Deforche, B.; Plaut, P. Understanding the relationships between the physical environment and physical activity in older adults: A systematic review of qualitative studies. *Int. J. Behav. Nutr. Phys. Act.* **2014**, *11*, 79. [CrossRef]
51. Nie, P.; Li, Q. Age-friendly community environments and the age trajectories of long-term care dependency among Chinese older adults. *Soc. Sci. Med.* **2025**, *365*, 117614. [CrossRef]
52. Fan, L.; Xiong, Y.; Peng, Y. Assessing Accessible Travel Satisfaction in Old Communities: A SEM Study. *Buildings* **2024**, *14*, 1273. [CrossRef]
53. Nowossadeck, S.; Gordo, L.R.; Alcantara, A.L. Mobility restriction and barrier-reduced housing among people aged 65 or older in Germany: Do those who need it live in barrier-reduced residences? *Front. Public Health* **2023**, *11*, 1098005. [CrossRef]
54. Zhang, N.; Yang, Q. Public transport inclusion and active aging: A systematic review on elderly mobility. *J. Traffic Transp. Eng. (Engl. Ed.)* **2024**, *11*, 312–347. [CrossRef]
55. Yu, J.; Ma, G.; Wang, S. Do Age-Friendly Rural Communities Affect Quality of Life? A Comparison of Perceptions from Middle-Aged and Older Adults in China. *Int. J. Environ. Res. Public Health* **2021**, *18*, 7283. [CrossRef]
56. Pan, Z.; Liu, Y.; Liu, Y.; Huo, Z.; Han, W. Age-friendly neighbourhood environment, functional abilities and life satisfaction: A longitudinal analysis of older adults in urban China. *Soc. Sci. Med.* **2024**, *340*, 116403. [CrossRef] [PubMed]
57. Gan, C.; Chen, M.; Rowe, P. Beijing's Selected Older Neighborhoods Measurement from the Perspective of Aging. *Sustainability* **2020**, *12*, 4112. [CrossRef]
58. Yu, W.; Piao, Z.; Zhang, L.; Wang, H.; Zhou, B. An empirical study on the impact of residential built environment on the quality of life of older people: A case study of existing residential areas in Dalian. *J. Hum. Settl. West China* **2024**, *39*, 15–20.
59. Mayordomo-Martinez, D.; Garcia-Mateos, G. Evaluating Accessibility Solutions in Collective Residential Buildings: Field Research in Southeast Spain. *Buildings* **2024**, *14*, 1621. [CrossRef]
60. Yang, Q.; Xu, F.; Lu, W.-Z.; Yang, Z.; Bai, Y.; Wen, B. Green renovation and multi-objective optimization of Tibetan courtyard dwellings. *Build. Environ.* **2025**, *279*, 113071. [CrossRef]
61. Chen, Z.; Huang, G. Greenspace to Meet People's Demand: A Case Study of Beijing in 2005 and 2015. *Remote Sens.* **2021**, *13*, 4310. [CrossRef]
62. Carlsson, G.; Slaug, B.; Schmidt, S.M.; Norin, L.; Ronchi, E.; Gefenaite, G. A scoping review of public building accessibility. *Disabil. Health J.* **2022**, *15*, 101227. [CrossRef]
63. Siikonen, M.-L. Current and future trends in vertical transportation. *Eur. J. Oper. Res.* **2024**, *319*, 361–372. [CrossRef]
64. Zhao, J.; Peng, Z.; Liu, L.; Yu, Y.; Shang, Z. Public Space Layout Optimization in Affordable Housing Based on Social Network Analysis. *Land* **2021**, *10*, 955. [CrossRef]
65. Zallio, M.; Chivran, C.; Clarkson, P.J. Exploring Inclusion, Diversity, Equity, and Accessibility in the Built Environment: A Case Study. *Buildings* **2024**, *14*, 3018. [CrossRef]
66. Henje, C.; Stenberg, G.; Lundalv, J.; Carlsson, A. Obstacles and risks in the traffic environment for users of powered wheelchairs in Sweden. *Accid. Anal. Prev.* **2021**, *159*, 106259. [CrossRef] [PubMed]
67. Soltanzadeh, A.; Mazaherian, H.; Heidari, S. Optimal solutions to vertical access placement design in residential high-rise buildings based on human behavior. *J. Build. Eng.* **2021**, *43*, 102856. [CrossRef]
68. Arrigoitia, M.F. *Un*Making Public Housing Towers. *Home Cult.* **2014**, *11*, 167–196. [CrossRef]

69. Zang, Y. *Intelligent Reconstruction Plan for Old Stairs in Ordinary Community*; Springer International Publishing: Berlin/Heidelberg, Germany, 2020; pp. 1711–1715.
70. Ahrentzen, S.; Tural, E. The role of building design and interiors in ageing actively at home. *Build. Res. Inf.* **2015**, *43*, 582–601. [CrossRef]
71. Borodinecs, A.; Korjakins, A.; Zajacs, A.; Iufereva, A. Smart Concept expansion from local to city scale. *MATEC Web Conf.* **2018**, *245*, 16002. [CrossRef]
72. Lai, S.; Deal, B. Parks, Green Space, and Happiness: A Spatially Specific Sentiment Analysis Using Microblogs in Shanghai, China. *Sustainability* **2023**, *15*, 146. [CrossRef]
73. Ciflikli, C.; Oner Tartan, E. A model for the visualization and analysis of elevator traffic. *Transp. Plan. Technol.* **2019**, *42*, 868–880. [CrossRef]
74. Liu, Y.; Li, H.; Li, W.; Wang, S. Renovation priorities for old residential districts based on resident satisfaction: An application of asymmetric impact-performance analysis in Xi'an, China. *PLoS ONE* **2021**, *16*, e0254372. [CrossRef]
75. Butler, L.; Yigitcanlar, T.; Paz, A. How Can Smart Mobility Innovations Alleviate Transportation Disadvantage? Assembling a Conceptual Framework through a Systematic Review. *Appl. Sci.* **2020**, *10*, 6306. [CrossRef]
76. Shen, L.; Tang, L.; Mu, Y. Critical success factors and collaborative governance mechanism for the transformation of existing residential buildings in urban renewal: From a social network perspective. *Heliyon* **2024**, *10*, e27672. [CrossRef] [PubMed]
77. Bayala, E.R.C.; Ros-Tonen, M.; Yanou, M.P.; Djoudi, H.; Reed, J.; Sunderland, T. Towards more inclusive community landscape governance: Drivers and assessment indicators in northern Ghana. *For. Policy Econ.* **2024**, *159*, 103138. [CrossRef]
78. Peris Cancio, L.F. *Social Work: Transforming Struggles into Strength Through Relational Empowerment*; Elsevier: Amsterdam, The Netherlands, 2024.
79. Castro-Arce, K.; Vanclay, F. Transformative social innovation for sustainable rural development: An analytical framework to assist community-based initiatives. *J. Rural Stud.* **2020**, *74*, 45–54. [CrossRef]
80. Stevens, K.A.; Marsh, L.T.S.; Pangerl, C.A.; Silio, A.; Qu, Z.; Ge, Y.; Wang, L.; Aksha, S.K.; Longenecker, H.E.; Emrich, C.T.; et al. Reimagining urban resilience and education hubs using a community-engaged, equity-centered approach. *Prog. Disaster Sci.* **2025**, *26*, 100414. [CrossRef]
81. Muhammed, Z.; Abubakar, I.R. *Improving the Quality of Life of Urban Communities in Developing Countries*; Springer International Publishing: Berlin/Heidelberg, Germany, 2020; pp. 357–370.
82. Li, Y.; Zhang, S.; Zhu, D. Co-creation of community micro-renewals: Model analysis and case studies in Shanghai, China. *Habitat Int.* **2023**, *142*, 102951. [CrossRef]
83. Teng, M.; Suo, J.; Zhong, H.; Kou, N.; Song, B.; Li, G. The Impact of Multi-Quality Renewal Elements of Residence on the Subjective Well-Being of the Older Adults—A Case Study of Dalian. *Psychol. Res. Behav. Manag.* **2023**, *16*, 761–780. [CrossRef]
84. Scott, M. Planning for Age-Friendly Cities. *Plan. Theory Pract.* **2021**, *22*, 457–492. [CrossRef]
85. Strzelecka, M.; Rechciński, M.; Tusznio, J.; Akhshik, A.; Grodzińska-Jurczak, M. Environmental justice in Natura 2000 conservation conflicts: The case for resident empowerment. *Land Use Policy* **2021**, *107*, 105494. [CrossRef]
86. Chen, X.; Ma, F.; Wu, Y.; Han, B.; Luo, L.; Biancardo, S.A. MFMDepth: MetaFormer-based monocular metric depth estimation for distance measurement in ports. *Comput. Ind. Eng.* **2025**, *207*, 111325. [CrossRef]
87. Appio, F.P.; Lima, M.; Paroutis, S. Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges. *Technol. Forecast. Soc. Change* **2019**, *142*, 1–14. [CrossRef]
88. Smith, H.J.; Huo, Y.J. Relative Deprivation. *Policy Insights Behav. Brain Sci.* **2014**, *1*, 231–238. [CrossRef]
89. Han, J.; Chan, E.H.W.; Qian, Q.K.; Yung, E.H.K. Achieving Sustainable Urban Development with an Ageing Population: An "Age-Friendly City and Community" Approach. *Sustainability* **2021**, *13*, 8614. [CrossRef]
90. Berg, C.N.; Deichmann, U.; Liu, Y.; Selod, H. Transport Policies and Development. *J. Dev. Stud.* **2017**, *53*, 465–480. [CrossRef]

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