

# Research on the Age-Friendly Transformation of Old Residential Communities

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**Abstract**—In our country, the population ageing pressure is increasing day by day. The infrastructure of the old residential areas is mostly old and the management is backward. The problems of the elderly involved in the process of their transformation need to be solved. In view of the existing problems in the old residential quarters, such as the building conditions, facilities and equipment, community service, residents maintenance, community environment, transformation predicament, etc., combined with national policies, guidance and industry norms. Based on the physical, psychological and social needs of the elderly, the corresponding design strategies are put forward, and summed up the analysis of the old residential areas suitable for aging transformation of the implementation path. The aim of this paper is to provide help for the upgrading of the old residential area.

**Keywords**—population aging, renovation of old residential communities, aging in place, urban renewal

## I. INTRODUCTION

Before the year 2000, the old residential communities constructed with government and institutional funding presented a sharp contrast to the residential areas built after the 1998 housing reform. Many of these older communities have lagged behind the developmental pace of the times [1]. After entering an aging society, China has witnessed significant trends in the aging population, characterized by a large and rapidly growing elderly population, high aging rates, increasing disability rates, and a noticeable trend towards empty-nesting. Due to the combined impact of China's current situation of aging before becoming affluent and the gradual reduction in family size, coupled with the relatively lagging social security system, the issue of elderly care has become particularly severe. As shown in Fig. 1, according to statistics from the National Bureau of Statistics of China, by the end of 2021, the elderly population over 65 years old had surpassed 200 million, accounting for 14% of the total population. It is anticipated that this ratio will continue to rise, approaching one-third by the year 2050. This poses significant challenges to China's social security, healthcare, and elderly care services. The International Monetary Fund (IMF) predicts that by 2023, China's population will reach 1.5 billion. However, the IMF expects a further slowdown in China's population growth rate due to factors such as aging and declining fertility rates. The population growth rate in China is projected to drop to below 0.1% per year before 2030, and the total population is expected to start decreasing before 2050. China's aging phenomenon exhibits significant regional disparities, with the eastern regions having relatively lower aging rates compared to the higher proportions of elderly populations in the central and western regions. The primary causes of these differences are the imbalanced

development between urban and rural areas and varying economic levels.

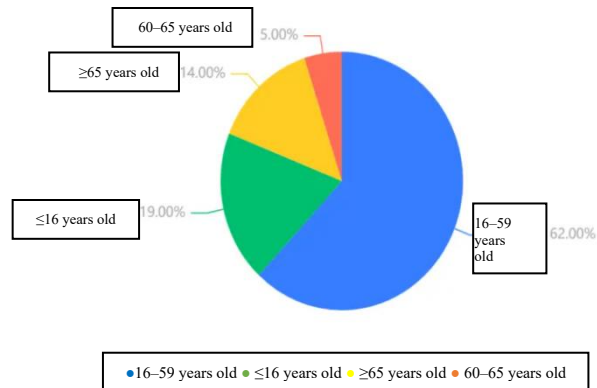


Fig. 1. Proportion of all age groups in the total population by the end of 2021.

## II. THE REALISTIC POLICY DEMANDS FOR THE RENOVATION OF OLD NEIGHBORHOODS

The Maslow's Hierarchy of Needs theory has played a significant role in reflecting the common patterns of human behavior and psychological activities. This theory categorizes human needs into five levels, akin to a ladder, ranging from lower to higher, and puts forth corresponding needs analysis [2] (see Table 1).

Table 1. Maslow's hierarchy of needs

Needs analysis	Social public needs
Physiological needs	Human life indispensably involves the fulfillment of both material and spiritual needs, which may encompass various aspects such as clothing, food, housing, transportation, and more.
Security needs	To ensure personal safety, prevent losses, and safeguard career development and property security, it is imperative to meet these safety needs.
Social needs	This includes emotional needs and aspirations for social status.
Esteem needs	A fundamental set of values that manifests not only in individual self-esteem but also in the respect of others.
Self-actualization	By striving to achieve one's dreams and goals, individuals can fully showcase their potential and talents.

In recent years, the country has successively issued several relevant documents regarding the renovation of old residential communities (shown as Table 2). Among them, "Guiding Opinions of the State Council General Office on Comprehensively Promoting the Renovation of Old Urban Residential Areas (State Council Office [2020] No. 23)" is noteworthy [3]. The aim is to more effectively address the

issues of aging urban and rural residences, meeting the dual demands of residents' daily living and economic growth. Based on different circumstances, the reconstruction of old residences is categorized into three types: basic, improvement, and enhancement. For the age-friendly renovation of old residential communities, various measures will be implemented, including comprehensive upgrades to the environment and facilities, the installation of drones on eligible residential buildings, improvement and renewal of infrastructure in residential communities and nearby areas, such as accessibility facilities, recreational amenities, and sports facilities. Additionally, comprehensive social welfare will be provided, including medical coverage, educational facilities, housing security, pension insurance, employment opportunities for people with disabilities, medical assistance, and educational facilities [4].

Table 2. Pension and community rehabilitation related policy documents

Time of promulgation	Filename	Content
June 2017	Opinions of the State Council on Strengthening and Improving the Governance of Urban and Rural Communities	Government departments are actively working to advance governance reforms in urban and rural areas, aiming to enhance the overall management standards of communities. These measures are designed to establish a more effective governance mechanism, promoting the modernization of governance in both urban and rural regions.
December 2018	Full text of communiqué of the 2018 Central Economic Work Conference	We propose improvements to the elderly care system to address urban elderly care challenges. Emphasizing the crucial role of governments at all levels, we also advocate for enhanced oversight and protection measures in the housing market.
April 2019	"Notice on improving the work of old residential areas in 2019"	Aiming to vigorously develop aging urban residences, the initiative calls for initiatives starting at the grassroots level, actively exploring various reform models, increasing financial investment, and establishing a sound fiscal support system to promote sustainable socio-economic development.
July 2019	"Technical Standard for comprehensive renovation of urban old residential areas"	Beijing Municipality has introduced, for the first time, the "Technical Standards for Comprehensive Renovation of Urban Old Residential Areas" to drive local economic and social sustainable development.
April 2020	"The State Council General Office's guiding opinions on comprehensively promoting the renovation of old urban residential areas"	Aimed at accelerating development, improving people's basic needs, breaking away from traditional management models, fostering social fairness and justice, and achieving fair, impartial, and sustainable development.
August 2020	"Technical Guidelines for reconstruction of old urban districts"	The objective is to establish more stringent standards for the comprehensive renovation of old residential communities

	in Sichuan Province (for trial implementation)"	in Sichuan Province, promoting their sustainable development and improvement.
September 2020	"The implementation opinions of the General Office of the People's Government of Sichuan Province on comprehensively promoting the renovation of old urban districts"	The aim is to deepen the improvement of the urban social control system, enhance the daily life quality of urban residents, and advance the health of neighborhoods.
May 2021	"On the comprehensive renovation of old residential areas for the implementation of the old transformation and barrier-free environment construction guidance"	To better meet the needs of the elderly, it is essential to incorporate appropriate environmental improvements and barrier-free services into the comprehensive redevelopment of old residential communities.
February 2022	"Implementation Plan of the 14th five-year plan for the renovation of old courtyard buildings in Chengdu"	The aim is to bring about significant transformation for the urban aging residences in Chengdu, with the goal of improving housing conditions and enhancing infrastructure. "Happy Chengdu" is intended to strengthen the implementation of the action plan to ensure the quality of housing in Chengdu and effectively prevent, reduce, or eliminate potential hazards.
July 2023	"Notice on steadily advancing the work of renovation of old residential areas in 2023 cities and towns"	The requirement is to sensibly arrange the urban old residential community renovation plan for the year 2024, indicating China's commitment to the ongoing progress of renovating old urban residential areas. This initiative is expected to benefit a greater number of urban residents.

"The Guiding Opinions on Comprehensive Renovation for Old Residential Communities, Implementing Elderly-Friendly Reconstruction, and Building Barrier-Free Environments" explicitly states that efforts should be actively made to promote the social welfare and environmental protection of the elderly population, ensuring their basic needs. Specifically, this involves various measures such as enhancing road safety, optimizing the layout of public spaces, increasing the coverage of social welfare, improving the quality and quantity of social welfare, and redesigning housing to include three main components: basic construction, renovation, and expansion. The basic construction part will be tailored to residents' requirements, while the renovation part will align with residents' preferences to better meet their housing needs [5].

### III. CURRENT SITUATION AND PROBLEM ANALYSIS OF OLD NEIGHBORHOODS

With the continuous advancement of urban old residential community renovation, the number of old houses has significantly decreased. However, simultaneously, there still

exist many old residential communities that require renovation. The renovation of old residential areas is a massive undertaking, necessitating addressing multifaceted issues, detailed as follows:

#### *A. Building Condition Analysis*

Many of China's aged residential communities, constructed several years ago, have endured the test of time and weather, resulting in varying degrees of aging in building materials and structures. This has given rise to numerous issues. For instance, within the community, roads exhibit problems such as surface cracking, subsidence, detachment, misalignment, and warping. Simultaneously, areas within the community experience pavement deficiencies, cracking, subsidence, and slippery conditions, posing potential threats to pedestrian safety. As shown in Fig. 2, internal walls and roofs also display cracking and peeling. The drainage system is incomplete, allowing rainwater to flow directly into the ground or infiltrate basements. Additionally, due to the aging of the community, there is a lack of sufficient fire safety facilities. Fire evacuation routes are often obstructed by garbage, and the absence of fire extinguishers is another noteworthy concern. Currently, these issues have impacted the daily travel needs of community residents, especially the elderly.



Fig. 2. The wall is falling off.

#### *B. Facility and Equipment Analysis*

As shown in Fig. 3, in the earlier phases of community development, with a low prevalence of private cars among residents, parking spaces were often planned together with the community road layout according to previous standards. This phenomenon was widespread in the context of those times. However, with societal progress and the continuous growth in the number of private cars, addressing the parking issue within old residential communities has become increasingly challenging. Especially in many urban areas, residential buildings have been transformed into high-end offices or mixed-use commercial buildings, exacerbating the existing parking difficulties within crowded communities. Currently, the existing number of parking spaces within the community cannot meet the demand for parking, and parking management is in a state of chaos. To cope with this issue, some residents are forced to use green spaces and fire evacuation routes for parking. This not only poses obstacles to the travel of the elderly and children but also severely impacts the living environment of the residents.

Additionally, as shown in Fig. 4, in these old residential communities, the aging of electrical equipment is evident, with wires visible throughout. Some residents even use these

wires for hanging laundry. In such circumstances, power lines within the community often experience faults and power outages. This occurrence has posed serious safety hazards for the elderly and children in the community.



Fig. 3. Vehicle parking and misplacing phenomenon.



Fig. 4. Wire aging.

#### *C. Community Service Analysis*

The neighborhood committee serves as a crucial intermediary for coordinating collaboration among various parties, facilitating the local renovation of old residential communities and managing various community affairs. Scientific property management of old residential communities is a prerequisite for renovation work. In the current community environment, the strength and functions of neighborhood committees have been somewhat constrained, and they have not fully exerted their corresponding utility. For instance, to enhance the living environment of the community, some renovation projects focus primarily on aesthetic improvements, neglecting the renovation of property management. As a result, property services managed by neighborhood committees in some old residential communities continue to be the responsibility of community management departments, leading to a lack of change in the property management approach after community renovation. Some community staff also lack theoretical knowledge and practical experience. Prolonged deficiencies in rationalized management, even after community renovation, can intensify conflicts in the renovated community.

#### *D. Resident Maintenance Analysis*

To excel in the renovation of old residential communities, understanding the genuine needs of residents is paramount. Residents are the owners of the community, and their needs deserve respect. However, factors such as the older age, lower



educational levels, and conservative thinking of many residents in old residential communities contribute to a lack of enthusiasm and initiative in their participation in the renovation process. This, in turn, hinders the government's leadership. Additionally, some residents may lack a strong sense of collective consciousness. They not only fail to contribute to renovation efforts but, driven by self-interest, may even resist, obstruct, or damage the progress of renovation work, posing significant challenges to the entire renovation process.

#### *E. Environmental Issues Analysis*

Due to the dispersed spatial layout of most old residential communities in China, there is a lack of centralized green spaces and a variety of plant species. The landscape is relatively monotonous, leading to insufficient maintenance of existing greenery. As shown in Fig. 5, due to residents' unauthorized use, common areas like lawns have lost vitality. Many internal green spaces and vegetation have been uprooted, and trees have been felled. This results in shared public spaces, originally intended for residents, being occupied by individual residents for private use.



Fig. 5. Disorder of green plants.

#### *F. Challenges in Renovation Analysis*

With the continuous development of cities, some old residential communities face challenges due to missing historical records, incomplete building procedures, and the complexity and lengthy approval process for renovation. The renovation process involves multiple departments, and the communication difficulties among these departments contribute to slow progress in the renovation of old residential communities. Additionally, the limited profitability and long payback period for the renovation of old residential areas result in low participation from various stakeholders, leading to numerous loopholes in the renovation process. This, in turn, triggers a phenomenon where responsibility is passed around, limiting the effectiveness of maintaining public facilities within old residential communities.

Furthermore, in actual renovation work, the proportion of government investment is absolute, and government departments are unable to fully leverage social resources for financing projects or generate profits from these projects. This inadequacy in financial input from local governments primarily results in "pure investment", influencing the standards of renovation in some old residential communities, particularly in areas such as lighting, security, and fire safety. Thorough overall renovations are compromised. While basic

renovations may temporarily improve the existing environment of old communities, they may fall short of meeting the living needs of residents in old residential communities compared to the standards of new-era communities, especially as urban economies grow.

### **IV. DESIGN STRATEGIES FOR AGE-FRIENDLY RENOVATION IN OLD RESIDENTIAL AREAS**

The challenges faced by the elderly are not merely the loss of individual physical functions but the gradual decline in overall bodily functions, which differs from the situation of disabled individuals. In response to this characteristic, this paper proposes a planning and design approach under the concept of age-friendliness. Age-friendly design aims at facilitating ease of use. Therefore, age-friendly design should be guided by a "people-centric" philosophy, organically integrating physiological, psychological, and social adaptation at three levels.

#### *A. Physiological Needs*

With advancing age, the physical functions of the elderly deteriorate, and physiological capabilities gradually diminish. Older individuals face increased risks to their safety when confronted with accidents such as collisions, falls, or dislodgments. Therefore, in the age-friendly renovation of old residential communities, designing strategies to address the physiological needs of the elderly is crucial to ensure they can live in a comfortable, safe, and convenient environment.

China is currently experiencing a rapid development of the aging population, making the elderly a significant focus in the renovation of old residential communities. However, their life needs are often overlooked. Solutions addressing their life needs include:

**Barrier-Free Design:** Implementing barrier-free designs, including the establishment of accessible pathways and ramps, to meet the travel needs of elderly individuals with limited mobility.

**Safety Features:** Considering the balance and stability of the elderly, installing sturdy railings and handrails in areas such as stairs and corridors to reduce the risk of falls. Using non-slip materials for floors and carpets to minimize slipping hazards, ensuring adequate lighting, especially in dimly lit areas. Installing emergency call systems and medical assistance equipment to address urgent situations.

**Home Facilities:** Designing home facilities that cater to the needs of the elderly, including easily accessible sanitary facilities and comfortable resting areas.

**Smart Technologies:** Introducing smart home technologies, such as home automation systems, to provide convenient home control for the elderly.

These design strategies contribute to creating a living environment suitable for the elderly, enhancing their quality of life, and promoting the sustainability of the community.

#### *B. Psychological Needs*

Grounded in the emotions of love, respect, and nostalgia, we are committed to creating a space that caters to the diverse needs of the elderly, allowing them to freely express themselves and engage in effective communication with others to enhance the age-friendliness of old residential communities.

To elevate the quality of age-friendly design, as shown in Fig. 6, several key considerations are prioritized. Firstly, the creation of social spaces is crucial. This involves installing resting areas, gardens, and other communal features in public areas to provide spaces for socializing and relaxation, mitigating potential feelings of loneliness among the elderly. Secondly, through thoughtful planning and greenery, a serene environment is cultivated, reducing noise and environmental stress to facilitate psychological relaxation and comfort for the elderly. Taking into account the seniors' memories and emotions, incorporating traditional elements like cultural murals and old photo exhibitions helps evoke emotional resonance.



Fig. 6. Community space design renderings.

Furthermore, the creation of activity spaces is essential. Organizing regular fitness, cultural, and entertainment activities fosters social interaction and joy, providing a platform for mutual support and encouragement among the elderly. Considering the psychological well-being, introducing mental health support, including counseling services, helps seniors address emotional challenges.

### C. Social Needs

Research indicates that face-to-face communication can effectively reduce the risk of depression among the elderly [6]. As seniors transition into retirement, their lifestyle undergoes significant changes, shifting focus from work to family, friends, and various other aspects. Addressing the new challenges brought about by these changes becomes crucial in implementing reforms for aging. Therefore, in the age-friendly renovation of old communities, addressing the social needs of the elderly is of paramount importance. It is necessary to establish communication spaces in the community and incorporate facilities that facilitate interaction to help seniors steer clear of negative emotions.

Firstly, the design should prioritize the planning of social spaces, providing resting areas, social seating, outdoor

activity spaces, encouraging interaction and communication between residents, and alleviating potential feelings of loneliness. Secondly, diverse social activities should be organized to meet the varied needs of the elderly, enhancing their awareness of social participation. Considering the emotional attachment of seniors to their families, communal spaces for gatherings can be established in public areas for residents to host family gatherings and community events. Additionally, supporting volunteer activities for the elderly encourages their participation in community service, boosting their self-esteem and sense of social identity. The design could also consider introducing digital social tools to promote online socialization, helping seniors stay connected with family and friends.

By comprehensively addressing the social needs of the elderly, designing an environment that fosters community interaction, harmony, and sharing contributes to creating a more cohesive and fulfilling community. In summary, face-to-face communication, through the creation of a community environment, increased interaction, and the promotion of community activities, reduces the risk of depression among the elderly in aging communities, allowing them to live with positive emotions and enjoy their later years.

## V. THE IMPLEMENTATION PATH FOR THE AGE-FRIENDLY RENOVATION OF OLD NEIGHBORHOODS

In addressing the challenges faced by old communities during the aging process and incorporating design strategies based on the needs of the elderly, the following implementation pathway for the age-friendly renovation of old residential areas is proposed:

### A. Establish a Collaborative Renovation Mechanism and Strengthen Coordination among All Parties

To successfully achieve urban renewal, it is crucial to establish an efficient collaborative mechanism to ensure close cooperation among various stakeholders, especially in areas no longer suitable for existing old communities. In the early stages of the renovation, the establishment of a multi-stakeholder project management system involving various relevant entities is necessary to promote the construction of a collaborative mechanism and enhance coordination among the parties involved. This system should collect information provided by various departments, forming a unified database for analysis and research to provide a data foundation for decision-making. This platform offers opportunities for real-time interaction and collaboration, promoting information sharing, issue communication, and decision-making.

In the later stages, regular evaluations and supervisory checks should be conducted on all parties involved. In the renovation plan, the government should play a leading and supportive role to ensure smooth implementation. Legislation should clearly define the responsibilities of design units and construction companies, establishing clear policies, regulations, and standards. This legal framework provides the basis and financial support to guarantee the smooth progress of the project. The renovation project should be coordinated with other departments, treating it as an integral part and establishing effective incentive mechanisms, among other measures.

Furthermore, attention should be given to the genuine

needs of residents, expanding channels for their participation and enhancing their proactiveness. While seeking residents' opinions, they should also be involved in the entire renovation project, allowing them to fully express and contribute their ideas, thereby increasing residents' trust in the renovation work. Enhancing the participation and coordination of various entities is essential to ensure the smooth progress of the renovation work, creating a more livable environment for elderly residents.

### *B. Optimize the Spatial Utilization Pattern and Carry Out Localized Transformations Based on Specific Conditions*

When conducting the age-friendly renovation of old residential communities, it is essential to optimize spatial layout based on the characteristics of different communities and the needs of elderly residents, tailoring the approach to each specific location to create a more suitable and comfortable living environment. For instance, addressing internal issues in old residential communities involves clear functional delineation to establish multiple distinct functional zones. Conducting surveys on the surrounding road network and traffic capacity, clearing unauthorized constructions within the community, promptly utilizing vacant land after demolition, and implementing regular inspections are crucial steps.

Considering the natural conditions and local cultural characteristics of old residential areas, a thorough analysis of their internal layout has been conducted. Through survey analysis and comparison of the actual conditions of each community, recommendations for locally suitable architectural structures and unit designs are proposed. Planning and implementing corresponding schemes are crucial to ensure the smooth progress of the project.

At present, many old-fashioned residential communities are suffering from limited resources and waste of space. Therefore, we need to take various measures to effectively develop these spaces and try our best to make them more meaningful. Only in this way can we better realize social progress and make these communities more beautiful. As shown in Fig. 7, while planning and upgrading the non-locomotive parking shed, we also need to pay attention to the greening construction. The most important thing is to clearly understand the overall area and type of each house and accurately estimate the available space of each house. In the process of dealing with idle places, each residence needs to make reasonable planning and arrangement according to the current state, so as to improve the overall quality of life of the residence.



Fig. 7. Non-locomotive parking shed design renderings.

Through adaptive renovation strategies that cater to the actual needs of the elderly, optimizing the spatial layout of old residential communities as described above can create a more suitable and comfortable living environment, thereby improving the quality of life for elderly residents.

### *C. Enhance Communication during the Renovation Process and Build a Network of Interpersonal Relationships*

In the process of age-friendly renovation in old residential communities, establishing an effective interpersonal network and strengthening communication are crucial to ensure the smooth implementation of the project and the satisfaction of community residents.

The first and foremost task is to establish a comprehensive communication platform involving various stakeholders such as government representatives, designers, construction teams, and homeowners. Secondly, on this platform, all parties engage in information exchange and interaction. Regular meetings are held to ensure that the latest developments, issues, and solutions of the project are widely disseminated and shared, enabling everyone to have a comprehensive understanding of the project's latest dynamics. Additionally, actively listening to the voices of community residents is essential. To gain in-depth insights into residents' needs, concerns, and suggestions, various forms of communication, such as resident forums and surveys, are employed to provide more comprehensive information. Through such a renovation plan, ensure that residents' expectations are genuinely met, enhancing their participation and satisfaction. Emphasize transparency in information disclosure and operate with integrity. During the project's progress, timely convey crucial information such as developments, budgets, and plans to residents and other relevant stakeholders. Maintain highly transparent communication to avoid any situations that may lead to suspicion and misunderstanding.

Facilitate the establishment and development of neighborly relationships. Foster the formation of friendly neighborly relations by organizing community gatherings, mutual assistance groups, and other activities to enhance interaction and connection among residents. Through regular solicitation of opinions and feedback from residents and other relevant stakeholders, deeply reflect on and comprehensively improve issues that arise during the renovation process. Strengthen communication in the age-friendly renovation of old residential communities, establish a robust interpersonal network, promote collaboration among all parties, making the renovation process smoother and more successful, and creating a brighter future for the community.

### *D. Establish a Sustainable Operational System to Achieve a Win-Win Situation for All Parties*

The age-friendly renovation of old residential communities not only involves physical environmental improvements but also establishes and enhances the community governance system. The neighborhood is the fundamental unit of urban management, and the diverse interests of community residents require finding common agreements through "consultation for important matters" and "decisions for everyone's affairs by everyone". To maintain the long-term effects of age-friendly renovation in old residential



communities, high-quality public services are needed to drive the community management into a virtuous cycle. Starting with neighborhood property organizations, mobilize property service resources, promote the extension of “neighborhood + property + public services” to households, and encourage the rapid development of new industries in modern community public services, such as health, childcare, and household services, using the “network platform + innovative units” approach.

Implement informatization, including the construction of an information system for the health records of the elderly and intelligent service systems. Establish a diversified service system, including daytime care, recovery training, psychological counseling, and more, to promote a healthy lifestyle adapted to the needs of different age groups and enhance their physical and mental health [7]. Build a modern governance mechanism for age-friendly urban and residential communities that fully involves retired seniors, ensuring that they can rely on their own strength to enjoy a respectful and quality daily life while also participating fairly in social allocation, resource sharing, and economic and social development.

## VI. CONCLUSION

For billions of people, the renovation of old residential communities is a livelihood project. In the context of the increasingly serious aging issue in our society, the primary task is to carry out aging renovations in old residential communities—a complex yet necessary undertaking with significant implications. As the trend of population aging intensifies, providing a suitable living environment for the elderly has become a crucial task.

Age-friendly renovation is not only a complex engineering task but also a vital societal issue. Therefore, it is essential to fully consider the interests and demands of community residents, starting the renovation from the perspective of meeting their material and cultural needs. Throughout the renovation process, active promotion of resident participation is necessary, listening to their voices and suggestions to ensure the comprehensiveness and effectiveness of the renovation. Only through the joint efforts of residents, the government, experts, and businesses can comprehensive age-friendly renovations of urban old residential communities be achieved, providing a good living environment and services for urban residents. The long-term sustainable development of renovations is closely related to resident satisfaction and support, mutually influencing each other and shaping the

future of renovations.

Considering factors from various domains, including social, economic, and technological aspects, age-friendly renovations of old residential communities are a critically important project. The goal is to improve the quality of life for the elderly and promote the sustainable development of communities. Given the accelerated aging process, increasing trend towards smaller households, and growing health demands, exploring age-friendly design and renovation strategies suitable for the Chinese context in old residential communities is particularly important.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

NY conducted the research and data collection; NY statistical processing and data analysis; NY wrote the paper and made a major contribution to the theoretical part of the paper; BW Provide guidance for the paper, all authors approved the final version.

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