

The Theory and Practice of Ageing Housing Transformation in China and Abroad: A Review

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ABSTRACT

This paper investigates the theoretical research and practical exploration in housing the ageing in western developed countries and China after France first entered the ageing society. The subject of housing the ageing was reviewed using the methods of literature search and induction analysis. In terms of practical exploration, three basic models of ageing adaptation in developed countries were extracted: public welfare policy, nursing insurance system, and market economy. The objectives, objects, contents, advantages, and disadvantages of the transformation were analysed; the practical exploration and problems encountered in China's pilot cities for ageing adaptation were summarized. Through comparative analysis, it is proposed that we should learn from the advanced experience of western countries to avoid their shortcomings. It is also suggested that the



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transformation of the people, the content, and the processes to be adapted to suit the local conditions in China.

Keywords: *ageing housing; transformation; China; regulations and policies*

INTRODUCTION

According to the data from the National Bureau of Statistics, by the end of 2019, there were 176 million adults aged 65 and above, accounting for 12.6% of the total population (Sohu, 2020), showing a large base, rapid development, empty nest, and unbalanced characteristics. Influenced by the traditional concept, more than 90% of the elderly choose home-based care, and the pension model is 9073 (90% at home, 7% in the community and 3% at an institution). The implementation of a "multi-level elderly care service system based on home-based care for the aged" is a necessary condition for the realisation of home-based elderly care. In contrast, most of the existing residential buildings in China have a life span of 30-40 years. The design for ageing has not been considered at the beginning of the design, so it is urgent to carry out the transformation suitable for ageing. Through literature review, this paper combs the theoretical achievements and practical experience in ageing residential adaptation at home and abroad. It puts forward suggestions for ageing housing transformation suitable for China's national conditions, to promote the large-scale implementation of adaptive ageing transformation, help more elderly people to live in old homes, promote the smooth operation of a "multi-level home-based elderly care service system", which can concentrate the limited resources to meet the needs of the mentally retarded and disabled elderly and realise the optimal allocation of social resources.

Using 'ageing housing transformation' as the search topic, a total of 161 pieces of literature are found on the CNKI database, mainly articles and master theses, with a small number of conference and newspaper literature. The content mainly focuses on introducing foreign research and strategies for ageing housing transformation. Cases research is rare but Professor Zhou Yanmin of Tsinghua University published a new book named "Typical Cases of Ageing Housing Transformation of Urban Communities in China Abroad" in 2022, to fill this research gap while in the field of elderly care in

developed countries, it has experienced a change from "elderly care in hospital" to "elderly care with facility" to "elderly care at home". "The research scope covers current housing, new housing and commercial housing for elderly people. The study not only provides a safe and elderly-friendly environment but also takes into consideration the right of the elderly to choose their living style.

RESEARCH SIGNIFICANCE

Due to the high cost of socialized elderly care and different culture, home-based care is still the foundation of China's elderly care system. As mentioned above, over 90% of the elderly choose to live at home in China. As a result, the question of how to make them age safely has become a critical social issue. The first problem that needs to be addressed to achieve home-based care is the ageing housing transformation. To create elderly-friendly home spaces to help old people with the reduced functional capacity to live safely at home, it is necessary to review existing research and practice, and then construct elderly-friendly design improvements based on them. Thus, it is necessary to review China's and international research on ageing housing transformation.

Secondly, compared with developed countries, the income of Chinese households is not yet at a high level. In addition, some old houses are outdated in terms of function and style, but still structurally solid. Compared with rebuilding, ageing housing transformation only needs limited resources to improve house functionality and meet the needs of the elderly efficiently, so it is economical and environment-friendly, especially in a developed country like China. It is also more affordable for the average household and is in line with the concept of sustainable development idea in China's current situation. This can improve the energy efficiency of residents. Most importantly, it can quickly resolve the social pressure brought by China's "getting old before getting rich", so combining existing research and practice to improve ageing housing transformation is practical, significant and sustainable.

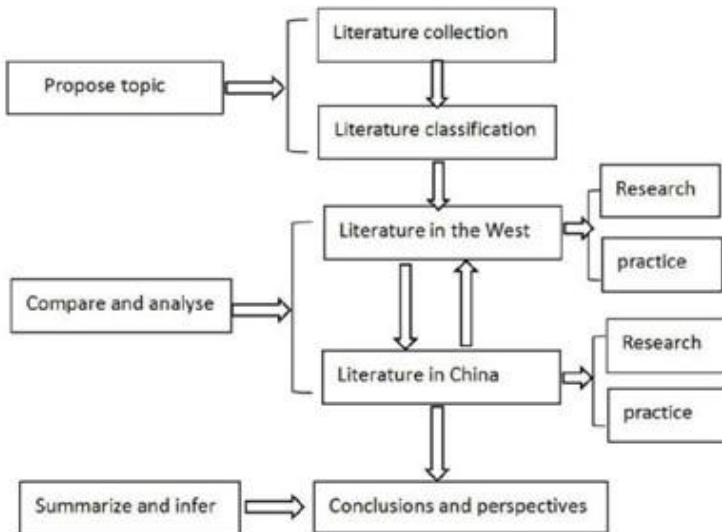
Thirdly, as mentioned above, due to the high socialisation cost of social pensions and the influence of cultural mindset, more than 90% of the elderly in China choose to age at home, constituting the basis of China's

pension system. Surveying and collecting data on ageing transformation research and practice can help designers to solve the practical dilemma faced by home-based care as soon as possible, and help most of the elderly to stay in their own homes independently and safely.

METHODOLOGY

As a review article, this paper mainly adopts research methods such as literature collection, literature classification, comparison and analysis, induction and deduction. Based on the collection of domestic and international literature in the field of ageing housing transformation, theoretical research and transformation practice will be sorted out according to the geographical fields of China and the western countries. By comparing and analysing the different conditions of China and the West, this paper will draw the advantages and avoid the disadvantages of the western countries, localize them according to the actual situation in China, propose suitable ageing housing transformation strategies for China in terms of transformation audiences, transformation contents and transformation processes, and offer perspectives. The research methodology is shown in Figure 1 below:

Figure 1
Research Methodology Flowchart



FINDINGS AND DISCUSSIONS

Review on Research of Ageing Adaptation in the West

In 1851, France was the first to enter the ageing society, followed by Sweden, Norway, Britain, Germany, and the United States. These western developed countries have entered the ageing society smoothly after the completion of industrialisation, that is, "getting rich first and then ageing", which has won the social foundation and response time for the academic community to research housing for the elderly.

The earliest monograph on old people's housing in the west is Sweden's "planning and construction of the old people's housing Stockholm". In the middle of the last century, relevant theoretical research began to emerge, such as the classifying of residential buildings for the elderly in Holland and the code for the elderly in Sweden. In 1967, "the residence for the aged in western countries" by Bayer and his team was one of the most influential Monographs in this field. In the last 70 years of the twentieth century, western architectural circles began to pay attention to the barrier-free design of elderly housing, focusing on the special needs of the elderly. Oscar Newman's "defensive space", as his representative work, significantly promoted the research of elderly housing. In the 1980s, the housing problem of low-income elderly has become the focus of attention. After the 1990s, the home-based care model combined with community service became the research focus. It is more comprehensive and scientific and centres the research object on the community environment and community service closely related to the elderly. Diane Carstens addressed the importance of outdoor spaces surrounding planned housing, which was often neglected (Carstens, 1993). Her book offered guidance on planning outdoor spaces to accommodate the needs of the elderly and a clear step-by-step format for easy reference.

Japan is the first country in Asia to pay attention to housing for the elderly. Its research feature is based on western theory and integrated with its national conditions and culture. It is more flattering, usually guided, organised, and promoted by the government, with substantial government participation. For example, the welfare law for the elderly was promulgated in 1963, which proposed the construction of public housing suitable for the elderly (Zhang, 2016). At the same time, the policy of giving priority to the

"families living with the elderly" was introduced. Subsequently, the general design standard for elderly housing was promulgated to clarify the design standards for the location, residential units, and living facilities of elderly housing. In 1995, it issued guidelines for constructing new residential buildings (e.g., Zhou, 2013). According to Carstens (1993), the relevant laws were proposed to ensure the safety of the elderly, in which a technical design code known as 'the design guide for the elderly housing' was introduced to recommend the elderly home be designed according to the occupant's physical function decline or disability case.

Japan pays close attention to research on universal housing (the so-called universal housing refers to the type of housing that can adapt to the changes in various stages of human life and can be enjoyed from birth to death) to reduce the cost of reconstruction in the future and to take care of the dignity and independence of the elderly. The design manual for the elderly, compiled by the housing Consortium for the elderly, mainly covers two sections: general design standards and design standards for different spaces. The spaces are divided into residential, public, and outdoor. They are equipped with basic standards and recommended standards, considering the basic demands of the elderly and flexible design, which has excellent reference value (Carstens, 1993).

Review of the Research on Ageing Adaptation in China

Domestic research began in the 1980s, which is different from the western countries' "practice first, then summarise". Domestic research focuses on the introduction of western theory. At that time, it focused on two aspects: the introduction of the elderly housing transformation in developed countries and the research on the indoor and outdoor environment of elderly housing. Professor Hu Renlu's residential environment design (Hu & Ma, 1995) for the elderly is the first comprehensive work on the indoor and outdoor environment of the elderly residence (Zhou et al., 2018). It introduces elderly housing, which is based on the survey of the needs of the elderly and discusses the principles and methods of indoor and outdoor space design for the elderly.

The research on old residential buildings in China is based on newly built houses. However, there are few studies on the suitable ageing transformation of existing houses. Starting from the shortage of old houses,

Shandong University's "transformation of the old houses for the aged" explores the suitable transformation of the interior space of the houses, considering the outdoor environment and facilities, focusing mainly on the theoretical discussion.

The research on the ageing of multi-storey residential buildings in Guangzhou area by the South China University of Technology (Lei, 2013) summarises the living status of the elderly in Guangzhou. It puts forward the technical transformation method of internal space by case method, which does not involve policy, economic or social aspects. Table 1 summarizes the relevant regulations and policies for ageing adaptation in China.

Table 1
Review of relevant regulations and policies for ageing adaptation in China

Name of Code	Content
Code for the design of residential buildings for the elderly (GB / t50340-2003)	It stipulates the indoor technical design of residential buildings for the elderly, that is, the housing configuration, area standard, and space size of indoor buildings are not included in the ageing transformation.
Code for architectural design of pension facilities (GB / 50867-2013)	It stipulates the design requirements of elderly living, medical care, public activity rooms, transportation facilities and other elderly facilities.
Code for planning facilities for the elderly in urban areas (GB / 50437-2007)	It proposes planning requirements for new construction, alteration, and expansion of facilities for older people in urban areas.
The 12 th Five-Year Plan for the development of China's ageing cause	It formulated the medium and long-term planning policy of combining a family pension with a social pension. It is suggested that family and community endowment should be the leading factor in developing social pensions and actively creating a new pension model in line with China's national conditions.
Some opinions of the State Council on accelerating the development of the pension service industry	It is proposed that the system of elderly care service be based on home, community and institution, and the consumption market for the elderly has initially taken shape. Generally, there are some problems, such as the insufficient supply of pension services and products, imperfect market development and unbalanced development of urban and rural areas. In the new period, we should actively face the ageing problem and promote the healthy development of social pension services.

Opinions on the formulation and implementation of elderly care service projects (No. 52) of the State Council of the People's Republic of China (No. 52)	It proposed to vigorously promote the construction of liveable communities and friendly cities for the elderly, strengthen the transformation of ageing facilities in communities and families, and prioritise the installation of elevators in residences with a high proportion of elderly residents. It is the crucial work content of the Ministry of Housing and Urban-Rural Development on the construction of elderly service facilities during the 13 th Five-Year Plan period.
Science and technology and industrialisation development centre of the Ministry of Housing and Urban-Rural Development	Since 2016, the science and technology and industrialisation development centre of the Ministry of Housing and Urban-Rural Development has actively promoted the implementation of relevant standards, such as the evaluation standards for old-friendly cities, the technical specifications for the ageing transformation of existing buildings, the applicable technical regulations for ageing adapted transformation components, the evaluation standards for liveable communities for the elderly, the technical specifications for the construction of social pension service stations, and the anti-skid and anti-bacterial land for the elderly. Six Standards of brick have been approved.
Industry Committee for the Aged of China Building Decoration Association	In October 2017, the Industry Committee for the Aged of China Association of Building Decoration compiled the evaluation standard for China's environment suitable for the elderly and invited builders, pension, architectural decoration design, materials, construction, auxiliary equipment for the elderly, landscape greening, health and other related enterprises to participate in the compilation. The standard is mainly applicable to the decoration of residential buildings for the elderly, pension institutions, the health industry, home care for the aged and to promote the standardisation process of the ageing industry in China
CHARLS database	It provides data support for the current situation of China's ageing population and the need for transformation.

The Practice of Adapting to Ageing in the West

In the 1970s, after solving the housing problem, western countries began to adapt to the ageing of old houses. By the 1980s, the transformation of old houses in Europe accounted for half to one-third of the total housing construction. The renovation measures adopted by various countries mainly

include revising the housing construction standards and formulating the restoration plan of old residential areas; subsidising individuals and groups to carry out the reconstruction of old houses, utilising subsidies, tax reduction, and loans; revising the housing policies and regulations to encourage private enterprises to enter into the housing maintenance including ageing adaptation.

There are three models of ageing adaptation in developed countries. One is the transformation based on public welfare policies, such as in Denmark and Sweden, which are characterised by high welfare and fair sharing of social resources; the second is the nursing system dominated by non-profit organisations and supplemented by the government, such as in Germany (Lu, 2014), the Netherlands and Japan (National Careers Support Council, 2009); the third is the ageing adaptation transformation based on the market economy, with the typical representative of the United States and the commercial operation to meet the needs of the ageing population to reduce the pressure on the government (Yao et al., 2017). Table 2 highlights the ageing adaptation model in developing countries, which include Sweden, Denmark, Germany, Netherlands, Japan, Canada, and the United States of America. Research showed that a favourable attitude towards home transformation was the key predictor: people who perceived that transformation might improve their performance in daily activities were four times more likely to have their homes renovated (Gosselin, et al., 2009).

Table 2:
Ageing Adaptation Model in Developed Countries

Types	Based on public welfare policy	Based on the nursing insurance system	Based on the market economy
Country	Sweden, Denmark	Germany, Netherlands, Japan, Canada	U.S.A
Transformation Goal	To prolong the time of living at home as much as possible and "live in your own home for life".	The nursing insurance system is led by non-profit organisations and supplemented by the government.	Basic transformation for all the elderly.
Transformation audience	Provides necessary help to everyone.	Universality	Universality

Transformation content	Eliminates the threshold height difference, toilet renovation and other economic conventional projects, the capital is not set an upper limit, choose low-cost construction method: if you want to improve, you need to pay the difference.	Gives differentiated services and financial subsidies according to different health statuses and daily activities.	The renovation of the barrier-free toilet and kitchen, stairlift, outdoor ramp, handrail, barrier-free toilet and the widened channel is not included in the renovation scope.
Implementation process	Unlimited application times; 1 week approval time, 1-2 months from application to completion.	It supports the upper limit of 2500 euro/case, and the application frequency is less than one time/year. If the project is not repeated, the application can be made multiple times, and freely controlled after approval.	It is coordinated by the ageing office and implemented through the ageing agency.
Advantages	High welfare / advocating fair sharing of social resources.	Flexible determination of funding proportion and scope.	The government support funds should not exceed 150 US dollars, and the reconstruction costs must be integrated with other channels or at their expense.
Dis-advantages	Lack of participation in architectural design, no fixed standard of funds	"Improper collection, friction with construction party" without review of construction party/ Lack of coordination among departments.	The content of the transformation is not rich enough.
Lesson Learnt	Consider recycling, such as metal ramps vs concrete ramps.	Universal benefit/ Standard construction and guaranteed quality.	Various market projects are suitable for ageing transformation, and the government has little pressure.

The United States and Canada have carried out the "certified ageing in place specialist" training in terms of the ageing industry. The certified personnel need to have the ability to assess the needs of home environment ageing adaptation, put forward transformation plans and formulate transformation plans. The applicants include nurses, rehabilitation practitioners, and construction and management practitioners. Their backgrounds are diversified, reflecting the comprehensiveness of caps and are in line with the practical requirements.

The practice of Ageing Adaptation in China

The existing residential buildings are suitable for ageing transformation but are not carried out in China. The outdoor transformation focuses on the greening of residential areas, public activity spaces and supporting facilities. In contrast, the indoor transformation mainly includes the building entrance and exit, vertical traffic, and the residence's interior. The installation of elevators in old multi-storey houses has attracted much attention.

Xiamen, Nanjing, Shanghai, and other cities have taken the lead and carried out small-scale transformations in the old residential areas, mainly by government purchases and carried out by social organisations. For example, Shanghai has listed the transformation suitable for ageing as a practical government project since 2012. Led by the municipal civil administration and funded by the social welfare lottery fund, housing for 1000 families with low-income security difficulties has been renovated free of charge every year. This project is based on practical experiences. At the same time, it also exposes some significant problems such as "transitional residence, fairness and contradiction between supply and demand". The current ageing adaptation transformation is in its infancy. Hence, public awareness of its existence is low.

Compared with the ageing transformation in Shanghai, installing elevators has become a hot spot in Guangzhou. In the 1980s and 1990s, many 7-10 floors of multi-storey residential buildings were built in Guangzhou. With the growth of the residents' age and wealth, the original vertical transportation mode could not meet the travel requirements of residents, and the demand to install elevators has increased yearly. In 2012, Guangzhou issued the Trial Measures for adding elevators to existing

residential buildings in Guangzhou, which defined the applicants for adding elevators (Zhang, 2016). However, due to the cost-sharing problem, it can still not promote this practice on a large scale. Therefore, in 2014, the "reference standard for sharing expenses by raising funds by adding elevators to existing residential buildings in Guangzhou" was issued, providing professional compensation scheme guidance, solving difficulties, and achieving certain results. The critical point of the ageing transformation of Beijing's residential buildings is to install elevators. The Civil Affairs Bureau selects the evaluation service agency to evaluate and decide on the transformation service provider through bidding.

The first ageing experience centre in Sichuan Province opened in Chengdu in 2017, focusing on the space, furniture, and facilities suitable for ageing transformation. The elderly can experience and choose flexibly. In 2017, the Xiamen ageing office launched the pilot project of suitable ageing transformation, focusing on two aspects: one is the public places in the community, including ladder slopes, installation of handrails, installation of rest facilities, and the removal of walking barriers. In 2017, the Jiangsu Provincial Department of Housing and Urban-Rural Development held a special demonstration meeting on the guidelines for the ageing of existing residential areas in Jiangsu Province to promote the transformation of existing residential areas to adapt to ageing. In terms of the market, Beijing, Chengdu, and other cities have already had professional transformations suitable for ageing which include decoration companies, business covers barrier-free design, water and electricity transformation, emergency rescue device and toilet redesign. In e-commerce platforms such as Jingdong and Taobao, sales of "products suitable for ageing transformation" have also begun to appear. The experience, lease, and purchase volume of pension service products are also rapidly increasing.

The differences between Chinese and Western pension cultures and the national conditions of geographical regions determine different pension demands. First, the western family relationship is relatively loose, the family concept of elderly care is not strong, and the acceptance of institutional elderly care is high, while the Chinese family's sense of belonging is strong and most of the elderly tend to live in peace and security. Secondly, the current 70-year-old Chinese have experienced the era of material shortage and are diligent and thrifty. China is still a developing country, and the ageing housing transformation is more in line with China's national

conditions, so we should not copy mechanically what we learn from the West. We should combine the national conditions, learn from the advantages, avoid the disadvantages, and localise and optimize them based on the following aspects:

Transformation of audience: Western countries are gradually entering the ageing society, showing the state of "getting rich first and then ageing", while China is accelerating to enter the ageing society, showing the characteristics of "getting old before getting rich", which has produced tremendous pressure on the society. Therefore, inclusive transformation should be the goal of China's ageing transformation.

Transformation content: the older adults in China have a large base, most of them are concentrated in old houses in old urban areas, and the local economy is different. Therefore, the reconstruction contents should be flexible and based on the module design as well as adopt the recyclable design to reduce energy consumption.

Transformation process: Sweden and other countries have no systematic design scheme and no builder's audit, which leads to no standard subsidy and "improper application". Therefore, it is necessary to emphasise the coordination among relevant disciplines and design a set of collaborative operation transformation processes.

Research prospects: China has a large population of the elderly, so it still needs much investment to implement the transformation of housing suitable for ageing. It is a wise choice to carry out standardised design and construction. At the same time, the digital era brings more opportunities for the renewal of elderly housing. The linkage and symbiosis of housing and community make it indispensable to optimize the environment and facilities suitable for the elderly in the community.

CONCLUSION

In conclusion, China is still a developing country, and the ageing housing transformation should align with China's national conditions and government policies. As such, we should not copy mechanically as we learn from the West. We shall implement inclusive transformation, considering

flexible and foresight reconstruction materials for a green and sustainable building, collaborative operation transformation processes and digitalisation and automation for the convenience of elderly care. Moreover, it is effective for the self-care elderly and the intermediary elderly to adapt to the ageing housing transformation. Therefore, optimising institutional pension buildings, such as apartments for the elderly, is more urgent when the elderly enter the nursing care stage.

In the follow-up study, the application strategy of standardised design and intelligent systems in elderly housing will be involved, considering the community environment and institutional pension buildings, to improve the cost performance and energy level of ageing transformation.

CONTRIBUTIONS OF AUTHORS

Zhang Junli contributed to the conception and manuscript writing, Musdi bin Hj Shanat contributed to the literature review, Ma Xiaoyuan contributed to the literature collection and analysis, and Khong Heng Yen helped with the language translation and modification.

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CONFLICT OF INTEREST

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