PROPERTY
RESEARCH
TRUST

How the built environment shapes an age-friendly community: Evidence from Guangzhou, China

Dr Ka Shing, Cheung
Dr Ling-Hin, Li
Dr Fan, Wu

APRIL 2023

The Property Research Trust is a charity registered in the UK and regulated by the Charity Commission, registered number 1085587. Companies House registered number 4044051.

Registered office 5th Floor, 167-169 Great Portland Street, London, W1W 5PF, UK

Property Research Trust

About the Property Research Trust Formerly the RICS Research Trust, we are an established grant-awarding charity, supporting research across the disciplines of land, real estate and construction. We have a strong track Property Research Trust record of delivering and disseminating high quality, independent knowledge and future thinking. We fund research globally. propertyresearchtrust.org

DOI: 10.52915/DSSE8667

Authors

Dr Ka Shing, Cheung (BSc, MPhil, MSc, PhD HKU, MRICS, PINZ)
Senior Lecturer in the Department of Property at the University of Auckland Business School.

Dr Ka Shing obtained his PhD from The University of Hong Kong (HKU). His research focuses on property markets, including understanding the roles governments and institutions can play in shaping sustainable housing markets. The roles that he is taking in the National Science Challenges (BBHTC) and other international contestable funded research projects empower him to contribute to government policy discourses on housing policies. He is a chartered surveyor at the Royal Institution of Chartered Surveyors (MRICS) and a full member of the Property Institute of New Zealand (PINZ).

Dr Ling-Hin Li (BSc Reading; PhD HK; MRICS; MHKIS; RPS (GP); SFHEA)
Land policy analyst, Associate Professor and Programme Director of the BSc in Surveying in the Department of Real Estate and Construction, University of Hong Kong.

Dr Li was the Associate Dean (Teaching and Learning) in the Faculty of Architecture, the University of Hong Kong, between 2016-2018. A Fulbright Hong Kong Scholar in 2006, Dr Li has a wide range of research interests in social and economic aspects of land use policy, more specifically in urban land regeneration, the impact of the built environment and urban development. Dr Li has written over 50 refereed journal papers in these areas and a number of academic books.

Dr Fan Wu
Assistant Professor in the Department of Real Construction Management, South China University of Technology.

Dr Wu's research focuses on Housing Environment and urban development. She has received a BSc in Construction Management from Tongji University in China and a PhD from the University of Hong Kong. Dr Wu has years of experience working as a project director on real estate consulting on more than 30 projects in China.

Acknowledgements

This study was funded by the Property Research Trust. The authors would like to thank Sarah Sayce and Edward Yiu of the Property Trust for their support. We would like to express our particular appreciation to Ms Yingyan Zeng at the Department of Construction Management, South China, the University of Technology, for her assistance with the survey and sampled statistics used in this report. We also wish to thank Ms Chuyi Xiong for her valuable technical support on this project.

Table of contents

Figures

Tables

Foreword

The global population is not just growing, it is also becoming older and increasingly based in urban areas. These trends have important implications if we are to create built environments where people of all ages can live and be treated with respect. In China, the concept of 'ageing-in-place' has been introduced already as a government priority.

This study identifies key areas which make a community more age-friendly and gaps where there are opportunities for technological advancements to be brought to bear. This will have the pleasing outcome of creating happier communities and ultimately reduce the burden on the public health system.

In addition, this important research identifies concrete policy areas to help local governments in China develop long-term strategic plans for urban regeneration programmes which incorporate the needs of senior citizens.

I am delighted that the Property Research Trust has been able to provide a home for this research and I am grateful to the distinguished team of academics who undertook the research and who have written this report.

Alan Dalgleish
Chair, Property Research Trust

Key messages

- Recognising the global phenomenon of an ageing population, creating environments where people of all ages can actively participate and be treated with respect becomes a priority.
- The concepts 'age-friendly community' or 'ageing-in-place' start to emerge and have been used to describe some of these strategies and initiatives.
- In China, the concept of age-friendly environments was first introduced in 2007 and became the prioritised task for the government in 2009.
- This study examines the prioritised critical components of the built environment in shaping such age-friendly communities in the Chinese context.
- The results suggest that senior citizens view different community and environmental attributes as positive or negative elements in contributing to an ideal age-friendly community, and their satisfaction is non-linear in nature.
- The Kano model, or the equivalent prioritisation frameworks, should be adopted to prioritise initiatives when implementing an aged-friendly community.
- Ageing-in-place with a more accommodating community will also help reduce the burden on the public health system.
- Our study also shows that there is a gap for developing high-tech health-related supporting facilities that will also contribute to a better age-friendly community.
- In a well-planned aged-friendly community, advances in technologies such as GPS tracking systems, online medical consultation and gadgets that foster the psychological wellness of senior citizens should be considered.
- Technology-related facilities are especially crucial for the current demographic of retirees because the mobile technology that millennials are able to enjoy was still very rudimentary when they were young and working hard to contribute to the economy.
- In general, for improving the age-friendly community of the community, resources, emergency equipment, green landscape, fitness and sports venues, and smart care services are those aspects prioritised to enhance experience.
- In general, for improving the age-friendly community of the community, resources, emergency equipment, green landscape, fitness and sports venues, and smart care services are those aspects prioritised to enhance experience.
- For attributes, there could be a different emphasis on construction and operation stages. In the construction stage, the community will attach higher importance to the must-be attributes. In the maintenance and redevelopment phase, however, the community will pay more attention to the attractive qualities with the highest operational efficiency.
- Our analysis asserts their roles in creating an age-friendly community for professionals in the built environment, such as surveyors and planners.

Executive summary

Discussion

The world is experiencing two demographic transitions, i.e., ageing population and urbanisation. By 2050, the global population is expected to increase by 2 billion to 9.7 billion in the next three decades, with the age group of 65 and over growing the fastest (UNDESA, 2019). In 2018, for the first time in history, persons aged 65 or above outnumbered children under five years of age globally. The number of persons aged 80 years or over is projected to triple, from 143 million in 2019 to 426 million in 2050. These trends suggest that ageing populations are a global issue across the world, in particular those developing countries. In five decades, it is estimated that over 80% of the global elderly population will be living in developing countries compared with 60% in 2005 (UNDESA, 2009).

Recognising such a global phenomenon of an ageing population, creating environments where people of all ages can actively participate and being treated with respect becomes a priority. This is particularly relevant in the current economic climate, where service providers face challenges in providing the needs of the elderly in a time of austerity and shrinking health care budget.

Traditional institutional care that hospitalised the elderly and keeps older people apart is also no longer desirable and perpetuates a negative view of ageing. Most OECD countries are committed to reducing the number of elderly living in institutions (OECD 2003:11). “The ageing process should no longer be viewed as an inevitable economic and social isolation from the rest of the community” (OECD 2003:173).

Given that the elderly requirement for specialised and resource-intensive services has been increasing, various strategies and initiatives are developed to meet the specific needs of older people in recent years. The concepts of age-friendly community or ageing-in-place start to be used to describe some of these strategies and initiatives.

Developing an aged-friendly community to ageing-in-place allows older people to remain in a community, either in their family homes or in supported accommodation of some shape and form, rather than moving into residential care. Living in an aged-friendly community also implies living independently of other family members. There has been a decrease in intergenerational living in most developed countries, even for frail older people (OECD 2003).

In this study, the term age-friendly is defined as these ageing initiatives based on the idea that places should enable older persons to be satisfied

in participating in their community. The term arises from an ecological perspective that an individual is intrinsically connected to their physical and social environment. When we better understand how a friendly built environment helps the elderly age in their place, it will allow more social resources to be reallocated and more focused to improve more elderly in need. The benefits of an age-friendly community include allowing people to easily stay connected with each other, helping people remain active and healthy, supporting people who cannot look after themselves to live with dignity and enjoyment, and treating everyone with respect.

However, the urban environment presents a complex setting to promote the wellbeing and contributions of older people (WHO, 2007). As issues involving ageing society in each country are almost unique, helping the elderly age in place requires a flexible and evolving environment to compensate for the physical and social changes associated with ageing.

When urban living becomes the predominant social context for most populations globally, it can directly and indirectly shape various factors within populations. Therefore, it is essential to consider the localised impact of various factors in the built environment on older people. This article will focus on how the built environment affects elderly satisfaction and summarise the current evidence of approaches and interventions used to make our cities more supportive of older persons.

An age-friendly community is a place where one can stay connected, healthy, active, and respected regardless of an individual's age. The global Age-Friendly Cities Project was started in 2006 by the World Health Organization (WHO, 2006). Many countries are taking part with hundreds of cities and communities involved. The project focuses on supporting healthy ageing in a community and has evidence-based research to find out what was currently done to support older people.

Eight key areas are identified to make a community more age-friendly: outdoor spaces and buildings, transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication and information, community support, and health services.

To address the challenges posed by the global ageing population, the World Health Organization (WHO) advocates age-friendly communities to foster the development of active ageing community initiatives. Although age-friendly communities are believed to be a promising way to help senior people have healthy and active lives, little is known about how these communities best foster positive health, social participation, and health equity.

China is chosen as the case because the country is one of the fastest ageing countries in the world. According to the National Bureau of Statistics of China (2020), the total population of 60 and above was more than 230 million at the end of 2050, accounting for 16.7% of the total population. In China's 12th

Five-Year Plan, the government proposed a “9073” old-age care pattern, of which 90% of older adults would be cared at home, 7% would be cared for in communities, and 3% would be cared for cared in institutions. Based on this policy, it is conceivable that up to 97% of Chinese older people will reside in their homes and communities. Thus, building age-friendly communities is an imminent issue that is closely related to most Chinese elderly and their wellbeing.

In China, the concept of age-friendly environments was first introduced in 2007 and became the prioritised task for the government in 2009. A nationwide campaign called “age-liveable community” was pioneered to create a favourable living environment for the elderly in urban China (National Working Commission on Aging, 2016). Moreover, a liveable environment was written as a separate chapter in the People’s Republic of China’s revised Law on Protection of the Rights and Interest of the Elderly in 2012, which provides a legal foundation for promoting age-friendly environments.

Given the importance of policies of age-friendly communities in China, a relatively few systematic evaluations of the built environment of a community’s impact on the elderly. There have not been many comprehensive studies assessing age-friendly communities and their impact on older people’s well-being in a Chinese context.

This study aims to better understand the critical components of the built environment in shaping such age-friendly communities. Specifically, the research objectives for a study in Guangzhou, China, are as follows.

1. To examine and understand how senior citizens view different community and environmental attributes as positive or negative elements in contributing to an ideal age-friendly community.

2. Using a customer satisfaction analytical framework based on the Kano model, identify and examine the main factors contributing to satisfactory age-friendly communities.

3. To empirically test the importance of the factors identified, by detailing a case study of a community, thereby enabling general conclusions to be drawn.

This study adopted a Kano model analysis to examine the relative importance of various features of housing communities in Guangzhou, China, in contributing to the age-friendly community. The Kano Model prioritises customer preferences and classifies them into five categories. Product teams can weigh a high-satisfaction feature against its costs to implement to determine whether strategically including a particular product feature into the product development roadmap.

The Kano Model is one of the most established prioritisation frameworks designed to help product teams prioritize initiatives. For example, Kano can help teams determine which features will satisfy and even delight customers.

Product managers often use the Kano Model to prioritise potential new features by grouping them into categories. These feature categories can range from those that could disappoint customers to those likely to satisfy or even delight customers.

The reason for adopting the Kano model in this report is to overcome the drawback of the traditional two-sided views on customers' satisfaction. Many built environment factors cannot be regarded as either good or bad. To illustrate such non-linear satisfaction, one may consider the provision of wi-fi in a hotel. Modern hotels spend considerable money installing wi-fi, but it is rare for guests to be impressed by this amenity.

However, if wi-fi were not available, this would inevitably result in many complaints. The Kano analysis can help disentangle such complex relationships. Industries such as healthcare are adopting such analyses to construct generalisable frameworks to enhance health care provision. Similarly, the model allows constructing a general framework capturing the non-linear and critical factors of the built environment that shape age-friendly communities.

Applying the Kano model supplemented by further quantitative analysis and a case study, we found that the senior citizens in Guangzhou have a strong sense of security within their community, which allows them to enjoy outdoor activities more. The results also indicated that social organisations and even semi-political institutions such as neighbourhood committees are critical links between community conditions and residents' satisfaction. It was also noticeable that senior citizens were the least satisfied with accessible amenities and day-care services.

For attributes belonging to different KANO classifications, there are also different strategies for construction and operation. In the construction stage, the community will attach higher importance to the must-be attributes, usually "taken for granted" by the senior citizens. In the maintenance and redevelopment phase, however, the community will pay more attention to the attractive qualities with the highest operational efficiency.

This means that a proper focus on these attributes strategically may lead, among the senior citizens, to a substantial rise in satisfaction with relatively little investment. Moreover, for the one-dimensional attributes, the community design team should balance the two dimensions, namely the design and construction phase and the operational dimension.

In general, for improving the age-friendly community of the community resources, the prioritised attributes to be enhanced are emergency equipment, green landscape, fitness and sports venues and intelligent/smart care services. On the one hand, in most Chinese cities, the development of smart communities is still more a concept than an action plan, and emergency equipment and smart care services are uncommon, especially in older

communities. On the other hand, limited by location and land resources, most communities will reduce the areas allocated to green landscapes and physical exercise. Most senior citizens are already accustomed to the inadequacy and imperfection of such facilities and services. Hence, if a community can be equipped with these factors to achieve excellent performance, senior citizens will be surprised and more satisfied.

Another essential aspect to consider in position aged-friendly community is amenity and daily life facilities. When senior citizens are required to travel long distances to access amenities or daily facilities, their constrained physical capacity will make them feel exhausted. When the community performs well in providing appropriate amenities and daily life facilities, the senior citizens will feel much satisfied compared to other enhancements or modifications.

The concept of “ageing-in-place” is still a relatively new idea in China, and support from communities needs to be enhanced. From a policy point of view, we argue that future community planning in China needs to consider the concept of “ageing-in-place”. To facilitate the implementation of “ageing-in-place,” it requires a better understanding of the elderly’s satisfaction with a community and hence creates an aged-friendly community.

This study shows that the senior citizens in Guangzhou are generally relatively satisfied with urban design variables such as urban landscape, road safety, and outdoor lightings. Healthcare services and hygienic conditions in their community are less satisfactory in Guangzhou than other cities. This may be a common situation for many old cities where sanitary infrastructure development may not have been well-planned and well-coordinated during urbanisation.

Moreover, the senior citizens are less satisfied with amenity and entertainment services provided in their community. From a commercial point of view, senior citizens are usually not the target consumer groups for the amenity and entertainment service providers. Hence, more consideration may be needed from the public sector.

At the other end of the scale, the two least satisfactory factors were “amenity” and “day-care service”, both of which had a relatively low score on satisfaction. This implies that the current design criteria of housing communities in China still do not factor in the needs of the senior citizens, especially concerning providing them with accessible amenities and day-care services.

Given the high-density urban development in most metropolitan cities in China, such as Guangzhou, it is challenging to reshape or modify old communities on a piecemeal basis. This implies that from a policy point of view, local governments in China need to develop long-term strategic plans in relation to urban regeneration programmes that would take care of the growing number of senior citizens. In any case, ageing-in-place with a more

accommodating community will also help reduce the burden on the public health system because a healthier generation of senior citizens will have lesser demand for hospital facilities, which could be directed to other patients with more urgent needs.

Finally, our study shows a gap for developing high-tech health-related supporting facilities that will also contribute to a better age-friendly community. In a well-planned aged-friendly community, advances in technologies such as GPS tracking systems, online medical consultation and gadgets that foster the psychological wellness of senior citizens should be considered. Technology-related facilities are especially crucial for the current demographic of retirees because the mobile technology that millennials can enjoy was still very rudimentary when they were young and working hard to contribute to the economy.

For professionals in the built environment, such as surveyors and planners, our analysis has implications for enhancing their role. First of all, land use planning that caters to senior citizens' needs is of utmost importance. Features that contribute to a safe environment, such as separating vehicles and pedestrians, will encourage senior citizens to carry out more physical exercises of various sorts.

In addition, elements that facilitate outdoor activities by the senior citizens and other age groups should also be incorporated into facilities management plans, so that the community's common areas can generate a more welcoming atmosphere. These considerations should be part of the development plan, especially when urban regeneration schemes are being contemplated.

Chapter 1
Towards an age-friendly community

In many cities around the world, developing an 'age-friendly' built environment in response to the needs of the growing elderly population has become a major social trend. There are several reasons for this. First, the worldwide trend to an ageing population and rapid urbanisation creates substantial housing shortages among the senior citizens in major cities (Li and Shen, 2013; Abramsson and Andersson, 2015; Chan and Ellen, 2017). The concept of an age-friendly built environment is widely regarded as key to addressing this challenging trend (Geller, 2015; Jeste et al., 2016; Menec, 2017).

Second, the increasing popularity of the retirement community triggers discussion of how senior citizens' quality of life is being influenced by changing social networks, inclusive activities, diversity and the built environment (Evans, 2009). Third, the various "ageing-in-place" policies advocate that older people should stay in their own homes and communities after retirement for as long as possible, thereby avoiding costly options of institutional care and underscoring the imperative for a global 'age-friendly community' concept (Lui et al., 2009). Different aspects of the age-friendly environment attract different research interests.

This report, informed by an "ageing-in-place" approach, examines the satisfaction level of various community planning and design attributes from the perspective of senior citizens.

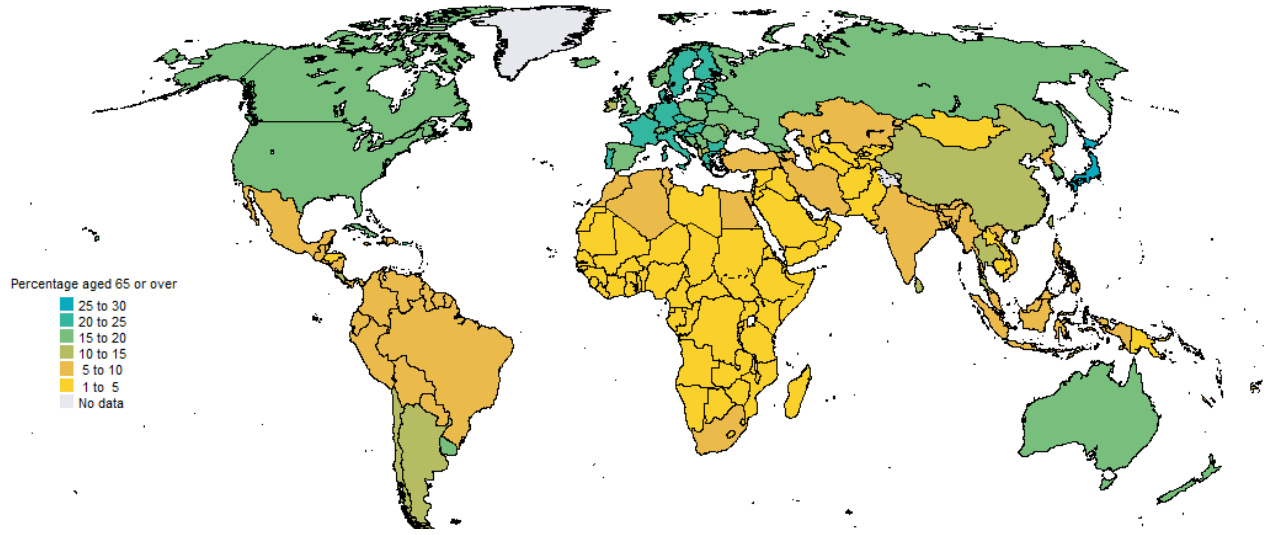
Global ageing and social responsibility

Addressing grand societal challenges through research, and engaging local stakeholders, are keys through which a community can develop its approach to "ageing-in-place". The WHO (2009, p.1) defines an age-friendly city as one that is: '…an inclusive and accessible urban environment that promotes active ageing…' The notion of 'active' refers to the idea that older people should be able to continue not just to participate in the labour market and to be physically active, but also to be involved in social, cultural, spiritual, economic and civic matters (WHO, 2002).

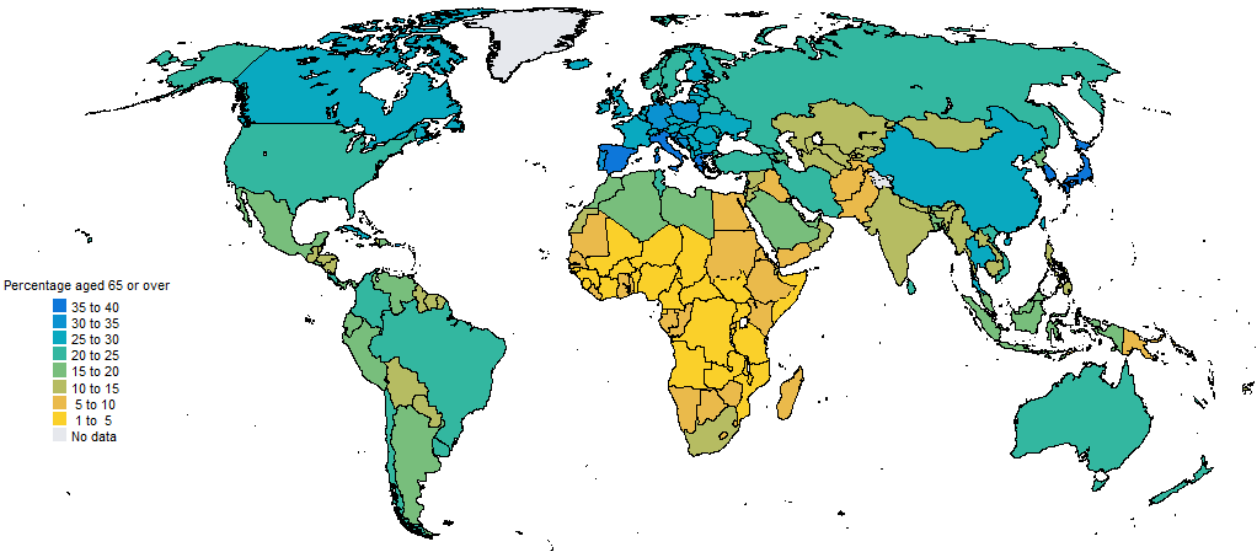
This idea was taken further in 2007 when the WHO launched the 'Global age-friendly cities' project.

WHO (2007) conducts focus groups with older people, caregivers, and service providers in 33 cities around the world to identify those factors that make urban environments 'age-friendly?' A resulting checklist of action points has addressed aspects of service provision (e.g., health services, transportation), dimensions of the built environment (e.g., housing, outdoor spaces and buildings) and social aspects (e.g., civic and social participation). This work concluded that progress in developing these actions should make cities 'friendly for all ages' and not just 'elder-friendly'. It should be standard in an age-friendly city for the natural and built environment to anticipate users with different capacities instead of designing for the mythical 'average' (i.e., young) person.

Percentage of population aged 65 or over, 2020



Percentage of population aged 65 or over, 2050 (medium-variant projection)



The age-friendly approach has been highly influential in raising awareness about the need to adapt urban environments to the demands of an ageing population. However, research is needed to examine the full range of approaches required (Buffel and Phillipson, 2016). Indeed, age-friendly approaches require supportive environmental attributes that may compensate for the lack of personal resources in lower-income groups of senior citizens. Consequently, the impact of the environment on different socio-economic groups may be disparate (Engel et al. 2016).

Eight essential domains for an age-friendly community

The WHO introduces eight domains of liveability that make an age-friendly community (Figure 1). These are: 1) outdoor spaces and buildings; 2) transportation; 3) housing; 4) social participation; 5) respect and social inclusion; 6) civic participation and employment; 7) communication and information, and 8) community support and health services.

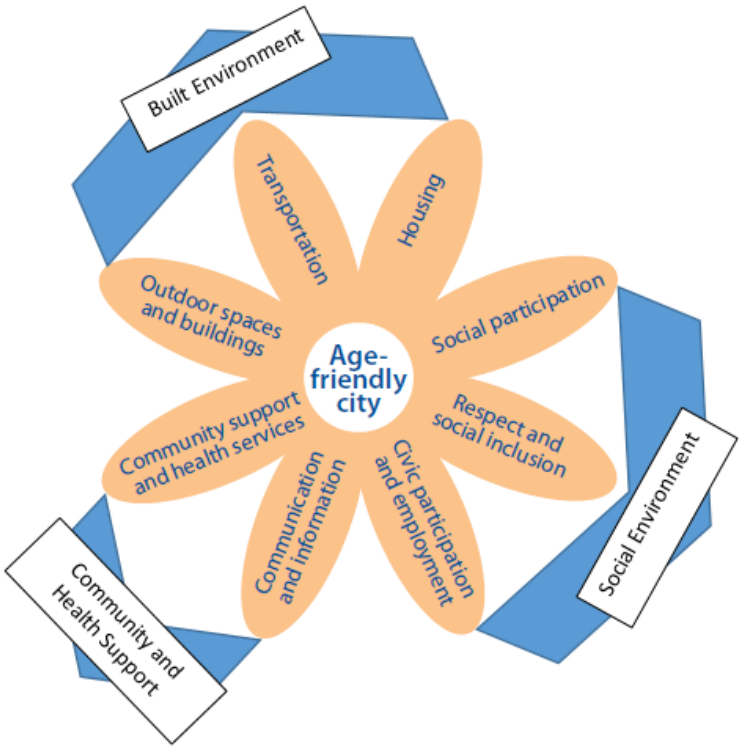


Figure 1: WHO eight domains of liveability for age-friendly communities
Source: Black, Badana and Hyer (2016) based on WHO (2007).

These domains can be clustered into three major groups: 1) built environment (i.e., transportation, housing and outdoor spaces); 2) social environment (i.e., social participation, civic participation and employment, respect and social inclusion) and 3) community support (i.e., community supports and health services, and communication and information).

These eight domains, covering the social and the built environment, are areas

that communities can address to improve their structures and services to meet the needs of older people and others as they age.

Outdoor spaces and buildings are one of the eight domains of age-friendly communities. The outside environment and public buildings have a significant impact on independence and happiness in daily life. The WHO age-friendly cities guide describes an outside age-friendly environment: easy to get there, feeling safe when out and about, the cleanliness of green or natural spaces, places to rest, and access to buildings. Accessible public buildings, walkable spaces, including parks, seating and public loos, all contribute to being age-friendly and can make a difference to people of all ages and abilities.

Transportation is another domain of an age-friendly community. Whether the elderly can access public transportation services or alternative options in a community is essential. Looking at every dimension of transport infrastructure, equipment, and services are integral to creating an age-friendly community. The most frequent reasons for not using public transport among those 65 and over are that it is not convenient and does not go where they want. Add on to that the fact that driving rates decrease with older age, and the need for better transport in age-friendly communities starts to become apparent. Before the COVID-19 pandemic, rural areas were already facing enormous challenges connecting those within the community to each other, but the virus has forced places to radically adapt.

Housing allows people in later life to age comfortably and safely within their community which is another essential element in an age-friendly community. More than 80% of homeowners aged 65 and over want to stay where they are. For example, in the U.K., 20% of homes occupied by older people in England failed the Decent Homes Standard in 2014. In age-friendly communities, information about what is on, where, when and how to get there helps promote social participation, as does the encouragement for people to have a ‘places to go and people to see’ attitude.

Respect and social inclusion Feeling valued and respected is essential for older people from all backgrounds. The WHO also advises that an age-friendly community includes education about ageing, intergenerational activities and respectful and inclusive services. Older people report experiencing conflicting types of behaviour towards them. Many feel they are respected, while others experience a lack of consideration.

The WHO uses anecdotal evidence to recommend that age-friendly communities could help keep older people engaged in paid or unpaid work through processes including better transport to the workplace, accessibility and increased employer flexibility. Good quality volunteering in later life has a measurable positive impact on mental health. Furthermore, paid work can have a positive impact on wellbeing as well as finances. Nevertheless, the opportunities for this diminishes with age: 72.3% of people aged 50-64 are in work, compared to 85% of people aged 25-49.

Communication and information is another domain of an age-friendly community. Staying connected with events and people and getting timely, practical information to manage life and meet personal needs is vital for active ageing. In an age-friendly community, ensuring information is accessible to older people involves using plain language, oral and print communication and ensuring electronic equipment and automated services are easier to use. While most information is now shared online, many people aged 60 and over have never used the internet. The information may be out there, but it is not always accessible for the elderly.

Community support and health services are strongly connected to good health and wellbeing throughout life, alongside accessible and affordable health care services. The provision of health care in age-friendly communities needs to be practical and accessible. To maintain health and independence, the WHO recommends optimising provisions such as accessibility to services, home care, residential care and planning for emergencies. Why is community support necessary?

By the time people reach their 80s, 54% of adults need help with one or more daily activities like bathing, cooking or using the toilet unaided. Based on current trends, healthcare spending will have to increase by 3.3% and social care spending by 3.9% every year for the next 15 years, just to keep pace with increased demand. As the older population grows in size, the need for health services and support in the community grows.

With more people living into their 80s, 90s and beyond, city regions across the world will need to plan for ageing populations. Understanding the relationship between population ageing and urban change has become a priority public policy agenda item. The case for such work is especially strong given that cities are where most people (of all ages) now live and where they will spend their old age. A report from the Organisation of Economic Cooperation and Development (OECD) (2015, p.18) reports that:

> *"Designing policies that address ageing issues requires a deep understanding of local circumstances, including communities' economic assets, history and culture. The spatially heterogeneous nature of ageing trends makes it important to approach ageing from an urban perspective. Cities need to pay more attention to local circumstances to understand ageing and its impact. They are especially well equipped to address the issue, given their long experience of working with local communities and a profound understanding of local problems."*

This argument raises a significant challenge for policies relating to ageing and urban environments. One major policy response has come from the WHO, through its approach to developing what has been termed 'age-friendly cities and communities.'

Applied research, for example, could help us identify relationships and interactions between the domains of liveability for age-friendliness, with the practical goal of influencing change across all levels of urban life. Realising the potential of age-friendly communities will require major initiatives at the national, regional and local government level, across all of the significant dimensions identified by the WHO.

However, a key argument of this report is that such work will not deliver age-friendly environments without the direct involvement of older people themselves. There are two main reasons for this: first, older people are the best group for reporting on the benefits and frustrations experienced through living in a particular area. Second, while progress has been made in identifying some critical policies for age-friendly work, there has been much less success in making older people central to policies and research development.

In this report, this argument is developed using a case study based in Guangzhou, China. The remaining parts of this report will be structured as follows. Section 2 provides an overview of elucidating the challenges of creating age-friendly communities in relation to the built environment and examines the premise of 'ageing-in-place' as a critical social policy. The research gap is then identified, and the report's research objectives are elaborated. In Section 3, Kano's methodology and its application will be introduced. In Section 4 an empirical analysis of the extent to which Guangzhou's senior communities meet the requirements of an 'age-friendly' community will be presented, supplemented by a case study. Section 5 draws conclusions.

Chapter 2
Meeting challenges of creating an age-friendly environment

Population ageing and urbanisation are two global trends that shape lives in the twenty-first century. As cities grow, the proportion of residents aged 60 and above is increasing. An age-friendly city can encourage active ageing by optimising opportunities for health, participation and security, for the senior citizen to enhance their quality of life. In practical terms, an age-friendly city adapts its structures and services to be accessible to, and inclusive of, older people with varying needs and capacities.

To understand the essence of an age-friendly community, it is essential to investigate what shapes such a community, especially its built environment. Since an ageing population is not necessarily the same as a senile population, the concept of an age-friendly community is about both the physical and psychological health of elderly citizens. Healthy elderly citizens need to be able to enjoy their neighbourhood freely daily for physical interaction, which is fundamental to their mental health. Therefore, more discussions and examinations on the correlation between built environment and senior citizens' quality of life are needed.

Moreover, we also notice that results have been inconsistent in the current body of empirical studies in this area. For instance, high socio-economic status/high income can be either positive (Liu et al., 2017) or negative (Feng et al., 2018) to the well-being of senior citizens in Chinese cities. Similarly, while walkability is shown to be insignificantly associated with a higher level of physical activities, other studies show that it leads to higher satisfaction for senior citizens (Engel et al.,2016; Chaudhury et al., 2016; Feng et al., 2018).

Quality of life is a relative term. In general, quality of life can be influenced by personal and environmental attributes. Quality of life, especially for senior citizens, can be measured through the assessment of both objective

and subjective attributes (Kahn and Juster, 2002). Objective measures include health conditions, physical capability, mobility and social cognition. Subjective measures are more about personal satisfaction with life attributable to individual resources, notably financial resources and family support. Nevertheless, Liu et al. (2017) find that most of the literature on the subjective well-being of senior citizens does not place heavy emphasis on environmental variables.

Source: Asian Development Bank; Photo Lu Guang

2.1. Quality of life and age-friendly communities

A limited number of studies have been devoted to connecting neighbourhood development and senior citizens' quality of life. Feng et al. (2018) find that the physical condition of Chinese senior citizens' houses plays a vital role in their quality of life, as do residential neighbourhood design and transportation connectivity.

Senior citizens should not be seen as a burden in the urban development process but as a vital social resource through their life experience and physical contribution to social productivity. Hence, they should be entitled and supported to access the full range of services in society, which will also empower them to contribute to society's social and economic life (Green, 2013).

Age-friendly communities should consider such factors as opportunities for healthy outdoor activities and a neighbourhood environment that stimulates social interaction and support among residents (Smith et al., 2013; Tiraphat et al., 2017). Moreover, according to Smith et al. (2013), neighbourhood

problems should be addressed by examining these environmental attributes. Within the category of neighbourhood problems, they find that variables that contribute to the development of the age-friendly community include the feeling of loneliness, neighbourhood safety, the transportation network, the availability of retail and leisure facilities, and the structural integrity of houses. What is interesting to note is that these physical and social attributes contributing to an age-friendly society are not culture- or country-specific. It has been found that as far as age-friendly community development is concerned, even within the same countries, neighbourhoods do have different attributes leading to different outcomes for the senior citizens (Nieboer & Cramm, 2018).

Since these environmental variables need to be thoroughly examined and considered, early planning for the age-friendly community is essential (Yung et al., 2016; Greenfield, 2018). Community planning that caters to senior citizens' individual needs in such details as the location and interior design of local pharmacies, which these senior citizens may need to visit more frequently, would contribute positively and significantly to their quality of life (Malet-Larrea et al., 2018).

Among various environmental attributes, accessibility, connectivity and walkability are essential elements that will help senior citizens be more active in their neighbourhood. These critical elements can enhance their physical interaction by enabling them to participate more in outdoor activities (Elsawahli et al., 2017). Barrier-free mobility facilities and passages are not necessary only within the residential building itself but also in public open spaces and on transportation facilities where they may promote social interactions (Huang et al., 2014). Hence, carefully designed street networks with safe and comfortable access to such open spaces as parks and the natural environment will help stimulate more outdoor activities, essential to senior citizens' physical and mental well-being (Kent and Thompson, 2014).

In addition, supportive design details include barrier-free facilities, effective air ventilation, comfortable lighting, better community safety and enhanced physical interaction among senior citizens. These have all been shown to prevent loneliness at home and enhance social capital for senior citizens (Mizukami and Noguchi, 2005; Sugiyama et al., 2009; Chaudhury et al., 2012; Chan et al., 2016). These design features do not need to be costly as long as they are carefully planned and configured (Ottoni et al., 2016). Simple features such as green spaces, easily recognisable signage and distinctive buildings will suffice (Walford et al., 2011; Phillips et al., 2013; Kemperman and Timmermans, 2014; Strobl et al., 2014).

Therefore, well-designed communities encourage senior citizens to have more interaction with nature and with other members of society, in addition to improving their physical health due to more outdoor exercise (Sugiyama and Thompson, 2006; Sugiyama and Thompson, 2007a, 2007b; Julien et al.,2012,

Yung et al., 2017, Wen et al., 2018). Moreover, it is noted that even among senior citizens, different generations may have different spatial requirements for their respective contributions to the neighbourhood, and hence a carefully designed community can also foster an element of diversity in the society (Del Barrio et al. 2018). This is true not just in our urban neighbourhoods but also in rural communities (Keating et al., 2013).

2.2. The ageing community in Guangzhou

Since 1999, China has become an ageing society, and over recent decades the ageing process has accelerated. The ageing population problem is particularly challenging to China because the demographic shifts there are rapid and have been exacerbated by the one-child family policy. Chinese policymakers face mounting challenges in overseeing the rapidly growing home-care sector, challenges which are exacerbated by a weak regulatory framework and the lack of enforcement capacity (Chen, F., Choi, A., & Cheung, K.S., 2012; Feng, 2013).

According to the United Nations (2017), the number of Chinese citizens aged 60 or above reached 229 million, constituting 16% of the total population. By the end of 2050, this number is estimated to double, indicating a dramatic increase to 35%. This estimate implies that the burden for China to take care of its senior citizens will be huge. Therefore, over the past few years, the country has been devoting much effort to cultivating the concept of an age-friendly community.

Intending to establish an integrated care system for senior citizens by 2020, in 2007, China released “Several Opinions on Accelerating the Development of Old-Age Care Sector”, offering specific objectives and measures for the country to target (The State Council, 2007). When it comes to retiree housing in China, age-friendly institutions are also well thought of. However, caretakers in China might not be well trained (Wang, 2006).

Although 70% of the senior citizens in China are currently living in rural areas, it is expected their share will decline as urbanisation thrives (Man, 2011). Consequently, the demand for specialised housing for senior citizens will increase.

Guangzhou, one of the major cities in China and the most important one in Southern China, started to become an ageing society in the 1990s. According to data from the Guangzhou Municipal Civil Affairs Bureau, the proportion of the aged population and the dependency ratio in Guangzhou continued to rise from 2012 to 2017. The ageing situation in Guangzhou is becoming increasingly severe. By the end of 2017, the number of older people aged 60 and above in Guangzhou had reached 1.168 million, accounting for 18.03% of the registered population. Within the urban areas, Yuexiu, Liwan and Haizhu districts have already entered into the stage of moderate ageing (where the proportion of the population who are aged exceeds 20%).

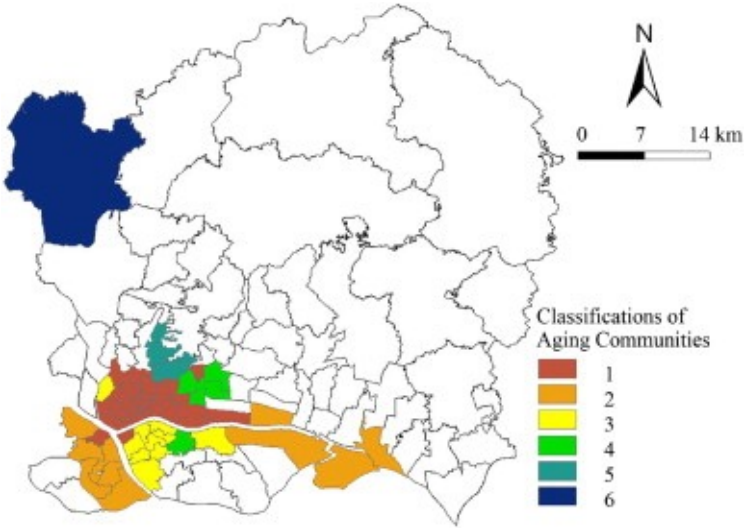
Despite Guangzhou’s high-speed economic growth and urbanisation process,

many older people live in relatively old houses, including public housing and mixed-use commercial housing. The age of these buildings is generally more than ten years, and some exceed 30 years. According to government statistics, there are currently in Guangzhou 779 senior housing communities built before 2000 with sub-standard infrastructure and dilapidated building structures, involving 0.8 million households.

In 2016, the government announced the Guangzhou City Urban Renewal Measures, which put forward the concept of "micro-modification" as a strategic policy to regenerate the city. Under this new policy concept, micro-modification will be applied to encourage gradual restoration, improvement, and regeneration rather than large-scale demolition and redevelopment. The primary objective of this shift, while revitalisation is undertaken, is to allow the old city areas to be preserved with their cultural characteristics.

In 2017, the Ministry of Housing and Urban-Rural Development selected 15 cities to participate in a pilot scheme to carry out the micro-modification of senior residential communities, and Guangzhou was the only first-tier city on this list. In 2018, Guangzhou planned to carry out micro-modification projects that would cover over 200 senior communities, with around 800 more old neighbourhoods to be added in the next three years.

Because of this background and the latest initiatives focusing on ageing communities, we think that a case study on Guangzhou will generate insights and implications for academic and applied research and policy. Although studies were using Guangzhou as a case study to investigate the concept of Ageing-in-place (e.g., Zhou, Xie & Kwan, 2015), those studies were more focused on identifying categories of ageing communities and their spatial distribution. Our study is to further prioritise the built environment impacts on elderly satisfaction in the traditional inner-city communities.



Classifications of ageing communities in Guangzhou, 2010. (Zhou, Xie & Kwan, 2015)

Notes: Six classifications were thus identified: No. 1 - traditional inner city elderly communities; 2 - old enterprise elderly workers' communities with some reconstructions; 3 - elderly old commercial housing communities; 4 - traditional ageing danwei compounds; 5 - elderly communities with significant immigration; and 6 - suburban elderly communities; our further case study is located at the traditional inner city elderly communities.

Chapter 3
A quantitative approach to access an age-friendly environment

In this report, we examine the importance of various environmental attributes to an age-friendly community by means of a robust analytical process known as the Kano analysis.

This analytical framework will be explained below. We first conducted a questionnaire survey among senior citizens in Guangzhou. The data obtained were then tested with robust reliability tests. These tests confirmed the relative importance of the factors which we selected from various literature reviews. In addition, to further analyse the outcomes, we conducted a case study based on the factors chosen. The following sections describe our analyses in full detail.

3.1. Analytical framework – Kano Model

In developing age-friendly communities, the elderly's perception of quality is a significant criterion of effectiveness. That is why many retirement village providers are focusing on the improvement of senior citizens' satisfaction as a strategy to optimise costs and service quality (Anikeeff & Müller, 2012). Nevertheless, senior citizens' satisfaction is based on an intricate combination of perceived needs, and disentangling such demands is challenging.

The Kano model was first developed in the field of product development, examining customers' satisfaction (Kano et al., 1984). Over the years, a lot of research has started to adopt the Kano analysis to understand people's satisfaction with services provided or products marketed. This is demonstrated by the fact that in consumers' satisfaction research and product/service performance analysis (Wu et al., 2010; Ullah et al., 2011; Kim and Lee, 2015; Yao et al., 2018), many healthcare services providers use the Kano model to evaluate patient satisfaction (Materla, Cudney, and Antony, 2017).

According to the Kano model, the preference of customers is attributable from five main categories of satisfaction level. These five levels are: “must-be qualities”; “one-dimensional quality”; “attractive quality”; “indifferent quality” and “reverse quality”. The Kano model is a useful methodology for understanding the various criteria that will help increase customers’ satisfaction (Atlason et al., 2014). The model primarily relies on questionnaire surveys to provide necessary data on both satisfaction and dissatisfaction. For more robust outcomes to be generated, different statistical analyses can then be applied to the data collected (Ullah et al., 2011; Kim and Lee, 2015).

The reason for adopting the Kano model in this report is to overcome the drawback of the traditional two-sided views on customers’ satisfaction. To illustrate such non-linear satisfaction, one may consider the provision of Wi-Fi in a hotel. Modern hotels spend considerable money on installing Wi-Fi, but it is rare for guests to be impressed by this amenity. However, if Wi-Fi were not available, this would inevitably result in many complaints. The Kano analysis can help disentangle such complex relationships. Industries such as healthcare are adopting such analyses to construct generalisable frameworks to enhance health care provision. Similarly, the model allows constructing a general framework capturing the critical factors of the built environment that shape age-friendly communities.

Putting this phenomenon in the context of our analysis of senior citizens’ satisfaction (or dissatisfaction) with their community, it is not unreasonable to expect that elderly respondents would naturally comment more on issues they do not usually take for granted, or those over which they have little control such as amenities or daily-life facilities locations in their neighbourhood’ than on those they would expect as basic (or “must-be”) requirements or qualities such as the structural safety of their building. The Kano model, therefore, can be used to more precisely identify senior citizens’

preferences for certain essential aspects of their communities.

As indicated in Figure 2, the "must-be" quality attributes correspond to the basic requirements of housing communities, and the absence of these attributes could lead to extreme dissatisfaction among senior citizens. These "must-be" requirements are expected and taken for granted. When they are implemented, senior citizens will be merely neutral to them (i.e., around the origin of satisfaction level in Figure 2). However, when they fail to be implemented, the senior citizens will be very dissatisfied and frustrated.

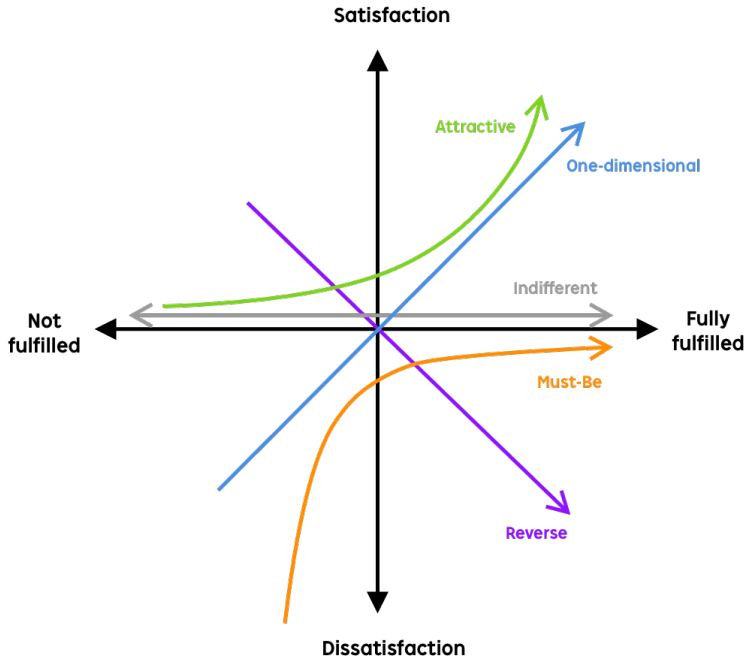


Figure 2: Graphical illustration of the Kano model. X-axis: Investment; Y-axis: Satisfaction

Meanwhile, "one-dimensional" quality attributes refer to those attributes that are directly proportional to the level of satisfaction: the presence of such attractive quality attributes leads to higher satisfaction, but the absence of these results in proportional dissatisfaction. "Attractive" quality attributes are those that satisfy customers when achieved fully but do not cause any dissatisfaction when not. Senior people may be happy to have these. However, without them, there will not be an impact on their perceptions of the community. Attributes that are neither positive nor negative to customers are referred to as "indifferent quality", while "reverse attributes" are the negative aspects that likely trigger dissatisfaction.

3.2. Research design

The Kano model provides us with an approach to building up an analytical framework. The research was conducted in four steps, namely (1) conducting

the preliminary study, (2) developing and administering Kano questionnaires, (3) processing the survey results, and (4) applying Kano quantitative analysis. Measuring perceptions was difficult but not impossible.

One great advantage about the Kano model is that the model accounts for both having and not having some functionality. This shows the extent to which something is wanted, needed or indifferent for our customers. We do this through an evaluation table that combines the functional and dysfunctional answers in its rows and columns, respectively, to get to one of the previously described categories. Each answer pair leads to one of those categories and a couple more that use this question format. In essence, the views of the senior citizens were gathered and evaluated in accordance with the matrix of satisfaction levels depicted in Table 1.

Table 1: Kano's Evaluation

		Dysfunctional				
	Features of their community	1. Like	2. Must-be	3. Neutral	4. Live with	5. Dislike
Functional	1. Like	Q	A	A	A	O
	2. Must-be	R	I	I	I	M
	3. Neutral	R	I	I	I	M
	4. Live with	R	I	I	I	M
	5. Dislike	R	R	R	R	Q

Notes: A = Attractive; M = Must-be; R = Reverse; O = One-dimensional; I = Indifferent; Q = Questionable.

Collecting every respondent's positive - and negative - form answers allows you to use the above Kano evaluation table to understand individual perceptions of the features. Mandatory (M), linear (L), and exciter (E) features quickly stand out, but the survey also provides insight into three other types of answers.

Indifferent (I): The customer is neither satisfied nor dissatisfied about whether the product has this feature.

Reversed (R): The customer does not want this product feature. The prospect would prefer if it were not included.

Questionable (Q): There is a contradiction in the customer's answers to the questions. This typically signifies that the question was phrased incorrectly or that the customer misunderstood the question.

Given the fact that we're asking from both sides of the same thing, we are able to tell if 1) someone does not fully understand the questions or features of the community we are describing; 2) what we propose is actually the opposite of what they want. These are not actual Kano categories; they are mere artefacts of the questionnaire but useful. If someone says she "dislikes"

the functional version and “likes” the dysfunctional version, this person is clearly not interested in what we are offering and perhaps actually wants the opposite. This new category is called Reverse (R). If most customers are telling you some feature is a Reverse, you can just switch the Functional and Dysfunctional questions and score their answers as if you had asked the questions in that order. When you get conflicting responses (such as “Like” and “Like”) to both questions, you have a questionable answer. For this very reason, it is suggested that cells (2,2) and (4,4) from the standard Kano evaluation table be changed to also be questionable (Q). Some of these are to be expected in your results, but if you get a majority of users with questionable answers, there’s probably something wrong with what you are asking.

Steps in the Kano model analysis

Prior to the quantitative analysis, preliminary interviews and focus groups, together with the literature search, were carried out to identify essential characteristics of an age-friendly community.

After the preliminary study, a list of items representing senior citizens’ needs in age-friendly communities was generated. These quality attributes were further refined and grouped into five categories of requirements: safety, comfortability, accessibility, social needs, and community services, with components of each requirement being shown in Table 2.

Safety includes road safety. Pavements are well-maintained, free of obstructions and reserved for pedestrians (f1). Outdoor safety is promoted by good street lighting, police patrols and community education (f2). Community emergency planning needs to take into account the vulnerabilities and capacities of older people (f3). In terms of security, a gated community with an appropriate security system is preferred (f4). Comfortability of the community includes the Green landscape (f5), Amenity (f6), and Hygiene (f7). Green spaces and outdoor seating are sufficient in number. Public areas are clean and pleasant.

Accessibility refers to the identification system (f8), avoiding some strangers to be in the community. Barrier-free facilities (f9) should be introduced whenever possible. For example, pavements are non-slip, are wide enough for wheelchairs and have dropped curbs to road level. Pedestrian crossings are sufficient and safe for people with different levels and types of disability, with nonslip markings, visual and audio cues and adequate crossing times. Daily-life facilities (f10) include general grocery stores for daily-life items such as rice, food, drinks, etc.

Social needs include entertainment and leisure venues (f11) and fitness and sports venues (f12). Venues for events and activities are conveniently located, accessible, well-lit and easily reached by public transport. Events are held at times convenient for the elderly. Activities and events can be attended alone or with a companion. Activities and attractions have to be affordable, with no

hidden or additional participation costs. Gatherings, including older people, are held in various local community spots, such as recreation centres, schools, libraries, community centres and parks.

Last but not least, community services will include health care services (f13), home care services (f14), and day-care services (f15). An adequate range of health and community support services is offered for promoting, maintaining and restoring health. Intelligent/smart care services (f16) have also become important, particularly with many elderly nowadays being more computer literate. Telephone answering services give instructions slowly and clearly and tell callers how to repeat the message at any time. Electronic equipment, such as mobile telephones, radios, televisions, and bank machines, has large buttons and big lettering. There should be broad public access to computers and the Internet, at no or minimal charge, in public places such as government offices, community centres and libraries.

As previously mentioned, the Kano survey was then applied to examine how senior citizens perceived these age-friendly communities' quality attributes. The Kano survey consisted of two parts: the first part gathered primary demographic data such as age, gender, housing tenure situation etc., while the second part provided a list of built environment-related attributes to be evaluated by the participants.

We started our survey using a convenience sampling method through which respondents were selected because they were relatively easy to recruit for the study via personal contacts by our team members. After successful interaction with the first batch of participants, we then applied a snowball random sampling technique. The first group of respondents were encouraged to introduce more participants to our research team in Guangzhou.

Because these are close-knit communities, most senior citizens tend to be more willing to participate if their peers have participated. Our study covered senior citizens from a variety of communities spanning seven urban districts in Guangzhou. Hence, their views were more representative than if they had come from the same community. In total, from a total of 538 questionnaires received, we used 528 effective responses.

Table 2 Requirements for age-friendly communities: a preliminary study

Requirements	Categories
Safety	f_1 Road safety
	f_2 Outdoor lighting
	f_3 Emergency equipment
	f_4 Security
Comfortability	f_5 Green landscape
	f_6 Amenity

	f_7 Hygiene
Accessibility	f_8 Identification system
	f_9 Barrier-free facilities
	f_{10} Daily-life facilities
Social needs	f_{11} Entertainment and leisure venues
	f_{12} Fitness and sports venue
Community services	f_{13} Health care services
	f_{14} Home care services
	f_{15} Day-care services
	f_{16} Intelligent/smart care services

Notes: f_{10} Daily-life facilities include general retail stores for daily-life items such as rice, food and drinks etc. f_{13} are Health care services. f_{14} Home care services are different in the sense that the former is more about medical needs, and the latter is more about housekeeping requirements for the senior citizens. f_{15} Day-care services are a combination of f_{13} and f_{14} but in specific arrangements outside the senior citizens' home. f_{16} Intelligent/smart care services are technology-based and technology-enhanced healthcare services and devices

3.3. Demographic statistics of the survey

Before showing the results of our analysis, the following illustrates some basic background data about our respondents.

Age and gender distribution

Of 528 questionnaires collected, 205 were from male respondents, and 328 were from females. The gender ratio of male and female was about 1:1.6. The apparent higher female respondents may be due to females' higher tendency to socialise and women in general live longer.

In terms of age, respondents are evenly distributed across age groups. 26.7% of respondents were in the age group of 60-69 years old, followed by 20.0% from 50-59 years, and then 15.0% from 40-49 years old. The respondents above the age of 70 accounts for 38.3% of the total. Hence, the composition of our respondents was either close to retirement or retirees. This sample would be able to provide a more comprehensive view of the age-friendly community to our research team than would a representative sample of the population.

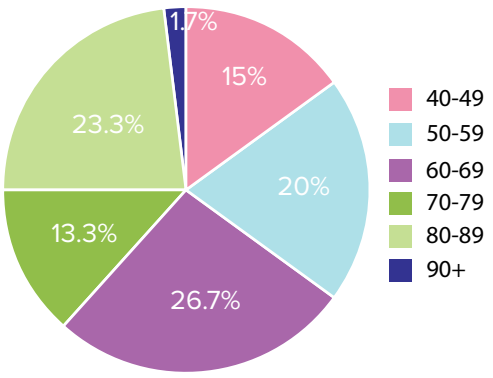


Figure 3: Distribution of respondents' age

In terms of health conditions, respondents who reported an average health condition account for 82.77% of the sample. On the other hand, 15.34% of the respondents stated they had chronic diseases or various physical impairments, and 1.89% of them needed daily assistance from other people.

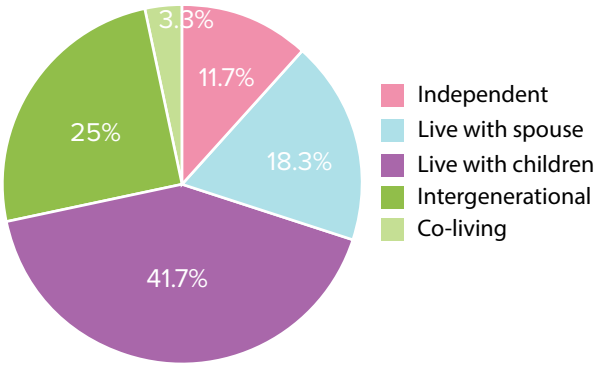


Figure 4: Distribution of respondents' living status with family

41.7% of the respondents are living with their children. The proportion of the respondents who were 60 years old or above and were living with their children dropped sharply. However, the drop slowed and was reversed when the age of respondents increased further. We think this "U"-shaped phenomenon may be due to most senior citizens who had just retired either seeking more independence in life or trying to avoid being a burden on their children, and hence not living with them. However, as they grow even older, their deteriorating physical condition coupled with psychological issues such as loneliness may necessitate assistance from their children, so the proportion of co-living with children rises again. This is characteristic of Asia, where the concept of a large family is still acceptable in most people's minds.

Respondents' housing information

The majority of respondents (i.e., 61.37%) lived in the two major residential and commercial districts in Guangzhou, namely Yuexiu District and Tianhe District. The remaining 38.63% came from other administrative districts. About 45.83% of respondents lived in traditional housing communities where a number of old single-block residential buildings are combined, and residents are connected through the semi-governmental neighbourhood committee.

Among all the respondents, about 3.3% lived in relatively new residential buildings (10 years or below). Most, about 56.7%, lived in 11 to 20-year-old residential buildings, while 30% lived in 21 to 30-year-old buildings. About 10% of them lived in relatively residential buildings over 30 years old. Hence, most of the retirees in our survey lived in relatively old residential buildings.

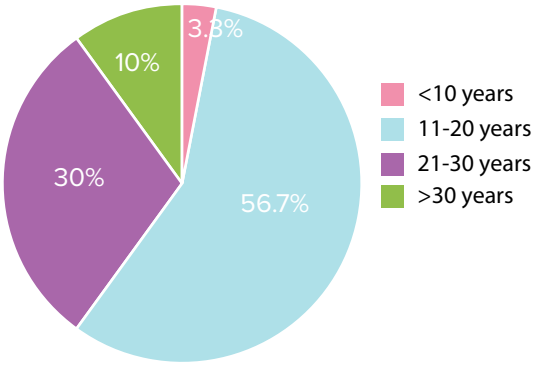


Figure 5: Distribution of respondents' housing age

To uphold the robustness of our analysis, we tested the questionnaire for reliability to ensure the consistency and reliability of the results. We calculated the reliability coefficient "Cronbach Alpha" for our sample, which illustrates a higher level of reliability if the value is higher than 0.8. As a general rule, if the value is between 0.7 and 0.8, the reliability is good, and a value between 0.6 and 0.7 indicates acceptable reliability; but any value less than 0.6 implies unacceptable reliability.

The results of our questionnaire reliability test are shown in Table 3. After calculation and analysis, the respondents' coefficient of (dis)satisfaction in the Kano questionnaire is 0.838, the coefficient of importance evaluation is 0.963, the coefficient of satisfaction is 0.945, and the reliability coefficient is greater than 0.8, indicating that the questionnaire has high reliability. Hence, the research data passed the consistency test.

Table 3 Results of the questionnaire reliability test

Items	Numbers	Cronbach's Alpha
Kano questionnaire	32	0.838
Importance	16	0.963
Satisfaction	15	0.945

After this, we further evaluated the various degrees of importance and satisfaction in accordance with the Kano model procedure with respect to different environmental attributes. Based on the Kano model, the importance scale categories adopted in this analysis is: not at all important, slightly important, important, fairly important, very important; and satisfaction categories are: very dissatisfied, somewhat dissatisfied, neutral, satisfied, to very satisfied.

In the analysis, the satisfaction of smart/intelligent care services (f16) for senior citizens were taken out because the communities where our participants came from basically did not know much about such services, so they were not asked to evaluate this attribute.

Figure 6 illustrates the rankings of importance of, and satisfaction with

different attributes. Our analysis shows that our respondents attached more importance to the community infrastructure and environment attributes, while community services were less valued. This may be due to the prolonged neglect of community services in the old housing communities in Guangzhou, leading residents to expect little such service. On the other hand, respondents were more sensitive to factors related to safety and residential comfort.

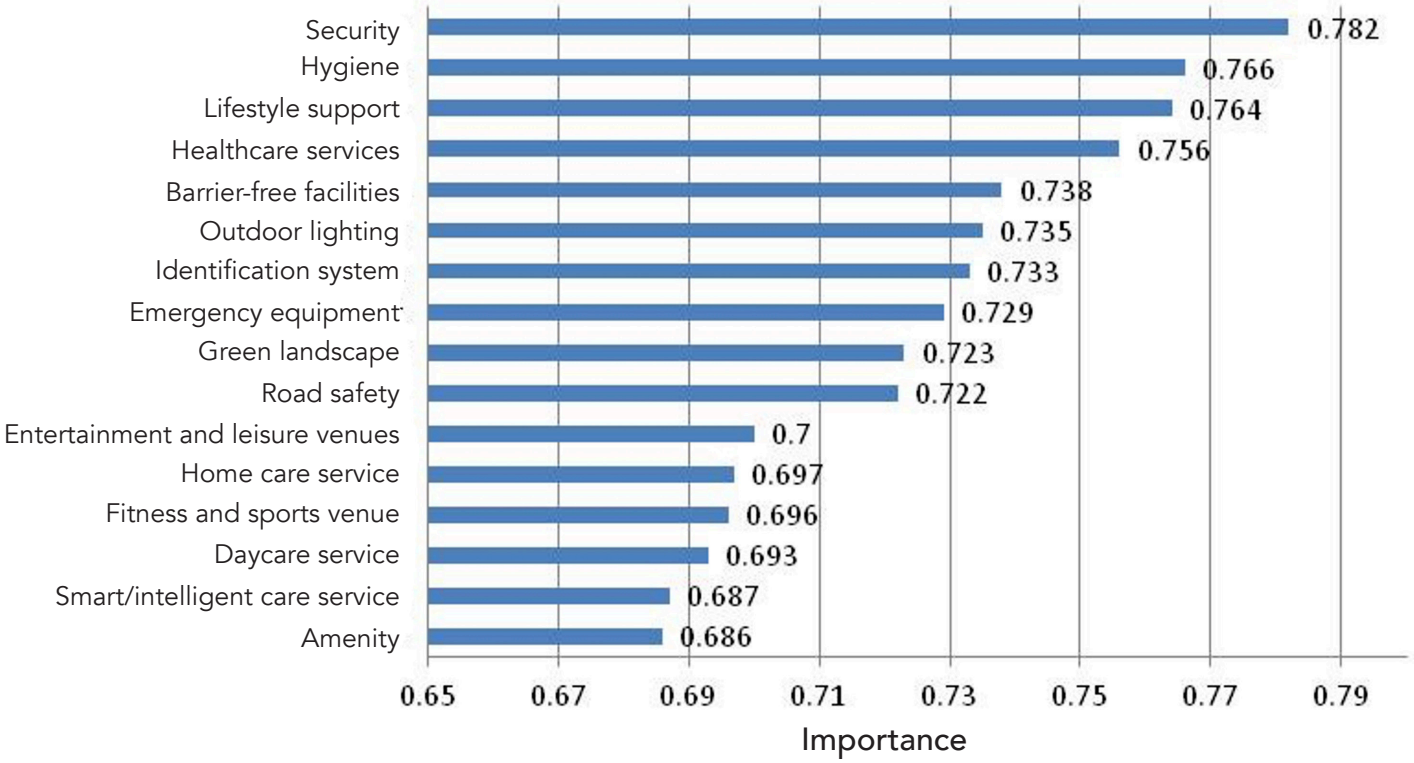


Figure 6: Attributes importance ranking

In terms of satisfaction, most of the community infrastructure and environmental attributes would meet the needs of the senior citizens in our sample, as shown in Figure 7. However, the supply of community services was not considered satisfactory, and in particular, the locational distribution of these services would not meet the daily social needs of the senior citizens. Even if the importance of these factors is not the highest, the lowest satisfaction ratings indicates that the lack of these factors will cause dissatisfaction among the senior citizens.

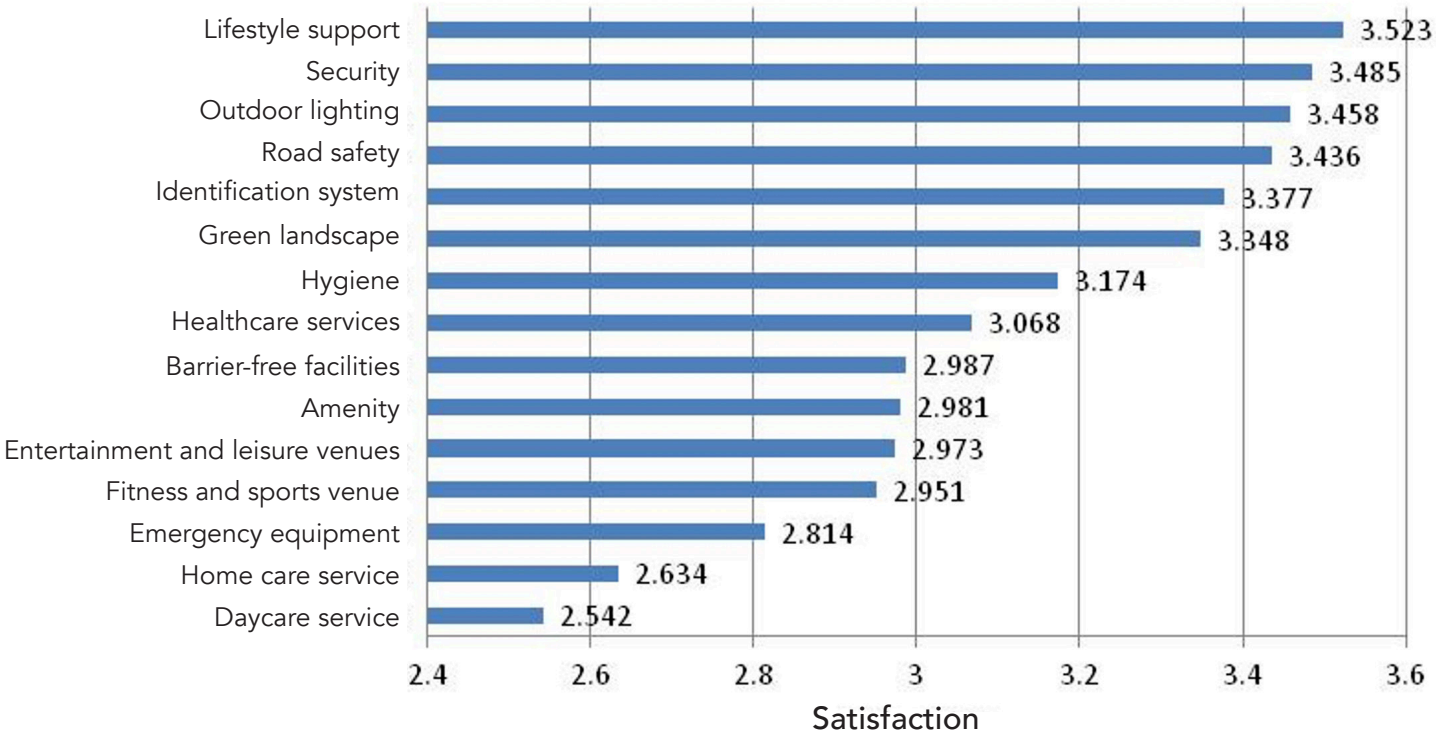


Figure 7: Attributes' satisfaction ranking

Demand for reshaping their community into more age-friendly

Figure 8 shows that in terms of the need for reshaping and modifying their existing community into a more age-friendly one, most respondents (80.0%) thought this attribute was necessary. Only 11.7% believed the community did not need to be reshaped, and 8.3% were neutral. Among those who were neutral on this issue, only 10% were in the 40-59 age group.

Respondents in this age group were still working and hence would naturally spend less time in the neighbourhood on a daily basis. On the other hand, the regular users of the neighbourhood space, the retirees, tended to have a stronger wish for improvement, except those in the age group 80-89, who might not be able to visit community open space as often as they wished. It can be seen that, in order to cater to the needs of the senior citizens in Guangzhou who spend a lot of time in the community area, the need to reshape and re-plan existing residential communities is urgent.

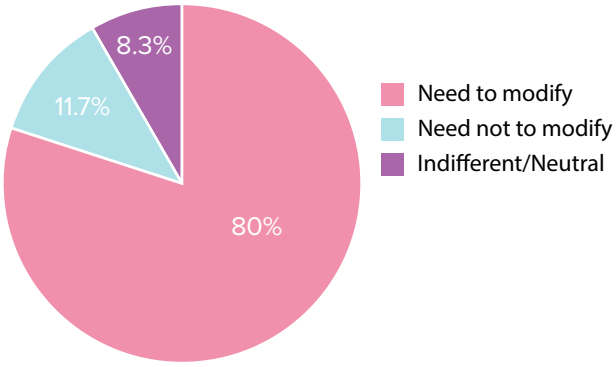
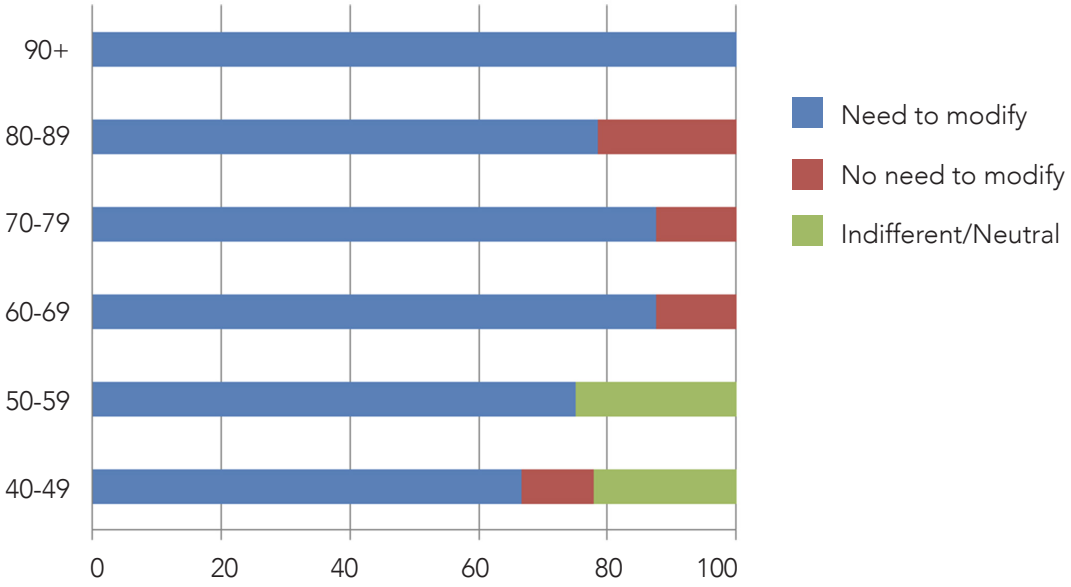


Figure 8: Demand distribution for an age-friendly community (by age)



Chapter 4
Results and discussions

Based on the data we collected and on Meng and Jiang's (2011) study, we further computed all attributes' coefficients. The Kano classification of each attribute is shown in Figure 9.

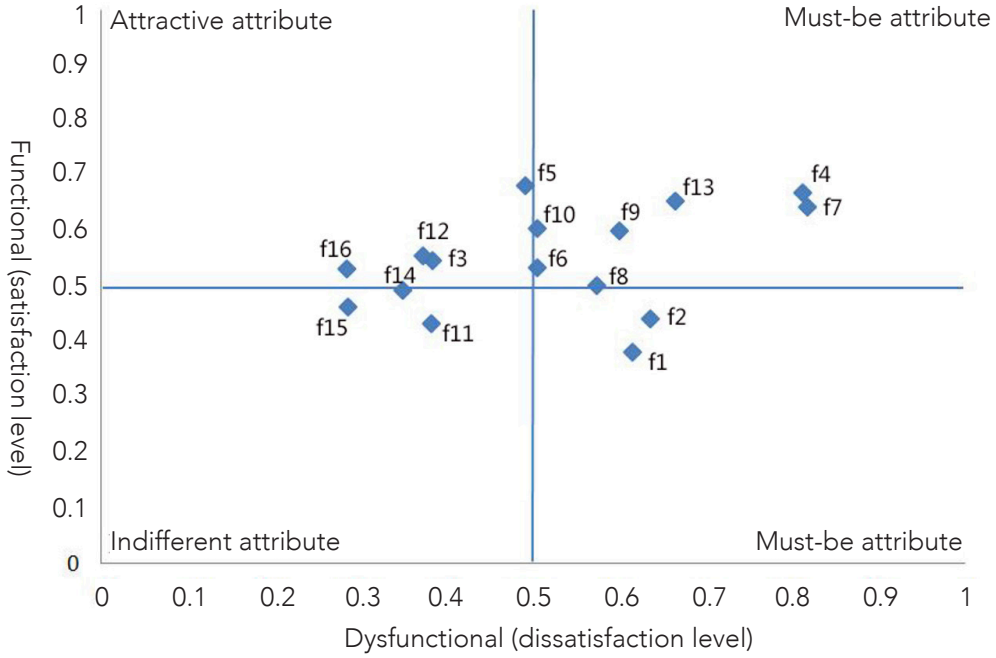


Figure 9: Scatter plot of community facilities and services

There are also different strategies for the construction and operation stages for attributes belonging to different KANO classifications. From the survey, we further analysed the elderly their satisfaction levels in two different development phases. Different communities could be facing different resources and challenges. Some of them are in the planning stage, and therefore more flexibility to modify the design in facilitates. In contrast, in some existing communities, the room for further enhancement and modification could be limited. Therefore, the Kano analysis can better identify elderly satisfaction with different situations of a particular community.

For instance, in the construction stage, the community will attach higher importance to the must-be attributes, usually "taken for granted" by the senior citizens. In the operational phase (including maintenance and redevelopment), however, the community will pay more attention to the attractive qualities with the highest operational efficiency. This means that a proper focus on these attributes may lead, among the senior citizens, to a substantial rise in satisfaction with relatively little investment. And for the one-dimensional attributes, the community design team should balance the two dimensions, namely the design and construction phase and the operational dimension.

The specific classification and strategies for each attribute are shown in Table 4. Different communities can reference the situation of their own to prioritise and tailor-made their plans to transform their community to be more aged-friendly. More relevant enhancement programmes can be structured to devise more targeted strategies to make the community more aged-friendly.

Table 4: Kano classification and corresponding optimisation strategy

Kano classification	Factor	Strategy	
		Design and Construction	**Operation**
Must-be	f_1 Road safety f_2 Outdoor lighting	Scientific and rational planning	Ensure its basic functions
Critical attribute (more of one-dimensional)	f_8 Identification system	Requirements are slightly lower than "must-be" factor	Value of modifying this factor at operation stage is higher than "must-be" factor
One-dimensional	f_4 Security f_7 Hygiene f_9 Barrier-free facilities f_{13} Health care services	Be considered comprehensively	More efforts should be placed on the management and improvement to conduct necessary modifications
Critical attribute (more of one-dimensional)	f_6 Amenity f_{10} Daily life facilities	Ensure its basic functions, and take more consideration when needed	Second prioritised items to be modified
Attractive	f_3 Emergency equipment f_5 Green landscape f_{12} Fitness and sports venue f_{16} Intelligent/ smart care service	Ensure its basic functions	Modification with high modification efficiency
Critical attribute (more of indifferent)	f_{14} Home care service	Ensure its basic functions	Ensure its basic functions has a certain value by modifying this factor
Indifferent	f_{11} Entertainment and leisure venues f_{15} Daycare service	Ensure its basic functions	Ensure its basic functions

In general, for the age-friendly modification of the community resources, the prioritised modification include emergency equipment, green landscape, fitness and sports venues and intelligent/smart care services. On the one hand, in most Chinese cities, the development of smart communities is still more a concept than an action plan, and emergency equipment and smart care services are uncommon, especially in older communities.

On the other hand, limited by location and land resources, most communities will reduce the areas allocated to green landscapes and physical exercise. Most senior citizens are already accustomed to the inadequacy and imperfection of such facilities and services. Hence, if a community can be equipped with these factors to achieve excellent performance, senior citizens will be surprised and more satisfied.

The second modification is amenity and daily life facilities. When senior citizens are required to travel long distances to access amenities or daily facilities, their constrained physical capacity will make them feel exhausted. When the community performs well in providing appropriate amenities and daily life facilities, the senior citizens will feel much satisfied as compared to other modifications.

Further analysis – A case study

The previous section has described the need to plan, design and develop age-friendly communities in Guangzhou and has analysed the factors that contribute to the satisfaction of senior citizens. After identifying these factors, we now further study within an existing community to verify these factors.

In order to justify the practicality and effectiveness of this evaluation system, we selected the Bingzheng community in Zhongshan 4th Road in Yuexiu District as an example to conduct this empirical robustness analysis (Figure 10). The Bingzheng community resembles our sample communities in the survey described above. It consists mainly of single residential blocks, with a neighbourhood committee as the core in the old town.

Bingzheng Community is very near to a Metro Line station (Line 1) and is a community under the administration of the Bingzheng Community Committee. There are markets, stores, a primary school, a community hospital, home service centres, a civic plaza, and other daily-life facilities in the community. The community's general development status is not balanced. This community has low-rise, small high-rise and high-rise residential buildings with building ages ranging from 10 years to more than 30 years. Therefore, the population mix is rather diverse, and public space planning does not satisfy everyone.

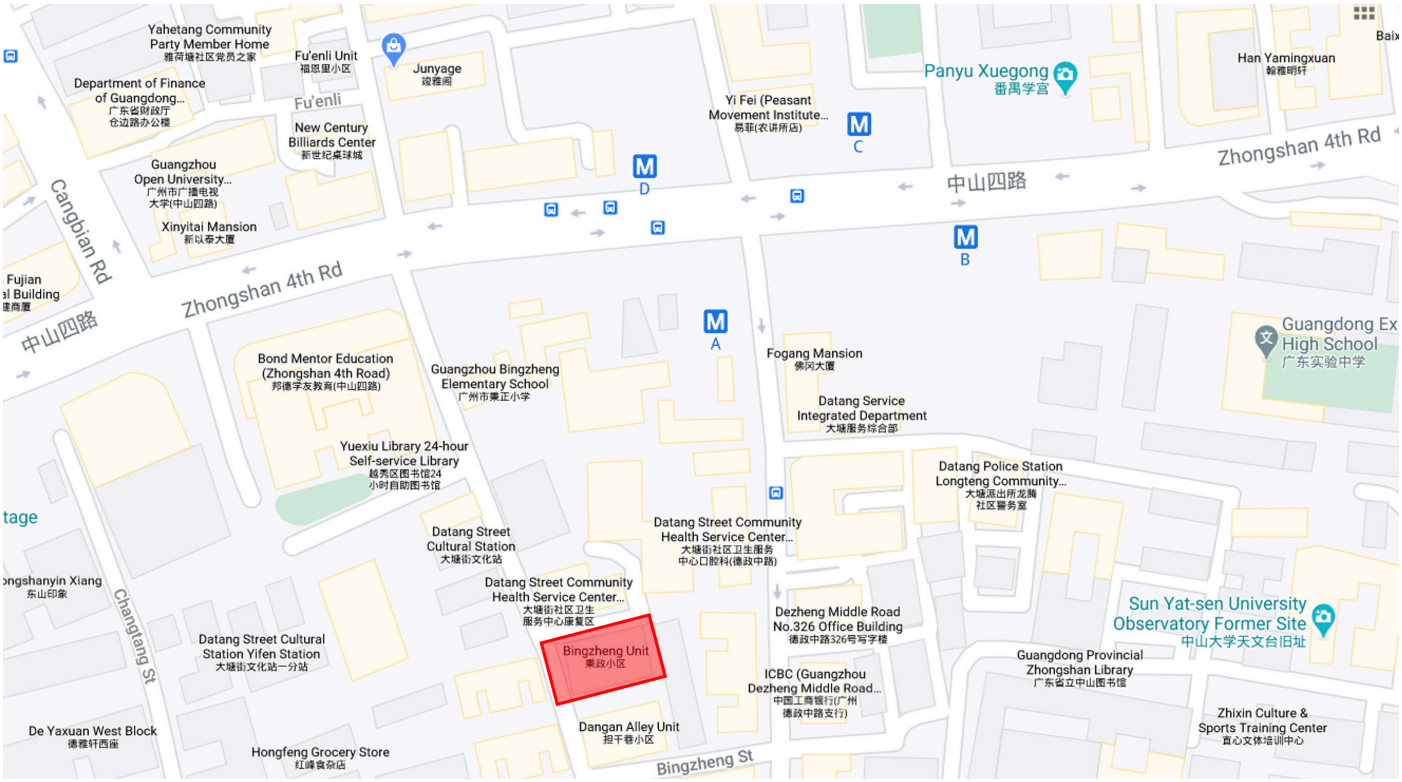


Figure 10 Bingzheng Community in Zhongshan 4th Road in Yuexiu District. Source: Google Maps

For our respondents from the Bingzheng Community, the average scores on each attribute are shown in Table 5. Since smart care services are an emerging service and knowledge of them among the senior citizens is extremely low, this factor was not scored.

Table 5: Indicator scoring of Bingzheng Community

Attribute	f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8
$\bar{M}i$	3.793	3.812	2.493	3.273	3.169	3.177	3.258	3.025
$\bar{N}i$	5	5	3.495	5	3.589	4.701	5	5
Attribute	f_9	f_{10}	f_{11}	f_{12}	f_{13}	f_{14}	f_{15}	f_{16}
$\bar{M}i$	3.271	3.904	3.268	3.058	3.516	3.099	2.292	–
$\bar{N}i$	4.986	4.168	4.391	3.338	5	3.527	3.059	–

The Kano model data and the final modification coefficient of each attribute for the Bingzheng Community are shown in Table 6.

Table 6: The final modification coefficient of Bingzheng Community

Attribute	r_i	IR_0	$tana_i$	$IRad_j$	I_i
f_1 Road safety	0.724	1.318	0.622	1.559	0.464
f_2 Outdoor lighting	0.776	1.312	0.699	1.475	0.526
f_3 Emergency equipment	0.669	1.402	1.430	1.266	0.528
f_4 Security	1.053	1.528	0.826	1.670	0.631
f_5 Green landscape	0.842	1.133	1.393	1.094	0.770
f_6 Amenity	0.736	1.480	1.064	1.445	0.509
f_7 Hygiene	1.041	1.535	0.791	1.718	0.606
f_8 Identification system	0.763	1.653	0.881	1.770	0.431
f_9 Barrier-free facilities	0.850	1.525	1.003	1.523	0.558
f_{10} Daily life facilities	0.789	1.068	1.200	1.056	0.747
f_{11} Entertainment and leisure venues	0.578	1.344	1.139	1.296	0.446
f_{12} Fitness and sports venue	0.669	1.092	1.498	1.060	0.631
f_{13} Health care services	0.934	1.422	0.986	1.429	0.654
f_{14} Home care service	0.606	1.138	1.418	1.096	0.553
f_{15} Daycare service	0.546	1.334	1.635	1.193	0.458
f_{16} Intelligent/Smart care service	0.604	–	1.877	–	–

According to the final modification coefficient in Table 6, the coefficient ranking was as shown in Figure 12, and the age-friendly level of the Bingzheng Community was analysed.

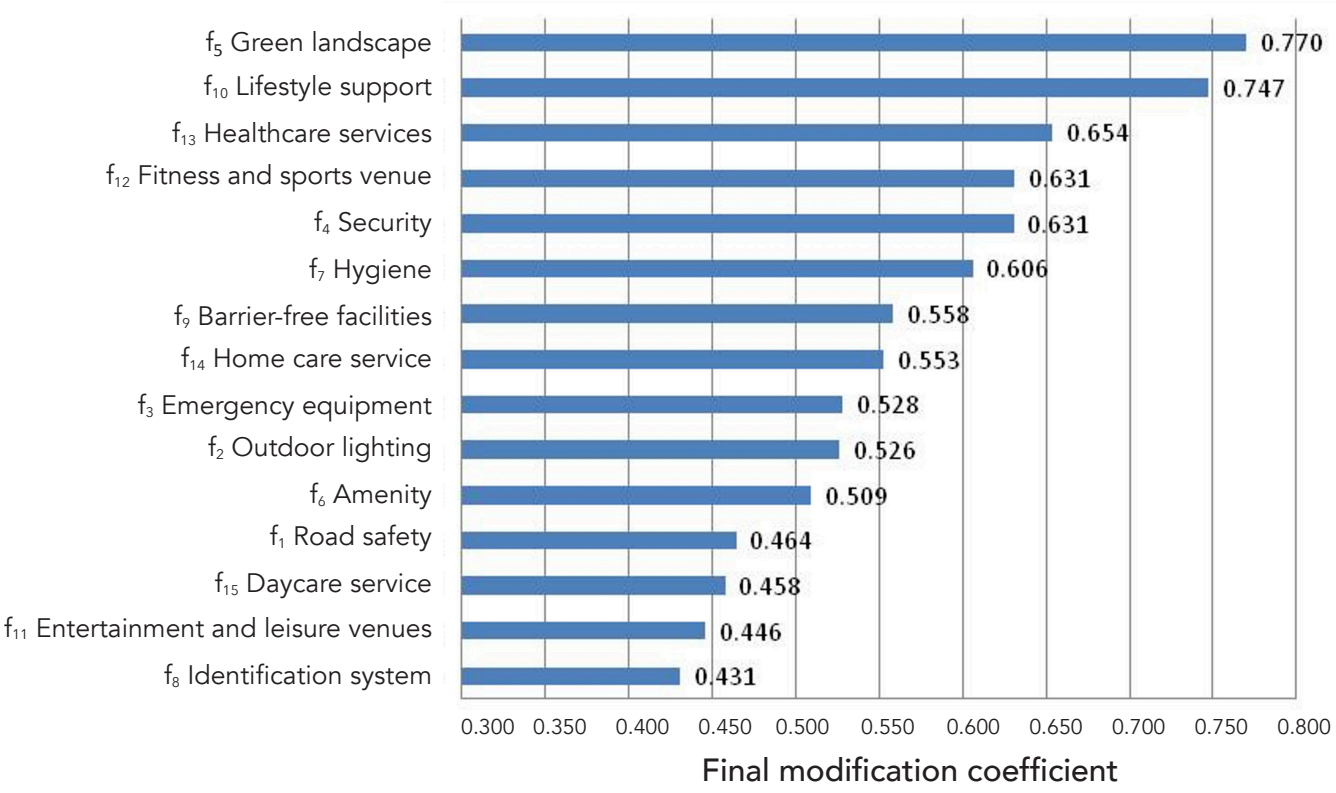


Figure 12 Ranking of final modification coefficient of Bingzheng Community

Chapter 5
Conclusion

In this report we set out to examine the relative importance of various features of housing communities in Guangzhou, China, contributing to the age-friendliness community concept from the users' point of view. By applying the well-established Kano model to examine consumers' satisfaction levels, we found several variables that were imperative for developing age-friendly communities. Because of the versatility of the Kano model, we were also able to highlight those variables that were deemed necessary but with different degrees of satisfaction as perceived by some users of the community, namely the senior citizens.

First of all, we found that the most critical factor in contributing to an age-friendly community from their point of view was "security". In this respect, their level of satisfaction was also relatively high. This shows that Guangzhou, though a megacity, is perceived to be a relatively safe city, especially in the older communities. The security of a community is a necessary pre-condition for senior citizens to enjoy outdoor activities and other community services. As many of our respondents came from the old-style housing communities with closer social networks among residents, we found that social organisations and semi-political institutions such as neighbourhood committees were critical links between community conditions and the satisfaction of residents (Ross, 2011).

In general, the senior citizens in Guangzhou are relatively satisfied with urban design variables such as urban landscape, road safety and outdoor lightings. These are also factors contributing to the sense of community security in general. Given the relatively fragile conditions of the senior citizens, incentivizing them to carry out more outdoor activities hinges on how safe they feel going outside. Healthcare services and hygienic conditions in their community are relatively less satisfactory in Guangzhou. This may be a common situation for a lot of old cities where sanitary infrastructure development may not have been well-planned and well-coordinated during urbanisation.

Moreover, the senior citizens are less satisfied with amenity and entertainment services provided in their community. Given the rapidly changing entertainment culture globally, there is, unfortunately, a problem in balancing the needs of various generations within the community. From a commercial point of view, senior citizens are usually not the target consumer

groups for the amenity and entertainment service providers and hence more consideration may be needed from the public sector. At the other end of the scale, the two least satisfactory factors were “amenity” and “day-care service”, both of which had a relatively low score on satisfaction. This implies that the current design criteria of housing communities in China still do not factor in the needs of the senior citizens, especially concerning providing them with accessible amenities and day-care services.

The concept of ageing-in-place is still a new idea in this society, and traditionally senior citizens do not spend a lot of time in the public space of their communities in China. Given the high-density urban development in most metropolitan cities in China, such as Guangzhou, it is also challenging to reshape or modify old communities on a piecemeal basis. This implies that from a policy point of view, local governments in China need to develop long-term strategic plans in relation to urban regeneration programmes that would take care of the growing number of senior citizens.

In any case, ageing-in-place with a more accommodating community will also help reduce the burden on the public health system. A healthier generation of senior citizens will have lesser demand for hospital facilities, which could be directed to other patients with more urgent needs.

Finally, our study highlights a gap for developing high-tech health-related supporting facilities that will also contribute to a better age-friendly community (Chaudhary and Kumar, 2017). In a well-planned aged-friendly community, advances in technologies such as GPS tracking systems, online medical consultation and gadgets that foster the psychological wellness of senior citizens should be considered.

Technology-related facilities are especially crucial for the current demographic of retirees because the mobile technology that millennials can enjoy was still very rudimentary when they were young and working hard to contribute to the economy. This finding becomes much relevant after the pandemic.

Before the Covid-19 pandemic, people without access to the internet were already at a significant disadvantage in seeking job opportunities, accessing financial support, ordering online, and connecting with organisations. The pandemic has dramatically exacerbated this situation. For the first time, many people have increasingly had to rely on the internet and digital devices to access support, get things done, and participate more fully in society. There is a lack of awareness among the elderly of the support available.

There is an ongoing need for devices to be made available. Corporate and small businesses need to continue collaborating with device recycling charities to offer used kits that can be distributed to local groups. Local authorities and digital support groups should encourage peer support through campaigns for volunteer digital champions. Many 50 to 70-year-olds are confident digital users and would be ideal for helping understand users’ needs. An aged-

friendly community has to focus on how technology can enhance the elderly's quality of life in the future.

No single organisation, sector or agency can create change alone. Focusing on the needs of a specific place can help identify shared investments, priorities and outcomes more readily than at a national level. While each local context is different, there are often sufficient similarities to enable shared learning. A bottom-up localities approach can draw inspiration and ideas from one another and identify sound principles and practices in each local community.

By working across multiple localities with different contexts, rural to urban, neighbourhood to city, one can generate solutions that respond to the specific context and are applicable to others. Different localities have different assets and challenges. We believe that by taking these distinctive factors for particular places into account, we can generate solutions that are more likely to be appropriate, locally owned and sustainable.

For professionals in the built environment, such as surveyors and planners, our analysis has implications for enhancing their role. First of all, land use planning that caters for senior citizens' needs is of utmost importance. Features that contribute to a safe environment, such as separating vehicles and pedestrians, will encourage senior citizens to carry out more physical exercises of various sorts.

In addition, elements that facilitate outdoor activities by the senior citizens and other age groups should also be incorporated into facilities management plans, so that the community's common areas can generate a more welcoming atmosphere. These considerations should be part of the development plan, especially when urban regeneration schemes are being contemplated.

From a policy point of view, carefully designed micro-modification schemes, instead of large-scale redevelopment programmes, seem to be the optimal means for improving senior residential communities in order to promote the "ageing-in-place" concept. This will be beneficial not only to the senior citizens living in the community but also to their families and society. Indeed, the place where we live can have a considerable impact on our health and well-being.

Age-friendly communities make it possible for us to continue to live in our homes, participate in the activities that we value, and contribute to our communities for as long as possible. In an age-friendly community, the elderly can shape the place where they live. Local councils, businesses and elderly residents have to work together to identify and make changes in physical and social environments, such as volunteering employment, transport housing and the design of streets and neighbourhoods. While using the aged-friendly community framework developed by the WHO can help start planning an age-friendly community, a localised approach is needed to provide more

informative evidence of what help supports healthy and active ageing-in-place in a particular local community.

More work needs to be done to strengthen the underlying models shaping our understanding of aged-friendly communities. Becoming an age-friendly community requires political commitment; it means listening to the voices of older people and working in partnership to deliver on an action plan. A growing number of town districts cities worldwide are working to ensure that more people can live healthy and active later lives.

Given the potential for city planners, architects and building surveyors to promote aged-friendly communities, we recommend that more future research could be done with a greater emphasis on multidisciplinary research, expanding focus to the elderly and including more rigorous measures and study designs for intervention studies. We want more communities to join the vision and help create places to enjoy their later lives. Let us take action today for all our tomorrows and make our community be a better place for ageing.

Appendix - Prioritising different attributes in a particular community

To determine the priority of improving different attributes in a particular community, we evaluated the community's demand for various attributes. By assessing the actual level of satisfaction of each attribute with the combination of the X_i and Y_i in each indicator, we can compute the value M_i in the equation below. The parameter m_{ij} is the quality rating of the attribute f_i of the respondent j, ω_{ij} is the importance of the attribute f_i to the respondent j. These two parameters were obtained from other previous research studies (Meng and Jiang, 2011).

M_i indicates the average quality of f_i, $\overline{N}_i$ indicates the average quality of f_i of the benchmark community. The values of Ni were determined based on the KANO model satisfaction index ai. $\overline{N}_i = 5/\tan(a_i)$. According to the definition of a_i, $\tan(a_i)$ reflects the improved efficiency of satisfaction when corresponding factors are improved. The larger $\tan(a_i)$ is, the easier it will be for the elderly to be satisfied with attribute f_i.

In other words, a lower quality rating is needed for f_i to reach the benchmark standard, and the average perceived benchmark of quality will be lower. This approach is more reasonable than simply taking a full score of 5 as a benchmark quality rating. By this definition, the equation achieves its validity. As a rule, when $\overline{N}_i$ is greater than 5, and when $\overline{N}_i$ is less than $\overline{M}_i$, take $\overline{M}_i$.

$$\overline{M}_i = \sum_{j=1}^{J} \omega_{ij} m_{ij} / \sum_{j=1}^{J} \omega_{ij} \quad \overline{N}_i = 5/\tan(a_i) \qquad (M_i \leq \overline{N}_i \leq 5)$$

Further, we defined the initial improvement rate as IR_0 of fi, which indicates the expected improvement rate of the residents' satisfaction; the modified improvement rate IR_{adj} is the modification rate of the performance of f_i to achieve the expected satisfaction improvement of residents:

$$IR_0 = Ni/Mi \qquad IR_{adj} = (IR_0)^{\frac{1}{\tan(\overline{ai})}}$$

The larger the $\tan(a_i)$, the smaller the modified improvement rate IR_{adj} is needed to achieve the expected satisfaction improvement rate IR_0, that is, the higher the efficiency. This corresponds to the definition of the Kano classification, and hence the rationality of this model can be supported.

The final modification coefficient becomes $I_i=r_i^{\frac{1}{IR_{adj}}}$. The final transformation coefficient takes the Kano classification, the residents' importance perception, quality rating and modification efficiency into comprehensive consideration, reflecting the senior citizens' overall demand for various attributes. In the equation, when r_i is constant, the smaller the IR_{adj}, the higher the modification efficiency f_i becomes. This means that it is more worthwhile to conduct modification on f_i. By ranking the final modification coefficients of different factors, the priorities of the community for modification can be calculated. The larger the coefficient, the higher the priority.

References

Abramsson, M; Andersson, E (2015). *Changing Preferences with Ageing – Housing Choices and Housing Plans of Older People*. **Housing, Theory and Society**, 2016 (33), 1-25.

Anikeeff, M A; Müller, G (Eds) (2012). **Seniors Housing (Vol. 4)**. Springer Science & Business Media.

Atlason, R; Oddsson, G; Unnthorsson, R (2014). *Geothermal Power Plant Maintenance: Evaluating Maintenance System Needs Using Quantitative Kano Analysis*. **Energies**, 7(7), 4169-4184.

Black, K; Badana, A; Hyer, K (2016). *Caregivers' considerations on age-friendly community features*. **Annals of Gerontology and Geriatrics Research**, 3(2), 1041.

Buffel, T; Phillipson, C (2016). *Can global cities be 'age-friendly cities'? Urban development and ageing populations*. **Cities**, 55, 94-100.

Chan, Aileen W K; Chan, Helen Y L; Chan, Ivy K Y; Cheung, Bonnie Y L; Lee, Diana T F (2016). *An Age-Friendly Living Environment as Seen by Chinese Older Adults: A "Photovoice" Study*. **International Journal of Environmental Research and Public Health**, 13 (9), **International Journal of Environmental Research and Public Health**, 13 September 2016, Vol.13 (9).

Chan, S; Ellen, I (2017). *Housing for an Aging Population*. **Housing Policy Debate**, 27(2), 167-192.

Chaudhury, H; Campo, M; Michael, Y; Mahmood, A (2016). *Neighbourhood environment and physical activity in older adults*. **Social Science & Medicine**, 149, 104.

Chaudhury, Mahmood, Michael, Campo, & Hay. (2012). *The influence of neighbourhood residential density, physical and social environments on older adults' physical activity: An exploratory study in two metropolitan areas*. **Journal of Aging Studies**, 26(1), 35-43.

Chaudhary B; Kumar R (2017). *Role of Technology in Management of Health Care of Elderly*. **Journal of Gerontology Geriatrics** Res 6:391. doi:10.4172/2167-7182.1000391

Chen, F; Choi, A; Cheung, K S (2012). *Senior housing in China: A market in the making*. **CBRE Research Viewpoint**, Retrieved from http://f.tlcollect.com/fr2/012/21512/Asia_Senior_Housing_Viewpoint_Jul_2012_FINAL_20120725_secure.pdf

Curl, Ward Thompson & Aspinall (2015). *The effectiveness of 'shared space' residential street interventions on self-reported activity levels and quality of life for older people*. **Landscape and Urban Planning**, 139(C), 117-125

Del Barrio, E; Marsillas, S; Buffel, T; Smetcoren, A-S; Sancho, M (2018). *From Active Aging to Active Citizenship: The Role of (Age) Friendliness*. **Social Sciences**, 7(8), 134. MDPI AG. Retrieved from http://dx.doi.org/10.3390/socsci7080134

Elsawahli, H; Shah Ali, A; Ahmad, F; & Al-Obaidi, K (2017). *Evaluating Potential Environmental Variables and Active Aging in Older Adults for Age-Friendly Neighborhoods in Malaysia*. **Journal of Housing For the Elderly**, 31(1), 74-92.

Engel, Chudyk, Ashe, Mckay, Whitehurst, & Bryan. (2016). *Older adults' quality of life – Exploring the role of the built environment and social cohesion in community-dwelling seniors on low income*. **Social Science & Medicine**, 164, 1-11.

Evans, S (2009). *'That lot up there and us down here': social interaction and a sense of community in a mixed tenure UK retirement village*. **Ageing & Society**, 29(2), 199-216.

Feng, J; Tang, S; Chuai, X (2018). *The impact of neighbourhood environments on quality of life of elderly people: Evidence from Nanjing, China*. **Urban Studies**, 55(9), 2020-2039.

Feng-Han Lin; Sang-Bing Tsai; Yu-Cheng Lee; Cheng-Fu Hsiao; Jie Zhou; Jiangtao Wang; Zhiwen Shang (2017). *Empirical research on Kano's model and customer satisfaction.* **PLoS ONE**, 12(9), E0183888.

Geller, L (2015). *Age-Friendly Communities*. **The Canadian Nurse**, 111(1), 23-27.

Green, G (2013). *Age-Friendly Cities of Europe*. **Journal of Urban Health**, 90, 116–128. https://doi.org/10.1007/s11524-012-9765-8

Greenfield, E (2018). *Getting Started: An Empirically Derived Logic Model for Age-Friendly Community Initiatives in the Early Planning Phase*. **Journal of Gerontological Social Work**, 61(3), 295-312.

Greenfield, E; Oberlink, M; Scharlach, A; Neal, M; Stafford, P (2015). *Age-Friendly Community Initiatives: Conceptual Issues and Key Questions*. **The Gerontologist**, 55(2), 191-198.

Herzberg, F; Mausner, B; Snyderman, B B (1959). **The Motivation to Work**, John Wiley & Sons. Inc, New York, 195.

Högström, C; Rosner, M; Gustafsson, A (2010). *How to create attractive and unique customer experiences: An application of Kano's theory of attractive quality to recreational tourism*. **Marketing Intelligence & Planning**, 28(4), 385-402.

Huang, C; Tsay, S; Lockwood, C; Yang, B; Mu, P (2014). P*olicies that promote age-friendly cities and enhance the well-being of inner-city dwelling older adults: A systematic review protocol*. **JBI Database of Systematic Reviews and Implementation Reports**, 12(9), 69-80.

Jansen, S J; Coolen, H C; Goetgeluk, R W (2011). **The measurement and analysis of housing preference and choice** (p. 272). Springer.

Jeste, Blazer, Buckwalter, Cassidy, Fishman, Gwyther, Feather. (2016). *Age-Friendly Communities Initiative: Public Health Approach to Promoting Successful Aging*. **The American Journal of Geriatric Psychiatry**, 24(12), 1158-1170.

Julien, D; Richard, L; Gauvin, L; Kestens, Y (2012). *Neighbourhood characteristics and depressive mood among older adults: An integrative review*. **International Psychogeriatrics**, 24(8), 1207-1225.

Kahn, R L; Juster, F T (2002). *Well–Being: concepts and measures*. **Journal of Social Issues**, 58(4), 627-644.

Kahneman, D; Tversky, A (1979). *On the interpretation of intuitive probability: A reply to Jonathan Cohen*.

Kano, Noriaki; Nobuhiku Seraku; Fumio Takahashi; Shinichi Tsuji (April 1984). *Attractive quality and must-be quality*. **Journal of the Japanese Society for Quality Control** (in Japanese). 14 (2): 39–48. ISSN 0386-8230

Keating, N; Eales, J; Phillips, J E (2013). *Age-Friendly Rural Communities: Conceptualizing 'Best-Fit'*. **Canadian Journal on Aging**, 32(4), 319-332. http://dx.doi.org.myaccess.library.utoronto.ca/10.1017/S0714980813000408

Kemperman and Timmermans. (2014). *Green spaces in the direct living environment and social contacts of the aging population*. **Landscape and Urban Planning**, 129, 44-54.

Kent, J L; Thompson, S (2014). *The three domains of urban planning for health and well-being*. J**ournal of planning literature**, 29(3), 239-256.

Kim, M; Lee, K (2015). *Influences of intrinsic and extrinsic factors on consumer acceptance of orange juice using consumer liking testing and Kano analysis techniques*. **Food Science and Biotechnology**, 24(5), 1687-1693.

Lawton, M; Fowler, Raymond D (1990). *Residential Environment and Self-Directedness Among Older People*. **American Psychologist**, 45(5), 638-640.

Li, B and Shi, H B (2013). *Intergenerational Housing Support between Retired Old Parents and their Children in Urban China*. **Urban Studies** DOI: 10.1177/0042098013483602.

Li, M; Shen, K (2013). *Population Aging and Housing Consumption: A Nonlinear Relationship in China*. **China & World Economy**, 21(5), 60-77.

Lin, F H; Tsai, S B; Lee, Y C; Hsiao, C F; Zhou, J; Wang, J; Shang, Z (2017). *Empirical research on Kano's model and customer satisfaction*. **PloS one**, 12(9), e0183888.

Lui, C W; Everingham, J A; Warburton, J; Cuthill, M; Bartlett, H (2009). *What makes a community age-friendly: A review of international literature*. **Australasian Journal on Ageing**, 28(3), 116-121.

Liu, Y; Dijst, M; Geertman, S (2017). *The subjective well-being of older adults in Shanghai: The role of residential environment and individual resources*. **Urban Studies**, 54(7), 1692-1714.

Llinares, & Page. (2011). *Kano's model in Kansei Engineering to evaluate subjective real estate consumer preferences*. **International Journal of Industrial Ergonomics**, 41(3), 233-246.

Malet-Larrea, A; Arbillaga, L; Gastelurrutia, M; Larrañaga, B; Garay and Benrimoj, S; Goyenechea, E (2018). *Defining and characterising age-friendly community pharmacies: A qualitative study*. **The International Journal of Pharmacy Practice**.

Man, J (2011). *China's housing reform and outcomes*. **Lincoln Institute of Land Policy**

Materla, T; Cudney, E A; Antony, J (2017). *The application of Kano model in the healthcare industry: a systematic literature review*. **Total Quality Management & Business Excellence**, 1-22.

Meng, Q; Jiang, X (2011). *A method for rating customer requirements' final importance in QFD based on quantitative KANO Model*. **International Conference on Service Systems and Service Management**, 2011, 1-6.

Menec, V (2017). *Conceptualizing Social Connectivity in the Context of Age-Friendly Communities*. **Journal of Housing For the Elderly**, 31(2), 99-116.

Mizukami, & Noguchi (2005). *Living condition and resident's view in collective houses for the aged: In case of public housing built in 1990-1991 in Otofuke, Akabira and Takikawa* (Architectural Planning and Design). **AIJ Journal of Technology and Design**, 11(21), 221-225.

Nieboer, A P; Cramm, J M (2018). *Age-Friendly Communities Matter for Older People's Well-Being*. **Journal of Happiness Studies**, 19(8), 2405-2420 http://dx.doi.org.myaccess.library.utoronto.ca/10.1007/s10902-017-9923-5

OECD (2015), *Ageing in Cities*, **OECD Publishing**, Paris https://doi.org/10.1787/9789264231160-en.

Ottoni, C; Sims-Gould, J; Winters, M; Heijnen, M; McKay, H (2016). *"Benches become like porches": Built and social environment influences on older adults' experiences of mobility and well-being*. **Social Science & Medicine**, 169, 33.

Phillips, Walford, Hockey, Foreman, & Lewis. (2013). *Older people and outdoor environments: Pedestrian anxieties and barriers in the use of familiar and unfamiliar spaces*. **Geoforum**, 47(C), 113-124.

Roe, J; Aspinall, P; Ward Thompson, C (2017). *Coping with Stress in Deprived Urban Neighborhoods: What Is the Role of Green Space According to Life Stage?* **Frontiers in Psychology**, 8, 1760.

Smith, R; Lehning, A; Dunkle, R (2013). *Conceptualizing Age-Friendly Community Characteristics in a Sample of Urban Elders: An Exploratory Factor Analysis*. **Journal of Gerontological Social Work**, 56(2), 90-111.

Strobl, Maier, Mielck, Fuchs, Richter-Kornweitz, Gostomzyk, & Grill. (2014). *Living conditions: Stumbling block or path to successful ageing?* Results of the **Augsburg regional conference** "Living environment, age and health". Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz, 57(9), 1120-6.

Sugiyama, Leslie, Giles-Corti, & Owen. (2009). *Physical activity for recreation or exercise on neighbourhood streets: Associations with perceived environmental attributes*. **Health and Place**, 15(4), 1058-1063.

Sugiyama, T; Thompson, C (2006). *Environmental Support for Outdoor Activities and Older People's Quality of Life*. **Journal of Housing For the Elderly**, 19(3-4), 167-185.

Sugiyama, & Ward Thompson. (2007a). *Older people's health, outdoor activity and supportiveness of neighbourhood environments*. **Landscape and Urban Planning**, 83(2), 168-175.

Sugiyama, T; Thompson, C (2007b). *Outdoor Environments, Activity and the Well-Being of Older People: Conceptualising Environmental Support*. **Environment and Planning** A, 39(8), 1943-1960.

The State Council (2007). *Several Opinions of the State Council on Accelerating the Development of the Service Industry*, Retrieved from: http://www.fdi.gov.cn/1800000121_39_3301_0_7.html

Tiraphat, S; Peltzer, K; Thamma-Aphiphol, K; Suthisukon, K (2017). *The Role of Age-Friendly Environments on Quality of Life among Thai Older Adults*. **International Journal of Environmental Research and Public Health**, 14(3).

Ullah, A; Tamaki, J; Ullah, AMMS. (2011). *Analysis of Kano-Model-Based Customer Needs for Product Development*. **Systems Engineering**, 14(2), 154-172.

United Nations, Department of Economic and Social Affairs, Population Division (2017). *World Population Ageing 2017 - Highlight*. **United Nations**.

Walford, Samarasundera, Phillips, Hockey, & Foreman. (2011). *Older people's navigation of urban areas as pedestrians: Measuring quality of the built environment using oral narratives and virtual routes*. **Landscape and Urban Planning**, 100(1), 163-168.

Wang, H (2006). *Strategies for Retirement Community Development in China.* **Massachusetts Institute of Technology**.

Wen, C; Albert, C; & Von Haaren, C (2018). *The elderly in green spaces: Exploring requirements and preferences concerning nature-based recreation*. **Sustainable Cities and Society**, 38, 582-593.

World Health Organization. (2002). *Active ageing: A policy framework* (No. WHO/NMH/NPH/02.8). Geneva: **World Health Organization**.

World Health Organization. (2009). *WHO Global network of age-friendly cities*. Geneva: **World Health Organization**. Online.
Available http://www. who. int/ageing/Brochure-EnglishAFC9. pdf (accessed 14 November 2011).

Wu, H; Tang, Y; Shyu, J (2010). *An integrated approach of Kano's model and Importance-Performance Analysis in identifying key success factors*. **African Journal of Business Management**, 4(15), 3238-3250.

Yao, Chuang; & Hsu (2018). *The Kano model analysis of features for mobile security applications*. **Computers & Security**, 78, 336-346.

Yung, Esther H K; Conejos, S; Chan Edwin H W (2016). *Social needs of the elderly and active aging in public open spaces in urban renewal*. **Cities**, 52, 114-122.

Yung, Esther H K; Ho, Winky K O; Chan, Edwin H W (2017). *Elderly satisfaction with planning and design of public parks in high density old districts: An ordered logit model*. **Landscape and Urban Planning**, 165, 39-53.

Zhou, S; Xie, M; Kwan, M P (2015). *Ageing in place and ageing with migration in the transitional context of urban China: A case study of ageing communities in Guangzhou*. **Habitat International**, 49, 177-186.