A Pyramid Model of Inclusive Design to Get Outdoors for China's Ageing People

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Abstract. To help people aged 60 years or older who are experiencing the functional loss be self-reliant and go out activities happily and safely is an urgent issue. This paper conducts a preliminary study on what developed countries or regions have done to cope with the ageing people in terms of inclusive design and then analyses the challenges in China. A Pyramid model to help create an inclusive outdoor environment for China's aged people is suggested through literature review.

**Keywords:** Ageing people · Getting outdoors · Inclusive design · Pyramid model

1 Introduction

"World Population Ageing 1950–2050" by United Nations, reveals China has the largest number (12 million) aged 80 years or older presently. In 2050, the number will reach 99 million, whilst the number aged 60 years or older will reach about 480 million, exceeding one-third of the total Chinese population. Figure 1 demonstrates average annual population growth rate at age 60 or older, 65 or older, and 80 or older from 1950 to 2050 [1]. In the meantime, about 49.7% of urban Chinese senior citizens with families live apart from their offspring who are well known as elderly "empty-nesters" [2]. These "empty-nesters" have to look after themselves.

Functional loss of aged individuals in the ageing society is more or less experienced at different levels. Inclusive design toolkit developed by the University of Cambridge, Engineering Design Center introduces a framework for related data to measure a person's capability, or assess the ability level that a product demands to use it. It contains seven categories of capabilities: vision, hearing, thinking, communication, reach & stretch, dexterity and mobility [3]. The most relevant capability with getting outdoors is the mobility. It involves combination of locomotion, reach & stretch, and dexterity. All too often, people with low dexterity also have locomotion or reach & stretch disadvantage. As illustrated in Fig. 2, 14.7% of the Great Britain (GB) adult population has less than full ability in one or both of seven categories in the Disability Follow-up Survey conducted by GB, while at that time the total number of population is 45.6 million.
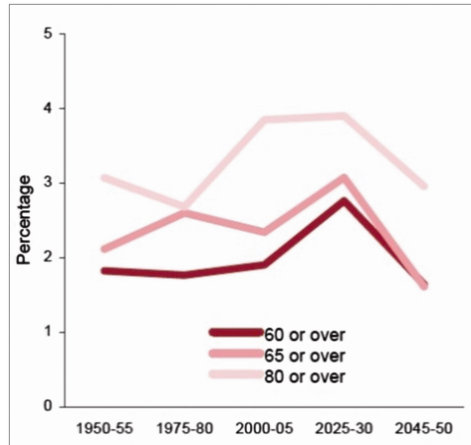
Fig. 1. Average annual population growth rate at age 60 or older, 65 or older, and 80 or older: world, 1950–2050 [1]
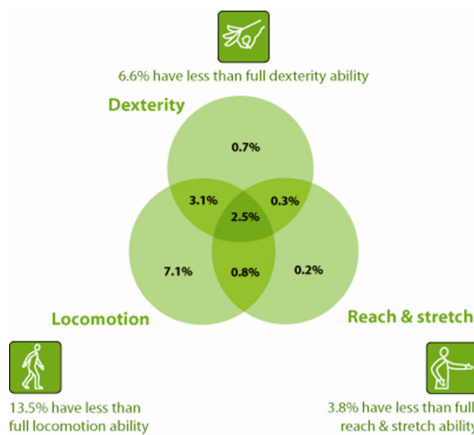
Fig. 2. Prevalence of the population with less than full ability in locomotion, reach & stretch, and dexterity, where the overlapping circles indicate the population that has capability losses in one or more categories [3]

As little as five minutes of exercise a day in the outdoors can improve mental health, according to a British study published in the journal Environmental Science and Technology. P. John Clarkson and R. Coleman [4] addressed "Older people go out into their local neighborhoods very frequently, regardless of season, and walking is very much the predominant form of transport. The three major reasons given for going out are: socializing, getting physical exercise and fresh air and contact with nature."

Yet, despite their desire for walking out, the most impaired capability is locomotive within the population aged 75 years or older in GB, older people have to stay at home for long time rather than getting out due to overburdened public resources and the lack

of health care providers. To be self-reliant, they should be able to commute from home to the outdoors or other destinations even with functional loss. This situation urges governors, researchers, designers and manufacturers take inclusive design seriously into account. In such developed countries as UK, USA, Japan, inclusive design regarding the outdoor environment from research to knowledge base and product production has been in progress.

Compared with the developed countries or regions, the barriers for China's old people to get outdoors are much higher for reasons such as China's rapid urbanization, high population density and basic facilities deficiency. As designers as well as future aged people, the authors aim to make a preliminary study on how to help aged people take an active part in built environment and lead a quality life. This paper focuses on the following issues:

- What capabilities impact on ageing people's quality outdoor life?
- What developed countries or regions did to make an inclusive environment for aged people?
- What challenges China is encountering with concerning ageing population?
- How can China learn from developed countries or regions?

2 Literature Review

2.1 Origins of Influences and Ideas on Inclusive Design

Inclusive design, a concept coined in 1994 in UK, is employed often as a design approach in design field. It focuses on design for the whole population. There are three origins of influences and ideas on it [4], as Fig. 3 illustrates.
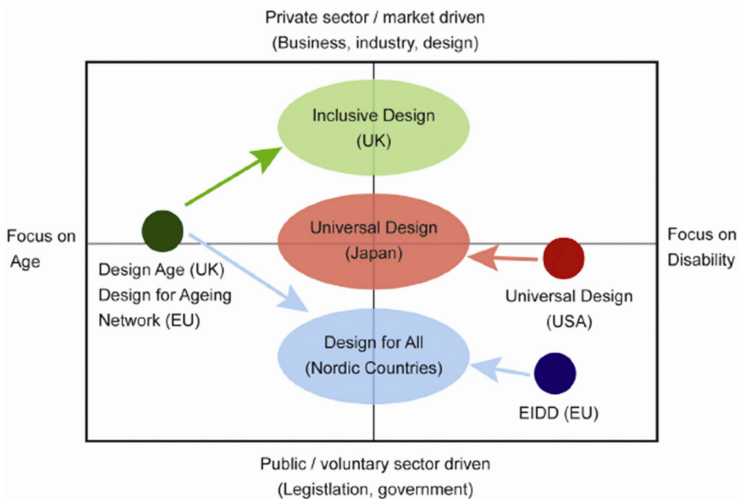

Fig. 3. Three origins of influences and ideas on inclusive design [4]

- Firstly, universal design in the USA, originated as a disability-inclusive architectural design approach, and a major influence on the emergence of universal design in Japan.
- Second, DesignAge, Design for ageing network (EU) and the European Institute for Design and Disability EIDD (EU) emerging with other groups, giving rise to Inclusive Design in the UK and Design for all in Europe. Inclusive design in UK is mostly private sector or market driven, while design for all are mostly public or voluntary driven due to Nordic country's strong welfare.
- Japan's universal design reflected the reality of the most advanced society in terms of population ageing. The famous Ubiquitous (U)-Japan made information and communications technology (ICT) available tools for disabilities.

2.2   Three Approaches in Terms of Legislations and Initiatives

Accordingly, disability civil rights legislations and initiatives have been launched or implemented. I. Audirac [5] argued there were three broad approaches on inclusive design in above developed countries or regions. Table 1 shows disability civil rights legislations and initiatives in Europe, USA and Japan.

Table 1. Disability civil rights legislations and initiatives [5]

Countries or regions	Disability civil rights legislations and initiatives
Europe	European Commission (EC) White Paper on European Transport Policy to 2010
	EU's e-Inclusion 2005 and e-Accessibility
	UK Disability Discrimination Act (DDA), 1995
USA	Americans with Disabilities Act, 1990
	Architectural Barriers Act, 1968
	Rehabilitation Act, 1973
	Safe, Accountable, Flexible, and Efficient Transportation Equity Act, 2006 (aims to reduce barriers to transportation and provide services beyond ADA requirements)
Japan	e-Japan Strategy, 2001, and U-Japan Strategy, 2004
	"Heart Building Law" or Law for Promoting Easily Accessible and Useable Building for the Aged and the Disabled, 1994, 2002
	"Barrier-Free Transportation Law" or Law for Promoting Easily Accessible Public Transportation Infrastructure for the Aged and the Disabled, 2000

Europe. Governmental and non-governmental organizations (NGO)-led approach of planning at all levels for accessible products, services, and environments with an eye on the older market.

USA. Inclusive network of think tanks, advocacy NGOs, consultancy groups, and university in which architects, industrial designers, and engineers lead the way, intend to influence their respective industries about the social and market benefits of designing

for the widest possible usability beyond the Americans with Disabilities Act (ADA) accessibility standards.

Japan. Japanese multinational and corporate-led approach directed on access to the information society, chiefly post-industrial and production oriented, and focused on industrial procurement guidance and design standards with a global market scope.

2.3 Design Guidance

USA: 2010 Americans with Disabilities Act Standards for Accessible Design Guidance on the 2010 ADA Standards for Accessible Design. "The US was the first nation to fully embrace and codify design as a civil right for people with disabilities." [6] The Department of US Justice published revised regulations for Titles II and III of ADA 1990 in the Federal Register on September 15, 2010. The 2010 Standards set minimum requirements: both scoping and technical, for newly designed and constructed or altered state and local government facilities, public accommodations, and commercial facilities to be readily accessible to and usable by individuals with disabilities, typically mandated [7].

UK: Guidance of Inclusive Mobility by the Department of Transportation 2005. Guide published by the department of transportation in UK is to provide good access for disabled people; designs that satisfy their requirements also meet the needs of many other people. Those who are travelling with small children or are carrying luggage or heavy shopping will all benefit from an accessible environment, as will people with temporary mobility problems and many older people. Thus, the overall objective of this guide is to provide inclusive design and through that achieve social inclusion [8].

2.4 Research Programs

UK: I'DGO Research Program (2003–2012). I'DGO research program funded by Extending QUAlity Life (EQUAL) in UK [9], aims to support old people's quality life and demand in built environment through inclusive design. Its first phase was started in 2003 and finished in 2006. Follow-up project named I'DGO TOO was launched in 2007, and the findings were reported in 2012 [10].

Based on evidence from their research, I'DGO publishes a 13 part toolkit. Each part addresses a different environmental feature of streets and neighborhoods. Each guide proposes recommendations for the inclusive design of the environmental feature. And recommendations are for all scales from urban form to street furniture. In addition, WISE proposed a concept "Streets for life" as well as design strategies and guidelines. Their findings have been published in China named "Inclusive urban design: streets for life". In this book, six guidelines are given: familiarity, legibility, uniqueness, accessibility, comfort, safety [11].

UK: i~design Research Program. I'design research program is funded by EQUAL in UK. It is carried out in three phases: i~design1, i~design2, i~design3. The i~design team

plays a key role in developing BS:7000-6 (2005) which provides the guidelines for adoption of inclusive approach to design of products in UK. I~design program brings a number of outputs including inclusive design toolkit and design with people toolkit.

2.5   Design Toolkits

Inclusive Design Toolkit (IDT). IDT answers three questions in UK context. It contains: What is inclusive design? Why do inclusive design? How to design inclusively? On this site, the toolkit provides information about user capabilities such as vision, hearing, thinking and mobility. Take the example of mobility, the toolkit presents mobility which is divided into fourteen mobility levels and related design guidance, etc. [3].

Design with People Toolkit (DWPT). Developed by the team of i-design 3, DWPT has been created by the Helen Hamlyn Center for Design at the Royal College of Art to share ways to design with people. The toolkit provides ten real individuals with different degrees of functional loss across the spectrum of capability as well as five categories of case studies and other resources such as design methods, developing protocols for ethical practice [12].

3   Methodology

The authors explored the web source to acquire the latest demographic and reviewed the literatures to find out capability variation and what developed countries carried out to help build an inclusive outdoor environment. Additionally, the lead author utilized observations of how ageing people to get outdoors during her stay in the USA as a visiting scholar. In order to get deep design strategies, this paper made case studies to see how improve outdoor environment through products and services design as well. Based on the analysis of challenges of inclusive design in China, the authors proposed a model of Pyramid to help aged people getting outdoors more happily and safely.

4   Case Studies

Besides law enforcement and design guidelines engages in inclusive built environment in UK, there are also a number of product or service related designs, which help mobility-disadvantaged people to get outdoors. Figures 4 and 5 are two case studies designed for people with limited mobility published by i~design program. In these cases, designers respond to the Disability Discrimination Act (DDA), adopt inclusive approach through design process, and help people with locomotive loss get outdoors easier as well as meet the needs of many other people.

Fig. 4. The four-wheel mode (left), the two-wheel mode with the case open (right) [12]

Fig. 5. Physical layout of the "smart" bus shelter with easy access to waiting area (left), the waiting area for bus (right) [12]

4.1 Caddy: A Combined Mobility Aid and Roller Suitcase (2006) [12]

The Caddy™ is designed as a mobile case which works as granny trolley, the mobility aid and roller suitcase with aesthetic innovation. It provides storage, support and seating. It can be pulled with one hand, or pushed with two, enabling use by people of all abilities. Users can easily switch between the two and four-wheel modes through the pivoting rear-leg frame and lockable castors. There is a rigid polymer outer shell, with all features and fixing points molded in. A removable fabric case sits within the shell to form the storage compartment, and is accessible through the top from both front and back, as illustrated in Fig. 4. Large diameter wheels with integral axles and rubber tyres help them negotiate uneven terrain and small kerb and reduce jarring. Compression brakes engage when the user is seated, avoiding the need for lever brakes, which are difficult for people with reduced grip. A large curved handle allows different gripping and leaning options, with adjustment levers integrated into the form.

4.2 Is that My Bus?: A "Smart" Bus Shelter (2004) [12]

The bus shelter is reconsidered to make boarding a bus easier for older people with limited mobility or vision. It involves bus shelter environment, smart cards, disabled travelers, information systems, and service design. Design solutions are generated after the team identifies the key problems. The layout of the bus shelter has been reconfigured and existing telecommunication technologies have been integrated into the physical

design of the shelter. It avoids the complex access by simple interaction at the point of need, as shown in Fig. 5. How does the "smart" bus work for visually impaired people and wheel chair users?

For Visually Impaired People. Visually impaired people take the Smartcard "Freedom Pass" which contains limited information about their condition. They have Proxim add-on to their cards. Before they leave for the bus stop, Proxim device will be activated to make sure they won't walk pass the bus stop. The Proxim reader fitted to the bus stop detects them and the bus stop identifies with an audio message to tell what routes and direction. When they touch down the reader in the shelter, it will collect fares. But when they touch down the reader in the bus, it will activate the speaker in the bus. The audio system will announce every approaching bus stop in time to request desired stop. (Note: no "next-stop" announcement in common buses in UK.)

For Wheel Chair Users. Wheel chair users take the Smartcard "Freedom Pass" which contains limited information about their condition. When they arrive at the stop, they touch down the reader embedded in the shelter. It will identify them as wheel chair users. The information will highlight the logo on the flag/RTI and is communicated to the drivers. Then drivers will pull in at the recommended position. Users can easily access in the bus.

5   A Model of Pyramid to Help Get Outdoors

5.1   Challenges in China

As a developing country with the largest ageing population in the world, China has to face bigger challenges. Basically, China's inclusive design is government and experts led approach. Being a vulnerable social group, aged people intend to be overlooked by the country's top-down planning system. Though several legislations related barrier-free design have been published in past decades, inclusive design hasn't seized the Chinese popular imagination nor shaped the personal or professional identity of most designers. Currently, there are around four challenges China is encountering with:

Inefficient & Deficient Existing Inclusive Facilities. One of the most often example of inefficient inclusive facilities is that lots of sidewalk for the blind couldn't work well due to maintenance problem. And deficient facilities to get outdoors mainly are reflected on the accessible transit. Though China has the largest aged population, they can't be seen often on the streets.

Focus of Inclusive Design Shift. In the international dimension, inclusive design cares for not only disabled people, but also people of all ages. China's decision makers should catch up with this focus shift. They should give the opportunity to aged people to have their voice. Government and experts should reconsider the demands of ageing people from city scale, neighborhoods or community to even small lanes.

Research Organizations Engagement. Based on literature review, so far there are only two inclusive research organizations across China: Inclusive Design Research Center (IDRC) at Tongji University and Tianjin Barrier-Free Research Institute at Tianjin University. Underlying cause is the lack of public sectors, private sectors even market drivers.

Design Education Involvement. Inclusive design hasn't been a common set of design curriculums in colleges or universities. All very often, it is an elective course or a coursework. This fact indicates educators haven't reached the consensus that inclusive design should be considered as one of important design approaches. As future designers, the students must put old people at the heart of design process.

5.2   A Model of Pyramid

Based on above research findings, the authors summarised a preliminary model of Pyramid to tackle ageing challenges in China as illustrated in Fig. 6. The Pyramid model builds upon a tiered government and experts led approach to establish a powerful network of inclusive design. Tiered approach as a pyramid contains:
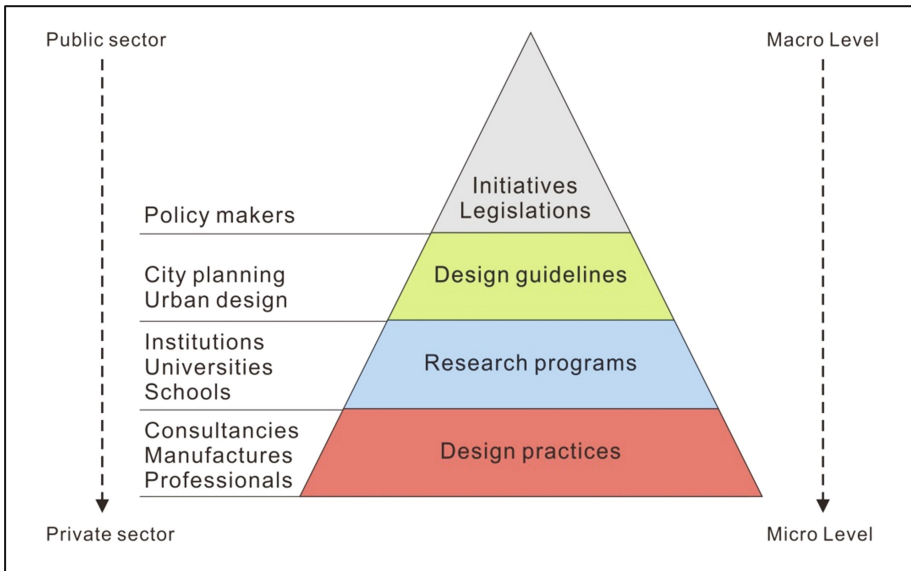
Fig. 6. Model of pyramid (Color figure online)

Red Tier: Design practices at micro level could be booming and driven by private sectors including the design consultancies, manufactures and design professionals.

Blue Tier: Research programs mainly conducted by institutions, universities and schools.

Green Tier: Design guidelines formulated by city planning and urban design-related governmental organizations.

Top Tier: Legislations and initiatives launched by policy makers to support other tiers.

Through four parties' engagement in the Pyramid, happier and safer outdoor environment might be built.

6   Conclusion and Future Work

Aged people are getting to be included in outdoor environment in developed countries or regions where inclusive design has been delivered since last century. These countries or regions already acquired great achievements and rich experiences. A wealthy of inclusive products and services are emerging though new design challenges are coming out. Whether legislations making, design guidelines formulated with minimum mandated requirements, research programs engagement or detailed product designs involves a large number of stakeholders and is time consuming. Considering the complexity of each tier of Pyramid model, getting outdoors more happily and safely in China has a long way to go.

The limitation of this paper is the lack of quantitative research and pilot study for a specific outdoor activity problem. The Pyramid model should be refined in next stage. Further studies will focus on inclusive product design such as outdoor shopping facilities and street furniture for older people based on a typical ageing neighborhood.

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