Case Studies on Promoting the Rights of Older Persons through Expansion of Public Accessibility of Assistive/Welfare Technology

AGAC ASEM Global Ageing Center

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ACCESSIBILITY OF ASSISTIVE TECHNOLOGY AND WELFARE TECHNOLOGY FOR OLDER PERSONS IN NORWAY

ARNE H EIDE

Assistive technology (AT) and welfare technology service delivery in Norway involves a range of different actors. This includes the professional service delivery system at national, regional and municipal levels, relevant sectors such as transport, health (including occupational and physical therapy), culture and education, and employers, users and users' families. While the responsibility for AT service delivery is anchored in the Norwegian Labour and Welfare Administration (NAV) under the Ministry of Labour and Social Inclusion, it is a decentralized system with municipalities as the first point of entry, responsible for most of the direct contact with individuals in need of assistive technology and related services. While welfare technology solutions are also handled and distributed through the primary health care system, this is anchored in the Ministry of Health and Care Services.

The distinction between assistive technology[1] and welfare technology[2] is blurred and the terminology in use varies across countries. In a Norwegian context, NAV is responsible for assistive technology that can support activity and participation for persons with functional difficulties, for adaptations at workplaces and to support ageing in place. Welfare technology is intended to support ageing in place, prevent the need for services and avoid or postpone admission to institutions. Welfare technology can be categorized into technology to support i)

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[1] Assistive technology (AT) is a **term for devices, systems, and services that help people with disabilities and older people to perform activities of daily living and improve their functioning and independence**. AT can include **mobility devices, software programs, and hardware and software that assist people with disabilities in accessing computers or other information technologies**. Source: Assistive technology (who.int)

[2] Welfare technology is a concept that refers to **technology which improves the lives of those who need it**. It is used to maintain or increase security, activity, participation or independence for people with a disability or the elderly. Welfare technologies are assistive technologies that provide physical, social and cognitive assistance for older adults and persons at risk of disability. Welfare technology is a digital transformation and system-wide approach beyond a single assistive technology. Welfare technology may be seen as a Nordic concept and goes under different names in other parts of the world. Source: Welfare Technology | NVC (nordicwelfare.org)

safety/security, ii) compensation (for functional decline) and well-being, iii) social contact, and iv) treatment and care (Isaksen 2017). The distinction between a participation/activity approach (NAV) on one hand and management of health condition (health services) on the other is reflected in the organization of services and responsibilities between NAV on one hand and the health care system on the other, as well as in the legislation and funding mechanisms. Basically, AT is an individual right in the Norwegian system and is covered by the Act on Social Security. The requirement is that need and relevance for supporting activity and participation are qualified through a professional assessment. Access to welfare technology is on the other hand determined by what is assessed as "necessary health care" according to the Health and Care Services Act. Still, the distinction between assistive technology and welfare technology is not clear-cut in practice, and is becoming even less clear with digitalization.

Funding and implementation of AT and welfare technology service delivery in Norway are a public responsibility. Welfare technology may however come with some limited out-of-pocket expenditure for the user/patient depending on the responsible municipality. The private sector is involved in different ways, for instance as suppliers of AT into the public service delivery system and through private clinics that have an agreement with the health and care system to deliver services. The total dominance of the public sector also implies that there is a close connection between the public policy level and the practical implementation of services, compared to more fragmented or market-oriented systems. Part of the backdrop to the current situation is thus the program Live Your Whole Life that was launched in 2018 to offer solutions for municipalities to help ensure safe and healthy ageing for their residents. The main aim was to spread and implement innovative approaches to support ageing at home, the social inclusion and community integration of seniors, provision of meals and/or nutrition services, and continuous and coordinated health care services. Provision of AT and welfare technology must be seen in the light of a clearly pronounced ambition to strive for an age- friendly society: "All older persons should be able to continue enjoying their daily lives, even when health issues arise and public services are needed." (op.cit., page 8).

1. AT Service Delivery

The Norwegian Assistive Technology Service Delivery system started as a pilot in 1977. Development was driven by a close collaboration between the Ministry of Health and Social Services (MoHCS 2012), Organisations for Disabled People (OPDs) and relevant professional

organizations, with the applied research agency SINTEF leading the process and hosting the secretariat of the Council for Assistive Technology. Development was strongly rooted in a Nordic collaboration on service delivery models, and the testing and development of AT standards. From 1995, a uniform, public and national system for Assistive Technology was in place in Norway, organized under the Ministry of Health and Social Services (MoHSS) and, today, the Norwegian Labour and Welfare Administration (NAV [3]) (Sund 2017a; b; MachLachlan et al. 2018). This system is based on principles of equal access nationally and is funded through National Insurance. This is a rights-based system embodied in Norwegian law for individuals who meet the necessary criteria. Internationally, Norwegian service delivery of assistive technology is regarded as an advanced example of a human rights-based system (Holloway et al. 2023).

A centralized purchasing mechanism is in place within NAV. Private suppliers compete to get their products into the assortment of NAV and Assistive Technology Centers (ATCs), one of which is located in each of the 19 counties (prior to a recent reform that reduced the number of counties). These centers acquire the assistive devices based on the central tender system and distribute the devices to individuals and municipalities. Devices are owned by NAV, are lent out to users, and returned to the ATC centers when no longer in use or there is need of replacement. A program is in place to ensure the repair and recycling of devices when this is deemed economically viable. Around 30 percent of distributed assistive products are second-hand.

**Photo: One of the 13 Assistive Technology Centers in Norway**

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[3] NAV is a national administrative agency that combines municipal and government services.

NAV administers the funding and provides the assistive devices. The ATCs are responsible for AT for individuals with significant and permanent impairments, although service is mostly done at municipal level. Municipalities are responsible for acquiring and delivering AT in case of temporary disabilities and for residents of nursing homes. Municipalities are responsible for any follow-up after extradition, regardless of whether the need is permanent or temporary. Referrals from municipalities to the ATCs are done when needed, following professional assessment. The ATCs provide guidance and technical support to the municipalities when required. While also funded through NAV, hearing and orthopaedic services are provided through hearing centers and orthopaedic centers.

Different data systems keep track of the number and age of users of AT, what kinds of AT are available in the service delivery system, costs, processing and delivery times and more. A Government-appointed Expert Committee looking into effectiveness and innovation in the AT service delivery system underlined user involvement as an overall goal for the services, based on the assumption that this is beneficial for both the individual and society (MoLSA 2017). The report was based on a comprehensive investigation of different aspects of AT services conducted in the light of other large reforms in the Norwegian health and welfare system during the last 10–15 years. The committee concluded that the current Assistive Technology Service Delivery system needs adjustment, but also that the overall model should be maintained. The committee further concluded that good access to the right assistive devices on time is a decisive factor in individuals with functional difficulties being able to live independent lives and participate in society – and that this no doubt is also beneficial for society, both in social and economic terms. A recent study did however point out that user involvement in the service delivery process, while high on the agenda in the Norwegian service delivery system, is still in need of improvement (Pedersen, Kermit and Söderstrøm 2020).

Figure 1. The Assistive Technology Service Delivery system in Norway
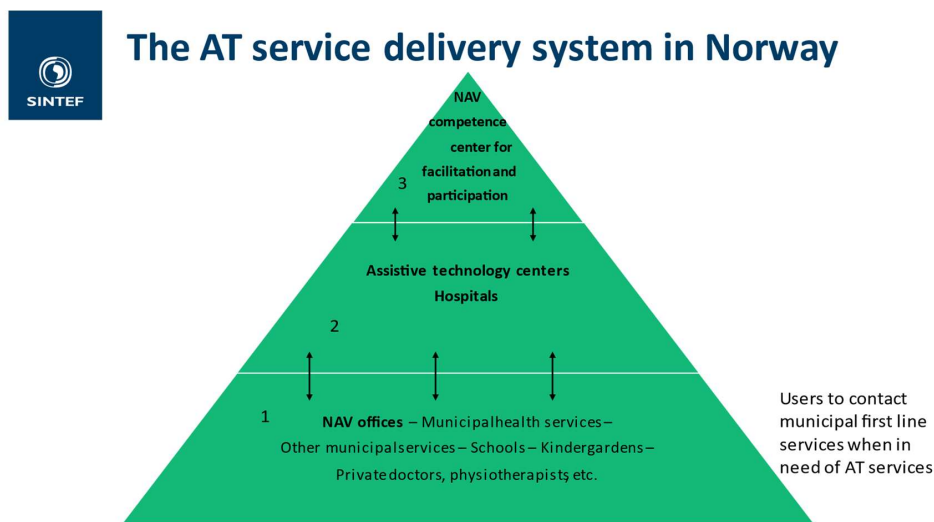
In 2020, a total of 526,000 individuals received at least one assistive product through NAV and primary healthcare in the municipalities, which is around 10 percent of the Norwegian population[4]. More women (11 percent) than men (8 percent) received at least one product. Among the receivers of at least one product, 39 percent were above 67 years, and among this sub-population (aged 67 and above), 25 percent received at least one assistive product.

For comparison, a total of 116,000 individuals received welfare technology solutions in 2021[5], largely through the primary health services in their municipalities. This is around 2 percent of the total Norwegian population. The vast majority of receivers of welfare technology solutions are older persons, and around one-third of the population above 80 years used welfare technology in 2021.

2. Hearing Services and Prosthetics and Orthotic Services

Hearing services and prosthetics and orthotic services are both organized as part of the specialist health services. There is a total of 29 hearing centers localized at hospitals across the country. Private and public specialized orthopaedic clinics are available across the country.

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[4] Source: BufDir: https://www2.bufdir.no/Statistikk_og_analyse/nedsatt_funksjonsevne/Helse/ bruk_av_helsetjenester_og_tekniske_hjelpemidler/
[5] Source: National directorate of health: https://www.helsedirektoratet.no/rapporter/omsorgstjenesten-- aktivitetsutvikling-og-erfaringer-fra-pandemien/statistikk--bruk-av-omsorgstjenester/velferdsteknologi-i-ulike- aldersgrupper-og-helsefellesskap

3. Welfare Technology

Over time, several white papers have pointed to implementation of technology as part of the solution to capacity problems in the health sector in Norway, which are due to the increasing number of older and chronically ill persons. Digitalization is assumed to contribute substantially to increased productivity in municipal health and care services. The Norwegian authorities have therefore in the last decade attempted to stimulate use of digital technology, first through a National welfare technology program, then through a follow-up Health technology program currently in progress (Directorate for e-health 2022).

3.1 The National Welfare Technology Program

The National Welfare Technology Program (2014–2024) is a collaboration between the Norwegian Association of Local and Regional Authorities (KS), the Directorate for e-health and the Directorate of Health (https://www.helsedirektoratet.no/tema/velferdsteknologi/velferdsteknologi) (MoHCS 2012).

The ambition of the program is to promote the use of welfare technology in municipalities. This is achieved through the following measures:

1. Amplifying the use of digital home follow-up among individuals with chronic diseases, in order to encourage municipalities to make use of digital tools in collaboration with general practitioners and hospital trusts/hospitals.
2. Extending welfare technology to children, youth and adults with congenital or early acquired disabilities. Individuals with permanent disabilities will require life-long services, and early intervention is seen as an investment for both the individual with disability and for society.
3. Establishing a permanent welfare technology network among municipalities to share and build welfare technology competence across the country.
4. Supervising municipalities to build competence in and around municipal health and care services.
5. Establishing national standards for architecture and infrastructure that can be adapted to the future increased use of welfare technology, providing input to actors in the health care sector, including suppliers, for facilitation of development and procurement.
6. Building capacity in municipalities for improving digital competence among older people through facilitating meeting places and interaction to prevent solitude and digital exclusion and strengthen older people's competence to access digital health information

and receive digital health services, for instance via video- and e-consultations. The latter is a subsidized scheme for trying out new tools and training methods. For instance, in 2021, funding was provided to three NGOs to implement training in the use of digital tools by older people across the country. An evaluation of the program reported positive results such as increased competence in the use of digital tools, and more contact within families and across generations. The evaluation also pointed to potentially reduced solitude and exclusion, and the importance of improved digital literacy as a necessity for using services such as banks and communication with public services (Johnsen 2017).

Although only one of the above measures mentions older people specifically, it is safe to say that, other than the measure specifically for children, youth and adults with early acquired disabilities, the measures will in effect mainly concern older persons.

4. Current Situation

The Norwegian market for welfare technology is increasing by around 20 percent per year. A handful of suppliers offer welfare technology platforms that can collect information from a large number of products from smaller suppliers. Few suppliers offer open platforms, leading to municipalities being locked within one ecosystem when they have made their initial choice/purchase. In fact the welfare technology market is still limited in Norway, due, among other things, to the slow pace of implementation in municipalities and nursing homes. The suppliers have the products and the necessary services available, but there are few buyers and mostly small purchases. Suppliers experience the market as slow, and that tedious decision-making processes delay implementation of new technology. In addition, demand is mostly for tailor-made rather than standardized solutions that can easily be scaled up (Directorate for e-health 2022).

Even though use of welfare technology is increasing, health personnel and other personnel in health and care services experience insufficient support in using digital tools and solutions to perform their work. It is for instance a challenge that individual health information is stored in different digital systems that do not speak to each other and are not able to collaborate. This is the case both within municipal service areas and between municipal health services and other health service actors. A handful of large suppliers offer platforms that that can "talk" to a large

number of products from smaller suppliers. Most of these platforms are not open, leading to municipalities being "locked in" when they have made their choice of supplier. There are furthermore substantial challenges with regard to individual patient data when it comes to access and an overview of available information, with insufficient support for work processes, limited functionality in several health areas, lack of decision-making support, solutions that are not user-friendly, insufficient training, and computer program irregularities.

Municipalities that have participated in the National welfare technology program report saved time, reduced costs and increased service quality. Time is saved through reducing the number of physical visits; there is consequently less driving. Use of digital monitoring reduces costs through less need for staffing at night. Municipalities and researchers report gains for patients through experience of freedom, being in control, dignity, and independence in daily life (Grut et al. 2019). It has further become easier to get in contact with the services, and response time has been reduced. Health care personnel report reduced stress due to more regular workloads, better conditions for collaboration, a calmer work environment, fewer reported deviations, and increased patient safety. Next of kin report increased feelings of safety due to reduced stress and worrying. In spite of this positive feed-back, the full potential for implementing welfare technology in the municipalities has not been realized. There is substantial variation between municipalities, and still a relatively low number of users, in spite of the steady increase in use over the decade-long program period. Further gains are thus expected to come from continued efforts to scale up use of welfare technology.

While the program has had some good results, small municipalities in particular report lack of competence to make the right, or best, purchases of technology, high human and economic costs related to organizational changes and capacity building, weak and slow gains from digitalization, and absence of economic stimulants for investing in new technology.

The ambitions, and some of the measures, in the National welfare technology program will be carried forward in a new Health technology program from 2023/24 (Directorate for e-health 2022). Specific measures are suggested to resolve the problems identified during the National welfare technology program. As an overall strategical move, the ambition is to move away from large, nationally-funded programs towards financial mechanisms aimed at reducing the risk of investments, and provide support and mentoring to municipalities. We will also see a shift of the responsibility for scale-up of welfare technology from the national level to municipalities and suppliers.

5. Case study – Technology for Localization and Way-Finding (gps)

New technologies and organizational innovations are often tried out in smaller pilots. The pilots are evaluated and then reported in a format that is available to decision-makers at different levels. The initiative to carry out a pilot study and/or implement a new technology may come from the municipalities, the responsible ministry, a user organization or a research institute – depending on whether this is an element in a national program, a research and innovation funding scheme, or an initiative from municipalities and suppliers.

The use of Global Positioning System (GPS) technology illustrates how new welfare technologies may be implemented within the existing service delivery system in Norway. GPS is a satellite-based navigation system that can be used by anyone who needs to keep track of where he or she is. With increasing numbers of older persons in the population across the world, the number of persons suffering from dementia and other cognitive age-related diseases will also increase. This is already today a substantial challenge worldwide for health services and those who are next of kin to persons with dementia. Many persons with dementia have problems with orienting themselves and finding their way to places they need to go to. Persons with dementia may also "wander" and get lost, without the ability to find their way home. One early study reported that more than 40 percent of persons with dementia had experienced problems in finding their way home; this was a recurring problem for close to 30 percent (McShane et al. 1998, cited in: Torvik and Alm 2023). In Norway, around 10 percent of rescue operations concern older persons, often with dementia (Torvik & Alm 2023). Fortunately, good technological solutions exist to help persons find their way or help formal and informal carers to locate the person who has got lost. This technology helps individuals to sustain their independence and freedom of movement and to continue living a life with the required quality.

With welfare technology and AT being positioned on the political agenda through the initiatives referred to above, funds have been allocated to research and innovation that can contribute to improve and develop services. Some of this research is described in this section. This is not a systematic review but rather a selection of examples of high relevance to the case study of GPS, providing context for the description of the complexities involved in implementing and scaling up welfare technology in Norway to support the ambition of "A full life – all your life".

6. Lessons from Current Research

GPS technology has been tried out in many small-scale pilots to find out if and how it can support persons with dementia and their next of kin in way-finding, ageing in place, and sustaining a level of freedom of movement. In a study among a larger cohort of persons with dementia and their next of kin, the persons with dementia were equipped with GPS when performing outdoor activities as part of their daily life (Øderud et al. 2015). The study documented that using GPS for locating persons with dementia provided increased safety for the person with dementia, their family caregivers and their professional caregivers. By using GPS, persons with GPS may maintain their autonomy, enjoy their freedom and continue their outdoor activities in spite of the progression of the disease. The study further concluded that factors of importance for successful implementation of GPS technology are that health personnel are trained to assess the needs of the person with dementia, that ethical dilemmas are considered, that caregivers have adequate knowledge of how to use the technology, and that routines for administering the technology are in place.

A qualitative study among health personnel confirmed that nurses and health workers (in this case) reported a positive attitude towards GPS technology and that they experienced the technology to be effective in supporting ageing in place (Torvik & Alm 2023). Successful implementation requires that all involved have the necessary competence to use the technology. Implementation early in the course of the disease will yield better results as the person with dementia can get used to the technology before the disease itself makes this more difficult. Another qualitative study found that use of GPS technology increased both perceived security among next of kin and freedom for the person with dementia to live the life he or she wanted (Tuft & Hesleskaug 2016).

A recent synthesizing review of 23 research reports from pilots in Nordic countries from the perspective of persons with dementia, looking particularly for signs of exclusion, identified three overarching themes: using GPS to stay safe, taking control, and the value of GPS data (Bartlett, Brannely and Topo 2019). Most of the articles reviewed found that using GPS technologies prevented harm and promoted well-being. The question about who should take control and make the decision about using GPS technologies was emphasized in several papers. In most cases, use of GPS technology provided the next of kin carer control over the person with dementia. Five papers reported how data provided through GPS technologies can provide valuable real-time, accurate information about a person's spatial behavior and walking trips. The review revealed a growing interest in the use of GPS among persons with dementia, and

took this as an indication of effective policy implementation. The review recommended consulting persons with dementia in further research, innovation and service development, rather than relying solely on the opinions of health workers or next of kin, which is the most common perspective in welfare technology research.

Thomassen (2021) discusses the limitations of existing legislation as a barrier to implementing GPS technology and other technology using personal data. In Norway, the law on patient and user rights of 2013 paved the way for use of localization technology for individuals without the ability to consent. A decade later, there is still some way to go before this technology is fully integrated in health services in the municipalities. Øderud et al. (2015) argue that preconditions for successful implementation include training health personnel to assess needs and ability to consent, thorough consideration of ethical dilemmas, providing caregivers with adequate knowledge to use the technology, and making sure procedures for administering the GPS are in place. Inadequate training of health personnel may lead to uncertainty in their assessment of ability to consent and compromise their management of situations where the older person in question is unable to consent. The point here is that even when laws and regulations are in place, there are still several other preconditions that need to be in place for the successful implementation and scale-up of GPS technology; this has high relevance for welfare technology in general. There is still need for capacity- building in the Norwegian system for full-scale implementation of GPS, and there is need for municipalities to adapt their organizations to use a technology that requires flexibility in services.

7. A Service Delivery Model for Localization Technology

In Norway, it is a political ambition that municipal health service should offer high quality welfare technology solutions to individuals; this concerns mostly older persons, where the aim is to support an independent life and ageing in place, and reduce or postpone dependency. Integrating welfare technology into municipal health services is however a complex task; initially many small pilot studies sought to gain experience, being supported by research and innovation. To continue with the case study, integrating GPS technology requires that municipalities have the necessary competence and capacity. An innovation program ("Safe tracks") in five municipalities, with the involvement of 13 additional municipalities, aimed to develop a general service model for integrating localization technology (GPS) in municipal health services. Challenges for the implementation of GPS technology comprised, among others,

lack of competence and support, weak finances, uncertainty about return on investments in welfare technology, and absence of clear procedures for procurement, technical support, follow-up, and responsibilities.

In collaboration with the participating municipalities and users (patients with dementia and their families), the innovation study developed a service model to be used by municipalities. At a general level, the core of the model is integration of technology, implementing organization and the human resources in the organization. It is critical that municipalities, prior to implementing the service model, make the necessary preparations through identifying needs (in the municipality), assessing costs and gains, anchoring the model within the relevant services and at the municipal political level, deciding on the funding and payment model, procuring the technology and related services, carrying out a risk analysis, negotiating an agreement on data handling with the supplier of the technology and obtaining the necessary permissions, and clarifying consequences for existing services in terms of service model tools and training. Skipping or ignoring any of these elements in preparing for the implementation of new technology in municipal health services increases the risk of sub-optimal services and reduced return on investment.

The steps in the model are as follows:
- General mapping of needs, establishing an overall picture of the individual patient/user's situation
- Detailed mapping to obtain a clear picture of the patient's/user's challenges in moving outdoors on his/her own and establish whether it is possible to put in place a safe localization service
- Individual mapping/adaptation of services to i) establish routines and assign responsibilities in the follow-up of the individual patient/user, and ii) to configure the technology to fit patient/user need and movement pattern
- Training and trial period to make sure that the person with dementia and the carer/next of kin are familiar with using the technological solution
- Quality assurance after the trial period for further adaptation
- Daily use including follow-up and intervention if and when needed
- Termination if and when the patient/user no longer can use or benefit from the technological solution

This description of the different steps and considerations needed in order to secure successful implementation of new welfare technology in municipalities concerns one particular technology (GPS) and a specific context (Norwegian municipal health services). Other types of welfare technology and different contexts may require different approaches. For instance, the organization of health services and the public/private mix and, related to this, the entire service delivery model for welfare technology, vary considerable between different countries and contexts. Readiness of health workers and patients to use welfare technology will also vary substantially. Another critical aspect is whether technological solutions are free or have to be paid for out-of-pocket. In Norway, the funding model is decided in each municipality, so there is some variation with regard to how much is funded by the municipality and how much is paid for by the user. With these and other contextual differences in mind, it is still the case that many of the elements in the model described above will be relevant in different contexts. An overall message is that introduction of new technologies, in this case as AT or welfare technologies, is about much more than availability of products; successful implementation requires a systematic and comprehensive approach to the whole "value chain", from product to service delivery system to the individual user.

8. The Techno-Organizational Network

The complexity of the context for implementing localization technology (GPS) and the range of human and non-human components is illustrated by Spilker and Nordby (accessed 07.08.23) as a "techno-organizational network" (Table 1).

Table 1. The techno-organizational network (adapted from Spilker and Nordby (accessed 07.08.23)

The techno-organizational network		
Technical elements	Organizational elements	Surrounding elements
The GPS device	The patient with dementia	Other emergency services
The alarm center	Relatives	Other healthcare professionals
The battery	The safety patrol unit	Technology equipment
The alarm button	The home care service	Network providers
Geofences	The occupational therapy unit	Legal expertise
The RFID chip	Health and welfare offices	Convalescence homes
Homes	Laws and regulations	More peripheral relatives
Physical surroundings		

The table provides an indication of the complexities involved in the establishment of a localization service that at first may seem easy to put up. This is about much more than providing new technology; it involves organization of a highly compound network of human and non-human actors and factors that are given new or additional roles and responsibilities, including new actors and new competencies not previously engaged directly with health care. The example is from a pilot project in a large Norwegian municipality and the framework is suggested by the authors as a framework for relational analyses of technologies in care (Spilker & Nordby 2019).

9. Discussion

Norway has a well-developed and "mature" organization for service delivery of AT – including for older people. The system has been developed over more than three decades and has been through various revisions and modifications over the years. There are no particular measures directed towards older people in need of or using AT in this system. The overarching principle is that assistive products are a right for everyone in need, and allocated for the purpose of supporting daily life activities and social participation. This does of course mean that assessments will vary between age groups, as older persons have different problems and needs when compared to younger cohorts. Welfare technology to prevent the need for services, to support ageing in place and avoid or postpone admission to institutions is, on the other hand, less "mature", and not rights-based in the same way as AT. Its allocation depends on how local primary health services understand "necessary healthcare", and is thus subject to larger variation depending on, for instance, competence and economy at the level of municipalities. Allocation of welfare technology and related services is by and large more complex than AT service delivery as it often requires tighter follow-up and depends on a wider support network (see Table 1) and infrastructure.

It is thus safe to say that Norway has progressed far concerning AT generally, including in services to older people. Welfare technology is in a transition phase from piloting to full integration in municipal health services. This phase has been supported by a large national program that included specific measures directed towards older people. A new arrangement for health technology is underway. A shift in government strategy has been signaled, and it can be expected that future stimulation from the national health authorities will be in the form of financial risk reduction and counseling rather than new national programs. This shift may come

at the right time as competence, capacity and motivation have been built up at the municipal level and created greater receptivity.

Effect studies of welfare technology are few. The conclusion of an earlier review of the benefits of AT and welfare technology was however that they paid off in most cases, and that costs were much less than for new and expensive medicines (Hem and Dale 2016). There is however a larger number of evaluations and qualitative descriptions of their experiences from users/patients, next of kin, and health professionals. Most of the pilot studies on implementation of welfare technology report positive results in the form of greater security and independence and better quality of life. The assessment of the Norwegian Directorate of Health of the National Welfare Technology Program is that the program has resulted in substantial benefits in the form of saved time, avoided costs, and increased quality of services for users/patients, next of kin and health workers (Isaksen 2017). For the individual patient/user in Norway, costs will rarely be an issue, as AT is free and welfare technology may come with relatively small out-of-pocket payments. While affordability is mostly not an issue in the Norwegian context, and access to AT is good and well-organized all over the country, access to welfare technology varies among municipalities and is currently not fully integrated into existing primary health services. This service is currently being built up, however, and it can be assumed that access to welfare technology will continue to improve in the years to come. The example of GPS technology is intended to illustrate that implementing a new service within an existing municipal health service may on one hand be a good strategy for the sustainability of the new service, but it is also a difficult task that involves many actors and structures within and outside the health system. Innovation and new services within an established system may create "resistance" in different ways; there may be legislation in need of revision, funding mechanisms, capacity and competence that are not in place, and professions and individuals who may have interests that are not always conducive to change. In addition, municipalities need to adapt their organizations to a new, challenging task. The lesson from establishing AT service delivery in Norway is that "things take time" and that there is a need to try out different solutions, to generate knowledge through research and innovation, establish funding mechanisms, reform legislation and prepare the health sector (in the case of welfare technology) – these and other factors contributing to reforms such as the integration of welfare technology need time to be fully operational.

Norway ratified the UN Convention on the Rights of Persons with Disabilities (CRPD) (UN 2006) in 2013 and is thus committed to fulfil the rights included in the Convention. The

Convention is the most widely ratified human rights convention and establishes the right of persons with disabilities to participate in society on an equal basis with others. According to Smith et al. (2022), AT is central to the realization of the CRPD. The right to participate in society is fundamental for the Norwegian AT service delivery system, which is often referred to as a human rights-based service. While the rationale for building up welfare technology services differs, and is governed by "necessary health services", it is in effect also supporting the activities of daily life and enabling participation.

10. Conclusion

AT and welfare technology services in Norway are not the exclusive preserve of any particular age group. All citizens have the right to AT when they need it to support daily life and social participation. To turn this around, older people have the same rights as anybody else to AT. In practice, there is of course an age gradient in the demographic distribution of functional difficulties, and the need for AT increases with age and natural functional decline. Concerning welfare technology, this is linked to health needs, not to specific age groups, but it will in practice, to a large extent, be a service that is utilized by older people due to the association between age and health problems such as dementia.

The Norwegian health care system is founded on the principle of universal health care, funded through the National Insurance Scheme (NIS). Out-of-pocket expenditure is kept at a low level and will rarely be a barrier to accessing services. The AT and the health care system are decentralized and accessible to all. While the system is not without its problems, and there are challenges for instance concerning access to health and technical personnel, effectivity and co-ordination, it may be regarded as a good example of a human rights-based system. This is a costly and complex system that requires a developed economy and a strong public sector. The complexities of a human rights approach to AT and welfare technology should not be underestimated and other service delivery models are needed to fit different contexts and economies.

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PROMOTING ACCESS TO ASSISTIVE TECHNOLOGY FOR HEALTHY AGEING IN SINGAPORE

CAROL MA HOK KA

1. Abstract

Singapore is taking a proactive approach to addressing its ageing population by implementing comprehensive strategies such as the Action Plan for Successful Ageing, and Healthier SG. These strategies aim to ensure that every individual can age with dignity, health, and confidence. This study focuses on Singapore as a case study to explore the accessibility of assistive technology for healthy ageing. Assistive technology plays a crucial role in empowering older adults by enhancing their independence and overall well-being. Global projections indicate a growing demand for assistive products, and Singapore's ageing population reflects this trend, as people might suffer chronic illness or disability when they get older, and they might need some assistive products to support their daily activities. Therefore, providing access to assistive products aligns with the World Health Organization's principle of equitable health opportunities.

Singapore has implemented various initiatives to improve access to assistive technology. Government programs like Senior Go Digital and GovTech's Accessibility Enabling team focus on improving digital skills and availability. Initiatives like Home Access and the Seniors' Mobility and Enabling Fund (SMF) address the affordability and availability of assistive technology. Additionally, the Living Lab and Gerontechnology Ambassador initiatives, driven by the community and the university, educate older adults about the benefits and accessibility of assistive technology. These initiatives echo the 6As (Affordability, Availability, Accessibility, Accommodation, Acceptability and Appropriateness) of access to care in assistive technology.

However, there is still more work to be done in addressing the concerns, rights, and experiences of older adults. To successfully adopt assistive technology, it's essential to understand the concerns and preferences of older adults, uphold their rights to dignity, privacy, education, and health, and consider their user experience. These factors are also crucial for enhancing the acceptance of technology among older adults.

Singapore's emergence as a super-aged society presents a distinctive opportunity to champion and protect the rights of older individuals through the accessibility of assistive technology. By adopting an approach that upholds dignity, inclusivity, well-being, and privacy, Singapore can foster an environment where its ageing population can age gracefully while enjoying their fundamental human rights. This pursuit aligns harmoniously with the government's aspiration to transform Singapore into a compassionate, enabling and caring society that caters to the needs of all citizens, regardless of their age.

2. Background

Super-Aged Society in Singapore

Singapore's government has adopted a comprehensive, whole-of-society strategy to address ageing and cultivate an environment where all citizens can age with confidence, dignity, and peace of mind. The introduction of the Action Plan for Successful Ageing in both 2015 and 2023 marks a notable milestone in the strategic policy framework of Singapore. This comprehensive initiative seeks to facilitate a holistic experience of the ageing process, engender active modes of living, and cultivate a socially inclusive environment across generational cohorts. Concomitantly, the government's commitment to advancing population health is exemplified by the Healthier SG campaign of 2023, which reflects a heightened dedication to empowering the entirety of the Singaporean populace to assume stewardship over their health trajectories, thereby realizing prolonged phases of healthful longevity.

According to the World Health Organization (WHO) World Report on Ageing and Health (2015), it is important to maintain the functional ability that can foster health and well-being in promoting healthy ageing. However, when individuals get older, they are more likely to have chronic illnesses or suffer from disabilities (Ministry of Health, 2022b). This might also lead to a decline in their intrinsic capacity (the combination of the individual's physical and mental,

including psychological, capacities) and functional ability (the combination and interaction of intrinsic capacity with the environment a person inhabits) (WHO, 2019, Zhou & Ma, 2023).

It is against this backdrop that the WHO has propounded the Integrated Care of Older People (ICOPE) assessment framework to assess six key domains – locomotion, cognition, vitality, psychological well-being, vision, and hearing – in which to operationalize the concept of intrinsic capacity and functional ability to support healthy ageing (Beard et al., 2016; WHO, 2015, WHO, 2019). Its guiding principles, which are very important (WHO, 2019, p. 3), are:

1. Older adults have the right to the best possible health
2. Older people should have equal opportunity to access the determinants of healthy ageing, regardless of social or economic status, place of birth or residence, or other social factors
3. Care should be provided equally to all without discrimination, particularly without discrimination based on gender or age

Indeed, Singapore has upheld all these principles to promote a "healthier you and healthier SG" for the whole nation.

Health, Well-being and Assistive Technology

In Singapore, 976,000 Singaporeans and Permanent Residents (PRs) were unable to perform, or had a lot of difficulties with, at least one basic activity in the six domains of hearing, self-care, mobility, remembering, seeing, and communicating (Department of Statistics, 2021). In 2022, 367 older adults went through the first ICOPE assessment in Singapore, and 284 older adults (77.4 percent) were found to have a decline in the six IC domains. Cognition (31.3 percent), hearing (33.5 percent) and vision (42 percent) were relatively higher compared to other ICs. It was also found that age was significantly associated with cognitive decline, hearing loss, and limited mobility (Ma, 2022). Another study in Singapore projected that there would be a five-fold increase over the next 40 years regarding disability prevalence across the mild to severe spectrum (Ng et al., 2020). These studies provide a glimpse of the growing demand for community care services that require various forms of support and assistance with daily activities, or even the possible use of assistive living technology to enable older adults to age in place.

What is Assistive Technology?

Promoting the utilization of assistive technology can serve as a pivotal element in empowering older adults to improve their independence, mobility, communication, and overall quality of life within a smart nation context such as Singapore. Some digital technological solutions may even be used to help older adults maintain autonomy and support ageing-in-place. (Calvaresi et al., 2017; Khosravi & Ghapanchi, 2016; Kim, Gollamudi & Steinhubl, 2017; Mostaghel, 2016). According to the WHO (2023), Assistive Technology is an umbrella term to cover systems and services related to the delivery of assistive products and services. The purpose of using assistive technology is to maintain or improve an individual's functioning, autonomy, and independence, which can promote their health and well-being. Some assistive technologies can help to prevent, or reduce the effect of, secondary health conditions such as lower limb amputation in people with diabetes.

Other examples of assistive products include hearing aids, wheelchairs, communication aids, pill organizers, memory aids, walking sticks, spectacles, etc. With the increase in population ageing, there will be more than 3.5 billion people needing at least one assistive product by 2050, and older adults might need two or even more (WHO, 2023). In 2023, more than 2.5 billion people globally needed one or more assistive products, and it is estimated that older adults in Singapore also have a high demand for using assistive technology (WHO, 2023).

Right to Access the Use of Assistive Technology

The utilization of assistive technology not only promotes independence and well-being but also reduces dependence on caregivers and lessens the strain on formal health and support services. As a result, ensuring accessibility to suitable assistive products holds paramount importance in the development of community care. According to Wyszewianski and Mclaughlin (2002), *"'access' is a major concern in healthcare policy and ranks among the most frequently used terms in discussions about the healthcare system"* (p. 1441). This concept applies similarly to assistive technology for older adults.

Penchansky and Thomas (1981) noted that the right to accessibility encompasses the expectations of both providers and clients. It also delves into the question of whether there exists a right to access. This can be encapsulated within the 6As of access to care in assistive technology: Affordability, Availability, Accessibility, Accommodation, Acceptability and

Appropriateness. Table 1, adapted and modified from Penchansky and Thomas's (1981) framework, outlines these 6As in the context of assistive technology:

Table 1: 6As of Access to Care in Assistive Technology (adapted and modified from Penchansky and Thomas's (1981) framework)

6 As of Access to Care in Assistive Technology	Definition
Affordability	Refers to the cost of assistive technology and whether older adults have the financial means and willingness to invest in the technology. It considers whether the technology is reasonably priced and within the budget constraints of potential users.
Availability	Refers to the presence of assistive technology and its capability to meet the needs of older adults effectively. It encompasses whether the necessary devices or services are accessible and ready for use when required.
Accessibility	Refers to the geographic accessibility of assistive technology, assessed by how easily older adults can obtain and access these devices or services in their physical location or region.
Accommodation	Refers to considering the constraints and preferences of older adults, including their ability to use assistive technology, and gathering feedback from their experiences to make necessary adjustments and improvements.
Acceptability	Refers to the willingness of the user to accept and feel comfortable using a particular assistive technology. It encompasses factors related to user preferences, comfort, and satisfaction with the technology.
Appropriateness	Refers to the assessment of whether it is suitable or appropriate to use a specific assistive technology.

While the positive impact of assistive products on the health and well-being of older adults is widely acknowledged, the 6As of access to care in assistive technology remain limited in their application globally.

3. Support Schemes for Accessing Assistive Technology in Singapore

As a forward-looking nation, Singapore strives to empower individuals to lead purposeful lives with the seamless support of technology. The 6As framework for access to care in assistive technology holds paramount significance for older adults and individuals with disabilities. Especially in the wake of the COVID-19 pandemic, the healthcare sector has been pivotal, and has innovated in delivering essential services by:

Continuously researching assistive technology and robotics: These efforts are directed at creating promising solutions that enable independent living and the self-reliant completion of daily tasks for older adults. For instance, the Government Technology Agency (GovTech) and the Agency for Integrated Care (AIC) have delved into the application of radar sensors to detect instances of older adults falling at home. By identifying human-shaped objects and analyzing angles and speeds, these sensors can detect falls and automatically alert next-of-kin or caregivers. Additionally, around 150 older adults residing in Marine Parade, Bedok South, and Ang Mo Kio have been equipped with internet-enabled touchscreen tablets for free. These devices enable older adults, especially those with mobility challenges, to remotely consult polyclinic doctors through video conferencing. They also serve as "digital concierges", issuing automated reminders for medication, healthy eating, and regular exercise (Irene, 2023).

Enhancing patient care: This involves the implementation of automated bathing machines, mobility-monitoring droids, and the Temi robot, which assists with greetings and surveys. For example, St Luke's Eldercare used AI & EDGE cameras to detect movement and alert a nurse to intervene to prevent a fall.

Alleviating healthcare worker workload: Technological tools such as delivery drones and robots for delivering meals and medication have been introduced to reduce the burden on healthcare professionals. For example, Alexandra Hospital is using a robotic nursing assistant (RNA) to aid the productivity of nursing staff by taking over mundane tasks, such as vital sign monitoring, medication and item delivery and Tele-presence.

Additionally, there are various conferences and exhibitions aimed at promoting the silver economy and the utilization of assistive technology in Singapore. Eldex Asia and Ageing Asia are the two primary conference organizers in Singapore. They extend invitations to various technological product companies and showcase the latest products from around the world that

would be suitable for care settings in Singapore. They operate both business-to-business and business-to-client channels to promote the silver economy.

Moreover, they welcome older adults, caregivers, and eldercare organizations to participate in their events. These events serve to educate and inspire the community, helping them understand the potential usefulness of various assistive technological products in caregiving and independent living.

In order to promote ageing-in-place, there is also a variety of government and community-led initiatives in Singapore, all aimed at promoting the 6As of care in assistive technology (Table 2) Here are examples of some of these initiatives:

Table 2: Government and Community-Led Initiatives Promoting Access to Assistive Technology

Government-led Initiatives	Organized By
1. Senior Go Digital programme (https://www.imda.gov.sg/en/seniorsgodigital)	IMDA
2. GovTech's Accessibility Enabling team (https://www.tech.gov.sg/singapore-digital-government-journey/diversity-and-inclusion)	GovTech
3. Home Access Programme (https://www.imda.gov.sg/how-we-can-help/home-access)	IMDA
4. Housing Development Board (HDB)'s Smart Enabled Home (https://www.hdb.gov.sg/cs/infoweb/about-us/our-role/smart-and-sustainable-living/smart-hdb-town-page/hdb-smart-home-exhibition)	Housing Development Board
5. Housing Development Board's Enhancement for Active Seniors (EASE) (https://www.hdb.gov.sg/cs/infoweb/residential/living-in-an-hdb-flat/for-our-seniors/ease#:~:text=Enhancement%20for%20Active%20Seniors%20%28EASE%29%20The%20EASE%20programme,and%20improve%20mobility%20and%20comfort%20for%20elderly%20residents.)	Housing Development Board
6. Seniors' Mobility and Enabling Fund (SMF) (Seniors' Mobility and Enabling Fund	Agency for Integrated Care (aic.sg)	Agency for Integrated Care (AIC)
7. The Assistive Technology Fund (ATF)	SG Enabled

(https://www.enablingguide.sg/im-looking-for-disability-support/assistive-technology/assistive-technology-fund)	
Community-Led Initiative	
8. Gerontech Living Lab & Gerontechnology Ambassador Training	Gerontology Programme of Singapore University of Social Sciences and SG assist

3.1. Government-Led Initiatives

3.1.1. Senior Go Digital Programme

To ensure that older adults are not excluded in the technology era, the Infocomm Media Development Authority (IMDA) launched the Senior Go Digital Initiative in May 2020. This program is specifically designed to equip older adults with essential digital skills. To facilitate their access to the internet for searching appropriate assistive products, the mobile access for older adults scheme ensures that telco mobile plans and smartphones remain affordable for older adults who may face financial difficulties (Mulati et al., 2022; IMDA, 2022). Additionally, the government has established SG Digital community hubs at various Community Clubs/Centers and public libraries across the island. These hubs offer citizens one-on-one guidance in acquiring basic skills such as downloading, password protection, making calls, and texting as well.

3.1.2. GovTech's Accessibility Enabling team

The Accessibility Enabling team of GovTech was established in 2022. The team was created with the purpose of crafting government services that were all-encompassing, taking into consideration the distinctive viewpoints and utilization behaviors of both persons with disabilities (PwDs) and older adults. This team synergizes with agile development approaches and advocates for the integration of automated accessibility assessments within the assistive technological product development journey. The team achieves this objective by offering consultancy provision, conducting training sessions, disseminating informative guides and playbooks, and engaging in outreach endeavors in order to improve the accessibility of assistive technology.

3.1.3. Home Access Programme

IMDA has also introduced the Home Access program, which offers eligible Singaporean families two years of subsidized fiber broadband connectivity. This initiative has played a role in raising Singapore's household broadband penetration rate from 87 percent in 2016 to 98 percent in 2020.

To further assist vulnerable older adults residing in the community in embracing digital technology, volunteers from corporate and youth partners (such as Singtel, TriGen, Youth Corps Singapore, and Heartware Network) offer personalized coaching to older adults at Senior Activity Centers. These coaching sessions are aimed at helping older adults acquire new digital skills and gain familiarity with basic smartphone usage.

The aforementioned undertakings contribute to education and the enhancement of awareness, availability, and acceptance of assistive technology. Additionally, there are initiatives that address affordability, accommodation, appropriateness and accessibility, with the aim of assisting older adults in acquiring the necessary assistive technology to maintain their independence and foster ageing in place.

3.1.4. Housing Development Board (HDB) Smart Enabled Home

Aligned with the Smart Nation vision, the Housing and Development Board (HDB) has introduced the Smart Enabled Home initiative to bolster smart living in Singapore. Within this framework, several smart home devices and applications have been developed to cater to senior living needs. One such example is the Elderly Monitoring System, a highly beneficial solution for monitoring the health, well-being, and safety of older adults, particularly those living alone.

This system incorporates motion sensors that promptly notify older adults or their family members during times of need or when irregular behavioral patterns are detected. It proves especially valuable when extended periods of inactivity are observed. By offering such proactive alerts, this system grants families greater peace of mind while carrying out caregiving responsibilities.

(Image credit: Housing & Development Board (HDB))

Source: Elderly Monitoring System (smartnation.gov.sg)

3.1.5. Housing Development Board's Enhancement for Active Seniors (EASE)

Another commendable initiative by HDB is the EASE (Enhancement for Active Seniors) program. This program empowers eligible households to install assistive technology devices that enhance the age-friendliness of their homes. To qualify, applicants must be between the ages of 60 and 64 and require assistance with one or more Activities of Daily Living (ADL). Additionally, they are required to submit a functional assessment report endorsed by a qualified assessor.

Furthermore, HDB provides valuable tips and a home design guide for families living with elderly members who have dementia.

3.1.6. Seniors' Mobility and Enabling Fund (SMF)

According to the Agency for Integrated Care (AIC) (2023), the SMF not only provides holistic support for older adults with necessary tools and equipment for their mobility, but also promotes independent living during the golden years. Older adults aged 60 or above can apply for the fund if they require the following support (Table 3):

Table 3. Funding Support and Items

Funding Support:	Items:
1) Assistive devices for increased mobility	Assistive devices include: • Basic wheelchair/pushchair • Motorised wheelchair/scooter • Pressure relief cushion • Pressure relief mattress • Hearing aids • Spectacles • Shower chair • Hospital beds • Walking aid • Other special equipment like suction pumps, transfer boards, or oxygen concentrator
2) Home healthcare items to facilitate ageing in place	Home healthcare items include: • Nasogastric tubes • Adult diapers • Nasal tubing • Wound dressings • Milk feeds • Catheters and catheter sets • pH indicator test strips • Thickeners
3) Specialized transportation services to various hospice care centers, eldercare centers and dialysis centers	Transport services

Sources: AIC homepage: Seniors' Mobility and Enabling Fund | Agency for Integrated Care (aic.sg)
Homeage homepage: A Guide to Seniors' Mobility and Enabling Fund (SMF) - Homeage

The fund can provide eligible older adults with up to 90 percent of the funding needed to promote their independence and autonomy.

3.1.7. The Assistive Technology Fund (ATF)

To enable independent living, SG Enable has also created a fund so persons assessed to have a physical disability, visual or hearing impairment, intellectual disability, or autism, can purchase assistive technology. The ATF provides individuals with a subsidy of up to 90 percent of the cost of assistive technology devices, subject to a lifetime cap of $40,000. The fund can be used to acquire, replace, upgrade or repair assistive technology devices for education, training, employment, rehabilitation, and independent living. These devices include wheelchairs and

hearing aids. The fund will also cover medical devices (e.g. oxygen concentrators and suction pumps) and spectacles for Singapore citizens at or above age 60, who remain served by ATF.

3.2. Community-Led Initiatives

Singapore exhibits a notably higher presence of government-led initiatives in promoting the utilization of assistive technology. In alignment with the national strategy of adopting a comprehensive societal approach to address the challenges posed by an ageing population, the Gerontology Programme at Singapore University of Social Sciences is collaborating with SG Assist, an organization founded by caregivers in Singapore, to establish a Gerontechnology Living Lab. The Living Lab receives funding support from the Ngee Ann Kongsi philanthropic organization, and serves as a platform to showcase a diverse range of assistive technological products aimed at promoting ageing in place and independent living. This innovative university-community partnership model is specifically designed to provide educational programs, training for gerontechnology ambassadors, and gerontechnology showrooms. These resources are tailored to benefit both caregivers and older adults by actively listening to their needs and feedback. They also can provide valuable insights into the potential advantages of integrating assistive technology into the ageing process. This inclusive approach can help to better promote the understanding and use of assistive technology.

The Living Lab's layout is designed to resemble a typical household's living room and bedroom, with a focus on connecting the concepts of living, dining, medical care, and mobility when considering assistive living technology. Some of the products developed include a smart door lock, a walking stick holder, a fall detector, swivel seat cushions, a soft handled knife, a bed rail, digital pill box, etc.

3.2.1. Gerontechnology Ambassador Training

In addition to showcasing various assistive products, there are also educational programs for caregivers and older adults. One of the innovative community-led projects is the Gerontechnology Ambassador Training program, which equips older adults and caregivers to understand the current landscape of assistive technology and what products are available. The primary goal of this initiative is to educate older adults about the advantages and disadvantages of utilizing assistive technology in their daily lives and to empower them to embrace the available technological advancements. The training program is structured across three progressive tiers of Gerontechnology, each tailored to enable ease of adoption by participants.

This approach ensures a comprehensive and personalized experience for every individual involved. Alongside the training, ad-hoc volunteer opportunities and micro-jobs are integrated, to provide older adults with a platform where they can share their expertise in gerontology, their experience in caregiving, and their dedication to empowering fellow older adults through technology.

Furthermore, this program is strategically designed to address the evolving needs of older adults as they age. It incorporates the Integrated Care for Older People (ICOPE) framework, endorsed by the World Health Organization (WHO), as part of the foundational knowledge training for the ambassadors. This framework emphasizes the program's commitment to a comprehensive and well-informed approach. This alignment ensures that the training adheres to global standards for the care of older adults, promoting a holistic understanding of the ageing process.

The overarching objectives of the Gerontechnology Ambassador initiative encompass the following:

- Equipping older adults with knowledge of assistive technology: Equip older adults with the requisite knowledge to confidently utilize gerontechnology and understand where to access it.
- Enabling adoption of assistive technology: Foster independent living by encouraging the adoption of assistive technology.
- Engaging the community: Cultivate a supportive community of gerontechnology enthusiasts.
- Educating and advocating to the public and peers: Disseminate awareness about gerontechnology and promote its integration.
- Empowering lifelong learning and participation: Facilitate opportunities for active ageing through micro jobs and volunteerism, contributing to ongoing learning and engagement.

These objectives work in harmony with various government initiatives and echo the principles of the 6As framework for access to care in assistive technology, as illustrated in Table 4:

Table 4: Alignment with 6As of Access to Care in Assistive Technology

6As of Access to Care in Assistive Technology	Definition	Gerontechnology Ambassador Training
Affordability	Refers to the cost of assistive technology and whether older adults have the financial means and willingness to invest in the technology. It considers whether the technology is reasonably priced and within the budget constraints of potential users.	Provide older adults with choices and a cost list of available assistive technology.
Availability	Refers to the presence of assistive technology and its capability to meet the needs of older adults effectively. It encompasses whether the necessary devices or services are accessible and ready for use when required.	Understand the specific needs of older adults and the availability of relevant assistive technology in Singapore.
Accessibility	Refers to the geographic accessibility of assistive technology, assessed by how easily older adults can obtain and access these devices or services in their physical location or region.	Inform older adults about the accessible locations to obtain assistive technology in Singapore.
Accommodation	Refers to considering the constraints and preferences of older adults, including their ability to use assistive technology, and gathering feedback from their experiences to make necessary adjustments and improvements.	Equip older adults with knowledge and skills on how to effectively use assistive technology
Acceptability	Refers to the willingness of the user to accept and feel comfortable using a particular assistive technology. It encompasses factors related to user preferences, comfort, and satisfaction with the technology.	Encourage older adults to provide feedback and share their experiences regarding the acceptance and comfort levels of using assistive technology.
Appropriateness	Refers to the assessment of whether it is suitable or appropriate to use a specific assistive technology.	Find out the suitability of using particular assistive technological products with particular older adults.

The emergence of community-led initiatives marks a novel development, indicating the need for a more grassroots approach to drive the adoption of assistive technology in Singapore. In

essence, while it remains crucial to promote the utilization of assistive technology in the country, efforts to do so are currently in their nascent phase. The expansion of educational programs and the widespread endorsement of the 6As framework for Access to Care in Assistive Technology are imperative, particularly considering the growing body of evidence supporting the role of assistive technology in facilitating independent living and promoting ageing in place.

4. Recommendations

In alignment with the 6As framework for Access to Care in Assistive Technology, it is essential to place significant emphasis on the voices, rights, and experiences of older adults when it comes to using assistive technology.

Voices of Older Adults in Using Assistive Technology: It is important to recognize that not all older adults are immediately receptive to incorporating assistive technology in their daily lives. A study by Low et al. (2021) highlighted that some older adults may not perceive an immediate need for healthcare-related technology. Concerns related to service regulation, potential side effects, and affordability were also expressed. However, older adults in the study exhibited a willingness to adopt technologies that supported their health goals, provided they were affordable and easy to use, and personal data was protected (Gell et al., 2015; Pino et al., 2014). Therefore, considering the opinions and preferences of older adults is crucial in encouraging the adoption of assistive technology.

Rights of Older Adults: As outlined by the WHO (2019), older adults have inherent rights to access the highest quality of healthcare. This encompasses various rights, including:

- Right to dignity and respect: Assistive technology solutions should be designed with a deep respect for the dignity of older adults, ensuring they can maintain autonomy and personal agency.

- Right to participation and inclusion: Digital inclusivity should be ensured through user-friendly interfaces and accessibility features that accommodate older adults with varying levels of technical proficiency.

- Right to safety and security: Smart home technology can contribute to safe living environments for older adults, incorporating features such as fall detection systems, smart locks, and emergency response mechanisms.

- Right to privacy and data security: Data privacy and security must be prioritized during the design and implementation of assistive technology to safeguard sensitive information.

- Right to education and access: Tailored digital literacy programs should be provided to older adults, enhancing their ability to effectively use and benefit from assistive technologies.

- Right to health and well-being: Telehealth services offer convenient access to medical consultations, thereby promoting mental and physical well-being.

It is most important to engage older adults in the research and design of assistive technologies, so that they can understand their needs and rights in using the products (Mannheim et al., 2019).

Experience of Older Adults: The user experience plays a pivotal role in promoting the adoption of assistive technology among older adults. Perceptions of usefulness and ease of use are influenced by a range of external factors, including individual differences, system characteristics, social influences, and facilitating conditions. Given that older adults experience a decline in functional and intrinsic abilities as they age, it is essential to comprehend their perceived challenges, positive experiences, and the usability of products. These factors are influenced by health needs, ethnicity, socioeconomic status, social influences, and learning styles (Garcia et al., 2023; Tan & Taeihagh, 2021; Hill, Betts, and Khosravi & Ghapanchi, 2016; Gardner, 2015). The experiences of older adults can provide valuable insights into assistive technology products, aiding in their refinement and redevelopment to better align with the specific needs of older adults in the future.

5. Conclusion

Singapore's emergence into a super-aged society presents a distinctive opportunity to champion and protect the rights of older individuals through the accessibility of assistive technology. More education programs and community initiatives could be promoted in order to understand the needs and experience of older adults, especially to enable the technology to advance rapidly. By adopting an approach that upholds dignity, inclusivity, well-being, and privacy, Singapore can foster an environment where its ageing population can age gracefully while enjoying their fundamental human rights. This pursuit aligns harmoniously with the government's aspiration to transform Singapore into a compassionate, enabling and caring society that caters to the needs of all citizens, regardless of their age.

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PROMOTING THE RIGHTS OF OLDER PERSONS THROUGH WELFARE TECHNOLOGY IN SOUTH KOREA

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Due to aging and low birth rates, the demographic structure of South Korea is changing rapidly. According to the National Statistical Office, as of 2022, the rate of older persons aged 65 and over was 17.5 percent of the total population, and the total fertility rate was 0.78, which is the lowest since birth statistics were first compiled in 1970. Given that the number of older people is increasing rapidly, it is estimated that South Korea will become a superaged society in 2025, only 25 years after becoming an aging society in 2000 (Statistics Korea, 2023). The transition to a superaged society is progressing more rapidly in South Korea than in other nations. As a result, the time has come for Korean society to address the changes in its demographic structure.

1. The Process of Development and Utilization of Welfare Technologies in South Korea

Social welfare services play an important role throughout the life cycle. For older people specifically, care services may play a more important role, given that older people face various physical, psychosocial, and functional issues. Accidents and emergency safety issues involving older people, such as falls, traffic accidents, and solitary death, have recently emerged as important social problems in South Korea (Kim & Suh, 2017). Additionally, there is an imbalance between supply and demand in older persons' care due to a generally aging population and a low birth rate; strategies to solve such imbalance issues are needed. With the advent of the Fourth Industrial Revolution, welfare technology using information communications technology (ICT) and the internet of things (IoT) is starting to come into use to solve social problems for older people in South Korea.

Welfare technology, which was first introduced in the Nordic countries in 2010, is an innovation in welfare services that increases the living convenience of subjects by utilizing technologies such as ICT or IoT to solve various social problems (Kang et al., 2019; Mork & Vidje, 2010). The purpose of welfare technology is to improve quality of life for vulnerable groups such as older and disabled individuals, utilizing technologies (i.e., ICT, IoT, AI) as a means to solve social problems. In South Korea, the first trial in the use of welfare technology is the "Emergency Safety and Relaxation Services for the Elderly Living Alone" program (ESRS), which has been carried out by the central government since 2008. The ESRS is a welfare technology-based IoT service whose aim is to respond quickly to crisis situations involving older people by detecting emergencies related to fire, gas, and human activity, using IoT sensors (Ministry of Health and Welfare, 2020). Although the term "welfare technology" has been frequently used in South Korea since the "Fourth Industrial Revolution" was identified at the Davos Forum in 2016, the first time that welfare technology was introduced in South Korea was in fact in 2008, when ESRS was first used to provide technology and welfare convergence services for older people.

Most of the welfare technologies currently in use in South Korea provide for older people who are economically and physically vulnerable or living alone. As indicated in Lim et al. (2021), the use of welfare technology for older people is mainly conducted through government-led policies, though in some cases, private companies take the initiative and carry out welfare technology-related services in cooperation with local governments. In addition, as the government has recently expanded government financial support to research examples of innovative technology application, many companies are striving to develop welfare technologies and provide services based on them. Most welfare technologies developed through financial support from the government, as well as government-led technologies, target vulnerable older people living alone. As such, welfare technology in South Korea has the characteristics of a public good; thus, welfare technology is given to vulnerable groups free of charge under the leadership of the government. However, it is a significant burden on the government to apply and expand welfare technology free of charge to all citizens aged 65 or older living in South Korea, given that welfare technology is a social service that demands a considerable cost to develop new technologies beyond human resources. Furthermore, as the population ages, there are many more potential applicants who may benefit from welfare technology, though those who are not familiar with new technologies will need to be introduced to the concept. Such characteristics of older people may be another burden on the use and

application of welfare technology at government level.

The current study provides several examples of welfare technology provided in both the public and private sectors, and discusses the meaning of the application of these welfare technologies in terms of the human rights of older individuals. Additionally, this study will present strategies for expanding the public accessibility of welfare technology for older people, and discuss its benefits and limitations.

2. Examples of Utilizing Welfare Technology for Older Koreans

Prior to the use of the term "welfare technology" in South Korea, policies and projects heading in the direction of welfare technology were already beginning to emerge in the fields of science and technology. After the South Korean government launched Vision 2030 in 2006, its vision for the future direction of state administration, terms such as "quality of life" and "warm science" emerged in the fields of science and technology, and policies advocating "solution of social problems" or "improving quality of life" were proposed. In 2011, the National Science and Technology Agenda described an aging society as a social problem and emphasized the role of science and technology in solving it (Park, 2014). The Science and Technology Innovation Policy Agenda 2030, announced in 2020, has set "promoting science and technology policies to strengthen social problem-solving capabilities" as a major item on the science and technology innovation agenda (Byun, et al., 2020). Increasingly, ICT and IoT are being used to solve social issues such as the safety and care of older individuals. Various types of welfare technologies for older people are currently being used in South Korea. As shown in Table 1, this chapter will introduce 1) ESRS conducted at the central government level, 2) the "Health Safety Management Solution (IoT) for Elderly People Living Alone" project (hereinafter referred to as the Solution Project), independently conducted at local government level, and 3) artificial intelligence (AI) care projects operated by companies in partnership with basic local governments. Given that these government-level projects do not clearly present the effectiveness of the project, I will additionally describe a project carried out in the private sector with government financial support to indicate the effectiveness of welfare technology for older individuals.

Firstly, the central government's ESRS program for older people living alone, started in 2008, is the first Korean welfare technology-based service that combines welfare and ICT/IoT. The ESRS focuses on the safety of, and potential emergencies among, older people living alone by

utilizing IoT technology that transmits and receives data in real time through sensors attached to objects. In other words, fire and gas detection sensors installed in the homes of older people living alone alert a local monitoring center to emergency situations which can then be speedily reported to 119 (the emergency phone number). This project continues to be supported at government level, and the next generation model, introduced in 2020, also provides welfare information and care functions by adding ICT technology (Ministry of Health and Welfare, 2020). Various problems such as the malfunction of installed equipment, data transmission errors, and problems in the delivery system have led to constant criticism of IoT-based ESRSs. As of 2023, it is known that central government is preparing not only to upgrade the service but also to verify its effectiveness. The ESRS is financed by a 1:1 match between central and local governments. Therefore, not all local governments are pushing for it forcefully; for example, the Seoul metropolitan government does not provide ESRS.

Secondly, however, the Seoul metropolitan government has been carrying out the Solution Project since 2017, with the aim of strengthening a safety net for vulnerable older people using IoT instead of providing the central government's ESRS. In the Solution Project, IoT is installed in the households of older people living alone, and their health and safety are managed through constant monitoring and continuous feedback. This project is currently being expanded to all autonomous districts in Seoul; as of 2019, it was operating in approximately 5,000 households (Park et al., 2019). IoT sensors distributed through the Solution Project are all-in-one sensors that detect movement, temperature, illumination, humidity and fire, and monitor gas safety. The focus is on health and safety management via customized services based on information obtained from the sensors., rather than on emergencies. However, no research has yet been presented on the effectiveness of health and safety management through the Solution Project.

Thirdly, certain private companies provide ICT-based welfare technology in collaboration with local or basic local governments. Such private companies tend to develop and provide AI-based advanced technologies such as AI smart speakers and robots, beyond IoT and ICT. Most care services using AI are likely to be carried out through cooperation between the public sector and private companies, because providing care services using advanced technologies imposes a significant financial burden on central and local government. The purpose of AI care services using AI smart speakers is to support the daily lives of older persons through the emotional support of talk-based care, help elderly people to experience less loneliness and feel safe and

self-reliant. People need instruction in the use and management of these devices. Private companies supply these services free of charge to consumers while sharing costs in cooperation with local governments. because the target does not know the exact information about the device and has not secured market value. Private companies seem to be implementing differentiated strategies from existing products to secure targets through such cooperation with the public and to increase marketability in the future (see Table 1).

As described above, in South Korea, there are welfare technologies provided by the government at the national level or by local government, while the central government has also recently provided financial support for developing and applying welfare technologies in the private sector. Since 2018, the Korean government has been pushing for a "community care" policy so that older people can live safely and well. Here, I present a case study of research into the application of welfare technology in the context of the community care policy.

This research project aimed to develop a welfare technology-based community care model for vulnerable older individuals living in public silver housing (housing specifically for older people) by applying welfare technology to community care. The project aimed firstly to strengthen self-reliance capabilities, secondly to provide customized health care suitable for the physical, emotional, and cognitive functions of older individuals, and thirdly to provide daily life support services through welfare centers. With regard to welfare technology-related devices, a smart frame, which is ICT equipment to communicate with and provide services to older people at home, has been developed and put into use. Older people can communicate with social workers, family members, and acquaintances through smart frames, manage their schedules, check notices at social welfare centers, and inform the authorities of emergency situations. For maintaining physical function, the programs "Balance Pro," which is effective in strengthening lower limb muscles and maintaining balance, and "9988," which is effective in strengthening upper limb muscles and improving cognitive ability, are used. A "Happy Table," which allows up to four users to interact in a game, strengthens emotional and cognitive functions. Additionally, IoT equipment such as door sensors, activity sensors, and radar sensors are installed in the house to support the safety of elderly individuals, and a system has been established to respond to accidents through continuous monitoring. Along with the installation of such welfare technology-related equipment, case management by social workers was conducted for three months, and, to test the effectiveness of the program, anxiety, depression, memory, cognitive function, life satisfaction, and physical function among the older people

involved were comprehensively compared with those of a control group who had similar case management but without the introduction of welfare technology equipment. It was found that among the experimental group, welfare technology-based community care services improved the level of depression, and had a positive effect on memory and cognitive function. In addition, overall life satisfaction was positive compared to the control group. Physical function for the experimental group was maintained, while among the control group it declined. This study suggests that the quality of service can be improved through the convergence of welfare and technology, i.e. applying welfare technology to the community care model; the study has important implications for the applicability of welfare technology in providing welfare services for older people in the future.

3. A Human-Rights Based Approach to the Use of Welfare Technology

The promotion of human rights is becoming a major goal for sustainable development around the world. The most important aim is for everyone to participate equally, without being alienated. As a conceptual framework for understanding poverty and development and a guide to program process and results, the human rights-based approach presented by the UN can provide a basic framework for understanding older people's participation in welfare technology. This section aims to contribute to the expansion of welfare technology in the future by analyzing whether the welfare technologies currently in use in South Korea are provided with proper regard for availability, accessibility, acceptability, and quality.

The *availability* of welfare technology can be analyzed by evaluating whether enough services are actually being delivered. As indicated above, the welfare technology currently supplied by the Korean government is provided specifically to vulnerable older individuals. Those who receive welfare technology services are mainly those who live alone or are economically vulnerable; however, people who have spouses, or physically vulnerable people who receive long-term care services, are excluded. Additionally, technology-based services in the public sector are not provided for older individuals who are healthy or wealthy, regardless of how old they are. The experience of most private companies is that devices or equipment for older people do not sell well in the market; private sales rarely occur. So, given that most welfare technologies are provided through the public sector, making welfare technologies available for use by older people who are not vulnerable is very difficult. As of 2023, the government aims to distribute ESRS to approximately 300,000 older people. This means that the availability of

actual welfare technology in South Korea is low –less than 3 percent of the total older population is provided with ESRS. The general public knows that welfare technologies are provided by the government and that various types of welfare technologies that are provided at the corporate level are supplied through public institutions such as welfare centers. Therefore, it will be necessary to present more detailed statistical figures on how many elderly people are using welfare technology.

The concept of *accessibility* is used to evaluate whether service access is available to everyone without discrimination in terms of their physical, economic, and informational status. Currently, various welfare technology-related services provided by the Korean government recruit eligible older people through public institutions, so there are many limitations in terms of accessibility. In the case of ESRS, there is discrimination in the physical aspect because services are not provided to physically vulnerable persons who are receiving long-term care services. There is also economic discrimination inasmuch as services are not provided regardless of an older person's income level. Most welfare technology-related services are promoted through the internet, so if there is no internet at home, discrimination in terms of information accessibility also exists. Reducing these discriminatory aspects at a time when actual available services are limited is a considerable contradiction, inasmuch as the service someone wants might not be available at an appropriate time. Therefore, from the perspective of service accessibility, it is necessary to consider the aspects of universality and selectivity in providing social services together. Nevertheless, if there is a target who wants to receive a service, discrimination in service accessibility should be prevented by providing various pieces of information so that they can receive as similar services as possible.

Acceptability can be analyzed by evaluating receptivity to technology, and responses to the services provided, according to age and gender. The acceptability of welfare technology is thought to have a significant relationship with the characteristics of welfare technology. What the person receiving the service thinks about the welfare technology he or she is receiving is related to his or her ability to accept welfare technology in general, which will be related to his or her receptivity to technology. For example, in the case of IoT sensors, which are the kind of welfare technology that are most widely distributed to older people, some people say that they are relieved because they feel safe and protected, while others say that they are uncomfortable because they feel like someone is constantly watching them. Efforts to increase acceptance through a clear explanation of the technology provided are important, but the degree to which

the person thinks and reacts to the technology can also be considered an important factor. According to a study (Kim et al., 2022) that investigated the acceptance of welfare technology by older individuals in South Korea, the level of acceptance and willingness to use welfare technology was generally high. The study also confirmed that the level of acceptance and willingness to use welfare technology was higher when people already had some experience using welfare technology services. In particular, this study found that the use of welfare technology expanded due to COVID-19. It appears that the various welfare technologies currently provided in South Korea might initially cause a feeling of rejection among older individuals; however, acceptance of this technology is currently increasing due to its effectiveness.

The *quality* of services needs an evaluation based on scientific evidence and appropriateness. Few studies have been conducted about the effectiveness of the welfare technology currently supplied by the government. Of course, news that older people in crisis have been saved through ESRS or Solution Projects is often reported. In the case of ESRS, a safety and usability evaluation of the device should be prioritized, given that there is continuous news of malfunctions and data transmission errors in installed equipment. For example, whether a device presents itself to older people in a friendly manner, and whether the data provided by the device are accurate, should be evaluated. After that, it will be necessary to evaluate the effectiveness and efficiency of the overall service, including of the device. Nevertheless, projects carried out with government financial support have gradually reached the stage of presenting the effectiveness of services using welfare technology, and some services report their effectiveness. To extend welfare technology to more subjects as an innovative service, the effectiveness of the services must be guaranteed.

4. Strategies for Expanding the Public Accessibility of Welfare Technologies for Older Adults

The Korean government currently provides various types of welfare technology to older individuals, principally for emergencies and safety. Welfare technology supplied by central government is mainly provided to economically vulnerable people over 65 living alone, and welfare technology provided by local governments, basic local governments, or private companies often focuses on economically vulnerable older people as a service target. Regarding the types of services provided as welfare technology, IoT and ICT have been central,

but welfare technology has recently been expanding to include AI smart speakers and robots. Since the development of new technologies is accompanied by financial support, the government also seems to be burdened with expanding welfare services based on the convergence of welfare and high technology.

Given this context, what changes will be necessary considering the current supply situation of welfare technology in South Korea? Is the current supply enough? Or will it be necessary to expand the supply? Considering the publicity of welfare technology, it seems reasonable to provide services centered on the vulnerable who cannot use it properly. However, it does not seem reasonable to exclude those who are not economically vulnerable but who do not know enough about welfare technology. Currently, technology is being developed at a very rapid pace, and it is difficult for older people who are not familiar with digital culture to approach new technology. Most private companies pioneer new devices through sales channels that are centered on the market; however, they fairly rapidly tend to turn to the public sector because they are aware of the difficulties of distributing and selling technology to older people through the market. As a result, there are likely to be many cases where welfare technology-based services are not actually provided because economically-vulnerable people are not registered in the public network. Therefore, greater access to information about services should be prioritized, in order to extend welfare technology.

Due to aging and low birth rates, the caregiving burden for relatives of older people, and the authorities, is currently increasing in South Korea. Replacing caregiving services with technology can be an important way to provide high-quality services with less manpower. In this respect, expanding access to welfare technology for all older people in South Korea is of paramount importance. South Korea is experiencing a considerable burden in terms of scalability because the government currently provides welfare technology to older people for free. Of course, welfare technology needs to be supplied to consumers at low cost because it is a public good. However, it is not cheap to provide welfare technology-based services for free, since each device has a certain unit price. Accordingly, more research is needed on ways to expand welfare technology to all older people living in South Korea.

To consider the scalability of welfare technology, the following matters need to be considered. Firstly, regarding designing a burden structure for consumers' costs – considering the unit price of technology and the continuous increase in the older population in South Korea, it is difficult to provide welfare technology-based services to everyone for free. Therefore, it is necessary to

design a burden structure based on a sliding scale through subject analysis. Here, we need to consider the major characteristics of priorities in the sliding scale. In other words, it will be necessary to design a burden structure which takes account of the possibility that older people are blind spots in the community, and which considers their economic situation, health status, and place in the family structure all together. What is an essential service for some older people can be a selective service for others. That is, it is necessary to create a system that can sufficiently provide the desired service while taking account of the cost burden.

Secondly, developing technology that is friendly and effective for older people is challenging. Before designing a burden structure through analysis of actual subjects, the priority needs to be the provision of qualitative and effective services. Indeed, when a device provided is recommended as friendly and effective for older individuals, they or their children can use it at their own expense. To this end, it is necessary to conduct a living lab-based experiment that will allow service users to directly evaluate the usability and effectiveness of a device. Using living labs to evaluate the usability and effectiveness of devices in providing welfare technology-based services to older people will enable more effective and efficient consumer-centered services instead of provider-centered services.

Thirdly, there is the challenge of promoting the use of devices that have been developed. As mentioned earlier, South Korea is currently selectively recruiting subjects in providing welfare technology-based services. As a result, it is safe to say that there is little information on welfare technology for those who are not selected. Sometimes, people only hear that these services are being provided through the news. Further active consideration is needed of how to promote welfare technology-based services to all older people, and discover which promotion method is the most effective for older individuals.

Finally, in South Korea, welfare technology is made available to older people through public bodies such as central government, local government, and basic local governments. At the same time, however, private companies are trying to promote use of their welfare technology devices among the public. In this process, there is a mixture of services, such as the overlapping supply of various types of welfare technologies to subjects. Integrating such mixed welfare technologies and forming a system in which service providers, consumers, and industries can provide effective and optimal services to consumers through discussion together could be the starting point for expanding welfare technology in the future.

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Table 1. Major Purposes and Services of Welfare Technologies for Older Adults

	ESRS	ESRS Next Generation	Solution Project	AI Care Business
Purpose	Coping with emergency situations for older people living alone	Coping with emergency situations for older people living alone	Enhancing tight safety net using IoT for older people living alone	Supporting independent living for vulnerable populations
Technologies	IoT sensors	IoT sensors, ICT	IoT sensors	AI smart speaker, ICT
Services	Monitoring emergency situations, safety checks, etc.	Monitoring emergency situations, safety checks, health monitoring, providing basic information	Health and safety care using regular monitoring, talk-based services with care coordinator	Managing technologies, instruction for use, talk-based care, cognitive games, providing information

# CASE STUDIES ON PROMOTING THE RIGHTS OF OLDER PERSONS THROUGH EXPANDING PUBLIC ACCESSIBILITY OF ASSISTIVE TECHNOLOGY

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1. Introduction

In recent years, the demographic landscape of many nations has shifted markedly. Thailand is no exception, experiencing a significant rise in its older population. As of 2022, the population of Thailand was 66.7 million, 12.5 million of whom were older persons (*Population from registration,* 2022). In 2022, the country entered what is known as a "complete aged society" with 20% of the population being above age 60 (Foundation of Thai Gerontology Research and Development Institute, 2022). According to the most recent United Nations estimates, by 2050, the proportion of older persons in Thailand is projected to be 38.3% of the population (ESCAP, 2022).

The demographic shift does not affect both the female and male populations equally. Among the 20.3% of older persons in the Thai population in 2023, there were 5.7 million men and 7.8 million women (Figure 1) (Office of the National Economic and Social Development Council, 2019). It is projected that by 2038 the proportion of older persons will increase to 30.4% of the population, with 8.3 older men and 11.7 million women (Office of the National Economic and Social Development Council, 2019). As women spend more time in old age, a greater number of females who require additional care assistance is expected.

Figure 1. The Demographic Structure of Thailand by Age and Sex, 2023 and 2038
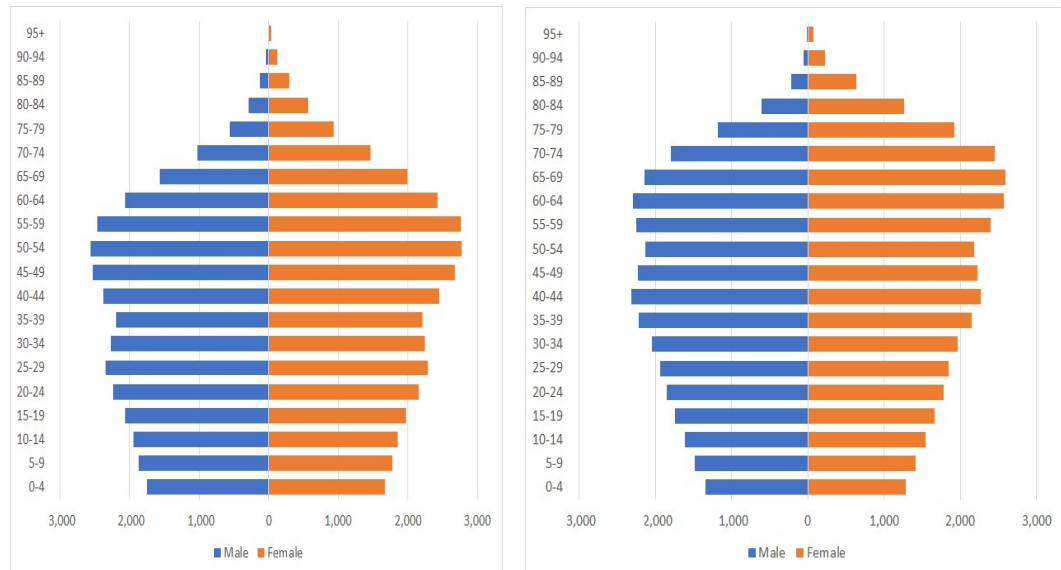
Source: Office of the National Economic and Social Development Council, 2019

An ageing population presents both challenges and opportunities. The vast knowledge and experiences of older individuals can be harnessed as valuable social and economic resources. To fully capitalize on these changes, it is imperative that older persons remain healthy and actively participate in society. As individuals age, they frequently experience diminished physical and cognitive functions, leading to a growing reliance on assistive technology (WHO & UNICEF, 2022). With the older population growing, there's an anticipated increase in the demand for care. Age-related health issues, which are sometimes inevitable, can limit the capacity of older persons to engage in various social and economic activities.

Assistive technology thus is one of the beacons of hope. Assistive technology can enhance older individuals' ability to perform tasks they might otherwise be unable to do, or increase the ease and safety with which tasks can be performed (WHO, 2016). Such technologies can range from simple devices like walking sticks to advanced systems such as computerized communication devices. By leveraging assistive technology, older persons can maintain their independence, continue to contribute to their communities, and enjoy a better quality of life.

Objective

Recognizing the potential of assistive technology to meet the needs of an ageing population, there is a pressing need for policies that promote its accessibility and adoption. **This report thus explores Thailand's progress with policies to develop assistive technologies for older persons, investigates the development of assistive technologies specifically for the Thai older population, analyzes the alignment of Thailand's use of these technologies with the UN's Principles for Older Persons, and evaluates Thailand's strengths and challenges in broadening assistive technology accessibility.**

Definition of Assistive Technology

Assistive technology is "a subset of health technology [which] refers to assistive products and related systems and services developed for people to maintain or improve functioning and thereby promote well-being." (WHO, 2016). It can enable people with reduced functioning due to old age, disability, chronic disease or mental health conditions to participate productively and independently in various dimensions of society, such as employment and education. Such technology can alleviate the increasing demand for caregivers and reduce strain on the healthcare system, prolonging the period before older individuals require long-term care.

People of all ages may be in need of assistive technology, starting from children with disabilities to older adults facing gradual functional decline. The concept of assistive technology is intertwined with assistive products, which are tools ranging from hearing aids and prostheses to computer software and apps for communication (WHO, 2016). Examples of assistive products range from items we are used to seeing in our daily life – wheelchairs, prosthetic limbs, eyeglasses, walking frames, and hearing aids – to information and communication technology and devices such as computer software, alternative communication tools, and memory aids (WHO, 2016).

In this study focusing on older individuals, assistive technology is defined as products, systems, or services that enhance functioning for those with disabilities, age-related issues, chronic diseases, or mental health conditions.

Framework

Access to assistive technology is enshrined as a human right. The United Nations Principles for Older Persons, adopted under General Assembly resolution 46/91, encompass ideals of independence, participation, care, self-fulfillment, and dignity (UNOHCHR, 1991). These principles emphasize the centrality of older persons' needs and agency when introducing assistive technologies, ensuring their ability to make autonomous decisions about their life's course. For example, the principle of independence not only accentuates the unrestricted access to essentials like water, food, and shelter but also the freedom for older persons to decide about their participation in the labor force and the desire to remain at home as long as feasible. Furthermore, the principle of participation champions the engagement of older persons in societal and community activities, empowering them to make significant decisions about themselves and contribute their expertise to societal challenges. Care underscores the necessity for diverse caregiving options, from family to institutional settings. Self-fulfillment emphasizes the right of older persons to a holistic life experience, encompassing educational, cultural, and religious pursuits. The principle of dignity, meanwhile, asserts the imperative of treating older individuals with respect and fairness. Analysis of Thailand's assistive technology initiatives and commendable practices will be framed by the United Nations Principles for Older Persons.

In alignment with other UN member states, Thailand consistently embraces the principles of the Madrid International Plan of Action on Ageing (MIPAA) (Bhula-or et al., 2022). MIPAA, a pivotal global blueprint, zeros in on three core objectives: the role of seniors in development, promoting health and well-being in old age, and fostering supportive environments. Notably, MIPAA underlines the critical importance of assistive technology and pertinent legislative support for older people's welfare (Bhula-or et al., 2022).

Methodology

The authors undertook a comprehensive review of Thailand's assistive and welfare technology initiatives by delving into several esteemed research databases. These databases include Google Scholar, a freely accessible web search engine that indexes scholarly articles across various disciplines; Scopus, a bibliographic database providing abstracts and citation tracking for academic journal articles; ResearchGate, a professional network for researchers that offers access to numerous scientific publications; and ThaiJo, a leading digital platform that curates academic journals from Thailand. Our search was strategically directed at recent literature in

English or in Thai, with a selection criterion for publication dates from 2013 to 2023. To ensure precision and capture the most relevant articles, search terms were carefully chosen to revolve around themes such as "assistive technology", "welfare technology", and "older persons" (Smith & Johnson, 2015). This methodology enabled a holistic and updated perspective on the topic at hand.

2. Overview of Assistive Technologies Usage

Globally, more than 2.5 billion people require assistive technology, with the number of persons in need likely to rise to 3.5 billion by 2050 (WHO & UNICEF, 2022). However, while most countries have at least one piece of legislation touching on assistive technology, many countries have not yet implemented a national plan for its provision (WHO, 2016; WHO & UNICEF, 2022). In addition, gaps in assistive technology access remain wide between countries (WHO & UNICEF, 2022). Only 1 in 10 people who need assistive products currently have them, and in cases where people do get access to assistive technology, an estimate of up to 75% is abandoned by its users (WHO, 2016).

There exists a wide array of challenges in the provision of assistive technology in the dimensions of capacity, budget, affordability, logistics, awareness, quantity and quality (WHO & UNICEF, 2022). Importantly, vulnerable populations such as women and people with disabilities face additional barriers in their access to assistive technology, and in many countries women are two times more likely to be deprived of necessary assistive products (WHO & UNICEF, 2022).

As a reflection of the country's ageing population, Thailand's assistive technology market is growing rapidly (Kasikorn Bank, 2021). Moreover, the compound annual growth rate of assistive technology and medical equipment is projected to reach 7.8% by the second half of the decade (Kasikorn Bank, 2021).

3. Assistive Technology in Thailand's Legislation

Thai legislation first emphasized the rights of older persons in 1982 through the inaugural National Plan for Older Persons (1982-2001) (Bhula-or et al., 2022). The Act on Older Persons B.E. 2546 (2003) furthered this commitment, notably through the establishment of the National Older Persons Commission and Section 54 of the Thai Constitution. This constitution explicitly states that seniors over sixty with limited income are entitled to state aid. More recently, the rights and roles of older persons have been accentuated in various national strategies, plans, and agendas spanning 2017 to 2037 (Bhula-or et al., 2022), Of note is Thailand's 13th Economic and Social Development Plan (2023-2027), which focuses on enhancing the societal participation of seniors with disabilities (Office of the National Economic and Social Development Council, 2023). In 2020, a comprehensive four-dimensional approach for the ageing society, encompassing economic, social, environmental, and health sectors, was endorsed. Notably, this approach pushes for infrastructural improvements and better accessibility for older and disabled persons (*Measures in four dimensions (economy, environment, health, and society) to promote the longevity of the Thai people in the context of an ageing society*, 2020).

However, regarding the provision of assistive technology, there is no explicit provision for older persons. The Thai government has underlined pivotal principles to uphold and promote access through the Constitution of the Kingdom of Thailand 1997. Article 55 provides that individuals, particularly those with disabilities, be granted access to public amenities and other state-sponsored assistance, as specified by the prevailing laws. In addition, Section 80 says, "The State shall protect and develop children and the youth, promote the equality between women and men, and create, reinforce and develop family integrity and the strength of communities. The State shall provide aids to older persons, the indigent, the disabled or handicapped and the underprivileged for their good quality of life and ability to depend on themselves."

The provision of assistive devices is explicit in the case of people with disability, which means that it includes older persons (Constitution of the Kingdom of Thailand, 1997). Article 55 says, "The disabled or handicapped shall have the right to receive public conveniences and other aids from the State, as provided by law."

In addition, Article 1 of Ministerial Regulation No. 3 (B.E. 2537), anchored to the Rehabilitation of Persons with Disabilities Act B.E. 2534, projects a firm commitment that individuals with disabilities, recorded under the public registration system, can become beneficiaries of a comprehensive suite of medical rehabilitation services. Among those medical rehabilitation services, people with disabilities can access equipment and assistive devices tailored to their needs (ADB, 2020; Boisselle & Grajo, 2018) (Bhula-or et al., 2022).

According to the Persons with Disabilities Empowerment Act B.E. 2550 (2007), those with disabilities may receive assistive products based on a doctor's recommendation. Assistive products are mostly provided for free, with hospitals being able to reimburse the cost of the product if they are on the government-approved funding lists (Boisselle & Grajo, 2018). Most devices are provided by the Ministry of Public Health, followed by the Ministry of Education covering children with disabilities, as well as the Ministry of Digital Economy (Boisselle & Grajo, 2018). In addition to provisions made under the Persons with Disabilities Empowerment Act B.E. 2550 (2007), various non-profit organizations and grassroots initiatives also provide older persons with assistive products (ADB, 2020).

While the Thai Constitution makes provision for those with disabilities, there is a noticeable absence of explicit support for assistive technology tailored to the general older population. Current legislation implies that for seniors to access assistive devices, they must register as disabled. Local authorities may have specific projects or subsidies, but these are not uniformly applied or explicitly mentioned in national regulations.

4. Thailand's Good Practices in the Field of Assistive Technology

4.1. Assistive Technology: Products

Assistive technology products augment seniors' life quality. With the private sector at the forefront of innovation, Thai stalwarts like the National Science and Technology Development Agency (NSTDA) and the National Research Council of Thailand (NRCT), in collaboration with other stakeholders, are offering new devices. This chapter outlines select case studies which detail some of these innovations.

4.1.1 Medical Related Products

Adjustable Bed

The National Science and Technology Development Agency (NSTDA) has recently introduced the Jo-Ey adjustable bed – another new assistive device which enables an older person to change their position in bed from lying down to sitting and standing up through use of a remote control (Foundation of Thai Gerontology Research and Development Institute, 2022). This bed provides a more affordable alternative to imported products, and comes free, similar to using a hospital bed at home (The National Science and Technology Development Agency, n.d.-a). This promotes the principle of independence. The design was given over to the SB Design Square Company to promote mass distribution of the assistive device.

Mobility Devices

Several Thai institutions have made strides in the development of mobility devices. Recently, the National Research Council of Thailand (NRCT) collaborated with several leading universities to create new assistive technology devices. As a result, Srinakharinwirot University introduced a rehabilitation device for patients with cerebrovascular disease or muscle atrophy, which targets the movement of the forearm, hand, and fingers (Foundation of Thai Gerontology Research and Development Institute, 2022). Burapha University has developed a device which alleviates ankle, knee and hip stiffness and raises blood flow through automatic leg elevation to prevent muscle shortening among bedridden or otherwise physically impaired older persons (Foundation of Thai Gerontology Research and Development Institute, 2022).

NSTDA has developed M-Wheel, a wheelchair accessory device that adds electrical power to a traditional wheelchair, making it able to cover distances of up to 20 kilometers or drive for up to 4 hours (Foundation of Thai Gerontology Research and Development Institute, 2022; The National Science and Technology Development Agency, n.d.-b). The M-Wheel accessory can increase the ability of older users to travel farther and more independently, therefore centering the principles of independence, care, and self-fulfillment from the United Nations Principles for Older Persons.

Visual Aids

Chulalongkorn University, also in collaboration with NRCT, has developed an LED lamp device that helps older persons and others with impaired vision to distinguish between objects

more clearly due to heightened contrast (Foundation of Thai Gerontology Research and Development Institute, 2022). This initiative promotes the principles of care, independence, and self-fulfillment from the United Nations Principles for Older Persons, allowing recipients to receive accessible and convenient physical therapy or assisting them in performing work-related or leisure activities.

4.1.2 Robotics

In response to the COVID-19 pandemic, Thailand has prioritized the promotion of Information and Communication Technology (ICT) in older persons' healthcare (UN ESCAP, 2021). The robotics field has received support from the Ministry of Public Health, together with the Ministry of Science and Technology, and benefited from tax exemptions from the Board of Investment (UN ESCAP, 2021). These initiatives resulted in the development of Thailand-based CT Asia Robotics' Dinsow Mini service robot, originally intended to be used in healthcare facilities, which became available for private purchase to be used in people's homes (UN ESCAP, 2021). The Dinsow Mini is able to respond to commands, can be controlled remotely, and includes a 3D digital camera and a Falling Detection System that is able to send alarms to family members (Innovation Thailand, 2021). The robot was shown to improve fall prevention knowledge among Thai older people in senior homes, according to a recent quasi-experimental study (Maneeprom et al., 2019). This project functions in accordance with the United Nations Principles for Older Persons, in particular the dimensions of independence and care, since the robot can be used in an older person's home and provide them with a higher degree of agency, thereby avoiding unnecessary hospital stays.

4.2 Assistive Technology: Systems

This section delves into standout practices, from the Community-Based Long-Term Care Program's innovative home-based elderly care to Chulalongkorn University's Smart City Initiative and the expansive Thai ARi project, highlighting Thailand's commitment to improving senior living through research, innovation, and inclusivity.

4.2.1 Community-Based Long-Term Care (LTC) Program

Community-Based Long-Term Care (LTC), conceived and administered by Thailand's National Health Security Office, debuted in 2016 with a pilot phase. Its primary mission was

to provide high quality in-home care for elderly individuals with disabilities, particularly those who are bedridden (Zhongming et al., 2020). This project's stewardship is delegated to local administrations, and its operational funding comes from the Local Health Fund, which is based on community-oriented values.

A distinguishing characteristic of the LTC program goes beyond traditional caregiving. In addition to coordinating routine visits by devoted carers and developing scrupulously-tailored care plans by specially trained care managers, the program aims to close the accessibility gap by providing beneficiaries with assistive devices. Recognizing the diverse requirements of the community, the program expanded in 2019 to include individuals under the age of 60 and those who are not covered by the Universal Healthcare Coverage Scheme. This strategic expansion resonates with the United Nations Principles for Older Persons' principles of independence and care. By ensuring that beneficiaries can reside at home for extended periods of time and by facilitating seamless, accessible care, the program reaffirms its commitment to these principles.

However, as with many other ambitious endeavors, the LTC program has encountered its share of obstacles. While it enjoys a commendable annual growth rate, financial constraints and legislative obstacles have emerged as significant obstacles, potentially thwarting its goals of nationwide coverage and comprehensive benefit delivery. Key focuses for its evolution include attaining financial stability, navigating legislative complexities, investing in the ongoing development of its workforce skills, and fostering cohesive collaborations between multiple departments (Zhongming et al., 2020).

4.2.2 Smart City Initiative

Center of Excellence in Universal Design (CEUD), Chulalongkorn University operates under the Faculty of Architecture (Chulalongkorn University, n.d.). The Center has introduced several initiatives to promote both the adoption and the quality of assistive technology in Thailand (Chulalongkorn University, n.d.). Among them is the Universal Design Academy course, which prepares students to prioritize accessibility in the design of infrastructure (Chaiyong, 2021). The CEUD also provides project teams with multidisciplinary knowledge regarding the needs of people with disabilities and older persons (Chulalongkorn University, n.d.). The current focus areas of the Center include the Development of an Age-friendly City with the National Research Council of Thailand and Koh Kred Universal Design Renovation with the Ministry of Social Development and Human Security (Chulalongkorn University, n.d.).

The project in Ko Kret island included providing design guidelines for the improvement of the Moo-7 and Pak Kret Piers, increasing accessibility for people in a wheelchair (Jiravanichkul et al., 2020). The guidelines included providing facilities such as ramps, landings and stairs for older persons and persons with disabilities (Jiravanichkul et al., 2020). The project aligns with the United Nations Principles for Older Persons. The Universal Design Academy centers inclusion in its operations, and promotes the principles of dignity and participation by ensuring relevant stakeholders are educated about the needs of older persons. Meanwhile, the projects undertaken by the CEUD show their commitment to the principles of independence and self-fulfillment through the improvement of infrastructure.

4.2.3 Chula ARi and Thai ARi

Supported by the Chulalongkorn University Empowerment Program and the Second Century Fund (C2F), the College of Population Studies launched this multidisciplinary three-year initiative in 2018. Thai ARi originated from the Chulalongkorn University Platform for Ageing Research Innovation (Chula ARi). Its objective was to foster knowledge, innovation, and area-based research in geriatrics, with a vision to shape government policies in support of ageing ("'Thai ARi' (Thailand Platform for Aging Research Innovation): A Project for Enhancing Life Quality of Senior Citizens on Sichang Island," 2022). This would, in turn, enhance well-being and quality of life for senior adults. Upon the successful culmination of the Bangkok-based Chula ARi, the project was broadened in 2021 as Thai ARi. This expansion was backed by the Research and Innovation Funds of the National Research Council of Thailand (NRCT), drawing upon knowledge and findings from Chula ARi. The aim was to amplify the benefits of Chula ARi for senior citizens across other Thai provinces. Thai ARi represents a concerted effort among Chulalongkorn University's various departments, local education bodies, communities, and organizations. Their shared vision is to foster an "Active Ageing and Age-friendly Community", thereby elevating the quality of life for seniors and strengthening communities. The initiative has been launched in Lampang, Chumphon, Chaiyaphum, and Chon Buri provinces. Specifically, Sichang Island in Chon Buri Province has been pinpointed as a primary research hub.

The Thai ARi project focuses on utilizing insights from the Chula ARi research to understand and address Sichang community's needs, especially regarding older persons. This involves disseminating research and sharing strategic planning and evaluation. Efforts are also geared towards creating systems that champion active ageing and quality living in Sichang, targeting

areas like healthcare, innovation, environment, the economy, and societal participation. Emphasis is on community involvement, ensuring alignment with national ageing-related strategies and masterplans.

4.3. Assistive Technology: Services

The good practice highlighted in this section showcases Thailand's assistive services. University-led home modifications and grassroots initiatives such as forOldy enhance older people's living conditions, promoting autonomy and emphasizing community support.

4.3.1 Home Modifications

An important part of assistive technology consists of home modifications, and initiatives regarding improving home environments have been undertaken in Thailand. In 2013, researchers from Mahasarakham University, Faculty of Medicine, working with hospitals from target provinces and an interdisciplinary team of volunteers from the communities, engineers, architects and social workers, developed a home environment modification program for those with physical disabilities, which included senior participants (Tongsiri et al., 2017). The researchers utilized the International classification of functioning, disability and health (ICF) to measure the level of functioning (Tongsiri et al., 2017). The target provinces included Kalasin, Khonkaen, Mahasarakham and Roi-Et, and 43 homes were renovated (Tongsiri et al., 2017). The modifications ranged from comparatively small, such as the installation of handrails, to room rearrangement and rebuilding (Tongsiri et al., 2017).

The Persons with Disabilities Empowerment Act, which provides an option for those with disabilities to receive a 20,000 Thai Baht subsidy aimed at modifying the home environment, paid for, on average, 70% of the repair costs, with the rest provided from local government or the participants (Tongsiri et al., 2017). The modifications performed as a result of the project dramatically decreased difficulties of walking, getting up, and other physical actions (Tongsiri et al., 2017). The initiative promoted the principle of independence enshrined in the United Nations Principles for Older Persons, as it allows older persons to live in their own homes, but with a safer environment. However, the modifications were not sufficient for those in the most severe condition, such as those unable to walk (Tongsiri et al., 2017). The project highlighted the importance of government subsidies, interdisciplinary efforts, and local initiative for the improvement of the quality of life of persons with disabilities.

4.3.2 Local Community-Driven Initiatives

The forOldy network is an example of a local community-driven initiative designed to bolster access to assistive technology. As noted by the Asia Health and Wellbeing Initiative (2020) and Tantuvanit (2021), the network has expanded its reach to encompass eight distinct communities within Bangkok. The network promotes activities and avenues tailored for older individuals, ranging from at-home care solutions to enlightening educational programs.

The initiative also includes the "Grandma's" Shop, started in 2010 as a response to many low-income older persons in the area not having access to affordable mobility devices (Asia Health and Wellbeing Initiative, 2020; Tantuvanit, 2021). The shop provides older persons the opportunity to rent and buy assistive devices at cheap rates, including walkers, wheelchairs, medical beds, and many others. It cleans and repairs devices which it acquires through donations. Those unable to pay are linked with people willing to donate devices in, for example, instances where a relative has passed away (Asia Health and Wellbeing Initiative, 2020). The forOldy network is efficient and comprehensive, centering accessibility in its activities. Therefore, the network centers the principles of independence, participation, dignity and care in its operation, being originated as a grassroots campaign by a fellow older person and allowing older persons from low-income areas to exercise renewed agency in their respective communities.

5. Challenges in Accessing Assistive Technology

In its enduring commitment to older individuals, Thailand has made notable advancements in assistive technology, though challenges persist. Table 2 offers a contributive analysis, mapping Thailand's assistive technology progress and hurdles against the United Nations Principles for Older Persons. Notably, while efforts accentuate independence, care, and self-fulfillment, the dimensions of participation and dignity require further attention.

Table 2. Thailand's Assistive Technology Situation through the United Nations Principles for Older Persons

Principle	Observation
Independence	Numerous recent advancements in the field of assistive technology highlight the independence of older persons, with inventions such as the M-Wheel electric wheelchair accessory and the Long-Term Care Program paving the way for increased agency of the population group.

Participation	Currently, there is a lack of initiatives that promote the participation of older persons in the field of assistive technology development, distribution, and education. Although the forOldy network community initiative is a notable example, other communal projects should be encouraged. Moreover, while older persons' participation is highlighted in Thai legislation through the economic and social dimensions, the intersection of both age and disability is still lacking.
Care	The principle of care is well-emphasized in Thai legislation regarding both persons with disabilities and older persons. It is illustrated through such recent inventions as the Jo-Ey adjustable bed.
Self-fulfillment	Smart City Initiatives, Chula ARi and Thai ARi projects, as well as devices such as visual aids, contribute to the prioritization of older persons' ability for self-actualization through improved infrastructure as well as knowledge- sharing and education.
Dignity	The dimension of dignity is repeatedly highlighted in Thai legislation; however, the absence of specific age and disability provision in targeted programs may leave out this vulnerable group. Thus, the importance of expanding the Long-Term Care Program and other such initiatives cannot be overstated.

Source: Analyzed by the authors

Several factors contribute to the disparity in assistive technology uptake, including limited accessibility, scarcity of advanced devices, knowledge gaps among occupational therapists, and acceptance challenges among the elderly. Drawing from prior literature, the authors categorize these challenges into three primary areas, as follows:

5.1 Accessibility

Access to advanced assistive technology in Thailand remains limited, particularly regarding more sophisticated products (ADB, 2020). The majority of these assistive products are imports, many of which fall short in terms of quality (WHO, 2021). Lersilp et al. (2018) conducted a study that involved reviewing medical records and interviewing medical professionals and policymakers in four Chiang Mai communities. Their findings indicated that most provided assistive devices were low-tech, such as walkers and crutches, and were predominantly second-hand. Furthermore, the database documenting recipients of these assistive devices lacked comprehensive data. Notably, there were gaps in recording the specific type of technology given, absence of disability details, and issues in tracking the devices' distribution (Lersilp et al., 2018).

5.2 Low-Tech Devices and Limited Infrastructure

Additionally, another cross-sectional survey of home-bound older people aged 60 and over was conducted in Putthinoi et al. (2017). Researchers analyzed the presence of assistive technology in their homes according to WHO's International Classification of Functioning, Disability, and Health (ICF) framework as well as the home environment (Putthinoi et al., 2017). It was found that, first, there was a low number of assistive technology devices present in their homes, and the ones that were present were low-tech (Putthinoi et al., 2017). Secondly, the home environment was not safe, with a high risk of falls, and did not have appropriate modifications that would enable independent functioning (Putthinoi et al., 2017). In addition, limited digital infrastructure further affected coverage in many areas (Bhula-or, et al., 2023).

5.3 Acceptance

In addition, there are issues of acceptance of assistive technology among older persons (Boisselle & Grajo, 2018). Occupational therapists who work in the field of assistive technology are few due to it not being widely covered in conventional training (Boisselle & Grajo, 2018). For instance, a recent study of Thai occupational therapists, the majority of whom worked in the country's public hospitals, revealed that more than half reported a less than sufficient knowledge of the services provided by assistive technology (Thawisuk et al., 2022). Beyond the challenges of accessing assistive technology, the digital divide among older persons poses another barrier to accessing technological tools and infrastructure.

There is evidence that the level of unmet care needs among older persons is increasing over time, especially in poorer regions (Phetsitong & Vapattanawong, 2022). Considering the country's shrinking labor force and the rise in the share of older persons among the population, assistive technology can be one of the possible options to offset caregiver shortage. However, some elderly are reluctant to utilize assistive products and may therefore prefer caregivers (Boisselle & Grajo, 2018).

6. Recommendations

With an increasingly ageing population, the provision and adoption of assistive technologies have become a crucial part of ensuring a better quality of life for older persons in Thailand. While the nation has made commendable efforts in introducing initiatives to aid its older

citizens, several areas need reinforcement. Affordability, innovation, education, and inclusion emerge as four critical pillars in addressing the challenges faced by Thailand's elderly population. Whether in the area of expanding welfare schemes for increased affordability or ensuring that medical staff are educated on recent advances, there is an evident need to foster an ecosystem where assistive technology is accessible, understood, and relevant. Moreover, it is essential that as we advance technologically, we do not lose sight of the human aspect, underscoring the importance of including older persons in the decision-making process, understanding their unique needs, and ensuring their dignity and participation. The detailed recommendations are listed as follows:

6.1 Affordability

Accessibility of assistive technology remains low, especially for people in poverty and those living in rural areas. The greatest issue, and therefore the most vital recommendation, is to increase the affordability of assistive devices. Thailand should expand welfare schemes that cover assistive devices for older persons, as well as work on increasing knowledge of existing laws that older persons could utilize in order to obtain assistive devices for free or at a subsidized rate. One of the vital schemes Thailand should expand and continue investing in is the Long-Term Care Program, which provides comprehensive care for older persons and is set to include assistive devices. The holistic approach would allow for older persons to be educated about and become accustomed to the assistive devices introduced to them, increasing the rate of retention and their ultimate usefulness. Much of the country's assistive technology is imported and therefore comes at high costs. In addition, as Thailand's older population is increasing, the demand for assistive devices is likely to rise. As part of the country's R&D strategy, Thailand should continue encouraging local manufacturers to enter the growing field of assistive technology through government grants and collaborations.

6.2 Innovation

While there are a number of good case studies, challenges remain in encouraging older persons to adopt assistive and welfare technology. Factors that encompass a broader range of design considerations were previously introduced through the Technology Adoption Model (TAM) by Davis (1989) and the Diffusion of Innovations Model by Rogers (1995).. However, Chaiwoo Lee and Joseph F. Coughlin (2014) identify additional factors – affordability, accessibility, technical support, social support, emotion, independence, and confidence – which

suggest that existing models may have limitations when designing technology for older adults. These new factors address individual and social characteristics of older adults, highlighting the need for a more comprehensive approach.

Future research should continue to explore the factors that prevent older persons from adopting assistive technology and strive to design it accordingly. Empirical studies can aid to further discussion of more services and service-oriented design. By incorporating these factors into design, technology can be made more appealing to and usable by older adults, enhancing their overall well-being and interaction with technology. Based on Yap et al. (2022), the factors influencing intentions among older persons to adopt technologies are categorized into seven major groups for the purposes of analysis and comparison: technology, social, psychological, personal, cost, behavior, and environment.

While Thailand is making strides in the distribution of assistive products, gaps remain in the dimension of high-tech assistive devices. Recent initiatives feature sophisticated assistive technology that can be used at home, alleviating the need to check into hospital and therefore increasing quality of life for older persons. These achievements showcase the country's human capital achievements and call for the continued support of local assistive technology professionals.

6.3 Education and Training in Assistive Technology

A pivotal element for the successful implementation of new assistive technology is education. Educating older persons and their family members is vital, but many older adults primarily obtain their information from medical and care staff. Hence, it is essential for professionals, especially those in the fields of occupational therapy and geriatric medicine, to be well-informed about the latest developments in assistive technology. This knowledge enables more effective utilization of government programs and schemes tailored for those in need. Furthermore, it is crucial to incorporate assistive technology topics into medical curriculums for doctors and nurses. Organizing seminars focused on assistive technology can also help disseminate vital knowledge to medical and care professionals already in the field.

6.4 Inclusion

While Thailand has shown that the principles of care, independence and self-fulfillment from the United Nations Principles for Older Persons are well-centered in their assistive technology

initiatives, those of participation and dignity were found less frequently. In the future, Thailand may wish to involve older persons themselves in the process of manufacturing and distribution of assistive devices. When discussing the distribution of new high-tech assistive devices, demand is one of the key components which determine the viability of new products. A survey of older persons, their adult children, and medical professionals at a major hospital revealed a high demand for assistive devices and smart home technology (Visutsak & Daoudi, 2017). Respondents raised issues of cost and the need for assistive devices to fit in with existing home environments (Visutsak & Daoudi, 2017). In cases where cost was an issue for families, respondents highlighted smart watches, video monitoring, and fall monitoring devices as most vital (Visutsak & Daoudi, 2017). As a result, passive-intervention devices which would monitor the well-being of older persons in the background were the first priority (Visutsak & Daoudi, 2017).

To bridge the gaps, Thai government agencies, alongside assistive technology engineers and manufacturers, should delve deeper into understanding the needs of older persons. By basing policies and products on these insights, devices tailored to a Thai older person's needs, family contexts, and cultural nuances are more likely to be effective in the long run. While endeavors like local initiative campaigns resonate with these principles, leveraging governmental resources could boost their efficiency many times over. Moreover, older individuals eager to stay in the workforce can be upskilled to become caregivers and educators on assistive products and related government schemes. Engaging older consultants in the design and manufacture of assistive products can also ensure these technologies genuinely cater to older persons' needs and preferences.

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PROMOTING THE HUMAN RIGHTS OF OLDER PERSONS THROUGH EXPANDING THE PUBLIC ACCESSIBILITY OF ASSISTIVE/WELFARE TECHNOLOGY IN JAPAN

TAKEO OGAWA

1. Agenda: Current Assistive/Welfare Technologies from the Perspective of the Human Rights of Older Persons in Japan

Japan is undergoing the fastest expansion in population ageing and depopulation in the world. It became an ageing society in 1970 (when the percentage of over 65s in the total population was over 7%), an aged society in 1995 (over 14%), and a super-aged society in 2005 (over 21%). Currently, Japan faces the challenge of sustaining the lives of an ever-increasing number of older persons (OPs) in the face of population decline, the result of its decreasing birthrate and increasing death rate. Japan has forged past the classical models of the demographic transition theory and is now entering the stage of population decline.

Table 1. History of Demographic Ageing and Technological Innovation and Regulations in Japan

	% of 65$^+$	year	Innovation and Utilization of Assistive/Welfare Technology	Regulation
Pre-ageing Society	5.7	1960		
		1961		National Pension Law
				National Health Insurance Act
		1963		Act on Social Welfare for the Elderly
		1968		Basic Consumer Act
Ageing Society	7.1	1970		Special Measures Law for Depopulated Municipalities
	9.1	1980		The 3rd Special Measures Law for Depopulated Municipalities
		1982	The Association for Technological Aids	
			Japanese Type Mobile Phone	
		1986	Irodori Business, Kamikatsu-cho	
		1992	Dissemination Center for Practical Long-term Care	
Aged Society	14.6	1995	Temporary Housing after Kobe Awaji Great Earthquake	Basic Act on Measures for an Ageing Society
		1996		General Principles concerning Measures for an Ageing Society
		1998		The 6th Comprehensive National Development Plan
	17.4	2000		Long-term Care Insurance Act

		2003	Smart Phone	Act on the Protection of Personal Information
Super-aged Society	20.2	2005	Therapy Robot "PARO"	
		2006		Act on the Prevention of Elder Abuse
		2008	Rehabilitation Robot "COGY"	
		2009	Powered Suit "HAL"	
		2011	Reconstruction after Higashi Nihon Great Earthquake through ICT Development	
		2014	Matsumoto-city Health Lab	
		2016	Play Station VR	The 5th Science and Technology Basic Plan
			Kamakura-city Living Lab	
		2017	Fukuoka-city "Fukuoka 100"	
		2018	Development and Dissemination of Nursing Robots and Support Systems	The Guideline on Measures for an Ageing Society 2018
	28.6	2020	COVID-19 Pandemic	"Digital Garden City" Initiative
			Japan Business Federation "Healthcare in the 'Society 5.0' Era"	
		2022		Amended Act on the Protection of Personal Information
		2023		Dementia Basic Act

Source: Illustrated by Author

The Japanese national government began initiating ageing-ready policies in 1960. As technological innovation rapidly evolves, various assistive/welfare technology (AWT) devices have been developed to support frail OPs and people with disabilities (PwD). Wheelchairs, beds, toilets, bathtubs, and a variety of other self-help equipment have been manufactured and sold by private companies.

To provide AWT information directly to OPs who need long-term care (LTC) and to their family caregivers, the Ministry of Health, Labour and Welfare (MHLW) decided to establish

"Dissemination Centres for Practical Long-term Care (DCPLC)" in prefectural and government-designated cities in 1992. The main pillars of this program are LTC promotion activities and AWT equipment exhibitions.

The Japanese government passed the Basic Act on Measures for an Aging Society (BAMAS) in 1995, and in 1996 the Cabinet approved the Guideline on Measures for an Ageing Society (GMAS) in order for projects for an ageing society to be managed centrally by ministries and agencies. The Guideline describes five pillars: Employment and Income, Health and Welfare, Learning and Social Participation, Living Environment, and Survey and Research.

In the 2000s, assistive/welfare technology such as the Smart Phone (2003), Therapy Robot "PARO" (2005), Rehabilitation Robot "COGY" (2008), and Powered Suit "HAL" (2009), appeared in Japan.

Today, the Japanese government states that it has entered the "Society 5.0" phase of societal development. The 5th Science and Technology Basic Plan (STBP) in 2016 recognized that the structures of society and the economy would be transformed due to the evolution of many changes, including ICT, and now the "Era of Great Transformation" has arrived. Society 5.0 is a phase of societal development that is human-centered, intended to balance economic advancement and social problem-solving in a system that integrates cyberspace and physical space. Society 5.0 follows the hunting society (Society 1.0), agricultural society (Society 2.0), industrial society (Society 3.0), and the information society (Society 4.0). Society 5.0 uses the latest technologies like the Internet of Things (IoT), AI, and big data, in various sectors and industries. The structure of Society 5.0 is based on the social change resulting from digital transformation (DX).

The GMAS has been reviewed approximately every ten years in anticipation of changes in society. Currently, measures are being promoted under the Guideline approved by the Cabinet in 2018, aiming for innovation created by technological advancement. The GMAS 2018 advocates improvements in ICT literacy and in the utilization of advanced technology to activate the market for seniors. The GMAS 2018 is based on the 5th STBP in 2016.

Will older persons in Japan be able to protect their human rights in this rapidly changing society of science and technology? One hypothesis is that innovations in AWT will make it easier for OPs to ensure their human rights. Another hypothesis is that OPs are more likely to have their

human rights violated because they may not be able to adapt to scientific and technological innovations.

2. Evaluations based on the Age-friendly City Framework

In evaluating AWT, let us look at it in the framework of the eight areas of the "Age-friendly City" initiative, developed since 2007. In 1991, the United Nations General Assembly adopted these Principle**s** for Older Persons: Independence, Participation, Care, Self-Fulfilment and Dignity. Based on these principle**s**, the World Health Organization (WHO) published "Active Ageing: A Social Policy Framework" in 2002 to coincide with the UN Second World Assembly on Ageing in Madrid. To promote this framework, WHO has created a global network of "Age-friendly Cities". The eight interconnected domains of the Age-friendly City are: Housing, Transportation, Outdoor Spaces and Buildings, Community and Health Services, Communication and Information, Civic Participation and Employment, Respect and Social Inclusion, and Social Participation.

2.1 Housing

The WHO argues that the housing conditions of OPs are often linked to their quality of life, and affect whether they are able to age independently and actively in their community. In Japan, local governments provide not only residential care homes for poor older persons but also public housing for those who have low incomes. As OPs age, public housing needs to be redesigned.
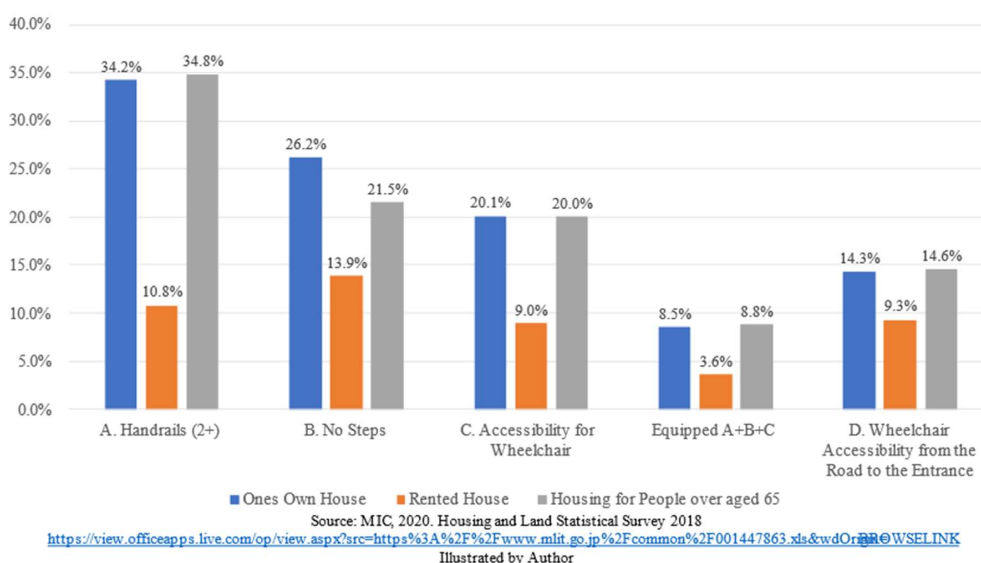
Consequently, the Ministry of Land, Infrastructure, Transportation and Tourism (MLIT) and the MHLW have been complementing each other since 1987 to develop housing for OPs. Under this collaboration, the "Silver Housing" project was promoted to incorporate specific design features in public housing, where the number of elderly residents has increased. These features include barrier-free design, added monitoring functions, and assigning life support advisors.

After the Great Kobe-Awaji Earthquake in 1995, the Silver Housing model was adopted for both temporary evacuation housing and reconstruction; and after the Chuetsu earthquake in 2004, the concept of a community-based comprehensive care system was developed by 2007,

providing care services in the client's place of residence. This is Ageing-in-Place Japanese-style.

In 2018, the Ministry of Internal Affairs and Communications (MIC) reported that 34.8% of homes where OPs were living were equipped with handrails, 21.5% did not have any steps and were wheelchair accessible, and 43.6% of them were located near an Adult Day Care Centre.

Figure 1. Well-Equipped Housing in Japan

Source: MIC, 2020. Housing and Land Statistical Survey 2018
https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.mlit.go.jp%2Fcommon%2F001447863.xls&wdOriginBROWSELINK
Illustrated by Author

In 2020, the MLIT launched the "Next-Generation Housing Project," which utilizes Internet of Things (IoT) technology and other technologies to contribute to the dissemination and enlightenment of leading technologies for next-generation housing.

And today, even if OPs are bedridden in a facility, they can live a safe and convenient life surrounded by various equipment and devices that use Internet of Things technologies. This monitoring equipment makes full use of software technology to protect the privacy of the older people using it. In addition, the MHLW is promoting a subsidy project (2019) to promote the introduction of digitization and care robots in long-term care facilities (LTCFs).

For example, an increasing number of OPs in LTCFs are using bed-exit ~~sensors~~, excretion sensors, and non-contact thermometers. Hot-bath facilities are extremely important in Japan, and have been made safer with the introduction of various AWT related to bathing assistance.

A private research company conducted an online survey of 503 LTCFs from June 13 to July 1, 2020, and found that the introduction rate of care software was 70%, the introduction rate of care robots was less than 10%, the introduction rate of tablets was 45%, and the introduction rate of chat tools was 39%. It can be said that LTCFs are still far from digital transformation. According to the survey, 20% of employees resist digitalization, and 90% of them are in their 40s or older (Kaigo-no-Komimi, 2020). There is an ongoing need to improve the awareness of frontline staff.

In addition, facilities that have introduced advanced care robots are facing interface problems, the absence of evaluation systems, and cost burdens. If these issues are not resolved, the conditions for housing for OPs will not be improved (Zenkokai, 2020)

Since 2017, Fukuoka-city has been ~~advancing~~ projects in anticipation of its older population living to the age of 100. The Fukuoka 100 plan calls for an online visitation system for LTCFs free of charge, enabling online visits between residents and their families. The plan aims to maintain quality of life for OPs, and also prevent transmission of infectious diseases. Sixty percent of facilities said they had achieved their mission. In addition, ICT-based monitoring sensors have been installed for OPs living alone, and if abnormal values regarding temperature, humidity, lighting, etc. are found, a safety center calls to confirm the person's condition, or visits. As a result, cases in which risk of heart attack or stroke was identified and that neededt hospitalization for examination, were cared for early.

2.2 Transportation

The WHO states that OPs should ideally be able to use and navigate their city's transport system with ease. Furthermore, vulnerable OPs should be able to move within their home with the assistance of some AWT. These recommendations match the growing number of OPs with mobility needs in ageing Japan.

The ageing of rural townships and municipalities is because many OPs have been left behind in rural areas as the younger generation has left for the cities. These municipalities have been described as depopulated areas since 1970. Securing transportation for their elderly residents

has become a growing issue. In 2003, the Cabinet Office began to address the problem of transportation in depopulated areas through a deregulation measure called "Special Zones for Structural Reform". As a result, Kamikatsu-town in Tokushima Prefecture requested approval for mobility support activities by paid volunteers. Since then, mobility support by paid volunteers using private cars has spread nationwide and has been implemented not only in depopulated areas but also in large cities. In 2020, the Act on the Revitalization of Regional Public Transportation was enacted, and by 2023, 354 municipalities had formulated regional public transportation plans.

MLIT began working to solve this problem at national level in 2020. "Mobility as a Service (MaaS)", as it is now known, is a system that integrates all modes of transportation – buses, trains, taxis, and airplanes – into a single service, and seamlessly connects route searches and payment. MaaS is said to have advantages for vulnerable people such as OPs and PwD, and secures last-mile delivery problems for people living in depopulated areas.

In the same way, Aizuwakamatsu-city in Fukushima, Hitachi area in Ibaraki, Tsukuba-city in Ibaraki, Maebashi-city in Gunma, Shizuoka-city, Izu area in Shizuoka, Otsu-city in Shiga, Kasugai-city in Aichi, Maizuru-city in Kyoto, Hiroshima-city, Takamatsu-city in Kagawa, and Nan'yo area in Ehime have been prompted to initiate programs based on MaaS. Carpool Matching App (Teshio-town, Hokkaido 2007), Deliveries with Drone (Chichibu-city, Saitama 2021), and Autonomous Driving (Eiheiji-town, Fukui 2022), are further developments.
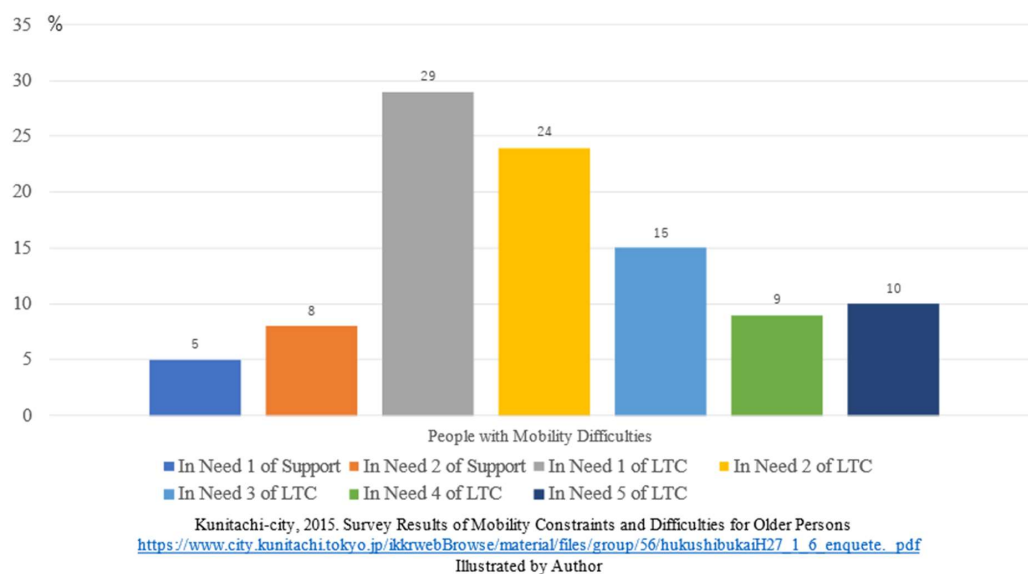
In 2006, MLIT enacted a law that integrated the Act on Barrier-Free Promotion of Public Facilities (1994) and the Act on Promotion of Barrier-Free Public Transportation and Ancillary Facilities (2000). As a result, by 2008, its goals for the elimination of stairs, the installation of toilets for OPs and PwD, and the installation of Braille guidance blocks for the visually impaired in passenger facilities, had almost been achieved. Since then, the emphasis has shifted to the development of good design, which the Ministry said had almost achieved its target by 2021 (MHLW. 2023). Good progress has been made by the airlines (nearly 1005), trains (76.0% in 2020), non-step buses (65.5% in 2021), and ships (55% in 2021). While positive changes are occurring, there is still work to be done to achieve full compliance with….

Furthermore, AWT has been developed for people with reduced instrumental activity of daily living (IADL) to support their mobility with wheelchairs. In 1992, the spread of transfer/mobility support equipment progressed through the DCPLCs established in all

prefectures and major cities. Since the long-term care (LTC) insurance system was established in 2000, transfer and mobility equipment has become even more widespread, and developments in AWT utilizing ICT and robot technology to aid the mobility of OPs have been announced one after another. Therefore, MHLW is embarking on the construction of platforms for the development, demonstration, and dissemination of care robots in 2021.

Figure 2. Percentage of Older Persons Who Have Mobility Difficulties and Require Long-Term Care

Kunitachi-city, 2015. Survey Results of Mobility Constraints and Difficulties for Older Persons
https://www.city.kunitachi.tokyo.jp/ikkrwebBrowse/material/files/group/56/hukushibukaiH27_1_6_enquete._pdf
Illustrated by Author

2.3 Outdoor Spaces and Buildings

The WHO states that a clean city with well-maintained recreational areas, ample rest areas, well-developed and safe pedestrian and building infrastructure, and a secure environment provides an ideal living environment for seniors to age-in-place. In Japan, there are many difficulties in securing and designing public spaces due to the small proportion of habitable land and the large proportion of private land. In order to promote urban planning that is friendly to OPs, it is necessary to overcome this problem.

In 1994, the Ministry of Construction enforced the Act on Promotion of Construction of Specified Buildings that can be easily accessible by OPs and PwD, and in 2006, this Act was integrated with the Traffic Barrier-Free Law (2001) to form a new Barrier-Free Law. This law aims to promote the facilitation of the movement of OPs and PwD in schools, hospitals, theaters,

assembly halls, department stores, hotels, offices, apartment buildings, facilities for OPs, parks, public transportation, stations and parking lots, in order to make public spaces accessible. The target was set to be achieved in 2010. Since 2010, 2020 was set as the target for the second term, and the subsequent target year is set as 2025.

Table 2. Next Goals in the Basic Strategy on the Barrier-Free Law

		Completed in 2019	Goal for 2025
Roads		63%	about 70%
City Parks	Gardens, roads and squares	57%	hectare
	Parking lots	48%	60% of parks over 2 hectares
	Toilets	36%	70% of parks over 2 hectares
Off-Street Parking		65%	75%
Buildings		61%	67% of Buildings over 2,000 ㎡
Traffic Signals, etc.		99%	100% in principle

Source: https://www.mlit.go.jp/report/press/content/001373537.pdf

Pedestrian crossing lights that change too quickly are dangerous for older pedestrians. Therefore, the police agency is adjusting the traffic control system so that when OPs press a button, the time to switch traffic signals is longer. Furthermore, implementation of a device that automatically adjusts the signal switching time without pressing a button by linking it with a smartphone has begun.

A new problem is the installation of security cameras. Although this is effective in reducing traffic accidents and crimes, excessive installation has been criticized as an invasion of privacy. Therefore, new rules and policies are being created to determine where cameras are installed, under what circumstances videos are made public, and methods of face-masking to assure privacy.

Figure 3. The Challenges of Outdoor Spaces and Buildings

One of the "Dementia Friendly City" initiatives undertaken by Fukuoka 100 is the universal design of public toilets. If an older person is searching for the location of a toilet, the newly designed facilities will use enlarged signage, colors and pictograms to designate their location and the difference between men's and women's entrances.

Fukuoka-city is also promoting walking as an exercise to lower lifestyle-related diseases. In its demonstration project, older adults were asked to use a computer app to record their daily steps and offered gifts and discounts at restaurants and shops. As a result, the number of app registrants increased threefold, and the growth rate of steps increased by 10% overall, from an average of 5615 steps to 6169 steps.

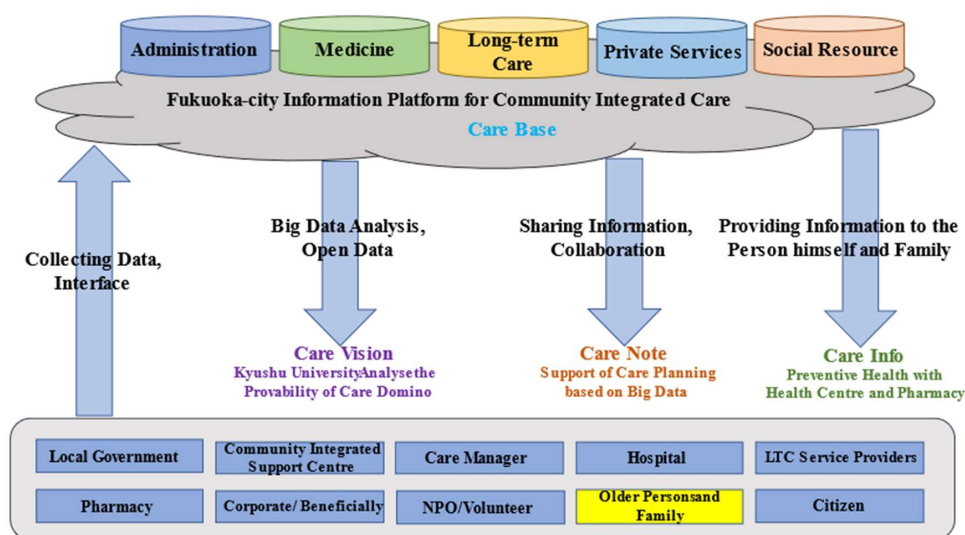## 2.4 Community and Health Services

The WHO states that accessible and affordable community and health services are crucial in keeping seniors healthy, independent and active. In 1961, before Japan became an ageing society, the government implemented a universal coverage system of pensions and health insurance to protect OPs. A public long-term care insurance system was enacted in 2000 for OPs who need LTC regardless of income.

However, the Japanese government has found it increasingly difficult to maintain the cost of social security under the current social insurance and tax systems. There are competing political issues related to the poverty of the working generation and the declining birthrate. Therefore, in 2013, the government enacted an "Act on Promotion of Reforms to Establish a Sustainable Social Security System" aimed at **a** comprehensive reform of the social security and taxation system.

In order to reduce the need for LTC, the Act makes it necessary to strengthen preventive activities among older people, including reviewing their lifestyle habits. Medical institutions are obliged to avoid simply transferring elderly patients with disabilities to the LTC sector. LTC services should be provided at home, if at all possible, not in facilities. But to live at home continuously, with the help of the community, it is necessary to establish a community-based comprehensive care system, which involves cooperation from the people around the older person, and appropriate use of AWT.

In Japan, the system that makes it easy for OPs to live in a community and to easily access health care and LTC services is called the Community-Based Integrated Care System (CICS). With the revised LTC Insurance Act since 2011, the aim is to create a community where medical care, LTC, preventive LTC, and life support are seamlessly provided in the home setting.

Figure 4. Fukuoka-city Information Platform for Community Integrated Care

Illustrated by Author

There are many service providers related to health care and LTC in the community, and the number of OPs using them is increasing. Information is managed separately by a service provider, which has been an obstacle to creating a seamless system of care, because a seamless system of data-sharing poses problems of personal information protection. Therefore, Fukuoka 100 decided in 2018 to build its own community-based integrated care system. First, Fukuoka-city built a big database by integrating data related to people's health insurance, LTC insurance, and data from the residential registration system. Using this data, the Kyushu University School of Medicine analyzed residents' health and LTC status changes over time and assessed their risk of falling. Kyushu University is now using this critical insight for the development of its second step, digital inclusion. The digital inclusion of OPs involves three steps: connectivity, critical insights, and increased digital literacy. Fukuoka Health Center can now identify high-risk targets who may fall into LTC conditions and guide them to preventive care programs. The CICS also aims to provide an AI information service that supports care managers, who create care plans based on the data.
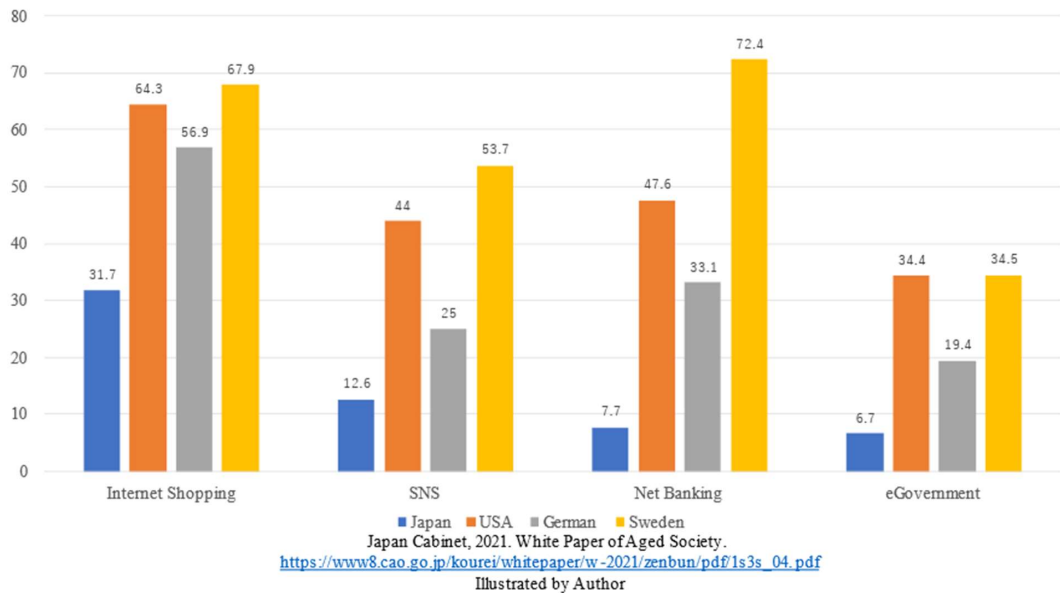
In addition, Fukuoka 100 has started a data management project jointly with Fukuoka-city, a university, and a private company, to enable each citizen to have access to their own personal health records. ICT initiatives related to the use of smartphone apps for personal medical data are assisting with preventive health and frailty prevention and medication coaching. Information is seamlessly being shared between clinics, pharmacies, and individuals for improved quality care and quality improvement.

2.5 Communication and Information

The WHO states the following. "Staying connected with events, news and activities with timely, accessible and practical information is a key part of active ageing, especially with the trend of information overload in urbanized cities. Technology can be tapped on to spread information quickly, but also plays a role in social exclusion."

When Japan developed information technology, the mobile phone was invented as an extension of traditional telephone technology. However, international competition meant Japan's mobile phone began to lose ground to the smartphone that was based on internet technology. Consequently, many OPs who depend on Japanese-type mobile phones have found themselves pushed further into one side of the digital divide.
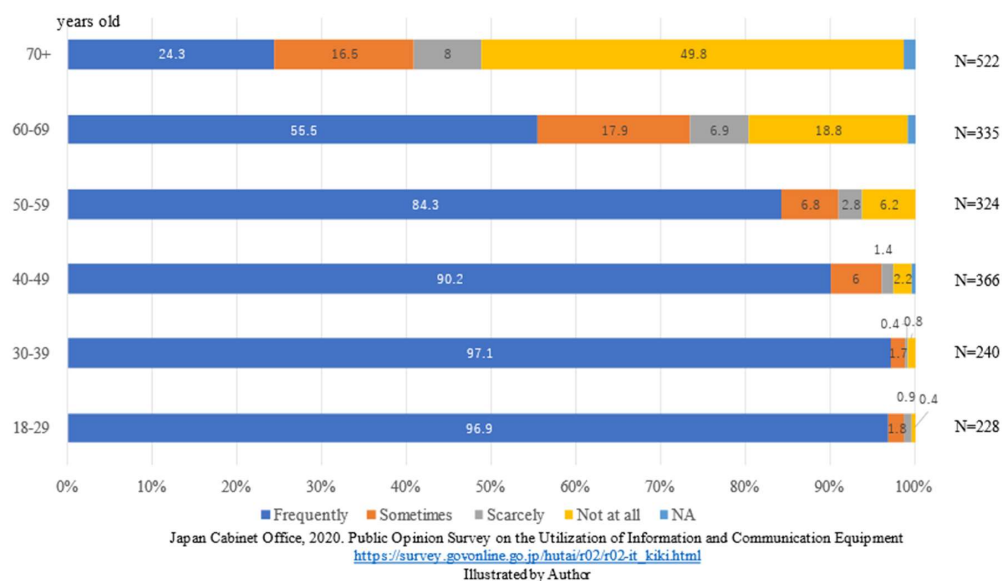
Figure 5. International Comparison of the Use of Information and Communication Equipment (multiple answers)

Japan Cabinet, 2021. White Paper of Aged Society.
https://www8.cao.go.jp/kourei/whitepaper/w-2021/zenbun/pdf/1s3s_04.pdf
Illustrated by Author

According to the results of a survey on the use of information and communication devices, the number of older people (60 years and over) in Japan using internet-based services is significantly lower than in other countries; this relates to areas such as information retrieval, shopping, social networking, online banking, and other services available using the internet.

In its "Public Opinion Survey on the Utilization of Information and Communication Equipment", published in 2020, the Cabinet Office in Japan reported that 24.3% of people older than 70 often use smartphones and tablets. This percentage is very low compared to elders in other countries and to other age groups in Japan.

Figure 6. Use of Smart Phone/Tablet by Age Group

years old

Age	Frequently	Sometimes	Scarcely	Not at all	N
70+	24.3	16.5	8	49.8	N=522
60-69	55.5	17.9	6.9	18.8	N=335
50-59	84.3	6.8	2.8	6.2	N=324
40-49	90.2	6	2.2	1.4	N=366
30-39	97.1	1.7	0.4	0.8	N=240
18-29	96.9	1.8	0.9	0.4	N=228

■ Frequently ■ Sometimes ■ Scarcely ■ Not at all ■ NA

Japan Cabinet Office, 2020. Public Opinion Survey on the Utilization of Information and Communication Equipment
https://survey.govonline.go.jp/hutai/r02/r02-it_kiki.html
Illustrated by Author

To solve the problem of OPs finding themselves on the wrong side of the digital divide, MIC launched a subsidy project in 2020 called the "Digital Utilization Environment Construction Promotion Project". As a result, private mobile phone shops and community centers currently hold workshops on how to use online services to support access to public information sources such as "Mynaportal"[2] and e-TAX.

Digital inclusion for OPs is meant to be achieved in three steps: connectivity, critical insights, and increased digital literacy. However, municipalities in Japan are still focusing on improving connectivity, which is the first step. For example, in a project aimed at bridging the digital divide for OPs in Shibuya Ward, they are lent smartphones for free. At the same time, Kaga-city, Ishikawa Prefecture, is subsidizing the purchase of smartphones.

In addition, MIC recruited "digital utilization support staff" in 2021 to improve the digital literacy of OPs. It has started a project to train ten million OPs at 5,000 locations by 2025.

Since 2013, MHLW and the Ministry of Economics, Trade and Industry (MITI) have focused on the field of care robots and communication. Addressing the issue of older persons with cognitive decline, "Talking Robots" that use Artificial Intelligence (AI) have been developed for use with and by dementia clients.

For instance, talking robots that pattern communication with OPs with dementia are equipped with "storytelling mode", "song mode" and "quiz mode". Using the "LTC guidance by dialogue function", robots are able to speak slowly for a long time to assist OPs who prefer slow conversations. Robots are also able to customize scenarios for each person and talk about where he/she came from and when he/she grew up. Likewise, "Weak Robots" are able to speak making mistakes to induce OPs to demonstrate their residual abilities.

2.6 Civic Participation and Employment

Regarding civic participation, the WHO states that OPs can gain fulfilment from active involvement in voluntary activities or work, as they provide satisfaction and keep them socially engaged. In Japan, Information and Communication Technology (ICT) initiatives have spread from depopulated areas to the entire country. Since 1986, in Kamikatsu-town in Tokushima Prefecture, older farmers have been positioned as contractors, for example setting up a "leaf business" to compete for orders using their personal computers and information technologies. (Previously overlooked, the leaf business caters to high end restaurants for the seasonal leaves, *buds and flowers that are used to give finishing touches to authentic Japanese dishes.)*

In 1986, Ogawa-village in Nagano Prefecture set up a food manufacturing company that utilizes the skills of OPs 60 years and over without retirement pensions. The company has flexible working hours and work-sharing arrangements, and has succeeded in both face-to-face sales and internet sales to young people. The success of senior businesses in depopulated areas means the practice has spread as an example of active ageing, leading to nationwide support for the idea of extending or abolishing the retirement age and creating diverse employment opportunities for older people.

Since 2016, Kashiwa-city in Chiba Prefecture has been developing activities to promote employment for OPs using a matching app called "Gathering Brisk Elderly in the Region (GBER)", which is matching employers and work-seekers.

When "PARO" was developed in 2005, many OPs in LTC facilities were positively affected by their experience with these robots. During its development, Japan relied on Danish researchers to gather supporting data for the product. Then, in order to address convenience, accessibility and affordability issues, still during the planning stage, the participation of end-users was solicited. A superior product was the result.

In 2014, Matsumoto-city formed a consortium of government, universities, private companies, and residents to launch a health lab. In 2016, Kamakura-city created a living lab for active OPs. In 2017, as previously described, Fukuoka-city launched "Fukuoka 100", declaring that it would implement 100 initiatives by 2022 to prepare for the era of 100-year lifespans. The Fukuoka 100 plan places major importance on social engagement for older people.

International comparisons show that OPs in Japan are likely to want to work, that Japan has a relatively low proportion of those who do not work. However, it is also true that people gradually become unable to work as they get older. The challenge going forward is to enable OPs to sustain their ability to work through using AWT.

Figure 7. Not Working Rates in Japan, USA, Germany and Sweden: Older Persons by Age
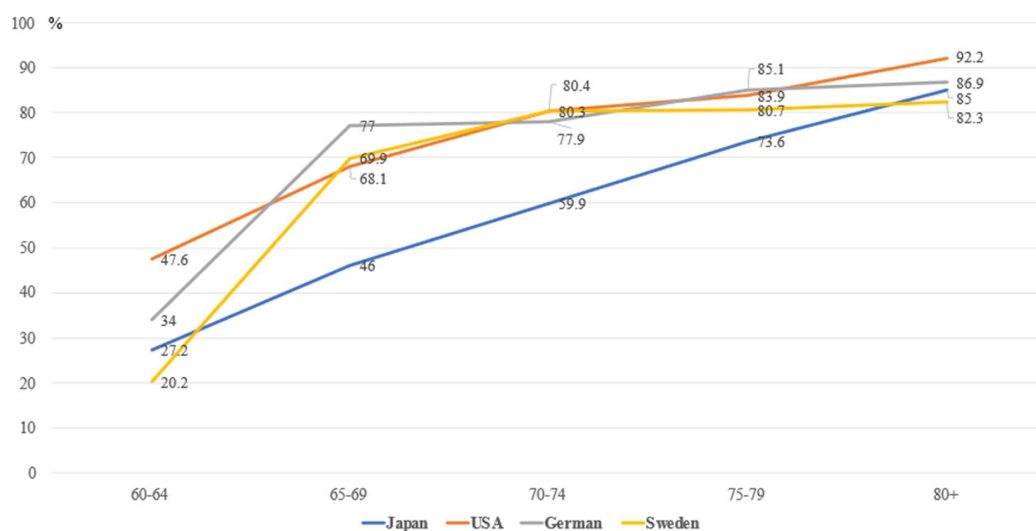

Japan Cabinet Office, 2001. International Comparative Survey on the Life and Attitudes of the Elderly 2001
https://www8.cao.go.jp/kourei/ishiki/r02/zentai/pdf/0.pdf
Illustrated by Author

2.7 Respect and Dignity

Regarding respect and dignity, the WHO states that an inclusive society encourages OPs to participate in their city's social, civic and economic life. However, in the age of fundamental technological innovation, OPs often find themselves in a situation of maladjustment. Those who have conducted their lives using old technology lose dignity and are less respected when new technologies make their skills obsolete. In addition, there are cases of OPs becoming victims of crime in a new technological environment that they are unfamiliar with. In Japan,

the number of crime victims among OPs is decreasing. However, technology-related scams and fraud have been increasing. Many scams targeting OPs are aimed at people who are unfamiliar with the operation of information devices, cash dispensers, digital currencies and similar ICT products and services.

Figure 8. Percentage of Elderly Victims by Crime Type in Japan
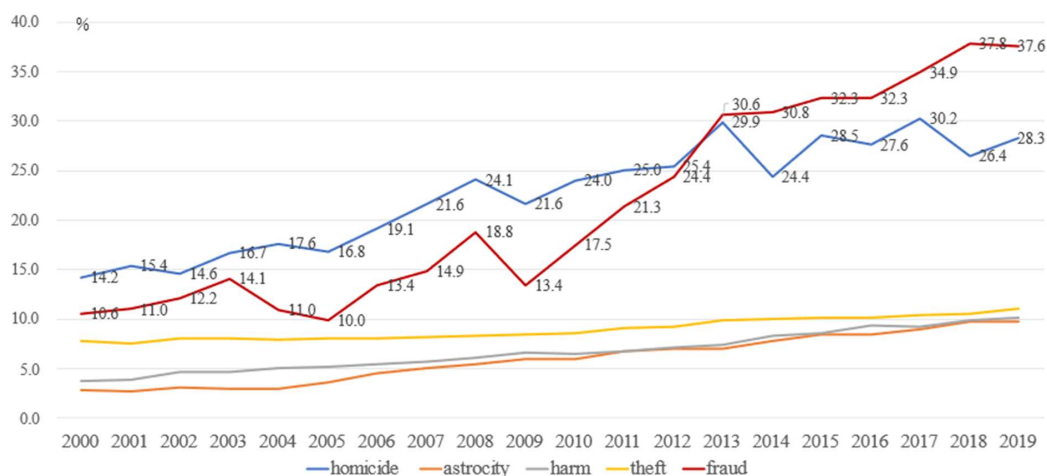
Source: Police Agency, 2020. White Paper on Policeexcerpt 2020.
https://www.npa.go.jp/hakusyo/r02/honbun/html/wf111000.html
Illustrated by Author

To protect the right to privacy of older people, the Personal Information Protection Law (PIPL) was enacted in Japan in 2003. However, in the era of digital transformation, it is not only necessary to protect personal information but also to promote its proper use. Large amounts of digital data are being generated, collected, and stored. By analyzing such information using AI, improving the efficiency of business processing and prediction accuracy, and providing optimal advice to individuals and public institutions, it will be possible to create a positive and safe environment for older people. The amended PIPL in 2023 permitted the use of pseudonyms and waived the need to disclose personal information.

In 2020, the Japan Business Federation announced "Healthcare in the 'Society 5.0' Era". For promoting digital transformation (DX) to address the spread of COVID-19 at the time, it advocated three actions: "DX of individual-based healthcare", "DX of medical care and LTC provision system", and "development of environmental and related legal systems for DX". Personal data, managed separately by supervisory authorities, should be developed as an

integrated personal health record (PHR) to reflect the life course of the individual. This PHR database would help in areas such as preventive health and enable the development of pre-symptomatic indicators. The Federation also proposed the revision of the Personal Information Protection Law. The concept of Authorized Public Purpose Access, in which the World Economic Forum distributes and utilizes data such as medical information for specific public purposes, has been proposed internationally. The Federation argued that Japan should engage with, and lead, this debate. It can certainly be said that the protection of personal information as an element of human rights theory is facing new challenges.

In Japan, half of OPs do not feel that they have been left behind digitally. However, 22.4% of OPs do feel some alienation. Which AWT will be able to improve this situation? For OPs, the problem is not only the resolution of the contradiction between the protection of personal information and the use of public information. Even if OPs do find themselves on the wrong side of the digital divide, it is important to make sure they are socially integrated so that they do not become socially disadvantaged. In particular, in order to protect the dignity and social inclusion of OPs with reduced IADL and ADL and cognitive decline, adult guardianship activities and LTC skills need to be improved.

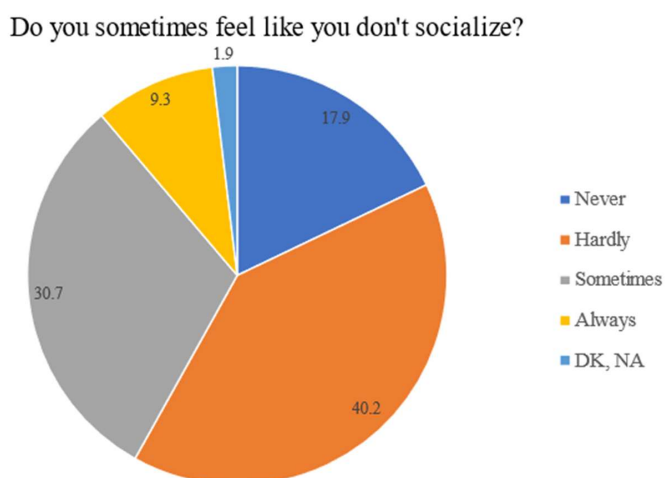**Figure 9. The Feeling of Being "Left Behind" for Older Persons in Japan**
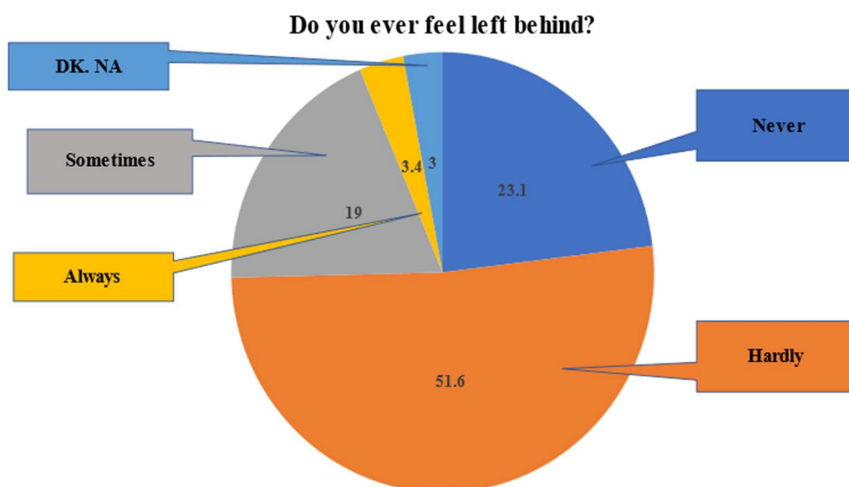
Results of the FY 2021 Survey on the Participation of Older Persons in Their Daily Life and Local Communities
https://www8.cao.jp/kourei/ishiki/r03/zentai_/
Illustrated by Author

2.8 Social Participation

Participating in leisure, social, cultural and spiritual activities in the community, according to the WHO, fosters OPs' continued integration with society and helps them stay engaged and informed. Older people tend to live alone over time. It is a phenomenon associated with being unmarried, the independence of children, and the death of a spouse. In 1998, MHLW's "Council for the Promotion of Community Creation where Older Persons Can Live with Peace of Mind" recognized that "isolated" lives would no longer be considered a matter of limited interest. It pointed out that there was a need to develop and continuously operate a two-way communication system utilizing ICT to reduce social isolation.

Figure 10. Feelings of Non-Interaction with Others by Older Persons in Japan

Do you sometimes feel like you don't socialize?

- Never — 17.9
- Hardly — 40.2
- Sometimes — 30.7
- Always — 9.3
- DK, NA — 1.9

Results of the FY 2021 Survey on the Participation of Older Persons in Their Daily Life and Local Communities
https://www8.cao.jp/kourei/ishiki/r03/zentai_/
Illustrated by Author

In 2021, the Japanese government appointed a minister to address loneliness and isolation measures, and established a task force in the office of the Cabinet Secretary. The proportion of lonely and isolated OPs in Japan is in fact less than among younger. people However, the number of OPs living alone is gradually increasing, while those who are becoming withdrawn and dying at home without being noticed are also increasing in number.

As a measure to alleviate the isolation of OPs living alone at home, social workers and community volunteers have been visiting older people to determine their need for support and to encourage them to use appropriate services. However, these efforts alone are not enough to

encourage daily social participation. Therefore, under the CICS in each region, efforts have been made to confirm the safety of older persons with a telephone reassurance program, and with a program to encourage reports of abnormal signals by meter readers, postal workers, newspaper delivery workers, and courier companies visiting the homes of OPs.

For energetic and active older persons, e-sports are attracting attention for their effectiveness in preventing dementia, relieving stress, and promoting socialization. Misato-town of Kumamoto Prefecture, for example, has a monthly program held in collaboration with the Kumamoto e-Sports Association since 2020. Tests such as electroencephalogram (EEG) measurements showed that about 90% of participants experienced an improved attention span. In addition, electronic gaming activities created opportunities for interaction among OPs living alone. In 2020, Kobe-city established and began operating an e-sports facility for those over 60 years old. In the future, senior members with experience in e-sports are expected to become instructors who will introduce e-sports to others to promote social participation.

Japan which has been holding the National Sports Festival since 1946 introduced e-sports in 2022 by Tochigi Prefecture. In addition, the Senior Sports and Culture Festival has begun promoting the social participation of OPs with e-sports from 2023, when Ehime Prefecture takes over the venue. This sports festival is known as "Nenrinpick" which is a coined word with *nenrin* meaning "growth ring" and "pick" for Olympic. E-sports are gradually becoming established as one of the opportunities for senior social participation.

3. Lessons Learned and Recommendations based on Japanese Cases
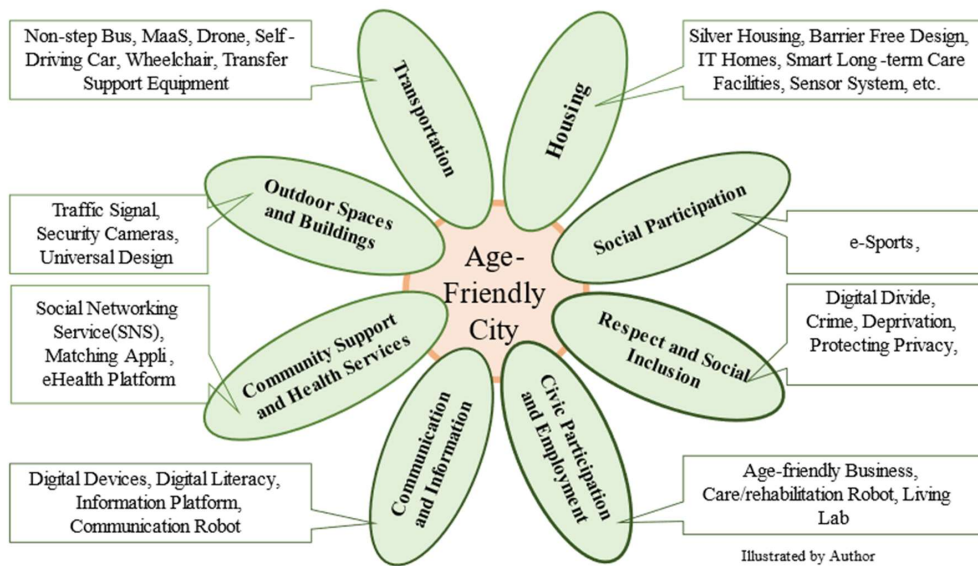
As described above, it can be said that digitalization of AWT for OPs in Japan is belatedly but steadily taking hold. This can be summarized and illustrated as Figure 11.

There are some lessons to be learned from Japan's efforts. First of all, AWT for OPs should envisage two target-age-groups among older adults. One is OPs seeking to maintain their IADL, and the other is OPs with reduced ADL. For the former, we should aim to develop technologies to support the independence of OPs themselves, and for the latter, we should aim to develop technologies that improve the work of caregivers and care workers (see Figure 12).
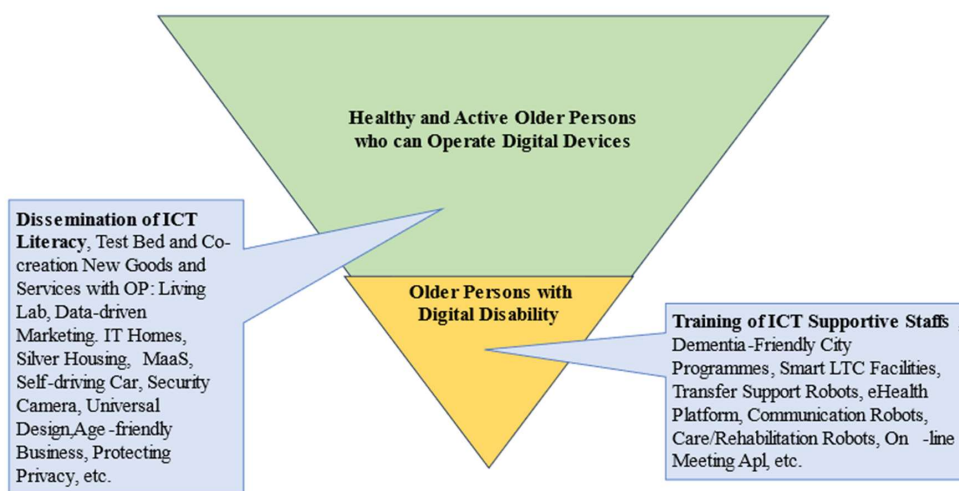
Secondly, AWT utilizing digital technology should envision first transitioning from paper documents ito electronic ones, then the stage of creating a platform to develop and utilize

digitized databases, then finally the stage of service improvement derived from analysis of the database. In the coming period of societal transformation called Society 5.0 or DX, the digitalization of Japan will involve the introduction of various digital devices and the connection of data generated by individuals, local governments, and individual offices as a value-added chain of connectivity. We cannot stop there. It will be necessary to deepen our insights based on big data. In addition, both older persons themselves and their care workers will need to improve their digital literacy and use the knowledge and skills gained to improve their quality of life and quality of work.

Figure 11. Digital Challenges of the Age-friendly City Framework in Japan

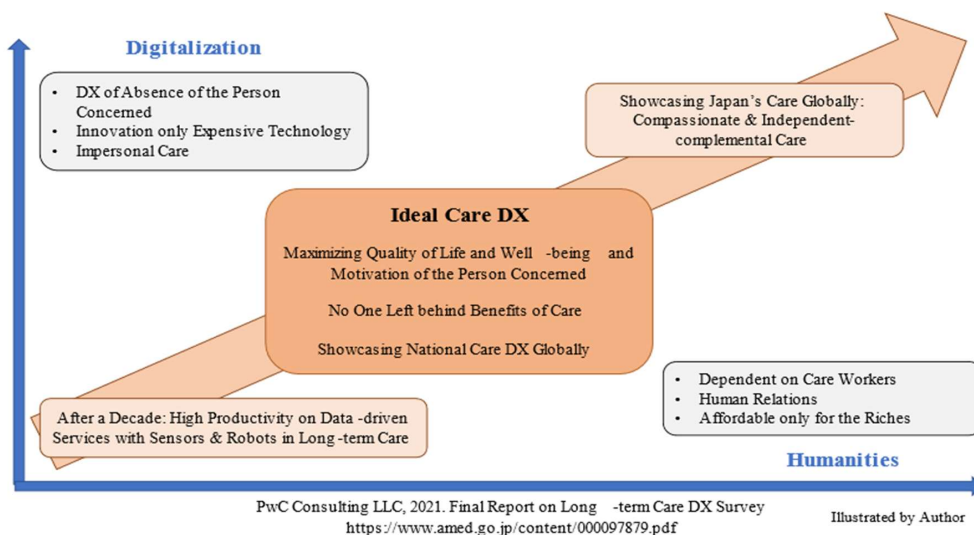**Figure 12. Two Target Groups of Older Persons for Assistive/Welfare Technology**

Healthy and Active Older Persons
who can Operate Digital Devices

Dissemination of ICT
Literary, Test Bed and Co-
creation New Goods and
Services with OP: Living
Lab, Data-driven
Marketing. IT Homes,
Silver Housing, MaaS,
Self-driving Car, Security
Camera, Universal
Design,Age -friendly
Business, Protecting
Privacy, etc.

Older Persons with
Digital Disability

Training of ICT Supportive Staffs,
Dementia-Friendly City
Programmes, Smart LTC Facilities,
Transfer Support Robots, eHealth
Platform, Communication Robots,
Care/Rehabilitation Robots, On -line
Meeting Apl, etc.

Illustrated by Author

Thirdly, information management methods should work towards creating measures to proactively enhance the human rights of all parties and not just adopt defensive strategies to protect personal electronic records. In order to promote universal welfare, it will be necessary to work towards creating a society that is person-centered, prevention-oriented, and not resistant to change. This will require the creation of a society where it is possible to provide medical care and accumulate LTC data through robotic LTC devices. For applying this data to LTC services, an integrated information platform of medical and LTC information is required.

And fourthly, innovation in AWT should be driven by a desire to improve not only productivity but also humanity. In Japan, ICT has begun to be used for LTC with the aim of providing care based on scientific evidence. Decades from today, AWT as sensors, robots, and data will be used to reduce the labor burden in LTC. However, progress in digitalization alone can lead to inequality in accessing services, with some receiving good care and others deprived. Technology should not only improve the labor productivity of care workers, but also improve the quality of life of older persons who receive services, protect their human rights, and build a caring community. Care DX with AWT may be an effective means to realize such ideals. However, there may still be people who will be left behind. To create a truly inclusive society where people living together feel empowered, it is necessary to build a social system in which

"people who understand", "people who don't know", "people who can" and "people who cannot" will be able to understand each other and work together.

Figure 13. Care DX Looking Towards Two Decades in the Future

PwC Consulting LLC, 2021. Final Report on Long-term Care DX Survey
https://www.amed.go.jp/content/000097879.pdf

Illustrated by Author

To promote AWT innovation that ensures the human rights of OPs, we need to promote collaborative research and development that includes OPs in diverse situations based on what we have learned from efforts in Japan. In order to establish care DX, it is necessary to establish a collaborative consortium involving various stakeholders such as LTC service providers, companies in different fields, investors, researchers, and policymakers. In addition, the participation of OPs in this consortium is essential.

Footnotes:

1: IADL and ADL are assessment indices of the needs of long-term care. The former indicates vulnerability in daily life. The latter indicates vulnerability in social life.

2: "Mynaportal" is an online window for administrative procedures involving for instance childcare and LTC. The government provides services such as checking citizens' personal information held by administrative agencies, receiving notifications from administrative agencies, etc. It started in 2017.

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Figure 12. Two Target Groups of Older Persons for Assistive/Welfare Technology

Figure 13. Care DX Looking Towards Two Decades in the Future

Abbreviation

ADL   Activities of Daily Living

AI   Artificial Intelligence

AWT   Assistive/Welfare Technology

BAMAS   Basic Act on Measures for the Aged Society

CICS   Community-Based Integrated Care System

DCPLC   Dissemination Centre for Practical Long-Term Care

DX   Digital Transformation

GMAS   Guideline of Measures for Aged Society

IADL   Instrumental Activities of Daily Living

ICT   Information and Communication Technology

IoT   Internet of Things

LTC   Long-Term Care

LTCF   Long-Term Care Facility

MaaS   Mobility as a Service

METI   Ministry of Economy, Trade and Industry

MIC   Ministry of Internal Affairs and Communication

MHLW   Ministry of Health, Labour and Welfare

MLIT   Ministry of Land, Infrastructure, Transportation and Tourism

OPs   Older Persons

PIPL   Personal Information Protection Law

PHR   Personal Health Record

PwD   People with Disabilities

QOL   Quality of Life

STBP   Science and Technology Basic Plan

WHO   World Health Organization

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AGAC ASEM Global Ageing Center