International Standard

ISO 25556

Ageing societies — General requirements and guidelines for ageing-inclusive digital economy

Vieillissement de la population — Exigences générales et lignes directrices pour une économie numérique inclusive en matière de vieillissement

First edition
2025-05

Reference number
ISO 25556:2025(en)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 314, *Ageing societies*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 General

The fourth industrial revolution, characterized by rapid digital innovation and exponential growth, has transformed all sectors of society, including how we live, work, and relate to one another. Digital technology can assist in learning new skills, facilitate social interactions, foster independent and autonomous ways of living, and improve the management and delivery of public health, social care and other services. However, this does not mean that everyone and everything is connected or digitised. Nor does it mean that the social and economic consequences of digital technology are necessarily inclusive or beneficial. Digital technology can both create opportunities and increase inequalities. In fact, not everyone can benefit equally from digital technology. The COVID-19 pandemic has highlighted unequal access to digital technology across and within ageing societies.

Products and services are increasingly provided online. In ageing societies, some people are more likely to be digitally excluded and to experience barriers to accessing products and services online. The reasons vary, for example, people lack access to technology, or they are unable to use and fully benefit from the opportunities provided by technology. Digital inclusion can create opportunities for active and healthy ageing, including social and economic participation. Improving digital access and digital literacy can empower people. It is essential to ensure aging-inclusive design and to ensure the relevance of digital services and products. It is important to create ethical, safe digital environments free from ageism that embrace the diversity of older individuals.

Digital economy refers to economic and social activity reliant on, or significantly enhanced by, the use of digital inputs[42].Establishing ageing-inclusive digital economies (and related standardization) is not only significant but urgent. This document seeks to respond to the context and demands of rapidly evolving digital economies, by providing general requirements and guidelines for ageing-inclusive digital economies from the perspective of the needs of ageing societies, and by addressing common problems of an ageing-inclusive digital economy.

0.2 Opportunities of digitalisation in ageing societies

Digital technology can provide new opportunities and solutions for people living in ageing societies, such as:

— maintaining social connectedness, including connectedness to family members living apart;

— accessing digital communities for the latest updates and information;

— working online by using the internet and mobile devices;

— seeking employment using digital tools;

— participating in online learning;

— accessing digital services, e.g. online shopping, and smart transportation systems;

— accessing medical and health care online, as well as electronic personal health records, e.g. online diagnosis and treatment;

— using digital safety tools and measures, e.g. using smart devices to make an emergency call.

0.3 How can digital technologies support ageing societies?

Digital technology can support ageing societies in multiple ways, for example with regard to the following aspects.

— Visual capabilities – It can be increasingly challenging for older persons and other people to read texts written in small fonts. Therefore, text that can easily be enlarged or compatible with the use of screen magnifiers and screen readers, or both, can be essential.

— Hearing capabilities – Accessible content includes options for communicating with people with hearing difficulties, such as the availability of chats or messaging as an alternative to voice services. Accessible content is also compatible with hearing aid devices, for example, accessible smart TVs.

— Motor ability – To accommodate people with decreased motor skills, accessible information and communication technology (ICT) can be designed to interact seamlessly without requiring precise motor control. It can also support assistive technologies for optimal usability. For example, large clickable areas that include labels, especially for smaller controls, such as radio buttons and checkboxes are important accessibility features for people with limited dexterity.

— Cognitive capabilities – Some people can find it increasingly difficult to find specific information or recognize and access hyperlinks. It is important to consider these issues of usable and accessible designs. Making content easy to read and adding helpful features such as reminders can facilitate access.

— Communicating with the people responsible for websites or mobile apps is sometimes challenging. Accessible and easy customer support channels are important in order to help all customers.

— Social connection and isolation – Social connection can be increased through various ICT-related activities such as digital training and education, online peer-to-peer learning, and by providing support for sharing information.

— Vitality – People can experience a loss of vitality. E-health, telehealth and health apps can encourage healthy behaviour, monitor health and wellbeing.

Everybody ages differently, and people become more diverse as they age, for example in their independence, need for assistance, level of activity.

NOTE See Reference [46] for more information on ageing-inclusive digital economy.

Ageing societies — General requirements and guidelines for ageing-inclusive digital economy

1 Scope

This document provides general requirements and guidelines for an ageing-inclusive digital economy, aiming to enhance its applicability and credibility. It specifies the principles, aspects, scenarios, and actions for establishing or transforming to an ageing-inclusive digital economy.

This document is applicable to consumers, policymakers, administrations, organizations, and other stakeholders in the digital economy.

The requirements and guidelines in this document focus specifically on older persons.

This document does not cover information technology, ergonomics, and related requirements and guidelines which are defined or covered by other standards.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
ageing
natural progression of an individual's characteristics over time

Note 1 to entry: The impact of ageing will vary at different ages.

Note 2 to entry: The concept of ageing is very broad and comprehensive, and may include chronological ageing, biological ageing, psychological (psychosocial) ageing, cognitive ageing, functional ageing, social ageing, organizational age, and career age. See ISO 25550 for more information.

[SOURCE: ISO/IEC TR 22116:2021, 3.2, modified — Note 2 to entry was added.]

3.2
ageing society
demographics of an older population that shifts overtime

[SOURCE: ISO 25550:2022, 3.1]

3.3
diversity
characteristics of differences and similarities between people

Note 1 to entry: Diversity includes factors that influence the identities and perspectives that people bring when interacting in digital economy.

[SOURCE: ISO 25550:2022, 3.10, modified — In Note 1 to entry, “at work” was changed to “in digital economy”; Note 2 to entry was deleted.]

3.4
inclusion
inclusiveness
process of including all stakeholders

Note 1 to entry: This involves stakeholders from different groups being accepted, welcomed, and enabled to have a voice and to develop a sense of belonging.

[SOURCE: ISO 25550:2022, 3.11, modified — “inclusiveness” was added as admitted term; “in organizational contexts” was deleted from the definition; original Notes 1 and 2 to entry were deleted.]

3.5
ageing-inclusive
including all stakeholders in *ageing* (3.1) contexts where people of diverse ages are treated fairly and equally and included in all aspects of those contexts

[SOURCE: ISO 25550:2022, 3.15, modified — the term was changed from “age-inclusive” to “ageing-inclusive”; “organization contexts” was changed to “ageing contexts”; “all aspects of the organization” was changed to “all aspects of those contexts”.]

3.6
digital economy
economic and social activities reliant on, or significantly enhanced by, the use of digital inputs

Note 1 to entry: Digital economy includes digital technologies, *digital infrastructure* (3.8), digital services and data.

Note 2 to entry: Digital economy refers to all producers and consumers, including governments, utilizing these digital inputs in their economic activities.

Note 3 to entry: Adapted from Reference [42].

3.7
ageing-inclusive digital economy
digital economy (3.6) which is fair and equal to all stakeholders including people across all age groups in *ageing* (3.1) contexts

3.8
digital infrastructure
infrastructure driven by data and technology, based on the communication network, and centred on data computing facilities

3.9
user
customer
individual who utilizes infrastructures, products, services, environments, and any other components of an *ageing-inclusive digital economy* (3.7)

3.10
policymaker
government department, legislature, or other *organization* (3.12) that is responsible for making rules, laws, regulations, etc. for *ageing-inclusive digital economy* (3.7) and related issues

3.11
administration
government, agent, or other *organization* (3.12) who is authorized to supervise *ageing-inclusive digital economy* (3.7) and related issues

3.12
organization
public or private entity or partnership with the responsibility for the operation of *ageing-inclusivedigital economy* (3.7) or part of it

EXAMPLE Relevant *digital infrastructure* (3.8) owner, intelligent product manufacturer, digital service provider, digital platform operator, digital environment operator, and employer adopting digital work approach.

3.13
social media
online technologies and practices that people use to share opinions, insights, experiences and perspectives with each other, transforming traditional one-to-many interactions into many-to-many interactions

[SOURCE: ISO 690:2021, 3.43]

3.14
ageism
stereotyping, prejudice, and discrimination against people on the basis of their age

Note 1 to entry: Ageism takes many forms, including prejudicial attitudes, discriminatory practices, or institutional policies and practices that perpetuate stereotypical beliefs.

[SOURCE: ISO 25550:2022, 3.17]

3.15
accessibility
extent to which products, systems, services, environments and facilities can be used by *users* (3.9) with the widest range of user needs, characteristics and capabilities to achieve identified goals in identified contexts of use

[SOURCE: ISO 25550:2022, 3.2, modified — “people from a population” was changed to “users”.]

3.16
usability
extent to which an infrastructure, system, product or service can be used by specified *users* (3.9) to achieve specified goals with effectiveness, efficiency, convenience, safety, and satisfaction in a specified context of use

[SOURCE: ISO 19869:2019, 3.2.8, modified — “infrastructure” and “convenience, safety” were added to the definition.]

3.17
availability
degree to which a facility or service is available to *users* (3.9) when needed

[SOURCE: ISO/IEC TS 25011:2017, 3.2.4.3, modified — “an IT service” was changed to “a facility or service”.]

3.18
affordability
ability to be economically bearable for the target *users* (3.9)

[SOURCE: ISO 24513:2019, 3.3.19, modified — “target” was added before “users”; Note 1 to entry was deleted.]

3.19
security
combination of *availability* (3.17), confidentiality, integrity, and accountability

[SOURCE: ISO 17090-1:2021, 3.2.24]

3.20
privacy
right of an entity (normally an individual or an organization), acting on its own behalf, to determine the degree to which the confidentiality of their private information is maintained

[SOURCE: ISO/IEC 24775-2:2021, 3.1.46]

3.21
assistive technology
equipment, product system, hardware, software or service that is used to increase, maintain or improve capabilities and safety of individuals

Note 1 to entry: Assistive technology can include assistive services and professional services needed for assessment, recommendation, and provision.

[SOURCE: ISO 25552:2022, 3.28]

4 General

This document addresses the needs of older persons, with the goal of ensuring that older persons are active and valuable contributors in the digital economy. However, the requirements and guidelines in this document are also useful for including as many consumers as possible and emphasizing the principle of design for all.

Annex A provides information and recommendations on different scenarios of the ageing-inclusive digital economies, such as online shopping, banking products or services (BPoS), digital hospitals, digital entertainment, social media, transportation, smart communities, smart homes, working from home and in the workplace, and online learning.

Annex B provides information and recommendations on the actions needed to create an ageing-inclusive digital economy.

5 Principles for an ageing-inclusive digital economy

5.1 Combatting ageism

5.1.1 General

Ageism refers to stereotypes, prejudice, and discrimination against people on the basis of their age.

Ageism is often replicated in the digital economy, just as other implicit and explicit biases of society, and this can partly cause a digital divide between younger and older persons. The prevailing stereotype that older persons cannot master technologies is already internalized by some older persons themselves (an example of self-directed ageism), who sometimes do not even try to adopt new technologies, even when they are both available (see 5.4) and affordable (see 5.5).

Challenging ageism is critical to ensure well-being and the respect of human rights. Governments, organizations, and individuals can help to eliminate ageism in the digital economy.

5.1.2 Requirements

The organization shall:

a) address ageism to ensure that the digital economy is designed, developed, tested, implemented and evaluated equitably and responsibly;

b) take measures to:

   1) mitigate the risk of ageism;

   2) enhance digital economy inclusion and benefits for older persons.

EXAMPLE 1 Involving older persons directly in the design, development, implementation and evaluation of the digital economy.

EXAMPLE 2 Enhancing the inter-generational communication in the design, development, implementation and evaluation of the digital economy.

NOTE See Reference [47] for more information.

5.1.3 Recommendations

The organization should:

a) design, develop, test, implement, and evaluate the ageing-inclusive digital economy by, with, and for older persons;

b) train the multiple-generation workforce, irrespective of age, in both recognizing and avoiding ageism when approaching their tasks, and in their perception or recognition of ageing;

NOTE See Reference [47] for more information.

c) overcome and decrease forms of ageism and stereotype by capturing and respecting the heterogeneity of older persons and offering them more activities, products, and opportunities for self-fulfilment rather than only for health care and chronic disease management, e.g. entertainment, leisure, learning, productivity (work or other income-generating opportunities), sharing their knowledge and skills with younger generations, service to the community;

d) offer equal opportunities to older persons for participating in digital economy activities, to avoid the ageist cycles of injustice both in inputs and outputs, including, but not limited to:

1) offer options such as “retired” in forms which require disclosing occupational information;

2) offer free options of avatars, portraits, and virtual images with some symbols of some older persons, e.g. silver hair;

3) conduct online recruitment by using algorithms without age bias.

5.2 Accessibility

5.2.1 General

The goal of accessibility for an ageing-inclusive digital economy is to help ensure that people with progressive functional decline, disabilities and impairments related to age can perceive, understand, navigate and interact with intelligent products, digital services, digital platforms and digital environments by assistive technology.

5.2.2 Requirements

The organization shall:

a) present information that uses plain and non-discriminatory language;

NOTE 1 See ISO 24495-1 for more information about plain language.

b) design and present the structure and hierarchy of websites, apps, electronic documents and other digital assets, e.g. navigation features and user interfaces, to conform with standards such as the Web Content Accessibility Guidelines (WCAG),[38] ensuring accessibility for users with progressive functional decline, disabilities and impairments related to age;

c) ensure the intelligent product, digital service, digital platform and digital environment are compatible with user tools, including assistive technologies used by target users.

5.2.3 Recommendations

The organization should:

a) present information that is:

   1) accessible via multiple channels, e.g. tablets, smartphones, computers;

   2) accessible to all user types regardless of sensory abilities or restrictions, i.e. users can receive it through any of their senses;

   3) supportive of multiple language users;

b) provide users with easy-to-understand captions and descriptions for audio and video content respectively;

c) offer users an easy-to-use element that increases text size without loss of content or functionality;

d) provide ample time for users to read and understand content;

e) pause, stop, or hide the content that automatically moves, blinks, or scrolls;

f) not use colour as the only way to convey information;

g) provide legible labels when content requires input from users;

h) avoid either the interference or conflict, or both, with assistive technology and devices;

   EXAMPLE 1 A pacemaker can be influenced by a strong magnetic field or current.

   EXAMPLE 2 Hearing aids can increase environmental noise and generate new electromagnetic noise when working in a digital environment.

i) use well-formed elements with matching start and end tags, which are nested correctly, in accordance with the specific guidelines or specifications that apply to them.

5.3 Usability

5.3.1 General

Usability refers to several aspects of people engagement with and interaction within the digital economy that includes ageing populations. Usability encompasses the quality of the experience, the efficiency of task completion and the satisfaction derived from accomplishing those tasks.

Many functions can decline as people age, e.g. eyesight, hearing, speech, memory, balance, manual dexterity and skin sensitivity. Also, some older persons can need much more time to encode, retrieve and process information, and to make decisions.

Usability and accessibility (see 5.2) are two slightly different perspectives within an ageing-inclusive digital economy. Accessibility aims to ensure that people can complete tasks using technology, while usability strives to deliver high-quality, effective and satisfying experiences for all users. Ideally, these two concepts can converge to create solutions that provide equal access for all to digital products and services.

5.3.2 Requirements

The organization shall take the changing needs of ageing into account in the usability by design. In addition to accessibility, this includes, but is not limited to:

a) keeping the interface, layout, and navigation stable;

b) reducing the update frequency of apps, websites, software and other digital resources;

c) limiting the displayed information to necessary content;

d) avoiding overly distracting advertisements;

e) simplifying the operation and reducing cognitive load;

f) providing multi-sensory navigation.

5.3.3 Recommendations

The organization should:

a) create a variety of topics and content for a broad range of interests, preferences, expectations and needs of users, which are not limited by stereotypes of ageing;

b) arrange content by topic, not by age or demographic characteristics;

c) provide content and information in a direct and objective style avoiding any misleading or sensationalized styles;

d) deliver the content and information in manageable, easy-to-scan and easy-to-understand segments, using plain language and short sentences;

NOTE 1 Messages that have too much text, confusing words, programming language or daunting designs can make some people anxious.

e) use a suitable and legible font size for different situations;

NOTE 2 See ISO 24509 for more information about the legible font size for people at different ages.

f) promote recognition over recall in design whenever possible;

NOTE 3 According to psychologists, “recognition” is an easier task than “recall”, because “recall” is a more demanding process for human memory.

NOTE 4 Memory impairment can worsen with ageing. In several instances, people can forget where they had previously navigated to or what they had previously clicked on, and thus revisit those areas and pages again.

g) offer choices to users in an easy-to-understand manner;

h) place the important information and prioritize commonly used features at the easy-to-find places, making navigation easier for the maximum number of potential users;

EXAMPLE 1 The top of the website.

i) limit the design of pull-down menus and scrolling lists;

NOTE 5 Some users have difficulty managing both pull-down menus (which require users to hold them open to click a list item) and scrolling menu lists, since they possibly can’t control their hands, fingers and wrist movements enough to use these user interface (UI) elements.

NOTE 6 For some users, some scrolling menus go by too quickly, and some UI elements require challenging dexterity when swiping up and down to select the correct items.

NOTE 7 The illusion of completeness occurs when the content visible on the screen appears to be complete even though there is more information available below the viewable area. Users can assume that there is nothing more to see and are less likely to scroll down.

j) avoid actions requiring double clicks;

k) use more white space between text, foreground and background to maximize the legibility, e.g. character, line and paragraph spacing and other white spaces;

l) offer the choice of a colour scheme, other than black and white;

m) avoid yellow, blue and green tones;

n) avoid rapid changes in brightness between screens;

o) differentiate between interactive elements and static elements visually;

NOTE 8 Some people can be confused about the static elements with interactive visual signifiers, and they can find it difficult to distinguish them from interactive elements.

p) use large targets, and clear and visible confirmation for target capture on the user interface;

q) create adequate spacing around the interactive targets, to avoid clicking or tapping the wrong one accidentally;

NOTE 9 Large click targets are essential for all users, because not everyone has the ability or time to precisely hit small targets.

r) avoid image-only links;

s) use image and graphics which:

1) are high quality, clear, and large enough to be legible and discernible;

2) contain informative content, emotional content or other added value, which helps to convey information, explain concepts or showcase details;

EXAMPLE 2 The appearance, functionality, application scenarios, and usage methods of a product.

3) are relevant;

4) avoid distractions by not only being decorative;

5) can be accompanied by text to enhance comprehension, yet text should not fully substitute for them;

t) provide understandable terms and conditions, and increase user understanding;

NOTE 10 See ISO 21800[1)] for more information.

u) provide easy-to-find telephone contact information in a prominent location, in addition to online chat support;

NOTE 11 Some users often prefer picking up the phone over finding the information on the interface.

v) enable the downloading of any information from the webpage into PDF (portable document format) format for printing, a vital function for people who encounter difficulties with reading or web navigation, specifically those affected by dementia.

5.4 Availability

5.4.1 General

Availability is often used to describe the time when a facility or service is available in the digital economy, as well as the time required by a digital platform or system to respond to a request made by a user. High availability is the quality of a system or component that assures a high level of operational performance for a given time.

Some older persons who participate in the digital economy are more likely to blame themselves than younger groups when failures happen. In particular, it can be difficult for them to figure out whether the failures are due to their own operating mistake or to a system or network failure. Therefore, limited availability can further entrench the digital divide, which easily becomes the reason why some older persons mistrust and choose to not participate in the digital economy.

1) Under preparation. Stage at the time of publication: ISO/DIS 21800.

5.4.2 Requirements

The policymaker or the administration, or both, shall provide the communities and residences, especially those in remote areas or with few people, with:

a) resources or services to facilitate internet access with good speed and bandwidth for the average user;

b) trusted and stable digital infrastructure providing internet access, accessory devices, guidance and support.

EXAMPLE Community service centre, cybercafé, public library.

5.4.3 Recommendations

The policymaker or the administration, or both, should:

a) encourage the public institutions, e.g. local public libraries, and community groups to lend their Wi-Fi hotspot and increase Wi-Fi signals, so people can have no-cost broadband access when they need it;

b) motivate the organization to design and equip the intelligent products, digital services and digital platforms with appropriate tools alternative to the internet, e.g. telephone, which can work with low or intermittent internet connectivity and less digital skills, thereby facilitating the access to the digital economy;

c) provide relevant customer contact services with human staff, by telephone or other habitual contact methods, using easy-to-understand terms, descriptions and explanations, at a convenient time.

5.5 Affordability

5.5.1 General

Affordability has long been a foundational principle in communications policy, and it is key to bridging the digital divide. No matter how fast the connection is, how much data is available, how smart the device is, or how relevant the digital content is, people will only have meaningful connectivity if they can afford it.

The affordability of an ageing-inclusive digital economy means that the target users, including older persons, can bear the expenses, e.g. the cost of internet access and storage, laptops, mobile devices and digital services. Barriers to affordable infrastructure, internet service, computers and digital skill training prevent access to resources, services and opportunities, deepening social and economic gaps.

Strict budgeting, lack of digital skills, and low trust in free or discount internet offers or in digital skills training are actual barriers for some older persons to be involved in the digital economy.

What counts as affordable can be unstable over time. The unenthusiastic attitudes about the necessity of being involved in the digital economy by some older persons go hand in hand with not being able to afford it.

NOTE See Reference [55] and [58] for more information.

The affordability can be estimated by considering:

a) the cost that the target users can pay for the digital economy without significant adverse economic or social impact;

b) the allowances for subsidies and payment assistance programmes for low-income users.

5.5.2 Requirements

The policymaker or the administration, or both, shall take actions to improve the affordability of the digital economy for target users, including older persons, and to narrow the digital divide by reducing the cost and enhancing digital skills and trust.

5.5.3 Recommendations

The policymaker or the administration, or both, should:

a) address policies and aim to make the digital economy available to target users, including older persons, at a just, reasonable and affordable rate, or even free of charge, so that it can be easily accessed without significant adverse economic or social impact;

NOTE 1 Regardless of the type of internet connection – whether it is a high-speed option, such as fibre, cable modem, or digital subscriber line service, or an option with more limited access through cellular data plans, satellite, or dial-up service – policies are needed to ensure affordable and equitable access to the digital economy for all target users, especially older persons.

b) motivate sufficient and sustainable investments in digital infrastructure, offer or subsidize benefits for the internet service provider (ISP), and encourage healthy competition among ISP, especially outside of urban centres, to help drive digital availability for the target users, including older persons;

c) encourage trusted organizations, e.g. governments, public institutions and non-profit organizations, to lead or provide free or low-cost digital skills training, one-on-one support and guidance for people in need, including older persons in need, thereby providing access to the digital economy;

NOTE 2 Access to the digital economy can be challenging for some older persons, who can experience discomfort with computers, have privacy and security concerns regarding personal data, or find the registration process complex. Trusted entities such as governments, public institutions and non-profit organizations offer crucial support by providing free or low-cost digital skills training, personalized assistance and guidance, thereby facilitating their inclusion in the digital economy and addressing these specific barriers.

d) motivate internet and digital service providers and digital platform operators to provide free or discount programs or services for persons in need;

e) effectively inform people about free or discount programs or services mentioned in 5.5.3 c) and d).

5.6 Security

5.6.1 General

The security of the digital economy, which relies on the security of digital infrastructure, cyber data, information and personal privacy, has never been more crucial and complex.

Older persons are at risk like other age groups, however they are more vulnerable to the risk of digital fraud, attacks, violence or abuse. Digital criminals seek out older persons.

In addition, some older persons, especially those affected by dementia, often participate in digital economy-related activities with the help of others e.g. carer or volunteer. Such actions of sharing personal information can result in security and privacy risks, e.g. cause authorization abuse and data leakage.

5.6.2 Requirements

The organization shall set up countermeasures against internal and external risks in the total life cycle of the digital economy, particularly for the certain types of dangers or attacks to which some older persons can be more susceptible, e.g. falling, loss, abduction, health fraud, romance scams and financial traps.

NOTE 1 Due to the decline of physiological and cognitive function, some older persons can face many more safety threats, such as falling, getting lost or being abducted.

NOTE 2 Some older persons can tend to lag behind younger groups in terms of awareness and expertise with regard to internet security hazards, and they tend to have less knowledge and lower confidence in performing protective behaviours.

NOTE 3 There is already a series of laws, regulations, standards, guidelines and best practices on security controls for the digital economy, e.g. ISO/IEC 27001, ISO/IEC 27002, ISO/IEC 27003, ISO/IEC 27005, and ISO/IEC TS 27008, which can be applied to an ageing-inclusive digital economy.

5.6.3 Recommendations

The organization should:

a) confirm that the digital infrastructure and the free Wi-Fi available from public institutions which are mentioned in 5.4.3 a) are secure, legitimate and password-protected;

b) make the registration or sign-in optional rather than mandatory;

NOTE Some people, including some older persons, lack confidence in apps, software or websites that require registration or sign-in due to concerns about security and the disclosure of personal and financial information.

c) apply other processes, e.g. verification message to email or cell phone, automatic identification of cell phone number and sign-in by trusted accounts, rather than manual password input, when registration or sign-in is not possible;

d) introduce and explain good password practices (e.g. creating strong passwords and using password managers), and explain how to avoid risky password practices (e.g. sharing passwords with others, using the same password over multiple platforms and using passwords that can be easily guessed);

e) apply intelligent products and other digital resources with the functions of preventing falling, positioning, alarming and reminding, to reduce the fall and loss risks;

f) provide sufficient lighting, anti-skid ground, barrier-free passage, seats with moderate hardness and necessary auxiliary facilities (e.g. handrails) in virtual reality interaction and other digital activities, e.g. digital exhibitions or holographic movies.

5.7 Privacy

5.7.1 General

Data privacy is a topic of increasing concern for many older persons. Some of them are much more cautious about privacy than younger groups since they are not confident about protecting their privacy. They are often worried about how much information is collected by the intelligent product, digital service, digital platform or digital environment, and how little control they, as participants in the digital economy, have over sensitive data. At the same time, due to years of accumulated wisdom in life, many older persons have a heightened awareness of organizations that try to take advantage of them, so they do not like disclosing more than they expect.

On the other side, some older persons are more likely than younger groups to accidentally divulge personal data or share information publicly. As a result, gaining the trust of some older persons can be more challenging, which is a major cause for their reluctance to be involved in the digital economy. Studies show that, among older persons, one of the most common reasons for leaving the digital world is that they do not feel as though they have control over their personal information. For example, an app asking for too much data and location information is considered evidence of unnecessary collection and use of user's data.

5.7.2 Requirements

The organization shall:

a) only ask the users for the minimum necessary information;

NOTE 1 The concept and content of what information is necessary differ among countries based on local laws, regulations, standards and guidelines.

EXAMPLE In China, "The rule for necessary personal information in commonly used mobile internet apps" specifies the minimum necessary information in different scenarios. For example, for the apps whose function and service are "positioning and navigation" the necessary personal information refers to the user's location, departure place, and destination. For the apps whose function and service are "search and play music", users can use the apps without providing any personal information.

b) allow the users to view, withdraw and have control over the data they share;

c) inform the users about:

1) the detailed descriptions of the requirement mentioned in 5.7.2 a);

2) how the data they provide will be shared within a certain range, according to the specific activities in the specific digital economy.

NOTE 2 See also ISO 31700-1 and ISO 22458 where the requirements are of interest.

5.7.3 Recommendations

The organization should provide users with trusted, relevant and easy-to-use measures to protect their privacy. Some of the elements that should be available to users are:

a) staying anonymous;

b) creating or using a separate email account to sign up for services;

c) browsing the internet using a VPN (virtual private network);

d) choosing alternative options for accessing services that do not collect personal data.

NOTE See also ISO 31700-1 and ISO 22458 for more recommendations.

6 Aspects of an ageing-inclusive digital economy

6.1 Digital infrastructure

6.1.1 General

Digital infrastructure is the foundation for people to have meaningful, accessible and affordable access to the digital economy. Types of digital infrastructure constitute the technical base of the innovative ageing-inclusive ecosystem for digital economy. Building the ageing-inclusive digital infrastructure system is a complex task that requires coordination among many stakeholders, including governments, international organizations, communications service providers, makers of hardware and software, providers of digital services and content, civil society and the various groups that oversee protocols and standards on which digital networks operate.

NOTE The innovation ecosystems of the digital economy consist of government policies, regulatory frameworks and infrastructure, human capital, social networks, and funding and finance. Local and global markets can influence these.

6.1.2 Requirements

When distributing, investing in and constructing the digital infrastructure, the organization shall offer users stable, efficient and available communication channels and digital tools, e.g. access to electricity, phone ownership and network coverage, to promote and motivate them to get involved in the digital economy, particularly users with remote or solitary residence or with less income, education experience, digital literacy and community support.

6.1.3 Recommendations

The organization should:

a) take relevant actions (e.g. financing) to expand users' access to digital infrastructure;

b) make the infrastructure interoperable and open for third-party players, if applicable in the context;

c) locate the digital infrastructure in proximity to the communities served;

d) identify and understand the needs and characteristics of the targeted users, and provide the corresponding services and products;

e) offer human-assisted consultation, assistance, and other non-digital service approaches;

f) organize free events, e.g. workshops, seminars and training sessions, to improve the digital literacy of users.

6.2 Intelligent product

6.2.1 General

Intelligent products, powered by advanced technologies and vast amounts of internet data, feature capabilities such as computing, sensing, identifying, storing, remembering, connecting, simulating, learning and reasoning. In the digital economy, the use and impact of these products have significantly broadened, offering substantial benefits to users.

Intelligent products can be divided into categories, as shown in Table 1.

Table 1 — Categories and examples of intelligent products

Categories	Examples
Hardware	Smart devices in cars or electronic bus stop displays; VR gaming consoles for digital entertainment; smart pill dispensers and automated medical registration systems in healthcare.
Software	Applications, web pages.
Digital content	Videos, audio, games, text, graphic images, presentations and other types of resources used.

6.2.2 Requirements

The organization shall:

a) ensure that the intelligent products:

   1) are applied to the physical circumstance of the target users (e.g. progressive functional decline, disabilities and impairments related to age);

   2) meet the physiological, emotional and social needs of the target users;

   3) are designed to alleviate the target users' resistance to using them;

b) provide users with the instructions, guidance and support for installing and using the intelligent products.

6.2.3 Recommendations

6.2.3.1 Hardware

When dealing with hardware:

a) For the presentation of information, the following recommendations should be considered and adopted.

   1) The content on the display should be easily identifiable and avoid continuous scrolling or flashing text.

   2) The information on the display should be aligned with the corresponding control key, signage or indicator.

   3) If there is an indicator light, it should be visible during operation. While a flashing indicator light is more suggestive, it should avoid emitting a higher flashing frequency.

4) Tactile markings should be designed and installed using different materials, sizes and heights.

5) In addition to text and signage, sound information for operation instructions, feedback prompts and safety reminders should be added. Notably, voice information should be comprehensible if it is used.

b) For the interaction of information, the following recommendations should be considered and adopted.

1) Proper distance should be kept between control keys to avoid incorrect operation caused by mutual interference.

2) The frequently-used control keys should be placed at the most accessible position for users.

3) In addition to visual signals, tactile and auditory signals should be used to aid the users in locating either control keys, control panels or the key function points, or both knobs and sliders.

EXAMPLE The touch points and touch bars on or around control keys (e.g. keys, knobs, sliders) can assist in positioning.

4) The number of control keys should be minimized.

5) The control keys should be arranged according to the operation level or sequence. Meanwhile, different sizes, colours and materials should be used to emphasize the level and sequence difference of functions.

6) Feedback or warning notifications should be provided after touch control, by using sound effects, voice, graphics, vibration, light, etc.

7) Companion robots and communication interaction products should interact with users through text, voice, action, expression, etc.

c) For the functions and logic, the following recommendations should be considered and adopted.

1) The operational logic should be straightforward and intuitive.

2) Operation steps should be reduced.

3) Remote assistance should be provided so that users can easily contact customer service or relatives and friends for help when they encounter problems.

4) The distribution network steps should be simplified, and the network should be switched automatically by identifying the signal strength.

5) The hardware should have self-check functions, which can automatically detect faults during the breakdown and remind users and background operators.

6) As some users are sensitive to light and sound, hardware should allow to set the do-not-disturb function at night to prevent affecting their rest.

7) Connectivity and ecological compatibility of hardware should be achieved to avoid the inconvenience of frequent switching between multiple systems for users.

d) For usability, in addition to those in 5.3.3, the following recommendations should be considered and adopted.

1) The hardware shape should conform to the cognition of users and the actual functions, so that users can intuitively understand the hardware function.

2) Hardware should allow users to use effortless and customary postures to operate.

3) Wearing hardware should be lightweight and safe, and its material should rarely cause allergies. Besides, it should not cause discomfort to users when worn for a long time.

4) Portable hardware should be compact and light, with no sharp edges.

5) Monitoring hardware should have a short response time and high alarm accuracy to prevent false or missed alarms.

6) The hardware battery should have a long battery life and a low battery alerting function.

6.2.3.2 Software and digital content

When dealing with software and digital content:

a) For the information presentation, see 5.2.3 and 5.3.3 for relevant recommendations.

NOTE See Web Content Accessibility Guidelines (WCAG) for more information.[38]

b) For the information interaction between organizations and users, the following recommendations should be considered and adopted.

1) Interface controls (e.g. clicking, swiping, zooming, typing and pausing) should be implemented in a customary manner, avoiding complex and unconventional operational methods.

2) Information input should be provided in various ways, such as text input and voice recognition.

3) During operation, guidance, feedback and process reminders should be provided through sound, vibration and graphics to avoid users from being confused.

4) Sufficient operation time and attempts should be provided to users.

5) Positive encouragement should be given to users through text, sound effects, graphics, etc.

c) For the functions and logic, the following recommendations should be considered and adopted.

1) A tutorial for operation guidance should be provided.

2) A mature functional and content framework should be adopted, and the platform's information structure should be stable and try to avoid frequent framework adjustments.

3) The operation level should be simplified as much as possible to minimize the number of operations and jumps.

4) The functions should be simplified and combined according to the core requirements of different usage scenarios and the usage habits of users.

5) The authorized agent function should be provided so that either family members or designated individuals, or both, have the authority to remotely assist some users in need within the complex operations, with informed consent as prerequisite. Meanwhile, safety should be ensured during the operation process.

d) For safety and security, see 5.6.3 for relevant recommendations.

6.3 Digital service

6.3.1 General

The acceptance and use of digital services have become key features in everyday life, especially during the COVID-19 pandemic. Many face-to-face services shifted suddenly to digital formats. Digital services are designed to make life easier, by offering convenient, flexible and more affordable options against inequalities.

Digital services (e.g. using digital devices to access music, audiobooks and religious services, updating career resumes and applying for jobs online, registering online for vaccine appointments, and connecting with family members abroad) can help people, including older persons, maintain social functioning, mental and physical health, ensure their independence and engage with important life goals.

While the benefits of digital services are clear, these services often are underutilized by the people who need them most, e.g. older persons. Some older persons are more likely to encounter obstacles while using digital services, for example when troubleshooting on audio-visual platforms and navigating portals, or when typing and uploading information, which need a robust digital skillset.

As a result, offering digital services with accessibility, usability and safety, and helping users learn to use digital technology in a way that is not intimidating and accommodates their specific needs are both top priorities.

6.3.2 Requirements

The organization shall offer offline strategies or non-digital approaches, or both, to address users' challenges in using digital services.

6.3.3 Recommendations

The organization should offer the following:

a) digital solutions for users to connect with their families, friends and communities who can provide necessary training and support to meet the user's needs;

   EXAMPLE An app where users can use voice to record their grocery list, which would then be processed automatically by a vendor's system or manually by a family member.

b) either unique time slots or visit channels, or both, for the users in need, helping them access services;

c) special service channels (e.g. online shopping) and helplines for the users in need when emergencies, e.g. public health events, and earthquakes happen.

6.4 Digital environment

6.4.1 General

The digital environment includes the virtual world which is a subset of the larger cyber world. The virtual world provides immersive, simulated experiences, while the cyber world encompasses the entirety of internet-based activities and interactions. The virtual world has more robust accessibility, real-time, persistence, authenticity, interactivity and immersion characteristics. A typical configuration includes multi-user game, broadcasted or peer-to-peer multimedia production, and other features. The virtual world is based on various hardware and software technologies, e.g. virtual reality (VR)/augmented reality (AR)/mixed reality (MR). It can incorporate the components of the metaverse[2)].

The digital environment covers many needs of people, including older persons, e.g. entertainment, consumption and shopping, medical care, work and study. Depending on current technological trends, various brain-computer interface (BCI) devices and metaverses can be the future form of the virtual world, further empowering the digital economy and social participation of the users in need, including older persons.

6.4.2 Requirements

The organization shall:

a) recognize and acknowledge the diversity of older persons, and uphold their rights;

   NOTE 1 See IEEE 2089-2021 for more information.

b) protect the privacy and security of users in the digital environment;

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2) The IEEE Global Initiative on Ethics of Extended Reality (XR) Report – Metaverse and its Governance thinks of the metaverse as a collection of multiple advanced virtual worlds, connecting to the physical world.[62]

NOTE 2 Ensuring the privacy and security of older persons in the digital world is one of the main themes of the United Nations International Day of Older Persons in 2022[3)].

c) ensure the users' physical and psychological health in the digital environment, with high levels of user interaction and immersion;

d) ensure the digital environment does not:

1) threaten users' safety in the physical world;

EXAMPLE 1 Limitation of the user's field of view. When using a device that blocks the physical surroundings from view, users can become unaware of their physical surroundings, which can lead to accidents such as collisions and falling. Even if someone uses a see-through or semi-transparent device that overlaps a virtual object with reality, such distractions in physical surroundings can increase the risk of having an accident, such as falling.

EXAMPLE 2 Safety accidents caused by confusing reality with the digital environment. Accidents can occur in scenarios such as users trying to sit or lean against a digital environment chair or a wall that does not exist in real life.

NOTE 3 See ISO/IEC TR 23842-1 and ISO 22458 for more information.

2) impact the social cognition of users.

EXAMPLE 3 If users, by excessive immersion, cannot distinguish between the physical world and the digital environment, they can attempt to restart a real-life situation as if they could simply push the "reset button" in the digital environment.

NOTE 4 See ISO/IEC TR 23842-1 for more information.

6.4.3 Recommendations

The organization should:

a) moderately monitor, prompt and restrict the physical and psychological changes of some users in need in the digital environment under the premise of protecting privacy with informed consent as prerequisite;

b) encourage research on the physical and psychological treatment and rehabilitation of some users in need based on the digital environment;

c) remind users to consult a doctor or specialist before and after using the digital environment according to their own conditions and needs;

NOTE See ISO/IEC TR 23842-1 for more information.

d) pay attention to the addiction and over-dependence of the users in the digital environment, which includes addiction to news, short videos, games, and emotional dependence on virtual social interaction;

e) pay attention to the increasing potential threat of anonymity, verbal violence and virtual contact to the users in the digital environment;

f) encourage the multiple-generational communication and cooperation in virtual and physical worlds, to decrease ageism.

6.5 Digital literacy

6.5.1 General

Lack of digital literacy is one of the causes of the digital divide, rendering some people, including some older persons, marginalized and unheard voices in the digital economy. Improving an ageing-inclusive digital

3) https://www.un.org/zh/observances/older-persons-day

economy is not only about external systems, such as the social environment and specific products and services, but also about improving digital literacy.

Digital literacy includes but is not limited to the following:

a) Digital cognition, which requires people to be able to recognize and understand the digital technologies, products and services they are using, rationally view the advantages and disadvantages, and have an understanding of digital security (e.g. false information identification) and digital privacy (e.g. information leakage prevention).

b) Digital skill, which requires people to be able to accept, integrate and use common digital technologies, products and services, e.g. smartphones, tablets, PCs, and several apps. Furthermore, they need to be able to engage and use the digital skills, resources and information, and engage in emerging digital solutions.

c) Digital emotion, which requires people to be willing to use digital technologies, products and services in multiple scenarios, e.g. medical treatment, travel, study, work and entertainment, and be willing to overcome the difficulties in improving digital cognition and skills. Furthermore, they can take the initiative to improve the internalization of digital cognition and skills.

d) Digital responsibility, which requires people to understand the ethical and legal risks that can arise from using digital technologies, products and services, acquire and use them responsibly, and identify and consciously avoid ethical and legal risks.

Some people, including some older persons, do not want to interact with or use digital technologies, products or services, resulting in a high level of digital exclusion. While giving them the right to choose, enough opportunities and conditions can be offered to them with their consent to build an ageing-inclusive digital economy.

EXAMPLE Face-to-face learning can bridge the gap in the digital economy for those who lack access to the internet or digital media, or whose knowledge of the digital economy is very limited, and who need to make a first approach in person. Organizations can possess strategic allies or serve as intermediaries among various age groups within aging societies, enabling them to cultivate the necessary skills for the digital economy, given the widespread lack of proficiency in internet usage and hardware and software technologies.

6.5.2 Requirements

The policymaker or administration, or both, shall develop and implement policies and action plans to improve digital literacy.

6.5.3 Recommendations

The policymaker or administration, or both, should:

a) either budget initiatives and activities to improve digital literacy in government public expenditure projects, or provide financial subsidies for initiatives and activities to improve digital literacy, or both;

b) incorporate the popularization and assistance to improve the digital literacy in the social welfare activities;

c) encourage the target group, including older persons, to participate in policy development and implementation related to digital literacy.

d) encourage international cooperation to improve digital literacy to raise recognition and attention in various countries and regions, and share best practices for improving digital literacy;

e) establish digital literacy standards and evaluation systems, encourage all kinds of educational organizations and learning service providers to develop digital literacy courses and make them available online and offline;

NOTE 1 Training and professionalization of digital literacy teachers are helpful.

EXAMPLE 1 Centring on common apps and high-frequency application scenarios of smartphones, some third-age universities in China have developed practical micro-courses of digital life for older persons with regional and scene characteristics to effectively help improve their ability to use digital technologies, products and services[4)].

f) encourage the organizations to allocate specialized supporting personnel;

NOTE 2 The use process of digital technologies, products and services can improve digital literacy.

g) encourage non-profit and community organizations to encourage older persons with good digital literacy to serve as mentors and trainers for older adults;

EXAMPLE 2 Older scientists, experts and teachers in China are encouraged to participate voluntarily in digital literacy teaching and popularizing activities for older persons, forming a characteristic model of older persons' mutual assistance[4)].

h) encourage the younger generation in the workplace and at home to help older persons in need to build confidence and improve digital literacy, i.e. digital feedback;

EXAMPLE 3 A start-up business in Thailand provides services to serve the needs of older persons, including short-distance travel, training on digital literacy, social media usage and e-commerce, among many.

NOTE 3 ISO 25550 recommends that organizations encourage their workers to conduct intergenerational activities in the community. See ISO 25550 for more details.

i) encourage the employer to adopt digital work approach, create jobs for older job seekers and provide training for older workers to improve their digital literacy.

NOTE 4 See ISO 25550 for more details.

EXAMPLE 4 In transforming and upgrading intelligent manufacturing in China, some factories specially hire experienced older workers to steer the production line design and process layout.

4) https://www.gov.cn/zhengce/content/2021-06/25/content_5620813.htm?ivk_sa=1024105d

Annex A
(informative)

Scenarios of ageing-inclusive digital economies

A.1 Online shopping

A.1.1 General

Online shopping has become one of the important channels for people to shop, especially after the COVID-19 pandemic. As an important element in users' digital lives, online shopping involves a series of tasks and operations such as search, selection, payment and after-sales service. However, the platforms need to be well designed in order to make those tasks easy to understand and trustworthy. Ageing-inclusive customer service can also help those older consumers who are not familiar with digital platforms. Well-designed e-commerce websites that take into considerations the needs of the ageing population are important to ensure the transition of the group to online services and products.

A.1.2 Recommendations

In online shopping scenarios, the organization should:

a) make the design and layout of the online shopping platform easy to understand and use for target users, regardless of age;

b) highlight privacy and security features in the platform to create a sense of trust in the digital platform, for example by:

   1) using the shield and other graphics related to security design elements in the interface design of payment completion to tell users that their transaction operation is in a safe environment;

   2) giving users more obvious feedback, e.g. vibration or text prompt, when they complete the filling and input of personal privacy information, e.g. the address, mobile phone number, account number and password, so that they can feel their operation behaviour is safe and effective;

   3) prompting the requirements of the password, e.g. the number of alpha-numeric characters, special characters and cases of the alphabet characters, in the process of entering the payment password;

   4) asking for confirmation again to remind users that they are paying to the online shopping platform before the final submission;

   5) displaying the certification information or certificates for suppliers, commodities and services that have obtained them;

   6) highlighting the endorsement information in a place where it can be easily seen when the platform provides secure endorsements;

c) provide more inclusive search functions, considering that some users' understanding and association ability decline with ageing, for example by:

   1) setting, as keywords in the search bar, descriptions that the target users are more familiar with;

   2) allowing voice input, and having the system automatically identify keywords for search;

   3) giving some similar keyword labels or recommendations automatically according to the content entered by users when they repeatedly change keywords to search;

4) ranking the list of default sellers, goods and services based on the principle of high praise, and recommend those with high reputations;

d) provide flexibility to correct errors and alleviate fears to increase the users' confidence and trust;

NOTE 1 For some users, the decision to visit and use an online shopping platform is based on whether the platform can provide a safe and trustworthy environment.

e) provide full-stage operation guidance for users in need on the online shopping platform to help them complete the shopping, including:

1) adopting preferential and other activities to encourage people to be involved in online shopping;

2) giving a prompt of 'return to the product list' or 'go to the shopping cart' when users repeatedly jump from different product pages and feel confused about the current state;

3) guide and help the users in the whole process of shopping, to help avoid mistakes;

4) give clear feedback when the page state changes due to interactive operations, e.g. page jump, switching suspended window and the clicking button, in the process of online shopping;

EXAMPLE 1 After the users add the goods to the shopping cart, the system can tell them that they have completed the operation of 'adding the commodities or services to the shopping cart' in the form of a pop-up window or a large text reminder and other obvious prompts on the current page.

5) adopt the multi-mode guidance, including voice guidance, graphic tutorial guidance, and video guide;

NOTE 2 Voice guidance is highly accepted by some users, especially older persons. Therefore, repeatable voice guidance at an appropriate speed, and with easy-to-understand words, is a good choice.

NOTE 3 A graphic tutorial is a better way to provide aids, so users can repeatedly learn by themselves. Allowing the ability to easily print a paper version is also an excellent way to provide learning.

NOTE 4 A loop of instructional videos can help the users understand the whole operation process.

6) set clear, prompting information on each step, especially involving the account, password and other personal information to be confirmed multiple times;

f) not offer too many functions on the homepage of the online shopping platform, but highlight the key functions, including for example:

1) streamlining and highlighting the information displayed about either the goods or the services, or both, as much as possible, to reduce barriers to their understanding and operation;

2) planning the function modules commonly used, placing them in prominent positions on the page according to the frequency of use;

EXAMPLE 2 Search, favourites, shopping cart.

3) providing only one task per page, to reduce users' understanding cost;

EXAMPLE 3 Only the function of searching and browsing commodities or services is provided to users on the home page, so they only need to complete the task of looking for commodities or services.

4) introducing the important or new functions;

5) placing the historical browsing records (at least date of purchase, cost and bill) and supporting service on the home page, to help users finding them quickly, considering that some users can experience memory loss;

6) using the linear page flow, and allowing forward flow as much as possible to reduce the process of jumping back and forth;

EXAMPLE 4 Presenting the branch task by floating windows, so that the users can know which step of the task they are in.

g) evaluate the acceptability and preference of target users to marketing information comprehensively in the design of interface advertising, discounts and other marketing activities, aiming to select accurate display locations and concise content information that better aligns with the needs of target users;

h) simplify the account registration and deregistration process, and allow the users to log in through multiple channels, e.g. social accounts;

i) offer features that provide means, within the online shopping platform, to facilitate the accurate and effortless discovery of desired products, services and other relevant information;

j) provide easy-to-understand text and image description of the products or services, including but not limited to the following measures:

   1) As far as possible, pictures and icons should be displayed with more realistic images rather than abstract ones, and overly abstract graphics should be avoided.

      EXAMPLE 5 The button design of the shopping cart reflects the shape of an actual shopping cart.

   2) The expression of words and figures should be combined with the familiar scenes of target users to promote their understanding.

   3) Icons should be displayed with words as much as possible in online shopping platforms, so that users can accurately understand the meaning of the graphics.

      EXAMPLE 6 The button of the collection function is expressed with the text remarks of ‘collection’.

   4) Online shopping platforms should pay attention to whether the font size in pictures and icons can be seen clearly when displayed on different terminals.

      EXAMPLE 7 The words in pictures and icons can be seen clearly on the computer, but they can be too small on the mobile phone.

      NOTE 5 See ISO 24509 for more information about the legible font size for people of different ages.

k) provide reliable information, including but not limited to:

   1) strengthening automatic screening to block information and advertisements that pose a threat to users’ privacy;

   2) providing security pop-ups or security tips at each step of the shopping process to assist the users in determining whether the current online shopping operation is safe or not;

   3) providing valid links, and visually distinguishing between accessible and inaccessible links;

l) provide a simpler and clearer shopping process, including for example:

   1) providing no more than four levels of pages, especially in the transaction operation flow;

   2) indicating the level in the current shopping page, or the distance from the main menu, if there are many levels of pages;

   3) highlighting the operation buttons of the shopping process by enlarging, colour changing and bolding;

m) streamline the display information of products and services, including for example:

   1) presenting the information on goods and services in a significant way and a prominent manner;

      EXAMPLE 8 The information can be placed in the centre of the page or colour can be highlighted to facilitate identification by the users.

   2) displaying succinct-text, close-to-daily-life, and usual-expression description, with pictures or videos as far as possible;

3) avoiding words that are too modern or incomprehensible to the users;

n) provide efficient and intuitive search and comparison tools to help users quickly filter out products and services that meet their needs;

o) simplify the decision process, avoid unnecessary steps and choices, and enable users to make decisions more quickly including but not limited to the following measures:

1) When there is a change in the price of the goods or services before or after a period, the different prices before and after should be presented in a clear and trustworthy way to avoid the users wasting time comparing the prices.

2) Concessions information should be easy for users to understand and facilitate their price calculations, thereby reducing their shopping decision time.

EXAMPLE 9 The price of a single item after the discount can be provided at the same time, or even a comparison with the unit price before the discount, if multiple concessions are purchased.

p) simplify the payment process, guide users in every step of the payment process, and provide them feedback on payment status timely, to facilitate a smooth and secure process, including but not limited to:

1) adopting the technical means to help the users realize “automatic operation”;

EXAMPLE 10 Pre-filling information through data sharing.

2) informing the users of the status of the current order transaction and the correct operation method;

3) constraining or guiding the users’ operations with a thoughtful user interface;

EXAMPLE 11 Red can be used as the colour of the warning signal: especially in the design of order confirmation and payment buttons, the red button with a clear shape can be used as a visual reminder.

4) providing confirmation operation for payment;

NOTE 6 See ISO 21800[5)] for more information about payment terms and conditions.

EXAMPLE 12 If the users are required to enter the payment amount through the dialogue box to compare the payable amount before making the payment, this forces them to stop and make careful conscious decisions.

5) allowing and providing the function of sending information to either user’s family members or designated individuals of the users, or both, if they wish, when purchasing happens with informed consent as prerequisite;

6) establishing the binding family or designated individual accounts, and allow family members or designated individuals of the users to act as an agent, if they wish, with informed consent as prerequisite;

EXAMPLE 13 The users can send a link to their family members or designated individuals after they have selected a good product, and ask them to pay for it.

7) guiding the users back to the correct operation method through interface design, even if mis-operation has occurred, or reducing losses;

EXAMPLE 14 Transaction cancel button.

EXAMPLE 15 “Hesitation period”, especially for high-priced commodities or services.

q) pay attention to the psychological characteristics of some users who have a poor sense of security and strong self-esteem, optimize the communication between the online shopping platform and the users;

r) provide accurate and reliable after-sales service as stated in the terms and conditions, and supervise the suppliers to fulfil their responsibilities in after-sales services;

5) Under preparation. Stage at the time of publication: ISO/DIS 21800.

s) offer after-sales services, by providing phone, video or other voice channels in addition to the text dialog box to contact sellers;

t) provide the easy-to-find feedback channels, and easy-to-operate feedback process;

NOTE 7 The feedback includes, but is not limited to, interface experience feedback, shopping experience feedback, merchant reports.

u) promote the submission of feedback, by:

1) improving the enthusiasm of users to participate in providing feedback by offering coupons, free goods, etc.;

2) simplifying the feedback questions, and asking users fewer questions at a time;

3) offering users convenient and efficient channels for feedback on their opinions, to reduce some users' abandonment of feedback due to the difficulties in typing or ignorance of the complicated feedback process;

EXAMPLE 16 The users are encouraged to submit their contact information, if they wish, with informed consent as prerequisite, and then the online shopping platform contacts the users.

v) confirm that either product or service reviews, or both, are legitimate.

A.2 Banking products or services (BPoS)

A.2.1 General

In modern society, it is scarcely imagined that a person lives without touching BPoS such as deposit, credit and payment. Therefore, providing suitable BPoS that are aligned with the digital context is an essential aspect of ageing-inclusive digital economy. Consideration for ageing-inclusive is a social responsibility in the banking industry. It is widely recognized that additional risks are introduced along with the convenience of leveraging digital technologies.

NOTE 1 See ISO 21586 for more detailed information about BPoS.

A.2.2 Recommendations

In BPoS scenarios, the organizations should:

a) consider the customers' demands for digital BPoS in detail and carefully, by providing solutions that are catering to the needs and preferences of customers across all age groups;

b) describe the digital BPoS unambiguously and comprehensively;

c) minimize the use of unnecessary technical jargon, professional terms and buzzwords, opting instead for clear, straightforward language that target customers can understand;

d) offer more than one version of different descriptions for one digital BPoS if needed;

e) give additional notes in case only a vocabulary can describe something correctly and accurately;

NOTE 1 See ISO 21586 for further information about the description of BPoS.

f) allow a request to be raised from a channel and processed via another channel while the context can be inherited;

g) provide the staff with age-related, targeted training;

h) have a fixed staff serving the same customer;

NOTE 2 In many cases, some customers, including some older persons, prefer to communicate with an acquaintance.

NOTE 3 See ISO TR 6083 for more detailed information about the relevant knowledge required for staff offering BPoS to customers.

i) offer integrated service channels, through which customers can communicate via telephone, video call or in person;

j) offer terminals to customers that are aligned with their daily usage;

k) arrange the common and often used functions in a regular manner;

l) provide at least one specific digital BPoS of any category to every customer, in other words, age should not be a suitable reason to refuse to offer a BPoS;

EXAMPLE 1 The automatic repayment for the owed amount of the credit card from the pension account can be set up as a characteristic of a credit card BPoS.

NOTE 4 See ISO 21586 and ISO/TR 6083 for more detailed information about the ageing-inclusive BPoS design.

m) balance the financial risks of digital BPoS based on the customers' preferences;

n) expand the digital BPoS from serving one customer to the customer's family;

o) control the information security in a strict manner, for example by offering digital BPoS through a restricted and specific terminal, specific channel and specific hardware devices, with informed consent as prerequisite;

NOTE 5 See ISO 21586 for more detailed information about the ageing-inclusive BPoS security measures.

p) protect the customers' privacy in a strict manner, for example by restricting the service channels, assigning dedicated staff and offering a digital BPoS family-oriented service;

NOTE 6 Artificial intelligence (AI), privacy-preserving computation, privacy-enhancing data de-identification technologies, application of natural person identifier (NPI), and detailed multidimensional classification and grading based on evaluation can be facilitated to enhance privacy preservation for customers.

q) encourage the target users, including older persons, to participate in the development of digital BPoS;

EXAMPLE 2 Arranging for older persons to take the roles of product manager or other similar positions in the development of digital BPoS.

NOTE 7 The older programmers know what component, layout, button and input/output message are more suitable for their peers, so the iteration period can be faster.

r) involve older persons in the experimental testing of digital BPoS.

A.3 Digital hospital

A.3.1 General

A growing prevalence of multiple comorbidities, chronic diseases, balance disorders and falls affecting people have been observed with ageing, so there is a rapid and significant increase in people's demand for medical resources. Many hospitals worldwide are looking at using digital technology to help improving care for people, including older persons. The development of the digital economy has a significant potential effect on people's health. Early detection, remote care, and more efficient systems to manage the patients' journeys through their treatment are part of the solution to the current challenges. Digital technologies are key not only to improve therapies and clinical outcomes, but also to create better patient and physician experiences.

Ageing is sometimes accompanied by problems, e.g. physical decline and an increased prevalence of chronic diseases. These characteristics can distinguish some older persons as a special group in medical resource sharing. Improving the ageing-inclusive level in digital hospital scenarios is a necessary way to promote medical resource sharing, and it is also a collective responsibility of all social sectors.

A.3.2 Recommendations

In digital hospital scenarios, the organizations should:

a) simplify the process of registration, inquiry and printing test results, medical treatment, and other services;

b) offer the registration, inquiry and printing test results, and other services by various methods (e.g. telephone, internet and on-site), and voice, text or manual reminders of the process progress;

c) equip the intelligent platforms and terminals (e.g. registration machine, registration system, outpatient guidance desk, payment machines and self-service machines for printing test results) that cater to users' characteristics (e.g. declining vision, reduced motor ability);

d) apply the intelligent platforms and terminals:

   1) with the interface of well-arranged font, line space, and colour contrast;

      NOTE See 5.3.3 for more detailed recommendations.

   2) with the highlighted core functions;

   3) providing voice or text guidance or manual services throughout the whole process;

e) create convenient conditions for the journey to medical treatment via digital means;

   EXAMPLE 1 Offering the choice of ride-hailing service on the registration systems.

f) retain the manual service approach, which is equipped with guides for people;

   EXAMPLE 2 The human-powered service desk, the human assistance.

g) open fast tracks or accelerated routes for emergencies and serious illnesses, to provide one-stop medical services including registration, consultation, medical treatment and other specific services;

h) conduct popularization of registration, medical treatment, telemedicine and consultation in user-friendly forms that are easy to understand, on the registration machines or systems, as well as other channels;

i) provide medical services and other services, applying to the characteristics of progressive functional decline, disabilities and impairments related to age, e.g. follow-up chronic disease management services;

j) promote sharing of electronic medical records with informed consent as prerequisite, allow family members or designated individuals full access to health records, appointments, test results and other information, with informed consent as prerequisite.

   EXAMPLE 3 In case of new information, the notifications to the family members or designated individuals can be sent in the format that is acceptable to the users.

k) provide monitoring services and real-time data of the physiological, psychological or medical data of the users, in the hospital or at home, to their family members or designated individuals, with informed consent as prerequisite;

l) help the users obtain health monitoring, consultation and guidance, drug delivery, and other services to meet their health needs at home via service platforms;

m) provide guide services for home-based rehabilitation, assist the following of medical prescriptions process for rehabilitation by setting up sign-in management and rank incentive system to improve the efficiency of medical treatment.

A.4 Digital entertainment

A.4.1 General

Digital entertainment mainly refers to digital versions of music, cinema, radio, television, literary works, art works, audiovisual works, gambling, games, etc., which are commercially distributed to the public as entertainment, including digital media, new media, video on demand, video games, interactive entertainment, mobile entertainment, social media, streaming services, etc.

To achieve ageing-inclusive digital entertainment, it is important to consider the physiological and psychological changes brought by ageing into the design of digital entertainment products and services. Some users can encounter the following challenges and barriers:

a) difficulties with input, for example:

- uncontrollable and involuntary movements (i.e. dyskinesia);
- non-agile fingers;
- inability to hold down a key for a long time;
- inability to perform physical requirements for input.

b) output impairment, for example:

- cognitive impairment;
- visual impairment;
- hearing impairment;
- memory loss, inability to use complex interfaces or operations;
- stress response due to disturbing content;
- 3D vertigo or motion sickness.

A.4.2 Recommendations

In digital entertainment scenarios, the organizations should:

a) address the specific needs of users by offering convenience and comfort in the design of input functions, particularly for users with reduced physical function or impaired limb operation, while avoiding complex, difficult and large-scale physical operations.

EXAMPLE 1 For users who cannot hold down the button for a long time or complete the operation of the combination key, the input operation can be simplified and easier to complete, such as a single-click operation rather than a long press operation.

EXAMPLE 2 For users who are unable to carry out complex or major movements or large-scale activities, when using virtual reality (VR) entertainment media, the operation range can be reduced as much as possible, and operations such as turning around, large-scale swinging of limbs and large-scale neck movements can be reduced.

EXAMPLE 3 For users with severe physical impairments, alternative input options can be provided, such as a mode where multiple people jointly operate the same role.

b) design output functions that allow users to easily obtain feedback and information, foster participation awareness and avoid strong sensory stimulation;

EXAMPLE 4 For users with cognitive impairment, instructions and guidance can be concise and easy to understand, and quickly and easily accessible at any time.

EXAMPLE 5 For users with visual impairment, alternative methods for accessing information or providing responses can be provided, such as hearing and touch, to assist them in receiving feedback.

EXAMPLE 6 For users with hearing impairment, alternative methods for accessing information or providing responses can be provided, such as visual options and closed captions.

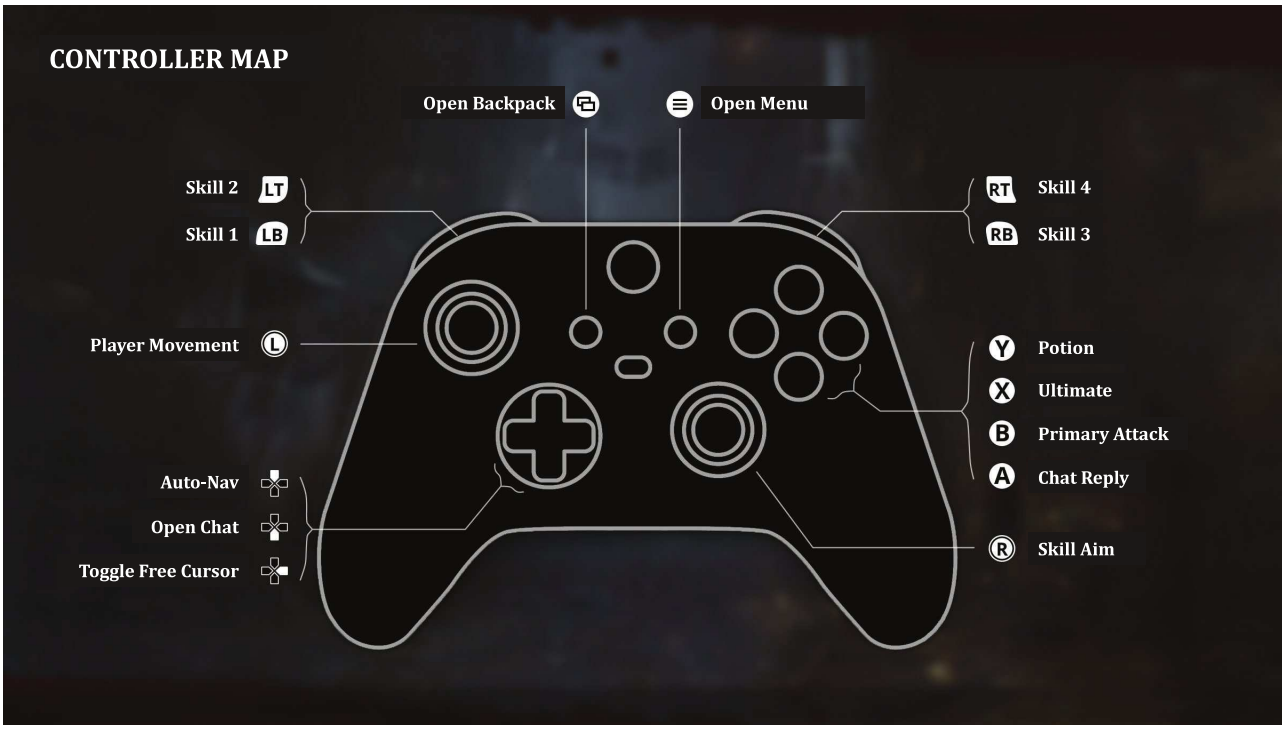
EXAMPLE 7 For users with memory loss, features that reduce the negative impact of memory loss can be provided, such as automatic preservation.

EXAMPLE 8 For users with heart diseases, strong visual, auditory or tactile stimuli can be avoided, such as horror and bloody-themed games.

EXAMPLE 9 For users with 3D vertigo or motion sickness, the visual stimulation can be reduced, as slowing down or stopping the visual motion effect can help relieve such symptoms.

c) provide custom layout function, and support custom adjustment of the size and position of head-up displays (HUD) content (see Figure A.1 for the best practice illustration);

NOTE 1 The users can set the layout of the graphical user interface (GUI), and the game can be played more flexibly for users with physical disabilities.

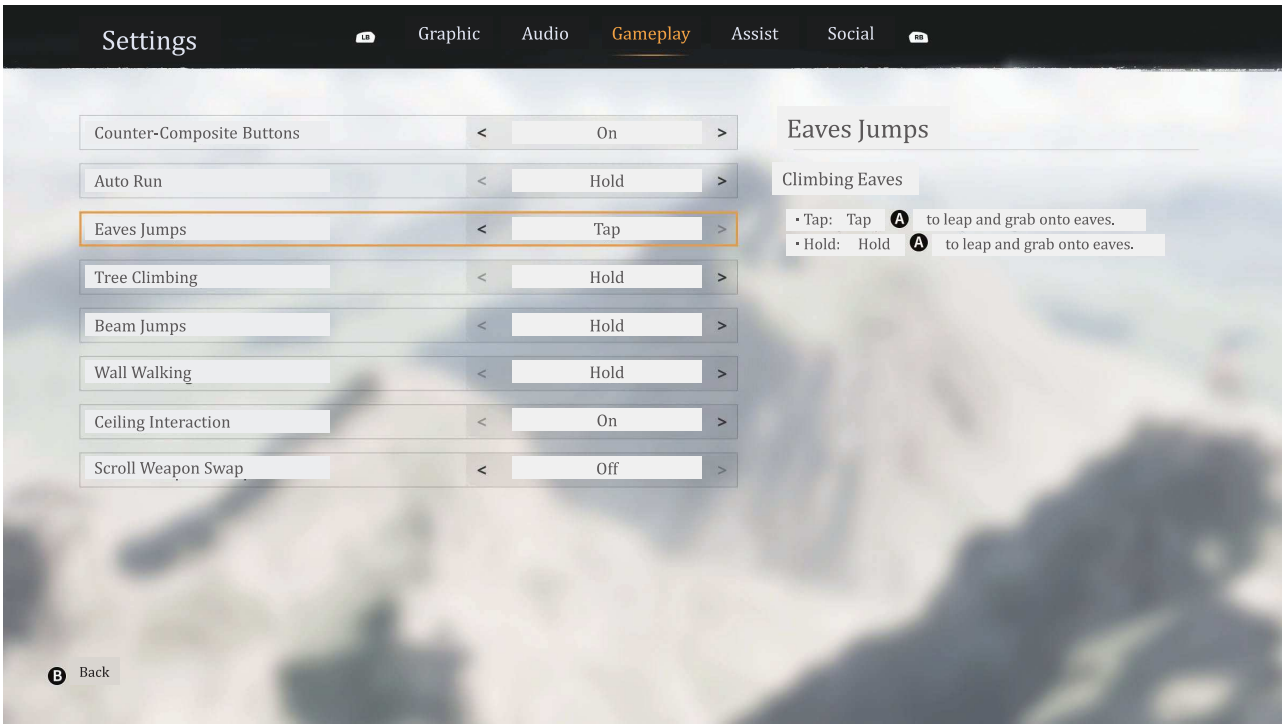


SOURCE: User Experience Center of NetEase Games (Guangzhou Boguan Telecommunication Technology Limited), reproduced with the permission of the authors.

Figure A.1 — Illustration of custom layout

d) adjust the control mode by combining the multiple controls of the gamepad, keyboard or mouse, and provide the corresponding simplified operation, so that the users with physical disabilities can easily perform the operation (see Figure A.2 for the best practice illustration);

NOTE 2 The users can adjust the operation mode of automatic running, climbing and other operations, from pressing and holding to tapping to open. Long-press operations can be simplified for the users with physical disabilities to single-click operations.



SOURCE: User Experience Center of NetEase Games (Guangzhou Boguan Telecommunication Technology Limited), reproduced with the permission of the authors.

Figure A.2 — Illustration of custom control

e) allow the users to adjust the properties of the text for functional controls, such as font, font size, font colour, thickness;

f) for media with horror, thriller and similar elements, provide a striking reminder at the beginning, through voice and text, or provide an option to close this type of element to help users with heart disease and other diseases or unwilling or refusing to view such content from using it;

g) allow users to turn on alternative functions such as screen reading and operation voice for the text information in the media;

h) allow users to turn on the prompt sounds for interactive operations, voice broadcast of the chat channel, and to customize the speech rate of the broadcast;

i) provide high contrast mode for screen information;

NOTE 3 High contrast mode can be achieved by adding a backplane to all HUD text information to improve recognition, and it can also be achieved by increasing the contrast of scene model, to make the distinction between the scene and the HUD more obvious and to improve recognition.

j) provide colour preference settings for text, partial UI and main art content;

k) provide the auxiliary subtitles option for speech, voice-over, character or environment sounds, and other auxiliary subtitles, which can provide a better experience for users with hearing-impairments;

l) provide clear, concise and prompt instructions and guidance, to assist all users;

m) provide the function of voice-to-text, which can be used synchronously with hardware, for users who have challenges typing with the gamepad or keyboard;

n) provide more body operation modes in VR-related entertainment activities for the users with physical disabilities, including but not limited to:

   1) the reach assist mode, which, for example, if the users need to bend down and squat to pick up objects, allows them to complete the pick-up operation by slightly lowering their arms;

   2) the bump/free turns mode, which, via the button on the VR handle similar to the shoulder button, can be used to complete the operation of turning the angle of view, to avoid the problem that the users with physical disabilities cannot turn around in a large range;

   3) the seated mode, which changes the perspective to that of a sitting user, with the UI and interactive objects lowered or shortened, allowing users to experience the entertainment activities in a sitting position throughout the process;

o) provide the operation modes for shared playing for users either in need or with severe physical disabilities, or both;

   NOTE 4 The users with severely impaired physical functions can be unable to undertake all the operations required by the entertainment alone.

   EXAMPLE 10 The users in a game device can share challenges through the built-in options of the device. When this option is turned on, two persons can control a game using two different controllers.

p) provide specialized adaptive equipment instead of standard equipment;

   NOTE 5 The adaptive controller (XAC) allows the user with disabilities to install different components instead of standard control equipment, providing greater flexibility.

q) provide the option of autosave to avoid the negative experience caused by forgetting to save;

r) provide the multi-dimensional auxiliary feedback, e.g. either sound or vibration, or both, to help the users build a cognitive system;

   EXAMPLE 11 The sound or vibration broadcasting 3D orientation, vibration feedback of environmental changes, etc. can increase the perception dimension.

s) set visual feedback for the indicative sound in the entertainment activities to provide a complete entertainment experience for the hearing-impaired users;

t) provide the function of turning off motion effects to prevent visual discomfort caused by excessive motion effects for the users;

   NOTE 6 In addition, the option of rotating control adjustment and zooming camera parameters can also be provided to alleviate the discomfort of the users caused by 3D vertigo or motion sickness.

u) provide the option of difficulty adjustment so that the users can control the level of difficulty.

   EXAMPLE 12 For some RTS (real-time strategy) video games, real-time or turn-based mode switching can be provided, which is convenient for users to control.

A.5 Social media

A.5.1 General

Maintaining social relationships and spending time connecting with others is essential to persons' emotional and mental well-being. Social media provides opportunities for older persons to engage in social contact, to either provide or receive support, or both, and to feel more independent regardless of geographical location or time.

The main motivations for some older persons and other people to use social media are enjoyment, engaging in social contact, and either providing or receiving social support, or both. In particular, older persons who engage in online social networking report that they are motivated by feelings of enjoyment and fun during use.

Enjoyment can be enhanced by integrating games and other activities (see A.4.2 for detailed recommendations of online games and other digital entertainment) into apps, but it is regarded mainly as the result of an (online) activity that complies with the needs and interests of the person.

NOTE See Reference [50] for more information.

At present, 69 % of adults are aged 50 to 64, and 40 % are over 65. Lack of digital literacy, fear of technology, lack of computer or a web-enabled device, physical disabilities and health problems are the main reasons some older persons do not participate in social media, and this can lead to social isolation. To help older persons benefit from the positive aspects of social media, it is important to be aware of barriers and challenges associated with the use of this media. Some of these are outlined below.

a) Information overload — Massive amounts of information are accessible over the internet. Doing a web search, e.g. on health-related information, can lead to dozens if not hundreds of relevant websites displaying a vast array of information on changing lifestyles and health behaviours. Such an overload of information can backfire, leading to the perception that the discrepancy between the actual and desired lifestyle is too large to succeed in improving lifestyle. This pitfall applies particularly to some older users who process internet content more slowly than younger users and can more easily be overwhelmed by too much information.

   EXAMPLE Control of information on the internet about 'miracle' products that can harm health, before verification or confirmation by a qualified professional.

b) Lack of language usability — Experiences determine human behaviour and language expression. With the increasing use of social media, communication styles among young generations have become more homogenous. However, for some older persons there still exist subtle differences in their communication styles compared to the younger generation. Different educational backgrounds can also be an issue for some older persons to participate in social media. Even when some older persons adapt to web life, mixed use of varying languages can cause problems with understanding.

c) Self-denial or technology discrimination — Older persons can receive negative feedback from others if they are slow to respond or do not understand internet terminology, and this can lead to negative experiences for older persons and can discourage their use of social media.

d) Fraud or scam activities — Criminals can target some older persons for fraud preying on perceived vulnerable conditions, e.g. social isolation, loneliness or lack of internet-related knowledge. Older persons can be reluctant to participate in social media activities as they are concerned about protecting the privacy of their personal information.

A.5.2 Recommendations

In social media scenarios, the organizations should:

a) use the language and terms that their target audience prefers;

b) provide relevant and funny content, which is motivating and attractive to the target users;

   NOTE 1 In some stereotypes, older persons pay more attention to some specific topics, e.g. health care and chronic disease management. But in fact, tourism, handicrafts, learning another language, content creation, sharing their knowledge and skills with younger generations, and servicing the community can become content they are more concerned about.

c) consider the range of technology illiteracy target users, and:

   1) add more graphs or figures to explain;

   2) provide AI assistants or human customer service tools to solve technical issues for the users in need;

d) provide a moderator or online resource to help users with information about data privacy protection issues and other relevant information;

   NOTE 2 The users can prefer to have an assigned moderator to whom they can address questions. Also, the moderator can be helpful in establishing and maintaining the 'code of conduct'.

e) provide a reminder to the users about common scams, as well as the scams or fraud spotted by algorithms;

f) launch popups to alert the users about scams or frauds, and use videos or audio to share common practical experiences with them;

g) provide users with information that can help them increase their awareness and help them avoid negative experiences on social media;

NOTE 3 Common scams on social media for some people, including some older persons, include stolen accounts, imposters on a professional network, malware links on the related feed, trick contests, and false online romantic relationships.

h) provide support services on the telephone to answer a variety of questions by the users in need, especially those questions that are not directly related to the social media platform itself, e.g. how to surf the internet;

i) help the users in need to increase their capacities, including the capability of:

1) analysing and evaluating the content;

2) using social media with confidence.

A.6 Transportation

A.6.1 General

Transportation is key to participation in society. The continuous application and development of digital technology in transportation provides for more accessible and convenient service experience for more and more users, but it also brings new challenges to some people, including some older persons.

A.6.2 Recommendations

In transportation scenarios, the organizations should:

a) equip the vehicles, e.g. cars, buses, subways, trains, ships and airplanes, with more inclusive designs, intelligent products and digital services to meet the needs of the widest range of people, including those with progressive functional decline, disabilities and impairments related to age;

b) equip the places and facilities related to transportation, e.g. railway stations, bus stops, airports, docks, with inclusive public information symbols, guidance systems, supporting facilities and devices for people with progressive functional decline, disabilities, and impairments related to age, and provide clear and easy-to-understand instructions for using these systems and devices;

c) design the interactive interfaces for information and services of the digital facilities, devices and apps that meet the needs of target users, including those with progressive functional decline, disabilities and impairments related to age (see 5.2.3 and 5.3.3 for additional recommendations);

EXAMPLE 1 The car human-machine interface (HMI) can be difficult to operate for persons with progressive functional decline, disabilities and impairments related to age.

EXAMPLE 2 E-map navigation, car-hailing apps on the cell phone or tablet.

EXAMPLE 3 Electronic labels, information boards and big screens in public transport stations and public vehicles.

d) provide various driving assistants for some people in need when they drive by themselves, to help them understand the traffic situation, and make wise travel decisions;

e) equip either the public transportation or vehicles, or both, with:

1) more inclusive payment methods;

2) accessible and real-time information and complete timetables.

NOTE See 5.3.3 for detailed recommendations.

A.7 Smart community

A.7.1 General

Ageing-inclusive smart communities can contribute to older persons living active and healthy lives and assist older adults in participating in their communities.

A.7.2 Recommendations

In smart community scenarios, the organizations should:

a) offer services that respect people's values and support their needs for independent living;

b) create a smart community service circle for people, providing appropriate services, e.g. domiciliary daily care, online shopping, home delivery, institutional rehabilitation care, palliative care, reservation through telephone or online platform;

c) provide universal access to information about smart communities through public lectures and other community activities, and improve people's awareness and acceptance of the digital infrastructure, intelligent products and digital services in the community;

d) apply intelligent products (e.g. sensory compensation, sports ability assistance, psychological compensation), which support people in need to live independently, through compensation methods, and offer them assistance and encouragement both physiologically and psychologically, so that they can use the intelligent products easily;

e) equip the intelligent products (e.g. intelligent intercom, intelligent landscape, intelligent parking), to be used by people using wheelchairs and other mobility aids;

f) provide operation guidance offline alternative services and notification service through short message service (SMS), email and phone, (e.g. utility bill balance inquiry and smart payment), when an intelligent community service platform is adopted;

g) pay attention to people's need for first aid, by setting different levels of monitoring according to the people's physical condition, care needs and personal will, with informed consent as prerequisite, and linking with hospitals, police stations and other emergency rescue services through network services;

EXAMPLE Smart communities can provide movement trajectory monitoring service in which functions such as electronic fence reminders and real-time track monitoring are set; emergency help buttons can be installed by beds, toilets and in other key positions.

h) encourage people's participation in the design, construction, governance and supervision of the communities;

i) balance the places and services for public activities between different generations by digital approach, to promote multi-generational communication and integration;

NOTE 1 See ISO 25553[6)] for more information.

j) apply intelligent means to help establish ageing-inclusive community, encourage opinion leaders to organize social activities, and promote communication on that topic.

NOTE 2 See IES RP-28-2007 approved by ANSI for more detailed information.

6) Under preparation. Stage at the time of publication: ISO/CD 25553.

A.8 Smart home

A.8.1 General

The smart home is the embodiment of the Internet of Things (IoT) for people. It connects all kinds of facilities in the home, e.g. audio and video servers, lighting systems, curtain controls, heating and air conditioning controls, security systems, digital cinema systems, and networked home appliances. It provides various functions and solutions such as home appliance control, lighting control, anti-theft alarm, environmental monitoring, HVAC (heating, ventilation, and air conditioning control), infrared forwarding and programmable timing control, which not only improve home security, convenience, comfort and entertainment, but also help provide a more sustainable living environment.

Older persons are some of the main users and beneficiaries of smart homes. The control and operation of smart home devices help meet the physical and mental changes brought about by age, and provide support for daily activities of living and emergencies (e.g. prevent falls, help with reminders and facilitate home health care).

A.8.2 Recommendations

In smart home scenarios, the organizations should:

a) apply the control devices which:

   1) can be easily operated by the users in standing, sitting and prone positions without bending or stretching their bodies;

   2) provide multisensory or multi-channel alternative control modes to help users operate without the auxiliary equipment, e.g. magnifying glasses, hearing aids;

   3) can be easily distinguishable by colour, size, shape, and other forms;

b) apply products or systems, e.g. lighting, voice, interface, which:

   1) are not similar to or conflict with assistant products or services for some users at home;

   2) prevent dangerous situations to users due to misuse or improper operation;

   3) reduce negative emotions, e.g. fear, worry and anxiety, of some users, and can be operated by the users with peace and calm;

c) maintain the stability of the system as much as possible, by reducing the update frequency and differences after updates;

d) provide enough time for the users to read and operate smart home products and systems;

e) not set an extremely long response time for smart home products and systems to avoid unnecessary repetitive operations;

f) set as few steps as possible in the logical process of operation, and make each step easily identified, stoppable and returnable during the whole process;

g) give the appropriate feedback when one step is completed in a series of actions;

h) provide the operation guidance at all stages, in both a simple written or oral form, or both, with only the necessary information for the users to understand easily;

   NOTE 1 Some people with hearing or visual impairments, and difficulties with comprehension, reading or concentrating can be often prevented from complex instructions or operating procedures. When the page contains multiple tasks, it is easy for them to miss important information or steps, affecting the completion of the final task.

i) lead the users to pay attention to the “fail-safe” systems, warnings and similar related issues;

j) retain the necessary non-intelligent operating channels, provide the users in need the familiar alternative control ways in case smart home devices or systems are not operable;

k) provide the multi-channel alternative operation mode in smart home products and systems;

EXAMPLE Mobile terminal solutions for people with reduced mobility, voice control solutions for people with poor vision, and mechanical control solutions for those with language impairments or who only speak dialects.

l) provide the auxiliary power supply when some users cannot respond to a sudden power outage reasonably or timely, which connects to the smart home product and sends a power cut signal to either their family members or designated individuals, or both, automatically and timely when the power grid is disconnected;

m) provide the authorized agent function so that family members and designated individuals have the authority to remotely assist the users in need, with informed consent and ethical criteria as prerequisite;

n) install the emergency call devices at user's fingertips, e.g. the head of a bed, so that they can be rescued in time in case of danger, e.g. falling;

o) connect the automatic emergency systems at home, e.g. water immersion detection or smoke alarm, to the local emergency disposal network, and send the alarms to the emergency centre and emergency contacts of the users automatically in case of emergency;

p) consider offering other forms of alarm in addition to auditory alerts, e.g. strobe lights which are easy to understand, and other visual stimulation;

NOTE 2 Using several different forms of stimulation at the same time can confuse some people and cause danger.

q) offer personalized service for the users, by providing custom service solutions based on their physical function, living environment, assistive device usage, demand preference, and other factors;

r) learn the living patterns of the users proactively to provide either more accurate monitoring data analysis results or emergency alarms, or both;

s) only collect, monitor and analyse personal data of the users, e.g. sleep data and breathing data, with informed consent as prerequisite;

t) identify and record the operation preferences of the users, with informed consent as prerequisite, and proactively provide suitable solutions by automatic methods;

u) protect the privacy and personal data of users throughout the whole process.

NOTE 3 While these recommendations address the specific needs of some older persons, this guidance would make smart home products and services more user-friendly for a wide range of users.

A.9 Work from home and at workplace

The work-from-home trend is increasing worldwide for a broad range of workers. With the development of digital technology, digital tools and services used in work scenarios have entered daily work. Also, digital technology, digital tools and services are used for work on the workplace. These digital technology, digital tools and services should be ageing-inclusive.

NOTE See ISO 25550 for more recommendations.

A.10 Online learning

A.10.1 General

Online learning plays a key role in today's digital world. It helps fight against ageism, improves digital literacy and increases awareness about personal safety and privacy online. Recognized by UNESCO, it is a vital part of lifelong learning and a key strategy for sustainable development for countries worldwide. Online

learning can help people improve their skills and gain knowledge. With the rise of the digital economy, more opportunities for learning have become available. Yet, this shift has widened the gap for those without computer skills and knowledge. Online education offers an accessible solution, potentially encouraging more people to learn and giving them access to high-quality digital materials and support.

Therefore, online learning can bridge the digital divide, enabling people to coexist more harmoniously within the digital economy era.

There is widespread agreement that, in the digital economy, the learning needs of all individuals, including older persons, are priorities for ageing societies, and the valuable role that older persons play in education and online learning is widely acknowledged.

A.10.2 Recommendations

In online learning scenarios, the organizations should:

a) provide equal learning opportunities to all, including older persons;

b) address and support the physical and cognitive needs of learners;

NOTE 1 See ISO 29994 and ISO TR 29996 for more information and inspiration.

c) consider age as an aspect of diversity, the same as gender and ethnicity, throughout the whole process of online learning design, development, and testing;

d) provide accessible information, in both digital and non-digital form;

NOTE 2 Appropriate digital tools and devices can enhance the learning experience, both for digital materials and for assisting with traditional, non-digital resources.

NOTE 3 See ISO/IEC 24751-1 for more information about digital auxiliary technologies and equipment.

e) tailor the learning pace, capacity, speed and assessment methods to each learner;

f) integrate online and offline experiences to improve the learning;

g) encourage learner interaction through offline activities to expand the social connections between learners and enable peer learning;

h) tailor the learning resources, courses and tools to meet the needs of the target learners;

EXAMPLE User interfaces that have easily distinguishable colours and large sizes. Icons and processes are designed for easy recognition. The design of the user interface maintains consistency with previous versions and accommodates users' established habits.

i) use online learning platforms that:

1) can be easily accessed by the target learners;

2) adhere to information accessibility standards;

3) meet the learning needs of the target learners;

j) protect the privacy of learners' data, e.g. learning content and browsing history;

NOTE 4 See ISO/IEC 40500 and ISO 31700-1 for more recommendations.

k) implement strict advertising rules to protect learners from being misled or deceived on the learning platform;

l) offer learners high-quality learning products and services at affordable prices.

Annex B
(informative)

Actions to create an ageing-inclusive digital economy

B.1 General

B.1.1 Assessing the current situation plays a pivotal role in creating an ageing-inclusive digital economy and meeting the needs of ageing.

Key elements of this assessment include:

a) the targeted users, age distribution and the needs of older persons within the targeted users;

b) the key factors, such as digital infrastructure (e.g. smart terminals), intelligent products (e.g. social media app specially designed for older persons), digital service (e.g. online recruitment service);

c) others, e.g. the strategic-plan, cost and timelines.

Assessment outcomes can refer to a well-established international scale or standards, if available.

EXAMPLE ISO TR 22411 provides information to address the needs of older persons.

B.1.2 Understanding the needs of the intended users and stakeholders by engaging with them directly is another key point. Through consultation and study, it is possible to identify:

a) the digital skills and literacy of the target users, paying special attention to the older persons;

b) the physical abilities of these users, such as vision, hearing, speech, balance, tactile sensitivity (such as fingerprint recognition) and muscle strength, again with a focus on older persons;

c) the cognitive aspects of the target users, including aspects such as intelligence and memory, particularly for the older persons;

d) additional factors relevant to target users, such as budget constraints and educational background.

Goals for developing or updating a digital item can be established based on the current state (refer to B.1.1) and findings from consultations and investigations. These objectives are practical, pertinent, and have consensus among all stakeholders.

B.2 Recommendations

B.2.1 The action-plan for establishing or transforming the ageing-inclusive digital economy should be developed by choosing or designing the proper content, timeline and method, determining a rational disposition and allocating the resources required.

The action-plan should be agreed upon between the stakeholders and implemented effectively according to the planned schedule.

B.2.2 The performance and the effectiveness of the ageing-inclusive digital economy should be evaluated, by determining:

a) what needs to be monitored and measured;

b) the methods for monitoring, measurement, analysis and evaluation, as applicable, to achieve valid outcomes;

c) the acceptance criteria to be used;

d) when the monitoring and measuring is performed;

e) when the outcomes from monitoring and measurement is analysed and evaluated.

Policymakers, administrations, organizations and other stakeholders of the ageing-inclusive digital economy should be given an opportunity to critically review their work reflectively and constructively, as a contribution to their improvement.

Appropriate materials and information should be documented and retained as evidence of the evaluation process and result, and related monitoring, measurement, analysis and other activities or outcomes.

Policymakers, administrations, organizations and other stakeholders should perform internal audits at planned intervals to provide information on whether the ageing-inclusive digital economy:

— conforms to the requirements of this document;

— is effectively implemented and maintained.

NOTE See ISO 19011 for detailed guidance.

The ageing-inclusive digital economy should be reviewed at planned intervals (e.g. at least once per year) and updated accordingly to maintain accessibility, availability, usability, affordability, security, and privacy.

B.2.3 Policymakers, administrations, organizations and other stakeholders should determine and take opportunities to make improvements, and take necessary steps to meet the needs of older persons and other stakeholders' requirements, including:

a) improving intelligent products, digital services, digital platforms and digital environments to meet current and future needs and expectations;

b) correcting and preventing any adverse outcomes;

c) improving the efficiency and effectiveness of the ageing-inclusive digital economy.

Policymakers, administrations, organizations and other stakeholders should continually improve the accessibility, availability, usability, affordability, security and privacy of the ageing-inclusive digital economy.

When evaluating performance (refer to B.2.2), the findings and recommendations should be used to assess whether any specific needs or opportunities for improvement exist as part of continual improvement.

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ICS 03.020; 03.080.01; 35.020
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