Istanbul Gelisim Univ J Soc Sci 2025:12(1);387-401
DOI: 10.17336/igusbd.1429059

DERLEME MAKALESİ / REVIEW ARTICLE

Gerontechnology: Technological Solutions for Sustainable Long-Term Care

Geronteknoloji: Sürdürülebilir Uzun Dönem Bakım için Teknolojik Çözümler

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Geliş/Received: 31.01.2024
Kabul/Accepted: 18.09.2024

Abstract

The rapid demographic aging brings with it various challenges in areas such as health, care, safety, isolation and disability. Finding solutions to this situation requires political, economic and social planning to ensure sustainability and support the well-being and quality of long term care. In the contemporary context, gerontechnological solutions are emerging as important tools for solving the social problems of rapid aging. Gerontechnology combines technology, design and gerontology, aiming to design technologies and environments that provide comfort and safety for older adults. The aim of this article is to discuss the development of gerontechnology and the opportunities it offers for ensuring the sustainability of long-term care. Methodologically, this study is a review study. The article begins by providing a comprehensive overview of the emergence and evolution of the concept of gerontechnology, which has led to a contemporary critical transformation in academia. Then, starting from the concept of digital transformation within the scope of gerontechnology, the article presents a detailed examination of older adults' attitudes towards gerontechnological products. In conclusion, gerontechnology has the potential to support older adults' independence and improve their quality of life.

Keywords

Gerontology, technology, aging, care, aging in place

Öz

Demografik yaşlanmanın hızla gerçekleşmesi sağlık, bakım, güvenlik, izolasyon, engellilik gibi alanlarda çeşitli zorlukları da beraberinde getirmektedir. Bu duruma çözüm bulmak, sürdürülebilirliği sağlamak, yaşlıların refahını ve bakım kalitesini desteklemek için politik, ekonomik ve

Barış Kılıç, Nisa Yıldız, Lutfiye İpek, Süheyla Sönmez Demirci, Meliha Güçlü Saz, Ahmet Aytepe, Gülüşan Özgün Başıbüyük , "Gerontechnology: Technological Solutions for Sustainable Long-Term Care", Istanbul Gelisim University Journal of Social Sciences, 12 (1), April 2025, pp. 387-401.

sosyal planlamayı gerektirmektedir. Çağdaş bağlamda geronteknolojik çözümler, hızlı yaşlanmanın getirdiği toplumsal sorunların çözümünde önemli araçlar olarak ortaya çıkmaktadır. Geronteknoloji, yaşlı yetişkinler için konfor ve güvenlik sağlayacak teknolojiler ve ortamlar tasarlamayı amaçlayarak teknoloji, tasarım ve gerontolojiyi birleştirmektedir. Bu makalenin amacı geronteknoloji bilimin gelişimini ve uzun dönem bakımın sürdürülebilirliğinin sağlanması açısından sunduğu imkanları tartışmaktır. Yöntem olarak bu çalışma bir derleme çalışması niteliğindedir. Bu makale, akademide çağdaş eleştirel dönüşüme yol açan geronteknoloji kavramının ortaya çıkışı ve evrimine kapsamlı bir genel bakış sunarak başlamaktadır. Daha sonra geronteknoloji kapsamında dijital dönüşüm kavramından yola çıkarak yaşlı yetişkinlerin geronteknolojik ürünlere yönelik tutumları dikkate alınarak makale ayrıntılı bir inceleme sunmaktadır. Sonuç olarak geronteknoloji yaşlı yetişkinlerin bağımsızlığını destekleme ve yaşam kalitesini iyileştirme potansiyeline sahiptir.

Anahtar Kelimeler

Gerontoloji, teknoloji, yaşlanma, bakım, yerinde yaşlanma

Introduction

Global demographic aging, driven by longer lifespans and declining birth rates, requires a focus on ensuring the well-being of older people in its biopsychosocial dimensions. This aging process brings with it both positive and negative aspects, as longer life expectancy contributes to a higher prevalence of age-related diseases. Consequently, adjustments to macro-level social policies, particularly in healthcare and social security, become essential. Even if policies emphasize productivity and health to delay long-term care, it is not possible to ignore the reality of long-term care in aging societies. Long-term care requires comprehensive political, economic, and social planning, with technology and digitalization serving as important tools to support sustainability and improve quality of care. However, when using these technological resources, ethical considerations and the specific needs of older people should be considered.

Gerontechnology

Gerontechnology represents a pivotal intersection of technology, design, and gerontology, aimed at enhancing the quality of life for older adults. This multidisciplinary field focuses on developing technological solutions that address the unique needs and challenges faced by the aging population (Skiba, 2014). At its core, gerontechnology seeks to leverage innovative technologies to promote independent living, social engagement, safety, comfort, and overall well-being among older individuals.

The concept of gerontechnology, a portmanteau of “gerontology” and “technology,” encompasses a broad spectrum of research and practical applications. It involves the creation, implementation, and distribution of technological environments, products, and services specifically tailored to support the aging process and improve the daily lives of older adults (Graafmans & Bouma, 1993; Martín-García et al., 2021). According to a comprehensive report by the US National Research Council (2003), gerontechnology initiatives typically focus on five key domains of life: living environments, communication, personal mobility and transportation, health, and employment, education, and recreation. These domains serve as a framework for developing technologies that can prevent age-related decline, compensate for functional limitations, and enhance accessibility and usability of various products and services for older individuals (Chen & Chan, 2014; Murciano-Hueso et al., 2022; Pew & Van Hemel, 2004).

Recent literature has further categorized gerontechnological applications based on their specific functions and contexts of use (Sundgren et al., 2020; Huang et al., 2021; Huang & Oteng, 2023). These categories include technologies for continuous data collection, cognitive and social assistance, remote health monitoring and care provision, and environmental adaptations to compensate for potential technological deficits in the home. In essence, gerontechnology serves as an umbrella term encompassing a wide array of technologies designed to support older adults across various aspects of their lives. By integrating technological advancements with gerontological insights, this field aims

to create innovative solutions that not only address the challenges of aging but also empower older adults to maintain their independence, engage socially, and pursue fulfilling lives well into their later years (Pew & Van Hemel, 2004; Martín-García, 2021; Huang & Oteng, 2023).

Emergence and Development of Gerontechnology

To address the issues posed by an aging population, the idea of gerontechnology has changed over time. In the latter half of the 20 century, the geriatrics and ergonomics movement gave rise to the historical development of gerontechnology. This movement's main goal was to enhance the way goods and services are designed by customizing the surroundings to each person's needs (Pinto et al. (1997). When professionals from a variety of fields started to address the technological needs and challenges of the aging population in the early 1990s, interest in the relationship between technology and aging increased and the field of gerontechnology emerged. (Sekine, 2004; Bouma et al., 2009).

Initially, gerontechnology focused primarily on developing assistive technologies and the accessibility of environmental systems. However, the approach has evolved and expanded to include the development of devices, systems, and programs more broadly. Through interdisciplinary collaboration, the applications and scope of gerontechnology became more diverse and comprehensive, integrating technologies such as wearable devices, monitoring systems, and digital platforms (Neven & Berschöld, 2022). Over the years, gerontechnology has evolved from a technology-centered approach to a more person-centered approach that considers older people's needs and desires (Graafmans & Bouma, 1993). Over time, the focus of gerontechnology shifted from the functional needs of older people to a more social perspective. Today, the focus is on promoting social engagement, independence, and overall well-being of older people using technology.

Academics emphasize the importance of a critical approach to gerontechnology development and design, considering perspectives beyond engineering and technology (Neven & Berschöld, 2022). The field of gerontechnology brings together diverse fields such as computer science, engineering, gerontology, geriatrics, and social sciences and is gaining prominence worldwide. Demographic aging has led to growing recognition that evolving technologies can play an important role in supporting successful aging and improving the overall quality of life for older people (Bouma et al., 2009). In recent years, research has increasingly focused on analyzing and understanding the relationship between aging and technology (Sandoval & Kwon, 2019; Neven & Berschöld, 2022; Czaja et al., 2022). Although a relatively new field, gerontechnology is gaining increasing attention due to its potential to provide effective solutions to cognitive and physical decline, as well as other limitations associated with aging (Pinto et al., 1997).

However, it is important to note that the field is still evolving and the concepts, theoretical models, and methods within gerontechnology are constantly evolving (Kim et al., 2021). Researchers and professionals in the fields of technology and gerontology are working together to explore and improve these concepts and to ensure that the technology developed is tailored to meet the unique needs of older adults (Bouma et al., 2009).

The Purpose of Gerontechnology

Gerontechnology arises from the recognition that new and emerging technologies can serve as effective tools to support successful aging and improve the quality of life for older people in an aging society (Pinto et al., 1997; Creber et al., 2016; Chen., 2020). The primary goal of Gerontechnology is to develop technologies and create environments that provide health, comfort, and safety for older adults while promoting independent living, social participation, and well-being (Hsu, 2015). This pathway encompasses a wide range of technologies, including wearable devices, monitoring systems, smartphone applications, and other emerging technological solutions (Skiba, 2012; Hsu, 2015; Creber et al., 2016; Sandoval & Kwon, 2019; Kim et al., 2021). These technologies are used in interventions aimed at improving the experiences of older adults in a variety of settings, including housing, communications, transportation, employment, health, education, and entertainment, and addressing specific challenges associated with aging (Skiba, 2012; Creber et al., 2016; Kim et al., 2021). With the emergence of new technologies, gerontechnology is becoming increasingly indispensable on a global scale.

Gerontechnology aims to improve the quality of life of older people by facilitating social participation, community engagement, communication, and independence while removing barriers that impede these activities (Teh, 2019; Søraa, 2022). The goals of gerontechnology can be summarized as follows: Preventing, delaying, or compensating for age-related sensory, cognitive, and physical impairments; reducing barriers to independence and social participation; ensuring health, comfort, and safety; preventing stigma; promoting autonomy and well-being; and enhancing the abilities of older people facing the challenges of aging.

Gerontechnology specifically aims to reduce barriers to independence and social participation in situations where physical or cognitive limitations may interfere with social relationships and autonomy (Hsu, 2015). Research shows that gerontechnology can improve the abilities of people facing the challenges of aging (Pinto et al., 1997). Gerontechnology employs various design elements to reduce age-related stigma and promote safety, comfort, and well-being among older people (Creber et al., 2016). With the growing number of older people, gerontechnology research is becoming increasingly necessary to promote independence and improve quality of life. Studies highlight the importance of addressing stereotypes and negative perceptions about aging in the development of gerontechnology. The interdisciplinary nature of gerontechnology addresses researchers and companies working to address the challenges of aging.

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- Prevention, delay, or compensation of age-related sensory, cognitive, and physical impairments,
- Reducing barriers to independence and social participation,
- Ensuring health, comfort, and safety,
- Preventing stigma,
- Promoting autonomy and well-being,
- Enhancing the abilities of older people facing the challenges of aging (Pinto et al., 1997; Fozard et al., 2000).

The use of gerontechnology in the treatment of older residents raises ethical concerns, according to some research (Pekkarinen et al., 2013; The, 2019. That emphasizes the necessity of a responsible framework and a deeper comprehension of the socio-technical aspects of gerontechnology in our society. The use of gerontechnology in the care of older adults in the community raises ethical issues that require responsible frameworks and sociotechnical understanding regarding the role of gerontechnology in our society (Pekkarinen et al., 2013; Teh, 2019; Søraa, 2022).

Critical Developments in the Gerontechnology: Socio-gerontechnology

As already mentioned, the main driving forces underlying social change in the 21st century are demographic changes with aging societies and major technological changes, and digital infrastructures draw attention to the increasing integration of older people into their daily lives. Thanks to these developments, the use of the digital world and contact information, as well as a range of technologies, has increased enormously in our daily lives. As people age, technology has also become more involved in people's daily lives and important to older people's identities, lifestyles, and social networks. At the same time, the expansion of these two driving forces led to the integration of disparate disciplines and the emergence of the gerontechnology with which they collaborate. However, many of these gerontological studies on aging and technology are application-oriented and technology-optimistic, asking how they can improve the lives of older people who are displaced. (Schulz et al., 2015).

More recently, more critical and cultural approaches in the sociology of aging, as well as in other study areas such as critical science, technology, and data studies, are attempting to break away from such intrusive forms of theorizing that older adults use to make sense of digital interactions (Peine & Neven, 2019). These approaches reflect on the age-discriminating stereotypes regarding the use of technology in design processes in later life and the resulting paternalistic attitude towards older adults (Neven, 2010; Mannheim et al., 2022) at time same time criticizing the techno-optimism of gerontological research on digital technologies as cited in Peine et al., 2021; Gallist et al., 2023). An emerging, multifaceted field of research, socio-gerontechnology focuses on how aging, caregiving, health, and technology already influence each other, and the social, infrastructural, cultural, and

material forces that underlie this interaction on gerontology, environmental gerontology, and sociology (Peine et al., 2021). The focus of socio-gerontechnology is not only on addressing the alleged problems or challenges of individual or population aging of new technologies but also on how housing is perceived for innovations/designs and social politics; It also examines how the target group is selected (Peine and Neven, 2021; Gallistl et al., 2023). Based on this viewpoint, design procedures and innovation projects also assume significance in our empirical comprehension of ageing, as these conceptions mirror widely held beliefs about the appropriate and possible ways to age in society (Lipp and Peine, 2022; Gallistl et al., 2023).

Sustainability, Aging, and Care

Population aging is a global phenomenon that is causing rapid and gradual growth due to factors such as human life expectancy and declining birth rates (Laidlaw et al., 2003; Shiba et al., 2016). However, negative attitudes towards old age persist, often referred to as a time of weakness and decline. This has led to the notion of apocalyptic demographics and the aging time bomb, in which older adults are viewed as a malevolent force that will overwhelm society. As the proportion of individuals aged 65 and above increases, the proportion of employable age groups decreases. Many people think that this trend will result in a lower workforce and labor shortages, which may make it more difficult for future generations to support the older people to the same extent. According to this perspective, once they retire, older people won›t increase national productivity or the economy. But it ignores the importance of volunteerism and unpaid labor, as well as the wider advantages of older people participating in worthwhile activities for society (Landorf et al., 2008; Yazdanpanahi & Hussein 2021).

In addition to social policy, academic research is also a focus of productivity. The study of the psychological, social, and biological aspects of aging has been the focus of the humanities field of gerontology since the 1940s. An attempt to explain how people can maintain a high quality of life as they age without giving in to hopelessness, depression, and/or extreme inactivity has led the sub-discipline of social gerontology, within this field, to develop several psychosocial theories of aging over the years (Nilsson et al., 2015). “Activity theory” (Havighurst and Albrecht, 1953), “Successful Aging” (Rowe & Kahn, 1987), “Active aging” (WHO, 2002), “Healthy aging” (Swedish National Institute of Public Health, 2006) and so on (Michel, 2015 Michel & Sandana, 2017).

The issue of long-term care is of utmost importance in modern welfare states globally, due to changes in demographics, service expectations, technological advancements, and economic pressures. This has led to a significant strain on older individuals, their families, and society. Women are primarily responsible for providing care. To address this issue, countries should adopt a person-centered approach that involves various stakeholders, including governments, businesses, civil society, communities, and households. This approach would enable older individuals to live independently with dignity, choice, personal security, and participation in their communities and society. It is important to note that aging varies greatly across countries and a more age-friendly approach is necessary to ensure healthy and dignified aging. The care and support systems should cover a broad range of activities, such as initial, acute, and terminal care, as well as assistance with daily living activities (Dann, 2014; Greve, 2017; Wilmoth et al., 2023).

The issue of providing long-term care in a sustainable manner is of utmost importance in welfare states due to the challenges posed by an aging population and a shrinking workforce. These challenges are intricate and interdependent, requiring solutions that address multiple levels, factors, and sectors. The solution to this problem lies in ensuring both social and economic sustainability, with social sustainability emphasizing basic needs like contentment, safety, freedom, dignity, and social responsibility as well as human rights initiatives. Sustainability in the context of healthcare and long-term care refers to the system’s flexibility, acceptability, affordability, and quality. Investing in technology and capital-intensive economic activity is a promising approach to population aging. Automation and artificial intelligence are reducing labor reliance and accelerating economic growth in advanced aging economies. Gerontechnological innovations benefit policymakers, technology developers, and older citizens equally, providing a “triple-win narrative” for solving the “grand challenge of demographic aging.” (as cited in Pekkarinen et al., 2019; Wilmoth et al., 2023).

Technology in long-term care is a topic of discussion, with widespread enthusiasm and fear. The role of technology in care remains unclear, but sustainable use can be achieved with good planning. Clear goals and user engagement are key, as stereotyping older technology users as passive recipients can lead to a triple loss. Rethinking services and work processes is essential, and orientation is a big issue. The sustainable use of technology requires planning and human resources, considering social, economic, cultural, and ecological aspects (Pekkarinnen et al., 2019; Gallist et al., 2023).

Usage of Gerontechnology in Care Facilities

The most popular service models for long-term care facilities are nursing homes, care homes (also known as residential homes), and rehabilitation centers. Individuals in long-term care facilities receive round-the-clock assistance with daily tasks like eating, bathing, and using the restroom. These people are often regarded as vulnerable and suffer from a number of chronic illnesses. (Chu et al., 2021). The provision of collective services in long-term care facilities has several disadvantages. In the physical facilities of long-term care facilities, which are outdated, non-functional, and not designed in line with technological development, there is old technological infrastructure and a lack of Internet access, which prevents the use of versatile modern technologies designed to improve the quality of life for them ensure the quality of life of the beneficiaries in the institution, nurture their relationships and support the staff. It is believed that conducting studies to review, design, construct, and update the physical standards of long-term care facilities will help improve the quality of life of beneficiaries in the facility (Zubritsy et al. 2013).

Chu et al. (2021) examined how person-centered care and long-term care settings can best be supported in the future to reintroduce the blueprints of health professionals, managers, and governments in long-term care settings and to seize the opportunities of technology in the wake of the COVID-19 pandemic. They presented technology recommendations for improving person-centricity in long-term care facilities. These recommendations include aligning the needs and capacities of service users and maintenance partners, as well as workforce operations, technology use, and technology design with a people-centric approach. For example, technologies based on Internet access help older adults maintain and develop relationships with their loved ones in long-term care facilities. Video calling, messaging platforms, social media platforms, and email are among the most encountered applications in care settings (Teo et al. 2019; Robic & Pavlic, 2021). These practices not only make caregiving easier but also become a tool for older people to stay as active as possible.

However, especially in the wake of the COVID-19 pandemic, it has been observed that older people in long-term care facilities experience reduced functioning, depression, social isolation, and an increased risk of illness if appropriate technological investments are not made. Even if there is no pandemic, help should be sought from telehealth services, artificial intelligence applications, wearable devices, and robotic technologies to provide older people with better quality of service and care and protect them from the risk of disease and prevent the development of mental disorders impede. Despite all the development promises of artificial intelligence and gerontechnology in long-term care, it has been noted that there are some concerns and risks associated with artificial intelligence applications in healthcare (Chen, 2020).

As a result, long-term care is defined in the context of gerontechnology (van Bronswijk et al., 2009; Lee et al., 2020 combines existing and emerging digital technologies with the desires and needs of older people. It is believed that it contributes to the aging well of older adults. Technological innovations that are required to raise the standard of care that older individuals receive and to better their living circumstances while residing in institutions are of great significance. Within the context of gerontechnology, it is thought to be very helpful in planning and constructing long-term care facilities in this area so they can adjust to the digital transformation.

Aging In Place

There are different definitions of the concept of ageing in place in the literature. Kalınkara and Arpacı (2013) commonly described as the desire of older people to live in a familiar environment. This approach helps maintain independence, self-regulation, and a social support network with family

and friends, making it a preferred choice for older people. Barett et al. (2012) stated that ageing in place ensures the continuity of the living environment, the preservation of independence in society and social inclusion. In this context, supporting living in one's own home not only ensures continuity in the living environment, but also gives older people a greater sense of freedom and independence in the organisation of daily life and social contact. It is recognised that for individuals ageing in place, the home will provide the best in well-being, comfort and safety, and that caregivers will retain the power to control and manage their lives.

Aging in Place uses scientific and technological advances to help people age healthier and more actively. This approach not only has the potential to help people live longer and healthier lives but also aims to improve the overall quality of life (Esendemir, 2016). Aging in place is a concept that has gained popularity with the advancement of modern medicine and scientific technologies. Research on aging in place aims to understand the causes of aging and mitigate them as effectively as possible. Several factors, such as genetic components, environmental influences, and lifestyle choices, affect the aging process. Aging in Place focuses on studying these factors to understand the causes and mechanisms of aging and intervene accordingly (Kim et al. 2017).

The needs of individuals aging in place are met, and a more comfortable and independent lifestyle is offered by using technological devices and smart home systems. An intelligent dwelling that anticipates and adapts to its users' needs is referred to as a "smart home". The "Smart Home" concept first emerged in the early 1980s in the United States, with the first application example in Turkey dating back to 1984. Some of the products in smart homes include smoke detectors, door entry control, security sensors, energy measurement devices, panic buttons, irrigation systems, earthquake sensors, lighting sensors, smart televisions, and speakers (Avcı, 2022).

Currently, the term "smart home" is being used in a broader sense rather than just referring to technology-equipped houses. In the literature, "smart home" now evokes the concept of "places to live that can use technology both inside and outside the house to give their occupants comfort, convenience, security, and enjoyment" (Aldrich, 2003). The safety, comfort, and other needs of individuals are being addressed through systems integrated with technology. This is because integrating these technological devices into homes makes it easier to ensure the protection and safety of older adults and facilitates their access to social support services. Through technological devices, even older adults who are unable to leave their homes find it easier to socialize and maintain connections with life (Gökçakan, 2019).

When designed for older individuals aging in place, environmental and wearable medical sensors and the use and benefits of technological devices can be discussed in detail. First, the overall health of older people can be monitored in real-time. Many parameters, such as blood pressure, heart rate, ECG, EMG, and body temperature, can be easily monitored by sensors and smartwatches. Also, alarms can be used to remind you to take medication. Smart homes allow you to measure air quality and detect gas leaks. Air purifiers create a cleaner environment for people with respiratory conditions, allowing them to live more comfortably. Sensors placed on floors can communicate the status of people who fall to their loved ones or the nearest healthcare facility, enabling early intervention (Mertens & De Maesschalck, 2015; Zhang et al., 2020).

According to earlier research, the process of older adults accepting and adopting gerontechnology is complicated, and existing models of technology acceptance do not include crucial variables unique to older adults who live in communities. Comprehending the psychological and contextual elements that impact older adults' technology perceptions and usage is crucial for the effective integration of technology for aging. To take into account these elements and encourage aging in place with the aid of technology, a conceptual model has been presented (Jaschinski et al., 2021).

In general terms, the use of technology facilitates the diagnosis of diseases, care, protection, and the provision of a safe living environment for individuals and their access to counseling services. Thus, the aging process of older individuals is supported within the familiar surroundings of their homes and environments. This situation can prevent the preference for more costly institutional care or postpone this decision to later (Terkeş & Bektaş, 2016).

Digital Transformation of Gerontechnology

Gerontechnology refers to the use of technology to support and enhance the lives of older adults, particularly in the context of healthcare and independent living (Maskeliunas et al., 2019). Digital transformation encompasses the process of integrating digital technologies into various aspects of society, including cities, to drive innovation, improve services, and enhance overall performance (Jnr, 2020). Gerontechnology can be seen as a subset of digital transformation, focusing specifically on the needs and challenges faced by older adults (Creber et al., 2016). The link between gerontechnology and digital transformation lies in the potential of digital technologies to enhance the effectiveness and impact of gerontechnology solutions. Digital transformation can enable the development and deployment of innovative gerontechnology solutions that address the unique needs and challenges of older adults. By leveraging digital technologies, such as artificial intelligence, Internet of Things, and data analytics, gerontechnology solutions can become more personalized, adaptive, and efficient (Alexopoulos et al., 2022).

The integration of gerontechnology into smart cities is a key aspect of digital transformation. As the global population ages, there is a growing need to develop technologies and solutions that cater to the specific needs of older adults. Smart cities, on the other hand, are urban areas that leverage digital technologies and data to improve efficiency, sustainability, and the quality of life for residents (Sha, 2022). In the context of smart cities, gerontechnology can be used to create age-friendly environments that promote healthy aging and enhance the overall well-being of older adults (Maskeliunas et al., 2019). For example, smart homes equipped with assistive technologies can monitor the health and safety of older adults, provide reminders for medication and appointments, and facilitate communication with healthcare providers (Maskeliunas et al., 2019). These also technologies can monitor the health and well-being of older adults, detect falls or emergencies, and provide assistance and reminders for daily activities (Wu et al., 2015).

In addition to healthcare, gerontechnology can also support independent living for older adults. Smart home technologies, for example, can automate tasks, monitor safety, and provide assistance to older adults in their daily activities. These technologies can help older adults age in place and maintain their independence for longer periods (Creber et al., 2016). Furthermore, gerontechnology can address the social isolation and loneliness often experienced by older adults. Digital platforms and social networking tools can facilitate social connections, enable virtual interactions, and provide access to information and resources. This can help older adults stay connected with their families, friends, and communities, reducing feelings of isolation and improving their mental well-being (Creber et al., 2016). Digital transformation can enhance the accessibility and usability of gerontechnology solutions. Older adults may face barriers in adopting and using technology due to factors such as an age-related decline in cognitive and physical abilities, lack of digital literacy, and negative attitudes towards technology (Wu et al., 2015). Digital transformation can address these barriers by designing user-friendly interfaces, providing training and support for older adults, and tailoring gerontechnology solutions to their specific needs and preferences (Wu et al., 2015; Alexopoulos et al., 2022). From a social policy perspective, the adoption of gerontechnology can lead to cost savings in healthcare and long-term care, as well as create opportunities for innovation and economic growth (Maskeliunas et al., 2019).

Attitudes of the Older People Towards Gerontechnological Products

The integration of gerontechnology into healthcare systems presents several challenges, particularly in addressing the diverse needs and preferences of older adults. A significant issue in the development and implementation of gerontechnology is the lack of emphasis on user acceptance and specific needs, which is complicated by the involvement of multiple stakeholders, including caregivers, geriatricians, eHealth professionals, social workers, and other healthcare providers (Kalınkara et al., 2016). The heterogeneity among older adults in terms of their technology usage and attitudes further complicates efforts to tailor gerontechnology to individual requirements (Haufe et al., 2019). Rapid technological advancements exacerbate these challenges, as older adults often struggle to keep pace with new developments due to potential physical and cognitive limitations, making the

adoption of novel technologies particularly difficult (Ekici & Gümüş, 2016). The adoption process is also influenced by sociodemographic and psychographic factors such as age, gender, education, and place of residence, which play a crucial role in determining the success of gerontechnology (Huang et al., 2021).

Research highlights that older adults' perceptions and use of technology are deeply embedded in their personal, social, and physical contexts (Peek et al., 2014; Kalınkara et al., 2024). For businesses and implementers to effectively provide and facilitate the use of gerontechnology, it is essential to understand the factors that influence technology acceptance among the elderly. Self-efficacy, anxiety, and facilitating conditions have been identified as key predictors of gerontechnology acceptance (Chen & Chan, 2014). To overcome the challenges associated with gerontechnology adoption, various models and tools have been proposed. For instance, the Socio-Technical Regime Transitions Model has been developed to support the design, development, and delivery of gerontechnological services, with an emphasis on privacy, information security, and cybersecurity (Kowalski & Østby, 2022). Additionally, the Gerontechnology Matchmaking (GTM) tool has been created to assist professionals in aligning gerontechnology with the individual needs and contexts of older adults, taking into account personal, social, physical, and technological factors (Haufe et al., 2019).

Attitudes towards gerontechnology among older adults vary, with studies showing that older adults tend to have more positive attitudes when the benefits of gerontechnology are perceived (Lebron et al., 2015; Turnbull et al., 2021; Wilson et al., 2021). However, negative attitudes are often observed when older adults lack a clear understanding of the technology in question (Abdul Rahman et al., 2021). Positive interest tends to be directed towards gerontological technologies that are perceived to improve the overall health of older adults, as opposed to those that are designed for specific medical conditions. For example, health information provided through digital devices is seen as more promising and acceptable than other devices, such as fall detection systems or smart wireless sensor systems, which may only be relevant to individuals with specific health problems (Cohen et al., 2017; Turnbull et al., 2021; Abdul Rahman et al., 2021; Özsungur, 2022).

In contrast, some studies have identified health and safety related gerontechnologies as the most critical, followed by technologies that enhance care and social connectedness, with mobility, leisure and health information devices also being important (Halicka & Surel, 2021). Devices related to housing and digital accessibility were rated as less important. Caregivers' perspectives on gerontechnology also vary, with some expressing positive attitudes towards technologies that improve the quality of life of older adults (Delbreil & Zvobgo, 2013; Portet et al., 2013; Chen & Chan, 2014), while others have reported dissatisfaction with the performance and suitability of certain technologies (Cohen et al., 2017).

Conclusion

As life expectancy increases, the world's population is aging rapidly, which particularly affects the older generation. This global aging trend leads to societal challenges in areas such as health, care, safety, transport, housing, isolation and disability. To meet these needs, we must take advantage of advancing technology. Gerontechnology, which combines technology, design and gerontology for the well-being of older adults, is gaining traction. Society often values individuals based on their productivity, which can lead to age discrimination. Gerontechnology can make care services more sustainable and less invasive. It is critical to older adults' independent living, health, and social engagement. Ethical concerns exist, but gerontechnology holds promise, driven by technological advances and an aging population. However, older adults face barriers to accessing technology and efforts should be made to promote their participation in the information society to prevent global crises and marginalization.

Funding: The author(s) received no financial support for the research.

Conflicts of interest: The authors declare that they have no conflict of interest.

Author Contributions: All authors developed the study proposal and contributed to the document; G.Ö.B supervised the whole process; B.K and N.Y. edited and translated the document to the English. All authors have read and agreed to the published version of the manuscript.

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Özet

Bu çalışmada uzun dönem bakımın sürdürülebilirliği açısından gerontekнolojinin önemi ve yerinin ortaya konulması amaçlanmıştır. Demografik yaşlanma her toplumun farklı hızlarla da olsa deneyimlediği bir süreçtir. Toplumda yaşlı bireylerin sayısı fazlalaştıkça değişen toplum yapısının farklı açılardan ele alınması ve özelleşmiş hizmetlerin oluşturulması gerekmektedir. Yaşlılık ve yaşlanma sadece olumsuz bir çıktı gibi düşünülmemeli aksine bilimsel veriler ışığında gerekli planlamalar yapılmalıdır. Gerontolojinin ele aldığı önemli konulardan biri olan uzun dönem bakım toplumsal ve bireysel açılardan ele alınmalıdır. Yaşam süresinin artması ve demografik yaşlanmanın sonucu olarak artık ölüm ve hastalıkların başlangıç süresi arasındaki ara gittikçe açılmaktadır. Bu noktada insana yakışır bakımın sağlanması, informal bakım veren bireylerin yüklerinin hafifletilmesi ve uzun dönem bakımın sürdürülebilirliği için gerontekнolojnin yarattığı fırsatın değerlendirilmesi önemlidir. Gerontolojinin çalışma dallarından biri olan gerontekнoloji; teknoloji, tasarım ve gerontolojiyi birleştirerek yaşlı bireylerin sorunlarına multidisipliner biçimde çözüm aramaktadır. Gerontekнoloji alanının gelişimine bakıldığında zamanla toplumsal değişimin etkisiyle değişiklik gösterdiği görülmektedir. 20. yüzyılın son yarısında geriatri ve ergonomi alanındaki çalışmalar gerontekнolojinin tarihsel gelişiminde rol oynamıştır. Alandaki ilk çalışmalar öncelikle yardımcı teknolojilerin geliştirilmesine ve çevresel sistemlerin erişilebilirliğine odaklanmıştır. Ancak alandaki perspektif cihazların, sistemlerin ve programların geliştirilmesini daha geniş bir şekilde kapsayacak şekilde genişlemiştir. Disiplinler arası iş birliği sayesinde gerontekнolojinin uygulamaları ve kapsamı daha çeşitli ve kapsamlı hale geldi ve giyilebilir cihazlar, izleme sistemleri ve dijital platformlar gibi teknolojileri entegre etmiştir. Yıllar geçtikçe gerontekнoloji, teknoloji merkezli bir yaklaşımdan yaşlı insanların ihtiyaçlarını ve isteklerini dikkate alan daha kişi merkezli bir yaklaşıma doğru evrilmiştir. Zamanla gerontekнolojinin odak noktası yaşlı insanların işlevsel ihtiyaçlarından daha sosyal bir perspektife kaymıştır. Günümüzde odak noktası, teknolojiyi kullanan yaşlı insanların sosyal katılımını, bağımsızlığını ve genel refahını teşvik etmektir. 21. yüzyılda toplumsal değişimin temelinde küresel demografik ve teknolojik değişimlerdir. Bu gelişmeler sayesinde dijital dünyanın ve iletişim bilgilerinin yanı sıra çeşitli teknolojilerin günlük hayatımızda kullanımı büyük ölçüde artmıştır. İnsanlar yaşlandıkça teknoloji de insanların günlük hayatlarına daha fazla dahil olmaya başladı ve yaşlıların kimlikleri, yaşam tarzları ve sosyal ağları açısından önem

kazanmıştır. Aynı zamanda bu iki itici gücün genişlemesi, farklı disiplinlerin entegrasyonuna ve iş birliği yaptıkları geronteknolojinin ortaya çıkmasına yol açmıştır. Ancak yaşlanma ve teknolojiye ilişkin bu gerontolojik çalışmaların çoğu uygulama odaklı ve teknoloji açısından iyimser olup, yerinden edilmiş yaşlı insanların yaşamlarını nasıl iyileştirebileceklerini sorgulamaktadır. Son zamanlarda, yaşlanma sosyolojisinin yanı sıra eleştirel bilim, teknoloji ve veri çalışmaları gibi diğer çalışma alanlarındaki daha eleştirel ve kültürel yaklaşımlar, yaşlı yetişkinlerin anlamlandırmak için kullandıkları bu tür müdahaleci teorileştirme biçimlerinden kopmaya çalışmaktadır. Gelişmekte olan, çok yönlü bir araştırma alanı olan sosyo-geronteknoloji, yaşlanma, bakım verme, sağlık ve teknolojinin hâlihazırda birbirini nasıl etkilediğine ve gerontoloji, çevresel gerontoloji ve sosyoloji üzerindeki bu etkileşimin altında yatan sosyal, altyapısal, kültürel ve maddi güçlere odaklanmaktadır. Sosyo-geronteknolojinin odak noktası yalnızca yeni teknolojilerin bireysel veya nüfus yaşlanmasından kaynaklanan iddia edilen sorunları veya zorlukları ele almak değil, aynı zamanda konutların yenilikler/tasarımlar ve sosyal politikalar açısından nasıl algılandığıdır; Ayrıca hedef grubun nasıl seçildiğini de incelemektedir.

Bu makalenin ana kavramlarından bir tanesi de sürdürülebilirlik ve sürdürülebilir uzun dönem bakımdır. Fakat sürdürülebilirlik ve bağlantılı olarak üretkenlik kavramlarının eleştirel açıdan da ele aldığımızın altının çizilmesi gerekmektedir. Genellikle zayıflık ve gerileme dönemi olarak adlandırılan yaşlılığa yönelik olumsuz tutumlar devam etmektedir. Bu, kıyamet demografisi kavramına ve yaşlı yetişkinlerin toplumu ezecek kötü niyetli bir güç olarak görüldüğü yaşlanan saatli bomba kavramına yol açmıştır. 65 yaş ve üzeri bireylerin oranı arttıkça istihdam edilebilir yaş gruplarının oranı azalmaktadır. Pek çok kişi, bu eğilimin daha az iş gücü ve iş gücü sıkıntısına yol açacağını, bunun da gelecek nesillerin yaşlı insanları aynı ölçüde desteklemesini zorlaştırabileceğini düşünmektedir. Bu bakış açısına göre yaşlılar emekli olduklarında ulusal üretkenliği veya ekonomiyi artıramayacaklardır. Ancak gönüllülüğün ve ücretsiz emeğin öneminin yanı sıra yaşlı insanların toplum için değerli faaliyetlere katılmasının daha geniş avantajları da göz ardı edilmektedir. Üretkenliğin teşviki yaşlanma ilgili farklı kavramsal perspektiflerde göze çarpmaktadır. Burada dikkat edilmesi gereken durum yaşlı bireyler bakıma muhtaç olup olmaksızın toplumun bir parçası olduğu sosyal devlet anlayışının unutulmaması gerektiğidir. Sürdürülebilir bakım ekonomik olarak toplumsal faydayı gözettiği kadar özellikle informal/formal bakımın yükünü azaltmayı hatta insan onuruna yakışır bakım hizmetlerinin oluşturulmasını amaçlamamaktadır. Uzun dönem bakımın önemli iki ayağı olan yerinde yaşlanma ve kurumsal bakımda teknoloji kullanımının hizmetin kalitesinin artması açısından faydalı olacaktır. Bakımda teknoloji kullanımı hakkında etik kaygılar mevcuttur lakin geronteknoloji, teknolojik ilerlemeler ve yaşlanan nüfus nedeniyle umut vaat etmektedir. Yaşlı yetişkinler teknolojiye erişimde engellerle karşı karşıyadır ve küresel krizleri ve ötekileştirmeyi önlemek için onların bilgi toplumuna katılımlarını teşvik etmek için çaba gösterilmelidir. Son olarak uzun dönem bakımda teknolojinin entegrasyonunu kolaylaştırmak için yaşlı bireylerin geronteknolojik hizmet/ürünlere bakış açılarının dikkate alınıp onların da bir paydaş olduğu unutulmamalıdır.