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Adoption of Technology by Elderly People: Opportunities and Barriers

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Abstract

Demographic changes introduced through population aging and the recent proliferation of technological innovations constitute indisputable realities of the digital era marked by rampant digital reliability. Research has brought to light that the existing standardized design principles for technology are insufficiently attentive to the specific needs of elderly population. This, in turn, has unduly affected technology adoption rate among elderly who are designated as the digitally marginalized segment, especially within the developing nations. This paper presents a systematic review to illustrate the complex relation between attitudes of elderly towards technology and the role of well-designed technologies curated for an ageing population in offering opportunities to improve the quality of later years. Research evidences from scholarly works are systematically collated to focus on structuring the numerous factors impacting technology (non)adoption and continued usage by elderly people. Adhering to the inclusion criteria of selecting studies only written in English, this paper summarizes the factors namely, personal characteristics, social contexts and technology-related dimensions, to provide rich insights into the chosen area of investigation. Here, we discuss the role of diverse technological interventions, and the challenges faced by those aged at least 50 years in maneuvering or coping with new technologies and adapting to the transforming structures. The findings suggest the necessity to focus on the opportunities created when technologies bridge the design gap. The corpus of evidence is pulled to recommend effective strategies to overcome present barriers. We suggest involving the elderly as co-designers. The paper concludes by addressing the directions for future research.

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I. Introduction

The world is currently witnessing remarkable demographic transitions owing to population ageing. Moreover, the commencement of a digital era has transformed the socio-economic landscape by affecting the ways in which cultural goods and services are generated, reconfigured our traditional forms of sociality and set the stage for a perpetual technological revolution. Within a digital era, age of a person becomes pivotal in understanding social inclusion or exclusion. It is interesting to note that despite the growing popular belief that less value is placed on old age within the transforming structural contexts and socio-technical systems of the contemporary society, the ideas of positive ageing and active ageing have attracted widespread attention. The issue of inequality, which is frequently referred to as the 'digital divide' in the digital lexicon, becomes a point of contention in the technical development process, especially, for elderly people who, for long, have represented the digitally marginalized group, particularly in the context of developing countries. Since social innovations have now assumed unprecedented forms (Manzini, 2015), touching the lives of the younger as well as the elderly population, one effective strategy to ensuring active ageing, avoiding institutionalization, minimizing reliance on others, and encouraging greater social participation may be mediated through digital technology. Here, we define social innovations as "new ideas (products, services and models) that simultaneously meet social needs and create new social relationships or collaborations. In other words, they are innovations that are both good for society and enhance society's capacity to act" (Manzini, 2015, p. 11). In fact, within the present digital age, our understanding of the self and the world is influenced by digital technologies in ways that contribute to molding our embodied lives in multifaceted ways (Hirvonen et al., 2022). To put it differently, since both biological and psychological ageing impact cognitive and physical functional ability during old age, adoption of technology might be considered a feasible way to ensure well-being. As people live longer, it is crucial to acknowledge the role that technology plays in increasing social contact (Khosravi et al., 2016), minimizing the communication gap (Cotton et al., 2011), supporting everyday tasks, and heralding social inclusion through the use of diverse digital technologies. This becomes fundamentally crucial within the digital era characterized by a shift of majority of its businesses and services to online domains (Quico, 2008, as cited in Mikkola & Halonen, 2011). Against such a backdrop, dignified living and social inclusion for elderly people might be re-instated with an expansion of the opportunities for digital participation, searching for strategies to help them adapt within a technology safety envelope and, most importantly, turning our attention

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towards the dynamics or factors of technology (non)adoption. Situated within a digital era, we might state that the proliferation of evolving technological innovations and the ageing of the population across the globe present a pressing need for elderly people to invest considerable resources, time and effort to navigate through the present and future technical systems, enabling them to improve their quality of life. Noteworthy in this context is the fact that though a technology-enabled life can be a part of wider attempts to reorganize services and caregiving opportunities, Hardey and Loader (2009) noted that the promise of enhanced efficiency might not always be fulfilled. Thus, it becomes necessary to invest greater research efforts in accomplishing a deeper comprehension of the reasons and the contexts in which technologies falter. Such an understanding is conceivable by adopting an integrated lens to investigate the association between socio-technical components and their agentic and structural settings.

Interestingly, despite a greater number of elderly exhibiting a noteworthy trend of adapting to diverse technologies in a digital era, it was noted that not much attention is given to developing a user-centered design keeping in mind their heterogenous necessities, preferences, and aspirations (Neves & Mead, 2021). The probable reason for the existent non-alignment of technology design with the particular requirements of the ageing population might be located in our shared misconception of the seniors as comprising a uniform cluster of minority users of technology (Hardey & Loader, 2009) or as people characterized by technophobia, being non-tech savvy, and technology non-users (Neves et al., 2018). This might be regarded as sufficiently explaining the scarcity of research and academic literature on the significance of personal contexts and socio-technical factors as determinants of technology (non)adoption or (non)use in later life.

The systematic review undertaken herein brings to light the positive impact of technology in improving cognitive performance, daily activities and overall health when age-friendly solutions are curated keeping their unique needs in minds. Moreover, we also systematically review the existing literature to illustrate the factors behind technology (non)adoption, thereby bringing to focus the barriers to learning digital skills and using digital technology in old age. Some of these barriers are related to motivation (Cody, Dunn, Hoppin, & Wendt, 1999 as cited in Tsai, et al., 2017) and attitudes (Barrett, 2011 as cited in Delello & McWhorter, 2017) of elderly people, while others indicate issues of privacy concerns and trust (Morris et al., 2013). Additionally, the reasons behind discontinued usage or non-adoption are situated in inappropriately designed technologies that are developed without an active

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involvement of elderly people as co-designers leading to offer technologies that are unattractive and lack meaning in their lives (Peine et al., 2014). Co-design, Sanders and Stappers (2008) argue, implies the convergence of designers' creativity and collaborative efforts in the design development process from people without training in design. Re-designing technology along with elderly people as co-designers or co-developers might have an enduring impact on technology adoption rate, caregiving opportunities, ensuring security and inclusiveness of the elderly users in the larger society.

Digitally non-inclusive design unleashes the adverse effects of social isolation, further deepening the digital divide for elderly people. Sin et al., (2021) commented on the impact of non-inclusive design highlighting that the under-represented technology users like elderly people find themselves on the wrong side of the divide unpacking associated social consequences of adversely affecting the social well-being of older people by excluding them from essential services like banking, shopping, healthcare, and social connection that are increasingly moving to the digital space. Under such circumstances, elderly people now stand in greater need of re-inventing their lives, and searching for better coping mechanisms to deal with the reconfigured and constantly updating societal structures of the technology-driven contemporary digital era.

II. Objectives of the Study

The systematic review aims to outline key issues associated with technology adoption among elderly population as reported by published research articles. The opportunities associated with adopting technology during old age are elaborated through a discussion of the role of digital technology. The perceived and actual barriers to technology usage or adoption are analyzed through investigating the factors correlated with technology (non)adoption during twilight years. The present study, firstly, attempts to identify the factors that impact attitudes of elderly people towards adopting and consistently using technology; secondly, to emphasize how technological interventions have been or should be utilized, according to the authors, to create opportunities for active aging, preserving autonomy and realizing maximum potential in old age besides acknowledging diversity, and differences in the consequences of technology (non)adoption among this heterogenous group; and thirdly, to identify the challenges the seniors face in adopting or coping with digital technologies restricting their scope for social inclusion in the present digital era.

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Against this backdrop, we conduct a systematic review to address the following questions:

1. What are the factors impacting adoption and usage of digital technology by elderly?
2. How are these factors pivotal in understanding the potential role of technology in improving physical and psychological well-being in old age?

The paper is structured as follows: it introduces the readers to the role of well-designed technologies in unfolding positive outcomes in old age, the next section discusses the objectives of the study and methods chosen for the review of several articles published in peer-reviewed journals. This stage is followed by a description of the reported results (findings) and a consequent discussion to scope the parameters of technology adoption in old age and finally suggests recommendation(s) to project a conceptual lens for designers, policy makers and service providers to close the grey digital divide.

III. Methodology

This study develops a systematic review of existing research on the association between elderly people and technology within the framework of analyzing the role of technology, the interplay of the factors influencing technology adoption and emphasizing the value of their creative engagement as collaborators, co-designers or co-developers of technology. It attempts to present an overview following the review process (as shown in Fig.1) with the goal of contributing to the body of knowledge by addressing the above stated research questions.

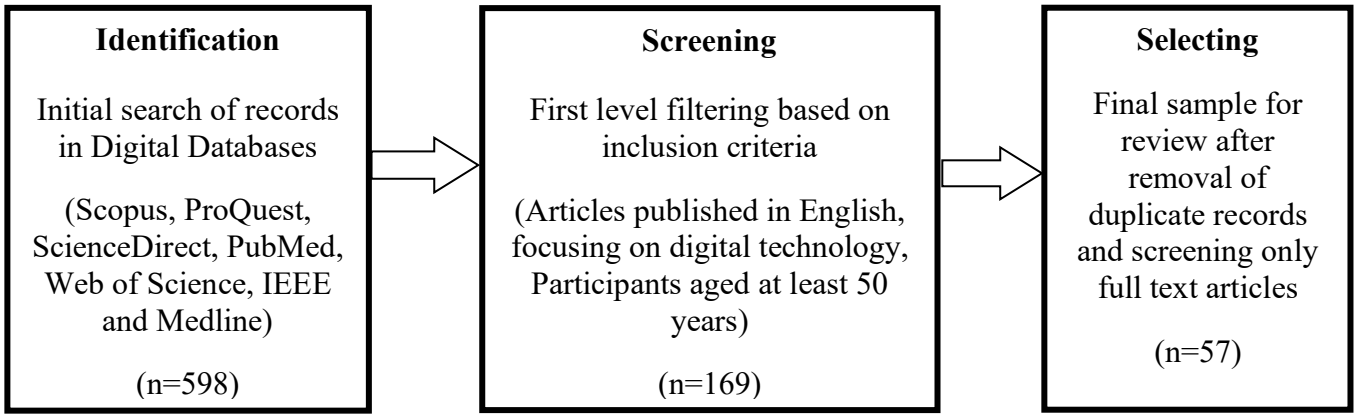

Fig.1. Flow diagram outlining the systematic search strategy/process

A systematic search across multiple disciplines was conducted to evaluate and synthesize research evidence and to incorporate empirical studies conducted between 2007 and 2023. The range of databases consulted were Scopus, ProQuest, ScienceDirect, PubMed, Web

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of Science, IEEE and Medline to cover the multidisciplinary nature of research and reflect an extensive literature in myriad contexts.

Driven by the objective to provide in-depth insights into overarching concepts related to the factors, opportunities and barriers in implementation of digital technologies in old age to advance aging research, we selected only published original articles that reported the factors related elderly people's attitudes towards digital technology and the role that emerging technologies play when successfully implemented. The search was conducted in February, 2025 with broad keywords combined into three groups: elderly (e.g., older adults, aged, seniors, silver surfers); factors of technology adoption (e.g., personal characteristics, technology acceptance, use, social factors, rejection, barriers) and role of digital technology (e.g., computers, ICT, smartphones, social media, assistive robots, assistive technology, eHealth, tele-care, telemedicine).

Through the above-mentioned search words, 598 articles were identified. Subsequently to check for eligibility of the identified articles, we conducted a scanning of the titles and abstracts to filter out a total of 169 papers based on inclusion criteria apt for the current investigation. Moreover, following the established guidelines of Kitchenham and Charters (2007), the study selection criteria focused on including only those empirical studies that offered direct evidence about addressing the research question(s) relevant to accomplish the objectives of the study. The next step included the removal of duplicate records and screening only full text articles, leading to a final sample of 57 research articles selected for the review. The dual-process of inductively and deductively analysing the information was adopted to outline common themes and recommendations.

Inclusion Criteria

Kitchenham & Charters (2007) suggested that a systematic review is to be conducted through determining study selection criteria to scan studies that are to be included in, or excluded from, the review. The paper followed the inclusion criteria of incorporating: (a) only original and peer-reviewed articles and publications (including conference proceedings) written in English and following qualitative, quantitative, or mixed methods strategies; (b) empirical studies with an evaluative component of personal, social and technology-related factors impacting technology adoption or actual use of digital technology in old age; (c) participants included were 50 years or older or had a mean age of 50 as groups when the empirical studies were

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conducted. Though the age of 50 years is not necessarily considered 'old age' in the strict sense of the term, the choice of this inclusion criteria was dictated by two factors. One, this was the common methodology adopted in some of the relevant reviewed literature. Two, on the one hand, this age-group is indicative of the onset of certain age-related barriers and on the other hand, the penetration of technology among this age group will, in future, be almost indistinguishable from that in the rest of the general population. The exclusion criteria involved: (a) review papers, unpublished work, letters, editorials, and conceptual articles written in languages other than English; (b) studies that focus on older technology and not emerging technologies; (c) empirical studies done on individuals/groups other than elderly people.

Data Extraction and Analysis

Data extraction forms were designed to incorporate information and main contents retrieved from all the 57 articles. These forms were designed keeping in mind that the final sample of articles included in the study ranged from qualitative-quantitative to mixed methods strategies. The parameters included in the standardized information-set were: author, publication year, research title, source, abstract, region of research, methodology, participants (selected through inclusion criteria), theoretical model, technique, etc. After multiple readings of the selected 57 articles, and based on initial coding of findings and discussions, thematic analysis was conducted to develop two main themes- roles of digital technology and factors of technology (non)adoption with sub-themes under each theme.

IV. Findings and Discussion

The 57 articles included in the review were published within 20 years, commencing from the year 2007 and recording an increase in the past few years. The reason for this growth in scholarly interest might presumably be associated with two major demographic trends- one, the unprecedented population aging; two, the widespread diffusion of technological innovations.

Talking Technology for Well-being and Social Support for Elderly

Numerous studies in academic literature abundantly demonstrate the potential benefits that technology might promise to ensure well-being among elderly. This systematic review calls for an in-depth understanding and contextualization of well-being (physical and psychological)

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dimensions of technology (non)adoption within a wider framework (See Table 1.1). Digital technology is broadly classified into everyday technologies (involving hardware devices like mobile phones, computer, or technologies like information and communication technology (ICT), internet, social networking sites) and remote or assistive technologies (involving ICT devices, robots, tracking, monitoring and assistive devices for health care and social support) (Kebede et al., 2022).

Adopting Technology for Physical Well-being

Technology can be used for an active management of elderly people's health, regulating self-care, addressing health issues and re-instating independent living. Early detection of diseases or age-related changes through regular reporting of health data becomes viable with the deployment of numerous technologies like the Novel Assessment of Nutrition and Ageing (NANA) toolkit that offers a holistic understanding of a person's daily functioning through tapping data on diet, cognition and activity rate (Astell et al., 2014). Technologies such as these are crucial in health and nutrition monitoring among elderly patients, especially those chronically ill, debilitated or suffering from restricted mobility (Sixsmith et al., 2013), besides benefitting their caregiver(s) (Heide et al., 2012), and making health management cost-effective (Tao & McRoy, 2015). The growth of Information and Communications Technologies (ICTs) has been instrumental in minimizing the cost of institutionalized care, enabling aging in place by utilizing technologies to create a supportive home environment, independent living, better access to community support, and efficient delivery of care (Muller & Sixsmith, 2008; Sixsmith & Sixsmith, 2008). Arnaert & Delesie's (2007) study on the homebound elderly in Belgium projected the effectiveness of video-telephone nursing care in improving the overall health functioning, levels of social activity and memory, and bringing a positive changes in self-perception. The ability to handle internet is also associated with boosting confidence to take better and informed health and financial decisions (James et al., 2013).

Adopting Technology for Psychological Well-being

The systematic review undertaken here reported studies illustrating the role of technology in psychological or emotional well-being. Several studies highlight an association between greater computer engagement and lower loneliness (Blazun et al., 2012; Carpenter & Buday, 2007), consequently reducing psychological distress (Chopik, 2016; Cotten et al., 2014),

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promoting social participation and providing better old age support. Tsai and Tsai's (2011) study on social support reflected how videoconference intervention program on elderly residents in 16 nursing homes demonstrated long-term effectiveness in reducing perceived loneliness and improving depressive status and social support between 3-12 months post intervention. Research comparing the effectiveness of social networking site (SNS) technology among elderly social media users as against the non-users, demonstrated that the former felt more socially connected (Hutto et al., 2015), were more content with their current social roles, and showed higher confidence or less uneasiness about using technology (Bell et al., 2013). Studies have also documented the role of companion robots in lowering feelings of loneliness (Robinson, et al., 2013), with virtual support groups and computer-based interventions contributing to both physical and psychosocial well-being that correlate to enhanced self-efficacy, empowerment, social support, and reduced depressive symptoms among chronically ill elderly (Weinert et al., 2008). Furthermore, within the digital era, internet is considered a pivotal communicative tool- a vehicle to create and sustain social ties, thereby keeping social loneliness at bay (Sum et al., 2008; Cotten et al., 2013). Thus, inversely proportional relation between internet use and loneliness is indicated. These studies do not, however, imply replacing traditional forms of communication through technologies like social media, but turn our attention towards creating opportunities for augmenting social connectedness and socializing in old age, especially in the case of homebound, frail or immobile elderly people. Mention-worthy here is a lack of consensus among researchers on the positive outcome(s) of ICTs on psychological well-being, with some of the studies documenting no relationship between technology usage and psychological well-being (Slegers et al., 2008; Toepoel, 2013).

Author(s)	**Year**	**Participant Age (in years)**	**Sample Size**	**Country/ Region**	**Method**	**Technology Type**	**Findings**

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Arnaert & Delesie	2007	72 (mean age)	17	Belgium	Interview, functioning measured using 8 assessment scales at 6-month intervals	Video-Telephone (VT)	VT improves health, memory, communication, social activity, self-perception
Carpenter & Buday	2007	>=50	324	United States of America	Survey-Cross-sectional	Computer/ ICT	Loneliness is alleviated through Computer use
Muller, & Sixsmith	2008	60	14 focus groups (with 90+ users)	Europe (Germany, Spain, Netherlands, UK)	Focus group interviews and individual interviews	ICT	Creates supportive home environment, allows assisted living, aging in place, increases independence, lowers social isolation
Sixsmith, & Sixsmith	2008	80-89	40	UK	Interviewing participants surveyed in Enable-Age Project	ICT for telecare	Enables independent living, access to community support, better delivery of care
Slegers et al.	2008	64-75	123 (intervention group) 68 (control group)	Netherlands	Randomized controlled trial	Internet/ Computer	No significant contribution of computer training in improving mental health

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Weinert et al.	2008	51.8 (Mean age)	183	United States of America	Questionnaire Interview	Computer intervention	Higher self-efficacy, empowerment, social support
Sum et al.	2008	>=55	222	Australia	Survey-Cross-sectional	Internet	Higher internet use as a communicative tool reduces social loneliness
Tsai, & Tsai	2011	60+	90 (experimental group=40; comparison group=50)	Taiwan	Quasi-experimental longitudinal design	Videoconference program	Long-term positive effect in reducing loneliness and depressive symptoms among residents of selected nursing homes
Erickson, & Johnson	2011	>=60	122	Canada	Survey-Cross-sectional	Internet	Higher the use of internet, lower the level of loneliness
Blazun et al.	2012	Mean age= 72.4 (58 participants) and 72.9 (45 participants)	58 (baseline) 45 (follow-up study)	Finland, Slovenia	Quasi-experimental study	Computer	Higher internet use as a communicative tool, decreases loneliness
Heide et al.	2012	73.2 (avg. age)	130	Netherlands	Survey-loneliness questionnaire of de Jong Gierveld	CareTV	Social and emotional loneliness decrease, health care and safety facilitated

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Cotten et al.	2013	82.8 (mean age)	205	United States of America	Regression analysis	Internet	Increase in social contact, decreased loneliness but not lower perceived social isolation
Toepel	2013	55-75+	1171 participants (55-64 years), 637(65-74), 210 (aged 75)	Netherlands	Survey-Cross-sectional	Computer/ Television/ Radio	Passive leisure activities involving television, radio, computer engagement not associated with reducing social isolation
James et al.	2013	82.2 (Mean age; range:60-101)	661	United States of America	Survey-Cross-sectional	Internet	Higher the frequency of internet use, better the ability to make health and financial decisions
Robinson, et al.	2013	55-100	40 (intervention group=20 Control group =20)	New Zealand	Randomized controlled trial	Companion Robot	Significant declines in feelings of loneliness over the trial period
Cotten et al.	2014	>=50	3075	United States of America	Survey-Longitudinal (4 waves of data, Year 2002-2008)	Internet	Positive outcome of internet use on mental health, lowering depression and loneliness

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Astell et al.	2014	65-89 (mean age=72.39)	40	UK	Trial-NANA assessments-dietary, cognitive, physical activity at 4week intervals for three 7-day periods	NANA toolkit (with touch screen computer, webcam, handy nanometer)	Data reporting from home on health-related behaviours, evaluating nutrition and cognitive function made easier
Tao, & McRoy	2015	>=60	Unspecified	United States of America	Survey	Telehealth, Computerized system	Caregiving simplified through tracking changes in health
Hutto et al.	2015	51-91	268	United States of America	Survey-Cross Sectional	Social Network Sites (SNS) interventions	Use of social media increased social satisfaction
Chopik	2016	>=50	591	United States of America	Survey-Longitudinal	Social networks, Internet, Smartphone	Social technology improves subjective well-being, health condition, cultivates relations, decreases depressive symptoms

Table 1.1. Role of Digital Technology in Physical and Psychological Well-being

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Get Going with Technologies: Perception, Adoption and Barriers

Tables 2.1, 2.2, and 2.3 present a list of factors contributing to elderly people's (non)engagement with digital technologies. These factors play a crucial role in determining their (non)adoption, intentions to (non)use and shape their perceptions of and attitudes towards overcoming barriers. Here we grouped the varied constructs emerging from the literature into three categories to offer a meaningful analysis: personal characteristics, social contexts, technology-related dimensions.

Personal Characteristics Shaping Perceptions towards Technology Adoption

Health status of an elderly person might act as a facilitator or barrier in technology usage. The literature documented good health as a significant personal characteristic (Kononova et al., 2019; Berner et al., 2019; Brody, et al., 2019) determining attitudes and ability to troubleshoot (Leese et al., 2021), consequently influencing engagement with technology. The motivation of forming and sustaining social bonds outweighs the barrier of cognitive impairment (Leone et al., 2018). Furthermore, other motivating factors of successful users might be social support, reassurance, perceived relevance, or practical applications of the concerned technology in their daily lives (Tsai et al., 2017) and the desire to acquire knowledge and digital skills (Betts et al., 2019) through training sessions to stay updated, independent, active and seek digital support (Pihlainen et al., 2023). Other personal characteristics that reportedly positively impact technology adoption among elderly consumers of technology are higher income and education (Betts et al., 2019; Menéndez et al., 2020; Kadylak et al., 2021; Rasekaba et al., 2022).

Some of the personal barriers to adopting or using technology consist of negative perception of a specific technology as irrelevant or inappropriate (Vaportzis et al., 2017). Limited knowledge or awareness (Preusse et. al., 2017), aversion, low interest, skills and confidence issues (van Deursen, & Helsper, 2015) might originate from no to low prior experience and lack of trust (Godfrey, & Johnson, 2009) prohibiting or restricting interaction with digital technologies. Moreover, there might be other barriers like inaccessibility, financial constraint, space constraint to accommodate a device, and unversed with technical language (Morris et al., 2007; Charness, & Boot, 2009; Joyce et al., 2011).

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Personal Characteristics	Technology Type(s)	Determinants	Author(s) (with year of publication)	Findings
Health Status	1. Activity trackers 2. Internet 3. Computer	Good physical health	1. Kononova et al. (2019) 2. Berner et al. (2019) 3. Brody et al. (2019)	Physical functioning is crucial to technology adoption
Motivation	1. Tablet computers/iPads 2. InTouch 3. Remote monitoring technology	1. Social connectedness 2. Social support, reassurance 3. Relevance of technology 4. Self-driven (desire to gain knowledge/ skills, stay updated, independent and active, derive entertainment) 5. Need for digital support	1. Tsai et al. (2017) 2. Leone et al. (2018) 3. Betts et al. (2019) 4. Leese et al. (2021) 5. Pihlainen et al. (2023)	Attitudinal factors like acceptability, readiness, motivation impact adoption and adherence to technology
Income and Education	1. Television 2. Phones 3. Computer 4. Social Media 5. Email 6. Printer 7. Tabs/iPads	1. Cost affordability linked to income 2. Education linked to positive attitude	1. Erickson & Johnson (2011) 2. Betts et al. (2019) 3. Menéndez et al. (2020) 4. Kadylak et al. (2021) 5. Rasekaba et al. (2022)	Technology adoption is positively impacted by higher income and education
Barriers	1. Perception of technology as inappropriate/ Irrelevant 2. Skepticism, low interest, skills and confidence issues		1. Morris et al. (2007) 2. Charness, & Boot (2009) 3. Godfrey, & Johnson (2009) 4. Joyce et al. (2011)	

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	3. Untrustworthy 4. Other constraints: Cost, Space, Language Barrier, Inaccessibility	5. van Deursen, & Helsper (2015) 6. Vaportzis et al. (2017) 7. Preusse et. al. (2017)

Table 2.1. Personal Characteristics Determining Technology Adoption

Summarizing the Social Contexts for Technology Engagement

Social support, as argued by Tsai and Tsai (2011), refers to a multi-dimensional construct that might be categorized as: emotional, informational, instrumental, and appraisal support. Since social networks diminish with age (Toepoel, 2013), it is important to illustrate the social context for comprehending technology (non)adoption. Older people's perceptions are shaped by the advice and support received from family and friends (Pan & Marsh, 2010; Greenhalgh et al., 2013; Lai et al., 2015; Askari et al. 2020), and the need felt to stay connected with their loved ones. However, once proficiency is achieved in maneuvering technology, social support might no longer act as a significant factor in determining sustained usage (Pan & Marsh, 2010; Macedo, 2017). Moreover, support is sought only when elderly people are not made to feel disempowered, or shamed for their ignorance (Outila & Kiuru, 2020; Herscovici & Manor, 2022) and when there is no associated feeling of privacy getting breached with data or information becoming accessible to those offering support (Safarov, 2021).

Social Contexts	**Determinants**	**Author(s)** **(with year of publication)**	**Findings**
Social Support Networks	Advice and Support from family and close networks	1. Pan & Marsh (2010) 2. Greenhalgh et al. (2013) 3. Lai et al. (2015)	Perceptions and adoption of technology are positively impacted by

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		4. Askari et al. (2020)	the existence of a supportive environment
Contexts when social support is not sought	1. High proficiency in usage on own 2. Disempowerment, discomfort in revealing ignorance 3. Breach of privacy	1. Macedo (2017) 2. Outila & Kiuru (2020) 3. Herscovici & Manor (2022) 4. Safarov (2021)	Elderly people's technology adoption and engagement revolve around sustained support received from social networks

Table 2.2. Social Contexts Influencing Technology Adoption

Examining Technical Reasons for Technology (Non)Adoption

The attitudes of elderly people towards technology and their intention or likelihood to adopt a particular technology are also tied to technology-related or technical factors. Studies conducted during the mentioned time period have helped turn our attention towards some prominent factors. The fundamental ones are those that relate to affordability of and accessibility to technology (Menéndez et al., 2020; Safarov, 2021; Dequanter et al., 2022). This helps in providing a deeper understanding of the issue of grey digital divide between those with and those without access to a myriad range of new technology forms (Tural et al., 2021). Though technology is laden with the potential of offering inexpensive and accessible services to older people, and facilitating better communication, this segment of the population often finds itself grappling with the digital gap created by cost-ineffective technology (Herscovici & Manor, 2022) and regular updating of everyday technologies (Cerna et al., 2022), requiring them to constantly update their skills to cope with the ever-evolving digital learning processes embedded in their day-to-day lives (Rohner et al., 2021). Besides cost, timing and geographical location, the opportunities to acquire digital skills are also influenced by the ways digital support is administered to elderly people, making it befitting and personally invigorating for them (Pihlainen et al., 2023). Another significant determinant of technology (non)adoption and (non)usage, as documented by academic literature, is the design of technology. Learning digital skills in later years is hampered when a technology is designed and developed without investing thought on the needs of the consumers it aims to cater (Neves & Mead, 2021). Moreover, inappropriate or non-inclusive design have lasting adverse effects like discontinued usage, non-

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adoption, and social isolation, consequently widening the grey digital divide (Sin et al., 2021). Simple design of technology associated with ease-of-use (Nägle & Schmidt, 2012; Su & Tong, 2021), compatibility and physical aspects of devices permitting portability due to weight and size act as facilitators, while jargon laden instructions or information (Vaportzis et al., 2017), absence of feedback, and any assistance mechanism to monitor instances of privacy breach or challenged data security (Dermody et al., 2021; Ghorayeb et al., 2021; Ienca et al., 2021), unfilled support needs and incompatibility between technology service designs and the users' regimen (Outila & Kiuru, 2020) negatively impact perceived usefulness, adoption and intention to interact with technology exhibited by the elderly population.

Technical factors	**Determinants**	**Author(s) (with year of publication)**	**Findings**
Facilitators	Affordability Accessibility Design-Ease of use, compatible, portable	1. Menéndez et al. (2020) 2. Safarov (2021) 3. Dequanter et al. (2022) 4. Tural et al. (2021) 5. Herscovici & Manor (2022) 6. Nägle & Schmidt (2012) 7. Su & Tong (2021)	Cost and accessibility are significant concerns for elderly, the absence of which deepens the grey digital divide Designs when simple, compatible, and portable have a positive impact on adoption and usefulness
Barriers	1. Rapid updates 2. Constant coping, learning, re-learning 3. Digital support administered effectively 4. Incompatible/ non-inclusive design 5. Technical instructions 6. No feedback/assistance	1. Cerna et al. (2022) 2. Rohner et al. (2021) 3. Pihlainen et al. (2023) 4. Neves & Mead (2021) 5. Sin et al. (2021) 6. Vaportzis et al. (2017) 7. Dermody et al. (2021) 8. Ghorayeb et al. (2021) 9. Ienca et al. (2021) 10. Outila & Kiuru (2020)	Acquiring digital skills, adopting a new technology, and sustained usage of technology get negatively affected when users' needs, expectations and preferences are not taken into account by the

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	7. Challenged security/ privacy 8. Unfilled support needs		designers and service providers

Table 2.3. Technology-Related Dimensions Influencing Technology Adoption

The rich corpus of data produced by the literature search helps distil the role of technology in transforming the later years of life by taking care of physical and psychological health and effectuating overall well-being. Understanding the role of technology becomes crucial against the backdrop of the present digital era, witnessing a rapid growth of social networks, and wider diffusion of technological interventions across all age strata. The main themes that emerge from the systematic review more or less revolved around favourable views towards the contribution of technology in enhancing safety, care, dignified living, better scope for continued workforce participation, meaningful social engagements, and digital inclusion. Interestingly, not all studies have presented unanimous views on the same theme.

Functional independence, which might be achieved through deployment of elderly-friendly technology, is indispensable for healthy ageing, and preserving self-esteem (Weinert et al., 2008), consequently enabling elderly people to feel empowered enough to act on their informed choices. This benefits them as well as their caregivers by extending the opportunity for self-care, partially compensating for the decreasing number of care-givers within the present society, besides extending opportunities to provide support and caregiving in a cost-effective and sustained manner (Muller & Sixsmith, 2008; Sixsmith & Sixsmith, 2008; Heide et al., 2012; Tao & McRoy, 2015).

Furthermore, studies conducted to examine the potential of technology in positively contributing to psychological well-being, turned attention to the role digital technologies might play in facilitating social connectedness, better communication with health experts or service providers, closing inter-generational communication gap, enhancing social satisfaction, and lowering feelings of depression or loneliness among this segment of the population (Erickson, & Johnson, 2011; Blazun et al., 2012; Cotten et al., 2014; Hutto et al., 2015; Chopik, 2016). Besides the compelling need for greater social connection experienced during the twilight years, the studies highlight that technology is adopted for other significant reasons like

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knowledge and skill acquisition, preserving autonomy and self-identity, staying actively engaged in meaningful and pleasurable pursuits, receiving digital support and fueling the desire to stay updated owing to the fear of social exclusion. The prominence of these motivating factors reflected through the documented literature implies that elderly people perceive digital technology both as a facilitator of independent living and as an empowering tool. However, the social context of creating a supportive learning environment through encouragement and patience received from family and other social support networks becomes a non-negotiable factor as well (Pan & Marsh, 2010; Greenhalgh et al., 2013; Lai et al., 2015; Askari et al., 2020).

Yet another crucial determinant of whether digital technology will act as a boon or bane is not only dependent on the personal characteristics and the social contexts of the potential or actual users, but also on several technology-related factors. One such fundamental factor is the design of technology. Since the rising popularity of the internet and hand-held portable devices, like mobiles, tablets, or computers, among this segment of the population signals them as a rapidly-growing group of consumers (Betts et al., 2019), discussions on designing for and with elderly people have become crucial. Evidence from the literature selected for this systematic review suggests that well-designed technologies curated for an ageing population might facilitate the later-life in numerous ways (Nägle & Schmidt, 2012; Su & Tong, 2021). Besides mitigating digital exclusion due to interface design, a well-designed technology becomes instrumental in enhancing opportunities for workforce participation or continued work post-retirement, helps them navigate independently, and eventually improves their social well-being. Conversely, standardized design principle(s) that are insufficiently attentive to the specific needs or preferences of this heterogenous group, and that are ineffective in addressing the concern of preserving the privacy of the elderly population, act as barriers to technology adoption.

V. Conclusion

The systematic review undertaken here overviews international scholarly published works spanning a range of diverse issues within the field of ageing and technology. The paper takes into consideration numerous digital technologies to offer novel insights into comprehending the impact of technology on the lives of elderly people situated within a digitized contemporary society. We contend the compelling need to direct research efforts to examine elderly people's attitudes towards adopting technology and the contexts that hold relevance in determining

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positive perceptions and sustained usage among them. Furthermore, we argue that to ensure continued digital engagement and a durable relation between elderly people and technology and to overcome the barriers faced with technology usage in old age, the need to involve them in the development process as active collaborators with technology designers and with academics from diverse disciplines is non-negotiable. However, this systematic approach to review evidence on the role of technology and the factors of technology (non)adoption among elderly, which was undertaken through an extensive search across all notable databases, has certain limitations. Firstly, our inclusion criteria mandated reviewing scholarly works published only in English. The second limitation pertains to the problem associated with generalization of Western-centric findings in the context of developing nations. Since majority of the works reviewed here were conducted in the United States of America, followed by those from Europe, the findings applicable to the Western contexts might differ from and impact our comprehension of the scenario within the national context.

The paper, however, hopes to make a significant contribution to the existing domain of knowledge. The information-rich spectrum of opportunities and barriers associated with adopting technology during old age as documented in the reviewed works might be instrumental in providing practical guidelines to technology designers, turning their attention towards pertinent ethical considerations to be made while developing technologies for the ageing population. This might also help designers and service providers acknowledge the fact that the frontiers of the existing technological systems need to be expanded to cater to their unique needs more efficiently. Furthermore, this study might set out a baseline for directing policy makers' attention towards the need to frame policies to generate greater awareness and to make provisions for training to ensure wider adoption of technology among this digitally marginalized segment of the population. The direction for future research to explore their everyday world of experience with digital technology is recommended.

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