

Digital Readiness and Cybersecurity Awareness of Older Adults: A Conceptual Framework for Safe Participation in AI-Enabled Smart Communities

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Abstract — Population ageing and rapid digital transformation are reshaping healthcare systems and smart community infrastructures. As AI-enabled smart communities increasingly rely on telehealth platforms, smart home systems, and Ambient Assisted Living solutions, older adults' safe digital participation becomes a critical challenge. This study applies an integrative literature review to examine how technophobia, digital readiness, and cybersecurity awareness influence older adults' participation in such environments. By synthesising two literature reviews, the paper identifies key sociodemographic and contextual factors, including education, digital experience, socioeconomic status, and access to support. The findings also highlight emerging AI-driven risks, such as deepfakes, AI-generated phishing, personalised manipulation, and algorithmic bias. Based on these insights, the paper proposes a conceptual framework linking technophobia, digital readiness, cybersecurity awareness, and safe digital participation. The framework contributes to an interdisciplinary understanding of inclusive and secure AI-enabled smart communities.

I. INTRODUCTION

Population ageing and the rapid expansion of digital technologies are two global processes that increasingly shape contemporary societies. According to projections of the World Health Organization [1], the number of people aged 60 and above will continue to grow substantially in the coming decades. At the same time, digitalisation is progressing rapidly, influencing various sectors of everyday life, including healthcare, public administration, communication, and commerce. In Europe, policy initiatives aim to ensure that by 2030 at least 80% of citizens possess basic digital skills, which are considered crucial for economic competitiveness and innovation [2], [3]. Despite these developments, older adults often experience difficulties when adapting to rapidly evolving digital environments. Many individuals in this age group did not grow up with digital technologies and therefore face greater barriers to their use. One of the frequently discussed obstacles is technophobia, which refers to anxiety or fear related to advanced technologies and their potential consequences [4], [5]. Research shows that technophobia can significantly limit older adults' willingness to engage with digital services and may restrict their access to online information, communication tools, and digital public services [6], [7], [8].

At the same time, digital technologies offer important opportunities for improving quality of life in later life. Studies indicate that digital tools can support independence, facilitate communication with family and friends, and enable easier access to services such as banking, healthcare, and online public administration [9], [10], [11], [12]. These developments are particularly visible in emerging smart city and smart community environments, where digital infrastructures, data-driven systems, and AI-based technologies are increasingly used to support ageing populations [13], [14]. Within these environments, technologies such as telehealth platforms, smart home systems, Ambient Assisted Living solutions, and socially assistive robots are designed to enhance autonomy, safety, and well-being among older adults [15]. However, the adoption of these technologies largely depends on older adults' digital readiness, confidence in using digital systems, and the availability of support during the learning process [16], [17].

In addition to technological barriers, digital participation also raises important cybersecurity concerns. As individuals increasingly rely on digital platforms for communication, financial transactions, and healthcare services, exposure to online risks becomes more pronounced. Cyberattacks such as phishing, identity theft, and various forms of social engineering represent common threats in digital environments [18]. Although older adults are not necessarily the most frequently targeted victims overall, certain characteristics—such as lower digital literacy, reduced confidence in using digital technologies, and limited access to support—may increase their vulnerability to cyber threats [19], [20]. Previous studies have examined older adults' technology adoption, technophobia, digital literacy, and engagement with digital health or smart home technologies. Other research has focused on cybersecurity awareness, online risk perception, and protective behaviours among older adults. However, these research streams are often developed separately and rarely connected to the specific context of AI-enabled smart community environments.

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Existing research has examined several dimensions of older adults' digital engagement, including technophobia, digital literacy, and cybersecurity awareness. However, these aspects are often investigated separately, while relatively few studies explore how they interact within AI-enabled smart community environments. Understanding these relationships is particularly important as societies increasingly rely on interconnected digital infrastructures to deliver healthcare services and social support to ageing populations. To address this gap, the present study synthesises insights from two literature reviews focusing on technophobia and cybersecurity awareness among older adults. Based on these findings, the paper proposes a conceptual framework that explains how technophobia, digital readiness, and cybersecurity awareness interact to influence the safe digital participation of older adults in AI-enabled smart community environments. The main contribution of this paper is therefore the integration of these previously separate research streams into a conceptual framework that links technophobia, digital readiness, cybersecurity awareness, and safe digital participation in AI-enabled smart community environments.

II. METHODOLOGY

A. Research design

This study applies an integrative literature review approach to synthesise existing research on digital inclusion, technophobia, and cybersecurity awareness among older adults in the context of smart healthcare environments. The analysis builds upon two previously conducted systematic literature reviews focusing on (1) technophobia and technology readiness among older adults and (2) cybersecurity awareness among older adults. The integrative approach enables the identification of common themes, conceptual overlaps, and research gaps related to the digital transformation of healthcare infrastructure in smart cities and communities. The search was conducted in several major academic databases in order to capture research from both social science and technical disciplines. The selected databases included Web of Science (WoS), Scopus, PubMed, and IEEE Xplore, enabling coverage of literature related to ageing, digital technologies, and cybersecurity.

B. Literature search strategy

The search strategy combined keywords related to older adults, technology adoption, and cybersecurity risks. Two main groups of search terms were used. The first group focused on technology readiness and digital inclusion and included terms such as "older adults", "elderly", "technophobia", "technology anxiety", "digital literacy", and "technology adoption". The second group addressed cybersecurity awareness and online risks and included terms such as "cybersecurity", "cyber attack", "security risk", "cyber awareness", and "security practices". The search queries combined these terms using Boolean operators (AND,

OR). Examples of search strings included: (older adults OR elderly OR seniors) AND (technophobia OR technology anxiety OR digital literacy) AND (technology adoption OR digital readiness). The search focused on peer-reviewed articles published between 2020 and 2025 in order to capture recent developments related to digital technologies and cybersecurity in ageing populations. Studies published before 2023 were retained because they provide relevant evidence on relatively stable determinants of digital participation, such as technophobia, digital literacy, technology confidence, access to support, and general cybersecurity awareness. However, the rapid emergence of generative AI and LLM-based assistants has changed the cybersecurity threat landscape. Therefore, AI-specific threats, including deepfakes, AI-generated phishing, and personalised manipulation, require continued empirical investigation.

Although the reviewed literature provides substantial insights into technophobia, digital readiness, and cybersecurity awareness among older adults, relatively few studies explicitly examine how these factors influence participation in digitally mediated environments such as smart communities or digital healthcare ecosystems. This gap highlights the need to integrate existing knowledge on digital inclusion and cybersecurity with emerging research on smart cities and digitally enabled healthcare infrastructures.

C. Study selection

The present study synthesises findings from two systematic literature reviews addressing (1) technophobia and technology readiness among older adults and (2) cybersecurity awareness among older adults. In the first review as seen at Figure 1, the initial search identified 46 articles across the selected databases. After removing duplicate records and applying inclusion and exclusion criteria, 15 studies were retained for the final analysis.

In the second review (as seen in Figure 2), the initial search identified 187 articles across IEEE Xplore, WoS, and Scopus. Following the removal of duplicates, title and abstract screening, and full-text eligibility assessment, 14 studies were included in the final sample. Together, these studies formed the basis for the integrative analysis conducted in this research. The selected literature was further analysed using qualitative content analysis to identify common themes related to technophobia, digital readiness, cybersecurity awareness, and their implications for the digital inclusion of older adults. To avoid double-counting, the two review streams were not treated as independent cumulative pools of evidence. Instead, the synthesis was conducted thematically, with studies used to identify recurring concepts, relationships, and gaps across technophobia and cybersecurity awareness. This approach helped reduce the risk of confirmation bias and supported a more balanced interpretation of the reviewed literature.

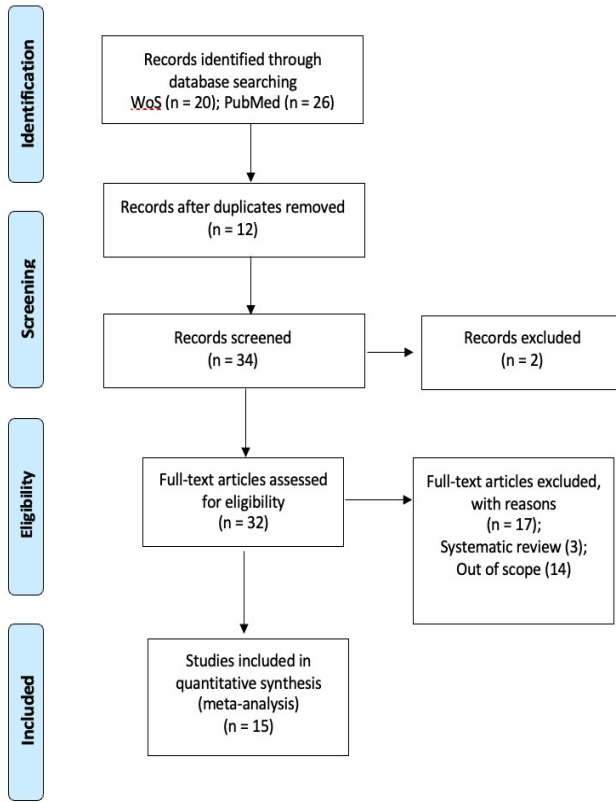


Fig. 1. Flowchart of the first study selection process.

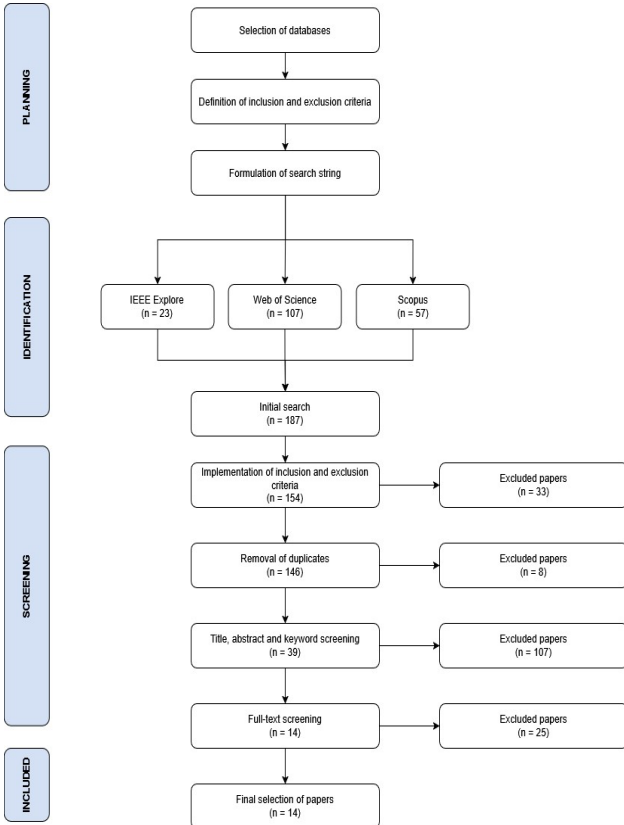


Fig. 2. Flowchart of the second study selection process.

III. SYNTHESIS OF LITERATURE FINDINGS

A. Key findings on technophobia and digital inclusion in smart communities

The first literature review analysed 15 studies examining technophobia among older adults and their participation in digital environments. The findings show that technophobia is influenced by several sociodemographic and psychosocial factors, particularly age, education level, digital literacy, and self-perceived technological competence [6], [7], [8], [21], [22]. Studies consistently highlight intergenerational learning and targeted digital education as the most effective approaches for reducing technophobia and strengthening digital skills among older adults [23], [24], [25].

AI-enabled smart community environments can support older adults' digital inclusion when technologies are introduced through guided exposure, supervised use, and user-centred design [11], [26]. Within such environments, older adults interact with technologies such as telehealth platforms, Ambient Assisted Living systems, socially assistive robots, and voice-user interfaces, which can support healthcare access, independent living, and social connectedness [27], [28]. However, research also shows that technophobia remains a significant barrier to adoption, often outweighing the positive effects of trust in technology [29]. Studies further emphasise the importance of continuous support and accessible training, as personalised and low-threshold learning approaches, such as remote assistance or community-based training, can significantly reduce technophobia and enable older adults to engage with digital services more confidently [30], [31]. Building on these findings, support can be understood as multidimensional, including technical, social, and community-based assistance. These forms of support may reduce practical barriers, strengthen confidence, and improve digital readiness. However, the reviewed studies do not provide sufficient comparative evidence to identify one universally superior pedagogical model; peer-led, instructor-led, individual, and group-based training may be effective under different conditions. Together, these findings suggest that AI-enabled smart communities should combine accessible design, guided learning, and ongoing support to strengthen digital literacy and confidence.

Older adults increasingly use digital technologies in AI-enabled smart communities, including telehealth platforms, smart home systems, and AI-based assistive technologies. Although these tools can support healthcare access, independence, and social participation, they also introduce cybersecurity risks. Limited digital literacy and cybersecurity awareness may increase vulnerability to phishing, identity theft, and social engineering, making digital skills and cybersecurity education essential for safe participation in smart community and digital healthcare systems.

B. Key findings on cybersecurity awareness among older adults

The findings indicate that cybersecurity awareness is shaped by a combination of demographic and contextual factors, particularly education level, digital experience, access to support, and living environment [19], [20], [32]. Older adults most frequently encounter cyber threats such as phishing, identity theft, and social engineering scams, which often exploit emotional manipulation and trust [33], [34], [35]

The review further shows that although many older adults adopt basic protective behaviours—such as avoiding public Wi-Fi networks or verifying suspicious messages—more advanced security practices are less consistently implemented, often due to limited digital skills or confidence [35], [36], [37]. Limited digital skills, low confidence in using digital technologies, and uncertainty regarding privacy and security settings often prevent older adults from adopting these more technically demanding protective measures.

These findings are particularly relevant in the context of AI-enabled smart communities, where older adults increasingly interact with digital services such as telehealth platforms, smart home systems, and AI-based assistive technologies. In such environments, cybersecurity awareness and digital literacy become essential prerequisites for safe participation, as insufficient knowledge of online risks may increase vulnerability to cyber threats while using interconnected smart community and digital healthcare services.

IV. CONCEPTUAL FRAMEWORK

Digital participation of older adults in smart communities can be understood as a multifaceted process shaped by several interrelated factors identified in the literature review. In particular, sociodemographic characteristics, technophobia, digital readiness, and cybersecurity awareness play a key role in determining whether older adults are able to safely and confidently engage with digital technologies in AI-enabled smart community environments.

The reviewed studies indicate that sociodemographic and contextual factors—such as age, education level, socioeconomic status, digital experience, and access to social or technical support—play an important role in shaping older adults' attitudes toward technology and their level of technophobia. As illustrated in Figure 3, these factors represent the starting point of the conceptual framework and influence how older adults perceive and engage with digital technologies. Higher levels of education, greater digital experience, and the availability of support are generally associated with lower levels of technophobia, whereas limited digital skills, insufficient support, and financial constraints may increase anxiety and uncertainty when interacting with digital technologies.

Technophobia, in turn, negatively influences digital readiness. Individuals who experience stronger feelings of anxiety or fear when using digital technologies are less likely to develop confidence in their digital skills and may show lower willingness to adopt new technologies. Digital readiness therefore reflects the level of digital literacy, confidence in using digital tools, and the willingness to engage with digital technologies. Lower levels of digital readiness may also limit the development of cybersecurity awareness. Individuals who lack confidence and experience in using digital technologies may find it more difficult to recognise potential cyber risks and apply safe online practices. Consequently, they may become more vulnerable to cyber threats such as phishing, identity theft, and social engineering attacks.

Within AI-enabled smart community environments, older adults increasingly interact with technologies such as telehealth platforms, smart home systems, Ambient Assisted Living solutions, and AI-based assistive technologies. Safe and confident participation in these environments therefore depends not only on access to digital technologies but also on sufficient digital readiness and cybersecurity awareness, which enable users to recognise potential risks and adopt appropriate security practices.

The conceptual framework presented in Figure 3 should be understood as a heuristic and conceptually derived model rather than as an empirically tested causal pathway. While it illustrates a plausible sequence between sociodemographic factors, technophobia, digital readiness, cybersecurity awareness, and safe participation, these relationships may also be bidirectional. For example, increased cybersecurity awareness and positive digital experiences may strengthen confidence and reduce technology-related anxiety. Similarly, the role of digital readiness as a mediator between technophobia and cybersecurity awareness is proposed conceptually rather than statistically tested in this study. Alternative relationships are also possible, including a direct effect of technophobia on cybersecurity awareness, since technology-related anxiety may discourage older adults from engaging with digital tools and learning about online risks. Future empirical studies should therefore test both mediated and direct pathways between technophobia, digital readiness, cybersecurity awareness, and safe digital participation. Finally, the proposed framework contributes to the literature by integrating insights from research on technophobia, digital inclusion, and cybersecurity awareness among older adults. While these aspects are often examined separately, the model demonstrates how they interact within AI-enabled smart community environments and provides a clearer understanding of the conditions required for safe digital participation.

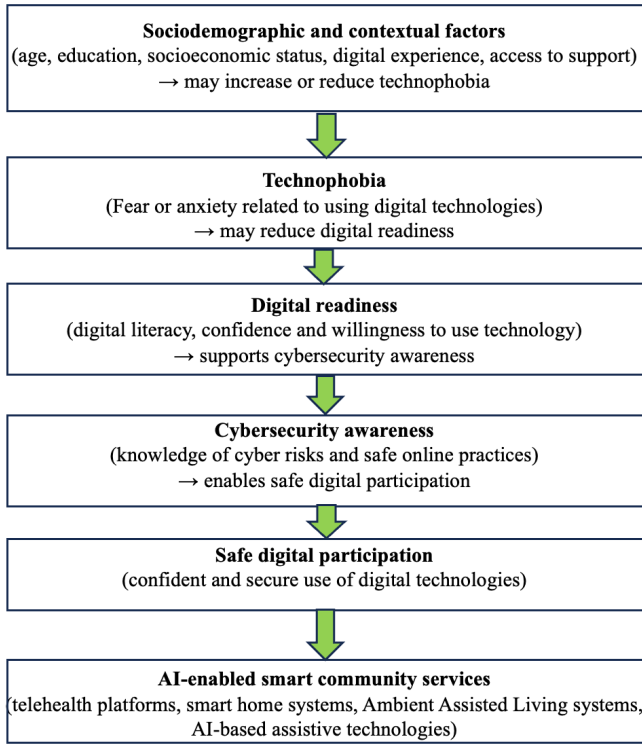


Figure 3. Conceptual framework of digital participation of older adults in AI-enabled smart communities

V. IDENTIFIED GAPS

Despite the growing body of research on technophobia, digital inclusion, and cybersecurity awareness among older adults, relatively few studies explicitly examine cybersecurity challenges within AI-enabled smart community environments. Existing literature often addresses these topics separately—for example, focusing on technology anxiety among older adults, cybersecurity awareness in general digital contexts, or the development of smart community technologies. However, limited attention has been given to how cybersecurity risks emerge when older adults interact with interconnected smart community systems such as telehealth platforms, smart home technologies, Ambient Assisted Living solutions, and AI-based assistive services. A further gap concerns the limited attention given to AI-driven cybersecurity and ethical risks that may specifically affect older adults in smart community environments. While existing studies frequently address phishing, identity theft, and social engineering, less attention has been paid to emerging AI-enabled threats such as deepfake scams, AI-generated phishing messages, personalised manipulation, and algorithmic bias. These risks are particularly relevant in digitally mediated healthcare and smart community services, where older adults may rely on automated recommendations, identity verification systems, or AI-based assistive technologies. Future research should therefore examine how AI-driven threats may influence trust, safety, and equitable access to services among older adults. This gap highlights the

need for further research that integrates perspectives from digital inclusion, cybersecurity, AI ethics, and smart community studies in order to better understand and support the safe digital participation of older adults in AI-enabled environments. Future research should also empirically validate the framework through longitudinal studies, participatory design, in-situ observation, and controlled simulations such as phishing or deepfake recognition tasks, with appropriate ethical safeguards.

VI. CONCLUSION

This study examined the role of technophobia, digital readiness, and cybersecurity awareness in shaping the digital participation of older adults within AI-enabled smart community environments. By synthesizing findings from two literature reviews, the study highlighted that older adults' engagement with digital technologies is influenced by a combination of sociodemographic factors, technological confidence, and access to support. The findings suggest that technophobia can significantly limit digital readiness, which in turn affects cybersecurity awareness and increases vulnerability to cyber threats in digital environments.

Based on these insights, the study proposed a conceptual framework that illustrates how these factors interact to influence the safe digital participation of older adults in AI-enabled smart communities. The model emphasizes that digital readiness and cybersecurity awareness represent key enabling conditions for the successful adoption of digital healthcare services, telehealth platforms, smart home technologies, and other AI-based assistive systems. By integrating insights from research on technophobia, digital inclusion, and cybersecurity awareness, the framework contributes to a better understanding of the conditions required for inclusive and secure smart community environments. The main achievement of this study is the development of an interdisciplinary framework that clarifies how social, technological, and cybersecurity-related factors jointly shape older adults' safe participation in AI-enabled smart communities. As a conceptual study, its main limitation is the absence of empirical validation; future research should therefore test the proposed relationships in real-world smart community and digital healthcare settings.

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