

Bridging the Digital Care Gap: Opportunities and Challenges of Technology-Supported Social Services for Older Adults in Slovenia and Croatia

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Abstract—The paper investigates the potential of digital technologies to enhance the quality of life of older adults in Slovenia and Croatia through a comparative empirical study. The research is based on a structured quantitative survey conducted between January and February 2025 among 458 social care service providers (238 in Croatia and 220 in Slovenia). The questionnaire examined providers' assessments of existing social care challenges, current availability of digital solutions, and perceived feasibility of introducing technological and social innovations in elderly care. Descriptive statistics were used to evaluate perceived barriers and opportunities, while exploratory Mann–Whitney U tests were examined between-country differences in the selected digital technology items. The results indicate that both countries face comparable structural constraints, primarily staff shortages and limited financial resources. The analysis further shows that providers perceive high feasibility and acceptance of low-complexity digital solutions, such as emergency alarm systems, video communication tools, and medication reminders, while advanced technologies, including robotics and virtual reality, remain less implemented and cautiously perceived. The findings highlight a significant discrepancy between recognized technological potential and practical implementation, suggesting the need for stronger institutional support, targeted training, and user-centered design approaches in the integration of digital innovations into social care services.

I. INTRODUCTION

Population ageing represents one of Europe's key demographic and social challenges and has a significant impact on the development and organization of social care services, a trend that similarly affects other developed countries worldwide [1]–[4]. In this context, countries such as Slovenia and Croatia, alongside other developed nations, are facing a growing proportion of older adults, increasing life expectancy and increasing needs for long-term care, support services and innovative forms of assistance that would enable older people to stay in their home environment for as long as possible and be actively involved in the community [5]. Alongside demographic changes, European countries are also facing the challenges of digitalization of services, as the extensive digitalization of public services may pose a risk of exclusion not only for certain groups of older people but also for social and health care employees [6]. This is particularly relevant for an increasingly ageing workforce, with a growing proportion

of professionals aged 60 and over, who may face additional challenges related to digital skills, adaptation to new technologies, and changing work processes if digitalization is not accompanied by targeted training, organizational support, and inclusive digital policies [7].

In both Slovenia and Croatia, the social welfare system is based on a combination of institutional and community-based forms of care. In Slovenia, the operation of social welfare services is regulated by the Social Welfare Act [8] and numerous implementing regulations and rules, with the strategic direction set by the Resolution on the National Social Welfare Program 2022–2030 [9], which emphasizes the accessibility of services and the strengthening of community-based forms of care. Similarly, in Croatia, the field of social services for the elderly is regulated by the Social Welfare Act [10] and supported by numerous strategic documents that highlight social inclusion, equal opportunities, and the development of integrated and user-friendly services. Despite relatively comparable normative starting points, both systems face similar challenges in practice, such as a lack of staff, limited financial resources, and weaker coordination [11]. In this context, digital and social innovations are increasingly recognized as one of the key responses to the pressures brought about by demographic change.

Strategic documents in both countries encourage the use of information and communication technologies and the development of user-oriented services [12]. A key aspect lies in how strategic directions are implemented in practice; therefore, this exploratory cross-border study examines implementation readiness for technology-supported elderly care from the perspective of social care providers in Slovenia and Croatia. Its main contribution is linking provider-level empirical evidence with a multilevel implementation pathway. The study addresses three research questions: RQ1: Which structural barriers do providers identify in elderly care services? RQ2: Which digital and social innovations are perceived as most feasible? RQ3: What priorities can guide a cross-border implementation agenda?

II. RESEARCH

Digital technologies and innovations are increasingly recognized as key approaches for adapting social welfare

services to an aging population; however, their effective use largely depends on whether health and social care professionals recognize the opportunities these technologies offer. When such potential is acknowledged, digital solutions can provide substantial support in daily work processes, contribute to more efficient service delivery, and reduce workload pressures [13]–[15]. A survey was conducted on this topic between 9 January and 28 February 2025, with the aim of gaining insight into existing services and challenges, as well as identifying opportunities for introducing digital and social innovations, as part of the Interreg CENTINOSS Project (*Center for Innovation in Social Care*).

A. Objective

The aim of the research was to analyze how social care service providers in Slovenia and Croatia assess the existing possibilities and potential of introducing digital innovations in support of older adults. Special emphasis is placed on understanding the perceived role of digital solutions in improving the quality of life of older adults, especially in the context of independent living, safety, social inclusion and accessibility of services.

B. Methodology and participants

The research was conducted using a structured online questionnaire intended for providers of social care services for older adults in Slovenia and Croatia. The purpose of the questionnaire was to gain insight into the perceptions of providers regarding the existing possibilities and potential of introducing digital innovations within social care services, with a particular focus on their contribution to improving the quality of life of older adults.

In Croatia, 238 providers of social services for the elderly participated in the survey. Public institutions dominated the survey, representing most valid responses, followed by private providers and, to a lesser extent, other organizational forms. In Slovenia, a total of 220 providers participated, which were also mainly public institutions that play a key role in providing institutional and community-based forms of care. In both countries, participants assessed the possibilities of introducing concrete digital solutions using five ordered categories (1–5) indicating increasing availability or implementation, and an additional non-ordered option, 6 = cannot assess. The latter was retained in the descriptive interpretation as an indicator of limited familiarity with a technology but was excluded itemwise from the inferential tests. Between-country differences in the ten digital technology items were examined using two-sided Mann–Whitney U tests; Holm-adjusted p-values and effect sizes ($r = Z/\sqrt{N}$) were used to interpret the results. Non-responses were excluded itemwise.

III. RESULTS WITH DISCUSSION

The responses provide insight into the experiences and opinions of social service providers regarding the use of digital technologies and innovations in the context of improving the quality of life of older adults.

A. Assessment of the current situation in the field of social care services

In Slovenia, social service providers most frequently identified staff shortages as the greatest challenge in the provision of social care services for older adults, with 59% of respondents ranking it as the most significant obstacle. This was followed by a lack of financial resources ($M = 2.4$), while challenges such as poor coordination between the health and social sectors, insufficient legislative support and limited support from local decision-makers were rated as less critical. Geographic accessibility was rated as the least problematic of the listed challenges ($M = 5.0$).

In Croatia, providers of social services for the elderly also most often highlighted the lack of staff as the biggest challenge in providing services ($M = 1.42$) and was ranked first among the challenges in most cases. The second most important challenge is the lack of financial resources ($M = 1.99$). Challenges related to poor coordination between the health and social sectors, insufficient legislative support and limited support from decision-makers in the local community were rated as moderately important. Geographic accessibility was also rated as the least problematic challenge in Croatia ($M = 3.82$). Fig. 1 provides a comparative overview of the relative importance of identified challenges, emphasizing the structural nature of workforce and funding limitations within social care systems in both countries.

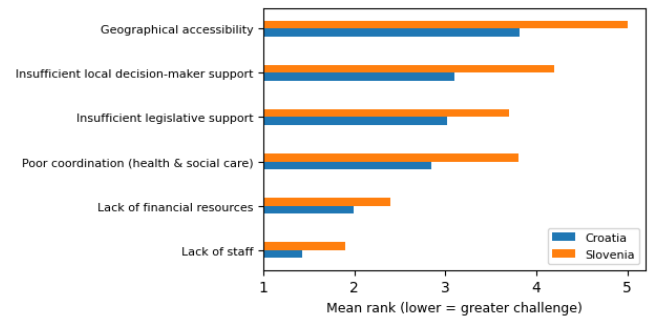


Fig. 1 Key challenges in providing social services for older adults

B. Assessment of the current situation in the field of digital technologies

In Slovenia, social care providers generally assessed the possibilities of introducing digital innovations to improve the quality of life of older adults as insufficient, but with a strong need for further development. For most of the innovations discussed, most respondents chose the answer "we want more options", which indicates the generally recognized potential of digital solutions, while at the same time lacking systemic support and widespread use in practice. The most positively evaluated innovations were applications enabling easy video calls with friends and family, with 40% of respondents indicating a desire for more opportunities ($M = 3.3$; $SD = 1.2$), followed by tablets adapted for older users, with 37% of respondents expressing a desire for more options ($M = 3.1$; $SD = 1.2$). For safety-oriented solutions such as GPS tracking for people with dementia or at risk of getting lost, 39% of respondents expressed a need for more options ($M = 2.9$; $SD = 1.4$). For e-books and audiobooks, Slovenian social service providers expressed their potential for improving the quality of

life of older adults, as the average feasibility assessment ranges from the need for more options ($M = 3.1$; $SD = 1.2$). Virtual reality was assessed as a less feasible digital solution, as the average value indicates limited existing options and a cautious attitude of social care providers towards such technologically demanding innovations ($M = 2.7$; $SD = 1.5$).

In Croatia, social service providers perceive that the possibilities for introducing digital innovations to support the quality of life of older people are still limited, but at the same time they express a clear need for their upgrading and wider use. The assessment "we want more options" prevails in most of the solutions discussed, which shows that they recognize digital technologies as a promising development direction, which is not yet properly positioned in the existing system. Among the more accepted forms of digital innovation, applications for video communication with family and friends stand out, with a good third of participants expressed a need for additional options ($M = 2.95$; $SD = 1.3$), and tablets adapted for older users, for which a similarly large proportion of participants highlighted a desire for improved accessibility ($M = 2.83$; $SD = 1.32$). The social care providers also paid special attention to solutions related to safety and health. GPS tracking for people with dementia or an increased risk of loss was assessed as meaningful and useful, but not yet sufficiently widespread ($M = 2.89$; $SD = 1.47$). The respondents assessed the possibilities of introducing virtual reality glasses as low, which indicates that this technology is poorly spread in the context of elderly care and is still quite far from everyday practice ($M = 2.40$; $SD = 1.53$).

In both countries, the highest average scores are achieved by video calling applications, with Slovenia achieving a slightly higher average value ($M = 3.3$) than Croatia ($M = 2.95$). A similar pattern is observed for tablets adapted for older users, and for e-books and audiobooks, where the average values in both countries are around the value "we want more options". This shows that these technologies are recognized as useful. For GPS tracking, the perceived options in Slovenia ($M = 2.9$) and Croatia ($M = 2.89$) are very similar, indicating that it is a technology with clearly perceived potential in the field of security. Lower average scores are achieved by virtual reality in both countries, with the perceived feasibility being slightly higher in Slovenia ($M = 2.7$) than in Croatia ($M = 2.4$) (Fig. 2).

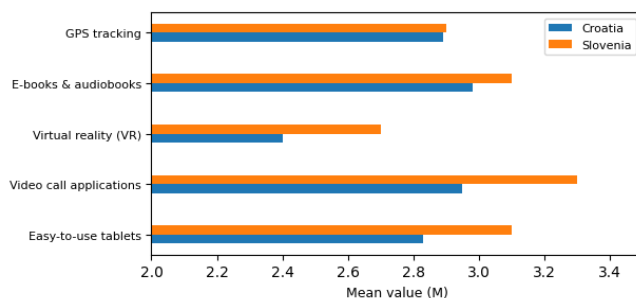


Fig. 2 Perceived feasibility of technological innovations 1-5

Among digital solutions, emergency alarm systems were rated as the most established technology in Slovenia ($M = 3.2$; $SD = 1.3$). Similarly, medical reminders were recognized as meaningful and useful support for older adults, but not yet widespread enough, which is reflected in the average rating,

which also indicates a desire for more options ($M = 2.9$; $SD = 1.3$). Smart digital devices adapted to older users were recognized as having the potential to support independence and daily functioning ($M = 3.1$; $SD = 1.2$). In contrast, care and social robots were rated significantly more cautiously. Robots for physical care assistance achieve a low average score, indicating limited existing options ($M = 2.4$; $SD = 1.6$), while social robots were rated even lower, reflecting their very limited presence and the cautious attitude of social care providers towards their use in practice ($M = 2.3$; $SD = 1.6$).

Among the digital solutions discussed, emergency alarm systems were perceived as the most established form of support for older adults also in Croatia, with the average score indicating their partial presence in practice and the need for further expansion ($M = 3.1$; $SD = 1.2$). Medical reminders were assessed as a sensible and useful solution, but not yet widespread enough, which is reflected in the average score indicating a desire for more options and systemic support ($M = 2.9$; $SD = 1.3$). Smart digital devices adapted to older users were also assessed relatively positively, as social care providers recognize their potential to support independence and daily functioning ($M = 3.0$; $SD = 1.2$). Care robots achieve a low average score, indicating limited existing options and numerous organizational and technological barriers to their introduction ($M = 2.2$; $SD = 1.5$), while social robots were rated even lower, reflecting their very limited presence in current practice ($M = 2.1$; $SD = 1.5$).

A comparison of Slovenia and Croatia in these digital solutions shows a very similar pattern in both countries. Emergency alarm systems are recognized as the most established and practically applicable technology in both environments, with Slovenia achieving a slightly higher average score than Croatia. Medical reminders and smart digital devices adapted to older users are also rated relatively positively in both countries, but the average scores consistently indicate the need for wider use and additional system support, with small differences between the countries. In contrast, robotic care solutions and social robots are rated significantly lower in both countries, reflecting their very limited presence in practice and a low level of readiness for their introduction. Overall, the findings show that Slovenia and Croatia are very similar in terms of the perceived feasibility of these technologies, with Slovenia achieving slightly higher average scores for most items, while the differences remain relatively small (Fig. 3).

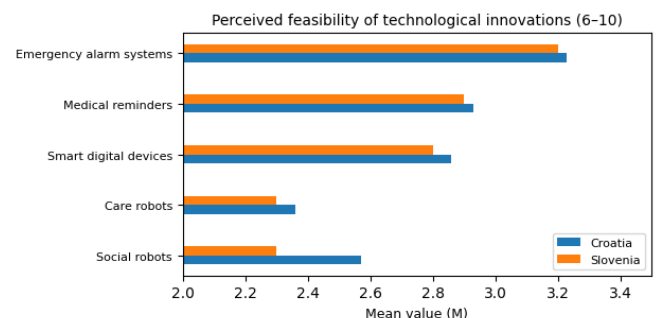


Fig. 3 Perceived feasibility of technological innovations 6-10

C. Comparing similarities and differences between countries

Across the two countries, the findings reveal a shared implementation gap: social care providers recognize the potential of digital technologies, yet their availability and routine integration into elderly care remain limited. Staff shortages and limited financial resources represent the main structural constraints, while low-complexity and safety-oriented solutions, such as emergency alarm systems, medication reminders, GPS tracking, and video calls, are perceived as more feasible than robotics or virtual reality. Slovenia shows slightly higher average scores for several technologies, whereas Croatian providers more often emphasize the need for future expansion. Overall, the results suggest comparable readiness profiles rather than fundamentally different national models.

To assess whether the observed descriptive differences were statistically supported, Mann–Whitney U tests were performed for the ten digital technology items using valid ordered responses only. The non-ordered “cannot assess” category was excluded from the inferential tests. After Holm correction, only easy-to-use tablets differed significantly between countries ($U = 17294.5$, Holm-adjusted $p = 0.018$, $r = 0.168$), with higher ordered assessments among Slovenian providers. Video-call applications showed an unadjusted difference ($p = 0.021$), but this did not remain significant after Holm correction (Holm-adjusted $p = 0.188$). No other between-country differences remained statistically significant after Holm correction for GPS tracking, e-books and audiobooks, virtual reality, emergency alarm systems, medication reminders, smart digital devices, care robots, or social robots. Since all effect sizes were small, the inferential results support the interpretation that Slovenia and Croatia show broadly comparable implementation-readiness profiles, with differences mainly reflecting variation in degree rather than fundamentally different national models.

Taken together, the descriptive and inferential findings suggest that this implementation gap should be interpreted as a digital inclusion issue rather than a purely technological problem. Even when digital tools are available, their effective use depends on older adults’ digital skills, confidence, individual preferences, and access to practical support from providers [16], [17]. European policy and recent studies similarly emphasize digital competences, inclusive access to e-health and social services, and tailored learning support as preconditions for reducing inequalities in ageing societies [18]–[20]. Comparative European evidence further shows that digital inclusion varies across national contexts and is shaped by digital literacy programmes, mentoring opportunities, and broader structural or educational disparities [21]–[24]. The present findings are consistent with this literature: scaling up digital technologies in elderly care requires not only equipment and infrastructure, but also staff training, user-centered guidance, and the involvement of older adults in co-designing solutions.

IV. IMPLEMENTING AN ACTION PLAN FOR SCALING UP DIGITAL TECHNOLOGIES IN ELDERLY CARE

Based on the empirical findings of this study and with reference to existing strategic frameworks at the European and national levels, an action plan for scaling up the use of digital

technologies in elderly care services in Slovenia and Croatia was developed. At the European level, the agenda aligns with the European Care Strategy [25], which emphasizes accessibility, quality, workforce sustainability, and digital innovation in long-term care systems. At the national level, it builds upon the regulatory and strategic documents governing social care systems in Slovenia and Croatia, as discussed in the Introduction. Importantly, the agenda is explicitly grounded in cross-border cooperation between Slovenia and Croatia, reflecting the shared structural challenges of the two systems as well as their institutional and organizational specificities.

The results demonstrate a consistent gap between the recognized potential of digital technologies and their actual implementation in everyday care practices in both countries. While social care providers in Slovenia and Croatia express openness toward digital solutions, particularly low-complexity and safety-oriented technologies, their use remains constrained by structural, organizational, and competence-related barriers. At the same time, the comparative analysis reveals nuanced differences in perceived feasibility, availability, and readiness for implementation between the two national contexts.

In this regard, Slovenia currently demonstrates a more advanced position, having already tested the formal introduction of e-care services through pilot projects as early as 2018, within broader efforts supporting the transition toward a systemic long-term care framework [26]–[27]. These pilot initiatives contributed to experiential learning in the integration of digital solutions into care practices and were followed by the adoption of Slovenia’s first Long-Term Care Act in 2021 [28]. However, the subsequent implementation phase also revealed a range of challenges, including organizational adaptation, coordination across sectors, and issues related to the acceptance and use of digital technologies among professionals and users alike [6], [29].

In contrast, Croatia is currently entering a phase of intensified pilot activities and strategic planning aimed at establishing a more comprehensive and systemic framework for elderly care. From this perspective, the two countries represent different stages of policy and implementation cycles, creating significant opportunities for cross-border learning and the transfer of experience. Slovenia’s practical insights from early implementation [30], both successful approaches and encountered obstacles, can inform Croatia’s ongoing system development, while Croatia’s pilot-based approach offers a testing ground for adaptable and context-sensitive solutions. Taken together, these findings indicate that digital transformation in elderly care cannot be achieved solely through technological availability but requires coordinated, context-sensitive, and cross-border actions across multiple system levels.

In response to these findings, a multilevel implementation agenda with an action-oriented perspective was formulated within the framework of cross-border collaboration between the Laboratory for the Development of Assistive Technologies at Alma Mater Europaea University (Slovenia) and the Centre for Innovation of the Primorje-Gorski Kotar County (Croatia). The proposed framework, presented in Fig. 4, conceptualizes digital implementation as a pathway that connects European policy frameworks with national system support, organizational integration, staff competencies, and outcomes

for older adults, while enabling mutual learning and transfer of good practices between the two countries.



Fig. 4 Multilevel Implementation Pathway for Digital Technologies in Elderly Care

At the European and national levels, the agenda highlights the importance of translating strategic commitments into operational mechanisms that are compatible across borders, including stable funding schemes, service standards, and structured training programs. At the organizational level, implementation requires internal coordination, designated responsibilities, and the normalization of digital technologies within everyday workflows. Progress at this level can be monitored through process-oriented key performance indicators, including the appointment of a digital-care coordinator, completion of practical digital-skills training among care staff, adoption of written digital-care protocols, average response time to emergency alarms, number of unresolved technical incidents or maintenance requests, proportion of users receiving onboarding support, and annual cross-border exchanges of implementation practices. These indicators focus on organizational readiness, workflow integration, and sustainability of use rather than on the technical performance of individual devices. At the professional level, awareness-building and practice-oriented training remain key conditions for acceptance and sustainable use, particularly when technologies are perceived as supporting, rather than burdening, daily care work.

In addition to its implementation focus, the agenda also defines key directions for further research. Because the present survey did not collect device-level technical data, future implementation-oriented studies should also examine technical requirements, interoperability, data protection and ethical

issues, maintenance costs, and long-term support models for smart devices, alarm systems, and robotic solutions.

Beyond these device-level issues, further research should examine systemic, organizational, and individual barriers affecting the integration of digital solutions within each national context, as the comparative findings suggest that institutional settings, service organization, and professional practices may shape implementation pathways. Such analyses would enable a more precise understanding of country-specific challenges and support the development of tailored implementation strategies within a shared cross-border framework. Comparative research across additional European contexts would further contribute to understanding the role of institutional and cultural factors in shaping technology adoption. Moreover, longitudinal studies are needed to assess the long-term effects of digital technologies on the quality of life, autonomy, and social inclusion of older adults [31]–[32], as well as on workforce sustainability in social care systems.

By integrating cross-border implementation pathways with research priorities, this agenda provides a coherent framework for advancing both practical application and scientific understanding of digital technologies in elderly care. It directly responds to the empirical evidence presented in this study and supports a shift from fragmented pilot initiatives toward more systemic, coordinated, and sustainable digital innovation across Slovenia and Croatia.

V. CONCLUSION

The research showed that social service providers in Slovenia and Croatia face similar structural challenges, such as staff shortages and limited financial resources, which limit the wider use of digital innovations. At the same time, there is a clear willingness to use digital technologies, with low-tech solutions such as alarm systems, medical reminders and video call applications being better accepted than more advanced technologies such as social robots or care robots. The exploratory Mann–Whitney U tests largely confirmed this descriptive pattern, with only easy-to-use tablets showing a statistically significant between-country difference after Holm correction and with a small effect size.

The results highlight the gap between identified needs and available options, indicating the need for systemic support and staff training. European strategies and initiatives promoting digital skills and the inclusion of older people in the digital society represent an important framework support for reducing digital inequalities. For the future, further research into the effects of digital innovations on the quality of life of older people and examining the factors influencing the adoption of technologies is crucial.

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