

Intergenerational Community Spaces as Social Infrastructure for Reducing Loneliness and Digital Exclusion in Ageing Smart Cities

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Abstract - Loneliness and digital exclusion among older adults are increasingly recognized as important public health challenges in ageing smart cities. Recent research highlights the importance of social infrastructure, community participation, and intergenerational interaction in reducing social isolation and supporting healthy ageing.

This paper explores the relationship between loneliness, digital exclusion, and intergenerational community spaces through a conceptual synthesis of recent literature and selected international examples. A review of studies indexed in the Scopus database indicates growing scholarly interest in intergenerational approaches, social infrastructure, and digital inclusion over the last decade.

Existing evidence suggests that accessible community spaces and intergenerational programs may strengthen social connectedness, digital inclusion, and participation among older adults. International examples, including the Slovenian network of multi-generational community centres (VGC+), illustrate the growing importance of community-based approaches within age-friendly smart city development.

The paper concludes by identifying future research directions related to spatial planning, digital inclusion, and long-term sustainability of intergenerational community spaces.

I. INTRODUCTION

Loneliness and social isolation among older adults have become important public health challenges over the past decade, requiring broader systemic responses within the framework of the World Health Organization's Decade of Healthy Ageing initiative [1]. The growing prevalence of these conditions not only affects psychological well-being and quality of life, but also places increasing pressure on health and social systems. In contemporary smart city environments, older adults additionally face forms of digital exclusion that have been identified as important predictors of social isolation [2]. Research increasingly emphasizes that loneliness is not merely an individual problem, but is also influenced by broader social factors, including accessibility of community spaces and availability of social infrastructure within urban environments [3],[8].

Previous interventions addressing loneliness have often focused primarily on individual-level approaches, while more recent studies highlight the importance of structured social interaction and community-based support [6].

In this context, intergenerational cooperation has emerged as an important approach for strengthening social participation and reducing social isolation among older adults [7].

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Studies of student-led intergenerational programs report positive effects on psychological well-being and life satisfaction among institutionalized older adults [9]. Similarly, virtual reverse mentoring initiatives suggest that supportive intergenerational interaction may improve digital confidence and reduce subjective feelings of loneliness in technological environments [10].

Existing research additionally suggests that digital solutions alone are insufficient for reducing loneliness without accessible and socially inclusive community environments [10]. In this context, intergenerational community spaces may represent an important form of social infrastructure that combines community participation, intergenerational interaction, and digital inclusion within local environments. Previous studies indicate that accessible community hubs can support social connectedness, knowledge exchange, and social participation among older adults [11], including vulnerable groups during transitional life periods such as the time following hospital discharge [5].

II. LITERATURE REVIEW

To identify relevant literature, an exploratory search was conducted in the Scopus database in February 2026 using a combination of keywords related to intergenerational approaches, social infrastructure, community spaces, loneliness, digital exclusion, and ageing populations.

The search strategy combined Boolean operators ("AND", "OR") and the TITLE-ABS-KEY function in Scopus. The search yielded 433 documents. Figure 1 illustrates the annual publication output between 2016 and 2025.

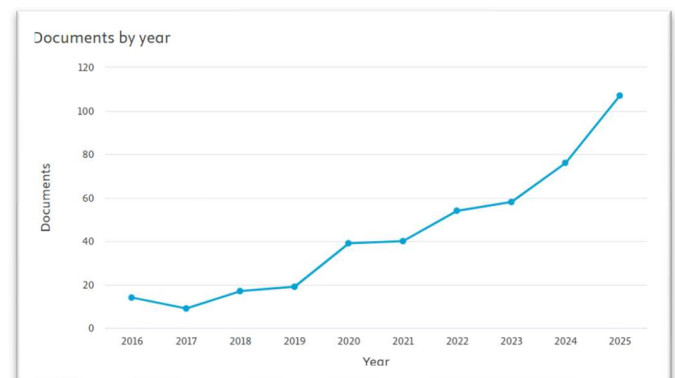


Fig. 1: Annual number of Scopus-indexed publications related to intergenerational approaches, social infrastructure, loneliness, and digital inclusion (2016–2025).

The findings indicate a substantial increase in scholarly interest in intergenerational initiatives, social infrastructure, community-based approaches, loneliness prevention, and digital inclusion among older adults over the last five years.

A review of the literature on the various aspects of this topic indicates that understanding loneliness in contemporary urban environments requires a broader insight into the relationship between social infrastructure, digital inclusion, and intergenerational participation. Recent studies increasingly describe loneliness not only as an individual psychological condition, but also as a structural consequence of weakened community ties, declining public interaction spaces, and unequal access to social and digital participation [10], [11], [12].

Several authors emphasize the importance of social infrastructure in mitigating loneliness among older adults. Research on urban communities demonstrates that access to libraries, community centres, parks, and informal “third places” significantly contributes to social interaction and community cohesion [10]. A recent European study additionally confirmed that higher availability of social infrastructure is associated with statistically lower levels of loneliness, particularly among older adults living alone [6]. Similarly, a scoping review on the social infrastructure of loneliness argues that loneliness is increasingly linked to the disappearance of accessible public spaces that enable informal and low-threshold social interaction [11]. These findings suggest that age-friendly urban environments require not only technological development, but also investment in accessible and socially inclusive community spaces.

Another major theme emerging from the literature is digital exclusion. Longitudinal analyses conducted across multiple countries show that limited digital access and low digital literacy are among the strongest predictors of loneliness and social isolation in older populations [4]. Researchers argue that older adults who lack digital competencies are increasingly excluded not only from communication, but also from access to health information, social participation, and community services. Importantly, the relationship between digital exclusion and loneliness appears consistent across different socioeconomic and cultural contexts, suggesting that digital inequality represents a broader structural challenge in ageing societies [9].

In response to these challenges, numerous studies highlight the potential of intergenerational programs. A systematic review of 54 studies by Canedo-García et al. [11] found that intergenerational initiatives significantly improve social inclusion, self-esteem, and perceptions of usefulness among older adults, while simultaneously reducing age-related stereotypes among younger participants [2]. Similar findings were reported in studies focusing on digital intergenerational programs, where technology became a medium for social connection rather than merely a technical skill [1]. Digital intergenerational programs additionally suggest that the effectiveness of such programs depends strongly on reciprocity, empathy, and the development of trust between generations. Their review showed that older adults experience reduced technological anxiety and increased digital confidence when learning occurs through supportive intergenerational relationships rather than formal instruction alone [12].

Particularly promising are reverse mentoring approaches, in which students and young volunteers support older adults in the use of digital technologies. Evaluation of the Cyber-Seniors program demonstrated statistically significant reductions in loneliness after participation in virtual intergenerational mentoring activities [10]. Participants also reported increased confidence in using digital communication tools and stronger feelings of social connectedness. Similarly, recent student-led intergenerational support programs showed positive effects on psychological well-being, life satisfaction, and resilience among institutionalized older adults [9]. These findings indicate that intergenerational interaction itself may be as important as digital learning outcomes.

The literature also highlights the importance of continuity of social support during vulnerable life transitions. Zheng et al. proposed an intergenerational mentoring model for older adults following discharge from emergency care, arguing that structured social contact with younger volunteers may reduce the risk of re-isolation and improve emotional well-being [5]. Their work introduces the concept of generativity, suggesting that older adults experience greater meaning, motivation, and social engagement when they are included in reciprocal intergenerational relationships rather than passive support systems.

Taken together, these findings suggest that effective responses to loneliness and digital exclusion require integrated community-based strategies that combine social infrastructure, intergenerational participation, accessible public spaces, and digital support. The literature increasingly supports the idea that community environments designed around interaction, inclusion, and participation may play a central role in promoting healthy and socially connected ageing in smart cities.

III. COMMUNITY SPACES AS SOCIAL INFRASTRUCTURE

Intergenerational Community Spaces (ICS) should not be understood as an entirely new intervention, but rather as a conceptual approach that integrates existing evidence on social infrastructure, intergenerational participation, and digital inclusion in the context of smart cities and healthy ageing. The concept builds upon research showing that loneliness among older adults is closely associated with limited social participation, reduced accessibility of community spaces, and digital exclusion [9], [10], [11], [12]. Comparable approaches have already been identified internationally. A recent Canadian case study from Quebec demonstrated that age-friendly environments are most effective when they combine accessible public spaces, intergenerational opportunities, community services, and coordinated local policies [13]. The authors identified “proximity” and “transversality” as key mechanisms supporting active ageing and social participation.

In the study, proximity was understood not only as physical accessibility, but also as a relational and social dimension of community life. Human-scale urban planning, concentration of services within local neighbourhoods, and accessible community infrastructures were associated with stronger social participation, feelings of safety, and a greater sense of belonging among older adults. The authors additionally emphasized the importance of outreach community services

and active listening to older adults' needs within local governance structures.

The concept of transversality referred to integrated and cross-sectoral approaches combining urban planning, social participation, intergenerational spaces, and unified municipal policies. Particularly important were intergenerational public spaces that encouraged informal interaction between generations, as well as community programs designed to support participation across different age groups. The study further highlighted that accessibility should be understood broadly, including not only physical and financial accessibility, but also psychological and social accessibility, especially for older adults experiencing isolation or reduced mobility.

Similar principles are also reflected in Slovenian strategic policy documents. The Strategy of a Long-Lived Society emphasizes intergenerational cooperation, active participation of older adults, and the development of environments that support social inclusion and quality ageing. The strategy specifically highlights the importance of intergenerational knowledge transfer, community participation, and the establishment of intergenerational centres and other structures that enable social connectedness across age groups [14].

These policy orientations have also been operationalized through the development of multi-generational community centres (VGC+), financed through the European Social Fund Plus. Since 2024, a national network of 16 centres has been operating across Slovenia, providing accessible intergenerational spaces, community activities, social support, education, and preventive programmes for vulnerable groups, including older adults. The centres are intended to strengthen local social inclusion, intergenerational interaction, and community participation, particularly in smaller municipalities where they function as important local social hubs. Current project financing is planned until 2029.

The concept of Intergenerational Community Spaces is therefore based on the assumption that technological solutions alone are insufficient for addressing loneliness and social isolation among older adults. Existing research increasingly suggests that digital inclusion is most effective when embedded within accessible community environments that enable regular social interaction, intergenerational contact, and participation in local community life. In this context, ICS may represent a useful conceptual direction for integrating digital support, social infrastructure, and community participation within age-friendly smart city development.

Despite their potential benefits, intergenerational community spaces may also face important implementation challenges. These include long-term financial sustainability, availability of trained social mediators and volunteers, unequal accessibility between urban and rural environments, and differences in local institutional capacities. Additional challenges may arise from varying levels of digital literacy, mobility limitations among older adults, and dependence on temporary project-based financing mechanisms.

IV. RESEARCH AGENDA

Recent research increasingly highlights the importance of intergenerational community spaces as critical forms of social infrastructure in ageing societies. Existing studies demonstrate that social participation, intergenerational interaction, and digital inclusion can significantly contribute to reducing loneliness and improving quality of life among older adults. At the same time, important research gaps remain regarding the long-term effectiveness, spatial organization, and sustainability of these community-based models within contemporary smart city development.

Future research should:

1. Investigate how spatial design and social infrastructure influence intergenerational interaction and social connectedness among older adults. Research in this area should explore the role of shared spaces, accessibility, semi-public environments, and community-oriented architectural design in fostering spontaneous everyday interaction, strengthening social cohesion, and reducing loneliness. Particular attention should also be devoted to GIS-based spatial analysis, walkability assessment, and accessibility indicators that could support evidence-based planning and territorial distribution of intergenerational community spaces within smart city environments.
2. Study the integration of digital inclusion initiatives within intergenerational community spaces. Future studies should examine how reverse mentoring programs, digital literacy activities, and technology-supported community participation influence digital confidence, social participation, and psychological well-being among older adults in smart city environments.
3. Evaluate the long-term sustainability and effectiveness of intergenerational community centres. Particular attention should be given to Slovenian multi-generational community centres (VGC+) and their role in reducing loneliness, improving quality of life, and strengthening local social participation. Research should additionally investigate governance structures, cross-sector collaboration, and innovative financing mechanisms that could support the continuity of such centres beyond temporary European Social Fund financing periods.

By addressing these research priorities, future studies can contribute to a better understanding of intergenerational community spaces as integrated social infrastructures that combine physical space, community participation, and digital inclusion. Such research may provide evidence-based recommendations for policymakers, urban planners, healthcare professionals, and local communities seeking to develop more inclusive, socially connected, and age-friendly smart cities.

V. CONCLUSION

This paper explored the relationship between loneliness, digital exclusion, social infrastructure, and intergenerational participation in ageing smart cities. The reviewed literature shows that loneliness among older adults is influenced not only by individual factors, but also by the accessibility of community spaces, opportunities for social participation, and digital inclusion.

Existing studies suggest that technological solutions alone are not enough to reduce social isolation without accessible and socially inclusive community environments. In this context, intergenerational community spaces may represent a useful approach that combines social infrastructure, digital support, and intergenerational interaction within local communities.

International examples, including the Canadian case study and the Slovenian network of multi-generational community centres, demonstrate the growing importance of community-based approaches for supporting active ageing and social connectedness. At the same time, important challenges remain related to long-term sustainability, accessibility, governance, and financing.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors confirm that the original conceptual framework and synthesis of the primary sources provided the basis for this work. During the preparation of this manuscript, generative AI tools were used to improve language clarity, readability, and structural formatting. The authors reviewed and integrated the generated suggestions to ensure consistency with the research objectives.

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