How Can Municipalities Support Aging in Place using Technological Innovations? A Single-case Study in a Canadian City

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Abstract: Governmental planning has to reflect the worldwide shift in demographics as the proportion of older adults is rapidly growing. Concepts such as age-friendly cities and smart cities suggest that municipalities and technologies have a role to play in supporting older citizens. Still, it is not clear how municipalities can actually support aging in place via technology? This single case-study in the city of Côte Saint-Luc, Quebec, Canada gathered via eight focus groups, the perspectives of older citizens, caregivers, and representatives of the City regarding this subject. The approach of Miles et al. (2014) was used for data analysis. Stakeholders believe the City could support aging in place by helping older citizens access existing services through technology. Furthermore, the City could provide an existing infrastructure, maintain the trust of older citizens regarding privacy issues and provide appropriate technology at a cheaper cost. Nonetheless, additional resources and various partners are necessary to undertake this technological endeavour. The City's main responsibility would be related to the coordination of the new technological ecosystem comprising older citizens, their caregivers, volunteers, and partners providing services. More research involving multiple stakeholders is needed to conceptualize this technological ecosystem before implementing it in a real-world setting.

1 INTRODUCTION

Worldwide governments have been facing a shift in demographics as the proportion of older adults is rapidly growing in many parts of the world (United Nations, 2020). These changes are not only taken into account within governmental planning at a national level, but also at a municipal level. Cities contribute to the development and maintenance of living environments adapted to the needs of citizens as well as promoting economic activity in their territory (https://www.mamh.gouv.qc.ca/organisation-munici pale/organisation-territoriale/organisation-territoriale -municipale/regime-municipal-general/). More specifically, they may have decisional power regarding housing, roads, community and cultural development, recreation, urban public transport, and wastewater treatment.

Cities have the power to put in place initiatives to facilitate the lives of older citizens. In 2007, the World Health Organization (WHO) introduced the concept of age-friendly cities to support active ageing. The main idea is that cities adapt their structures and services to the needs of older citizens as a mean to promote health, participation, security and consequently quality of life. In recent years, the

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concept of smart cities has been also introduced as a way of better planning and supporting older citizens and optimizing the use of resources with technologies. Smart cities combine the City's infrastructure with information technologies in an effort to collect and analyze important quantities of data to offer better services based on citizens' needs (Winkowska et al., 2019). According to a recent systematic review, smart cities aiming to have an impact on healthcare mainly use technologies to support "population surveillance, active ageing, healthy lifestyles, disabled people, response to emergencies, care services organization, and socialization" (Rocha et al., 2019; p.1). As for the promotion of active ageing through technology, it can involve assessing for frailty (e.g. Abril-Jimanez et al. 2019), platforms that facilitate community engagement (e.g. Gomes et al., 2017; Righi et al., 2015) and applications to support daily activities (e.g. Liming et al., 2015; Villarrubia et al., 2014).

Torku et al. (2020) considers that age-friendly initiatives can be integrated in smart cities but more research is needed as their recent systematic review identified many barriers that can hinder their implementation: social, financial, political physical/environmental, and technological. For example, even if the integration of technologies is central to the concept of smart cities, their adoption by older adult is not guaranteed. A systematic review by Benoit-Dubé et al. (2020) concludes that older adults are more inclined to accept technology if they perceive benefits related to the technology, they know they can use it efficiently and safely, it is affordable and it will adapt to their physical and cognitive declines in the coming years. This means that the perspectives of older citizens have to be taken into account when choosing which technologies may be integrated in smart cities.

Garon et al. (2014) also notes that successful age-friendly initiatives are grounded by members of the communities such as community organizations, as well as representatives of private and municipal instances. The combination of these different perspectives is crucial in understanding the older adults' situation and needs. Furthermore, sharing power is also important. Righi et al. (2015) stress the importance of agency in the process of developing smarter cities and older adults should be able to suggest scenarios and not only respond to those developed by other stakeholders. Regarding the socioeconomical aspects of smart cities, Winkowska et al. (2019) reports that: "The role of inhabitants and local stakeholders stands out, meaning their participation in managing public affairs and decisions

making processes. There is a strong need for creating transparent principles of collaboration between local government and residents" (p.77).

These studies suggest that the development of smart cities has to be grounded in the perspectives of stakeholders and use a collaborative approach from the beginning. Before undertaking age-friendly initiatives, City officials and other stakeholders must first deliberate together on the following question: How can this city help older citizens stay at home using technological innovations?

2 STUDY SETTING

In 2017, Infrastructure Canada challenged municipalities and Indigenous communities across Canada to improve the lives of their residents through innovation, data and connected technology (https://www.infrastructure.gc.ca/cities-villes/index-eng.html). In this challenge, the winning projects selected by Infrastructure Canada would receive between 5 and 50 million in funding to implement their initiative depending on the size of the population. The City of Côte Saint-Luc (about 35 000 residents) submitted a proposal in 2018 (SHARED: Senior Health and Real-time Environmental Data) that was selected among the 10 finalists in the category of cities comprising between 30,000 to 500,000 residents. Therefore, the City received funding to develop a more in-depth proposition for the final phase of the contest. To develop the final proposal for the Smart Cities Challenge, the City partnered with the research team to do a pilot project (2018-2019) aiming to: 1) identify facilitators and barriers to aging in place; and 2) understand the perspective of multiple stakeholders regarding the use of technology to support aging in place. Part of the pilot project aimed at better understanding the role of the City in helping older citizens stay at home using technology.

In 2019, the City of Côte-Saint-Luc submitted the final proposal intitled the VillAGE Initiative that aimed at implementing a connected framework using technologies to help older adults: (1) live more safely and independently in their homes; (2) be better connected to their communities and city services; (3) be more socially engaged. » (p.3) (City of Côte St-Luc, 2019). Unfortunately, the VillAGE Initiative was not selected in the final round of the competition. Nonetheless, this collaboration with the research team was an opportunity to further advance scientific knowledge on the conception of smart cities. Rooted in the perspectives of multiple stakeholders from the City of Côte Saint-Luc, the present study aimed to

understand how can municipalities help keep senior citizens at home using technological innovations.

3 METHODS

A case-study design is relevant when the research question requires a comprehensive description of a social phenomenon (Yin, 2014). The perspectives of multiple stakeholders regarding the role of the City of Côte Saint-Luc in supporting aging in place via technology was explored using a qualitative single case-study designed. More specifically, multiple focus groups were used to explore the perspectives of stakeholders.

3.1 Participants

Purposeful sampling was used to identify participants that could bring in-depth information regarding the social phenomenon (Patton, 2002). Three groups of stakeholders were recruited to represent multiple perspectives: older citizens, caregivers and representatives of the City of Côte Saint-Luc. Older citizens and caregivers were recruited through community organizations by a member of the research team. As aging is a heterogeneous process, older adults 65 years and over from both genders and with varying levels of functional autonomy were purposefully recruited for better representativity. The project was approved by the CRIUGM Ethics Review Board (CER VN 16-17-22). All of the participants signed a consent form before taking part in the data collection process.

3.2 Data Collection

A focus group can be defined as "a group interview, centred on a particular subject (focus) and coordinated by a moderator or facilitator, who seeks to generate primarily qualitative data, by capitalizing on the interactions that occurs within a group setting" (Sim & Snell, 1996 p.189). Eight focus groups comprising a total of 46 participants were completed in November 2018:

- FG1: City directors (n = 3 women and 2 men);
- FG2: City counsellors (n = 2 women and 5 men);
- FG3: City staff (n = 4 women and 1 man);
- FG4: Older men from a social group (n = 6);
- FG5: Older women from a social group (n = 7);
- FG6: Active seniors (n = 6 women and 1 man);

- FG7: Vulnerable seniors (n= 4 women and 2 men);
- FG8: Children of seniors'(caregivers) (n = 3 women).

All focus groups were digitally recorded and took place in a meeting room at City Hall. They lasted on average 60 minutes and were facilitated by a researcher specialized in qualitative research. The interview questions were used in prior studies about the use of technology for aging in place. The main interview question were as follow: 1) Can you describe the obstacles you encounter in keeping older adults at home?; 2) What strategies have you tried to keep this population at home? And what are the impacts of these strategies?; 3) How do you think technology could help keep seniors at home? In addition, an observer accompanied the facilitator and took notes regarding the main topics discussed. At the end of each focus groups, they validated, with the participants, the main ideas that were expressed.

3.3 Qualitative Data Analysis

Qualitative data from the recordings of the eight focus groups were transcribed to facilitate data analysis. Miles, Huberman and Saldana's method (2014) was used for data analysis including coding and matrix building. First, descriptive codes were created, which labelled units of text (words, sentences, paragraphs) that encompassed a distinct meaning with regards to how the City could play a role in using technology for aging in place. The coding grid emerged from the data. A brief definition of each code was developed as the coding process progressed. A list of codes, each supported by excerpts from interviews, was created. Codification was performed by two research professionals and revised by a researcher specialized in qualitative research. Second, matrices were used to further analyse the main areas where the City could contribute by creating overarching themes to regroup multiple codes.

4 RESULTS

From the focus group data representing the perspectives of older citizens, caregivers and City representatives, the City's main responsibility in aging in place would be to help older citizens connect with people through technology. More specifically, four themes emerged to represent the City's main roles : 1) helping older citizen connect to their community and existing services; 2) providing an

existing infrastructure; 3) maintaining the trust of senior citizens regarding privacy issues; and 4) providing appropriate technology at a cheaper cost for older citizens.

4.1 Helping Older Citizens to Connect to Their Community and Existing Services

According to city directors, some of the older citizens are not engaging with city services or their community. It is reported that individuals with a higher socio-economic status are the ones who participate in events and have their voices heard. Individuals in poorer areas of the City have a low attendance rate to city activities and they are not the ones calling to complain. The City can help older citizen to stay connected to their community and city services by helping them to find the adequate place to fulfil their need.

> "I think it's not necessarily more services; it's connecting them to existing services, which will require more programs, and ways to do it. We have so many wonderful programs that they are involved in now – and as they get older and more isolated, we want to connect them to it." (FG2; M1)

To support aging in place, the main responsibility of the City would be about communicating information regarding available resources. Caregivers mention that it gets harder with age "to do all that research that is involved in finding out what the services are, and where to go and get them on your own" (FG8; W2). In response, many mentioned different technological means by which they could be informed by the City of available services. Emails from the city mailing list has proven useful for older adults to get general information about things that could be of interest to them. A city helpline has been suggested by an older citizen as an alternative to going to the local community service centre (CLSC) to get information about services.

City directors and counsellors warn against putting too many responsibilities on the municipality and suggests instead a reference service where older adults can call and learn where their needs could be met.

As one director explains:

> "What is the role of the city? I think it's almost to facilitate putting the right people in contact with the right places. (…) It has to be delivered

in such a way that it's easy to receive and digest. But at the same time, I don't think we as a municipality… We have certain obligations. We must clear the snow. We must collect the garbage. We must provide certain services and make sure that people have drinking water and sewage disposal. But we can't do everything. So, we need to identify the right partners that are able to deliver at the speed and pace of the recipient. Whatever it is that they need… and kind of help tailor it." (FG1; M1)

As the City cannot provide every type of services and answer all needs, structuring partnerships is important to respond to the demand. For example, partners can include the public social and health care system that provides care. However, when creating partnerships, keeping all partners satisfied can be a barrier. As a City counsellor illustrates, promoting access to services can have its downfalls:

> "To get a partnership with health government organizations (e.g. CIUSSS), the project must prove it can bring money to the government. However, the project might instead bring even more "traffic" in healthcare organizations." (FG2; M1).

The City is perceived as the interface between partners to create and organize the ecosystem around older citizens.

> « Everyone comes to it from their own perspective. We are a city. And our challenge is… we were given this challenge: how are you going to advance services, what is the challenge for residents in your community, through data-driven technology?" (FG2)

4.2 Providing Existing Infrastructures

The City of Côte Saint-Luc provides services through multiple infrastructures and some could be further used. For example, it has its own emergency system comprising technologies to manage and share information efficiently.

> "We already have a lot of the infrastructure. We have, for example, a 24-hour, 7 days a week dispatch centre. Integrating some technology or monitoring service is feasible." (FG1; M1)

According to participants, the implementation of technology requires more than buying and providing the technology itself, but it also means relying on existing human resources to support users. The library already provides educational activities for older citizens including some for the use of technology. A municipal counsellor also suggested the possibility of involving an existing group of volunteers in order to help implement technology, so as to bring a human aspect to it: "they would be real people helping people, to communicate and talk with them." (FG2; M1)

Still, there are limits to using existing infrastructures and resources. Library staff sometimes feel overwhelmed by some of the demands older adults have regarding technology as some exhibit difficulties in learning and come back with the same questions multiple times. Some City counsellors point out that existing city resources are not enough and that human resources specialized in technical support are key to a sustained use of technology:

" We would need almost an IT Geek Squad, as I mentioned – where if something goes wrong and they don't know what to do…" (FG2; M3)

Older citizens agreed with the idea that:

"You have to have someone experienced, who is technically knowledgeable to set it up, and literally put it in a casket that they can't touch any buttons. I mean it when I say that! 'Don't pull the wires out." (FG4; M2)

Indeed, implementing technologies for ageing in place requires more human resources and consequently a need for an additional budget.

"Without extra resources, nothing else is possible."; " it's not something that could be, "Oh here, now do this," without extra money for the manpower." (FG1; W2)

4.3 Maintaining the Trust of Older Citizens regarding Privacy Issues

Overall, stakeholders report that privacy risks are manageable and are worth it considering the benefits technologies could offer. Caregivers and older citizens explained that technologies may be acceptable when considering that the objective is to ensure well-being and safety of older adults.

"We all give up a certain amount of our privacy in order to benefit from all the technology that's out there. But we try to do it in a way that makes some kind of sense, and not just leave ourselves completely open to anything." (FG5; W6)

The organization or the person who offers technology needs to be deemed trustworthy by older adults for them to accept using it. Many older citizens already trust the City and use the technology offered by the library.

"W3: They use the online services [of the library]; they are not quite worried. I haven't had any experience with it. Moderator: But it's a trust thing, company environment. W3: Yes. Moderator: That's why they are not worried? W1: They know the library." (FG1)

As one City counsellor explains, the City already manages sensitive data through their emergency system and recognize the importance of privacy:

"The privacy issue certainly is front and centre whenever we look at technology. And how do we as a city take that responsibility? I do think that when you talk about our responsibility as a city – and being a new councillor, I am learning what these things involve. But I see this as an extension of our EMS service, almost. So, the will of the city to help the people in need, at this point. (FG2; M2)

One important issue is who has access to sensitive information. Potentially, specific people as designated by older adults could have access to that information. In fact, some older citizens have showed to be reluctant to have City employees share their personal information with their family members, even when they are in a vulnerable situation because they don't want their family members to know what is happening.

"Just for us, from what I see on a daily basis, it's a little bit more basic in terms of privacy. It's more on the physical end of things. We will get a lot of older adults that come to the centre frequently. Some of them spend their days there, and often will shower at the centre. And things will happen; either they will fall in the shower, or they need help. We are going to help them in a very vulnerable situation. And I am always a little bit reluctant as to how

much interaction we should be doing. And we always do end up helping; but then when we offer to call someone that can help them, either a child or someone that we can call to assist, they flat out refuse. They don't want us to contact their children, their family members. They don't want them to know about it. " (FG1; W3)

Similarly, caregivers would not want to be overloaded with information about their loved one's personal daily life:

"It's a slippery slope, you know? Having access to information about where my father is in the house, what is he doing, how long is he spending there, with whom is he spending time? You know, I wouldn't want… it's like Big Brother." (FG8; W3)

4.4 Provide Appropriate Technology at a Cheaper Cost for Older Citizens

Participants acknowledge that technologies can be expensive. Interestingly, even when older citizens do have the means to buy technology, they can be reluctant and question why they should spend that money.

"Again, from experience – and I'm talking as an ex-advocate for the patients. A lot of our problems were that the clients refused to spend money for the expenditures to do these things [technology]. And we used to tell them, "Look, you have the money." "It's not that. Why should I spend the money?" (FG4; M2)

Some caregivers and older citizens have suggested that technology could be provided by the City as a public service. It is mentioned that the library already provides technologies. Moreover, the City could have more power negotiating bulk price and having companies compete against each other for the contract.

"W5: I mean, if you're going to have that equipment, someone has to pay for it. I was just thinking, I know that at another Centre, you can get better telephones that are more… and you know, they provide them. Are we getting into a time frame where the services actually provide equipment for people to use, and help them use it? I mean, it would be equipment that should be returned when… it

belongs to the community. But that they can use… W3: The library now has iPads that you can borrow. I don't know if you can take them out…" (FG8)

The City could also have access to subsidies and means to identify the best products available to buy.

"If they are subsidized and they can say "Hey, come on over, we will give you this deal." Or if somebody working with the city can standardize what we are having, because you don't need a million different things that can't work, that would be really, really great." (FG4; M4)

5 DISCUSSION

The present study aimed to describe how can a municipality support ageing in place using technological innovations from the perspectives of multiple stakeholders living or working in the City of Côte Saint-Luc. Stakeholders believe the City could support older citizens by helping them to access existing services via technology. More specifically, the City could provide an existing infrastructure, maintain the trust of older citizens regarding privacy issues and provide technology at a cheaper cost for older citizens. Nonetheless, additional resources and various partners are necessary to undertake this technological endeavour. The City's main responsibility could be related to the coordination of the new technological ecosystem comprising older citizens, their caregivers, volunteers, and partners providing services.

Existing literature shows that few the age-friendly initiatives in smart cities have focused on connecting older citizens to resources through the use of technology. Righi et al. (2015) report two case studies in Barcelona, Spain aimed at: 1) designing innovative services for older citizens by enhancing social interaction between neighbours; and 2) co-creating geo-located content for informal learning scenarios. These authors concluded that not only was this type of endeavour feasible but it also empowered older citizens and helped them develop new social behaviours within their community. For the initiative to succeed, they report that it is important to develop technologies that can easily communicate with existing technologies such as social media. Many older adults and most partners are already using some of them and were concerned about the integration of the whole technological ecosystem. Still, these

projects only involved active and independent citizens.

In 2015, Liming et al. described the SHINESeniors project in Singapore aimed at making community care services effective using information and communications technology and sensor-enabled homes for older adults with chronic diseases. Liu et al. (2016) explains that this smart city project required an interdisciplinary approach and the consideration of the values of both the older adults and their caregivers. Success was based on integrating the perspectives of stakeholders in the development of the system.

As there are few examples of age-friendly initiatives within a smart city context, it is important to continue research in this domain. The present study's is part of the first phase in the development of a smart city initiative in the City of Côte Saint-Luc. Results cannot be generalized to other Cities, but give an insight on the role that a City can be expected to play to keep senior citizens at home using technological innovations. However, even with eight focus groups comprising more than 45 participants, saturation was not reached and further consultations with stakeholders are planned as funding was by obtained by the research team for a living lab in Côte Saint-Luc to develop a support model for older citizens around the telemonitoring of activities of daily living.

6 CONCLUSIONS

When it comes supporting aging in place using technology, this exploratory study shows that older citizens, caregivers and City representatives conceptualize the City as a structured and trusted matchmaker. These stakeholders expect the City to provide infrastructures but also negotiate collaboration with public and private partners to provide technologies at a reasonable cost and services that fulfil the needs of elderly citizens. Still, humans must remain at the heart of the smart city.

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