Systematizing a kaleidoscopic system of City Labs: problems and complexities of transforming results in public value

Proceedings of the OpenLivingLab Days Conference 2022

“The city as a Lab, but now for real!"

Re-working open innovation environments for inclusive, green and digital transition through emerging technologies

European Network of Living Labs

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""The city as a Lab, but now for real! Re-working open innovation environments for inclusive, green and digital transition through emerging technologies"

The "Call for papers" encouraged contributions from three different paper categories to stimulate a diverse participation of actors: 'Full Research Papers' providing consolidated scientific research, 'Practitioners Presentations' showing case studies from a practitioner perspective and 'Research in Progress Papers' presenting relevant preliminary results.

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Top Contribution Research Session

Wednesday, 21st September 2022

11:00 – 12.30 CEST

Sala Duomo

Full Research Paper

Service co-design fostering migrants' integration: The case of easyRights Living Lab

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Abstract

Living Labs share certain elements that consist of focusing on the co-creation of innovations in a real-world context, involving multiple stakeholders with the objective of generating sustainable values for all stakeholders and particularly focusing on the end-users. For engaging end-users in the innovation process, a high number of methods and tools exist. The challenge resides in selecting the appropriate means for each of the phases, especially when the challenges address socially vulnerable groups, particularly migrants and their communities. This paper explores the challenges of the creation of the easyRights Living Lab as part of the H2020 easyRights project, aimed at improving the integration of migrant communities in four European cities - namely Birmingham (United Kingdom), Larissa (Greece), Malaga (Spain), and Palermo (Italy). By emphasising the significant role of the co-design approach in the exploration, experimentation, and evaluation phases of the innovative development of local services, the paper explores how it is possible to enable social innovation in a co-creative and participatory framework that fosters inclusivity among a complex ecosystem of stakeholders, directly and indirectly, engaged with migrant communities in Europe. Some results of the easyRights Living Lab in the form of a wiki-space show how a co-design, co-creation, co-experimentation, and co-evaluation of the activities can orient towards fostering the integration and inclusion of migrants' communities.

Keywords

Co-design, integration, migrants, enabling, multilayer, service ecosystems

Setting the Scene: Living Labs as means to integrate socially vulnerable groups

Open communities in the public realm have been identified in a variety of contexts and due to the different types of innovation initiatives, the most relevant and known being the Living Labs. Many Living Labs have materialised in Europe and overseas as Quadruple Helix (QH from now on) ecosystems (Curley & Salmelin, 2013; Voytenko, 2015; Compagnucci et al., 2021). The actors within these systems are engaged in co-creation, validation, and testing of new prototypes in real-life environments, where the focus is set on the individual person, who is continuously monitored in their social roles such as citizen, user, consumer, or worker. The concept of the Living Lab has been considered by many observers as a major paradigm shift for innovation, which has started to move out of laboratories into open-air, real-life contexts (Almirall and Wareham, 2008; Steen and van Bueren, 2017).

When discussing migrants' integration into receiving societies, there is often the misconception that social integration is dependent on the only commitments of immigrants and their offspring when reaching a foreign country (Klarenbeek, 2021). Numerous scholars argued that this is not the case while endorsing the notion of integration as a process that also depends on the host country's structure, activities, and openness (see Lucassen, 2005; Korteweg, 2017; Klarenbeek, 2021). Some more specific cases, as in the case of Germany during the 80s and 90s as presented in Brubaker (2001), highlighted the pitfalls of social service provision when farmed out only through specific non-state organisations regulated towards specific migrants' nationalities. In the long run, treating immigrants as passive service receivers only reinforces the state's perception of their national origins' distinctions.

The limitations of a technocentric system follow what Klarenbeek (2021) defines as an ontological shift requiring a more relational approach to social integration as a two-way process, where the understanding of integration takes place between people who integrate and people who are integrated. Considering the various issues that emerge within social integration (power dynamics, the establishment of social boundaries, different moments in times in which outsiders and insiders perform specific activities), a relational approach emerges from a local participatory context where it is possible to manage diversity and combat discrimination (Gebhardt, 2016). Hence, by looking at European policies, they should be developed in relation to locally emerging needs, fostering the dialogue between top-down and bottom-up approaches to integration (Gebhardt, 2016). To take this concept further, it is possible to see how such a relational approach can be encountered in those participatory processes that aim at collaboratively mapping, analysing, and acting upon social systems to improve their service provision.

Living Labs present many of the necessary preconditions to take a more relational approach in social integration contexts (Hossain et al., 2019). This is surely encouraged by, but not limited to, the engagement of several constellations of stakeholders influencing both policies, as well as the experience level of integration. As supported by Compagnucci et al. (2020), within the different criteria defining the impact of Living Labs in societies, participation and co-design emerge as key values that can advance impactful innovation. The potential for Living Labs to work on many issues related to integration, such as policymaking, local government activation, and balance of power dynamics (Klarenbeek, 2021) stems from the possibility of identifying users as co-producers of innovation and the researchers as part of the process (Feurstein et al., 2008; Prahalad and Ramaswamy, 2004; Almirall et al., 2012). Moreover, this human-centric, experience-based perspective of Living Labs not only ensures a user-driven design and development of products, services, or applications but also a better adoption of end-users' needs. One of the main goals of these open communities is to reach a more sustainable innovation making the best use of the ideas, experiences, and knowledge of the people involved to ensure value creation and appropriation in economic, social, and environmental domains.

Shifting the traditional role of actors from observed subjects or consultants into active co-creators of value has become a distinctive attribute of Living Labs (Steen and van Bueren, 2017). Whether the users are companies, employers, public institutions, residents, or professionals, the benefits of engaging them in the innovation process would reduce the cost of the development process and boost the pace of achievements (Leminen et al., 2015) which eventually leads to improve the performance of industrial processes and generate sustainable outcomes (Buhl et al., 2017). Living Labs have a clear impact on promoting the development and implementation of innovative solutions in the transition to sustainable cities. Moreover, the promotion of experimentation and learning within Living Labs can break down barriers among participating communities and individuals, supporting social robustness and inclusivity (Arnkil et al., 2010). By orchestrating open innovation processes, local communities and individuals engage in active collaboration towards the same goal in equal levels of contribution and involvement.

This paper focuses on the effect that co-design methodologies of Living Labs have on social challenges such as the integration of socially vulnerable groups and how the (re)design of (public) services might be the first step towards migrants' integration in their new communities. The paper is structured in five sections: section two provides an overall view of the interlink between co-creative ecosystems toward social integration. Section three describes the case of the easyRights Living Lab, and how co-design was applied in the project ecosystem for the development of technical solutions to facilitate the process of migrants' integration into the local context. In section four, one of the results of the easyRights project is presented, as an example of a co-designed digital space that facilitates the interaction of actors of the Quadruple Helix ecosystem. The last section summarises some of the learnings and reflections on the role of co-design in Living Labs moving toward the integration of socially vulnerable groups.

Co-creation for social integration

The growing complexity of social challenges, as well as the necessity to engage citizens and other stakeholders in learning, collaborating, and designing together, has extended the application of co-design in the public realm. Participatory approaches have been acknowledged for their ability to address civic issues by providing a solution-oriented process based on the collaboration of multidisciplinary groups (Vaajakallio et al., 2013; Lodato and DiSalvo, 2018). In recent years, co-design initiatives have gained popularity in the public administration sphere (Karimi et al., 2022). In this scenario, they have a lot to offer such as setting common goals, identifying citizens' needs, activating connections among stakeholders, conducting experiments, providing design tools and practices, and establishing implementation plans, among others (Simonsen and Hertzum, 2012; Lodato and DiSalvo, 2018).

Beyond the previously mentioned applications in Living Labs, co-design practices have been adopted to intervene in local politics due to their core values of democratisation and citizen empowerment. Similarly, Ehn (2017) emphasises that participatory design practices could facilitate the process of democratic participation and decision-making in a more collaborative and experimental manner rather than relying on concealed scientific laboratories. Nevertheless, some researchers agree on the fact that the potential of co-design practices has not yet been fully explored in the public sector (Saad-Sulonen et al., 2020; Simonsen and Hertzum, 2012; Dalsgaard, 2012; Lodato and DiSalvo, 2018). Furthermore, several scholars argue that these promising democratic design "experiments" are yet far from having the expected "effect of shaping or re-shaping the city" and, so far, they have only proved the "value of the co-imagination of the city itself" (Lodato and DiSalvo, 2018). In addition, some argue that public sector innovations are based on top-down models that mainly promote efficiency and performance which result in failing to consider citizens' needs and societal challenges (Polini and Caforio, 2021).

Meanwhile, the recent approach collected in the Tallinn Declaration on eGovernment (EU/EFTA eGovernment Declaration, 2017) to social innovation and mobilisation of citizens highlights the significant role of the involvement of citizens as well as policymakers in the creation of better digital public services. According to Torfing and others (2019), the public sector is currently being transformed from legal authority and service provision to an arena of co-creation. One practical example among several recent innovation action (IA) projects, is the easyRights project. The project works towards the development of ICT-enabled solutions and toolkits for the implementation of inclusion policies by public administrations and civil society. It aims at improving the access of migrants to public services for an easier exercise of their rights, which can serve as a clear example of the value of such a shift in the approach to service provision. The following sections explore how the creation of easyRights Living Labs tackled migrant service development and innovation, and in what way migrants were actively involved.

The easyRights Living Lab

The easyRights project funded by the EU Horizon2020 program uses co-creation and artificial intelligence technologies to develop solutions that make it easier for migrants to understand and access the services they are entitled to. The predominant objective of easyRights is to foster a multi-level co-creative ecosystem in which different actors, including the service suppliers at the local governance system, migrants and organisations supporting migrants, project partners, and other citizens, cooperate in increasing the quality and performance of digital public services. The co-creation efforts are facilitated and supported by the various co-design tools and innovative processes. Such co-designed solutions are considered learning drivers and act in the direction of popularising co-creation to a wider audience and supporting the development of local communities (Concilio et al. 2022).

The easyRights project is being developed and deployed in four pilot locations including Birmingham in the UK, Larissa in Greece, Palermo in Italy, and Malaga in Spain. These pilot cities have been identified to showcase and experiment with a set of technological innovations to improve the current personalization and contextualization of the local welfare services available to migrants and empower them in getting better access and fruition to those services. In this manner, easyRights has facilitated the participatory re-design of services for migrants, such as the Clean Air Zone or the access to language courses in Birmingham (UK), diverse official registration processes in the cities of Larissa (Greece) and Palermo (Italy), the application to access and request for asylum-seeking in Malaga (Spain), or the job seeking processes and access the labour market in both Malaga (Spain) and Palermo (Italy). A relevant aspect to consider is that, while this paper considers the overall activities and results of the practices initiated by the project within the context of all the pilot cities, the principle focuses on one of the outcomes generated in the city of Palermo. For more detailed information on the activities within each pilot city, see the easyRights website at http://www.easyrights.eu/.

The easyRights Matryoshka model of Quadruple Helix ecosystems

In easyRights, QH ecosystems are open socio-technical communities where the four groups of actors involved (people, businesses, academics, and institutions) share a similar vision and contribute to the development of new practices, also benefiting from experience and knowledge related to the digital world. The project is strongly linked with the production, diffusion, and use of knowledge as a social learning process; therefore, it focuses on features in relation to problem-solving for the society, which is organised around particular applications, services, and procedures. In the vein of knowledge production, continuous communication, and negotiations between knowledge producers within QH ecosystems are crucial (Gibbons et al., 1994). The creation of QH ecosystems, and the consequent emergence of effective alignment dynamics among them, enables easyRights to implement further inter-institutional collaborations and consolidate strategic alliances in the local contexts. Simultaneously the easyRights' QH ecosystems are built in each of the pilot sites. In their local context, they oversee managing the local co-creation activities and supporting systemic changes in the local governance of migration-related services (easyRights D5.1, 2020).

The pluralism of knowledge coming from QH actors activated by the easyRights project allows for the emergence, co-existence and co-evolution of various knowledge and innovation paradigms (see Carayannis and Campbell, 2009). As shown in the figure below, knowledge co-production is the result of the interaction between different QH ecosystems as a sort of “Matryoshka” model where actors feed the engines through the power of pilot collaborative activities. The co-creation activities enable cross-cutting multi-level interactions between service experts (such as public officials or migrants) and the civic society. All the activities within these ecosystems contribute to a larger societal scale by guaranteeing the evolving alignment of collective action through various national and global initiatives toward migration integration.

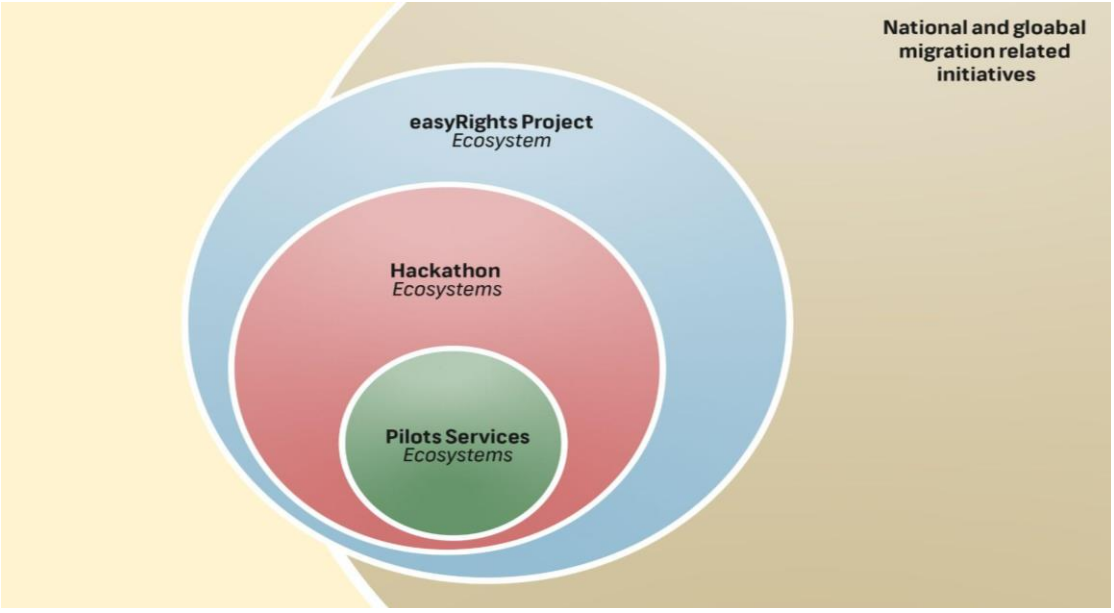

Figure 1. The easyRights’ complex network of Quadruple Helix ecosystems represented as a Matryoshka model.

The easyRights project ecosystem counted on the constant participation of a consortium formed by research groups, representatives from public municipalities, local NGOs working with migrants, and technical development groups. Within the course of action in each pilot, a large number of external actors brought their expertise to the development processes. Public officers, technical providers, and migrants participated as service experts in a wide range of activities aimed at redesigning and configuring the public services located at each pilot to be more accessible for migrants. Their expertise was key for understanding the functioning of the existing services, identifying potential opportunities for improvement, prototyping solutions at hackathon events, and evaluating such solutions. The established local QH communities (Fuster Morell and Senabre Hidalgo, 2020; van Waart et al. 2015) unfolded societal, organisational, and democratic relationships, and activated complex relations between the diverse groups of actors.

The generation of a multi-layered ecosystem through co-design

The collaborative interplay of easyRights QH actors -through the use of co-design tools and practices unfolded within three ecosystems (pilots, hackathons, and the project itself)-led to the establishment of the easyRights Living Lab. As participatory co-design practices envision the design process as a collaborative effort (Ehn, 2008; Bjögvinssion et al., 2012), the co-design activities within easyRights Living Lab act as democratic processes that enable proper and legitimate participation. The co-creation practices and co-design tools embed the idea of participants' tacit knowledge - that is, not merely their formal and explicit competencies, but those practical and diverse skills that are fundamental to the making of objects or artefacts (Bjögvinsson et al., 2012) or social practices (Reckwitz, 2002).

Driven by the principles of participation and co-design, the easyRights Living Lab established a working framework based on the real-life settings of each pilot city and engaged end-users and other relevant stakeholders. Due to the complexity of the challenge of migrants' integration, one of the core strategies of the easyRights project was the involvement and connection with the vast variety of actors involved in the creation, provision, and use of the services during the whole project cycle. The identification of key stakeholders within the project's ecosystem (decision-makers, public administration workers, residents, migrants, activists, researchers) with diverse levels of technical and topic expertise (amateurs, professionals, experts, novices) made it possible to initiate several co-design activities.

In line with studies on value co-creation and collaboration in design activities (e.g., see Kinnula et al., 2018; Saad-Sulonen et al., 2020; Torfing et al., 2019), the easyRights Living Lab shifted the focus from solely shared design activities to an approach that regarded all stakeholders who bring resources and take part in the activities around shared challenges in the production of public values. Moreover, the easyRights project acknowledged the social capacity for finding innovative context-rooted solutions and facilitated social and political assemblies based on the co-existence of a diversity of interests, concerns, and viewpoints. The use of co-design activities among the project ecosystems was grounded on the belief that all people can contribute to design when provided access to the appropriate setting (Mattelmäki and Sleeswijk Visser, 2011; Sanders and Stappers, 2008). But this approach also relied on the belief that the complex process of migrants' integration can only be undertaken by migrants themselves, as firm believers of the idea that those affected by a design should have a say in the design process (Ehn, 2008; Bjögvinsson et al., 2012).

In the same vein as Living Labs advocates and co-design practitioners, easyRights encouraged substantial collaboration with migrants and other key stakeholders in arranged situations and established what the experts refer to as an "event-driven process" (Brandt, 2001). These events were characterised by having a predesigned structure, tasks, and facilitation, and for resulting in co-constructed prototypes aimed at understanding or responding to the problem rather than a final polished solution (Vaajakallio et al., 2013). A clear example of these "event-driven processes" are easyRights hackathons; events are organised at each pilot city for the generation of technical solutions for improving the targeted services. The easyRights hackathons were envisioned as a facilitated set of activities to enable the co-design of technical prototypes that generated a positive impact on the experience of migrants within local public services.

Contrary to conventional hackathons targeted at long-established "solution-owners" (coders, engineers, technical profiles), easyRights extended the call for participation also to "problem-owners", relying on the cultural and technical diversity of profiles as the desired capabilities to address the services' intricate procedures. Certainly, coders and high technical profiles in all hackathons provided their expertise to build the solutions and guarantee their integration with the corresponding service requirements. However, to safeguard the human-centred approach and a context-rooted formulation of the proposed solutions, the participation of profiles with first-hand experience on the pain points and barriers that had to be broken down was essential. As a result, among the attendees of the easyRights hackathons, there were lawyers, developers, service designers, project managers, NGO professionals, social workers and, of course, migrants, working together on the improvement of public services.

Often, one of the main criticisms that have been highlighted in participatory processes is referred to the participation itself. Several authors (DiSalvo et al., 2012; Le Dantec et al., 2010; Merkel et al., 2004; Winschiers-Theophilus et al., 2010) point to the significant gap in the inclusion and diversity of participation when the dissemination of the calls for participation, the demanded dedication, or the language of the events, make impossible the attendance of certain groups such as women, children, or elderly. Despite being intended as 'open to any public', the characteristics of most participatory events marginalise the so-called "unexotic underclass" (Nnaemeka, 2013) from joining, so their experiences, needs and expectations are not represented nor considered.

In the easyRights Living Lab, the principle of inclusivity encouraged the generation and engagement of a truly diverse ecosystem of stakeholders for the project development. From the initial steps of the project, service owners, technical experts working with the service, migrants, and NGOs and organisations supporting migrants were identified, involved, and engaged to get a clear depiction of the service components, the steps migrants have to go through, the logistic and legal terms associated to each step, and the bureaucratic struggles and administrative barriers they have to overcome. Having all kinds of actors involved guaranteed multiple perspectives and expertise on the collected knowledge, facilitating the formation of meaningful, consistent, well-structured, and richly backed-up solutions for the services.

Results of the easyRights Living Lab: The case of easyRights' Wiki space

Social integration harbours a plethora of complex socio-technical challenges that hinder the possibility of creating a valuable impact on local communities. For instance, if we consider employability as one of the pillars for migrant integration, several studies demonstrated how public services lack experience in promoting socially meaningful initiatives that support access to the local labour market and consider the diversity of migrants' needs (Gebhardt, 2016).

Within the easyRights Living Lab, the Municipality of Palermo (Italy), embraced such a complex challenge using co-design and local participation. The activation of key stakeholders through the Living Lab's ecosystem, together with the organisation of local hackathon events, enabled the creation of functioning services supporting both migrants and public officials in dealing with the access of migrants to the job market. The Hackathon ecosystem (as part of the Matryoshka model, shown in Figure 1), envisioned the creation of a shared space that a) nurtures from collaboration and participation of several groups of experts on the topic of migrants' inclusion in the labour market (public officials, service providers, migrants, organisations supporting migrants, lawyers), and b) provides migrants with a digital tool to navigate the context of local employment and share their experiences as a substitution mechanism of word of mouth, commonly used by migrants to get to know about work opportunities (Sanchez et al., 2018).

With the purpose of clarifying and accelerating the job-seeking procedures (as was the case for the municipal government of Palermo, Italy), the Wiki was co-designed during the second easyRights hackathon in Palermo. According to Wagner (2004), a Wiki is "a collaboratively created and iteratively improved set of web pages, together with the software that manages the web pages". In Wikipedia (2022), one of the most known wiki spaces available online, a Wiki is defined as a collaboratively edited publication, which is managed and maintained by its own audience directly.

The easyRights Wiki (Figure 2) resembles the leitmotif of co-creation and participation that shaped the easyRights Living Lab in the first place. Such space was, in fact, created through the collaboration of different experts that contributed with procedural, experiential, and contextual knowledge. In other words, the Wiki space was created at a hackathon ecosystem, where the collaboration among migrant communities, ICT experts, service designers, local public officials, NGOs, and employment experts, shaped a functioning prototype of a collaborative space where knowledge is exchanged to accelerate the understanding of official procedures as a way to ease the access to the local labour market.

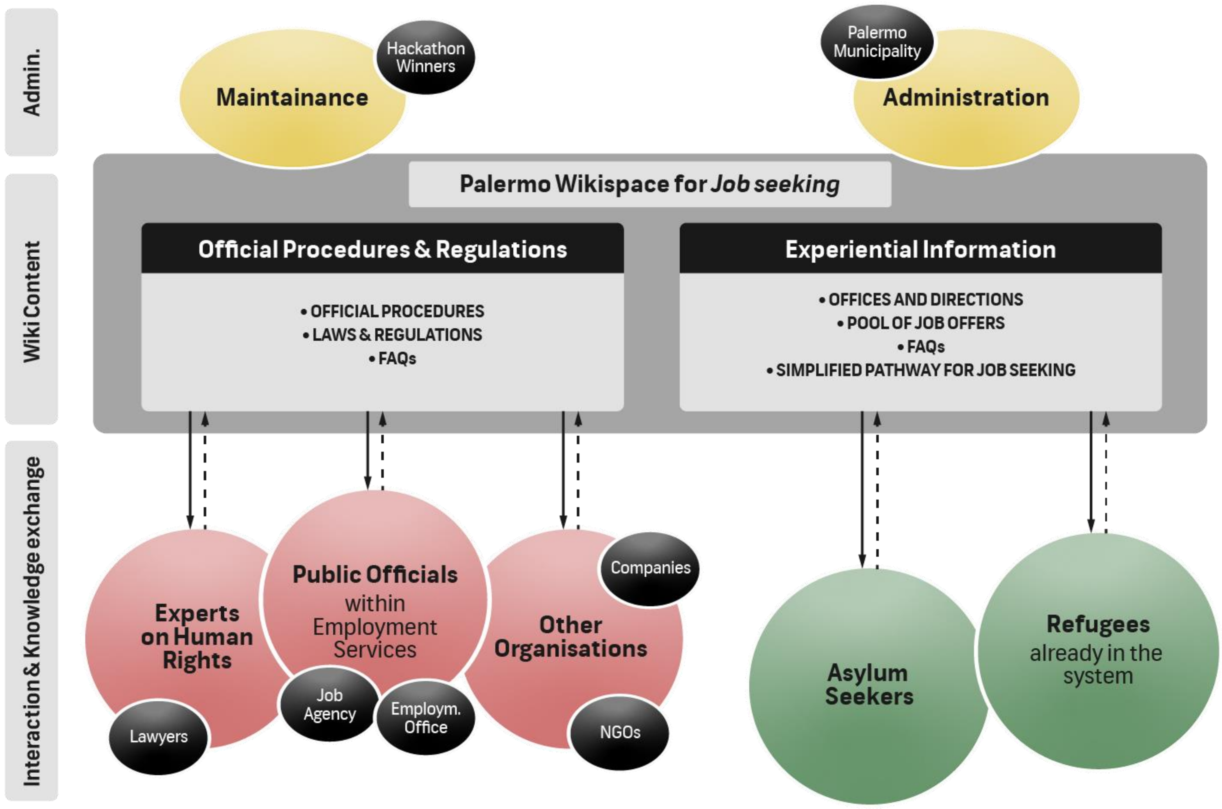

Figure 2. In the Palermo Wiki, different actors engage with the local employment procedures.

Figure 2 illustrates the role of the Wiki as a platform that facilitates knowledge creation between users with different degrees of expertise. Public officials and experts on human rights contribute with official information on procedures and current regulations. On the other side, migrant communities interact on the platform not only as receivers of such official information but also by providing experiential knowledge that can serve as a reference or inspiration for other refugees.

The case of the development of the Wiki for the Municipality of Palermo demonstrates how embracing the values of co-design and participation in the creation of technical solutions to social challenges, can be a powerful approach to ensure a more inclusive social integration. The chance for the Wiki platform to respond to a diversity of users' needs, stems from the possibility of making users key contributors to the collaborative space. From the point of view of public officials and migration experts, this Wiki works as a live environment where users can provide and update relevant information regarding local employment regulations and the labour market.

Accessibility to the service as well as its sustainability are two factors that make the difference in such a complex effort. In fact, the possibility for this Wiki to be administered and maintained is offered by the local municipality together with hackathon participants and migrant communities. They could establish a network of experts within employment regulations that create, curate, and keep updated the production and dissemination of knowledge as well as ensure coherency, consistency, and sustainability of the space over time.

Conclusion

This paper emphasises the human-centric, co-creative and participatory nature of the easyRights H2020 European project and the generation of a Living Lab as the result of this methodological approach that contributed to the integration of migrants. The easyRights project supports migrants in their search for responses to different needs, making them more autonomous from discretionary bureaucracies, saving time for both migrants and social service staff, and cutting costs for the public administration.

A project such as easyRights might not be able to fully address all the issues related to social acceptance. However, it contributes to identifying the challenges and envisioning solutions, emphasising that integration must be considered and experienced as a two-way process - a partnership between the receiving society and the migrants. In this endeavour, the application of participatory activities and co-design initiatives played an essential role. Relying on experimental efforts and empirical evidence gathered from different pilot cities involved in the easyRights project, the paper looks at the possibility to enable social integration in a co-creative and participatory framework that fosters inclusivity among a complex ecosystem of stakeholders.

The co-design component of the easyRights Living Lab positively impacted the process to address some of the perils and pitfalls of a top-down approach to social integration. In particular, the way co-design has been applied within the easyRights Living Lab demonstrates the possibility to advance social integration, to systematically activate many stakeholders within QH ecosystems, that are directly involved in several integration processes. One of the tangible outcomes of the easyRights Living Lab co-designed with the aim to improve migrants' integration processes in their new local contexts, is the development of the Palermo Wiki. This digital space, co-created for (and by) migrants, supports job-seeking in the city, an essential first step towards their integration. The Wiki space works as a social connector within specific procedures and systems, and it lubricates those processes by connecting migrants with people providing support in their everyday challenges. It also connects public officials with other experts providing knowledge on how such procedures look.

A single project such as easyRights may not solve the complex scene of social integration, but it highlights how the generated Living Lab contributed to outlining the preconditions for a valuable impact. The implementation of this framework based on co-creation (at the core of Living Labs' foundations) facilitates the dialogue between migrants, municipalities, and institutions working with migrants. It acknowledges migrants' rights and accelerates their access to basic needs, such as work, public health, and education. Eventually, the activation of local communities through co-design processes lead to the generation of the presented Wiki, a key space to envision a more inclusive integration.

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References

1. Almirall, E., Lee, M., & Wareham, J. (2012). Mapping living labs in the landscape of innovation methodologies. Technology innovation management review, 2(9): 12–18.
2. Almirall, E. & Wareham, J. (2008). Living Labs and Open Innovation: Roles and Applicability. The Electronic Journal for Virtual Organizations and Networks. 1(10): 21-46.
3. Arnkil, R., Järvensivu A., Koski, P & Piirainen, T. (2010). Exploring Quadruple Helix. Outlining user-oriented innovation models. Työraportteja 85/2010 Working Papers. Tampere, University of Tampere, Institute for Social Research, Work Research Centre.
4. Bjögvinsson, E., Ehn, P., & Hillgren, P. (2012). Design Things and Design Thinking: Contemporary Participatory Design Challenges. Design Issues, 28, 101-116.
5. Brandt, E. (2001): Event Driven Product Development. PhD dissertation., Technical University of Denmark.
6. Brubaker, R. (2001). The return of assimilation? Changing perspectives on immigration and its sequels in France, Germany, and the United States. Ethnic and racial studies, 24(4), 531-548. https://doi.org/10.1057/9780230554795_2
7. Buhl, J., von Geibler, J., Echternacht, L., & Linder, M. (2017). Rebound effects in Living Labs: Opportunities for monitoring and mitigating re-spending and time use effects in user integrated innovation design. Journal of cleaner production, 151, 592-602.
8. Carayannis, E. G. and Campbell, D. F. J. (2009) “Mode 3” and “Quadruple Helix”: Toward a 21st Century Fractal Innovation Ecosystem. International Journal of Technology Management, 46(3/4): 201–234.
9. Compagnucci, L.; Spigarelli, F.; Coelho, J. & Duarte, C. (2020). Living Labs and User Engagement for Innovation and Sustainability. Journal of Cleaner Production. 289. 125721. 10.1016/j.jclepro.2020.125721.
10. Concilio, G., Costa, G., Karimi, M., Vitaller del Olmo, M., & Kehagia, O. (2022). Co-Designing with Migrants’ Easier Access to Public Services: A Technological Perspective. Social Sciences, 11(2), 54.
11. Curley, M., & Salmelin, B. (2013). Open Innovation 2.0: A new paradigm. Intel and European Commission Joint Paper. Retrieved from the EU Commission. Available at: http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=2182Dalsgaard, P. (2012). Participatory Design in Large-Scale Public Projects: Challenges and Opportunities. Design Issues, 28(3), 34–47. https://doi.org/10.1162/DESI_a_00160
12. DiSalvo, C., Clement, A., & Pipek, V. (2012). Communities: Participatory Design for, with and by Communities. In Routledge International Handbook of Participatory Design. Simonsen, J., Robertson, T. Routledge, London. https://doi.org/10.4324/9780203108543
13. easyRights D5.1. 2020. The easyRights Deliverable 5.1: Triple Loop Learning Mechanisms. Available online: https://www.easyrights.eu/deliverables (accessed on 15 May 2022).
14. Ehn, P. (2008). Participation in Design Things. In Proceedings of the Tenth Anniversary Conference on Participatory Design 2008 (PDC '08). Indiana University, USA, 92–101.
15. Ehn, P. (2017). Learning in Participatory Design as I Found It (1970-2015) in Betsy DiSalvo, Jason Yip, Elizabeth Bonsignore and Carl DiSalvo et al. eds. Participatory Design for Learning: Perspectives from Practice and Research. Taylor & Francis. http://dx.doi.org/10.4324/9781315630830-3
16. Curley, M., & Salmelin, B. (2013). Open innovation 2.0: a new paradigm. OISPG White Paper, 1-12.
17. EU/EFTA eGovernment Declaration. 2017. Available online: https://https://wayback.archive-it.org/12090/20210727152404/https://digital-strategy.ec.europa.eu/en/news/ministerial-declaration-egovernment-tallinn-declaration (accessed on 28 July 2021). European Commission. 2011. Empowering People, Driving Change: Social Innovation in the European Union. Luxemburg: Publications of the European Union.
18. Feurstein, K., Hesmer, A., Hribernik, K. A., Thoben, K., & Schumacher, J. 2008. Living Labs: A New Development Strategy. In J. Schumacher &V.P. Niitamo (Eds.), European Living Labs – A New Approach for Human Centric Regional Innovation: 1–14. Berlin: Wissenschaftlicher Verlag.
19. Fuster Morell, M. and Senabre Hidalgo, E. (2020). Co-creation applied to public policy: a case study on collaborative policies for the platform economy in the city of Barcelona. CoDesign 2020: p. 1-20.
20. Gebhardt, D. (2016). When the state takes over: Civic integration programmes and the role of cities in immigrant integration. Journal of Ethnic and Migration Studies, 42(5), 742-758. https://doi.org/10.1080/1369183X.2015.1111132

21. Gibbons, M., Limoge, C., Nowotny, H., Schwartzman, S., Scott, P. and Trow, M. (1994) The New Production of Knowledge. The Dynamics of Science and Research in Contemporary Societies. London: Sage.
22. Hossain, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. Journal of Cleaner Production, 213, 976–988. https://doi.org/10.1016/j.jclepro.2018.12.257
23. Klarenbeek, L. M. (2021). Reconceptualising 'integration as a two-way process'. Migration studies, 9(3), 902-921.https://doi.org/10.1093/migration/mnz033
24. Karimi, M., Costa, G., & Concilio, G. (2022). Innovative ICT Based Solutions and (Im) migrants Integration. Social Sciences, 11(6), 244.
25. Kinnula, M., Iivari, N., Isomursu, M., & Laari-Salmela, S. (2018). 'Worksome but Rewarding' – Stakeholder Perceptions on Value in Collaborative Design Work. Computer Supported Cooperative Work (CSCW), 27(3), 463–494. https: //doi.org/10.1007/s10606-018-9328-y
26. Korteweg, A. C. (2017). The failures of 'immigrant integration': The gendered racialized production of non-belonging. Migration Studies, 5(3), 428–444. https://doi.org/10.1093/migration/mnx025
27. Le Dantec, C.A., Christensen, J.E., Bailey, M., Farrell, R.G., Ellis, J.B., Danis, C.M., Kellogg, W.A., Edwards, W.K., (2010). A Tale of Two Publics: Democratizing Design at the Margins, in: DIS 2010. pp. 11–20.
28. Leminen, S. (2013). Coordination and participation in living lab networks. Technology Innovation Management Review, 3(11).
29. Leminen, S., Turunen, T., & Westerlund, M. (2015). The Grey Areas Between Open and Closed in Innovation Networks. Technology Innovation Management Review, 5(12): 6–18. http://timreview.ca/article/948
30. Lodato, T. J., & DiSalvo, C. (2018). Institutional Constraints: The Forms and Limits of Participatory Design in the Public Realm. In PDC '18: Proceedings of the 15th Participatory Design Conference -Volume 1, August 20--24, 2018, Hasselt and Genk, Belgium, 12 pages. https://doi.org/10.1145/3210586.3210595
31. Lucassen, L. (2005). The Immigrant Threat: The Integration of Old and New Migrants in Western Europe Since 1850. University of Illinois Press.
32. Mattelmäki, T., & Sleeswijk Visser, F. (2011). Lost in CO-X - Interpretations of Co-Design and Co-Creation. In L-L. C. Norbert Roozenburg (Ed.), Proceedings of IASDR'11, 4th World Conference on Design Research, Delft University, International Association of Societies of Design Research (IASDR).
33. Merkel, C. B., Xiao, L., Farooq, U., Ganoe, C. H., Lee, R., Carroll, J. M., & Rosson, M. B. (2004). Participatory design in community computing contexts: Tales from the field. In Proceedings of the eighth conference on Participatory design: Artful integration: interweaving media, materials and practices-Volume 1 (pp. 1-10).
34. Nnaemeka, C. (2013). The Unexotic Underclass. [Blog post] MIT Entrepreneurship Review. http://miter.mit.edu/the-unexotic-underclass/
35. Pollini, A., & Caforio, A. (2021). Participation and Iterative Experiments: Designing Alternative Futures with Migrants and Service Providers. Social Sciences, 10(10), 363.
36. Prahalad, C. K., & Ramaswamy, V. (2004). Co-Creation Experiences: The Next Practice in Value Creation. Journal of Interactive Marketing, 18(3): 5–14.
37. Reckwitz, A., Toward a Theory of Social Practices:A Development in Culturalist Theorizing. European Journal of Social Theory, 2002. 5(2): p. 243-263.
38. Saad-Sulonen, J., de Götzen, A., Morelli, N., & Simeone, L. (2020). Service Design and Participatory Design: Time to Join Forces? in Proceedings of the 16th Participatory Design Conference 2020- Participation(s) Otherwise - Vol. 2 (PDC '20: Vol. 2), June 15–20, 2020, Manizales, Colombia. ACM, New York, NY, USA, 6 pages. https://doi.org/10.1145/3384772.3385133
39. Sanchez, G., Hoxhaj, R., Nardin, S., Geddes, A., Achilli, L., & Kalantaryan, S. (2018). A study of the communication channels used by migrants and asylum seekers in Italy, with a particular focus on online and social media. Luxembourg: Publications Office of the European Union.
40. Sanders, E.B., & Stappers, P.J., (2008). Co-creation and the New Landscapes of Design, CoDesign, 4 (1), 5-18, https://doi.org/10.1080/15710880701875068
41. Simonsen, J., & Hertzum, M. (2012). Sustained Participatory Design: Extending the Iterative Approach. Design Issues, 28(3), 10-21. https://doi.org/10.1162/DESI_a_00158
42. Steen, K., & van Bueren, E. (2017). The defining characteristics of urban living labs. Technology Innovation Management Review, 7(7).
43. Torfing, J., Sørensen, E., & Røiseland, A. (2019). Transforming the Public Sector Into an Arena for Co-Creation: Barriers, Drivers, Benefits, and Ways Forward. Administration & Society, 51 (5), 795–825. https://doi.org/10.1177/0095399716680057

44. Vaajakallio, K., Lee, J-J., Kronqvist, J., & Mattelmäki, T. (2013). Service Co-design with the Public Sector - Challenges and Opportunities in a Healthcare Context. In Proceedings of Include Asia 2013.
45. Van Waart, P.; Mulder, I. and Bont, C. (2015): A Participatory Approach for Envisioning a Smart City. Social Science Computer Review, p. 1-16.
46. Voytenko, Y.; McCormick, K.; Evans, J. & Schliwa, G. (2015). Urban Living Labs for Sustainability and Low Carbon Cities in Europe: Towards a Research Agenda. Journal of Cleaner Production. 123. 10.1016/j.jclepro.2015.08.053.
47. Wagner, C. (2004). Wiki: A Technology for Conversational Knowledge Management and Group Collaboration. Communications of the Association for Information Systems, 13(1). https://doi.org/10.17705/1CAIS.01319
48. Wiki. (2022). In Wikipedia. https://en.wikipedia.org/w/index.php?title=Wiki&oldid=1087434293
49. Winschiers-Theophilus, H., Chivuno-Kuria, S., Kapuire, G.K., Bidwell, N.J. & Blake, E., (2010). Being Participated - A Community Approach, in PDC 2010. 1-10.

Research In Progress Paper

Building Mobilaînés: a One-Stop Transportation Planning Service Co-Designed by and for Older Adults[1]

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Abstract

Among the many challenges of an aging population, mobility is an important issue that has a significant impact on the quality of life of older people and their social participation. Despite an asymmetrically developed offer of transportation services from one city to another, older adults do not necessarily use them, partly because they do not know which ones are adapted to their needs and preferences. This living lab aims to develop *Mobilaînés*, a one-stop platform transportation planning service combining different transport modes and services to help older adults move around in their community where, when, and how they wish. In its second phase (the designing of a web interface), the project brings together different disciplines and partners from different sectors and older adults. This paper focuses on the first phase and the beginning of the second one to report the main findings, the challenges encountered in building the first age-friendly mobility solution in Quebec.

Keywords

Older adults; Living Lab; Mobility; Transportation; Information System

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[1] The complete reseach protocol have been previously published under Creative Common CC BY 4.0: Provencher, V., Baillargeon, D., Abdulrazak, B., Boissy, P., Levasseur, M., Delli-Colli, N., Pigot, H., Audet, M., Bahrampoor Givi, S., & Girard, C. (2022). Developing a One-Stop Platform Transportation Planning Service to Help Older Adults Move Around in Their Community Where, When, and How They Wish: Protocol for a Living Lab Study. JMIR research protocols, 11(6), e33894. https://doi.org/10.2196/33894

Introduction

Difficulties related to mobility are frequently observed with ageing (Robnett, Chop, & Brossoie, 2020). Whether balance, diminished vision, reaction time, range of motion, diminished financial resources or social network: all can impede mobility capabilities, and social participation, increasing isolation, health problems and mortality risk (Fiedler & Consult, 2007). Cognitive abilities (Murman, 2015) and lack of digital literacy (Watering, 2005) can lead to difficulty planning outings and understanding public transportation options (Wong, Szeto, Yang, Li, & Wong, 2018). These means of transportation are not necessarily familiar to or used by older adults, due to related fears (getting lost, not being able to find a place to sit, having unwanted social contacts, etc.) (Shrestha, Millonig, Hounsell, & McDonald, 2017). Moreover, older adults often have different travel patterns than younger adults (O′Hern & Oxley, 2015). Also, some older adults do not find transportation planning apps easy or intuitive to use (Vechione et al., 2018).

This living lab aims to develop *Mobilaînés* (a contraction of *Mobilité* [mobility] and *Aînés* [older adults] in French), a Mobility as a Service (MaaS) platform (Wright, Nelson, & Cottrill, 2020) which incorporates different modes and forms of transportation services (adapted transport, bike, bus, taxi, walk) to help older adults move around where, when, and how they wish in Sherbrooke, a medium-sized city in Quebec, Canada. More specifically, personalized parameters often neglected in existing transportation planning tools (e.g. lifestyle habits, feeling safe when taking a trip) are considered (Shirgaokar, 2020). *Mobilaînés* thus aims to include a technological interface (a responsive web app) and human support (telephone) to consider the variability in digital literacy in the ageing population.

Mobilaînés brings together intersectoral partners, including transportation providers and various community organizations. A steering committee composed of 8 stakeholders from the public, scientific, private and community sectors and older citizens. The committee monitors the project's progress, reviews data collection methods and results, decides and prioritizes design aspects through each phase, ensuring its sustainability and respecting the citizen-centred living lab approach. "*Carnet de route*" ("Travelog"), *Mobilaînés'* public logbook[2], allows the various partners as well as the public to follow the progress of the project. As full partners in the process, members representing older adults help keep this population's perspectives at the centre of the creative process and ensure that their emotions, experiences, and limitations are considered in all decisions (Lindsay, Jackson, Schofield, & Olivier, 2012; Pedell et al., 2017; Waycott et al., 2012).

The design protocol of *Mobilaînés*

The design of *Mobilaînés* incorporates living labs' typical three main phases: exploration,

2 Example (in French). https://lippa.recherche.usherbrooke.ca/2020/06/30/carnet-de-route-mobilaines-3-lexploration-des-regards-experts/

experimentation, and evaluation (Bradwell & Marr, 2008) (Figure 1). *Mobilaînés* is now in phase 2.

Phase 1 is the exploration and allows to define the needs and preferences of the older people. Phase 2 is the experimentation phase during which the components (web application and phone support) of Mobilaînés are co-created. Phase 3 is where the prototype will be tested, and the scaling-up protocol discussed.

Note that this living lab has received funding to bring the project to a first prototype. That said, to ensure that we can scale up *Mobilaînés*, we have already included partners (including the city of Sherbrooke) in the project, to ensure the implementation and sustainability of the project, an important value of the living lab.

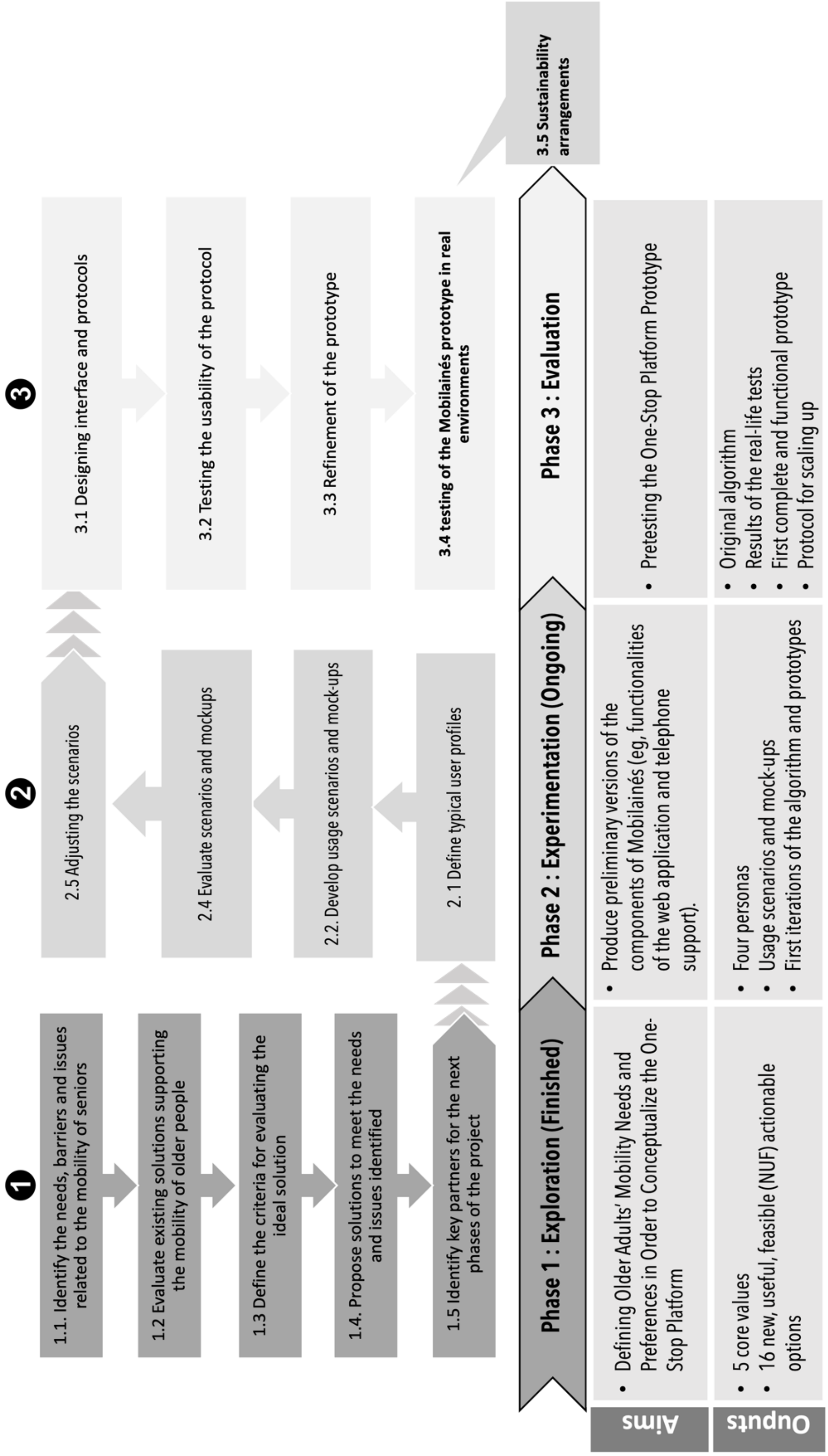

Figure 1. Mobilaînés design protocol

Phase 1 (Exploration): Defining Older Adults' Mobility Needs and Preferences

The aim of phase 1 is to support the conceptualization of the one-stop platform by documenting the realities, needs and expectations of older adults and transportation service providers as well as their satisfaction with existing mobility planning tools. To use the most up-to-date knowledge and experiences, we gathered: a) evidence from recent scientific and grey literature by performing two scoping reviews to identify facilitators and barriers to older adults' mobility and existing tools; b) data from surveys completed by the steering committee and older citizens (n=8) to prioritize the platform's values; and c) results from three steering committee meetings as well as five in-person workshops involving transportation service providers, community-based and public health stakeholders (n=12) and older citizens (n=18), along with telephone interviews with the frailest older adults (n=6).

Based on this knowledge, we established **5 core values**, i.e., the overarching values of the project that guide subsequent decisions. Thus, *Mobilaînés* must: 1) offer adapted routes for older adults; 2) provide reassuring routes; 3) identify pleasant routes; and 4) consider travel costs. The interface must also 5) be designed to be accessible to people with limitations.

The interviews with older adults, the workshops and the literature review led us to establish **34 needs or preferences**, converted into **16 new, useful, feasible (NUF) actionable options**, i.e., options that can be responded to by drawing on existing and accessible data. Since not all these options have equal weight in the planning algorithm, we conducted a workshop (

Figure 2) with 11 older adults to determine which options are "necessary," "interesting but not mandatory," and "not necessary."

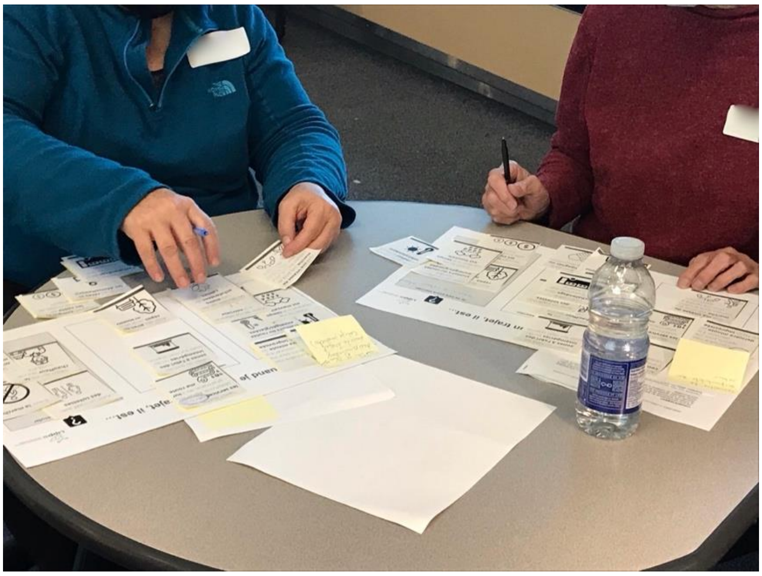

Figure 2. Workshop to determine Mobilaînés' mandatory options.

The results allowed us to distinguish between, on the one hand, the options that will be entered into the planning algorithm—thus influencing the suggested routes—and, on the other, the options that will be presented as additional information about the route (Table 1).

Table 1. Options incorporated into the development of the algorithm or presented as additional information about the route.

	Planning algorithm	Additional information
I want to know my options that allow me to make a spontaneous trip or last-minute changes	X	
I want to avoid using snowy/icy sidewalks or roads	X	
I want a route with rest areas where I can sit down	X	
I want to know where there are benches or areas sheltered from the weather or sun on my route		X
I want to know if someone can accompany me or help me get to my destination	X	
I want a route with bathrooms		X
I want to have the total cost of all the transportation I choose	X	
I want to take my walking speed into account	X	
I want to know what services (bus shelters, telephones, grocery stores, etc.) are on my route		X
I want to know the traffic of the locations and transportation		X
I want to avoid travelling if the weather is bad		X
I want to avoid making a trip in the heat and direct sunlight		X
I want to be able to compare transportation costs based on trip type and transportation options	X	
I want to avoid walking	X	
I want to use less busy or quieter streets (as opposed to traffic, noise, speeding cars, etc.)		X
I want to avoid hills and slopes	X	

Phase 2 (Experimentation): Cocreating the components of *Mobilaînés*

The aim of Phase 2 (ongoing) is to produce preliminary versions of the components of *Mobilaînés* (e.g. functionalities of the web application and the telephone support protocol). Based on data gathered in Phase 1, we identified in Phase 2.1, profiles of typical older-adult end users of the platform to produce personas: the *Active on the move*; the *Restricted Active*; the *Passive Isolated*; the *Autonomous Isolated*. These **four personas** (Nielsen, 2019) reflect older adults' different needs and preferences when planning trips (e.g. level of use and access to transportation planning tools) and moving around (e.g. frequency and assistance required to go out) as well as their digital literacy.

Phase 2.2, ongoing, includes the production of **usage scenarios and mock-ups** (static designs of the web application) to present *Mobilaînés*'s potential functionalities (content and interface), and the different ways older adult end users might utilize them. Once again, older adults are involved not only in the testing of the interface but also in its design. For example, to help the graphic design agency in the research of tone, imagery and UX (Figure 3).

Figure 3. Older adults working on mood boards for Mobilaînés' visual design

Phase 2.3 will be **testing the scenarios and mock-ups** with 12 older adults embodying the four personas who will evaluate the features of *Mobilaînés* in relation to their needs and preferences. Phase 2.4 will be a **refinement of the features** of the one-stop transportation planning service, based on the input of the older adults.

While this phase was to make use of static models and scenarios, the project's IT team–a researcher in computer engineering and his team of students–had to start programming the algorithm to ensure the feasibility of some of the needs expressed. Thus, some prototyping steps planned in phase 3 had to be brought forward. As a result, the work of linking up with the data provider partners (Société de transport de Sherbrooke, City of Sherbrooke) was also brought forward.

In this phase, different scenarios representing realistic uses of *Mobilaînés* will be created to refine its functionality (e.g. its ability to display interactive maps showing the most age-friendly routes, the ease of use of its interface), the accessibility of its interface (e.g. telephone support and use of technology), and to provide information about how the preliminary prototype matches older adults' needs.

Phase 3 (Evaluation): Pretesting the One-Stop Platform Prototype

Phase 3 will include 5 subphases. In phase 3.1, technology experts involved in the project will **implement the technology** platform functionality of *Mobilaînés*, based on the mock-ups and scenarios developed in phase 2. But as mentioned this phase has been brought forward. Prototyping of the *Mobilaînés* platform relies on an **original algorithm** (under development) based on the aggregation of data (e.g. timetables, real-time location information, and user-generated content) from different sources, including OpenStreetMap, the Google Maps, the Société de transport de Sherbrooke (the Sherbrooke transportation company), and open-source data from the City of Sherbrooke. Based on the available data and identified needs, the algorithm will find the most well-adapted and personalized itinerary to the given destination. Service agreements and protocols for human support (e.g. telephone) will also be determined.

In phase 3.2, older adults matching the personas identified in Phase 2 will **test the prototype's usability** in specific scenarios. Usability tests of the web application will be performed iteratively in 2 sessions (testing initial and revised versions) with targeted end users (n=8). Participants will test 3 usage scenarios in which they have to navigate the web interface and obtain travel information for a specific destination while inputting specific preferences. Interactions with the web portal application will be captured with screen recording software. Task performance in the 3 case scenarios (including aspects such as critical errors and the task completion rate) will be analysed (Hackos & Redish, 1998). A retrospective think-aloud session with gaze path simulation (Elling, Lentz, & de Jong, 2011) combining the captured streams (screen, face, and gaze) will be used to debrief the participants and identify usability issues. At the end of the session, participants will also complete the System Usability Scale (Jordan, 1996, [SUS]), a questionnaire frequently used to measure efficacy and satisfaction with usability when users perform specific tasks. The SUS will be combined with a questionnaire based on the Unified Theory of Acceptance and Use of Technology model (UTAT) to measure the perceived performance, expectancy, facilitating conditions, and social influence of new technology (Venkatesh, Morris, Davis, & Davis, 2003).

Phase 3.3 will involve **refinement of the prototype** according to the results obtained in phase 3.2.

Phase 3.4 will be **testing the *Mobilaînés* prototype in real environments**. Older participants (n=30) will be recruited through collaboration with local organizations and matched with the four personas to reflect a variety of needs, preferences, and characteristics, such as gender, income, rural or urban living area, and physical limitations. We will use a combination of qualitative methods, such as semi-structured interviews and logbooks, and quantitative methods, such as actigraphy, geolocation, and questionnaires (Chaix et al., 2019).

The final phase, phase 3.5, will involve discussions of ways to support the **adoption and implementation of *Mobilaînés*.** More specifically, to facilitate the transition toward scaling up the technologies emerging from *Mobilaînés*, public and private sector partners will support the steering committee in establishing sustainability modalities.

Conclusion

Mobilaînés began in September 2019 and is scheduled for completion by March 2024, one year later than originally planned, due to the pandemic. So far, we have been able to better understand: 1) the obstacles and facilitators of older adults' mobility and the existing planning tools; and 2) their needs and preferences in planning their trips. We have translated these needs and preferences into 16 new, useful and feasible options through an inventory of open data, obtained through close collaboration between several partners.

Particularly when they involve vulnerable or marginalized populations, living labs pose some challenges, namely diversity, communication, location, relationship and support for participants, timing and continuity (Callari et al., 2019; Lindsay et al., 2012; Schilling & Gerhardus, 2017). We encountered several of these but found solutions for most of the challenges. However, there remain issues associated with continuity and follow-up between stages of the project, due to the pandemic. Diversity (of age, physical condition and ethnicity) is still a challenge. Solutions are being implemented to address these challenges. For example, we sought input from older people to better design our communications. New contacts with the community, including seniors' residences, were sought to build the new team of older partners.

Despite these challenges, *Mobilaînés* continues to move forward into the second phase, which will give rise to the first functional models and the development of an original algorithm, and the only one in Quebec to help older adults plan their outings. *Mobilaînés* thus aims to become a crossroads where experience, knowledge, and innovation meet with the goal of fostering autonomy and freedom in older adults' decision-making regarding transportation while reducing the physical and psychological risks of being harmed when moving around. As we live in an era where re-engagement in the community needs to be supported, *Mobilaînés* will contribute to a more inclusive society by improving older adults' access to transportation, now and in the future, and by accommodating their current and anticipated needs.

References

1. Bradwell, P., & Marr, S. (2008). Making the most of collaboration : An international survey of public service co-design. London: Demos.
2. Callari, T., Moody, L., Saunders, J., Ward, G., Holliday, N., & Woodley, J. (2019). Exploring Participation Needs and Motivational Requirements When Engaging Older Adults in an Emerging Living Lab. Technology Innovation Management Review, 9(3), 38-49. https://doi.org/10.22215/timreview/1223
3. Chaix, B., Benmarhnia, T., Kestens, Y., Brondeel, R., Perchoux, C., Gerber, P., & Duncan, D. T. (2019). Combining sensor tracking with a GPS-based mobility survey to better measure physical activity in trips : Public transport generates walking. The International Journal of Behavioral Nutrition and Physical Activity, 16(1), 84. https://doi.org/10.1186/s12966-019-0841-2
4. Elling, S., Lentz, L., & de Jong, M. (2011). Retrospective think-aloud method : Using eye movements as an extra cue for participants' verbalizations. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 1161-1170. Vancouver BC Canada: ACM. https://doi.org/10.1145/1978942.1979116
5. Fiedler, M., & Consult, R. (2007). Challenges and Chances of an Ageing Society. Public Transport, 116.
6. Hackos, J. T., & Redish, J. (1998). User and task analysis for interface design. New York: Wiley.
7. Jordan, P. W. (Éd.). (1996). Usability evaluation in industry. London; Bristol, Pa: Taylor & Francis.
8. Lindsay, S., Jackson, D., Schofield, G., & Olivier, P. (2012). Engaging older people using participatory design. ACM Press. https://doi.org/10.1145/2207676.2208570
9. Murman, D. L. (2015). The Impact of Age on Cognition. Seminars in Hearing, 36(3), 111-121. https://doi.org/10.1055/s-0035-1555115
10. Nielsen, L. (2019). Personas—User Focused Design (2nd ed. 2019). London: Springer London : Imprint: Springer. https://doi.org/10.1007/978-1-4471-7427-1
11. O׳Hern, S., & Oxley, J. (2015). Understanding travel patterns to support safe active transport for older adults. Journal of Transport & Health, 2(1), 79-85. https://doi.org/10.1016/j.jth.2014.09.016
12. Pedell, S., Keirnan, A., Priday, G., Miller, T., Mendoza, A., Lopez-Lorca, A., & Sterling, L. (2017). Methods for Supporting Older Users in Communicating Their Emotions at Different Phases of a Living Lab Project. Technology Innovation Management Review, 7(2), 7-19. https://doi.org/10.22215/timreview/1053
13. Robnett, R. H., Chop, W. C., & Brossoie, N. (Éds.). (2020). Gerontology for the health care professional (Fourth edition). Burlington, MA: Jones & Barlett Learning.
14. Schilling, I., & Gerhardus, A. (2017). Methods for Involving Older People in Health Research—A Review of the Literature. International Journal of Environmental Research and Public Health, 14(12), 1476. https://doi.org/10.3390/ijerph14121476
15. Shirgaokar, M. (2020). Expanding Seniors' Mobility through Phone Apps : Potential Responses from the Private and Public Sectors. Journal of Planning Education and Research, 40(4), 405-415. https://doi.org/10.1177/0739456X18769133
16. Shrestha, B. P., Millonig, A., Hounsell, N. B., & McDonald, M. (2017). Review of Public Transport Needs of Older People in European Context. Journal of Population Ageing, 10(4), 343-361. https://doi.org/10.1007/s12062-016-9168-9
17. Vechione, M., Marrufo, C., Vargas-Acosta, R. A., Jimenez-Velasco, M. G., Gurbuz, O., Dmitriyeva, A., … Chow, J. Y. J. (2018). Smart Mobility for Seniors : Challenges and Solutions in El Paso, TX, and New York, NY. 2018 IEEE International Smart Cities Conference (ISC2), 1-8. Kansas City, MO, USA: IEEE. https://doi.org/10.1109/ISC2.2018.8656975
18. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology : Toward a Unified View. MIS Quarterly, 27(3), 425-478. https://doi.org/10.2307/30036540
19. Watering, M. R. van de. (2005). The Impact of Computer Technology on the Elderly. Consulté à l'adresse http://www.marekvandewatering.com/texts/HCI_Essay_Marek_van_de_Watering.pdf
20. Waycott, J., Pedell, S., Vetere, F., Ozanne, E., Kulik, L., Gruner, A., & Downs, J. (2012). Actively engaging older adults in the development and evaluation of tablet technology. 643-652. ACM Press. https://doi.org/10.1145/2414536.2414633

21. Wong, R. C. P., Szeto, W. Y., Yang, L., Li, Y. C., & Wong, S. C. (2018). Public transport policy measures for improving elderly mobility. Transport Policy, 63, 73-79. https://doi.org/10.1016/j.tranpol.2017.12.015
22. Wright, S., Nelson, J. D., & Cottrill, C. D. (2020). MaaS for the suburban market : Incorporating carpooling in the mix. Transportation Research Part A: Policy and Practice, 131, 206-218. https://doi.org/10.1016/j.tra.2019.09.034

Full Research Paper

How to ensure a long-term perspective for Nature-based Solutions? The case of proGIreg Living Lab in Turin

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Abstract

Nature-based Solutions (NbS) are cost-effective actions or infrastructures based on natural processes capable of generating social, health, economic and environmental benefits for urban communities. NbS are increasingly being planned and developed by engaging citizens in Urban Living Labs (ULLs), co-production spaces where local governments, private companies and academies empower citizens to experiment with innovative solutions able to tackle complex problems of contemporary society. However, at the end of ULLs, many local governments struggle to find policy devices that might guarantee long-term maintenance and opportunities of replicability to NbS. Grounding on the case of study of proGIreg Living Lab in Turin, this paper suggests three main policy-tools that can be used by local governments to keep maintaining, developing and replicating NbS beyond the timeframe imposed by temporary ULLs.

Keywords

Urban Living Labs; Nature-based Solutions; proGIreg; maintenance; replicability; policy tools.

Introduction

Nature-based Solutions (NbS) are actions or infrastructures based on natural processes capable of generating social, health, economic and environmental benefits for urban communities (European Commission, 2016). Ranging from green roofs and vertical farming to urban gardens and green corridors, via regenerated soils and pollinator friendly areas, NbSs consist of a broad and heterogeneous array of solutions (Katsou et al. 2020). At a time when the effects of climate change are becoming increasingly evident, NbS can represent effective devices or ideas to mitigate disruptive phenomena of climate change such as heat waves, air pollution, flooding, and biodiversity loss in urban ecosystems. Meanwhile, such solutions can have a meaningful effect in terms of social inclusion and well-being, leading citizens to strengthen their sense of responsibility and belonging by taking care of public spaces and goods. In addition, NbS and green areas in general, should be seen as an investment and not a cost, as it has often been shown that living in areas with high green cover reduces many expenses, including health expenses, so the quantity, quality and access to residential green space can have a significant impact on public health and the economy (Van Den Eeden et al. 2022).

Nowadays, NbSs are increasingly being planned and developed by engaging citizens in Urban Living Labs (ULLs). ULLs represent co-production spaces where local governments, private companies and academies empower citizens to experiment with innovative solutions able to tackle complex problems of contemporary society (Leminen and Schuurman 2021). Delivering real-life settings for policy experimentation, ULLs are promising user-centric tools capable of contesting traditional policymaking and proposing alternative models of collaborative governance. In such contexts of learning, citizens are asked to unleash their creativity to co-design, co-implement and co-assess innovations with the potential to mitigate climate impacts and improve the quality of urban life. In real-life settings, all stakeholders are led to learn through an iterative process of listening and dialogue aimed at developing and fixing step by step place-based innovations. Private companies have the opportunity to receive preliminary feedback about weaknesses and potentials of their products, and refine their ideas before getting into the market. Academies and research centers can carry out applied research without falling into the artificiality of scientific laboratories, and they can bring students to cope with concrete case studies and put in practice what they learn from their studies (Konstantinidis et al. 2021). Public administrations have the twofold chance to understand the needs and necessities of citizens, and improve the management of services and public spaces. As a result of these properties, ULLs are now fully embedded within broader metropolitan and urban strategies aimed at environmental sustainability, climate resilience and local development, such as the City of Amsterdam's five-year agenda for a circular economy or the City of Rome's Urban Plan for Sustainable Mobility. In spite of such recognition, much of the literature has highlighted how NbS initiated through ULLs often risk being abandoned once the funding project has ended (Avelino et al. 2016; Leminen et al. 2017). This dynamic can jeopardize the long-term impact of such initiatives, as it leads actors to stop cooperating to follow up on what was co-designed during the ULL. To respond to this risk, local governments are supposed to look to policy tools that can be complementary to ULLs, capable of ensuring that NbS can survive and grow without time-based impediments.

Grounding on a case study of ULL specifically focused on experimenting with NbSs, the proGIreg (Productive Green Infrastructures for post-industrial urban Regeneration) living lab in Turin (Italy), the following paper aims to provide an overview of policy tools that can ensure that NbSs continue to proliferate, develop and produce benefits in the long run. To accomplish this, our work delivers innovative policy recommendations for municipalities interested in guaranteeing valuable maintenance for NbSs, continuing to produce environmental and social benefits for communities, and saving public resources. To this end, the paper is divided into four main sections. The first presents the analytical framework and clarifies research methods. The second digs into the case study of proGIreg, and delivers an in-depth description of the seven NbSs. The third is devoted to outlining the policy tools that the city can put in place to ensure long-term maintenance, replicability and development for NbSs. The fourth presents conclusions and offers suggestions for policymakers and insights for future research.

Analytical Framework and methods

The following research originated within the European project proGIreg with the specific intent of offering insights for both the City of Turin and the other seven local governments involved in the project-Dortmund (Germany), Zagreb (Croatia), Ningbo (China), Cascais (Portugal), Cluj-Napoca (Romania), Piraeus (Greece), and Zenica (Bosnia and Herzegovina).

In this regard, the work adopted a qualitative analysis approach based on two main methods. First, desk-research was conducted to dig into the traditional tools adopted by the city of Turin for the maintenance and management of green infrastructures. Since NbSs do not have a well-defined framing within local regulations, this work involved the analysis of resolutions, determinations and official documents related to the management of public areas, common goods and green spaces. Second, the research team carried out participant observation and accompaniment for 36 months, assisting the City in engaging and dialoguing with local partnership actors aimed at building and updating the so-called implementation plan. This document provided for actors to meet with municipal officials on a six-monthly basis to understand what monitoring and maintenance tools could ensure a long-term perspective for the NbS tested through the project.

The case of proGIreg

ProGIreg is a 5 years (2018-2023) project financed by the European Commission under the Societal Challenges - Climate action, Environment, Resource Efficiency and Raw

Materials Programme of Horizon 2020 (https://cordis.europa.eu/project/id/776528). With a budget of 11M of Euros and the Coordination provided by the Rheinisch-Westfaelische Technische Hochschule of Aachen in Germany, the project aim is to implement various Nature-Based Solutions (NbS) which are citizen-owned and co-developed by municipalities, market and civil society stakeholders, organized in a Living lab. A specific area within each of the city partners (Dortmund, Ningbo, Turin, Zagreb, named frontrunner city and Cascais, Cluj Napoca and Pyreus as follower city) has been selected to be redeveloped and revitalized thanks to the benefits ensured by the NbS. The NbS to be tested i.a. include: regenerating industrial soils biotic compounds, creating community-based urban agriculture and aquaponics and making renatured river corridors accessible for local residents.

The City of Turin played the double role of front runner city (FRC), managing the activities and collaborating with other local partners to develop the NbS in Turin Living Lab of Mirafiori Sud and coordinator of the work package (WP) dedicated to support the implementation in all FRC. WP n.3 aim is to assist and help the partners in implementing the NbS. To do that the City designed, shared and managed a working methodology and some monitoring tools: an NbS timetable where to detail each activity carried out to plan, design and manage the single NbS and an Implementation Plan (IP) a working document to be used by the city to summarize and report, step by step and collectively (within the project team) all the activities designed and implemented, within the Living Lab framework, to realize the NbS.

This activity helped the cities in highlighting each phase of the effort needed to complete NbSs from the planning and procedural steps up to the maintenance and handover activities. Results, challenges and criticism encountered as well as the articulated process of implementing nature in (post-industrial) urban context represent a great source of knowledge to be used in further interventions.

The IP includes a section dedicated to long term sustainability issues, where the cities are asked to highlight how each NbS will be maintained over the time and after the end of the project. Grounding on this activity, Figure 1 summarizes the different options the FRC have designed and planned the maintenance activity in their IP realized during proGIreg timeframe. The FRC have been asked to display how each single NbS will be maintained and if they plan to hand over the NbS management. The FRC have planned different alternatives to ensure a long lasting sustainability of each NbS, taking into account not only the typology of NbS to be implemented but also other context based features that addressed the choice. By the time this paper has been elaborated, the project is still ongoing and some NbS are not fully implemented. Some critical issues are still to be solved and changes in the maintenance strategy and planning are possible, showing us how the topic needs to be further analyzed.

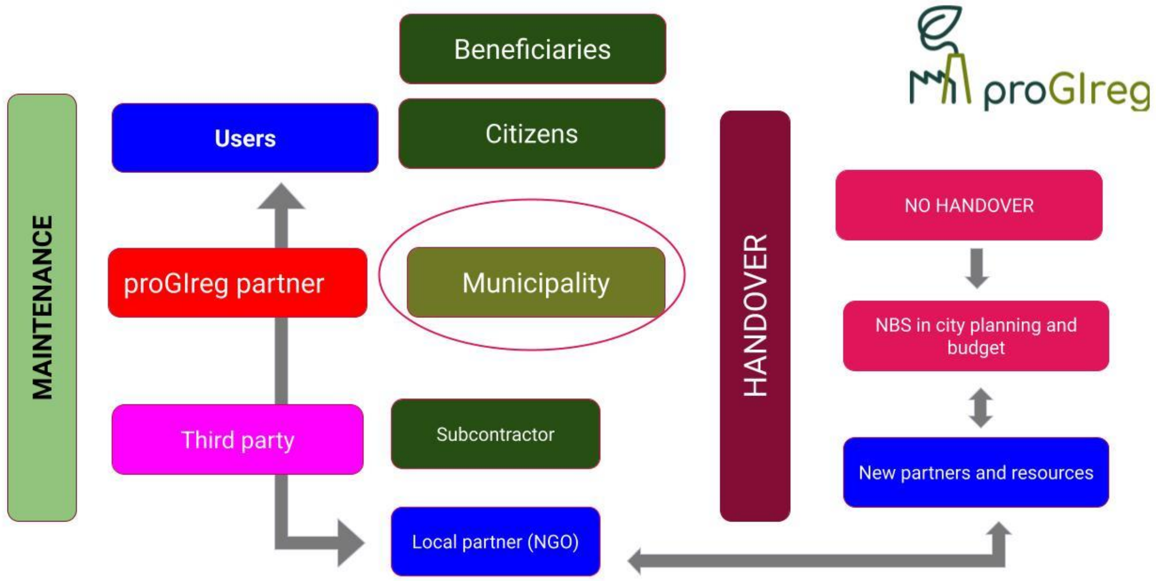

Figure 1. Maintenance and handover options in proGIreg implemented NbS.

The proGIreg partner (or a third linked party) who proposed the realization of an NbS was the subject who was in charge of the implementation and maintenance activity. Having the Living Lab methodology the involvement of citizen as one of its core approach (Georges et al. 2015), the NbS implemented in proGIreg were co-designed with stakeholders including groups of potential users. Thus the process of involvement helps in building a sense of ownership that could guarantee the maintenance over the years of the NbS. If we look deeply at the different options the partners selected to manatain the NbS, we see that the role of the City administration is pivotal. Many of the areas where the NbS were implemented are public property land so the City has the legitimacy and power to manage them directly. Moreover, and thanks to the Living Lab approach, the City can involve key local actors who will contribute to the maintenance. Notably, the participatory and inclusive approach allowed to reach and involve other third sector or voluntary organizations already working in the LL area but that was not possible to involve as an official partner of proGIreg or were not known by the City. Looking at the long term perspective, the experience gained with proGIreg project shows that to ensure a sustainable management of the NbS the cities have some options.

The most common choice is to embed the new NbS in the green maintenance activities of the city. This option, which doesn't foresee any handover, is conditioned by the necessity to obtain new resources within the City's budget to cover the additional costs. This criticism can be solved if the city integrates the new NbS in a city's plan like an urban green management plan, giving them appropriate relevance. Secondly, the city can adopt some institutional participation tools (like collaboration agreements, *see Discussion session below*) to involve in the maintenance of NbS, some organization or groups of users/citizens. Finally, the City can use the living lab as a tool to find new partners and additional resources that will ensure to maintain the NbS over the time.

Considerations on the implementation of NbS in cities

NbS are a relatively new topic in public policy and urban planning. Nevertheless, in recent years some policy analysts, agronomists, and urban geographers offered interesting contributions and delivered useful suggestions for implementing NbS on an urban scale (Stefanakis et al., 2019; Ascione et al., 2021; Battisti et al, 2021).

NbS are able to provide benefits that simultaneously satisfy SDGs and urban governments' challenges and goals. Taking into account the range of benefits, NbS might cover all of the three fields of sustainability, namely the economic, the societal, and the environmental ones (Ommer et al. 2022). Nonetheless, in order to guarantee a long-term impact of NbS on the three subfields of sustainability, an in depth pre-assessment of their impact should be performed. To disentangle this knot, some examples of NbS pre-assessment related to the three subfields are given below.

Regarding the environmental aspect of sustainability, it is necessary to consider the benefits that might result from NbS in a determined time frame. In this regard, considering the emerging topic of climate change, it is possible to apply a framework useful for the pre-assessment of costs and co-benefits provided by NbS in order to select the most suitable solutions in projected future climate conditions. (Calliari et al. 2019). To this end, Ommer (et al. 2022) claim that the long-run effectiveness of an NbS strictly depends on the growing rate of vegetation over time. Hence, it is necessary to take into account the impacts of NbS in short and long-term periods (Kabisch et al., 2016). Due to the strong dependency on the implementation context, the NbS should be sartorially adapted to the climatic conditions, tailoring solutions in each reality. (Colléony, A., & Shwartz, A.,2019).

Looking at the social sub-field, some authors have pointed out that an early engagement of place-based stakeholders may offer a useful evaluation scenario for assessing the potential long-term benefits of NbS. By adopting strategies for co-evaluating NbS, solutions can be well integrated into the social fabric and meet site-specific goals, such as integration between different ethnic communities, integration of disadvantaged groups, or educational opportunities for the younger generation (Frantzeskaki, 2019).

The success of NbS, depends not only on economic and environmental factors, but also on the psychological and social characteristics of the target population. In this regard, the understanding and pre-assessment of the human values (altruism, selfishness, biophilia...) of the population managing or using the NbS, can be decisive in the identification of targeted management strategies, which can guarantee a long-term perspective of the NbS implemented. Such considerations can be seen in the case study salt marsh restoration in Martha's Vineyard, Massachusetts (Joshephs and Humphries, 2018).

In order to engage different stakeholders in co-evaluating and co-creating NbS, proGIreg, among other useful techniques (see **proGIreg** edX **MOOC)**, proposes the 'Six Thinking Hats' method (STH). STH consists of engaging stakeholders in metaphorically wearing a hat to play different roles, predict possible evolutions of NbS, and take decisions by adopting a vast range of perspectives.

Looking at the economic pillar, NbS should be considered an investment, not a cost. Often, monetisation of the benefits obtained from NbS refers to the economic quantification of the ecosystem services (Costanza et al., 2017) that are provided. As an example, it can be seen how the creation of an infiltration area and urban riparian park in Costa Rica is also perceived by residents as an opportunity for the potential increase of property value (Neumann, V.A. & Hack, J., 2022). Furthermore, when analysing the cost-benefit and comparing the implementation of an NbS and a grey infrastructure (namely human-engineered infrastructure) aimed at coastal defence in Ireland, it emerges that both solutions are useful to achieve the objective set, but the NbS was several times more cost-effective than the grey infrastructure alternative (Hynes et al. 2022).

Discussion

Starting from the case study of the ULL of proGIreg in Turin, three main tools stand out as promising devices for maintaining, replicating and developing NbS in the long run: a. stakeholders' engagement b. collaboration agreements c. the Public Green Plan. In the following sections we will present these tools one at a time, starting with the most bottom-up device, i.e., stakeholder' engagement, and moving on to more institutional and traditional devices such as the Green Plan, attempting to highlight their main potential and implications.

Stakeholders' engagement

ULLs differ from other traditional policy instruments in that they propose to experiment with horizontal or quadruple helix governance configurations, in which government, research institutions, private companies and citizens collaborate with no predefined roles or hierarchies (Nesti 2018). From a theoretical viewpoint, ULLs are deeply rooted in the theory of Elinor Ostrom (1992), who first advocated the ability of civil society to succeed in defining and respecting shared rules to ensure the maintenance of collective goods. Taking inspiration from the Ostrom's theory, as demonstrated by several case studies (Voytenko et al. 2016;), the horizontal governance arrangement of ULL is crucial in making stakeholders feel genuinely engaged, integrated and responsible for the creation, implementation, management and evaluation of innovative solutions. This is of paramount importance not only during different phases of ULLs development, but also at their end, when municipalities are faced with the need to ensure continuity in the monitoring, potential replicability and development of solutions.

In this regard, the case study literature offers some clarifying examples. Stakeholders' engagement turned out to be pivotal to follow up on an NbS based on hydroponic growing infrastructure, called UrbanAquaFarm, which was initiated and tested in the ULL 'Sharing and Circular economy' held in Turin between 2018 and 2020 (Cuomo et al. 2021). At the end of the grant, the Falchera citizens' committee, which was involved during the ULL by the experimenters (a local start-up committed in alternative horticulture), decided to continue taking care of the installations, selecting crops according to the season, ensuring water exchange and monitoring vegetable growth. In other policy contexts, stakeholders' engagement enabled by means of ULLs has been critical to keeping alive NbSs based on waste management systems or innovative reuse of soil. This occurred in Amsterdam, where a group of developers participating in the Living Lab 'Circular Buiksloterham' decided to join forces to co-manage neighborhood spaces and plots independently, continuing to experiment with and improve natural systems for saving waters and turning organic waste into compost for local horticulture (Bonato and Orsini 2018).

Moving to the our case of study, the ULL of proGIreg has already demonstrated the capability to engage stakeholders effectively, succeeding in creating a collaborative network of actors in the South Mirafiori neighborhood that can cooperate to ensure the informal management of NbS. Taking inspiration from such positive experiences of stakeholders' engagement could be a useful resource to ensure long-term management of proGIreg NbS. Nevertheless, as recently expressed by many scholars, the management of NbSs, especially the more structurally complex ones, cannot be totally left to the citizen or private entity, but should be accompanied by the local governments without affecting the creativity and effectiveness of bottom-up initiatives of co-management.

Collaboration agreements

In an attempt to ensure a long-term perspective for NbS, local governments may have a wide range of collaborative agreements that can formalize and strengthen ways of monitoring as well as replicating solutions. Among them, three main contracts seem promising for the NbS of proGIreg: the experimental agreement, the collaboration pact and the convention for public works.

First, in recent years the city of Turin has used the so-called 'experimental agreement'' to allow start-ups to experiment with economically and socially innovative solutions in real-life settings. In this contract, the duties and rights of the City and the proposing companies have been specified; the methods and duration of the trials; the regulations relating to the publicity of the initiative. After passing an NbS pre-assessment using environmental, economic and social indicators, the subject signing the agreement with the municipality may benefit from a fast-track permitting process for occupation of public space and energy supply connection. Moreover, the experimentation agreement turned out to be very useful for data sharing in view of monitoring and improving NbS. In this regard, the proponent agrees with the City on how the data produced can be accessed in real time, as well as the type of data, and how it can be released to allow the city to be able to take action when needed. In proGireg, the experimentation agreement has already been adopted with the DUAL company to enable the testing of NbS called 'new soil,' namely a regenerated soil made from waste building materials, compost and zeolite, in public spaces. Since it demonstrated the feasibility of the experimentation in terms of bureaucratic constraints, the experimental agreement could favor replicability of this kind of NbS in other parts of the city, inspiring other private companies interested in testing their regenerated soil.

Second, the collaboration pact signed by civil society subjects and the relevant City officers, is a formal deal which enables the care and co-management of urban commons including some categories of NbS. This kind of pact represents a powerful tool to trigger a widespread civic sense and to foster the idea of a change in the type of relation between residents and the local authority. It is mainly described by the Regulation on Urban Commons n. 391, according to which any collaboration pact is required to start with a participatory co-design process in which the municipal offices accompany the signatories to understand the ways of coordinating and managing the urban asset even before the contract is signed. In proGIreg, a pact of collaboration was signed by the City and Fondazione Comunità di Mirafiori (a nonprofit organization active in social and environmental promotion in the neighborhood) for the management of an NbS, the boxed gardens on Via Morandi initiated thanks to the European-funded ULL. This pact entrusted Fondazione with the management of the green infrastructure, including among the contractual prerequisites the intent to involve citizens in the care and maintenance of the garden.

Third, the convention for public works might be the most effective form of collaboration agreement at very specific conditions. When the municipality does not intend to directly use the NbS beyond the end of the ULL, it is believed that, in order to ensure its proper management and preservation, as well as its opening to public use, the best solution for its complete recovery and re-functionalization may be represented by the assignment to third-party professional skilled non-profit entities, willing to carry out activities of collective interest. This is a traditional public contract used in this case thanks to a specific article of the public tender law (D.lgs 50/2016), that allows a private actor to carry out works, with own resources, for public purpose.This mode of agreement has already been implemented within proGIreg in Turin. From 2018, the space called ‘Orto WOW’ has been identified as a venue for the implementation of three NbS aimed at citizen engagement: a green roof, pollinator garden, and an apiary (Figure 2). From the early stage of experimentation, Orto WOW proved to represent a unique space of experimentation where alternative forms of cooperation between different categories of citizens and local government took place. In 2021, the City decided to adopt the convention for public works to guarantee a long-term perspective to this hub of NbS.

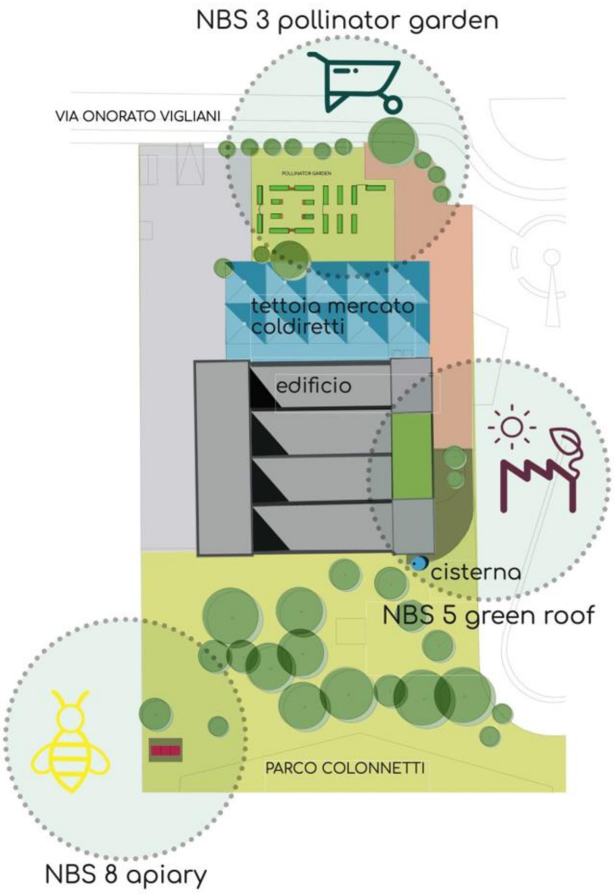

Figure 2. The three NbS implemented at Orto WOW in 2020 - Mirafiori Sud, Turin. (https://ortialti.com/portfolio/orto-wow/).

In the next months, a specific tender of concession will entail evaluation of project proposals from NGOs, based on many parameters, such as the degree of social utility, the level of innovation of the project, and the degree of sustainability of the proposal in environmental, social and economic terms. Different scores will be given to individual applications submitted by applicants for the purpose of concession approval. The winning nonprofit will be guaranteed a fee reduction from a minimum of 10 percent to a maximum of 90 percent from that determined on the basis of market values. The winning nonprofit entity will be guaranteed a fee reduction from a minimum of 10 percent to a maximum of 90 percent from that determined on the basis of market values.

Adopting collaboration agreements may be unsuitable under certain policy conditions for two main factors. First, they involve an ad-hoc administrative process that requires time and additional commitment from the local government. Second, since collaboration agreements are by nature administrative documents, they are difficult to be modified to meet new NbSs management needs or modified socio-environmental conditions of experimentation.

Nevertheless, collaboration agreements retain valuable benefits in promoting and managing NbSs, enabling citizens to develop creative ideas and local governments to create synergies with unconventional actors.

Public Green Plan

Several urban areas are characterized by high population density, commercial buildings and transport facilities. However, cities now face increasing pressure from growing populations, limited resources and the effect of climate change. Nevertheless, extreme weather events in urban areas in recent years have shown that a high presence of sealed areas in urban space is not conducive to a sufficiently resilient city.

Many researchers have highlighted the role of public green spaces in contributing to the resilience of cities by providing multiple ecosystem services. (e.g. Battisti et al., 2019; Saumel et al., 2020). NbS also plays a key role in this regard.

Nonetheless, the implementation of such solutions must be planned organically across the entire urban reality, creating a network of green areas and NbS that bring numerous benefits to all citizens, with priority given to the areas that most need such solutions.

In order to plan urban greenery wisely, an *ad hoc* plan or long-term strategy is needed.

To date, the general view on the implementation of green areas and NbS in cities can be summarised in two main points:

1. The increase in the number of trees planted in cities, for environmental purposes including reducing heat island phenomena, and for human well-being including psychological ones. The number of trees and the tree canopy cover are now two important indicators to classify cities according to the green spaces they have. "Treepedia" developed by Senseable City Lab of the Massachusett Institute of Technology (MIT), which measures the canopy cover in cities, places Singapore at the top of its the 'Green View Index' with 29% coverage, referring to cities with high population density (Treepedia, 2022).

   Turin, according to MIT calculations, has a Green View Index value of 16.2%. However, the minimum limit of the tree canopy cover is 30% to reduce air pollution and noise and foster mental health (IUCN, 2021).

2. The creation of new urban green areas, if possible at least 0.5 ha in size, including through the design of NbS in the urban environment (such as urban forest) in order to foster a closer connection to nature, especially in cities with high population density.

In order to create new green areas, also through the NbS, thus increasing the Green Infrastructure of Turin, the municipality approved the Strategic Plan of the Green Infrastructure (Turin Municipality, 2021), an analysis and programming tool to direct investments and management policies of the public urban green system of Turin in the next decades, integrating the urban planning tools.

This Strategic Plan originates from the National Urban Green Strategy, which foresees the involvement of stakeholders and necessarily multidisciplinary competences in order to develop suitable public policies and to direct municipal administrations towards the realisation of plans and projects based on ecosystem services and on the network of Green Infrastructures, defined to achieve specific social, environmental, financial and employment objectives. The National Urban Green Strategy is based on Law 10/2013, which regulates the development of urban green spaces.

The Strategic Plan also includes the topic of the management of green areas, where numerous urban green management options are presented and where a long and consolidated experience in the use of service contracts with a social clause is highlighted.

However, there is no long-term structured management plan for urban green areas and NbS to support the Strategic Plan of the Green Infrastructure.

Long-term experiences of planning and management of green spaces can be found in the USA and Canada, where several Urban Forest Management Plans (UFMP) are drawn up. The UFMP is based on the Urban Forest concept, which covers green areas in a broad sense and not only trees (e.g. green roofs, green walls). UFMP is a management plan, generally lasting 20 years, where there are ambitious final goals to be achieved. These goals must be pursued through functional sub-aims that are both five-year and yearly (van Wassenaer et al., 2012). It is a management plan that specifically indicates where and what to do in order to achieve the goals. Concrete examples of these UFMPs can be found in the City of Portland (2004) and the City of Tampa (2013). Many of the cited UFMP use criteria and indicators that can be found within the work done by Kenney, van Wassenaer and Satel (2011) who have implemented the work done by Clark and his colleagues in 1997. These indicators range from the canopy cover, to the public agency cooperation, to the visual assessment and to the public owned natural areas management, planning and implementation (Battisti et al., 2019).

It might therefore be desirable to adopt a similar instrument in the City of Turin as well, thus combining a strategic vision with management needs.

Such considerations should also be combined with the provision of NbS ecosystem services, especially related to tree management. It is shown that a tree goes from being a carbon emitter to being carbon neutral (and therefore able to have a positive trend on carbon uptake thereafter) many years after planting (about 26-33 years, referring to the City of Chicago). Trees sequester carbon at varying rates depending on species. In this case, the reference is *Acer rubrum*), depending on the management practices applied for care and maintenance (Petri et al., 2016).

Furthermore, the realisation of NbS linked to research projects (such as in proGIreg), should be coupled with a long-term management perspective, which goes beyond the time spent on scientific research, as they become part of the urban Green Infrastructure.

Looking at the main pros and cons of Public Green Plans, we can deliver a very particular and multifaceted picture. On the one hand, these instruments allow the valorisation of local ecosystems as key elements for urban development and deliver the best policy conditions to experiment different kinds of NbSs. However, these instruments are not binding for local governments and are strictly dependent on both the availability of resources and the level of continuity of political commitment. In addition, making specific reference to Turin, the existing Public Green Plan has more the appearance of a future urban green strategy of the City with some explanatory examples and proposals. The cons may result in the fact that many urban green activities and implementations do not have a defined number of steps and a certain time limit. The pro, on the other hand, is that although the IT-based green census is still in progress, there is already a future strategy that can guide careful and functional planning derived from the technical and practical knowledge of city officials and administrators.

Conclusions

The paper aims to analyze and consider the initial results and discussions that occurred in the current project, with the intention of using them in the management of the implemented NbS so as to ensure the provision of ecosystem services to the population over time.

ULLs are creative co-production spaces that allow various public and private actors to test innovative solutions, such as NbSs, in real-life settings through direct citizen engagement to respond to complex problems such as climate change. Nonetheless, at the end of ULLs tied to temporary economic resources, many cities struggle to find maintainable, replicable and developmental ways for the innovative solutions they have initiated. Grounding on the proGIreg case of study in Turin, our paper offered an overview of potential policy tools that can be used to ensure a long-term perspective for NbS. Local governments can rely on three main devices, each with its own characteristics and with a different degree of involvement of actors from below: stakeholder engagement, collaborative agreements and the Public Green Plan.

First, the stakeholders' engagement created through ULLs can create a sense of accountability among the actors who took part in the NbS experimentation on the ground. Such an informal network has proven capable of being able to define shared rules for maintaining simple solutions such as urban gardens or reuse of compost in common areas. Second, collaboration agreements can be a valuable tool to enable social associations, citizen committees, and businesses to continue caring for NbS or try to repurpose them in other testing areas. Third, the implementation of NbS, even if carried out for scientific purposes, must be part of a development strategy for the city's Green Infrastructure, which should mandatorily contain (or be combined with) a long-term management plan. In this way, a real provision of ecosystem services over time is guaranteed and green areas and NbS can thus be conceived as an investment and not as a cost.

Although these three tools may represent promising management modes for NbS, there is no basic replicable recipe for guaranteeing long-term maintenance of NbS in every policy context. In this regard, two suggestions for policymakers can be left in conclusion. First, a careful analysis of the setting and characteristics of the NbS should always be the starting point for choosing which policy tool to apply for their maintenance. Indeed, knowing the social and environmental dynamics of the experimental sites can play a key role in designing an effective long-term strategy for NbS. In pursuing NbS, the natural potentials of the target contexts should not be forgotten, which in Turin in particular reside in the rivers and hills, which are two green infrastructures that can be further enhanced. At the same time, the structural characteristics and management requirements of NbSs are critically important parameters from which to make an accurate instrument selection. Second, these tools should not be applied in an exclusive approach; instead, they can be adopted concurrently to enable NbS to naturally survive, grow and replicate. Local governments can then think of adopting these tools as a toolbox from which they can draw to creatively and innovatively ensure a long-term perspective for NbSs.

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References

1. Avelino, F., Grin, J., Pel, B., & Jhagroe, S. (2016). The politics of sustainability transitions. Journal of Environmental Policy & Planning, 18(5), 557-567.
2. Ascione, G.S., Cuomo, F., Mariotti, N., Corazza, L. (2021). Urban Living Labs, Circular Economy and Nature-Based Solutions: Ideation and Testing of a New Soil in the City of Turin Using a Multi-stakeholder Perspective . Circ.Econ.Sust. 1, 545–562).
3. Battisti, L., Corsini, F., Gusmerotti, N. M., & Larcher, F. (2019). Management and perception of metropolitan natura 2000 sites: A case study of La Mandria Park (Turin, Italy). Sustainability, 11(21), 6169.
4. Battisti L.; Larcher F.; Vercelli M.; Bonelli S.; Martelli F.; Paradiso F.; Ferracini C.; Ribotta L. (2021). NbS E BIODIVERSITÀ NELLE AREE URBANE: IL PROGETTO proGIreg A TORINO. RETICULA, 28, 58-70.
5. Bonato, D., Orsini, R. (2018). Urban Circular Economy: The New Frontier for European Cities' Sustainable Development. In Sustainable cities and communities design handbook (pp. 235-245). Butterworth-Heinemann.
6. Calliari E, Staccione A, Mysiak J. (2018). An assessment framework for climate-proof nature-based solutions. Sci. Total Environ., 656 (2019), pp. 691-700, 10.1016/j.scitotenv.2018.11.341
7. City of Portland, 2004. Urban Forest Management Plan. Retrieved February 20th, 2022 from https://www.portlandoregon.gov/parks/60402
8. City of Tampa, 2013. Urban Forest Management Plan. Retrieved February 20th, 2022 from http://docplayer.net/35177724-City-of-tampa-urban-forest-management-plan-november-2013.html
9. Clark, J.R., Matheny, N., Cross, G., Wake, V., (1997). A model of urban forest sustainability. J. Arboric. 23 (1), 17–30.
10. Colléony, A., & Shwartz, A. (2019). Beyond Assuming Co-Benefits in Nature-Based Solutions: A Human-Centered Approach to Optimize Social and Ecological Outcomes for Advancing Sustainable Urban Planning. Sustainability, 11(18), 4924. https://doi.org/10.3390/su11184924
11. Costanza, R., de Groot, R.,Braat, L.,Kubiszewski, I.,Fioramonti, L., Sutton, P., Farber, S., Grasso, M. (2017). Twenty years of ecosystem services: How far have we come and how far do we still need to go? Ecosystem Services, Volume 28, Part A, https://doi.org/10.1016/j.ecoser.2017.09.008.
12. Cuomo, F., Lambiase, N., Castagna, A. (2021). Living lab on sharing and circular economy: The case of Turin. Health Informatics Journal, 27(1), 1460458220987278.
13. European Commission, (2016). Nature-based Solutions. Available online: https://ec.europa.eu/research/environment/index.cfm?pg=NbS (Accessed on 16/05/2022)
14. Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. Environmental science & policy, 93, 101-111.
15. Georges, A., Schuurman, D., Baccarne, B., Coorevits, L. (2015). "User engagement in living lab field trials", info, Vol. 17 No. 4, pp. 26-39. https://doi.org/10.1108/info-01-2015-0011
16. Hynes, S., Burger, R., Tudella, J., Norton, D., Chen, W. (2022). Estimating the costs and benefits of protecting a coastal amenity from climate change-related hazards: Nature based solutions via oyster reef restoration versus grey infrastructure, Ecological Economics, Volume 194, 2022, 107349, https://doi.org/10.1016/j.ecolecon.2022.107349.
17. IUCN - 3-30-300 rule (2021). Available online: https://iucnurbanalliance.org/promoting-health-and-wellbeing-through-urban-forests-introducing-the-3-30-300-rule/ (Accessed on: 19/05/2022).
18. Josephs, L. I., & Humphries, A. T. (2018). Identifying social factors that undermine support for nature-based coastal management. Journal of Environmental Management, 212, 32-38.
19. Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., Haase, D., Knapp, S., Korn, H., Stadler, J., Zaunberger, K., Bonn, A. (2016). Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. Ecol. Soc., 21, 10.5751/ES-08373-210239.
20. Katsou, E., Nika, C. E., Buehler, D., Marić, B., Megyesi, B., Mino, E., ... & Atanasova, N. (2020). Transformation tools enabling the implementation of nature-based solutions for creating a resourceful circular city. Blue-Green Systems, 2(1), 188-213.
21. Kenney, W.A., Van Wassenaer, P.J., Satel, A.L. (2011). Criteria and indicators for strategic urban forest planning and management. Arboriculture & Urban Forestry 37, 108–117.

22. Konstantinidis, E. I., Petsani, D., & Bamidis, P. D. (2021). Teaching university students co-creation and living lab methodologies through experiential learning activities and preparing them for RRI. Health Informatics Journal, 27(1), 1460458221991204.
23. Leminen, S., Rajahonka, M., Westerlund, M., (2017). Towards Third-Generation Living Lab Networks in Cities. Technology Innovation Management Review 7, 21–35.
24. Leminen, S., Schuurman, D. (2021). Living Labs (9/10, 2021). Technology Innovation Management Review, 11(9/10).
25. Nesti, G. (2018). Co-production for innovation: the urban living lab experience. Policy and Society, 37(3), 310-325.
26. Neumann, V.A., Hack, J. (2022). Revealing and assessing the costs and benefits of nature-based solutions within a real-world laboratory in Costa Rica. Environmental Impact Assessment Review, Volume 93, 106737, https://doi.org/10.1016/j.eiar.2022.106737.
27. Ommer, J., Bucchignani, E., Leo, L. S., Kalas, M., Vranić, S., Debele, S., ... & Di Sabatino, S. (2022). Quantifying co-benefits and disbenefits of Nature-based Solutions targeting Disaster Risk Reduction. International Journal of Disaster Risk Reduction, 102966.
28. Petri, A.C., Koeser, A.K., Lovell, S.T., Ingram, D. (2016). How Green Are Trees? — Using Life Cycle Assessment Methods to Assess Net Environmental Benefits. Journal of Environmental Horticulture, 34 (4): 101–110.
29. Stefanakis, A. I. (2019). The role of constructed wetlands as green infrastructure for sustainable urban water management. Sustainability, 11(24), 6981.
30. Treepedia - MIT City Sensable Lab. Available online: http://senseable.mit.edu/treepedia (Accessed on: 19/05/2022)
31. Turin Municipality - Strategic Green Infrastructure Plan (2021). Available online: http://www.comune.torino.it/verdepubblico/il-verde-a-torino/piano-infrastruttura-verde/ (Accessed on: 17/05/2022).
32. Van Den Eeden, S.K., Browning, M., Becker, D.A., Shan, J., Alexeeff, S.E., Ray, G.T., Quesenberry, C.P., Kuo, M. (2022). Association between residential green cover and direct healthcare costs in Northern California: An individual level analysis of 5 million persons. Environment International, 163, 107174, doi: 10.1016/j.envint.2022.107174.
33. Van Wassenaer, P.J., Satel, A.L., Kenney, W.A., Ursic, M. (2012). A framework for strategic urban forest management planning and monitoring. Trees, People, and the Built Environment. In: Paper Presented at the Urban Trees Research Conference, Birmingham, UK, Edinburg: Forestry Commission, pp. 22–38.
34. Voytenko, Y., McCormick, K., Evans, J., Schwila, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. Journal of Cleaner Production, 123, 45–54. https://doi.org/10.1016/j.jclepro.2015.08.053

Practitioner Presentation Paper

Placemaking in the Urban Living Lab Heerlen and Aurora flat courtyard intervention: learning towards urban vitality in vulnerable and cultural diverse neighbourhoods.

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Abstract

The neighbourhood GMS in Heerlen-Noord, the Netherlands, is one of the 16 Dutch neighbourhoods that need extra focus to its livability and socio-economic challenges due to the historical development in the area and its current stigma in society. Placemaking as a planning philosophy and urban living labs as a planning approach both offer potential to address GMS its current urban challenges and reinvent itself as an area by drawing upon its unique values. In fact, this paper shows that while doing so and taking into account its local urban complexity is helpful to enable an inclusive participatory process from the start as well as including the multitude of local values to generate a physical intervention in place to seek transformation. Parallel, it shows the relevance of urban living labs as an infrastructure for innovation in education and being capable of enhancing student learning through interdisciplinary collaboration among urban stakeholders involved.

Keywords

Urban Living Labs, Co-creation, Placemaking, Urban intervention, Urban Vitality.

Case study introduction and context

The neighbourhood GMS in Heerlen-Noord suffers from a stigma as a result of the local historical context, i.e. the coal mines closure in the 60s and the consequent social urban challenges ever since. In fact, the neighbourhood is one of the 16 Dutch neighbourhoods that area assigned by the National Government as neighbourhoods that need extra focus to livability and its socio-economic urban challenges, such as energy poverty, low literacy or cultural diversity (Ministry BZK, 2020). One specific large social housing block of 228 housing units in GMS is the Aurora flat, owned by the local housing association Wonen Limburg. Aurora flat is 'known' in the area, mostly form negative perspective, i.e. due to the former army-drug related nuisance and current stigmatization because of the cultural and migration diversity of residents. Recently, Wonen Limburg 1) renovated the Aurora flat energetically and 2) painted the largest mural in Europe on it with the Spanish art collective Boa Mistura to boost the social cohesion of the neighbourhood and Aurora flat and to connect with the local municipal policy to embrace murals as a method to enhance the social quality of the urban environment. Besides, it adds to the spirit in Heerlen in its search to re-invent its local meaning, place identity and distinctive qualities for the city to overcome the faced urban challenges due to its historical development.

Picture 1. Aurora flat. Source: Boa Mistura.

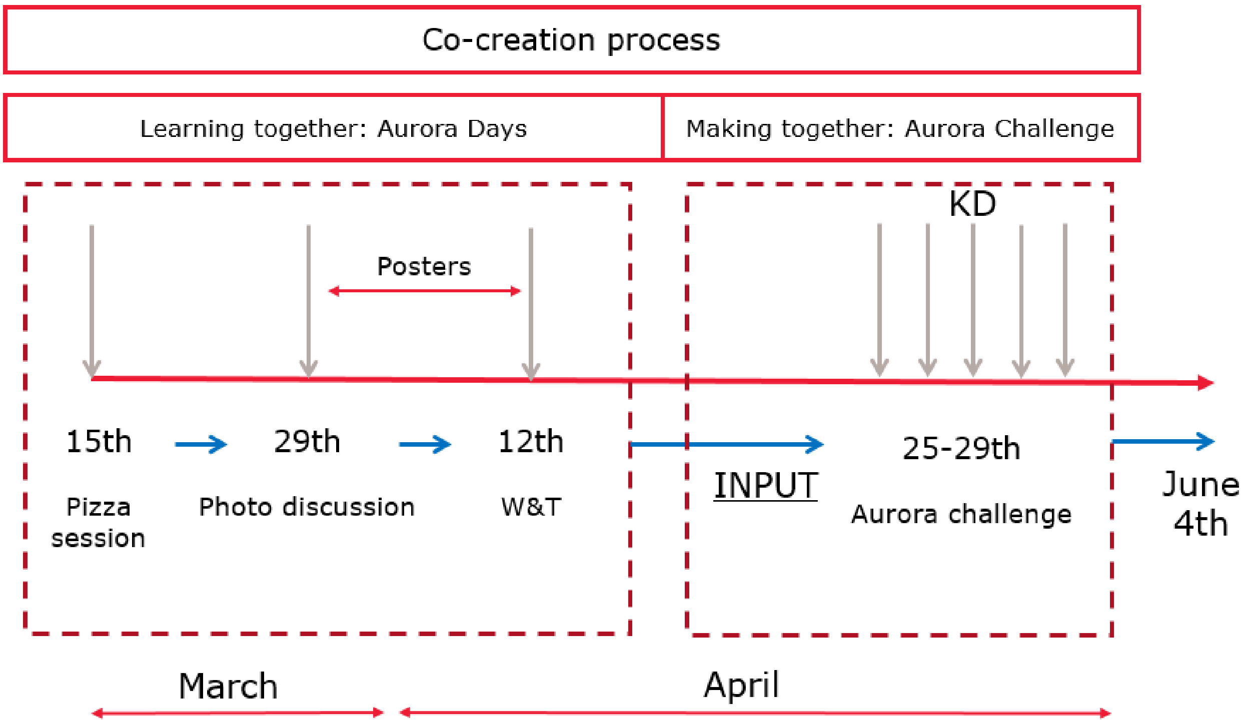
Conceptual and methodological approach in context

According to Marrades et al. (2021), placemaking in urban planning emerged as a response to the failure of other planning approaches and as a reconceptualization in how city sites are constituted and transformation takes place. As such, it offers an approach to bridge the gap between exchange value (economic profits) and user value (daily life activities). Placemaking also gives the chance to respond to urgent short-term needs of the local community and a direction to the long-term structural transformation. From spatial planning perspective, placemaking articulates urban sites as 'places' prioritizing and responding to demands from communities and focusing first and foremost on people (Marrades et al., 2021; Brenner et al., 2011). While placemaking as a concept lacks consistency in the way it is presented and even spelled in professional publications (Ellery et al., 2020), it may be defined as an incremental way to improve the quality of a place over a long period of time with context specific small projects and activities (Wyckoff, 2014). Consequently, it is seen as a process of creating 'quality places' that people want to live, work, play and learn in (Wyckoff, 2014). In fact and by doing so, Ellery et al. (2020) argues that placemaking creates an attachment or connection between the community and the place they live in, referred to as their sense of place.

Fincher, Pardy & Shaw (2016) stress the importance of local lived experiences and everyday encounters in placemaking for professional urban planners in order to overcome the gap between exchange and user value. Urban Living Labs (ULLs) provide the potential to overcome this gap since they are not only concerned with the place under study, but exists in relation to its historical, institutional, spatial and temporal dimensions while seeking transformation (Marrades et al., 2021). In this way, ULLs can be understood as city sites that provide a learning arena within which the co-creation of innovation can be pursued between local stakeholders and community actors (Liedtke et al., 2012). Rather than achieving a pre-determined objective per se, the focus is also on learning (Puerari et al., 2018) as a means to which experiments, i.e. interventions, become successful, because urban experimentation is *''fluid, open-ended, contingent and political''* (Raven et al., 2019 p.260) and centers people in the urban planning process and fosters the relation between those people and their places. As such, ULLs are transdisciplinary in nature and advance 'place understanding' through a process of collaboration and interactive learning (often referred to as their co-creation process). This distinguished them from neoliberal methods to planning as they are capable of meaningfully remake public space into places that are co-designed and reimagined by a community and local stakeholders while existing in relation to its context using placemaking as a concept and philosophy to urban and spatial planning. In the Dutch context, this may seem especially relevant in vulnerable neighbourhoods (see e.g. Abujidi, Blezer and Van de Weijer, 2021) with cultural and migration diversity because of its temporary, zoning and exclusion policy approach that creates a monoculture causing loss of potential to urban vitality (Knappers, 2022). The main answer that this experimental approach therefore tries to seek is how placemaking can be applied in a ULL context of extreme poverty, shrinkage, ageing and highly diverse community.

Aurora flat courtyard intervention

Currently, the Aurora flat courtyard is a parking lot for the tenants of Wonen Limburg. However, the parking lot is only rented for two-third of its capacity and the residents experience the courtyard as a site for illegal activities (ranging from illegal parking to drug usage), and as a non-inviting stressing environment (i.e. not climate adaptive and physically closed). Hereto, Wonen Limburg and the research centre Smart Urban Redesign (SURD) developed a co-creation process to identify residential needs and wishes for Aurora flat courtyard to transform it into a climate adaptive, circular and community space. In this process both learning together and making together as part of co-creation (Puerari et al., 2018) are outlined in the so-called Aurora Days and Aurora Challenge towards the Spektakeldag on June 4th 2022. In picture 2, the co-creation process is illustrated.



Picture 2: Schematic co-creation process in Aurora flat. Source: SURD.

Learning together: Aurora Days

On March 15, a informal pizza sessions was organized to get to know the residents in a first and accessible manner. Wonen Limburg baked pizzas in their movable pizza oven for everyone who came along during the afternoon and evening.

On March 29, photo discussion were held with specific target groups of Aurora flat to understand the context, needs and wishes more explicitly, i.e. from the children, elderly, mothers, singles and migrants. The eight pictures from locations around Aurora flat were taken because they draw the attention in the informal pizza sessions conversations. After the 29th, posters with in-between results were hung up at all four the entrances of Aurora flat to allow for adjustments, additions and refinements by residents themselves.

On April 12, a Walk and Talk around Aurora flat was held. It aimed to enrich the information gathered from the photo discussions in the similar target groups. Beyond understanding what elements residents favor or not, focus was also laid on understanding their urban experiences (e.g. feelings of safety and usage of the area through time and space).

Picture 3: Informal pizza session. Source: SURD.

Picture 4: Photo discussions. Source: SURD.

Picture 5: In-between posters. Source: SURD.

Picture 6: Walk and Talk sessions. Source: SURD.

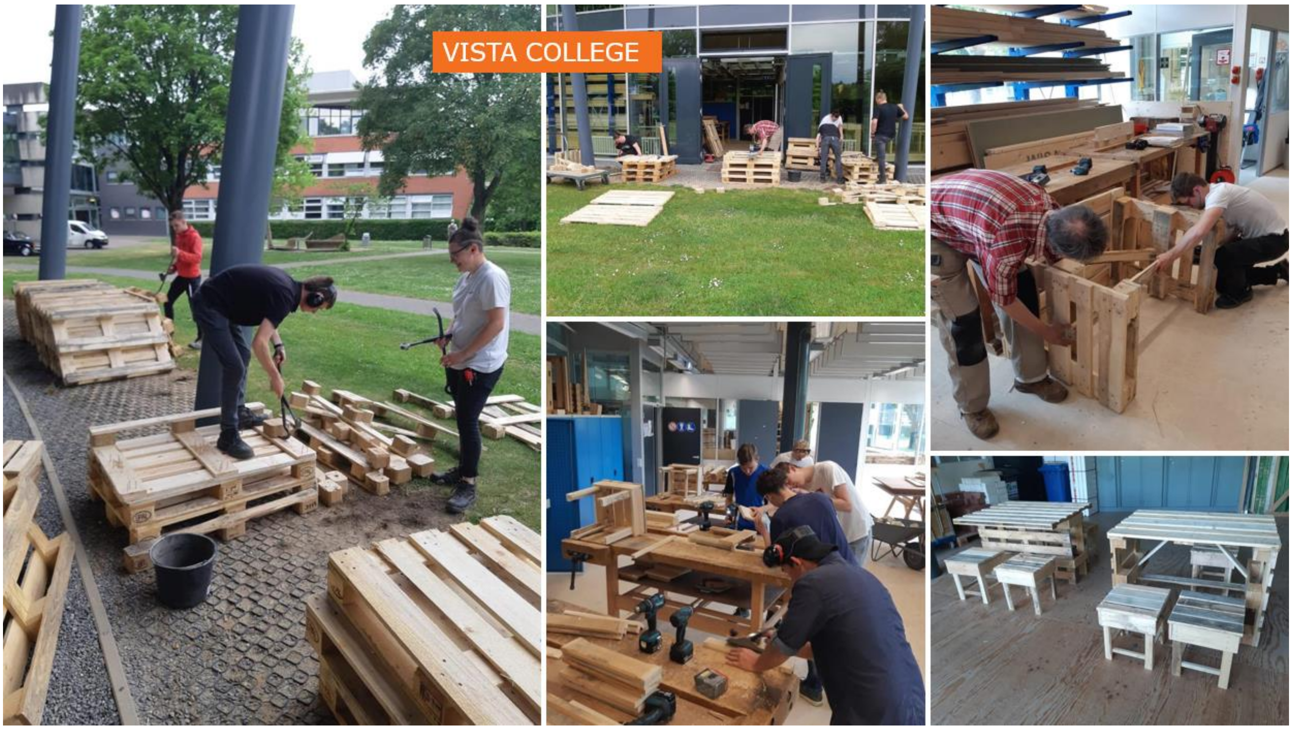
Making together: Aurora Challenge

In the week from April 25th till April 29th, a multidisciplinary design week was held in Aurora flat. Four international and interdisciplinary student groups worked for one week non-stop on the design challenge to translate the collected insights from the Aurora Days into an urban design intervention. The students ranged from first year BSc students to second year MSc students and came from the Netherlands, Iran and Germany and from the built environment, occupational therapy and nursing disciplines.

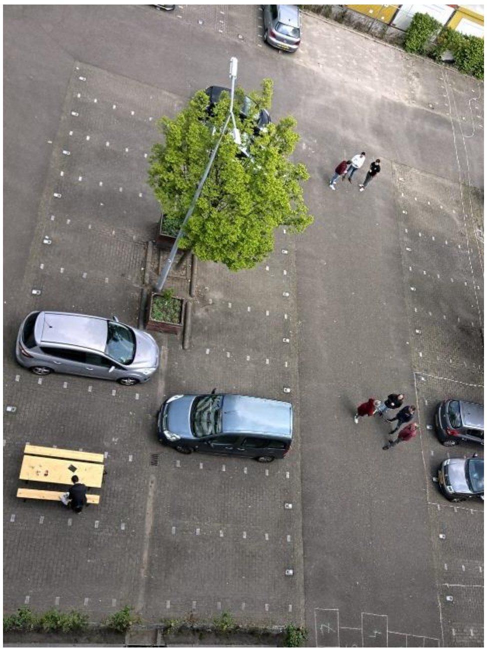
The Aurora Challenge led to a winning design, voted by residents, Wonen Limburg and local stakeholders, that is still to be outlined for realization and implementation in the academic year 2022-2023. Meanwhile, and due to time constraints and realistic expectations after the Aurora Challenge, elements (i.e. circular furniture) from the winning design were made in collaboration with the local trash and recycling company (RD4) and the local practical education institution (MBO; Vista college). These were showcased on June 4th on the so called Spektakeldag in which Wonen Limburg festively opened the mural on the building, because the original festival was postponed due to COVID19 restrictions.

Picture 7: Introduction about circular materials by 4th year students. Source: SURD.

Picture 8: Presentations of student (HBO) designs in the Aurora Challenge. Source: SURD.



Picture 8: Students (MBO) developing circular furniture from the designs. Source: SURD.



Pictures 9 and 10.

Left: the Aurora flat courtyard (parking lot) in the Aurora Challenge week.

Right: the Aurora flat courtyard on the Spektakeldag incl. the circular furniture.

Conclusion: lessons learned and outcomes generated.

Addressing local urban challenges in the neighbourhood GMS via placemaking in the ULL approach and the consequent co-creation process and urban intervention in the Aurora flat courtyard shows that drawing on the local urban complexity and multitude of values is helpful to enable an inclusive participatory process as well as to overcome local challenges in context. Two main (rather abstract) lessons are:

1. Placemaking and co-creation via ULLs offer a good opportunity to develop context specific and community aspired solutions and interventions to daily experienced urban issues that facilitates slow (incremental) but transparent transformation in place.

2. ULLs and co-creation created another alternative and spatial planning approach to local urban stakeholders and policy makers to address and govern neighbourhood development in context of extreme urban and social conditions that immediately create visible change. Consequently, it created more trust and ownership at the local community, i.e. residents of Aurora flat.

These two main lessons were the results of three practical elements in the process that may be transferred and adapted elsewhere:

1. Being in-situ for the relationship building between stakeholders involved is very important, especially the residents with the students. It seems this is particularly relevant for vulnerable neighbourhoods, i.e. with extreme urban and social conditions, because those target groups are rather concerned with their own everyday practices and livelihood compared to abstract sustainability challenges. For example, the circular furniture designed and implemented by students from various educational levels and stakeholders involved allows sustainability (i.e. circular economy and circularity itself) to become visible, understandable, and even touchable and useable in the courtyard in an adequate manner for the residents that may function as a social interaction vehicle in Aurora flat. Subsequently, raises awareness about sustainability while enhancing social interaction across cultural diverse residents (currently, this is being monitored).

2. Being in-situ for informal and spontaneous encounters with residents, besides the formal encounters in the co-creation process enhances place understanding in ULLs, because placemaking relies on the values that residents themselves attach to their built environment, and their perceptions and experiences of a place. Again, there may be a crucial role for students here due to their continuous presence while working on their solutions at Aurora flat. For example, residents who were bored or came home from doing groceries and therefore walked by our students (one student also lives in the Aurora flat) enabled a safe environment to share one's story or thoughts about Aurora flat next to the official and formal moments in the co-creation

process like the photo discussions.

3. The ULL approach has proven to be highly important for students to be in context to enrich and enhance interdisciplinary learning by working together on real life cases as well as integrating research, education and local socio-urban challenges in practice. In specific, our experiences show that students learn from other disciplines (i.e. occupational therapy, nursing and built environment), students learn from their own more or less experienced peers (i.e. 1st and 4th years together from same study), and students develop a more critical and entrepreneurial attitude towards the future of their own discipline as well as the environment they act in (i.e. critical thinking and engagement with practitioners). Altogether, this has shown to enhance motivation and agency to their own learning curve.

References

1. Abujidi, N., Blezer, S. and van de Weijer, M. (2021). The Urban Living Lab as tool for introducing circularity in the everyday life of vulnerable neighbourhoods: Case study Kerkrade-West, the Netherlands. Digital Living Lab Days 2021 European Network of Living Labs, 2021. Online. https://issuu.com/enoll/docs/dlld_2021_-_proceedings
2. Brenner, N., Marcuse, P., & Mayer, M. (2011). Cities for People, Not for Profit: Critical urban theory and the right to the city (1ste editie). London: Routledge.
3. Ellery, P. J., Ellery, J., & Borkowsky, M. (2020). Toward a Theoretical Understanding of Placemaking. International Journal of Community Well-Being, 4(1), 55–76. https://doi.org/10.1007/s42413-020-00078-3
4. Fincher, R., Pardy, M., & Shaw, K. (2016). Place-making or place-masking? The everyday political economy of “making place”. Planning Theory & Practice, 17(4), 516–536. https://doi.org/10.1080/14649357.2016.1217344
5. Knappers, L. (2022). Opening cities - Migrants in urban space (1st edition). THOTH.
6. Liedtke, C., Jolanta Welfens, M., Rohn, H., & Nordmann, J. (2012). LIVING LAB: user-driven innovation for sustainability. International Journal of Sustainability in Higher Education, 13(2), 106–118. https://doi.org/10.1108/14676371211211809
7. Marrades, R., Collin, P., Catanzaro, M., & Mussi, E. (2021). Planning from Failure: Transforming a Waterfront through Experimentation in a Placemaking Living Lab. Urban Planning, 6(1), 221–234. https://doi.org/10.17645/up.v6i1.3586
8. Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (BZK). (2020, 2 april). Overzicht 16 stedelijke vernieuwingsgebieden. Publicatie | Rijksoverheid.nl. Geraadpleegd op 28 juli 2022, van https://www.rijksoverheid.nl/documenten/publicaties/2020/03/31/overzicht-16-stedelijke-vernieuwingsgebieden
9. Puerari, E., De Koning, J., Von Wirth, T., Karré, P., Mulder, I., & Loorbach, D. (2018). Co-Creation Dynamics in Urban Living Labs. Sustainability, 10(6), 1893. https://doi.org/10.3390/su10061893
10. Raven, R., Sengers, F., Spaeth, P., Xie, L., Cheshmehzangi, A., & De Jong, M. (2019). Urban experimentation and institutional arrangements. European Planning Studies, 27(2), 258–281. https://doi.org/10.1080/09654313.2017.1393047
11. Wyckoff, M. (2014). Definition of Placemaking: Four different types. Planning & Zoning News. http://www.pznews.net/media/13f25a9fff4cf18ffff8419ffaf2815.pdf

Research In Progress Paper

Development of a Living Lab Co-Creation Tool Considering Japanese Characteristics

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Abstract

The purpose of this study is to develop a co-creation tool that takes into account the characteristics of Japanese people in order to develop new urban policies for aging society of Japan. First, we extracted relevant characteristics of Japanese people, pointed out the possibility that these characteristics might hinder the co-creation process, and proposed a tool to improve the co-creation process. The tool is designed to specify short-term and long-term values and to add corresponding activities, which is appropriate for Japanese people who are able to proceed with discussions in a cooperative manner while taking into account the opinions of other stakeholders. This tailor-made process, adapted to the characteristics of each people, can be applied to the development of co-creation tools for people in each country.

Keywords

Living Labs, Co-creation, tool development, Japanese characteristics

Introduction

As the need for open innovation has increased, many attentions have turned to the Living Labs, where stakeholders from industry, academia, government, and private companies can engage in co-creation. Living Labs are effective not only for technology development by companies, but also for policy making by local governments. In Japan, the co-creation approach in Living Labs is attracting attention as a way to develop and implement unprecedented urban development policies.

Japan has one of the most rapidly aging populations of the world, with 28.8% of the population aged 65 and over, and this is projected to reach 37.7% by 2050. Therefore, there is a need for a sustainable system based on the premise of the aging society. On the other hand, the suburban bed-towns that were developed during the period of rapid economic growth have become decrepit, and infrastructure and houses must be renewed. Nonetheless, the aging communities do not have the capability to implement them. Japan's urban development policy needs a new tool to pursue new values.

New urban development policies require the wisdom of residents who know their communities well. However, residents do not have information about new urban development and the methods to achieve it. On the other hand, companies and academia involved in urban development know the information and methods of innovative urban development. However, they are seeking to put them into practice in real communities. These factors have led us to believe that it is effective for local residents, companies, local governments and academia to discuss openly with each other to formulate and implement innovative policies.

The Living Lab methodology was adopted from outside Japan and cannot be applied directly to Japan. The unique characteristics that Japanese people exhibit when conducting workshops often hinder their success. Therefore, it is necessary to develop tools for co-creation that take into account the characteristics of the Japanese people.

The purpose of this study is to identify the factors that inhibit co-creation among the characteristics of the Japanese people as they relate to workshops, and to develop co-creation tools to mitigate these factors.

Existing Researches

Cho (2018) introduces the case of Seoul of South Korea and Shanghai of China on how to interact with the community when developing a Living Lab. Each Living Lab gradually becomes actively involved during the project's start-up period by different structures based on each citizen’s features. Therefore, tailor-made to each region is critical to the success of a Living Labs.

Also, for example, the Living Lab Methodology Handbook (2017) argues that there is no single methodology, but all Living Labs combine and tailor-made different user-centred co-creation methodologies to best fit their purpose. The key to success in any activity is to involve the users at the beginning of the process. In the case of a Living Lab for urban policies, the users are citizen in each city. Tailor-made to each region is critical to the success of a Living Lab

Hirai analyzed the characteristics of Japanese people by creating 45-item "scale of Japaneseness" based on descriptions of representative theories of Japanese people. While there are some points that differ from each individual's evaluation, the scale provides valuable information as a scale that allows for a systematic evaluation of the characteristics of the Japanese. However, it does not mention how the characteristics affect the process or outcome of the workshop.

Kitazume et al. organized the setup and methodology of Living Lab based on community associations in Japan. However, they did not provide specific co-creation tools.

Tool Development

The development of a co-creation tool based on Japanese characteristics was conducted in the following manner. First, from the literature on the characteristics of Japanese people, we extracted the characteristics of Japanese people that are relevant to the Living Lab workshop. Next, a format was created by modifying a tool that had been used in Japan in the past to take into account the characteristics of the Japanese. Finally, we confirm the validity of the format by filling in the format with a hypothetical project using the knowledge of people who have been in Living Lab workshops.

There are 45 characteristics of the Japanese proposed by Hirai, among which we focus on the following two points.

- Japanese people speak up while carefully considering the opinions of the members around them. This is an effective behaviour in a Living Lab, where synergistic effects of diverse opinions from stakeholders with different backgrounds are expected. However, because of the focus on the opinions of each stakeholder, it is easy to lose sight of the common goal of the discussion. It also avoids conflicts of opinion. Short-term and long-term goals should always be clearly stated, so that when discussions conflict, it is easier to find solutions in line with those goals.

- The Japanese value cooperation among participants. Collaborative activities by multiple stakeholders are expected. However, innovative actions to realize value may be inhibited. To prevent this, some processes are needed to clarify the actions to realize the expected value, and to realize new actions by checking the experience gained from those actions and applying it to improvements.

The goal of the tool is to visualize how each stakeholder will design the objectives and actions to achieve them during the start-up phase of the Living Lab, and to co-create the process by each stakeholder while applying the Plan-Do-Check-Action cycle (PDCA). The Living Lab involves stakeholders in different positions. Therefore, if a Living Lab operator or coordinator starts with the objectives of each stakeholder being disparate, discussions often shift from the planning stage. Therefore, the first step is to ascertain from each stakeholder himself/herself the purpose of participating in the Living Lab and the value of that participation. Next, in order to achieve these objectives, the coordinator envisions actions that will realize each stakeholder's value while working in the Living Lab. Furthermore, each action is systematically incorporated into the Living Lab activities. The actions of each stakeholder are then evaluated and, if necessary, modified or revised.

More specifically, the following Steps are used.

STEP1: Establish the project objectives and list the short-term and long-term values for each stakeholder.

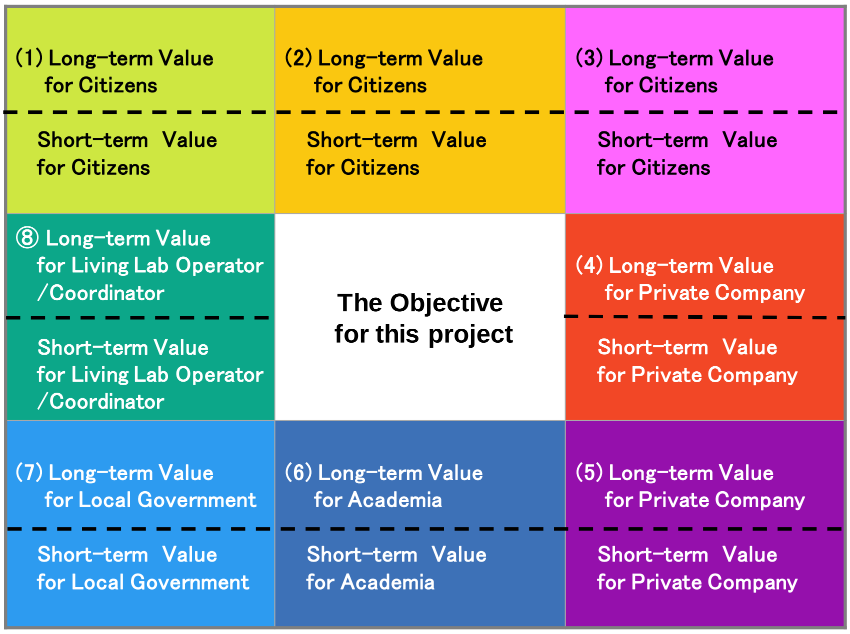

Figure 1. The Format of Co-Creation Tool.

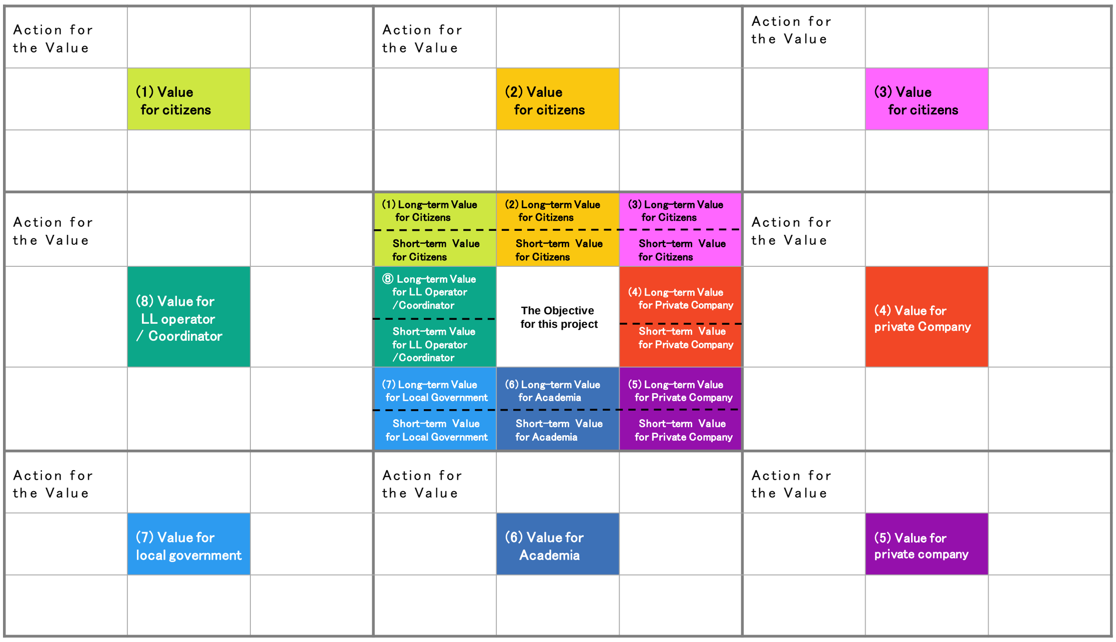

Figure 2. The Format of the Next Step of the Tool.

STEP2: Write the objectives in the center of the 3x3 matrix and the values for each stakeholder in the eight surrounding boxes. At this point, the most boxes are prepared for the citizens, because the value for them is most important. After that, the values for private companies, academia, local governments, and Living Lab operators should be added. Each value is divided into long-term and short-term values. (Fig.1)

STEP3: In addition, prepare 3x3 matrixes and write the actions necessary to achieve the 8Box values. In this step, be aware of the long-term value and look for actions to achieve the short-term value. (Fig.2)

(1) (Citizens) Longer healthy life expectancy Acquisition of healthy habits	(2) (Citizens) Community network expansion Increase in number of friends in the community	(3) (Citizens) Sustained connection to society Sense of fulfillment through social participation
(8) (LL Operator) Establishment of sustainable operation methods Development of new management methods	Living Lab Project Example: Development of healthy underwear	(4) (Private Company) Securing long-term profits Development of new products
(7) (Local Government) Improvement of brand image Results of co-creation activities	(6) (Academia) Contribution to Society through Living Labs Living Lab Research Achievements	(5) (Private Company) Acquisition of a good corporate image Achievements of SDGs initiatives

Figure 3. Example Use of the Co-Creation Tool.

In this study, the research group including the authors actually filled out the questionnaire, especially for Fig. 1, assuming a certain project purpose (Fig. 3). The objective is to develop healthy underwear. For example, values for citizens are acquisition of healthy habits, increase in number of friends in the community, and sense of fulfillment through social participation. By constantly sharing the common purpose of development of healthy underwear, we were able to increase the value of new product development for private company while aiming for the value of acquiring healthy habits for citizens themselves. In addition, among the various short-term values, including sense of fulfillment from social participation, we were able to select this that would lead to the long-term value of sustained connection with society. For companies, the SDGS led not only to the development of new products, but also to the value of their achievements in SDGS initiatives. For academia and local government, it was explicitly stated that it not only improves the results, but also contributes to society and improves their brand image. This result shows that this tool is effective as a co-creation tool based on the characteristics of Japanese people.

Note that there may be more than one value listed in each box, both long-term and short-term values. Rather, it is important that short-term values be associated with long-term values.

Concluding Remarks

This research proposed a co-creation tool that takes into account the characteristics of Japanese people. The proposed tool visualized short-term and long-term values. This is intended to make it easier for diverse stakeholders to initiate discussions toward short-term value while sharing the visualized long-term value as a goal image. This is especially necessary for Japanese who speak up while looking around them.

In addition, the approach is to describe the tool in steps from value to actions to realize the value. While emphasizing the process of realizing value, the tool allows for the materialization of ideas through actions and feedback on those ideas. For Japanese people, who value cooperation among participants, successful or unsuccessful experiences through actions are especially necessary to clearly recognize the value.

Thus, the proposed tool is effective for co-creation activities of a Living Labs in Japan, but it is important to further accumulate and improve the practice. Furthermore, this tailor-made process, adapted to the characteristics of a country, can be applied to the development of co-creation tools for people in each country.

Acknowledgment

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References

1. Cho, E. J.: Transforming a Neighborhood into a Living Laboratory for Urban Social Innovation: A Comparative Case Study of Urban Living Labs, International Conference on Cross-Cultural Design, Cross-Cultural Design. Applications in Cultural Heritage, Creativity and Social Development, pp.275-285, 2018.
2. Kitazume, K., Takaku, M., Nishiyama, M. and Okamura, Y.: Methodology for Establishing a Living Lab from Experiences in Japan, European Network of Living Labs, Proceedings of the Digital Living Lab Days Conference, pp. 278-284, 2020.
3. Hirai, M.: Stereotypes about the Japanese: Differences in Evaluations between “The Japanese” and “Myself”, The Japanese Journal of Experimental Social Psychology, Vol.39, No.2, pp.103-113, 1999, (in Japanese).
4. U1IoT: Living Lab Methodology Handbook, 2017.

Full Research Paper

Social System Design Methodology for Transitioning to a New Social Structure

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Abstract

Social system design in this paper is intended to achieve a comprehensive transition to a new social system, rather than overcoming partial social problems. In Japan, approaches to transforming society, such as elections and social activism, are not fully functional. Transition to a new social structure requires critiques from inside with the presentation of concrete activities. We propose a systematized social system design methodology that aims at a principled transition, based on analysis of recent practices developed in Omuta City, Fukuoka Prefecture.

Keywords

Social System Design Methodology, Sustainability Transition, Urban Living Labs

Introduction

The concept of Sustainable Development Goals (SDGs) aims to integrate the three aspects of society, economy and environment, and to encourage diverse stakeholders, including citizens, governments, and businesses, to transcend sectionalism and work together in a cross-sectional manner toward the meaningful society. As social issues are worsening and becoming more complex, a holistic approach to resolving the social issues is urgently required.

“Social system design" in this paper is also oriented toward the fundamental elimination of problems through a holistic transformation of the social system itself, rather than the piecewise resolution of local problems. Many of today's social issues are caused by the discrepancy between the existing social system and the reality of our life. Post-event and reactive responses will not lead to a fundamental resolution of the issues or the realization of the future desired. What is important is an approach that perceives society as a system that creates the problems and aims for its transformation.

Context

To begin this paper, we first review the weaknesses of conventional approaches in transforming social systems. The social system design discussed in this paper aims to overcome situations that fatally challenge conventional approaches.

In general, political activities are the most common approach to transforming any existing social system. The goal is to translate social ideals into legislation through civil debate in which representatives of citizens discuss and attempt concordance. However, the representative democracy adopted by many democracies might appear to be stable because the class structure of industrial capitalism is balanced against the corresponding mass parties representing social groups, but in post-industrial capitalism, this balance is being lost (Manin, 1997). It has also been said that the unwritten norms of "mutual tolerance" and "organizational self-control," necessary for democracy to function, are collapsing (Levitsky & Ziblatt, 2018). Thus, the dysfunction of representative democracy is being discussed mainly in developed countries; the same issue has been raised in Japan (Fujii, 2021).

The main alternative to democratic elections is rooted in the diverse needs of citizens. There is a history of citizen movements led by issue groups modifying an existing social system in piecemeal fashion. This alternative raises the possibility of position-oriented politics driven by citizen movements; it lies outside traditional parliamentary politics. Civic movements that pursue ownership with minorities as agents emphasize power relations of dominator / dominated and adopt confrontational actions in order to acquire political resources (Melucci, 1989). The assumption is that they can usefully objectify "enemies" external to themselves. However, in the 2000s, in the face of neoliberalism which neutralized political antagonisms (Mouffe, 2005) and left-avoiding populism as a situation unique to Japan, it became impossible to find an easily identifiable enemy, and civic activism is said to have transformed into something that provides a reason for living and a place for people who have difficulty adapting to society (Inaba, 2016)[1] .

Both approaches, democratic policy formation and civic activities driven by issue groups, face a situation in which they can no longer establish effective points of contention and clarify the issues in the traditional way, both of which assume a clear-cut adversarial structure, and changes are required given reasonable extrapolation of the current situation.

Related studies and research issues

In response to this situation, the search is on for a methodology that overcomes the limitations of the conventional approaches and triggers social system transformation; this paper is positioned within this context. Various related studies have attempted to correct the current situation, which has become increasingly pluralistic and complex, and yield an architecture that is appropriate for creating rational social structures, rather than tackling the problems with simple oppositional remedies.

Regarding representation, discussions on the various forms of political participation that make democracy function effectively are calling into question the traditional electoral system (Reybrouck, 2016). Some have long advocated "citizen assemblies" that utilize mini-public forums for citizen participation and deliberation (Smith 2009). Arguments have been made for evaluating the Irish Constitutional Assembly, which experimented with the idea, from the perspective of democratic control over policy making (della Porta, 2020). However, while these arguments for a more fully democratic system through diversification of the electoral system, assume a representative system and rational debates, and there is no inherent guarantee that these assumptions will effectively contribute to positive change of the social system. Indeed they need to be validated empirically. In this respect, this is an argument that awaits further development, and is beyond the scope of this paper, which is concerned with design methodology.

The following study of civic activities centered on group activities is noteworthy from the viewpoint of the issues raised by this paper. This was not a reduction to the old oppositional structure of "damage / perpetration" or "individual / government or corporation," but rather reexamined the civic movements accompanying MINAMATA disease based on the premise that individuals are also embedded in society (Sung, 2003). Based on the interdependency of the individual and society, the perspective of objectifying the cyclically reconstituted social system itself is also emphasized in this

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[1] According to Inaba, while social movements such as the Democracy Movement and Occupy Movement were revitalized worldwide in the 2000s, such movements were not so vibrant in Japan and non-protest-oriented movements attracted attention. Inaba acknowledges that social movements have became a place for minorities as described in the body of this paper; she also pointed out the need to find a new political possibilities.

paper[2]. However, the subject of this paper is a practical methodology that takes this cyclicality into account and approaches it in a concrete manner. In this regard, there is research on Japanese social education theory that discusses the process by which parties to a social issue structurally perceive the issue and transform the community in a learning process called Community Development (Miyazaki, 2019). This is highly suggestive in terms of the internal change of the people involved and the formation of a collective, but it remains within the framework of civil society theory, and so does not include discussions of policy or economics, and does not have the scope needed for holistic social system transformation.

Given this situation, social design[3] methodologies such as Sustainability Transition (Kohler et al.,2019) and Urban Living Labs (Cuomo,2022) have attracted attention as concrete practices to ensure the diversity of participation in support of various parties through collaboration. One of the research domain inf Sustainability Transition; Transition Management is a methodology in which citizens, governments, and businesses co-create a holistic agenda for social system transformation, and operate it in a way that connects it to the specific practices of the agents. However, it lacks a methodology to concretely implement the integrated transformation indicated by the agenda (Roorda et al., 2014), and has yet to fully realize a movement toward this transformation (Kohler et al.,2019). On the other hand, Urban Living Labs is a methodology in which citizens themselves take the initiative and co-create with urban stakeholders to solve problems through a design process toward sustainable urban transformation (Baccarne, 2014). However, a methodology to comprehensively and integrally grasp the complex intertwined elements of the entire city, called Urban Dimensions (Steen & van Bueren, 2017) has yet to be elucidated.

Two points are noteworthy in related research: the first is to take into account the circularity nature of indivisuals and the social systems, in which the individual is defined by society as well as the society is defined by the individual. The second is to ensure the diversity of participation through collaboration. On the other hand, the nature of the entities and methodologies to implement social system transformation in an integrated manner is a research issue that has yet to be adequately addressed. To contribute to social system transformation, this paper focuses on design methodologies that question the nature of subjects and practices in an integrated manner while overcoming social conflict structures inherent in the social system through diverse collaborations based on the circularity nature of individuals and society (rather than external criticism). As

[2] "Mutuality and circularity between the individual and society" refers to the way in which our decisions and behaviors constitute the social system, and at the same time, the constituted social system also defines our decisions and behaviors. Such understandings are based on M. Foucault's theory of power (especially the discipline model (Foucault, 1975)). This paper, however, is based on this Foucauldian understanding and explores a design methodology that differs from Foucault's "archaeology" and "genealogy" approaches.

[3] Manzini, an expert on social innovation, points out that modern society requires deep and significant systemic change (on the same level as the prior transition from feudal to modern society), and that what does not touch the roots of the system will not help in systemic transformation (Manzini, 2019).

the basis for social system design, this paper refers to specific practices created in OMUTA City, Fukuoka Prefecture, in Chapter 4, and attempts to systematize a general-purpose methodology in Chapter 5 from the advances made.

Social system design practice in Omuta city, Fukuoka prefecture

Emerging Social System Design Practices

OMUTA City contributed greatly to the industrial and economic development of Japan through the mining operations of the MIIKE Coal Mine (1873-1997) by MEIJI Government and a flourishing coal-chemical complex. However, the population of the city has almost halved from 210,000 in 1959 (the peak of the coal mining era), and the current aging rate is 37.3% (as of October 1, 2022) which is one of the highest in Japan among cities with more than 100,000 people. It is also widely known as an advanced region in terms of dementia care, because the number of people with dementia is increasing in the community, creating a situation in which many people are involved. In 2005, OMUTA City, together with its citizens, issued the "Declaration for Creating a City to Live with People with Dementia"[4]. The concept of "a town where people can wander around with peace of mind," which was proposed at that time, was a groundbreaking one. This concept aims to create a town where people with dementia can live like everyone else in the community, rather than in nursing homes or in communities isolated by gates. Traditionally the act of wandering and its positioning as a problematic behavior indicated deviation from social customs and triggered treatment and constraint. Overcoming similar situations in Japan, OMUTA's concept is an innovative one that aims to create a town where people with dementia, children, adults, or any other kind of person, are accepted into society.

From the perspective of this paper, this concept and the many practices in OMUTA City that have accompanied it, are the seeds of a social system design practice that finds new meaning for and leads the way to a shift in social systems.

Establishment of an organization for citizens to think and act for the entire city (2019) Establishment of the OMUTA Center for Future Co-Creation (PONI PONI) (2019)

It is clear that the activities traditionally proscribed by the issues of "dementia" and "the elderly" make it difficult to redesign the entire social system. This is because it is impossible to take account of the social issues that arise in various parts of the

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[4] In January 2005, Omuta City issued the "Declaration for Creating a City to Live with People with Dementia" in order to make it known throughout Japan that the entire city will support people with dementia and their families through cooperation among welfare, medical care, nursing agencies, the community, and government.https://www.city.omuta.lg.jp/hpKiji/pub/detail.aspx?c_id=5&id=6652&class_set_id=1&class_id=136 (accessed Aug. 1, 2022)

community. This is due to the fact that the silo structure of local government limited the areas that could be covered by individual policies. Therefore, the OMUTA Center for Future Co-Creation (hereinafter referred to as "PONI PONI") was established in collaboration with the public and private sectors as an "organization that is both independent and embedded" in the existing social system; it crosses vertical divisions in sectors and domains, with a core based on a new deeper concept related to dementia care (Kimura et al. 2019). PONI PONI was established as a public-private partnership. The founding members included those developing businesses within the community, those who had been involved in OMUTA's urban development from outside the community, those who shared the concept and had strengths in policy formation outside the community, and design researchers from companies. It is a team structure that is conscious of the fact that its remit is to design social systems.

National Model Project of Health Promotion for the Elderly Health Care (2019)

In parallel with the establishment of our organization, PONI PONI first focused on "care prevention" in response to the situation in OMUTA City, and developed in conjunction with OMUTA City, particularly the "Health Promotion Project for the Elderly Health Care" by the Ministry of Health, Labor and Welfare. This was because we believed that it was necessary to seek the effective integration of two different policy areas: "community-based comprehensive care," which was being promoted in the medical and long-term care fields, and "regional development," which aimed to correct the concentration of people, money, and resources in Tokyo. The project involved understanding the policy background of each area and engaging in dialogue with practitioners within and outside the region. As a result, we discovered a new transition concept: "from guaranteeing the right to exist (Article 25 of the Constitution) to guaranteeing the right to the pursuit of happiness (Article 13 of the Constitution)". This concept organically connects medical and nursing care with local development. The project report also addressed the Living Labs, which create collaboration between local players and outside companies to solve social issues, and envisions a specific approach for involving companies outside the region.

WAKU WAKU Life Salon (2019)

Subsequently, as a specific Living Lab practice project, PONI PONI implemented the "WAKU WAKU (This onomatopoeia means that “One’s heart pounded with expectation.”) Life Salon. This project responded to both the needs of local residents and the government to solve problems in OMUTA City and the need of companies to develop new services. In addition, the project embodied the Omuta's new transition concept which was discovered in the aforementioned "Health Promotion Project for Elderly Health Care. Specifically, participants aged 65 or older living in OMUTA City who voluntarily expressed interest in the "WAKU WAKU Life Salon" gathered for a total of five sessions to reflect on their lives to date and their daily lives, and to think about how they could become excited about the remainder of their lives.

For companies, this project was positioned as the search for concepts that would contribute to the development of IoT-based early disease detection services, and to organize UX/UI requirements. The knowledge this acquired would be used to launch new business companies. At the same time, for residents, the project provided an opportunity for elderly residents with limited places to go in the community to regain their motivation. For the government, it was an opportunity to find new measures to deal with matters that could not be approached through the existing long-term care insurance system. The project was designed and managed as a value-added activity in which the three parties involved in the Living Lab overcame their respective challenges.

Figure 1. Scene (left) and flyer (right) of Wakuwaku Life Salon.

In this way, we have newly discovered the potential of "dialogue that stimulates motivation" in the realization of a new concept through "dialogues" between the elderly and the staff of the WAKU WAKU Life Salon.

Questioning the views of humanity (2020)

After the "WAKU WAKU Life Salon," a dialogue was held with leading practitioners and experts from within the region and beyond to identify a new view of human nature that could comprehensively support corporate service implementation, local practice, and policy development. It became clear that the humanistic view of the "modern subject," which is the premise for all institutions and businesses in the modern society and which citizens widely believe should be realized, is no longer compatible with reality and is creating social challenges. The dialogue also suggested that the identity of the foundational human itself is shared with others and the environment. Furthermore, the phase of identity shifts from role (self-identity) to existence (ego-identity), not through discipline, but through release, and through "dialogue," motivation is stimulated from existence (ego-identity). In other words, a new view of the human being, which is necessary for social system design, was found.

Co-creation of OMUTA City Health and Welfare Comprehensive Plan (2021)

In order to redesign the entire social system, PONI PONI and OMUTA City collaborated to develop the OMUTA City Health and Welfare Comprehensive Plan, which is a comprehensive plan for daily life, with the aim of targeting activities in a broader policy area than just long-term care prevention. This plan was developed based on suggestions from projects in the area of long-term care prevention described above, as well as from various projects in other areas. Comprehensive plans of local governments in Japan are generally prepared by combining the plans of various departments as separate chapters into a single plan, but this does not lead to an integrated reappraisal of the community and daily life. Therefore, in this project, we attempted to create a single structure for the nine welfare-related administrative plans, and integrated them holistically into a single comprehensive plan.

Figure 2. Official booklet (left) and booklet for citizens (center, right).

In addition, in order to replace Japan's typical approach to administrative plans, which merely creates a list of "measures that can be implemented at the present time" based on existing administrative resources and past achievements, PONIPONI and OMUTA city decided to include "measures that should be addressed even though no means of implementation have been found at the present time" to create the free space expected to trigger novel co-creation activities.

Entrustment of community comprehensive support centers (2021)

In order to design social systems in a more practical manner, we were entrusted with two Community Comprehensive Support Centers, which are community-based, public interest entities. Community comprehensive support centers are institutions stipulated in the Long-Term Care Insurance Law and established by local governments for the purpose of comprehensively supporting the improvement of the healthcare and welfare of the elderly by providing comprehensive consultation for the elderly in the community, protecting their rights, creating a community support system, and providing necessary assistance for long-term care. In addition, in response to the recent revision of the long-term care insurance system, OMUTA City has also established a system to actively engage in "community development. Specifically, the center is the first place to receive so-called "in-between problems (system errors)" that occur in the community, and can be said to be the center of a regional network to solve "in-between problems" and promote long-term care. Therefore, it has a great advantage as a center of practice for designing social systems in that it can detect social system omissions, draw out collaboration through its network, and work beyond its own domain.

Sign comprehensive cooperation agreement with OMUTA city (2022)

Furthermore, PONI PONI signed a "Collaboration Agreement for the Realization of a Community Coexistence Society" with the city of OMUTA. Its subject is the promotion of the comprehensive plan formulated in 2021. This allows PONI PONI to officially support policy formation in a wide range of areas in conjunction with government departments and to collaborate with stakeholders within and outside the community to realize the vision of the policy. This will help turn around the situation that tends to occur in Japan, where "public matters are left to the government”. The partnership between OMUTA City and PONI PONI, a community-based social system design organization, has officially paved the way for the integrated implementation of policies that have been stove-piped since PONI PONI's founding by a private intermediary organization. From a different perspective, PONI PONI's assumption of the planning promotion secretariat has made it possible to promote administrative planning through a collective impact approach.

National model project on housing (2022)

In addition to the Welfare departmets collaboration, we started collaboration with the housing department of OMUTA City, on the "Model Project on Housing through Cooperation between Welfare and Housing Departments in Local Governments" by the Ministry of Land, Infrastructure, Transport and Tourism. Housing policy is said to be a highly integrated area that is linked to not only welfare but also urban planning and immigration. Naturally, this was one of the themes of the Comprehensive Plan for Health and Welfare, but by focusing on housing, it was possible to gain a detailed understanding of the policy background and conduct a survey of the actual situation in the region. In the process, we further discovered the concept of "substantiating social inclusion"[5] (miyamoto, 2017), which expands the Omuta's new transition concept.

Future Activities (2022)

In order to accelerate social system design, we are beginning to embark on the following activities.

One is to utilize "Comprehensive Project C," a type of long-term care prevention and daily life support service, as a "base for strategically restructuring and developing a new concept" in long-term care prevention. PONI PONI will, in collaboration with the

[5] Miyamoto cites the criticism of J. Young (Young, 1999), author of "Bulimic Society," that "repeatedly promoting social inclusion while society remains exclusionary will ultimately promote exclusion. He then points out that while it is good to include all excluded people as members of society, it is a logical contradiction to include people in an exclusionary or self-help society, and that social inclusion cannot be practically realized unless society itself changes.

Regional Comprehensive Support Center and other players in and outside the community, work on this project as an official initiative backed by a partnership agreement. PONI PONI will then proceed with a model project to structurally rethink and redesign the existing social system based on the principles it has discovered so far: moving "from guaranteeing the right to exist (Article 25 of the Constitution) to guaranteeing the right to the pursuit of happiness (Article 13 of the Constitution)" and "substantiating social inclusion.

Moreover, we are tackling the Future Prediction Project, the Incubation Project, and the creation of opportunities for collaboration with a wide range of citizens. The Future Project will work to design social systems based on objective forecast data and narrative visions of the future, in addition to dialogue with practitioners and experts that we have been engaging with. The incubation project will work to create new problem-solving and value-creating entities in the region, create workplaces, and show children and young people new technologies and ways of appreciating their own existence. The creation of opportunities for collaboration with a wide range of citizens will be undertaken with the aim of fostering a culture of "society can be changed" so that each citizen can play a leading role in creating new social systems and continuing to bring about change.

Social system design methodology

In this chapter, we attempt to systematize our proposal as a general-purpose methodology, using the social system design practice in OMUTA City as a starting point.

Grasping the types of social systems

Formal social systems such as laws and norms do not unilaterally influence people, but function as substantive social system only when people within the system behave in conformity with them (internalization of the system related to footnote No.2), see Figure. 3 (A). Design practitioners are strongly urged to first grasp social systems from the perspective that social systems are cyclically structured.

This makes it necessary to grasp the point that each area of the existing social system has become vertically divided due to specialization to increase efficiency (Figure. 3 (B)). On the other hand, people exist as an integrated entity, and each element of daily life is inseparably linked as a network (interrelationship) like an organism (Figure. 3(C)). The discrepancy between the two is often exposed by social issues.

In order to specifically design a social system as a design object, it is necessary to limit the object and make it tangible. Therefore, one option is to target a specific "region" with fixed scope as a microcosm of the social system (Figure. 3(D)).

It is also useful to use "policy" as a pathway to understand and work on the basic framework of the social systems in that region. However, it is important to note the two-layered structure (formal and substantive) of the social systems. For example, the formal policies can be changed through official procedures, but this alone will not reach the concrete change of social systems. The approach at the "substantive" level, which is the actual implementation of the plan's principles, requires building relationships and working with government officials and local stakeholders to collaborate in a substantive manner. In most cases, either a formal or substantive approach is taken, but in order to approach both sides (formal and substantive) of a mutually embedded structure for social system transformation, it is essential to obtain formal ostensible standing as well as to implement concrete practices for the substantive level (Figure. 3(E)).

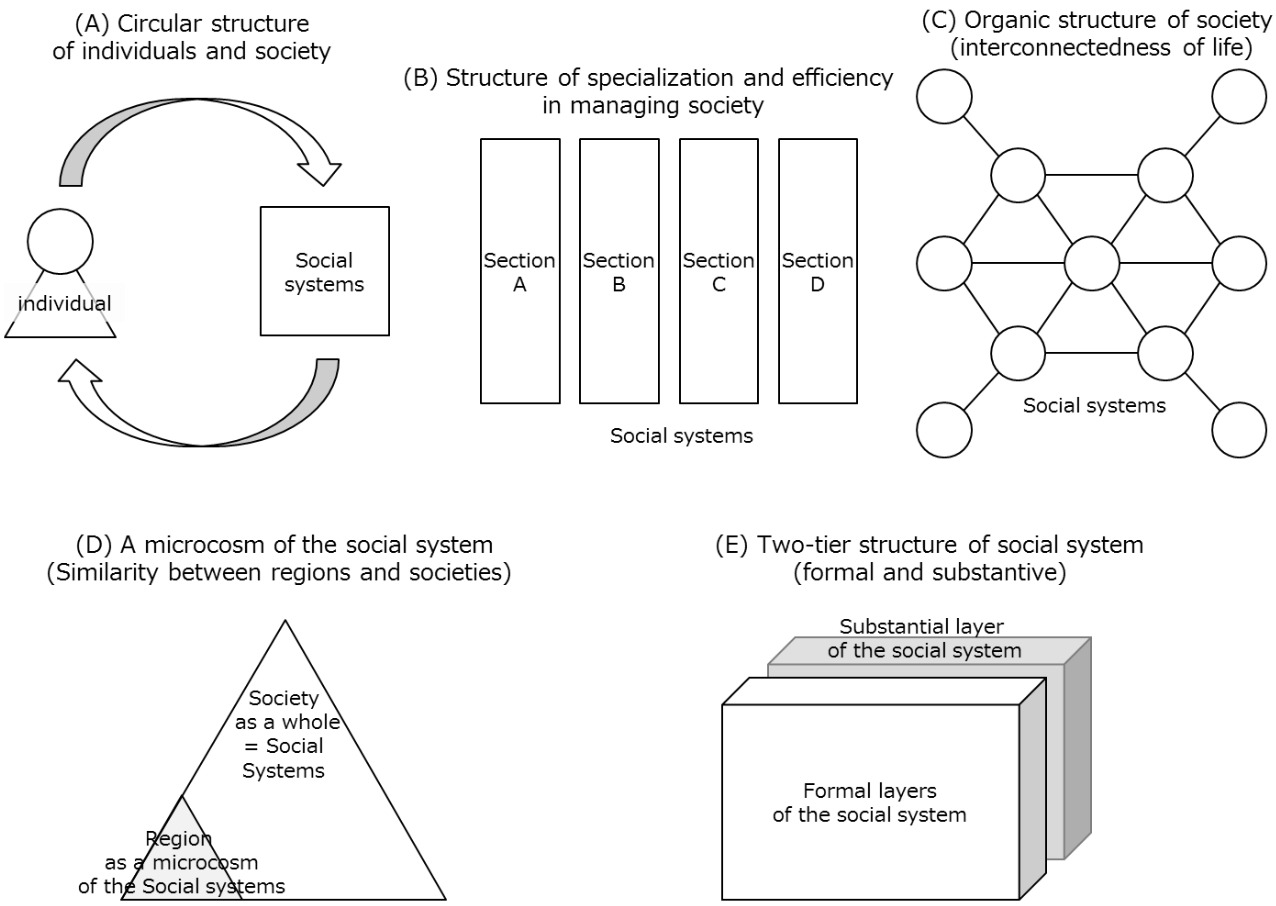

Figure 3. Types of Social System Structure.

Social system design practitioners

As mentioned in the previous section, the principles of a social system must function both in the environment and people's internal aspects like thoughts and behaviors, as both constitute the system in a circulatory manner. Therefore, any entity that seeks to design a social system must internalize and incorporate a new concept into the existing system in a way that functions while escaping from this circulatory structure, by reconfiguring the entire system. As described before, this is the situation; "organization that is both independent and embedded". Herein lies the basic position and approach of the social system design practitioner.

This is true whether the practitioner is an individual or an organization. In both cases, it is first necessary to free oneself from the functional roles defined by the existing social system. This means creating a situation in which one feels uncomfortable in one's surroundings as an undefined and contradictory entity. When the people around them try to understand the practitioner in an existing role, if the practitioner behaves accordingly, they will become incorporated into the existing system. It is necessary to continue to avoid this while retaining a certain influence on the existing social system. Influence must be both formal and substantive. Formality acts to create an environment conducive to broad-based movement, while substance contributes to individual, concrete conceptual practices.

As regards concrete practices, the scope of involvement should be unconstrained as much as possible in order to avoid stove-piping (specialization), which is one of the weaknesses of existing social systems. Rather, it is necessary to reconfigure (rearrange) each element of the social system so that new principles can be realized through interaction across a wide range of areas. This also coincides with the breadth of collaboration partners. Social system design practitioners are expected to have a common language and interest in a wide range of areas and sectors, and to take the lead in design.

Financial independence is also important. Receiving compensation for "being of value in the existing social system" can mean being captured by the existing system. In addition, when obtaining funding from a subcontractor's standpoint, the direction of the design may be strongly constrained by existing philosophies and ideas. In light of these considerations, it is important that funding be indirect, that fair relationships be established as much as possible when making contracts, and that the independent organization should not become too dependent on funds from a specific entity.

Process Model of Social System Design

This section outlines the process as obtained through practice (Figure. 4). These proceed in an iterated and expanding manner.

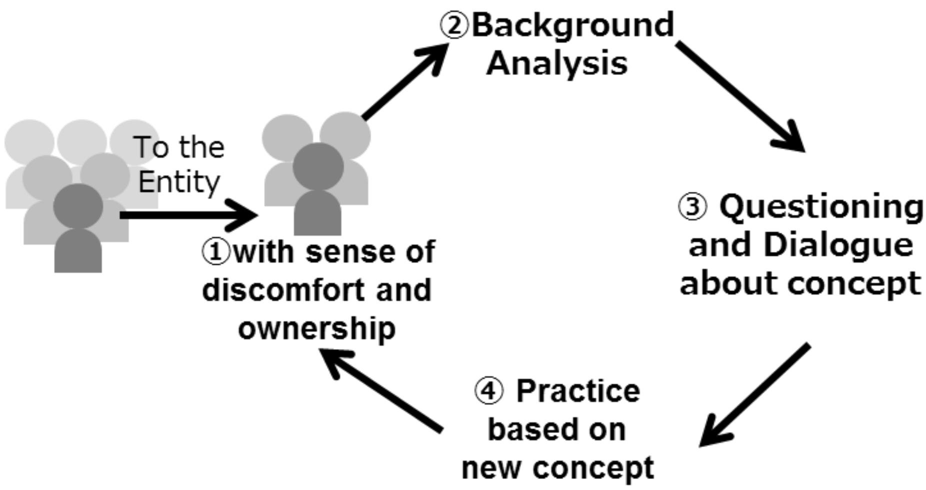

Figure. 4. Process of Social System Design.

Figure. 5 shows the relationship between this process and the practices described in the previous section.

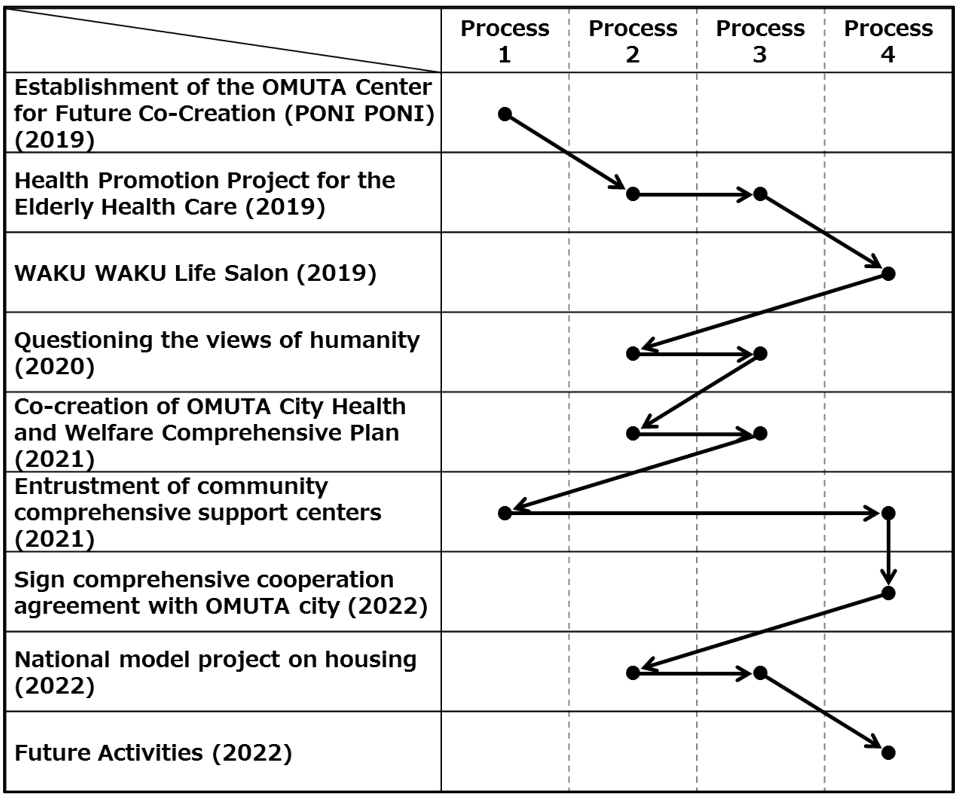

Figure. 5. Relationship between process and practices.

Process 1: Creation of Subjects with sense of discomfort and ownership

First, it is necessary to create a position in which the "subject (individual or team) can be embedded while remaining independent" from the interrelated social system. In this case, the driver for design is the designer's own sense of discomfort with the existing social system, as well as the individual's sense of ownership based on personal experience. However, it is difficult to cover the wide range of areas involved in designing a social system from just the direct experience of the individuals themselves. Therefore, when working as a team, it is necessary to ensure the diversity of experiences of the members and to take the experiences and positions of others as one's own. The position of being able to constantly perceive flaws in existing social systems is also the foundation of good design practice.

Process 2: Background analysis

The social system in front of us exists as if it were self-evident and invisible. However, in many cases, it was implemented at some point. As a clue to this, it is necessary to grasp how the policies were formed, find the structures and principles that created the problems beyond the events in front of us, and objectify them. It is important to note that policy intentions can easily change from positive to negative depending on changes in reality. Policy intentions cannot be judged on their content alone. It is necessary to understand the current situation in relation to reality.

Process 3: Questioning and Dialogue about concept

In order to develop a new social concept for an existing social system, it is necessary to ask questions about the concept and deepen the dialogue. In doing so, we will actively collaborate with experts and practitioners who are challenging society with advanced questions. It is important to open a forum for dialogue and questioning, as this will enhance the public nature of our practice and help us find collaborators who are uncomfortable with the existing social system. Furthermore, it is essential to create a circuit that connects these questions to implementation approaches. It is necessary to reflect the questions in the efforts of design practitioners themselves, as well as to have mechanisms to create new players in the field.

Process 4: Practice based on new concept

It is necessary to create practices based on the new principles found, embed them in the existing system, connect them to the existing network, and make them fully functional. Implementing and linking these practices can concretely infuse the existing social system with the new concept and transform the system into a different structure. It is also important to ensure a network that can permeate the existing social system and expand its functions in a continuous, interrelated, and chain-like manner. It is necessary to pursue not only local prototyping, but also practices that serve as a pump to spread the concept, so to speak.

Summary

This paper provided a theoretical view of the difficulties posed by social system transformation and a design logic to overcome these difficulties. It also presented concrete examples and processes to elucidate the practice of the approach, from which a general-purpose social system design methodology was derived.

First, this paper has shown that the conventional approaches to social system transformation (representative democracy and civil movements) assume a clear conflict structure, but this assumption makes it impossible to identify effective issues. In order to overcome this difficulty, it is necessary to approach the multifaceted structure of the social system, rather than reducing the pluralistic and complex society to an antagonistic structure (Chapter 2).

From this perspective, the theories of party movements based on the cyclical structure of individuals and society and the theory of social education, which deals with the process of local transformation by the parties involved, have attracted attention, but both of these theories lack practicality and integration. Although social designs such as Transition Management and Urban Living Labs have attracted attention as practices that ensure a diversity of participation to support various parties, they have not yet been established as methodologies for achieving integrated social transformation. Based on these theoretical considerations, this paper concludes that the design of social system transformation requires a design practice and methodology that integrates the cyclical nature of the individual and society and overcomes social conflicts through diverse collaborations, while being intrinsic to the social system (Chapter 3).

The paper then presented a concrete case study and process from 2019 to 2022 in Omuta City, Fukuoka Prefecture (Chapter 4) to illuminate such practices and methodologies, and at the same time derived a methodology for social system design from these practices (Chapter 5).

The following is a more concrete description of the practical aspects of the project. Regarding the entities inherent in the social system based on the cyclical nature of the individual and society, we presented concrete examples such as the establishment of the Omuta Future Co-creation Center (Section 4.2) and the commissioning of the Regional Comprehensive Support Center (Section 4.7). Regarding the practice of driving an integrated social system transformation within the existing social system through diverse collaborations, specific examples were presented, such as the Wakuwaku Life Salon (Section 4.4), the formulation of the Omuta City Health and Welfare Comprehensive Plan (Section 4.6). Of course, these individual cases do not have meaning in isolation, but rather are instances of design practices that realize integrated and comprehensive social system transformation through their interconnection in the series of processes described in Chapter 4.

The methodology derived from the characteristics and processes of these practices was described in detail in this paper, which presented five types to better understand multifaceted social systems (Section 5.1). The nature of the subject of design, which has tended to be overlooked by conventional design methodologies, especially in terms of its relationship to the circulatory structure of society (Section 5.2) was described. In addition, the process of social system design was modeled in four stages, and the specific practices in Omuta City were depicted within the process model (Section 5.3).

In order to develop this methodology into becoming more versatile and useful, it is necessary to further elaborate its contents and clarify the leadership required of designers and the nature of actual environments. Furthermore, this methodology should never be seen as ever complete. It is important that the methodology offer "continuous change" in order to respond to major shifts in new values such as the SDGs, based on the fact that modern social systems have characteristics that tend to move away from an integrated way of being and living, as discussed in Section 4.1.

References

1. Anthony et al. (2013) Speculative Everything, MIT Press.
2. Baccarne, B. et al. (2014) “The Role of Urban Living Labs in a Smart City.” XXV ISPIM Innovation Conference, Proceedings.
3. Cuomo, F.(2022) Urban Living Lab: An Experimental Co-Production Tool to Foster the Circular Economy. Soc. Sci. 11.
4. della Porta, D. (2020). How Social Movements Can Save Democracy: Democratic Innovations from Below, Polity.
5. Foucault, M. (1975). Surveiller et punir : naissance de la prison. Paris : Gallimard.
6. Frantzeskaki, N., et al. (2015), Urban Transition Management, A reader on the theory and application of transition management in cities, DRIFT, Erasmus University Rotterdam with the SUSTAIN Project.
7. Fujii, T. (2021). Why Representative Democracy Failed, Shueisha. (in Japanese)
8. Inaba, N. (2016). Research Trends in the Field (Social Movements) - Lost Hostility and the Whereabouts of the 'Wandering Subject'", Sociological Review. (in Japanese)
9. Kikuchi, Y. (2019). Reconsidering Social Security (Support Regionally),Iwanami Shinsho (in Japanese).
10. Kimura, A. et al. (2019), Sustainable person-centered Living Lab for regional management as extension of Japanese dementia care activities, In Proc.of OpenLivingLab Days 2019.
11. Kohler, J. et al. (2019) An agenda for sustainability transitions research: state of the art and future directions, Environ. Innov. Soc. Transit. 31.
12. Levitsky, S. and Ziblatt, D. (2018). How Democracies Die,Crown.
13. Manin, B. (1997). The Principles of Representative Government, Cambridge: Cambridge University Press.
14. Manzini, E. (2019). Politics of the Everyday, Bloomsbury.
15. Marvin, S. et al. (2018). Urban living labs: Experimenting with city futures. Routledge.
16. Melucci, A. (Keane, J. and Miler, P. eds.) (1989). Nomads of the Present: Social Movements and Individual Needs in Contemporary Society, Philadelphia:Temple University Press.
17. Miyamoto, T. (ed.) (2017). A Society That Will Not Fall Down: Institutional Strategies to Prevent Impoverishment and Isolation, Keiso Shobo (in Japanese)
18. Miyazaki, T. (2019). The Generative Logic of the Idea of Living: A Study Theory of Community Social Education, Toyokan Shuppansha. (in Japanese)
19. Mouffe,C. (2005). On the Political (Thinking in Action). London/New York: Routledge.
20. Reybrouck, D. (2016). Against Elections: The Case for Democracy,Vintage Digital; UK ed. edition.
21. Roorda, C. et al. (2014) Transition management in the urban context, Erasmus University Rotterdam.
22. Smith, G. (2009). Democratic Innovations: Designing Institutions for Citizen Participation, Cambridge University Press.
23. Steen, K. and van Bueren, E. (2017). The Defining Characteristics of Urban Living Labs, TIM Rev.
24. Sung, W. (Katagiri, S. and Tanbe, N. eds.) (2003). The Idea of 'Directness/Individuality' in the Early Minamata Disease Movement, in History and Criticism in Contemporary Sociology: Modern Capitalism and Subjectivity, pp.83-104, Toshindo.
25. Young, J. (1999), The exclusive Society :Social Exclusiton, crime and difference in late modernity, SAGE publications Ltd.

Thematic Research Session

Wednesday and Thursday, 21st - 22nd September

11:30-12:30 CEST

Sala Duomo

Research In Progress Paper

Systematizing a kaleidoscopic system of City Labs: problems and complexities of transforming results in public value.

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Abstract

The paper aims to present an eight living labs case study. In the framework of the H2020 SMARTDEST project focusing on mobility-related forms of social exclusion, eight partners in just as many cities, are asked to set up a city lab to co-design solution for social inclusion. This contribution highlights the challenges that the research team in charge to coordinate the eight labs is facing, as well as critical aspects and opportunities of living labs implementation and outcomes.

Keywords

Mobility, tourism, smart solution, social exclusion, social inclusion, co-design.

Introduction

The aim of this paper is to present a set of City Labs organized in eight cities in the framework of the EU-funded H2020 research project SMARTDEST. The H2020 project involves twelve research centers and universities[1] and aims at mapping, understanding, and framing on a theoretical level the processes through which new forms of mobilities (such as tourism and mobile dwelling) are reproducing new forms of social exclusion, imbalances, conflicts, and other ambivalent externalities in urban contexts. The effects of the pressure of new mobilities on the urban dimension can range from the rising cost of living, the congestion of public services, the housing shortages, the transformation of place identities to the marginalization of low-income workers and vulnerable inhabitants.

Diverse governance structures, regulatory frameworks, as well as other local and contextual factors, determine important and significant variation on urban transformations and the consideration of these differences represent important insights in the construction of adequate political responses and place-based solutions. The new models of mobility which are characterizing the so-called "age of mobilities" are determining in fact similar processes but with distinct characteristics among diverse contexts.

Nonetheless, the final objective is to develop innovative solution to social inclusion. On one hand, the project aims at improving the knowledge about these diverse effects of mobilities on cities. On the other, it aims at studying and in-depth analyzing the political, technological, and regulatory factors which are used and can be used to mitigate these negative externalities to produce a direct societal impact in urban contexts in which the project is contextualized.

In connection with this second mission of the project, a City Labs in each of the eight cities involved in the Horizon 2020 project is conceived as participatory laboratory to improve the knowledge and information sharing, the collective diagnosis and the collaborative design of solution aiming at improving the sustainability of the local ecosystems.

Case study cities and their labs

The cities and city-region where City Labs are going to be organized in the following months are Amsterdam. Edinburgh, Venice, Lisbon, Jerusalem, Ljubljana, Turin, Barcelona. Among them, four cities are well known cases in which the growth of tourism mobilities already determined the rise of social imbalances and exclusion, while the other four cities can be considered new "hotspots" of specific dimension of

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[1] Information at www.smartdest.eu.

broader urban dynamics induced by the rising dimension of short-term human mobility.

After a case study phase that last for more than one year, this final part runs from the middle of 2022 to middle 2023 and the local stakeholders (civic, institutional, business and community's actors) who were involved in the implementation of the case study analysis will be part of tailored laboratories. These Labs are meant to be opportunities to design and co-create solutions and to analyze and evaluate small-scale tactics such as social arrangements, regulatory and/or technological approaches, as well as management and planning innovations able to govern and/or to mitigate the negative externalities related to new forms of mobility.

One of the main goals of the project is informing and upgrading urban policy with new instruments and knowledge about the challenges that new forms of mobilities represent and determine, sustaining social inclusion and cohesion. Consequently, a further fundamental objective of the project is to find innovative solutions to inform the design of alternative policy options able to avoid or to mitigate new and old forms of social exclusion related to urban transformation processes.

The current phase of the project, which transforms the case studies in City Labs, is particularly challenging. While the City Labs share the project intentions and objectives, in operational terms they are rooted in the wicked problems identified during the case studies and the specific urban conditions.

The 8 cases can be differentiated through some key variables.

First, they differ in terms of effects induced by the tourism phenomena, and the tourism growth cycle. Some cities such as Venice, Barcelona, Jerusalem, Amsterdam, and Lisbon, are experimenting a long lasting phase of over-tourism dynamics while some other cities such as Edinburgh, Tourin and Ljubljana are not only in a diverse phase of the mobility cycle, but are also experimenting typologies of mobility related, for example to dynamics of festivalization, studentification, and workers' mobility.

Second, the forms of social exclusion addressed by each City Lab are different:

- Exclusion of long-term residents from public space uses; creation of exclusive student-center housing market and some repercussions on the traditional housing market (Turin).
- Social and spatial effects of labour precarity of tourism workers (Barcelona).
- Unbalanced distribution of the wealth and revenue that is related to tourism, and to a neglect of tourism infrastructure in the Arab part (Jerusalem).
- Social and spatial effects of labour precarity of tourism workers (Edinburgh).

- Dichotomy residents *versus* visitors: conflict on uses of place and housing exclusion (Lisbon).
- Various dynamics of resident's expulsion/exclusion; mobility, housing, and retail (Venice).
- Place transformation - The fabric, use and experience of the city (center) changed considerably, with the numerous hotels, restaurants, shops, and Airbnb locations catering visitors in (semi)public and private spaces. (Amsterdam).
- Marginalization of smaller stakeholders in the broad tourism city strategy (Ljubljana).

Third, differences among City Labs concern the specific "issue at stake" that each city lab should address. This aspect could concern

- The unveiling of an unknown socio-spatial dynamics
- An ongoing or potential conflict due to (ex/implicit) forms of social exclusion
- The exploration of opportunity of changes
- The urgency of dealing with an emerged issue

In this sense, the eight CityLabs that form the SMARTDEST project differ not only regarding the contexts in which each of them is being developed instead also regarding the forms of social exclusion investigated, the purposes of the labs, the methods and instruments adopted and implemented, the typology of stakeholders involved, the number of encounters organized and, finally, the objectives and outputs CityLabs aim to achieve The following tables present a transversal overview of CityLabs main differences concerning the just mentioned aspects.

Wicked problems in case study cities: the CityLabs' focus

Amsterdam	Intense tourism activity in the core areas, low level of tourism benefits trickling to 'peripheries'; discursive shifts on the desirability of tourism growth; conflicts on 'uncivil' tourism practices; missed opportunities to 'smarten up' tourism
Barcelona	Tourism gentrification related to the spread of short-term rentals, affecting (most remarkably) precarious tourism workers with gender/age/nationality intersections; mobility conflicts; lack of integration between tourism promotion strategy and housing / urban / labour policy: insufficient use of citizen-generated data/voices in policy design
Edinburgh	Forms of precarity in relation to festivalization; changing logic of attraction; laissez-faire approach to city management
Jerusalem	Unbalanced distribution of the wealth and revenue related to tourism, poor level of 'emancipation' of cultural minorities through the tourism economy

Lisbon	Neighbourhood gentrification and commercial change related to the rising weight of ‘transient’ populations (global mobilities); loss of sense of place and services for long-term residents; lack of available data feeding policy (regarding public space, local life and commerce, and citizens’ well-being)
Ljubljana	Poor development of opportunities for small cultural-creative entrepreneurs as a missed opportunity for higher added-value and more inclusive/sustainable tourism development; risk of mainstream tourist supply and embracing fully the growth paradigm leading to over-tourism
Turin	Lack of a shared view on the “student city”; data gap on the student housing sub-sector; students perceived as a monolithic population of city users and consumers vs localized studentification processes
Venice	Labour-related expulsion of residents from the Historic City and the Lagoon islands; unretentive city for highly skilled human/social capital; an aging city with mobility conflicts for elderly people; extreme housing market pressure from the intense supply of short-term rentals

Forms of social exclusion

Amsterdam	Place transformation - The fabric, use, and experience of the city (centre) changed considerably, with the numerous hotels, restaurants, shops, and Airbnb locations catering to visitors in (semi)public and private spaces. Low-income young population (to be considered in rel to SE typologies)
Barcelona	Social and spatial effects of labour precarity of tourism workers and other vulnerable residents in touristified neighbourhoods.
Edinburgh	Social and spatial effects of labour precarity of tourism workers
Jerusalem	Unbalanced distribution of the wealth and revenue that is related to tourism, and to a neglect of tourism infrastructure in the Arab parts
Lisbon	Dichotomy residents *versus* visitors: conflict on uses of place and housing exclusion;
Ljubljana	Marginalization of smaller stakeholders in the broad tourism city strategy
Turin	Exclusion of long-term residents from public space uses, and conflicts raising especially in night activities. Creation of exclusive student-focused housing market and its effect on the

	traditional housing market. Urban transformation decisions are driven by the "city as a place for students" narrative.
Venice	Various dynamics of residents' expulsion/exclusion; mobility, housing, and retail.

CityLabs' Objectives

Amsterdam	To avoid weak ties across the ecosystem, building trust and cooperation, Sustainability and inclusion. Participation strategies?
Barcelona	Co-Design policy scenarios of neighborhood change based on a participative process and using Agent Based Modelling, and defining open data solutions for revealing social changes derived from the uneven process of tourism and urban development
Edinburgh	Unpack current situation and identify pathways of solution. Knowledge to inform design solution
Jerusalem	Co-creation process of appealing space x tourism in Arab neighbourhood
Lisbon	To produce knowledge, awareness and to informed local urban policy. To enhance existing infrastructure (Lisbon Urban Information Centre) and piloting a city lab (scale-up issue)
Ljubljana	Policy and development precautions in order to build resilience to over-tourism
Turin	Setting up a synergic system and a collective understanding and vision among stakeholders. Knowledge sharing, building awareness on interconnections and students as a multifaceted population, co-Urban regeneration strategies based on student mobilities.
Venice	Co-create policy suggestions to repopulate the city, and co-creation of data about retail census

CityLabs' expected outcomes

Amsterdam	Success- and fail factors for participatory approaches of co-design whereby tourism is considered a strategy for change in the realm of city making; Tangible concepts of alternative futures and/or smarter legislation, co-developed with stakeholders; Strengthened relationships with organisations and groups that belong the tourism ecosystem.
Barcelona	The systematization and standardization of data on neighborhood change, gentrification, and tourism pressure, a conceptual reframing of the analysis of the social impact of tourism pressure in the city of Barcelona, the creation of policy scenarios and reproducible tools (open-source codes, dashboard, database), the sustainability of the City Lab's outcome
Edinburgh	A clear picture of the working lives of tourism and festival workers when 'on-stage' during the busy festival periods in Edinburgh; Insights into the relationship between precarious, frequently short-term workers in tourism and festivals and the everyday, workaday 'off-stage' interface they have with their host city, in terms of housing, transport, and community; Insights into possible COVID-induced changes to the working life experiences of tourism and festival workers in Edinburgh; Development of innovative methodological approaches to accessing the lived experiences of precarious workers.
Jerusalem	Developing a placemaking scheme that will: enhance the local community, improve the physical environment in Beit Safafa neighbourhood in Jerusalem, increase liveability and sustainable mobility in the neighbourhood
Lisbon	Accumulation of in-depth information about the impact of mobile forms of dwelling and tourism on the local social and commercial landscape, about the interaction between more mobile and less mobile resident populations; to pave the way for a platform monitoring residents' level of participation; the proposal of solutions to perceived problems; better-informed policymaking; to ensuring the LUL's continuity, sustainability, and expansion.
Ljubljana	Improved Ljubljana tourism stakeholder dialogue and understanding among different groups., Getting a grasp on how Covid-19 impacted the innovation in Ljubljana tourism and its stakeholders., Stimulate the formulation of a smart city hub that is currently lacking.
Turin	Production and dissemination of information about urban transformation related to universities and the student population; a conceptual reframing of the analysis of the social impact of observed transformation processes; the creation of a co-design process/participative process aiming at defining new ways to govern and to manage studentification-related regeneration process and induced effects; the creation of tools aiming to inform urban policies
Venice	A set of suggested policies to be implemented using the tools of government action. Stakeholders' organisation should identify compromise solutions that

	would align their internal policies with the overarching goal of addressing the wicked problem. Production of a data visualization platform (and data repository), to reproduce, reuse, and replicate the analytical approach used in other smartdest case study cities. Relationship building and brokering which may lead to coalition building and the potential formation of new groups that can carry the process forward beyond smartdest

Stakeholders involved

Amsterdam	An extensive landscape of stakeholders identified in the previous part of the research, linked to Smart Cities and to the Reinvent / regenerate tourism network and in particular to the network of ultlab.
Barcelona	Scholars and members of research institutes; Data technicians; Representatives of grassroots entities; Policymakers; professional associations.
Edinburgh	Tourism and festivals workforce, groups of specific workers representing both high skills (creative) and low skills (hospitality) Communities; public sector leaders in city governance, tourism and festivals, academics.
Jerusalem	Residents from Beit Safafa neighbourhood including community leaders. Relevant local stakeholders might be contacted as well based on their relevance to the study and chosen intervention strategies.
Lisbon	Representatives of local associations and of local administration (district level and municipal level), residents, business owners, academic experts, practitioners working on the labs' thematic. Participation will also be open to individuals, who will attend the CityLab if interested.
Ljubljana	Policymakers; Tourism entrepreneurs; Smart technology providers/developers/researchers; Grassroots movements from the culture and creative industries
Turin	Representatives of the universities and tertiary education institutes; representatives of inhabitants' and students' associations; local administrations; policymakers and professional associations; real estate developers and entrepreneurs, private actors, moderators, and scholars.
Venice	Representatives from stakeholders' organizations divided into thematic groups such as socio-economic sectors (Hospitality, Housing and Commerce), 4 population segments (Residents, Workers, Youths, Students) and the infrastructure sector (including Transportation and Digital infrastructure).

Techniques, methods, approaches

Amsterdam	The lab will adopt a place-based approach. Workshops of co-design and thematic sessions which will include reporting, bespoke, visualization, creative analysis, and additional field of desk research
Barcelona	The lab is conceived as a Community of Practice (cop). Participants will be asked to participate in a co-conceptualization, co-design, and co-analysis of the phenomenon and co-create a database and policy scenarios on neighbourhood change.
Edinburgh	The lab is based on focus groups and insider-led focus group workshops of co-design and co-definition that will Involve participants in the co-creation of knowledge and awareness.
Jerusalem	The lab is conceived as a process of co-planning and co-design based on small-group sessions or focus groups oriented at adding knowledge, mapping local problems, and reaching consensus; Co-design sessions oriented at defining innovative pathways for social inclusion and Plenary session deliberating on the end-results of City Labs will be organized.
Lisbon	The lab will function as an open forum where focus groups of participants will be engaged in social surveys, debates, share perceptions, and co-design solutions.
Ljubljana	The Lab is conceived as a process of consultation and involvement based on qualitative semi-structured interviews with key stakeholders and consultative focus groups aimed at consultations for innovative policy formulation
Turin	The lab is conceived as a series of meetings, public events, and focus groups to share knowledge; build awareness; support local stakeholders and administrators in producing instruments and policies. Stakeholders will be involved in the process of co- conceptualization, co-design, and co-creation.
Venice	The lab is an interactive process implying systematic repetition of sequences of activities to achieve a given result. It will combine Data Analyses and Ethnographic research within the planned Participatory sessions (focus groups). Participants will be asked to participate in co-conceptualization, co-design and co-creation processes. The lab will be organized on interviews with individual representative stakeholders and thematic Focus Groups

Each case study city is setting up the organization of the Lab autonomously but following a detailed structure that will characterize, and will allow to coordinate, the various activities which, all together, define this phase of the Project. For this purpose, a report which describes the general structure that SmartDest's City Labs are meant to follow in constructing the activities of the various labs in the coming months has been recently elaborated[2]s.

At the time of writing, since City Labs are still in phase of construction, it is not possible to detail the activities that each one of them will implement, however, from the preliminary transversal overview, it is possible to note that Labs are going to work on various policy fields and through diverse methods and approaches, integrating analysis of adopted strategies and policies, the analysis of space conflicts and disparities, the analysis of the data availability and the way in which data could be publicly used.

Methodologies which will be implemented by the diverse City Labs vary from one context to the other and range from processes of discussion and of co-analysis, to problem solving exercises, from process of mapping and data modelling to interviews and processes of knowledge production and dissemination, from processes of policy co-design to processes of placemaking co-design. Many of these activities will be implemented through problem-solving exercises, collaborative mapping, storytelling, and design thinking techniques. All these activities, accordingly to the different context in which will be embedded, will take the forms of plenary sessions, small group sessions, focus groups and roundtables.

All City Labs plan to involve a heterogeneous set of stakeholders whose number vary depending on the case (an average of 10-20 participants per session, except for plenary events addressed to a larger audience).

Depending on each case, social actors involved might be scholars, members of research institutes, policymakers, private actors, representative of inhabitants, grassroots, professional associations, representative of regional agency, of traders' association, real estate developers and entrepreneurship but also private actors and data technicians and producers. In some Labs, participation will also be open to everyone interested in the lab's work. At the end of the process, each City Lab is expected to produce innovative approaches that can fit in the realm of urban planning and management strategies to cope with exclusion challenges related to new forms of mobilities and is expected to evaluate the effectiveness, level of concretion, innovativeness of these proposed strategies.

Given this premise, the complexity of this kaleidoscopic system of SMARTDEST city labs is posing a series of practical as well as theoretical challenges.

Participatory processes represent fundamental instruments not only for the construction of a broader understanding of our society, rather also for the creation of

[2] "GENERAL FRAMEWORK, GOALS, CRITERIA AND METHODS OF WORK OF THE CITYLABS IN THE CASE STUDY CITIES"

collective solutions, shared values, methodology and instruments to accompany urban transformative processes in a more innovative, inclusive and just direction. Despite the growing awareness and belief on that, still some important aspects of how these processes can be structured and systematized are not clear.

Gaps still exist in the analysis and mainstreaming of the problem-solving effectiveness of living labs results, as well as on the way they produced outputs can be used in the creation of policy making processes at various levels (local, regional, and national).

As coordinator of this last phase of the SMARTDEST project, we aim to present the described City Labs' general framework and the challenges its complexity poses to open the discussion on the following themes:

- Each lab is a piece of a kaleidoscope within the overall project frame, rather than a research action that addresses the same topic in the same way in different cities. Hence, there is very little room for comparative aspects. The project requires a meta-framework in which to locate each piece of knowledge and action performed in the 8 labs.
- In parallel, each methodology enriches a portfolio of possible local and co-design actions. The 8 teams will be involved in different strategies and scenarios, which form together an interesting set of methods and paths.
- Finally, the ultimate challenge is to move from this complex system to a set of social innovation tools which can be replicated at a wider scale. This implies the establishment of a dialogue and an exchange of knowledge on the different obtained results with the aim of rescaling them and sharing them at the city, regional, and international levels.

In this sense, the OLLD22 conference, and in particular the sessions dedicated to Society and to Governance, represent an opportunity to discuss the 8-lab kaleidoscope not on a case-by-case basis, but in their complexity as a whole.

Conclusions

The article presented the case study of the Smartdest H2020 project, which is now facing the challenge of setting up a network of eight living lab across Europe and beyond. The Smartest project aim to define a roadmap towards solutions to mitigate social exclusion drivers, which might concern and involve technological innovation, governance restructuring, and citizens' empowerment. The ambitious objective of living labs is to find those innovative solutions to inform the design of alternative policy options able to avoid or to mitigate new and old forms of social exclusion related to urban transformation processes.

The article shows a framework in which each living lab has got a different issue at stake, particularly in relation to forms of social exclusion. We analyze the many differences that characterize each living lab, in terms of the contexts they are embedded and the different research approaches of each research group. Since the work is still in progress, our conclusions are oriented to have a confrontation on the challenges as well as opportunities that such a complex process entails, wondering how to make this experience of parallel and kaleidoscopic living labs re-scalable.

Research In Progress Paper

Sustainable cities and digital participation. Analysing and modelling digital social innovation processes in the governance of urban sustainability in Turin and Brussels

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Abstract

The paper describes the preliminary results of first steps of a research project conducted at the University of Turin – ESOMAS Department. The project aims to explore how the recently emerged and diversified domain of Digital Social Innovation (DSI) is equipped for tackling urban sustainability challenges and fueling democratic participation processes. By adopting the analytic perspective of digital geography and critical urban studies, the project explores the operative routines of digital social innovators communities in Turin and Bruxelles, and the multiple "spatialities" generated by the agency of socio-technological actors and supporting DSI initiatives in the city.

Keywords

Digital social innovation; sustainability; urban; participation; governance

Introduction

In recent decades, cities have been confirmed to be both the loci where multiple issues regarding how we live together emerge and as crucial sites to tackle urgent environmental, economic, and social crises. While we face climate change as a global threat, populations around the world experience in various forms that their urban living has become unsustainable due to massive energy consumption, waste production and inefficient treating systems, low air quality, etc. At the same time, the need to build more cohesive communities and to strengthen democratic principles and institutions by fostering participatory processes emerges in all its urgency. In this regard, common consensus exists on the multidimensional character of urban sustainability challenges, which requires a balance between environmental protection measures, social cohesion and the provision of democracy and social justice (Agyeman, 2003). Notably, in the context of ecological, social and economic crises special attention is devoted to the adoption of participatory and transparent approaches in science and politics (Pearsall and Poerce 2020).

In light of a general crisis of democracy in the Global North and considering the wicked nature of entwined economic and environmental problems, innovative governance processes have been often reputed to play a key role in the attainment of sustainability and socially emancipatory goals (Bulkeley and Betsill 2005). To this ends, the massive diffusion of the high bandwidth storage and the web 2.0 architecture has been welcomed as a shortcut toward the democratisation of governance processes, out of the inadequacy of traditional participatory approaches in terms of inclusiveness, accessibility, and degree of democracy, by generating citywide technology-supported leapfrogging and community-based decentralised knowledge and policy production systems.

Notably, diverse initiatives referred to as forms of Digital Social Innovation (hereafter DSI) distinguished for their potentiality of bringing together multiple actors in leveraging on digital technologies to foster socio-political transformations; and, at the same time, for questioning how technology is socially produced. According to a seminal definition adopted by the EU project *Digital Social Innovation for Europe (DSI4EU)*, DSI is a “type of social and collaborative innovation in which innovators, users and communities collaborate using digital technologies to co-create knowledge and solutions for a wide range of social needs” (Bria et al., 2014). Recent research signalled the existence of multiple and often diverging approaches to digitally enabled social innovation, whose diversity depends on the socio-political discourses mobilised, the cultural and economic context in which they are introduced, and the coalitions of actors involved (Certomà, 2021).

The project “Sustainable cities and digital participation. Analysing and modelling digital social innovation processes in the governance of urban sustainability in Turin and Brussels", started in February 2022. It aims to investigate how heterogeneous actors leverage on digital technologies in order to co-create knowledge and to collaboratively trace new paths for tackling sustainability issues at the urban level. At the same time, the project analyses the multiple spatialities that are co-constituted through the work of digital social innovators involved in different projects, mobilising recent insights from the so-called digital turn in geography (Ash et al. 2018)

The present paper introduces the preliminary results of the first phase of the research, consisting of a critical review of the literature that either discusses DSI or explores projects that could be labelled as forms of social innovation variously enabled by the digital. The analysis mainly focuses on both the role of technologies and the urban dimension of the investigated initiatives. The body of literature employed in order to frame the project is therefore constituted by: 1) reports, deliverables, and websites related to EU projects on DSI; 2) academic works explicitly referring to DSI in urban contexts; 3) academic works that without mobilising the concept of DSI yet discuss practices and initiatives that may fall within the boundaries of social innovation through/on the digital dimension of collective life.

The rise of Digital Social Innovation and its relevance for urban governance

The entanglement between digital technologies and cities has been widely studied within social sciences. Since the early adoption of the "smart city" paradigm, urban scholars have explored how the diffusion of an urban imaginary that praises digital technologies for their alleged capacity to solve multiple urban challenge has contributed to reframe different urban issues as problems in need for a technological solution, both through empirical studies (for an overview, see Karvonen et al., 2018) and by reconstructing the genealogy of the smart city narratives (see for example Hollands, 2008; Vanolo, 2014). As long as digital technologies became the principal mediators of how we live in (and make) the city, their urban dimension has been investigated from a different analytical angle, focussing on the pervasiveness of multiple devices, platforms, apps, etc. as mediators of our urban life. Notably, the subfield of digital geography (Ash et al., 2018) has drawn attention on how the relationship between digital technologies and the city is characterised by power relations and shaped by specific social, cultural, and material practices.

Recently, digital technologies in urban governance gained traction due to their possibility to enhance collaboration, participation, and co-creation processes that fuel shared production of knowledge or solutions to pressing societal challenges. This kind of application of digital technologies goes under different names, such as Digital Social Innovation, Civic Tech, Tech4Good, and Social Tech. The present contribution adopts the concept of DSI to refer to all the initiatives in which digital technologies are used to tackle societal challenges by means of an increased participation of citizens in collaborative processes that lead to find either new or underexploited ways to deliver socially progressive impacts.

Considering the recent introduction of the label, so far, DSI has received limited attention within social sciences and urban and geographical research. The lack of a clearly identifiable stream of research on the topic draws attention on "the status of interpretative flexibility in which DSI still lays [which] is an understandable result of the different communities of actors, geographical ties, multi-layered practices, and culturally specific contexts from which they emerge" (Certomà, 2021: 70). Therefore, although DSI cannot be interpreted as traditional social innovation "with a hint of technology", exploring the rich debate on social innovation allows to fill the two following gaps.

On the one hand, evidence from research on social innovation provides useful conceptual tools to understand DSI in a genealogical way (cf. Busacca, 2013), thus making explicit reference to the historical and spatial context in which a specific understanding of social innovation is formulated. On the other, research on the territorial dimension of social innovation paves the way to study DSI initiatives by acknowledging that "places have specific needs, and their communities are enabled or disabled by specific resources and relations, including their governance system and its potential for socio-political transformation" (Moulaert & MacCallum, 2019: 77).

Although a minimalistic understanding may lead to interpreting DSI as simply social innovation initiatives that are enabled by ICT (Misuraca & Pasi, 2019), digital technologies do not play a mere ancillary role. Instead, these represent the core of new social innovation processes. Technology in DSI is not just "a bundle of functionalities but rather […] a system of constraints and affordances [Faraj and Azad (2012)] that supports and fosters specific social practices" (Cortesi et al., 2021: np). Notably, the processes and projects encompassed by the label DSI share a common understanding of the digital as the dimension where social agency can determine social transformations, not only by using digital technologies but also (and more importantly) by reconfiguring the socio-technical systems in which technologies are produced and adopted (Certomà, 2021: 22). On the one hand, digital technologies allow for co-creation practices when different kinds of actors may take part in the innovation process (i.e., social innovation through the digital). Stressing this aspect, DSI may be considered as a typology of grassroots innovation, going beyond the rhetoric of participation and enabling bottom-up approaches toward the definition of community needs and potential ways to meet them (Smith et al., 2014). On the other hand, digital technologies represent the very means through which societal challenges are tackled (i.e., social innovation in the digital), thus signalling the possibility for different actors to get involved in the shaping of technology apt to implement social, political, and economic transformations.

To sum up, the literature review allows to understand DSI initiatives as socio-technical arrangements whose features and outcomes correspond to the contingent enactment of specific discourses on digital technologies, their roles in tackling societal challenges (notably, urban sustainability), contextual features, and the capacities of multiple actors to take part in seeking ways to face these challenges.

Pluralizing urban DSI: scoping the heterogeneity of socio-technical systems to collaboratively address societal challenges

Albeit the label "Digital Social Innovation" is mainly adopted in EU projects, other initiatives may equally situate within the realm of new interventions that leverage on digital technologies to address various societal challenges. The analysis of scientific and grey literature reporting about initiatives sharing features that are typically associated to DSI leads the way to the identification of projects that enlarge the scope of constitutive discourses, actor constellations, technologies, and spatialities.

For instance, recent works have identified the rising of "Urban Digital Platforms" (Chiappini & De Vries, 2022), as alternatives to corporate platforms, that are used to allocate public goods and services through civic and grassroots initiatives, and enable different practices spanning from civic crowdfunding (Chiappini & De Vries, 2022; Gullino et al., 2019) to knowledge-sharing to answer social needs in the city context. The platform Commonfare and the connected cryptocurrency (Chiappini, 2022) clearly exemplify how civic platforms work as urban socio-technical tools for welfare provision, since they enable public participation and citizen self-organisation in the production and redistribution of goods and services. In a rather similar way, Santala and McGuirk (2022: 3) characterise "communal sharing platforms" as enabling processes of re-signification of dominant urban structures.

Other scholars mobilise the framework of "technological sovereignty" to describe the socially progressive potentiality of "de-centralised networks of cooperatives, associations, and community initiatives experimenting with alternative practices of locally rooted, open-source digital development" (Lynch, 2020). When embedded in grassroots initiatives (Balaguer & Rasillo, 2021), digital technologies can foster alternative economies, eventually leading to non-monetary value exchange and support social cohesion.

Although highly heterogeneous and not explicitly mobilising the concept of DSI, these studies reveal how two of the most important traits of DSI – namely, co-production and collaboration – in their practical implementation may span from the more institutionalised inclusion of citizens within processes of planning and governance (e.g., collaborative governance platforms described by Temmerman et al., 2021), to collaborative effort towards the very replacement of existing institutions by means of digital tools.

Conclusions and next steps

The review of the literature allowed us to identify the still fragmented and contested domain of DSI, revealing the need for research that unpacks the heterogeneity of the phenomenon. This is possible by deconstructing the discourses and material practices that sustain and enable different DSI initiatives to emerge, by specifically focussing on those aimed at tackling urban sustainability issues. In the next steps, the project mobilises the epistemological and methodological approach of Actor-Network Theory, which is useful to disentangle the multiple human and non-human elements that shape each and all DSI initiatives. Particular attention will be paid to the territorial dimension of these initiatives, which usually goes unnoticed but is instead crucial for identifying the specific societal challenges, resources, and institutional arrangements of each local community studied.

To finalise the theoretical framework for the subsequent empirical research steps, further review of the literature is conducted to identify common and distinctive traits of DSI initiatives dealing with urban sustainability, by scoping the relevant literature and analysing selected cases. The literature review, together with the analysis of web portals collecting DSI initiatives (such as the one of the project DSI4EU), leads also to the identification of examples of DSI in urban sustainability. In this way, a matrix will be constructed to categorise the initiatives according to some characteristic features (for example, type of citizen engagement, sustainability issue, type of technology, discourse, funding, etc.).

In the following phase, the project is expected to identify prominent communities of digital social innovators in Turin and Brussels. Qualitative research methods such as semi-structured interviews and participant observation are used to explore how social actors who adopt digital tools for the definition and resolution of environmental sustainability problems interact and produce innovative results in the two cities, and what specific conditions of the intervention sites facilitate or hinder their action. At the same time, the project will benefit from the collaboration with Edgeryders, an international community-driven enterprise which involves more than 5,000 people globally to leverage on “collective intelligence” in tackling pressing societal challenges. Digital ethnography and Semantic Social Network Analysis (Cottica et al., 2020) provide further tools to analyse co-production of knowledge among digital social innovators at Edgeryders.

References

1. Agyeman, J., R. Bullard, and B. Evans (eds) (2003) Just Sustainabilities: Development in an Unequal World. Cambridge MA: MIT Press
2. Ash, J., Kitchin, R., & Leszczynski, A. (2018). Digital turn, digital geographies? Progress in Human Geography, 42(1), 25–43
3. Balaguer Rasillo, X. (2021). Alternative economies, digital innovation and commoning in grassroots organisations: Analysing degrowth currencies in the Spanish region of Catalonia. Environmental Policy and Governance, 31(3), 175-185.
4. Bria, F. (2014). Digital Social Innovation. DSI4EU project Interim report, Nesta—EU H2020. Available at https://waag.org/sites/waag/files/media/publicaties/dsi-report-complete-lr.pdf.
5. Bulkeley H., Betsill M. (2005) "Rethinking sustainable cities: Multilevel governance and the “urban” politics of climate change", Environmental Politics, 14: 42–63
6. Certomà, C. (2021) Digital Social Innovation. Spatial Imaginaries and Technological Resistances in Urban Governance, New York: Palgrave Macmillan
7. Chiappini, L. (2022). Commonfare as Urban Digital Platform: ‘Stories’ from Milan and Amsterdam. City, Culture and Society, 100462.
8. Chiappini, L., & de Vries, J. (2022). Civic Crowdfunding as Urban Digital Platform in Milan and Amsterdam: Don’t take pictures on a rainy day!. Digital Geography and Society, 3, 100024.
9. Cortesi, A., Berionni, C., Veeckman, C., Leonardi, C., Schiavo, G., Zancanaro, M., ... & Falelakis, M. (2022). Families_Share: digital and social innovation for work–life balance. Digital Policy, Regulation and Governance, 24(2), 162-178
10. Cottica, A., Hassoun, A., Manca, M., Vallet, J., & Melancon, G. (2020). Semantic social networks: A mixed methods approach to digital ethnography. Field methods, 32(3), 274-290.
11. Gullino, S., Seetzen, H., & Cerulli, C. (2019). Citizen-led micro-regeneration and the negotiation of new urban public spaces: A comparative case-study of civic crowdfunding in London. In J. K. Fisker, L. Chiappini, A. Bruzzese, & L. Pugalis (Eds.), The production of alternative space (pp. 123–135). Abingdon: Routledge.
12. Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?. City, 12(3), 303-320
13. Karvonen, A., Cugurullo, F., and Caprotti, F., (Eds.). (2018). Inside Smart Cities: Place, Politics and Urban Innovation. London: Routledge.
14. Lynch, C. R. (2020). Contesting digital futures: Urban politics, alternative economies, and the movement for technological sovereignty in Barcelona. Antipode, 52(3), 660-680.
15. Misuraca, G., & Pasi, G. (2019). Landscaping digital social innovation in the EU: Structuring the evidence and nurturing the science and policy debate towards a renewed agenda for social change. Government information quarterly, 36(3), 592-600.
16. Moulaert, F., & MacCallum, D. (2019). Advanced introduction to social innovation. Edward Elgar Publishing.
17. Pearsall H., Pierce J. (2010) Urban sustainability and environmental justice: Evaluating the linkages in public planning/policy discourse, Local Environment, 15: 569–580
18. Santala, I., & McGuirk, P. (2022). Communal sharing within and beyond digital platforms: Prefiguring interdependent sharing cities. Digital Geography and Society, 100026.
19. Smith, A., Fressoli, M., & Thomas, H. (2014). Grassroots innovation movements: challenges and contributions. Journal of Cleaner Production, 63, 114-124.
20. Temmerman, L., Veeckman, C. and Ballon, P. (2021), Collaborative governance platform for social innovation in Brussels. Social Enterprise Journal, 17(2): pp. 165-182.
21. Vanolo, A. (2014). Smartmentality: The smart city as disciplinary strategy. Urban studies, 51(5), 883-898.

Research In Progress Paper

Exploring Methods for Co-creation in Living Labs

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Abstract

Living labs adopt different methodological approaches for implementing their co-creation process. In this research in progress, we aim to understand how living lab methods, tools, and other enabling devices, are used to facilitate user involvement and particularly the roles of users during different stages of the innovation process. We interview living labs from different sectors and countries to draw the landscape of practices and the emergence of methods for user involvement within their contextual environment. It shows that living labs use a combination of methods while users iteratively play multiple roles during the innovation process. These collaborative activities take place in a fluid environment, emphasizing the “living” part of labs. Living labs have also learned and adapted to hybrid methods (physical and digital) in recent times.

Keywords

Living lab, co-creation, methodology, user involvement.

Introduction

Users are playing increasingly important roles during the innovation process (Bogers, Afuah, & Bastian, 2010). From giving input to product development to being the source of innovation, their roles are shifting, and users have become a focal point in the field of innovation studies (von Hippel, 1976, 1998, 2005). Innovators from firms and organizations are actively reaching out to users, seeking to exchange values and co-create innovative solutions (Prahalad & Ramaswamy, 2004). The living lab has been recognized as an inclusive environment and mechanism for innovators to effectively attract and engage users (Almirall, Lee, & Wareham, 2012; Westerlund & Leminen, 2011). Inside the living labs, activities are conducted around co-creation with users in real-life settings to develop solutions that can fulfill their needs (Leminen, Nyström, & Westerlund, 2015).

Users have different needs and participate in living lab activities differently, hence the existence of a spectrum of user involvement and methods for collecting their insights (Almirall et al., 2012). Studies also show the plurality of methods for implementing the co-creatin process (Almirall et al., 2012). Meanwhile, in-depth knowledge about the implementation of co-creation and methodological approaches is still scant. This study aims to explore the methods for user involvement in living labs and draw a landscape of current practices and the emergence within their innovation contexts. Our research questions are as follows: How do living labs implement their co-creation processes with users? What are user roles and the methods used during this innovation process?

Literature

Though user innovation is now a well-established aspect of innovation, there are still ongoing discussions about the extent of user involvement and approaches for articulating and deploying their contribution (von Hippel, 2005). It connects with a research and practice tradition around living labs, which is an open approach and environment for engaging multiple players particularly users during the innovation process (Westerlund & Leminen, 2011). Living labs provide the ground for user involvement, as in methodological approaches and real-world settings/facilitations (Almirall et al., 2012), by uncovering user needs and enabling their influence on the development of innovative solutions (Ballon, Van Hoed, & Schuurman, 2018). The essential parts of this concept are early engagement and real-life experimentation for facilitating user participation participation (Almirall & Wareham, 2008; Hossain, Leminen, & Westerlund, 2019).

The literature has identified four categories of living labs according to the driving actor of the innovation activities: utilizer-driven, enabler-driven, provider-driven, and user-driven (Leminen, Westerlund, & Nyström, 2012). Utilizer-driven living labs are established by firms for developing their innovative solutions. Enabler-driven living labs are founded by public or non-governmental organizations for regional or societal development goals. Provider-driven living labs are initiated by organizations like institutes or consultants for developing, promoting knowledge, and improving people's daily lives. User-driven living labs are initiated by a group of users with shared interests and to solve specific problems (Leminen et al., 2012). Knowing the types of living labs help scholars develop further studies for evaluating their methodologies and supporting innovators in adopting suitable approaches for innovation. It is also the starting point for mapping living labs in this research.

Living labs generally follow a linear or iterative innovation process, and they also adopt standardized and customized methods and tools inside their innovation contexts (Leminen & Westerlund, 2017). There is no single methodology for user involvement in living labs (Almirall & Casadesus-Masanell, 2010). Prior studies have also examined different approaches for engaging users at various stages of the innovation process (Beutel, Jonas, & Moeslein, 2017; Feurstein, Hesmer, Hribernik, Thoben, & Schumacher, 2008). Although the actual implementation varies, living labs help uncover users' needs and enable the co-creation of innovative solutions (Ballon et al., 2018). Recent studies have contributed to establishing a comprehensive understanding of the importance of co-creation with users in achieving sustainable outcomes (Compagnucci, Spigarelli, Coelho, & Duarte, 2021), as well as developing a framework of user engagement (Habibipour, 2022). Given the relatively short development period of this entire living lab phenomenon, further evidence is still needed to support the claimed user roles and intended levels of involvement within living labs.

Method

Following a qualitative research approach, we interview members of the European Network of Living Labs (ENoLL), an international cluster of living labs. These are established living labs in their fields across countries. Informants are living lab managers, project leaders, or people holding similar positions, those who have been actively involved in their activities with users. We followed a snowball sampling procedure, a wide-adopted method in qualitative research by starting from a small pool of samples (Given, 2008). We began with several known informants, asking them to recommend one or more potential referrals towards the end of the interview. We then contacted the referrals asking for interviews. During the semi-structured interview, questions move around their reflections on user involvement methods and user roles through the innovation process. Interviews are carried out digitally (or physically if possible). Each interview lasts for around 60-90 minutes. Interviews are recorded and transcribed for analysis. For privacy protection purposes, we have anonymized the identities of informants and their organizations. We had a trial run with one living lab in October 2021 to test the interview questions and make necessary adjustments. The official data collection started in March 2022 and expects to complete by October 2022. We have an envisioned sample of 20 and have interviewed 14 so far.

Preliminary Findings

The 14 living labs are from 12 different countries and multiple disciplines, including public service, health & welling, ICT, and urban. Interviews are still ongoing, and we have not started the full-scale analysis yet at this moment.

Nevertheless, here are some preliminary findings:

1. Living labs customize their methods for co-creation depending on the project/product and user groups. There is a wide range of combinations, including traditional ones like meetings, surveys, testing, interviews, training, and workshops and emerging ones such as gamification, interactive mobile/computer applications, social media platforms etc.

2. Living labs generally claim that users are involved throughout the innovation process. By taking a closer look at each stage of the innovation process, we found that users have different roles at different stages and the situation varies from lab to lab. Instead of following a linear process, users iteratively have multiple roles during the process where living labs shape and assign these roles depending on the project/task. In some living labs, users play more passive roles like informants and testers, while in some other labs, they take more active roles supported by methods and tools.

3. There is increasing attention on the “living” part, which emphasizes the creation of an inclusive and “fluid” environment in contrast to a more conventional physical environment. More flexible forms are suggested, such as a library, a community, a neighbourhood, or a mall, where users and other actors can find and join. Living labs move closer to users, anchoring their “real-life” key characteristic.

4. Some living labs have highlighted the importance of establishing an extensive and active user base with effective communication channels. There are different approaches among living labs. Some have built a user base/community on various platforms, while some don’t have a base of their own but rely on their network for recruitment for each project. The informant from Labs 3 mentioned: “We do have a database of different kinds of users. And the municipality has a large database of citizens’ information”. While the informant from Lab 8 said: “We don't give any financial incentives, so that is something that we cannot do. And because of the GDPR and so on, we cannot really have a kind of a pool of end-users. So, we have to recruit them for every project. We have quite good connections and experiences, but it's a challenge every time to have them on

board".

5. Living labs have experienced a significant shift toward using digital methods during the COVID-19 pandemic. Labs that heavily relies on physical activities have been impacted the most, with many activities postponed or cancelled. After the initial shock, living labs learned to embrace the "new normal" by trying out new ways for user engagement, such as digital methods and tools. This transition has accelerated their adaptation process. Although physical interactions are still considered the primary method, digital formats have been recognized for their advantages in creating new opportunities to reach a broader network, and the ease of use.

"We haven't been able to attend senior homes for example. So, basically those things would have been impossible, and the project had just had to change." (Lab 8)

"I think there's a great value in being able to have it online. Actually, I would say that your user engagement went up when we hit the pandemic, and everything moved online." (Lab 4)

Conclusion

This study, when completed, aims to identify the difference among the living labs in terms of their type, patterns of customization (of methods and tools), and possible outcomes from using these methods and tools. It intends to offer a holistic view of methods for co-creation with users and their implementation in living labs. We hope to contribute by deepening the understanding of user roles at varying stages of the innovation process and mapping the corresponding methods employed. The results would inform relevant research and in particular, help move this on from the question of whether users can play an active role in innovation to exploring how that could be accomplished. For practitioners, it also offers valuable lessons and inspiration about how to arrange their collaborative activities.

References

1. Almirall, E., & Casadesus-Masanell, R. (2010). Open versus closed innovation: A model of discovery and divergence. Academy of Management Review, 35(1), 27-47. doi:https://doi.org/10.5465/amr.35.1.zok27
2. Almirall, E., Lee, M., & Wareham, J. (2012). Mapping living labs in the landscape of innovation methodologies. Technology Innovation Management Review, 2(9), 12-18. doi:http://doi.org/10.22215/timreview/603
3. Almirall, E., & Wareham, J. (2008). Living Labs and Open Innovation: Roles and Applicability. The Electronic Journal for for Virtual Organizations and Networks, 10, 21-46.
4. Ballon, P., Van Hoed, M., & Schuurman, D. (2018). The effectiveness of involving users in digital innovation: Measuring the impact of living labs. Telematics and Informatics, 35(5), 1201-1214. doi:https://doi.org/10.1016/j.tele.2018.02.003
5. Beutel, T., Jonas, J. M., & Moeslein, K. M. (2017). Co-creation and user involvement in a living lab: an evaluation of applied methods. Paper presented at the Proceedings der.
6. Bogers, M., Afuah, A., & Bastian, B. (2010). Users as innovators: a review, critique, and future research directions. Journal of Management, 36(4), 857-875.
7. Compagnucci, L., Spigarelli, F., Coelho, J., & Duarte, C. (2021). Living Labs and user engagement for innovation and sustainability. Journal of cleaner production, 289, 125721. doi:https://doi.org/10.1016/j.jclepro.2020.125721
8. Feurstein, K., Hesmer, A., Hribernik, K. A., Thoben, K., & Schumacher, J. (2008). Living Labs: a new development strategy. In European Living Labs-a new approach for human centric regional innovation (pp. 1-14).
9. Given, L. M. (2008). The Sage encyclopedia of qualitative research methods: Sage publications.
10. Habibipour, A. (2022). Towards a sustainable user engagement framework in Living Labs. Paper presented at the XXXIII ISPIM Innovation Conference" Innovating in a Digital World", Copenhagen, Denmark, June 5-8, 2022.
11. Hossain, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. Journal of cleaner production, 213, 976-988. doi:https://doi.org/10.1016/j.jclepro.2018.12.257
12. Leminen, S., Nyström, A.-G., & Westerlund, M. (2015). A typology of creative consumers in living labs. Journal of Engineering and Technology Management, 37, 6-20. doi:https://doi.org/10.1016/j.jengtecman.2015.08.008
13. Leminen, S., & Westerlund, M. (2017). Categorization of Innovation Tools in Living Labs. Technology Innovation Management Review, 7(1), 15-25. doi:http://doi.org/10.22215/timreview/1046
14. Leminen, S., Westerlund, M., & Nyström, A.-G. (2012). Living Labs as Open-Innovation Networks. Technology Innovation Management Review, 2, 6-11. doi:http://doi.org/10.22215/timreview/602
15. Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. Journal of Interactive Marketing, 18(3), 5-14. doi:https://doi.org/10.1002/dir.20015
16. von Hippel, E. (1976). The dominant role of users in the scientific instrument innovation process. Research Policy, 5(3), 212-239. doi:https://doi.org/10.1016/0048-7333(76)90028-7
17. von Hippel, E. (1998). Economics of product development by users: The impact of “sticky” local information. Management science, 44(5), 629-644.
18. von Hippel, E. (2005). Democratizing innovation. Retrieved from http://web.mit.edu/evhippel/www/democ1.htm
19. Westerlund, M., & Leminen, S. (2011). Managing the Challenges of Becoming an Open Innovation Company: Experiences from Living Labs. Technology Innovation Management Review, 1(1), 19-25. doi:http://doi.org/10.22215/timreview/489

Practitioner Presentation Paper

Building a techno-moral city – Reconciling public values, the ethical city committee and citizens' moral gut feeling in techno-moral decision making by local governments

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Abstract

It turns out to be quite difficult to steer the development of the city in an ethical direction. Interdisciplinary dilemmas remain at the crossroads of financial, legal, social and administrative aspects regarding the use of technology in relation to its the citizens. Therefore, the city of Eindhoven has set up an ethical framework, ethical review board, and an ethical team.

The aim of this paper is to reflect on the role of the city lab to contribute to ethical awareness of the city. The paper discusses an experiment that was set up together with the Fontys University of Applied Sciences to map the moral positions of the citizen of Eindhoven with the so-called 'Moral Data City Hunt'. Its aim was to find meaningful ways to better mitigate the interests of the direct and indirect stakeholders in local techno-moral decision making.

To conclude, we will bring our insights from a policy point of view together and reflect on how the city lab can help to offer meaningful and transparent input for techno-moral decision making at the decentralized government level.

Keywords

City lab, Ethics, Ethical; Review Board, Citizen participation, Moral design, Moral Data City Hunt

Introduction

City councils struggle to keep up with the technological developments that can change the city. E-bikes transform the way cycle paths are used. Airbnb has an impact on the liveliness of a neighbourhood. Drones can have a profound effect on how streets are used. All technological developments require tailormade solutions to steer it in the 'right' direction. The City Council of Eindhoven has established an ethical value framework in support of ethical decision making on the implementation of new technology on all decision-making levels, including decisions by civil servants, alderman and council. The framework consists of the following values: autonomy, human-centric, privacy, security, control over technology, justice and sustainability.

Together with partners from the creative sector, a city lab was set up to involve citizens in finding solutions for these complex societal challenges. The city lab offers a maker space, organizes hackathons and events. It also seeks cooperation with local companies and research institutes. One of the initiatives was the so-called 'Moral Data City Hunt' (MDCH) to engage with the citizens. This is how we develop a local and bottom-up approach to discuss complex techno-moral issues with citizens and collect data that enables us to map ethical preferences and conflicting values per neighbourhood around ethical administrative dilemmas. These insights are translated into design principles that can be central to making and explaining administrative decisions.

In this paper we focus on this experiment. We will first describe the concept of ethical city and explain how Eindhoven tries to implement ethics in her policy making. Second, we will describe our experiment – the moral data city hunt. And third, we will bring our lessons learned from the experiment together with policy making. We conclude with some reflections on the city lab.

Ethical City?

In several studies, the Rathenau Institute (2020) explains that city councils should be more critical when new digital technologies are proposed. Digital technologies are often presented as solution for complex problems for municipal services, social support, housing, sustainability, local economic development, management and use of public space and infrastructure. New digital technologies can bring great benefits for government, businesses, and citizens, but its use is not without risk. It can lead to intended and unintended changes in society. Technology should be considered within its larger context. It is important that local politics are actively involved in the use of digital technology, so that decisions about this are democratically legitimized. But how does that work? And how could the council debate on digitization be improved?

The City of Eindhoven developed a model in which the council, alderman and civil service can engage in an ongoing ethical conversation. Three separate roles were identified: the council formulated ethical values, the civil service set up an (internal) ethical team that is able to help colleagues with ethical advice (we call it 'ethics-as-a-service') and an independent review board was established to provide counsel to the mayor and aldermen. Ideally this works like as follows; a civil servant works on a project and has some ethical dilemmas. They go to the ethical team and request ethical advice. The ethical team will have some discussions with the civil servant, possibly selects a method to work on and helps to identify and involve relevant stakeholders. The ethical advice is written down and shared with the ethical review board. The ethical review board is asked for a reflection on the advice so that the ethical team can learn from it. The ethical review board also writes an annual advice for the mayor and alderman on how to improve ethics in the organization. These views will also be published on the website of the ethical review board. The cycle aims to improve the quality of the ethical conversations over time and build a database of ethical views (figure 1). The development of the ethical framework is further explained in an open access paper: Van Veen & Visser-Knijff, 2022.

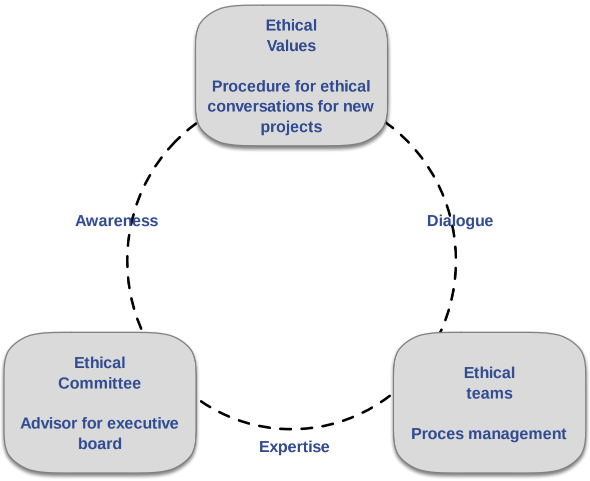

Figure 1. The ethical framework of the City of Eindhoven.

The establishment of an ethical review board fits in a larger development in the Netherlands. Many cities are setting up review boards, but differ in implementation, scope and tasks. Now Enschede, Hilversum, Amersfoort, Zwolle, Breda, The Hague, Helmond and Eindhoven have some sort of ethical review board. The general idea is that a group of ethical experts can give solicited and unsolicited advice to (local) administrators on ethical issues. In many cases, techno-moral themes are involved and are the core business of the ethics committee, or at least designated as a specific area of attention.

The formation of ethics committees specifically designed to discuss techno-ethical to guide dilemmas regarding the continued development of the smart city of the future is a recent phenomenon. Little scientific research has therefore been carried out on the specific effects of an ethics committee on the smart city. In other, related, disciplines, the phenomenon of 'ethics committee' is more established. Ethics committees typically exist in the medical sector (e.g. Bhatt, 2016, Voljč, 2017), business (e.g. Zyung et al., 2020; Greenwood, 2016; Wernaart, 2021) and in conducting research (e.g. Koepsell et al., 2014; Ayoub et al., 2019).

However, the involvement of citizens is an important question in this matter. Some ethical review boards invite citizens to have a seat, others focus more on representatives of societal organizations. Eindhoven has chosen a somewhat different approach. Together with MadLab

[1] - an organization from the creative sector - it has set up a city lab as a maker space where citizens and civil servants can meet and work together on new solutions. This city lab – Stadslab Eindhoven - initiates all kinds of events, hackathons, and meetings on new technology[2]. It labels itself as the R&D department of the city and works together with research institutes, schools, companies on finding new solutions for society.

Stadslab Eindhoven was officially opened on the 6th of March 2022. Its aim is to bring citizens, creative sector, civil servants, and companies together to work on the urgent challenges in society. The living lab offers a makers space and an open environment to meet and discuss relevant issues. The municipality of Eindhoven and the MAD foundation work together and formulate challenges and organize events. The Moral data city hunt was held before the official opening (on 2nd of December 2021) of the Stadslab but is considered its first experiment which led to many new initiatives on ethics.

The stadslab has formulated four principles:

We are a non-profit facility for social innovation, social creativity and technological implementation.

We make digital innovation in the city visible, understandable and discuss ethical issues.

We make knowledge, resources and programs available to residents, companies and public organizations.

We are a physical and digital breeding ground for all kinds of initiatives and research.

We offer access to the extensive 'quadruple helix' network of the Eindhoven innovation ecosystem.

Experiment: Moral Data City Hunt

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[1] madlab.nl
[2] Stadslabeindhoven.nl

Many countries carried out experiments with citizen participation in decision-making at decentralized government level. For example, citizen participation in stratified drawing of lots in France and Germany (Fishkin, 2018), Citizens' Councils in Ireland (Farrell et al., 2019) Canada (Grant, 2014), the United Kingdom (Boswell, 2021), Citizens' Dialogues in Sweden (Lund et al., 2022), and the European Union, or Future Design in Japan (Kobayashi, 2018). There are many variants and a varied jargon to indicate the participation of citizens in decision-making that are beyond official voting in democratic procedures. The Netherlands also has a rich practice in such experiments (see Van der Heijden et al., 2011; Van Houwelingen et al., 2014 in a general sense; Boogaard & Michiels, 2016 on citizen summits). Recently, a book by Eva Rovers (2022) on citizen participation has motivated local and national politicians to consider citizens' assemblies on specific questions.

What the mentioned studies have in common is that they face challenges in three areas:

- The first is how to not only involve the 'usual suspects' (usually the assertive citizen who knows the way to citizen participation initiatives), but also the less assertive, silent, citizen?

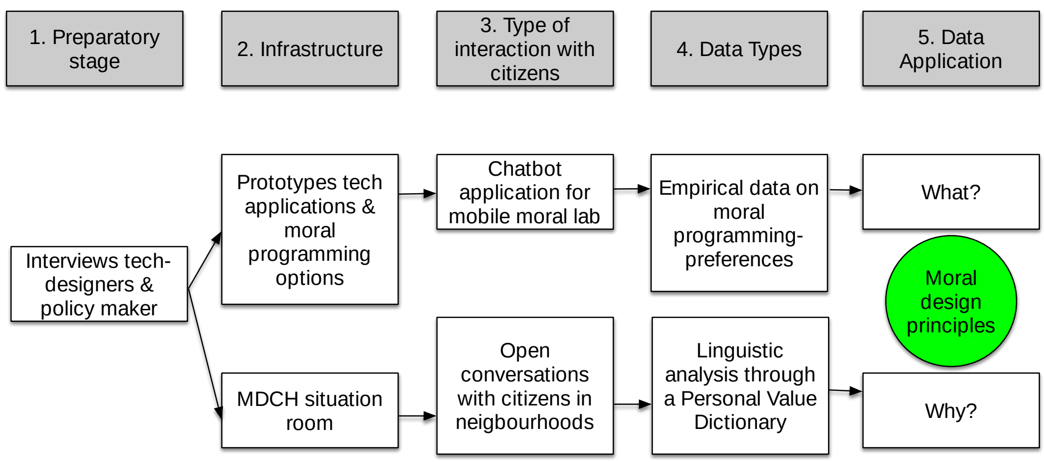
- The second is how to ensure that we really understand the citizen's voice? In many citizen participation experiments there are challenges involving unintended nudges, peer pressure or biases when interacting with citizens. Consequentially, we do not always fully understand what that citizen experiences, feels and believes regarding techno-moral issues. In other words: we are not always fully aware of the nature of the techno-moral preferences of the citizens involved, and how this translates into (e.g. public) values.

- Third, these citizen involvements are designed to jointly take decisions (some of them even suggest a unanimous voting for a particular decision), while this may overlook the meaning of friction in a society. Values collide in specific techno-moral dilemmas. Citizens are mostly in disagreement. It is important to better understand the nature of the disagreement and the meaning of these colliding values rather than to strive for a harmonized single outcome.

To overcome these challenges, we developed a local and bottom-up approach to discuss complex techno-moral issues with citizens and collect data that enables us to map ethical preferences and conflicting values per neighbourhood regarding administrative techno-moral dilemmas. To be more specific: Fontys University of Applied Sciences (research group Moral Design Strategy) and the city of Eindhoven launched the concept of Moral data city hunt (MDCH). This is a city-wide research activity that combines methodologies of empirical ethics and linguistic analysis. The idea is that in one day, the techno-moral gut feeling of a city is mapped into detail. The ‘hunt’ is centred around two techno-moral cases that are relevant in designing the smart city of the future. For instance, in the first hunt,[3] one case was about responsible drone-services, and another case dealt with a city-mobility app that can feed an algorithm that operates traffic signs in a city to optimize traffic mobility. Both themes have deep techno-moral issues that relate to privacy issues, citizen autonomy, mobility and accessibility. Examples of ethical challenges that relate to commercial drones are: where can drones fly? What should be done with video-footage that the drone produces while flying (e.g. can it be shared with authorities if it can help to catch criminals?), what risks are acceptable compared to ‘traditional’ delivery services (a drone may fall from the sky, a bus may cause a traffic accident, both can result in casualties; both can deliver your package)? Examples of ethical challenges that relate to the city mobility app are: should bicyclists be given priority in traffic downtown as a rule? Should polluting cars be given priority to make sure there is as little pollution downtown as possible, or should relatively clean (or electric) cars be given priority to encourage the purchase of cleaner (but also more expensive) cars?

The objective of this method is twofold: on the one hand it contributes to raising awareness amongst citizens that techno-moral issues are more important than ever and strengthens the urgency for citizens to participate in techno-moral discourse. On the other hand, it is a tool to collect detailed data that can be used to develop design principles for new technology that will become part of our future smart cities.

The MDCH-approach is composted if five research-elements (see figure 2).



[3] See for a video-registration of the Moral Data City Hunt in Eindhoven, the Netherlands, November 2021: https://www.youtube.com/watch?v=mnunJ0Mty7g

Figure 2. Moral data city hunt, research elements.

First, interviews with technology experts and policy makers are conducted to narrow down the scope of the technological possibilities that can be foreseen in designing or using the new technology involved, and better understand the potential moral issues that can play a role within these technological possibilities. This is important, since the complex technological designs we may expect to use in the (near) future are not always known by citizens. This means that for having a meaningful dialogue with non-technological people, we need to understand the technological potential first, and determine the way these technological possibilities may affect human values (Aliman & Kester, 2019).

Second, we need to build the required infrastructure for the MDCH. Since we collect two types of data that needs to be combined (see below at step three-five), two infrastructural items need to be built. One is that of a translation of technological possibilities and moral complications into understandable prototypes, language and visualisations in a chatbot in such a way that citizens can 'play' with the moral settings of these prototypes and set their preferred moral programming. For example, how risky should a drone be in terms of potential harm to people during usage compared to a delivery truck? Or: in what proportion should our mobility algorithm give preference to clean cars over polluting cars? The other is the creation of a situation room that enables researchers to receive linguistic data that will be collected during the MDCH and to be able to categorize that data in a personal value dictionary.

Figure 3. The chatbot of the Moral Data City Hunt.

Third, the MDCH takes place. In our example of the Eindhoven MDCH, 140 students were divided over the different neighbourhoods and brought the equipment (chatbot) in the streets. They asked people who would live in these neighbourhoods to interact with the chatbot, and invited them for an open conversation about the chatbot themes afterwards (figure 3 and 4). To this end, we propose a methodological approach (Wernaart et al., 2022) in which we engage citizens with the possible future design of new technology and invite them to morally program this technology. This approach is called 'augmented utilitarianism' (Aliman & Kester, 2022), and the involved data is collected through the chatbot application. Discuss this programming with these citizens in an open, unstructured conversation. The language used is translated – through a value dictionary- into core human values (Ponizovsky et al., 2020). This way, the language level of the respondent is not relevant, and the interviewer is not required to lead the conversation in a fixed direction (as would be in e.g. semi-structured interviews), potentially causing a research bias.

Figure 4. Screenshot of the chat bot.

Fourth, the MDCH activity leads to two types of data: the first type is empirical data regarding preferred moral programming options (what kind of people would prefer what kind of moral solutions in what kind of techno-moral challenges?).The second type is the linguistic data that is filtered using the Personal Value Dictionary (Ponizovsky et al., 2020) which is based on the value categorization proposed by

Schwartz et al. (1990, 1992, 1994, 2012, 2014). It enables us to understand the values that are expressed through language, and how these values relate to other (sometimes conflicting) values.

> What is the Personal Value Dictionary?
>
> Ponizovsky et al., (2020) propose a comprehensive theory-driven tool to detect and analyze personal value orientation in large amounts of texts, build on five different text corpora including single authored, self-expressive texts: the Personal Values Dictionary. These text corpora serve as both data input, and as source of validating the value dictionary. In essence, the proposed approach combines linguistic analysis theory and the value-orientation proposed by Schwartz et al. (1990, 1992, 1994, 2012, 2014). We are amongst the first to put this tool into practice and modify its usage to a Dutch-language setting. The tool in itself is a response to the criticism to the work of many value-scholars who mainly use self-reporting tools as a way of validating their findings. Self-reporting is to some degree biased and ineffective when exploring and analyzing human values.

Fifth, the data-collection now gives us insights in what the preferred moral settings should be according to the citizens of the involved city, and why these settings are chosen (based on what values). Please note that this is not a uniform conclusion, but rather a diverse collection of different viewpoints that are dominant in the discussion. Eventually, these insights are translated into design principles that can be central to making and explaining administrative decisions. Even when there are opposing values, the design principles might be constructed in such a way that it can protect most (or all) of the involved values. This contributes to transparency and trust in administrative actions and offers concrete tools and methodologies to settle moral administrative dilemmas not for but with citizens (Wernaart, 2022). This includes ways of connecting, collaborating, tackling problems and creating interventions in which policymakers or administrators are able to structure their work, give direction and achieve impact.

> What did Eindhoven learn from the data?
>
> - The coding and data analysis is still in progress, so final and validated results cannot be presented.
> - Talking about the positive and negative aspects of technology gave a huge awareness boost to the city: 140 students, more than 500 interviews and around 450 chatbot interactions.
> - The researchers find it remarkable that people in general have absolutely no idea what to expect from new technologies and how to contribute to a ‘better’ design.
> - People were, however, very enthusiastic to talk about new technologies and have great expectations.

- When people were asked to share their concerns about responsible drone services, they say that the camera feeds should not be recorded and publicly shared. They expect that delivery drones will be a less risky means of transportation than other transport modalities (scooters, bicycles, cars, vans, etc) and the drones should fly over the current network of roads so noise pollution is restricted.

- The Personal Value Dictionary and the ethical values formulated by the council do partly overlap; after the data is coded and analyzed we will try to match them.

Reflections for moral policies

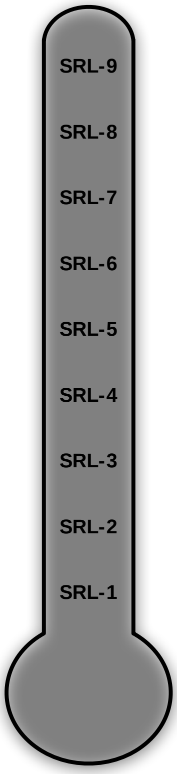
The Moral data city hunt was a very valuable experience for Eindhoven and the city lab, we would like to reflect on the following three topics:

- Citizen participation
- Societal readiness
- Societal challenges

Citizen participation. The MDCH-approach is very helpful to get in contact with large numbers of citizens in just a short period of time. The experience was very valuable for Fontys and Eindhoven. It brings us closer to the ‘silent’ citizens that are not intrinsically motivated to join citizen participation experiments or initiatives by literally bringing our equipment to the streets in all neighbourhoods. It overcomes bias, peer pressure or other distorting elements that can happen in other citizen-participation initiatives by augmented utilitarianism (chatbot) and linguistic analysis. Moral programming is done in complete privacy, and interviewing is not dependant on prefabricated interview structures; instead, it is the language of the interviewee that matters, regardless of the language level or knowledge of the theme. The MDCH method was tested and will be scaled up to other cities. It is our intention to set up an event with more cities on the same day to gather ‘moral data’. The method has its disadvantages as well. It takes a lot of time to analyse the data, especially when it depends on study programs and the availability of students.

Societal readiness. Innovation in the city is not only about developing, implementing and using technology, it is also about doing it in an ethical, legal and socially acceptable way. The concept of ‘societal readiness’ is quite helpful in this matter. We think that citizen involvement is important for responsible innovation in which ethical, legal and social issues are taken into account by the development of technology. The insights of the MDCH are especially valuable for the first three stages of the new societal readiness (SRL 1-3). The MDCH and the city lab offer a way to identify the moral values at stake which can bring the development of technology to the next level. Other participation approaches are necessary for the higher societal readiness levels.

Societal Readiness Level (SRL) is a way of assessing the level of societal adaptation of innovation to be integrated into society.



Levels

- SRL 1 – identifying problem and identifying societal readiness
- SRL 2 – formulation of problem, proposed solution(s) and potential impact, expected societal readiness; identifying relevant stakeholders for the project.
- SRL 3 – initial testing of proposed solution(s) together with relevant stakeholders
- SRL 4 – problem validated through pilot testing in relevant environment to substantiate proposed impact and societal readiness
- SRL 5 – proposed solution(s) validated, now by relevant stakeholders in the area
- SRL 6 – solution(s) demonstrated in relevant environment and in co-operation with relevant stakeholders to gain initial feedback on potential impact
- SRL 7 – refinement of project and/or solution and, if needed, retesting in relevant environment with relevant stakeholders
- SRL 8 – proposed solution(s) as well as a plan for societal adaptation complete and qualified
- SRL 9 – actual project solution(s) proven in relevant environment

Source: Danish Innovation Fund, 2019, https://innovationsfonden.dk/sites/default/files/2019-03/societal_readiness_levels_-_srl.pdf

Societal challenges. The challenge is to find meaningful ways to better mitigate the interests of the direct and indirect stakeholders in local techno-moral decision making. This is becoming quite urgent considering that society is facing major challenges in the areas of energy, raw materials, circularity, food, space, economy, education, healthcare, social and democracy: all issues involve local techno-moral decisions (Rotmans, 2021). The city lab can play an important role in linking researchers with citizens as a central base for MDCH; it can serve as a centrally located situation room, and it can be a place where workshops or interviews with tech-experts and policy makers can take place.

Conclusions

In this paper we described how the city of Eindhoven is trying to implement an ethical framework on different levels. We think it is important to have conversations about new technologies in the city. Too often, technology for social welfare, smart lights, crowd control and smart mobility was implemented without too much consideration of relevant stakeholders, with sometimes very harmful effects (Morozov, 2013). We expect that ethical conversations about public values at an early stage of technological development can bring more innovative solutions. Multidisciplinary dilemmas will always remain at the crossroads of financial, legal, social and administrative aspects but it is better to make them explicit in a democratic system. The MDCH is a powerful tool that can help to raise awareness about techno-moral dilemmas, and better understand the techno-moral gut-feeling (including friction) amongst citizens.

Eindhoven developed an ethical framework in which the council formulated a set of public values that guides the ethical conversations of the ethical team. The ethical team consists of peers that help their colleagues in discussing ethical matters. They had some extra training in different approaches on ethics and can reflect from an outsider perspective on a project. The ethical team put its advice down in a 3-pager that is sent to the external review board for reflection. The aim is to develop a learning cycle in which the reflections of the ethical review board help to improve the expertise of the ethical team. The city lab is a safe space for the ethical team to reflect with citizens on the moral issues of new technologies. For example, a roundtable was organized on our new policy on the security cameras in public spaces to identify concerns and stakeholders.

But our most important lesson learned is this: the city lab should not only have a good external network, reliable data and great people. It should also actively be supported by the council, the alderman and the civil servants. Only then is it possible to develop a shared understanding of the ethical issues and contribute to solutions for the common good.

References

1. Aliman, N-M. & Kester, L. (2022). Moral programming. In Moral design and technology. Wageningen: Wageningen Academic Publishers. https://doi.org/10.3920/978-90-8686-922-0_4
2. Aliman, N. , & Kester, L. (2019). Transformative AI Governance and AI-Empowered Ethical Enhancement Through Preemptive Simulations
3. Ayoub, N. M., Qandil, A. M., & McCutchan, J. A. (2019). Knowledge, Attitudes, and Practice Regarding Research Ethics Committees Among Health Care Faculty at Two Public Universities in Jordan. Journal of Empirical Research on Human Research Ethics, 14(4), 372–382. https://doi.org/10.1177/1556264619851351
4. Bhatt, A. (2016). Ethics committee minutes: Heart of ethics committee quality. Perspectives in Clinical Research, 7(1) doi: https://doi.org/10.4103/2229-3485.173774
5. Boogaard, G. & Michiels, A. (2016). G1000. Ervaringen met burgertoppen. The Hague: Boom Bestuurskunde.
6. Boswell, J., (2021) “Seeing Like a Citizen: How Being a Participant in a Citizens' Assembly Changed Everything I Thought I Knew about Deliberative Minipublics”, Journal of Deliberative Democracy 17(2). doi: https://doi.org/10.16997/jdd.975
7. Danish Innovation Fund, 2019, https://innovationsfonden.dk/sites/default/files/2019-03/societal_readiness_levels_-_srl.pdf
8. Farrell, D.M., Suiter, J. & Harris, C. (2019) ‘Systematizing’ constitutional deliberation: the 2016–18 citizens’ assembly in Ireland, Irish Political Studies, 34:1, 113-123, DOI: 10.1080/07907184.2018.1534832
9. Fishkin, J.S. (2018). Democracy When the People Are Thinking: Revitalizing Our Politics Through Public Deliberation. Oxford: Oxford Scholarship Online.
10. Grant, J. (2014). Canada’s Republican Invention? On the Political Theory and Practice of Citizens’ Assemblies. Political Studies. 2014;62(3):539-555. doi:10.1111/1467-9248.12059
11. Greenwood, M. (2016). Approving or Improving Research Ethics in Management Journals. Journal of Business Ethics, 137(3), 507–520. http://www.jstor.org/stable/24755762
12. Kobayashi, K. (2018) "How to represent the interests of future generations now," 05 May 2018, https://voxeu.org/article/how-represent-interests-future-generations-now
13. Koepsell, D., Brinkman, W.-P., & Pont, S. (2014). Human Research Ethics Committees in Technical Universities. Journal of Empirical Research on Human Research Ethics, 9(3), 67–73. https://doi.org/10.1177/1556264614540596
14. Lund, P., Lidén, G. & Nyhlén, S. (2022) Who talks and who listens? A qualitative analysis of citizen dialogues in rural Sweden, Local Government Studies, 48:1, 129-149, DOI: 10.1080/03003930.2021.1988936
15. Moral data city hunt on YouTube: https://www.youtube.com/watch?v=SMyARmXPOLA
16. Morozov, E. (2013). To Save Everything, Click Here: Technology, Solutionism and the Urge to Fix Problems That Don,Äôt Exist. London, UK.: Penguin Books.
17. Ponizovskiy, V., Ardag, M., Grigoryan, L., Boyd, R., Dobewall, H., & Holtz, P. (2020). Development and Validation of the Personal Values Dictionary: A Theory–Driven Tool for Investigating References to Basic Human Values in Text. European Journal of Personality, 34(5), 885–902. https://doi.org/10.1002/per.2294
18. Karstens, B., Kool, L., & van Est, R. (2020). Voeten in de aarde. Datagestuurde innovatie in de stad Retrieved Rathenau, Instituut, https://pure.knaw.nl/portal/en/publications/c9ad5c8b-4f3b-4d3b-88e8-eafaf4c0097f.
19. Rotmans, J. (2021). Omarm de Chaos. De Geus.
20. Rovers, E. (2022). Nu is het aan ons: oproep tot echte democratie. De Correspondent.
21. Schwartz, S. H., & Bilsky, W. (1990). Toward a theory of the universal content and structure of values: Extensions and cross-cultural replications. Journal of Personality and Social Psychology, 58(5):878–891. http://doi.org/10.1037/0022-3514.58.5.878
22. Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In M. Zanna (Ed.), Advances in experimental social psychology (pp. 1–65), 25. Orlando, FL: Academic.
23. Schwartz, S. H. (1994). Are there universal aspects in the structure and contents of human values? Journal of Social Issues, 50, 19–45. http://doi.org.fontys.idm.oclc.org/10.1111/j.1540-4560.1994.tb01196

24. Schwartz, S. H., Cieciuch, J., Vecchione, M., Davidov, E., Fischer, R., Beierlein, C., . . . Konty, M. (2012). Refining the theory of basic individual values. Journal of Personality and Social Psychology, 103(4): 663-688. http://dx.doi.org.fontys.idm.oclc.org/10.1037/a0029393
25. Schwartz, S. (2014). Functional theories of human values: Comment on Gouveia, Milfont, and Guerra (2014). Personality and Individual Differences, 68, 247-249. https://doi.org/10.1016/J.PAID.2014.03.024
26. Van der Heijden, W (2018), Waar is de journalist nu het Waterschap verzuipt? Nederlands Medianieuws.
27. Van Houwelingen, P., Boele, A., & Dekker, P. (2014). Burgermacht op eigen kracht? Een brede verkenning van ontwikkelingen in burgerparticipatie. Sociaal en Cultureel Planbureau.
28. Van Veen, M. & Visser-Knijff, P. (2022). Ethics in local politics: a case study of the city of Eindhoven. In; Wernaart, B.(ed.) Moral Design and Technology. Wageningen: Wageningen Academic Publishers. Open access: https://www.wageningenacademic.com/doi/book/10.3920/978-90-8686-922-0
29. Voljč, B. (2017). Jurisdiction of the medical ethics committees. Zdravstveno Varstvo, 56(4), 193-195. doi: https://doi.org/10.1515/sjph-2017-0026
30. Wernaart, B. (2021). Ethics and business, a global introduction. Palgave.
31. Wernaart, B. (2022). Moral design and technology. Wageningen: Wageningen Academic Publishers. https://doi.org/10.3920/978-90-8686-922-0
32. Wernaart, B., Kamp, J-A., Nader, B., Van Hest, I., Sweep, A-M. & Roberta Vaznytė, R. (2022) The moral data city hunt – how to morally map a city by combining empirical and linguistic data analysis? Philosophy of Human-Technology Relations Conference, 5-7 July 2022, Copenhagen.
33. Wernaart, B. (2022, 20 January). Inaugural Lecture: building value-based technology together. Fontys University of Applied Sciences. https://mcusercontent.com/4032a89641ed129ae47a7a817/files/fc493b82-770d-5fef-b4fe-eb264638d155/20220120_PDF_Lectorale_Rede_Bart_Wernaart.pdf
34. Zyung, J. D., Mittal, V., Kekre, S., Hegde, G. G., Shang, J., Marcus, B. S., & Venkat, A. (2020). Service Providers' Decision to Use Ethics Committees and Consultation in Complex Services. Journal of Marketing Research, 57(2), 278–297. https://doi.org/10.1177/0022243719898495

Research In Progress Paper

Trans-city data integration platforms: an explorative study on Smart Dublin and Torino City Lab

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Abstract

This paper contributes to the literature on living labs, innovation ecosystems, and the transformation to smart and sustainable cities by exploring the use of a trans-city data integration platform on the smart city programs Smart Dublin and Turin City Lab. Research on living labs and innovation ecosystems is growing and showing increasing interest in the urban scale and the development of smart cities. For the density and interconnectedness of actors and resources, smart cities are believed the perfect grounds for technological and social experimentation, and they may catalyze the transformation toward smart, sustainable, and inclusive societies. Crucially, this requires systematically collecting massive amounts of data from a multiplicity of local stakeholders. While research has often highlighted the opportunities and challenges related to this data collection at the city level, almost no study has yet investigated the potential of aggregating and integrating data from multiple cities via a common infrastructure. This explorative study aims at addressing this gap. Focusing on the smart city programs of Dublin and Turin, it fosters the conceptualization of trans-city data integration platforms and explores their applicability to two real-life smart city living labs. This was achieved by adopting the Quadruple Helix model of innovation, and then by qualitatively analyzing the two smart city programs and 53 subprojects. It was found that initiatives from Smart Dublin and the Torino City Lab display thematic overlaps and complementarities. Hence, this contributes to the existing literature by showing that a common infrastructure for data collection may be developed. Moreover, it informs policy makers and practitioners on the importance of collecting data that could be easily integrated also across geographies, so as to lead to major advantages of scale in the future.

Keywords

living lab, innovation ecosystem, smart city, data integration, open data, internet of things

Introduction

This paper contributes to the literature on living labs and innovation ecosystems by exploring the use of trans-city data integration platforms as assets for the transformation toward smart and sustainable cities (Kalinauskaite et al., 2020; Pucihar, Zajc, Sernec, & Lenart, 2019). Research on living labs and innovation ecosystems is growing with increasing interest in the urban scale and the development of smart cities. Indeed, for the density and interconnectedness of actors and resources, smart cities are believed the perfect ground for technological and social experimentation, and they may catalyze a new wave of participatory and sustainable innovations (Cillo et al., 2020; Zygiaris, 2013). This requires to systematically collect massive amounts of data from a multiplicity of local stakeholders (Pereira, Macadar, Luciano, & Testa, 2017; Walravens, Breuer, & Ballon, 2014). While research has already started to investigate the opportunities and challenges related to this data collection at the city level (Raghavan, Simon, Lee, Tan, & Kee, 2020), almost no study has yet investigated the potential of aggregating and integrating data from multiple cities in the same platform, hence forming a trans-city data infrastructure (ATIS, 2018). This explorative study aims at addressing this gap. Focusing on the smart city programs of Dublin (Smart Dublin) and Turin (Torino City Lab), it aims at fostering the conceptualization of trans-city data integration platforms and verifying their applicability to two real-life living labs. This will require answering the following questions:

1. To what extent are the projects from the two smart city programs comparable?
2. To what extent could data resulting from the two smart cities' experimentations be integrated?
3. What challenges would require to be addressed and what opportunities may be leveraged by integrating data from the two smart cities into a shared platform?

This was achieved by adopting the Quadruple Helix model of innovation (Carayannis, Grigoroudis, Campbell, Meissner, & Stamati, 2018), and then by qualitatively analyzing the innovation projects launched by the two cities. Providing a preliminary answer to the first research question, it was found that the two smart city programs share multiple overlaps and complementarities and may benefit from a common platform for data integration.

Theoretical Background

Sprouting from a wide and diverse literature in economics and management (Suominen, Seppänen, & Dedehayir, 2019), innovation ecosystems are often conceptualized as networks of actors coordinating their activities to achieve complex goals by breaking them down into discrete tasks (Konietzko, Bocken, & Hultink, 2020) and collectively creating and capturing knowledge and value (Iansiti & Levien, 2004). They fit well in the Quadruple Helix model of innovation, where universities, companies, governments, and civil society are intertwined in multiple knowledge, business, and social networks leading to the complex generation, diffusion, and utilization of knowledge and technology (Carayannis et al., 2018). For the purpose of this article, urban living labs will be considered a specific type of innovation ecosystems, focused on engaging citizens and local stakeholders in the co-creation of innovative solutions for city challenges (ENOLL, 2017). Indeed, smart city programs are expected to leverage the massive resources available in cities, and to catalyze innovation via participatory co-creation processes so to deliver more sustainable, smart, and inclusive societies (Cillo et al., 2020; Vilariño & Karatzas, 2018).

Crucially, this will be enabled by the growing availability of data on city processes resulting from the systematic use of Internet of Things (IoT) sensors to monitor water and air quality, energy use, road traffic, waste production and disposal, and so on (Allam & Dhunny, 2019; Byun et al., 2016; Veeckman & Temmerman, 2020). Provided to citizens, this data could be used to offer better services, customize services to their needs, optimize resource use, and improve circularity (Marchiori, Trautmann, & Bregy, 2021; Pereira et al., 2017). Moreover, data would become a new resource in its own and be potentially employed by local entrepreneurs to innovate and further improve existing services (Jussila, Kukkamäki, Mäntyneva, & Heinisuo, 2019; Kitsios & Kamariotou, 2022; Walravens et al., 2014). However, the predominant use of proprietary closed systems for IoT devices, of unstructured or semi-structured databases by governments and agencies, and the production of data in heterogeneous formats and semantics, currently impedes interoperability, portability, and integrability, hence hindering these developments (Ferraris, Santoro, & Pellicelli, 2020; Raghavan et al., 2020).

To overcome this issue, in the coming years, significant evolutions in data collection are expected, moving first towards general-purpose open data platforms able to break within-city boundaries, and then to fully integrated and open platforms where data are shared also with other cities and administrative levels, potentially adopting decentralized system structures, standardized interfaces or APIs, and monetization strategies (ATIS, 2018; Braud, Fromentoux, Radier, & Le Grand, 2021). Specifically, integrating data from multiple smart cities may provide unprecedented benefits, including lowered experimental redundancy, improved diversity, and efficiency of scale. Additionally, by fostering coordination and knowledge recombination across geographies, thematic silos, and organizational boundaries, it would foster opportunities for knowledge recombination, innovation, and entrepreneurship (ATIS, 2018; Binz, Truffer, & Coenen, 2014; Malerba & McKelvey, 2020; Scuotto, Santoro, Bresciani, & Del Giudice, 2017). While there are already some speculations on the potential benefits of this type of platforms, no research has been yet conducted on real-life settings.

Materials and Methods

This study focused on Dublin and Turin as two European cities with a well-developed and ongoing smart city program (European Commission, n.d.). Smart Dublin (Smart Dublin, 2020) brings together top international high-tech companies, the academia, and citizens to transform public services and enhance the quality of life (Coletta, Heaphy, & Kitchin, 2019). It has been founded by Dublin Local Authorities with the vision of tackling key challenges for society such as climate change, the digital divide, and social inclusion. Torino City Lab (Torino City Lab, n.d.) was launched by the Municipality of Turin to convert the city into an open urban lab for experimentation able to build up a smart and better place to live in thanks to the collaboration of international and local stakeholders (Cillo et al., 2020). Both programs support experimentation and an open approach to innovation, thus being consistent with the definition of living labs employed in this paper. In both cities, large amounts of data have been produced by a rich and diverse innovation ecosystem composed of corporations, small and medium businesses, start-ups and research organizations. Though both cities already possess open data platforms, neither of them is yet ready to integrate its data across departments or with other cities (Raghavan et al., 2020).

Acknowledging this current limitation, the present study aims at reviewing the experimental projects promoted by the two cities in the period 2020-2021 to identify affinities that could justify trans-city data integration in the future. With this aim, publicly available material was retrieved from the Smart Dublin's and Torino City Lab's websites (Smart Dublin, 2020, n.d.; Torino City Lab, n.d.) and analyzed via iterative and inductive cycles of qualitative content analysis (Kyngäs, 2020; Täuscher & Laudien, 2018). This enabled to group together the experimental projects implemented by the two cities, and to establish a first benchmark of thematic and technological similarities that could underpin future data integration.

Preliminary Results and Analysis

In 2020 and 2021, Smart Dublin and Torino City Lab developed 27 and 26 different experimental projects each (Table 1), which the inductive qualitative content analysis categorized in a three-level framework. First, an overarching District/City level was identified to respectively collect 7 and 6 projects who were particularly large in their thematic and technological scope. Second, four thematic categories were identified, and namely Culture (0 projects from Smart Dublin and 1 project from Torino City Lab), Environment (4 and 0 projects), Mobility (10 and 9 projects), People (6 and 1 projects). Third, three technologically oriented projects were identified, and namely

Urban Air Mobility (0 and 7 projects), Internet of Things (0 and 1 projects), and Security/Big Data (0 and 1 projects).

Table 1. Experimental projects from Smart Dublin and Torino City Lab (Own work).

Verticals	**Smart Dublin**	**Torino City Lab**
Smart District/Smart City	7	6
Smart Culture	0	1
Smart Environment	4	0
Smart Mobility	10	9
Smart People	6	1
Urban Air Mobility	0	7
Internet of Things	0	1
Security/Big Data	0	1
Total	27	26

These initial results indicate significant overlaps between the two smart city programs, specifically concerning the development of overarching projects aimed at whole-district or whole-city smartness (District/ City), but also individual themes such as Mobility and People. Nonetheless, from these initial results it appears that the majority of projects did not have a counterpart in the other program, as the Environment was only openly addressed by Smart Dublin, and Culture, Urban Air Mobility, Internet of Things, and Security/Big Data only by the Torino City Lab. Of course, this doesn't necessarily mean that the abovementioned themes or technologies were not of concern or not used, but only that they were not targeted by dedicated projects. Hence, the prosecution of this work will deepen the analyses to look more in detail into the technical specifications as well as into the societal objectives directly and indirectly pursued by each project.

In the meantime, these results confirm that a trans-city data integration platform could be applied to Smart Dublin and Torino City Lab. As Figure 1 shows, each smart city program could channel data from its experimentations into a shared digital infrastructure. There, data sourced from similar experimentations could be integrated to develop a critical mass sufficient to fuel advanced and data-intensive applications. Conversely, data from non-replicated projects could be used to provide initial insights into phenomena, lowering redundancy, and improving learning and efficiency (Allam & Dhunny, 2019; ATIS, 2018). This would make the best use of the two cities' infrastructures and resources, favoring coordination and resource use across distances and organizations (Binz et al., 2014; Scuotto et al., 2017). Accordingly, more and more diverse data may enable entrepreneurs to exploit scale to develop new innovations, improve existing services or invent new ones (Jussila, Kukkamäki, Mäntyneva, & Heinisuo, 2019; Kitsios & Kamariotou, 2022; Malerba & McKelvey, 2020).

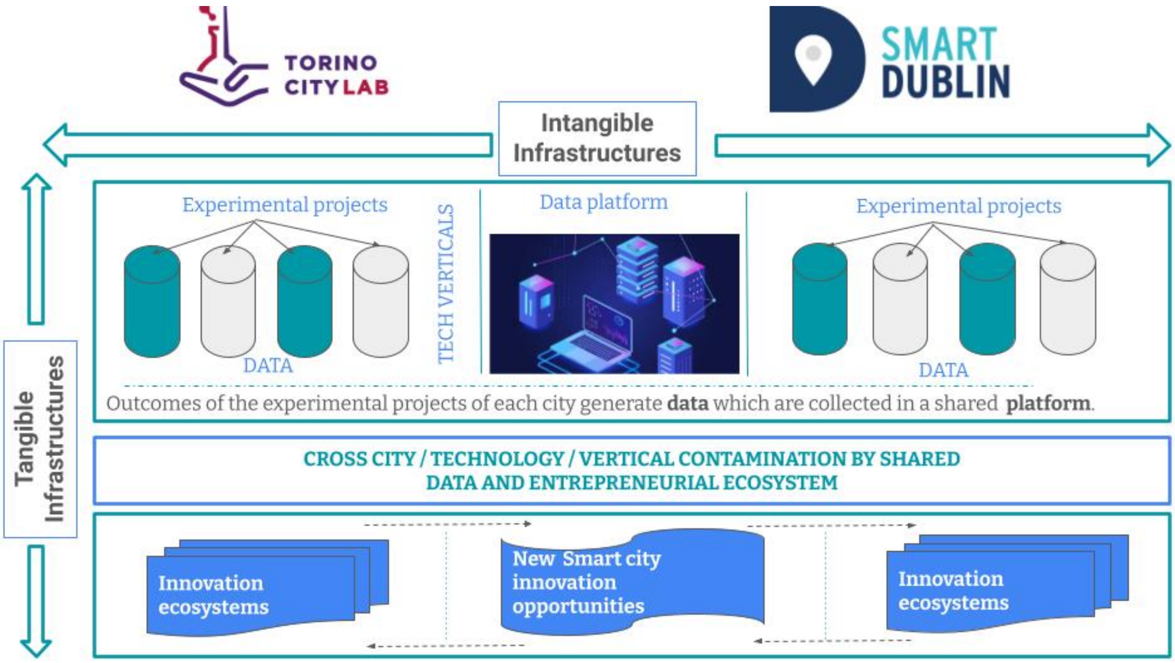

Figure 1. Framework for a trans-city data integration platform (Own work).

Conclusions

Adopting the Quadruple Helix model of innovation, this work qualitatively and inductively analyzed publicly available material on Smart Dublin and Torino City Lab. Among 53 projects launched between 2020 and 2021, it revealed a common interest for large-scope District/ City solutions, Mobility, and People, as well as projects of specific interest for only one of the two cities, such as those concerning the Environment and Culture. As both overlapping and complementary interests may provide opportunities for data integration in a common platform (Allam & Dhunny, 2019; ATIS, 2018), the prosecution of this study will necessarily deepen the analyses and explore use cases for data integration so as to answer the two remaining research questions.

Nonetheless, this work already contributes to the existing literature by fostering the currently embryonic conceptualization of trans-city data integration platforms and providing preliminary evidence on their applicability to two real-life living labs. Such platforms would enable resource sharing as well as coordination between actors operating in different ecosystems and potentially across scales, hence fostering learning, entrepreneurship, and innovation from what already enabled by open data (Binz et al., 2014; Carayannis, Grigoroudis, Campbell, Meissner, & Stamati, 2018; Walravens, Breuer, & Ballon, 2014). To achieve this, decision makers in the public sector and in businesses would have to implement policies to address the use of proprietary systems, closed communication languages, and unstructured data also beyond the local level. Moreover, this study may motivate them to adopt novel approaches to experimentation and open data that consider data integration across geographies, silos, and organizations since the design phase (Braud, Fromentoux, Radier, & Le Grand, 2021). Ultimately, this would contribute to smart cities and living labs by providing better data-intensive services, improve governments' transparency and accountability, and enable the active participation of citizens in developing solutions (ATIS, 2018; Cillo et al., 2020; ENOLL, 2017; Walravens et al., 2014).

References

1. Allam, Z., & Dhunny, Z. A. (2019). On big data, artificial intelligence and smart cities. Cities (London, England), 89, 80–91.
2. ATIS. (2018). Data sharing framework for Smart Cities. Retrieved from https://www.atis.org/smart-cities-data-sharing/
3. Binz, C., Truffer, B., & Coenen, L. (2014). Why space matters in technological innovation systems— Mapping global knowledge dynamics of membrane bioreactor technology. Research Policy, 43(1), 138–155.
4. Braud, A., Fromentoux, G., Radier, B., & Le Grand, O. (2021). The road to European digital sovereignty with Gaia-X and IDSA. IEEE Network, 35(2), 4–5.
5. Byun, J., Kim, S., Sa, J., Kim, S., Shin, Y.-T., & Kim, J.-B. (2016). IoT(internet of things) based smart city services for the creative economy. International Journal of Smart Home, 10(7), 185–192.
6. Carayannis, E. G., Grigoroudis, E., Campbell, D. F. J., Meissner, D., & Stamati, D. (2018). The ecosystem as helix: an exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. R and D Management, 48(1), 148–162.
7. Cillo, V., Farronato, N., Scuotto, V., Pironti, M., Pisano, P., & Del Giudice, M. (2020). Torino City Lab, an open innovation participatory ecosystem. The city works with entrepreneurial universities in shaping the smart city ecosystem. Grand Challenges: Companies and Universities Working for a Better Society. Sinergie Italian Journal of Management.
8. Coletta, C., Heaphy, L., & Kitchin, R. (2019). From the accidental to articulated smart city: The creation and work of ‘Smart Dublin.’ European Urban and Regional Studies, 26(4), 349–364.
9. ENOLL. (2017, July 13). About us. Retrieved May 15, 2022, from European Network of Living Labs website: https://enoll.org/about-us/
10. European Commission. (n.d.). Smart cities. Retrieved January 11, 2022, from https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en
11. Ferraris, A., Santoro, G., & Pellicelli, A. C. (2020). “Openness” of public governments in smart cities: removing the barriers for innovation and entrepreneurship. International Entrepreneurship and Management Journal, 16(4), 1259–1280.
12. Iansiti, M., & Levien, R. (2004). Strategy as ecology. Harvard Business Review, 82(3), 68–78, 126.
13. Jussila, J., Kukkamäki, J., Mäntyneva, M., & Heinisuo, J. (2019). Open data and open source enabling smart city development: A case study in häme region. Technology Innovation Management Review, 9(9), 25–34.
14. Kalinauskaite, I., Brankaert, R., Lu, Y., Bekker, T., Brombacher, A., & Vos, S. (2020). Living Co-Lab: A conceptual framework to set up and facilitate transdisciplinary collaborations to tackle societal challenges in a living lab setting. Proceedings of the Digital Living Lab Days Conference 2020. Presented at the Living Lab Days.
15. Kitsios, F., & Kamariotou, M. (2022). Digital innovation and entrepreneurship transformation through open data hackathons: Design strategies for successful start-up settings. International Journal of Information Management, 102472.
16. Konietzko, J., Bocken, N., & Hultink, E. J. (2020). Circular ecosystem innovation: An initial set of principles. Journal of Cleaner Production, 253(119942), 119942.
17. Kyngäs, H. (2020). Inductive Content Analysis. In The Application of Content Analysis in Nursing Science Research (pp. 13–21). Cham: Springer International Publishing.
18. Malerba, F., & McKelvey, M. (2020). Knowledge-intensive innovative entrepreneurship integrating Schumpeter, evolutionary economics, and innovation systems. Small Business Economics, Vol. 54, pp. 503–522. doi:10.1007/s11187-018-0060-2
19. Marchiori, E., Trautmann, J., & Bregy, R. (2021). The key role of a Living Lab in creating a blockchain-based digital ecosystem to support local businesses. Proceedings of the Digital Living Lab Days Conference 2021.
20. Pereira, G. V., Macadar, M. A., Luciano, E. M., & Testa, M. G. (2017). Delivering public value through open government data initiatives in a Smart City context. Information Systems Frontiers: A Journal of Research and Innovation, 19(2), 213–229.

21. Pucihar, A., Zajc, I., Sernec, R., & Lenart, G. (2019). Living Lab as an ecosystem for development, demonstration and assessment of autonomous mobility solutions. Sustainability, 11(15), 4095.
22. Raghavan, S., Simon, B. Y. L., Lee, Y. L., Tan, W. L., & Kee, K. K. (2020). Data integration for smart cities: Opportunities and challenges. In Lecture Notes in Electrical Engineering. Lecture Notes in Electrical Engineering (pp. 393–403). Singapore: Springer Singapore.
23. Scuotto, V., Santoro, G., Bresciani, S., & Del Giudice, M. (2017). Shifting intra- and inter-organizational innovation processes towards digital business: An empirical analysis of SMEs". Creativity and Innovation Management, 26(3), 247–255.
24. Smart Dublin. (2020, June 5). Smart Dublin. Retrieved January 11, 2022, from Smart Dublin website: https://smartdublin.ie
25. Smart Dublin. (n.d.). Smart Dublin Project Board.
26. Suominen, A., Seppänen, M., & Dedehayir, O. (2019). A bibliometric review on innovation systems and ecosystems: a research agenda. European Journal of Innovation Management, 22(2), 335–360.
27. Täuscher, K., & Laudien, S. M. (2018). Understanding platform business models: A mixed methods study of marketplaces. European Management Journal, 36(3), 319–329.
28. Torino City Lab. (n.d.). Torino city lab. Retrieved January 11, 2022, from https://www.torinocitylab.it/en
29. Veeckman, C., & Temmerman, L. (2020). Rainfall and Flood Monitoring through Citizen Science in Urban Living Labs. Proceedings of the Digital Living Lab Days Conference 2020. Presented at the Living Lab Days.
30. Vilariño, F., & Karatzas, D. (2018). The Library Living Lab Barcelona: A participative approach to technology as an enabling factor for innovation in cultural spaces. ISPIM Conference Proceedings; Manchester. Retrieved from https://search.proquest.com/openview/7a175021ef1d3f48b5c2d5f67f0d4d48/1?pq-origsite=gscholar&cbl=1796422
31. Walravens, N., Breuer, J., & Ballon, P. (2014). Open Data as a Catalyst for the Smart City as a Local Innovation Platform. Retrieved from https://papers.ssrn.com/abstract=2636315
32. Zygiaris, S. (2013). Smart city reference model: Assisting planners to conceptualize the building of smart city innovation ecosystems. Journal of the Knowledge Economy, 4(2), 217–231.

Full Research Paper

How Living Labs support the Quintuple Helix: lessons learnt for a digital transformation

Authors

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Abstract

In the process of growing societies, and especially in the digital societies we are moving towards, there is a need for a strong push for innovation that puts citizens at the centre of the revolution process as a fundamental pillar for building more resilient, cooperative and flexible communities. In recent decades, collaborative design approaches have been put in place to coordinate and manage innovation, facilitating the empowerment of communities and in the end, solving complex challenges. One of the most interesting approaches is the Living Lab (LL), which involves user-centred approach and user-driven innovation by a means to bring together different actors and roles to solve a particular problem. However, while new experiences are emerging that harness innovation and creativity, the potential barriers, enablers and impact for leveraging innovation around these creative environments to facilitate local innovation to be operative, overcome institutional blockage in situation and integrate new roles, sectoral approaches and identify co-development strategies are not clearly understood. This article analyses some of the lessons learned on how living labs can incorporate the Quintuple Helix as a driver to ensure broader participation and cooperation of local actors through the experience gained from the transformation and re-adaptation of the LifeSpace Living Lab after the experience of the ACTIVAGE Large Scale Pilot funded by the European Commission.

Keywords

Living Lab, Quintuple Helix, society, innovation

Introduction

At the beginning of 2022, at the London School of Economics, Luis de Guindos, Vicepresident of the European Central Bank, made a strong statement (Bank, 2022) urging everyone to work together toward three key goals for the EU post-pandemic economy: recovery, renewal, and resilience. These three goals are essential to address Europe's transition towards a green zero-carbon and digital economy in a post-pandemic scenario and in increasing uncertainty of the economy and policy balance.

Building a solid economy requires many factors that involve the society as a whole (Afonasova, Panfilova, Galichkina, & Ślusarczyk, 2019). In this process, a strong innovation-driven factor is necessary, placing citizens at the centre of the revolution process as a fundamental pillar to build more resilient, cooperative and flexible communities. In recent decades, collaborative design approaches have been launched to coordinate and co-manage innovation, facilitating empowerment of communities, and solving, in the end, complex challenges. One of the most interesting approaches is the Living Lab (LL) approach that includes end-user-driven innovation, bringing together different actors and roles to solve a particular problem (Nesti, 2018). Living Labs operate as facilitators in testing environments in which users and producers can co-create innovations. Their main objective is to create new products, services and infrastructures adapted to the real needs of society. Both public and private groups participate in these processes by involving manufacturers and end users in the entire production process in an iterative way, from ideation to testing, experimentation, and evaluation in real settings (Liedtke, Jolanta Welfens, Rohn, & Nordmann, 2012). Traditionally, living labs involve producers and final users in the whole production process of a new product or service. Smart Cities, Internet of Things (IoT), Artificial Intelligence (AI) and Big Data paradigms have transformed these collaborative methods and have recently gained traction in the field of living labs because they have accelerated the access to innovation, transitions for greater sustainability, data, and knowledge exchange, becoming drivers for policy development and innovation scaling up. Moreover, in view of the constant demographic change and according to the European Digital Strategy (Ayris, 2008), rising health and social costs threaten the sustainability of current health system models. Consequently, the number of people dependent on one another to age is steadily increasing. Therefore, it is important to also synergise these existing technological solutions to create value for those involved in the care of the elderly (Konstantinidis, Bamparopoulos, Billis, & Bamidis, 2015). Expanding living labs beyond the limits of laboratory settings, new forms of enlarged living lab governance models have emerged in a variety of daily settings, such as Urban Living Labs (ULL) and enriched the innovation process by including other issues in addition to technology, such as human behaviours, lifestyles, barriers to access or social interaction across socio-economic and cultural spectrum (Voytenko, McCormick, Evans, & Schliwa, 2016). In this context, there are several models of innovation that are constantly evolving. First, the triple helix model emerged, which consists of an articulation between three social actors, the university, the private sector and the government, with the aim of generating regional development in the field of innovation. Subsequently, the quadruple helix model of innovation emerged, which acknowledges four main actors in the innovation system: science, politics, industry and society. According to this model, more and more governments are giving priority to greater public participation in innovative processes (Carayannis & Campbell, 2010). Now, the number of models promoting new citizens' roles and local and regional problems towards a more sustainable and green services is representing a new completely new phenomenon for engaging citizens in participation, experimenting, and learning in the cities. In this sense, the introduction of the Quintuple Helix in recent years introduced the characteristics of social ecology and natural interactions between actors and the environment that enabled the integration between knowledge and innovation, making the definition of innovation ecosystems operative (Carayannis, Grigoroudis, Campbell, Meissner, & Stamati, 2018). However, while new experiences are emerging that leverage innovation and creativity, there is no clear understanding of the potential barriers, facilitators, and impact for catalysing innovation around these creative environments to make local innovation operational, to overcome institutional lock in situation, and to integrate new roles, sectoral approaches, and identify strategies of co-development. In fact, Living Lab experiences to guide urban living lab co-development are still few (Voytenko et al., 2016). This paper aims to frame the understanding of how living labs can incorporate Quintuple Helix as a driver to ensure more extensive participation and cooperation of local stakeholders through the experience and lesson learned from the transformation of the LifeSpace Living Lab by LifeStech at the Universidad Politécnica de Madrid (‘LifeSpace – LifeSTech’, n.d.).

Methods and materials

The LifeSpace is a city-scale ecosystem that is instrumented to enable the experimentation of co-creative design and validation of solutions (technical, but also socio-ecological) in real environments with a variety of user profiles implementing the Quintuple Helix to transfer knowledge among them. The ecosystem has its origins in the Smart House Living Lab (now renamed LifeSpace (Fig. 1), after a detailed re-engineering of the available infrastructure, fine-tuning of the methodological approach and deployment of new flexible and versatile services), founded in 2009 by the LifeStech Research Group of the Universidad Politécnica de Madrid. With a view to addressing the dynamism of the PERSONAS in the ecosystem and scaling up, the guidelines set out in the European Innovation Partnership on Active and Healthy Aging (EIP on AHA) Blueprint)(Vogt, 2021) were followed to better understand potential users their further development, considering their needs, aspirations, attitudes, dreams and other relevant characteristics.

The combination of the systematic analysis of the PERSONAS and the ecosystemic approach of the Quintuple Helix framework(Carayannis, Barth, & Campbell, 2012) allows combining a wide range of expertise and stakeholders to offer innovative and customised solutions aimed at promoting health improvement and social wellbeing-oriented services.

More specifically, by means of these methodological approaches, the LifeSpace has evolved to become an ecosystem that fosters knowledge and innovation in the value of knowledge particularly in the field of healthcare and biomedical engineering to influence public health policies promoting the impact on people's quality of life. The services offered are the following: identify real needs of citizens, generate, and share knowledge through applied and cutting-edge research; develop, test and launch new products and services that give added value to society as a whole; promote a complex and sustainable innovation ecosystem around the world of health and influence new political and legal measures in health and education.

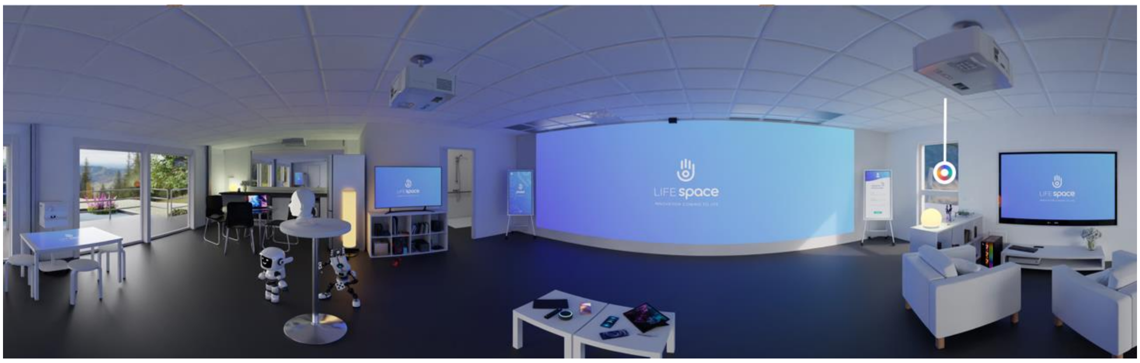

Figure 4. LifeSpace Living Lab and its ecosystem (author's elaboration).

One of the most important driving forces behind the evolution of LifeSpace was the Madrid Deployment Site (Madrid DS) from the ACTIVAGE project (Valero et al., 2021) (Barralon et al., 2019) (Fico et al., 2017) ('ACTIVAGE Project : Internet of Things (IoT) for Ageing Well', n.d.) , ne of the Large Scale pilots to demonstrate the usefulness of IoT on European digital market growth (Guillén et al., 2017). It was an opportunity to enrol a community in which not only target group (in this case older adults) was involved in the co-creation practices with the use of innovative technologies such as IoT in the Active and Healthy aging (AHA) domain. The participation of new actors such as public service providers, facilities, professionals, and the neighbourhood as a life community allowed the rethinking of the process of aging in terms of purpose and identity of life. The environment in this case, the neighbourhood, acts as an element to avoid loss of identity and motivation in elderly adults, while the actors of the daily participation of elderly users, not only from care and health services, but other daily activities such as transportation, social activities, etc., enriched the social innovation towards empowerment of older participants as citizens with the ability to plan their own ageing process. All these elements have been also analyzed through the activities that the Universidad Politécnica de Madrid has been entrusted with in the European H2020 VITALISE project under license number 101007990, which has provided the framework for research and analysis.

Results

The systematic analysis of the LifeSpace ecosystem and its changing interests as societies change, and considering the fields of health technology, digital health and innovation, reveals that sustainable development in knowledge societies can only be achieved when new insights are promoted and produced, and when innovations are further developed(Carayannis et al., 2012) To this end, the LifeSpace, by applying the Quintuple Helix as the main driver of its re-engineering, has managed to be successfully implemented in a deployment environment, composed of three main elements that compete in harmony: 1) SMART HOME LAB: Testing and validation environment where it is possible to simulate what is tested in real environments and experiments. This space has a control and observation room, which through a unidirectional mirror and strategically placed cameras, allows to supervise the use of services and applications in a non-intrusive way. Inside there is also a virtual reality room, which allows for the rapid prototyping of new services and virtual training; 2) AHARCADE CLUB: Interaction environment where technology is deployed to exercise solutions implemented in experiments beyond being demo focusing on AHA services such as exergames, social interaction applications, brain training activities, etc.; 3) NEIGHBORHOOD COLAB: Real environment for experimentation with end users of validated and tested solutions.

Breaking the physical walls of the living lab and extending the co-creation process to the neighbourhood has allowed us to go one step further in the social innovation process, improving the understanding and perception of the older adults as providers of relational goods and services and the importance of these goods for the sustainability of our societies.

Intelligent environments, such as how LifeSpace is evolving**,** have proven useful in stimulating new challenges and seeking new methods and ways for interaction patterns, behaviours and early discovery of needs and elements that contribute to empowering citizens and creating their own meaningful experiences. However, human behaviour is deeply influenced by the environment and its social relationships. In this context, the expansion of the LifeSpace to the city as a whole enhances this space to gain a much deeper, detailed and dynamic insight into these phenomena of creating and understanding citizen relationships. Fig. 2 shows the evolution of the LifeSpace through the helix models.

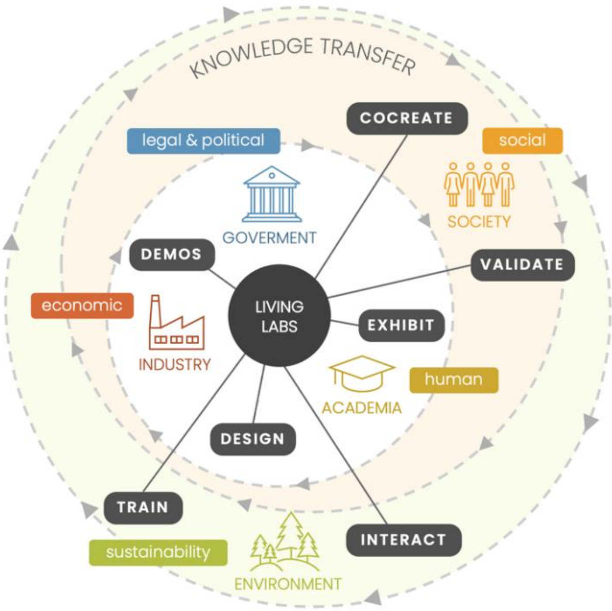

Figure 5. From triple helix to quintuple helix evolution in the LifeSpace Living Lab (author's elaboration).

Discussion on the lessons learnt

The constant evolution of our society and, particularly, the new challenging situations we are facing in the last decade, with very high impact of the social relationships, health and care systems and urban planning, has led us to try to understand the complexity of the society evolution from a more holistic point of view, incorporating new methods and techniques and accompany citizens in these changes. This transformation process has left us with a series of lessons learned that should be shared with the community to offer a view of how living labs, through the LifeSpace case study, have unavoidably renovated from the triple helix to the quintuple helix incorporating the key elements that allow this plasticity to respond to the different changing challenges that Europe is facing. In particular, we have been influenced in three main areas:

Synergies creation

LifeSpace has allowed the inclusion of key stakeholders along the phases of the traditional innovation chain and around the Triple Helix innovation loop, resulting in a consolidated and strong collaboration between researchers and public-private actors. This is crucial for the launching of other ways of collaboration around the Quadruple and Quintuple Helix. The consolidated work around the Smart House Living lab, then transformed in a new version of the Living Lab more flexible and technologically advanced, has enabled to engage in longitudinal measures to capture the effects and impact of the tested concepts and design systematically, from the early stages of the collaboration process and compare these results with previous experiences. For example, in case of the MAHA application, a new set services for providing social and care support to elderly people has been provided, by means of unobtrusive monitoring and suggestion and engagement with physical and cognitive training, well-being habits acquisition. Now, we could compare the current service providers technological support with the last research on assistive technology and the legal framework to introduce these new services in the public social system obtaining a deep understanding of the key enablers to improve from a realistic point of view. This facilitated the overlaps between these three actors' innovation visions, while fulfilling their individual expectations.

However, we have proven that for a smooth collaboration professional accompany process has revelated as key component at this living lab deployment stage, but the process must be kept flexible. The adaptation to the different decision times, workflows, even business visions require the establishment of a core groups for the LL process, that include representatives of every of the groups for gaining a better understanding of the context of the specific experiment. For example, in the case of MAHA deployment it was fundamental a well-coordinated core group formed by researchers from the UPM team, services providers with a extended experience on the social and care service provision as Tercera Edad Activa (TEA), and the continuous involvement of representatives of regional public health service.

Creating innovation

Breaking the limits of the traditional vision of the Living Labs, conceptualized in LifeSpace, has allowed one to raise new challenges and implement new methods and forms of collaboration. Extending the environment as part of the interaction and relationship experimentation has allowed discovering, enhancing, and empowered new exchange patterns between different groups of users, services providers, decision makers and other stakeholders that traditionally do not participate actively in the co-creation process in such unstructured but fully monitored manner. An example of such new ways of understanding user behaviour is the AHACADE Club, that explores the elderly user needs in relation to early symptoms of frailty using a holistic vision of the living routines: physical, emotional and cognitive. In this sense, the personalization of the technology is the core to the success of the solution. In situ implementation of the design and early implementation of continuous participation of all stakeholders are fundamental to supporting this process. But identifying the convenient frequencies of the sessions, balancing time of the sessions, the adequate number of participants and roles against the maintenance of the interest and motivation is one of the more challenging aspects of the process. The well stablished LL process core group deployed within LifeSpace facilitated the mobilizing effect of local participants and stakeholders, while a combination of co-creation (ICT solution testing) and shared decisions (how and when I, as user, want to use the solution) integrated into an interactive and flexible environment set-up build a pull factor for the participants. As results, more than 350 people participated in the AHARCADE club experience design, validation and testing. The design offered a combination of low threshold activities and options to more deeply discuss and solution created together. Besides this enriched experience, the professional management of all the tasks behind co-creation guaranteed the results of these activities was documented as complementary source of learning, increasing knowledge and boosting innovation in other related areas and facilitating the generation of new business models around the envisioned concepts.

Breaking barriers

Open the creative space to those citizens in general that normally do not participate in a planning, creation or design process it is necessary not only to enrich the creation process, but to raising awareness of innovation and increasing stakeholders' acceptance demands. Expanding living lab experiences to the neighbourhood was the last stage in our living lab rethinking process. To mobilize and obtain the local knowledge of such heterogenous groups in the test area, now become a real city area, as it is the NEIGHBORHOOD COLAB required a high networking capability and visible activities for attracting attention. In this sense, the low threshold activities on the street, such as, demo totems and awareness activities, are a valuable methodology for gaining insights into common people's perceptions. This demonstrates that the success of LifeSpace research is the permanent availability of the (interconnected) stakeholders around the Quintuple Helix ecosystem. This requires insight into the business viability of these ecosystems across the different collaborative activities and creative projects.

As results of the deep understanding of the specific location and specific population gained using this extended living lab sources, the business model identification become a core aspect of the co-creative sessions to identify critical success factors behind the tested solutions and how different actor's needs, factors, and interests affected the results of the successful innovations. The early discovery of the preconditions for viable and medium- and long-term collaborations is necessary to set indicators to assess the key drivers, strategies, and performance in every of the stages of developments and make results from the living lab comparable, scalable, and reproducible.

Conclusions

The redesign of LifeSpace Living Lab has allowed to accumulate a wealth of experience in understanding the ecosystem and how the ecosystem members themselves can improve, cooperate and progress to generate better solutions for all stakeholders involved in whose collaboration and success requires the efforts and commitment of the various actors. This paper unpacks the challenges of adopting innovation models in a changing technological context, as well as some lessons learned that can be incorporated into future methodological approaches that may emerge in other living labs. The main lesson learned is that living labs are increasingly becoming a well-known, necessary, and facilitating means to encourage the participation of end users, public and private entities, societies, and the environment in the process of ideation, co-creation, development and testing to increase the maturity of a solution, whether product or service, in terms of technical reliability, usability, acceptability, satisfaction, adoption and trust before its deployment in the market.

In addition, the Quintuple Helix approach has helped to create an unlimited experimental collaborative process more rich, holistic and integrative that before. LifeSpace becomes in sustainable environment that allow the seamless integration of specific needs, interests, willingness and organizational context of all the participants in the innovation process at every of its stages, in their environment. This allows the innovation process and the cooperation methodologies to be more consistent and, consequently, to apply the user-driven innovation techniques more efficiently as a pillar for designing technological solutions.

Finally, the Quintuple Helix collaboration has empowered participants in the innovation process, thanks to the holistic visions of the global ecosystem involved in this innovation. This has allowed a greater impact of the innovations created and improved the engagement and awareness of the proposed solutions.

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References

1. ACTIVAGE Project: Internet of Things (IoT) for ageing well. (n.d.). Retrieved 8 March 2022, from http://www.activageproject.eu/
2. Afonasova, M. A., Panfilova, E. E., Galichkina, M. A., & Ślusarczyk, B. (2019). Digitalization in economy and innovation: The effect on social and economic processes. *Polish Journal of Management Studies*, *Vol. 19, No. 2*. https://doi.org/10.17512/pjms.2019.19.2.02
3. Ayris, P. (2008). Digital Strategy: European perspectives. *Proceedings of the IATUL Conferences*. Retrieved from https://docs.lib.purdue.edu/iatul/2007/papers/40
4. Bank, E. C. (2022). *Managing Europe's economic recovery after the pandemic*. Retrieved from https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220210~2923b1c6d4.en.html
5. Barralon, Pierre, et al. IoT for smart living environments: recommendations for healthy ageing solutions. 2019.
6. Carayannis, E. G., Barth, T. D., & Campbell, D. F. (2012). The Quintuple Helix innovation model: Global warming as a challenge and driver for innovation. *Journal of Innovation and Entrepreneurship*, *1*(1), 2. https://doi.org/10.1186/2192-5372-1-2
7. Carayannis, E. G., & Campbell, D. F. J. (2010). Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate To Each Other? : A Proposed Framework for a Trans-disciplinary Analysis of Sustainable Development and Social Ecology. *International Journal of Social Ecology and Sustainable Development (IJSESD)*, *1*(1), 41–69. https://doi.org/10.4018/jsesd.2010010105
8. Carayannis, E. G., Grigoroudis, E., Campbell, D. F. J., Meissner, D., & Stamati, D. (2018). The ecosystem as helix: An exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. *R&D Management*, *48*(1), 148–162. https://doi.org/10.1111/radm.12300
9. Fico, Giuseppe, et al. Co-creating with consumers and stakeholders to understand the benefit of Internet of Things in Smart Living Environments for Ageing Well: the approach adopted in the Madrid Deployment Site of the ACTIVAGE Large Scale Pilot. En EMBEC & NBC 2017. Springer, Singapore, 2017. p. 1089-1092.
10. Guillén, S., Sala, P., Fico, G., Arredondo, M. T., Cano, A., Posada, J., … Lenz, O. (2017). IoT European Large-Scale Pilots – Integration, Experimentation and Testing. In *Cognitive Hyperconnected Digital Transformation* (pp. 221–282). River Publishers. Retrieved from https://library.wur.nl/WebQuery/wurpubs/532638
11. Konstantinidis, E. I., Bamparopoulos, G., Billis, A., & Bamidis, P. D. (2015). Internet of Things For an Age-Friendly Healthcare. *Digital Healthcare Empowering Europeans*, 587–591. https://doi.org/10.3233/978-1-61499-512-8-587
12. Liedtke, C., Jolanta Welfens, M., Rohn, H., & Nordmann, J. (2012). LIVING LAB: User-driven innovation for sustainability. *International Journal of Sustainability in Higher Education*, *13*(2), 106–118. https://doi.org/10.1108/14676371211211809
13. LifeSpace – LifeSTech. (n.d.). Retrieved 17 May 2022, from https://www.lst.tfo.upm.es/lifespace/
14. Nesti, G. (2018). Co-production for innovation: The urban living lab experience*. *Policy and Society*, *37*(3), 310–325. https://doi.org/10.1080/14494035.2017.1374692
15. Valero, C. I., Gil, A. M. M., Gonzalez-Usach, R., Julian, M., Fico, G., Arredondo, M. T., ... & Palau, C. E. (2021). AIoTES: Setting the principles for semantic interoperable and modern IoT-enabled reference architecture for Active and Healthy Ageing ecosystems. Computer Communications, 177, 96-111.
16. Vogt, J. (2021). The European Blueprint on Digital Transformation of Health and Care for the Ageing Society. *International Journal of Integrated Care*, *21*(S1), 151. https://doi.org/10.5334/ijic.ICIC20404
17. Voytenko, Y., McCormick, K., Evans, J., & Schliwa, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. *Journal of Cleaner Production*, *123*, 45–54. https://doi.org/10.1016/j.jclepro.2015.08.053

Practitioner Presentation Paper

NLAB4CIT - Network of Laboratories for Civic Technologies Co-Production: Digital Services for the Public Administrations of the future

Authors

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Abstract

Innovation in social services and PA does not only mean the introduction of new technologies to digitize services and for the optimization of work processes, but it also means rethinking the role that citizens (and businesses) have in the public service creation, production and management together with public servants.

NLAB4CIT has the ambition to make public services more accessible making the citizens more active in their design, co-creation and management, demonstrating the applicability of some existing digital solutions in different and new sectors of public services coproduction, widening the understanding of their factor of success and sustainability. The objective of the project is to facilitate citizens access, interaction and active contribution to local public services through co-design, co-creation and co-delivery processes where public administration and citizens collaborate, thanks to digitally enabled innovative solutions (Blockchain, AI, IoT, Augmented Reality, Geolocation in Social Networking, Opinion Formation) that will be provided by a European Network of Civic Technologies Laboratories.

Keywords

Civic technologies, Public Administration, Co-design, Digitally enabled co-production

The European context

On 19 February 2020, the European Commission presented its *Digital Strategy*[1] which aims at making Europe more fit for the digital age. The approach of the digital strategy is to achieve a digital transformation that will benefit everyone, based on three main pillars: technology that works for people; a fair and competitive digital economy; an open, democratic and sustainable society. This was conceived to ensure that Europe seizes the opportunities of digital innovation, and gives its citizens, businesses and governments control over the digital transformation.

In order to promote wider uptake and use of advanced digital technologies such as AI and data, the European Commission has proposed the Digital Europe Programme[2] 2021-2027 (DEP) to support the digital transformation of the European economy and society and bring its benefits to European citizens and businesses.

The programme will reinforce Europe's capacities in key digital technology areas through largescale deployment (e.g. high-performance computing; artificial intelligence; cybersecurity and trust; and advanced digital skills). Furthermore, the programme will widen their diffusion and uptake to ensure that also the public sector and areas of public interests, such as administrations, health and care, education, judiciary, transport, energy, environment, cultural and creative sectors, can deploy and access state-of-the-art digital technologies, in particular high-performance computing, artificial intelligence and cybersecurity.

The call for proposal

The NLAB4CIT project has received a grant of from the EC call for a Preparatory Action in the field of Digital Solutions for citizen engagement (*Preparatory Action - Smart local administration using IoT, AI, VR and Machine Learning tools to get closer and more present to the citizen* - CNECT/2020/3855995) that was launched in July 2020 by the DirectorateGeneral for Communications Networks, Content and Technology.

The aim of the call was to support the development and roll-out of digitally enabled innovative solutions for citizen engagement in policy making and decision making, as well as co-creation and co-delivery of public services at the local level.

The project has been positively evaluated, it started in November 2021 and will run until April 2023.

Partners

The project is Coordinated by the Department of Computer Science of the University of Turin and is carried out by a Consortium of 7 partners:

- 3 Local Authorities: Municipalities of Collegno (IT), Roeselare (BE), Kessariani (EL)
- 3 Research institutions: University of Turin (IT), Howest University of Applied Sciences (BE), Open Lab Athens (EL)
- 1 Network of Local Authorities: Association of Flemish Cities and Municipalities (BE)

Main Problem addressed

Public Administrations need to address the challenge of digital transformation by ensuring that public services meet the expectations of citizens and that civil servants have the skills needed to use new digital tools and technologies. However, introducing new technologies to digitize services, means also rethinking the role that citizens have in the public service creation, production and management together with civil servants. In such arrangements, the government should treat the public not as customers but as partners, expanding the role of the citizen from one of "*mere passive consumption of public services to one of active involvement to jointly tackle social problems*"[3].

Therefore, rethinking the role that citizens have in the public service co-design, co-production and co-management together with public servants can help overcoming the current market-driven, transaction-oriented approach to the management of public services (New Public Management) that leaves little rooms for active citizen participation[4].

Whereas co-creation, co-production and co-management of services in the past were constrained by the limited ability of government to effectively coordinate citizen actions and the difficulty of ordinary citizens to self-organize, the advent of the Internet's unique manyto-many interactivity and of ubiquitous communications promises to reimage the evolution of the government-citizen relationship around the concept of collaboration[5]. Technology enhances and expands the viability of and capacity for citizen co-production, not only in traditional citizen-to-government arrangements ("citizen sourcing"), but also in arrangements whereby the government informs, assists, and enables private actions ("government as a platform") or whereby citizens help one another, as in the case of commons, with IT as vehicle for collective action ("do-it-yourself government"). This can happen at all phases of the stages of the service delivery lifecycle: design, day to day execution and monitoring[6].

Approach

The NLAB4CIT project arises from an interdisciplinary research approach that involves the technological aspects of new digital solutions together with Ethics, Law, Public Right, Social and Political Sciences and Economics, which is studying the potentialities, the risks, the enabling and sustainability factors of the application of some disruptive technologies to innovation in public services.

Innovation here is meant as a combination of new technologies (Blockchain, AI, IoT, Augmented Reality, Geolocation in Social Networking, Opinion Formation) and new approaches to the engagement of citizens (co-design, co-production and co-management of public services).

Starting from this perspective, the NLAB4CIT project aims at validating and spreading existing digital solutions for the engagement of citizens in the co-creation of public services at the local level.

The project resorts to the so called Tech4Good technologies that: 1) advance good social and environmental causes; 2) involve technology-powered, affordable, trustworthy opensource solutions and services: 3) are developed through co-creation methodologies, to adapt to different local contexts; 4) are aimed at integrating inclusiveness and fairness principles into the design and development processes.

The NLAB4CIT work plan (Figure 1) is divided into strongly interrelated Work Packages (WP) which are presented in the following table.

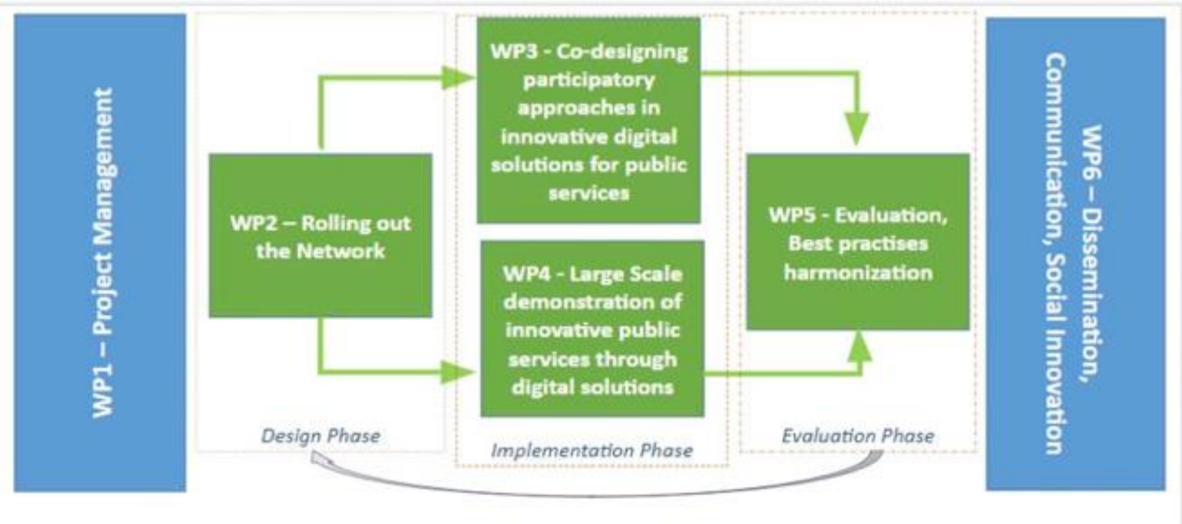

Figure 1. NLAB4CIT project structure.

WPs 2, 3, 4 and 5 are the core phases of the project, namely the design phase that includes the launch of the network (WP2), the two different strictly interrelated aspects concerning:

- the WP3, dealing with the co-designing of scenarios and roadmaps for PA's services development, that covers also the investigation of innovative case studies

- the Large-Scale Demonstrations, the WP4.

WP5 is dedicated to the monitoring and evaluation of what has been produced in WP3 and WP4 so that best common practices can emerge and systematically be shared and integrated in the delivery of innovative public services, involving citizens in the process of co-design, and policy recommendations with future perspectives elaborated. Strong engagement of citizens members is carried out in WP3 and WP4, while WP5 groups all the tasks dedicated to the assurance of the quality and coherence of the project methods and results.

4. Results

The NLAB4CIT project is expected to achieve the following results:

1. An Online Repository of tangible use cases of digital solutions and service co-creation methodologies

2. A Network of Local Laboratories on Civic Technologies (in the Municipalities of Collegno, Roeselare, Kessariani) to:

- exchange of good practices among innovative cities and research institutions;

- identification of common strategies for the adoption of digital solutions by the local administrators;

- easy access to use cases, co-production methodologies and digital technologies;

- further networking and dissemination for the involvement of new followers cities;

- Support the development of digitally enabling innovative solutions for citizens' engagement in policy and decision making, co-creation and codelivery of public services at local level.

3. A Sustainability plan for the scalability and long-term exploitation of the approach and the enlargement of the network.

So far, the project has moved significant steps towards the creation of the three Local Laboratories starting from the definition of a co-design process and scoping the area of intervention, the analysis of the needs, resources and ambitions of public officers, local stakeholders and citizens and the implementation of co-design sessions for the adaptation of the technological solutions for the needs identified. In detail:

Municipality of Kesariani (EL)

The Municipality of Kesariani, coordinated by Open Lab Athens, is developing a Community infrastructuring of Forest Fire Protection with the Volunteer Team of Forest Firefighters of Kesariani (VTFFK) which has a long history during the last decades on the protection of Imittos forest. It is a self-organized team of citizens (70-120 persons) who every year offer their free time in order to protect the forest in the summer months with basic support, resources and infrastructure from the Municipality.

The Local Lab will support actions and activation of resources for the Volunteer Team of forest firefighters of Kesariani focusing on the following areas:

- support in the installation of an archiving system of the communications during shifts in the forest;

- digitalization of radio waves through the integration of hardware on the existing equipment;

- creation of a meteorological station with sensors and Arduino microprocessors in the forest;

- development of a digital coordination platform for the VTFF.

Municipality of Roeselare (BE)

The Municipality of Roeselare, with the support of Howest University, is identifying a digital technology that could allow the involvement of young people in the the co-creation of a specific public space (Pastoorbos Park) by adding new play elements and maintaining existing infrastructure through a participatory design of the park. They are currently investigating different possibilities ranging from Virtual Reality to Minetest. Their interest is also to integrate gamification elements in order to engage children and teenagers in the process of co-design (Reach ages between 10-15 years old).

Municipality of Collegno (IT)

The Municipality of Collegno together with the University of Turin is co-designing services fostering participation and social exchange of different stakeholders (associations, CSOs, citizens, etc) that have as a reference point the Parco Generale Dalla Chiesa.

Based on the needs mapped through the workshops as well as the technologies available by the consortium, the pilot service will consist of two interconnected parts:

- Firstlife[7] instance to develop a territorial approach to promote local retail and cultural activities, networking and collaboration between the different local stakeholders;

- digitalization of the Collegno Youth Pass (discount coupons) for fostering the participation of all citizens by adapting CommonsHood[8] and developing a value exchange system.

Why is it of interest to the public

All project partners will be present in Turin during the Open Living Lab Days and will be available to share and discuss challenges, results achieved so far and their experience with the development of a Local Lab for Civic Technologies

The Online Repository can be exploited by various stakeholders (PAs, private sector, CSOs) and expanded with new use-cases.

The project provides an insight on a concrete and ongoing experimentation on civic applications of innovative technologies that can be of great interest for the participants.

References

1. European Commission 2020, Department of social services website, Australian government, accessed 6 August, 2022, <https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/shaping-europe-digital-future_en>.
2. Proposal for a Regulation (EU) 2018/0227(COD) of the European Parliament and of the Council of 6June 2018 establishing the Digital Europe programme for the period 2021-2027, accessed 6 August,2022 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A434%3AFIN>
3. Mattson, Gary A. “The Promise of Citizen Coproduction: Some Persistent Issues.” Public ProductivityReview 10, n. 2 (1986): 51–56.
4. Nam, T. “Suggesting frameworks of citizen-sourcing via Government 2.0.” Government InformationQuarterly, n. 29 (2011): 12–20.
5. Johnston, E. & Hansen, D. “Design les-sons for smart governance infrastructures”. American Governance, n.3 (2011): 197-212.
6. Linders, D. “From e-Government to We-Government: Defining a Typology for Citizen Coproduction in the Age of Social Media.” Government Information Quarterly n.29 (2012): 446–454.
7. Boella, G., Calafiore, A., Grassi, E., Rapp, A., Sanasi, L. Schifanella, C. "Firstlife: Combining socialnetworking and vgi to create an urban coordination and collaboration platform", *IEEE Access*, vol. 7, pp. 63230-63246, 2019.
8. Balbo S., Boella, G., Busacchi, P., Cordero, A., De Carne, L., Di Caro, D., Guffanti, A., Mioli, M., Sanino, A., Schifanella, C. "CommonsHood: A Blockchain-Based Wallet App for Local Communities,"2020 IEEE International Conference on Decentralized Applications and Infrastructures (DAPPS), 2020, pp. 139-144, doi: 10.1109/DAPPS49028.2020.00018.

Research In Progress Paper

How can an EduCoLab and a network of EduLabs contribute to modernising vocational education and training (VET)?

Authors

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Abstract

This article explains what has been done, what is being done and what is to be done to create a network of EduLabs in the Vocational Education and Training (VET) centres of the Catalan Autonomous Region (Spain), and to promote a VET EduCoLab to support the VET EduLabs network. This social mechanism is designed to contribute to the modernisation process of the professional education system considering digital technologies and the culture of innovation. In the VET EduLabs, the innovative teacher rethinks teaching using advanced digital technologies.

Keywords

Education, Vocational Training, Digital Transformation, Living Lab, EduLab, EduCoLab.

Introduction

By 2030, Spain will need twice as many 4.0 workers as it currently has. However, Spain currently has a 'severe deficit of middle managers and qualified technicians'[1]. If the VET education system does not change, this deficit will increase in the coming years.

To alleviate this situation, the I Strategic Plan for the Modernization of VET 2019-2022[2] was promoted and, at the end of March 2022, a new Organic Law on the Organization and Integration of Vocational Training[3] was approved. The law places special emphasis on innovation, digital transformation, and the integration of practices in the environment.

The response that we are giving from the Catalunya Collaboratory Program to help the social and digital transformation of VET has been to promote a VET EduCoLab as an aggregating, accelerating, coordinating social structure and as a training and support platform for social innovators that lead the VET EduLabs and the Applied Technology Classrooms (AtecA Classrooms) in the VET centres of Catalonia.

The Catalunya Collaboratory Program began in 2018, is financed by the Secretary of Digital Policies of the Generalitat de Catalunya and is designed and executed by the Digital Society Technologies Area (DST) of the i2CAT Foundation. Currently, the Catalunya Collaboratory Program has two lines of work: the promotion of territorial collaboratories, and thematic collaboratories. The impulse of the VET EduCoLab and VET EduLabs is framed within the line of thematic collaboratories.

Definition of VET EduLab and EduCoLab

Currently, the term EduLab has many meanings. In citizen innovation laboratories, such as the EduLab at Citilab in Cornellà (Barcelona), it is a social instrument dedicated to promoting *computational thinking.* In these EduLabs, Scratch language and Arduino hardware are taught, open source is promoted, and information on educational platforms and apps is provided to children, young people, and, fundamentally, primary and secondary school teachers[4] .The EduLabs of some other educational agencies work in a similar way, a the EduLab of the ILCE in Latin

1 Spanish Government (2021, June 16). España Puede. Recovery, Transformation and Resilience Plan. Component 20. Strategic plan to promote Vocational Training. Pag. 3. Available at https://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/16062021-Componente20.pdf

2 I Strategic Plan for the Modernization of VET 2019-2022 at https://www.educacionyfp.gob.es/dam/jcr:1bc3728e-d71f-4a8e-bb99-846996d8a2f2/i-plan-estrat-gico-de-formaci-n-profesional-del-sistema.pdf

3 Organic Law on the Organization and Integration of Vocational Training at https://www.educacionyfp.gob.es/destacados/nueva-ley-fp.html

4 EduLab from Citilab of Cornellà (Barcelona) at https://www.citilab.eu/projecte/edulab-escoles/

America[5].

In the university environment we find the term EduLab as a synonym for research group and program on educational innovation (eg. EduLab of the UOC, EduLab UC). Here the impact of digital technologies on the educational system, its spaces, content, skills, or the social and cultural learning environment is investigated[6].

In another sense, the term is used to designate groups of professionals. For example, the UNICA EduLab network that works on the implications of the Bologna Process in Higher Education[7] or the EduLab I+D+i of Manises and Xirivela (Valencia) where 'EduLab' is a word that designates the meeting space for teachers involved in improving the quality of the educational system where they create and share strategies and resources for teaching[8].

In other cases, the term is used as a company brand that markets educational products based on distance learning applications, educational machinery, and software[9], as a technology accelerator[10], or as a business group that offers international mobility management services for university students[11].

In the context of the Catalunya Collaborative Program, the term VET EduLab means a reference space in training centres that brings together innovative teachers in their mission to modernize the teaching plans of the different professional families for 4.0 workers. This innovative teaching staff uses EduLab to open their professional family to computing, electronics and multimedia to adapt the theoretical and practical contents of the subjects, and professional practices in companies, administrations, foundations and other entities. The VET EduCoLab is the instrument that provides training, inspiration, dissemination, coordination, and support for the social and digital innovation projects promoted by the EduLabs and the AtecA Classrooms. We are currently promoting the creation of VET EduLabs and the VET EduCoLab.

The first steps that have been taken in this direction are set out below.

First steps

Here we will distinguish actions of training, research, promotion of projects, promotion of VET EduCoLab and dissemination.

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[5] EduLab ILCE at https://www.ilce.edu.mx/index.php/innovacion/edulab
[6] UOC's EduLab at http://edulab.uoc.edu/es/ . Edu Lab of the Pontifical Catholic University of Chile at https://edulab.uc.cl
[7] UNICA EduLab at https://www.unica-network.eu/activity/working-groups/unica-edulab/
[8] EduLab I+D+i of Manises and Xirivela (Valencia) at https://edulabmx.wixsite.com/edulab
[9] See, for example, EduLab SARL https://www.edulab.com.lb or the EduLan Inc. at https://www.edulab-inc.com/ in Tokyo
[10] See, for example, Edulab, EdTech Accelerator from Warsaw (Poland) and their eduLAB 2.0 project at https://edulab.io/en/edulab-2-0-english/
[11] See, for example, the Edulab Educational Exchange Pvt. at https://edulab.in/

Training. The first activities date back to an online training on social and digital innovation that took place in mid-2020. This training was aimed at the members of the Collaboratory of Catalonia South (Colab CatSud), the first of the territorial collaboratories that promoted the Collaboratory Program in 2019. In this training, a section was created in which a group of teacher-innovators from VET participated organising what they called using different names such as Future Classrooms, Technological Classrooms, Virtual Classrooms, SmartClassrooms, Innovative Classrooms and which, at present, it's called, mainly, AtecA Classrooms (Applied Technology Classrooms).

Subsequently, from the Institute of Educational Sciences (ICE) of the Rovira i Virgili University (URV), active members of Colab CatSud, a request was made to the i2CAT Foundation to transfer knowledge about digital technologies to VET teachers. This training of trainers was organised online and offered to all VET teachers in Catalonia. The first course focused on 5G (75 hours) and was taught between April and May 2021. This course was followed by Cybersecurity (75 hours, May 2021), IoT (100 hours, June and July 2021), and Drones (45 hours, June 2022). A Blockchain course is scheduled for October 2022, followed by one on Virtual Reality and AI. In each of these courses 25 teachers are trained. The 5G course has already had two known impacts: The introduction of a module on 5G technology at the Julio Antonio Institute in the town of Ribera d'Ebre (Tarragona) in the 21-22 academic year, and the creation of a 5G Lab at the Sant Cugat Institute in Barcelona.

On the other hand, the Department of Education of the Generalitat de Catalunya made a first call to technologically equip the AtecA classrooms. In the middle of 2021 selected 33 centres and, from the EduCoLab, a Technological Classroom Dynamization Workshop was held for the coordinators of the AtecA Classrooms to identify equipment and suppliers and reflect on their uses in the classroom.

Projects. In parallel, three research projects aimed at modernising VET were promoted, involving teachers from VET institutes in South Catalonia territories. One, addressed to Horizon Europe, on the introduction of virtual reality environments in classrooms. Another, national, to the Ministry of Education and Science, on the transfer of digital research centres to VET teachers. And another, local, on AI applied to the evaluation of performance in the classroom. The proposals were not selected.

Research group. To give the project an academic dimension, the i2CAT Foundation and the URV, through the ARGET research group that works on educational technologies at the URV, and the DST that promotes the Collaboratory Program, created a three-year pre-doctoral scholarship to finance a thesis on the EduCoLab FP project. The scholarship was awarded in January 2022 and is being co-directed by ARGET and DST.

Subsequently, and coinciding with the actions to disseminate the new Organic Law on the Organisation and Integration of Vocational Training, ARGET - DST organised the first conference on Technological and Innovative Classrooms (April 1, 2022) which, formally, initiated the academic debate on the development of social mechanisms that can contribute to the socio-technical transformation of vocational training.

Dissemination. On April 22, 2022, the presentation: *Steps towards the creation of an EduCoLab* was presented at the Education table of the GKA Techno 2022, XI International Congress of Technology, Science and Society . A few days later, within the 24-hour Innovation Bacrelona programme, a presentation was given on How to Create an EduLab? To encourage VET schools to identify their social and digital innovators and start creating VET EduLabs.

EduLabs Drive. As of June 2022, the first three VET EduLabs were being promoted in three different institutes and professional families. One to connect the training cycle of viticulture with computer science and electronics. Another, doing the same in Tourism. And another, connecting a new cycle of Virtual Reality studies with other professional families.

In short, the training has made it possible to establish links with the community of VET teachers and identify innovative teaching staff, an investigation has been initiated to document the process of modernising VET from an academic point of view, and contacts have been established between the world of business and public administrations to connect digital technology with plans, teaching methodologies, internships in companies and the relationship with the centre's environment. That is, the preliminaries have been starting to create a quadruple helix community for the VET EduCoLab that supports the emerging VET EduLabs.

Next steps

Next, the VET EduCoLab motor group must be constituted, and a community of stakeholders created.

Those interested are all those people and entities that make up the VET ecosystem in Catalonia. Here we are talking about the Department of Education of the Government of Catalonia with its InnovaFP programme , the Municipal Education Consortia of Catalonia, among which the Consorci d'Educació de Barcelona stands out, the XarxaFP network promoted by the Barcelona City Council, and private entities such as CaixaBank's Dualiza and Fundació Bofill. They are the territorial networks of dual VET centres (Xarxes de FCT-FP Dual). They are the clusters of companies that market digital technologies in general, such as the Digital Catalonia Alliance , or those specifically focused on educational technologies, such as the EdTech Cluster, which see the introduction of AtecA classrooms as a commercial opportunity. They are the companies and entities that offer internships to VET students. They are also the research groups on educational innovation at Catalan universities such as the ARGET of the URV , the EduLab of the UOC , the GREUV of the UVic and other universities such as the UAB, UPF, UB, URL, UdG, UdL. They are the R+D+i carried out by digital research centres such as i2CAT, CTTC and CVC and, of course, they are the teaching staff-innovators of the centres, the students, their families and the communities in which they live and work.

From the VET EduCoLab, in addition to aggregating interested parties and contributing to boosting the existing VET ecosystem, training, dissemination and inspiration activities, research projects focused on the practical needs of VET teachers are being organised. The core of these activities is, by the time now, to help them transform their teaching plans, their methodologies, and their activities through the Teaching Plans Modernisation Workshop, to equip the AtecA classrooms in a realistic manner and synchronised with the teaching activity, and to teach by integrating the informatics, multimedia and electronics. This work must be done in each of the 26 existing professional families, family by family.

Conclusion

The EduCoLab Project arises at a time of structural need for the country. What stands out the most is that it originates not in the framework of the official education system but in the context of the innovation system. The education system approaches advanced digital technologies in search of resources to improve teaching quality and, for this, has created and is equipping the AtecA Classrooms. On the other hand, the innovation system, from the Digital Transformation strategy and, in search of the social impact of digital technologies, promotes the creation of new socio-technical spaces such as EduLabs and EduCoLab to apply technologies to teaching practice. Both systems share the same mission of improving the quality of the education system. But, in one, teachers go looking for technologies and, in the other, technologies go looking for teachers. The EduLabs and the EduCoLab FP are the space where both expectations meet and create the necessary synergy to achieve the mission of modernising FP and reducing the risks of the 'severe deficit of middle managers and qualified technicians' that currently threatens sustainability of the productive system in Spain.

Full Research Paper

TInnGO Tools

Authors

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Abstract

The Horizon Europe 2020 TInnGO (Transport Innovation Gender Observatory) project[1] aimed to facilitate the inclusion of women and underrepresented groups in smart mobility. Globally women form under 30% of the transport workforce. Significantly their travel needs are not met by current transport provision, despite evidence of different journeys and mobility concerns. Little research has been conducted on the inclusion of minority groups (such as those from BAME (Black, Asian, Minority and Ethnic communities and those with disabilities) – but a similar, if not poorer picture is likely. The design of future smart mobility is further skewed by the predominance of male transport designers and engineers.

The living lab approach has been shown to be effective in addressing mobility challenges. However, work with student designers and other stakeholders has highlighted barriers in the understanding and application of key underpinning concepts such as sustainability, diversity, intersectionality and empathy which might impede co-creation which may reduce design opportunities. To address this, TinnGO developed a series of tools to guide co-creation activities to increase empathy, understanding and use of intersectionality and design against UN Sustainable Development Goals for gender equality and sustainability.

Keywords

Intersectionality, sustainability, empathy, gender equality, transport, participatory methods

[1] https://www.tinngo.eu/

Introduction

Gender Smart Mobility (GSM) requires new services and vehicles, and the application of gender and diversity mainstreaming to create transport which is 'smart' because it is efficient and inclusive, not just technologically enabled. A smart transport system is not one that creates congestion, pollution, or destroys neighbourhoods, harms health and wellbeing, or creates transport poverty. Gender and diversity mainstreaming recognises the importance of applying intersectionality in creating fair and equitable transport services which can reduce the vulnerability of certain groups to social-exclusion related transport poverty.

Transport facilitates access to the labour market, healthcare, recreational and educational services. The emphasis on moving people to and from of city centres and servicing the car as a private mode of transport has fractured our cities, creating, pollution, congestion and unattractive urban landscapes (Banister, 2015). Current transport provision is not affordable or accessible to all, reducing life opportunities (Lucas, 2012). The recent emphasis on intersectionality (Crenshaw, 1989) has shown that many suffer multiple forms of transport poverty, leading to economic and social isolation (Uteng et al, 2020).

Although an integrated, fair and accessible transport system is key to social and economic development and justice, transport planning (and the wider Transport Business Ecosystem (TBE)) has focussed on the efficient movement of vehicles and the needs of the primary wage earner. As such those from already economically disadvantaged groups – i.e., women, elderly, people from BAME (Black, Asian, Minority and Ethnic) and LGBTQI+ communities, those with disabilities and on low incomes – are not served by current transport provision.

TinnGo has estimated (Lynce, et al, 2021) that current transport provision only meets the needs of a third of EU citizens; whilst Pirra et al (2021) demonstrated that the needs of women are not met by current transport provision. Owing to gendered roles in society women perform most household, caring and nurturing duties, even when in paid employment. As such their transport needs are different– they make shorter, more frequent journeys, temporally and geographically limited based on the demand of their non-paid roles (Maffi et al, 2018). Until recently such journeys were not measured or regarded by transport planning. They simply did not count. As such women are subjected to greater forms of transport poverty because of their gender – they may pay higher transport costs to feel safe, be denied access to private transport, or make longer journeys because transport services have not been designed to accommodate their 'non paid' activities (Faiz et al, 2020).

Since 2012, the principal author, in her capacity as Principal Investigator of 3 major EU transport related projects (FP7 METPEX, H2020 CIVITAS SUITS and H2020 TInnGO)[2] has heard that traditional hard to reach groups are still 'hard to reach'. This is despite growing evidence that citizen engagement leads to better end results, an increase in tools and case studies (e.g. ELTIS platform[3]) to support participation and co-creation, the requirements for citizen engagement to be embedded in Sustainable Urban Mobility Plans[4] and for drawing down funding,

The Transport Business Ecosystem (TBE) is still largely dominated by white, middle-class, middle-aged men, graduating from male dominated STEM disciplines who have little knowledge, understanding or empathy with those from different groups and their travel needs. Only 22-27% of women are employed in the sector (EC2020a), usually at lower grades; most of whom can point to or have experienced gender discrimination. As such there is a sizable communication gap between transport providers, operators and users of transport services (Tovey et al, 2016). Transport consultation processes and surveys may not be as extensive or empowering as expected (Woodcock, 2018) as they may fail to capture the detailed experiential insights needed to provide high-quality service offerings and vehicles which meet the needs of a diverse population, or there may be a lack of wherewithal on how to gain and use the information provided.

Smart Mobility (SM) is posited as a means of delivering key benefits such as a reduction in pollution, congestion, noise and costs, whilst increasing safety and improving transfer speed. These were only later expanded to include accessibility and social benefit, i.e., transport should be affordable for everyone and help provide a better quality of life. Descriptions of SM remain based around STEM and ICT innovations, reflecting a technological rather than social justice orientation. SM is marketed as a future in which mobility becomes a personalised, on demand service with greater consumer choice and new models of ownership. However, analysis of visual representations shows SM futures are technology led and exclusionary (Christensen et al, 2021).

This is unsurprising given SM's roots in STEM subjects such as computing, engineering, manufacturing and planning where gender imbalances are significant and pervasive (Pirra et al, 2020). Worryingly, a gender gap has already been recognised in SM in the UK and Nordic regions with studies revealing that most users are young, male and have higher incomes (Singh, 2019). SM entrants, such bike sharing and e-scooters schemes, are not designed for women with caring commitments, who may require child seats and storage for shopping. These groups

[2] https://cordis.europa.eu/project/id/314354/reporting, https://www.suits-project.eu/
[3] https://www.eltis.org/
[4] https://www.eltis.org/mobility-plans/sump-process

are excluded when developers focus on early adopters. SM relies heavily on the use of technology, using apps to access services which requires levels of digital literacy and ownership beyond the reach of certain demographics, such as those on low incomes and the elderly. So, whilst SM may advance choice and offer sustainable modes of transport, these advances will not be equally advantageous. This highlights a need for a deeper understanding and consideration of users with differing needs and abilities. If left unchecked, this trend will limit the opportunities for women's employment in SM and impact the type and inclusivity of future development in Smart Mobility innovations.

In line with Lefebvre (1996) TInnGO argued that a smart city cannot be smart if it is not founded on social justice and equity. It should be a space shaped according to inhabitant's needs, allowing all citizens to fully enjoy urban life with its services and advantages, and to take a role in its planning. Gender relevant aspects of a smart city - mobility, safety and security, employment and sustainability - have been identified as fields of action for the EU. However, progress is slow, impeded by lack of willingness or ability to adopt measures that would create a fairer system.

Intersectionality, Social and mobility Justice

Research in the areas of Mobility Justice (Sheller, 2018), Transport Justice (Martens, 2016) and Transport Poverty (Lucas et al, 2016) highlight the disparities in mobility and accessibility for citizens from disadvantaged backgrounds.

In relation to SM we would argue from a feminist perspective for an end to practices of discrimination and a redistribution of power relations so that citizens have a much stronger say in how such systems work and receive fair treatment. There is a clear issue around control of the SM sector, who influences/chooses how mobility is played out. Living labs provide opportunities for citizens to be engaged as members of the quadruple helix. However, efforts are needed to ensure equality in co-creation through shared understanding and tools to enable discussion/observations to rise above the anecdotal and effect real changes. The quadruple helix model provides a way of breaking down these power structures.

Intersectionality can advance the understanding of gender and transport through the inclusion of additional characteristics to show that transport needs depend on age, race, income and location. It posits that lives cannot be reduced to single characteristics, and experiences cannot be understood accurately if one factor is prioritised (Hankivsky et al., 2014). The interconnection of these structures creates intersectional disadvantage, creating an interdependent system of discrimination and disadvantage.

Transport related social exclusion has a significant impact for certain groups, i.e., disabled, elderly, low-income families, and women (Lucas, 2012). Research has shown the differential impacts of poor accessibility experienced by disadvantaged groups (Titheridge, et al.,2014) and identified socio demographic effects related to personal characteristics. Social exclusion is a constraints-based process which restricts the ability of certain individuals or groups to participate in the normal activities of the society in which they reside and has important spatial manifestations (Preston and Rajé, 2007). Faster modes of transport incur higher cost than slower more sustainable forms of transport, but access to faster modes offers access to wider opportunities within a given time.

Transport systems should be designed to alleviate poverty and enable all citizens to access the places they need. Titheridge et al (2014) recommended that in order to achieve such aspirations equity criteria should be developed and implemented to ensure that those marginalised in society have their needs met. This could improve the understanding of differing needs and enable more targeted approaches to improving mobility and accessibility.

The role of living labs in SM

Since 2006, living labs have been recognized by the EC as key tools for open innovation. In the EC Sustainable and Smart mobility strategy for Europe Urban Mobility, they are a recognised as way of transforming urban mobility by providing opportunities for cities, research, and industry to have a real involvement and commitment with citizens and guarantee the success of the European Green Deal.

The Urban Mobility Labs (EIT, 2021) aim to bring all the stakeholders involved in the development of the mobility product, service, or policy to one table, to enable the co-creation of a common perspective on key issues and opportunities. As such they can facilitate an open dialogue between all involved parties, aiming at a better understanding of other stakeholders` values, interests, challenges, and ideas. The EC Sustainable and Smart mobility strategy for Europe states that “citizens are and should remain a driving force of the transition”. Moreover, “a new pact is needed to bring together citizens in all their diversity, with national, regional, local authorities, civil society and industry working closely with the EU’s institutions and consultative bodies” (EC,2020b).

TInnGO established 10 mini living labs as beacons of engagement and data collection on gender and diversity sensitive smart mobility across Europe (Woodcock and Christensen, 2022). TInnGO’s tools described below relate to the need to develop common understanding at the start of co-creation activities, and to find ways of translating citizen insights into design actions.

The problem

Creating a paradigm shift in transport requires building capacity across the TBE, including designers of future transport, engineers and citizens, to enable them to create more gender and diversity sensitive smart mobility products.

As part of TInnGO, it was planned that design students would develop novel smart mobility solutions from design briefs set by 10 national hubs, relating to women's everyday mobility problems in multimodal end-to-end journeys (from planning to arrival)[5]. Topics included breastfeeding, carrying shopping, safety and security at bus stops, exercise, traveling with dependents, community-minded bus stops, planning and complaining about services (Magee et al, 2021).

Unfortunately, covid travel restrictions prohibited face-to-face co-creation activities and meant that the UK, TInnGO team served as proxies or expert witnesses, sharing their own experiences and there was reduced contact with other labs. However the severely restricted 12-month design activity showed that

- the concepts of 'gender', 'diversity sensitive' and 'smart mobility' were difficult for those new to the area.
- terms evolve as the industry and technology matures. For example, 'smart' once referred to technology enablement, vision zero, but can be flipped to refer to a system which reduces the need for travel; sustainable can refer to green transport, active forms of transport (walking and cycling) or the longevity of a scheme.
- Gender Action Plans, privileged gender over other categories and failed to recognise diversity, so we expanded 'Gender sensitive' to 'gender and diversity' (Breengard et al, 2021).
- The relationship between 'smart' and 'sustainable' is also poorly defined.
- Designers were overwhelmed by the need to consider intersectionality. Viewing people as belonging to a range of underrepresented groups, facing multiple challenges, led to dark places, in which designers struggled to create SM products which would deal with all the problems a person from a vulnerable group might face.

The design of seemingly stand alone, gender and diversity sensitive smart mobility innovations, such as child bicycle seats becomes complex - when decision making needs to be informed by experiences and lifestyles unfamiliar to designers, and their

[5] See design at https://oip.transportgenderobservatory.eu/ideas-lab

usage has to be considered in the wider context (e.g., bicycling culture, infrastructure, cost, weather). Many designs were service or systems oriented, relying on or requiring integration with other agents/devices/systems before being implemented.

Overview of tools and methods developed in TinnGO

Designing into this space requires an appreciation of its 'wickedness' (Rittel and Webber, 1973) requiring new ways of thinking. To address this we developed practical tools to support early co- creation processes to assist quadruple helix (Hasche et al 2020) agents (industry, government, academia, and users/civil society) achieve common understanding.

The following sections provide a brief overview of the TInnGO design tools. Although developed in the transport domain, these can be applied to other contexts to develop a more sophisticated understanding of the context in which innovations have to be developed. Examples and templates are available from the TInnGO web site.

Gender and Diversity Action Plans

Gender Action Planning (GAP) is a central pillar in European work for gender equality[6]. While gender is a recurrent cause of discrimination and inequality in the transport sector, other categories, such as disability and age, also play crucial roles in mobility barriers. Table 1 provides details of five key dimensions - affordability, effectiveness, attractiveness, sustainability, and inclusivity.

Table 1. The 5 dimensions of Gender and Diversity Action Plans.

Dimension	Rationale	Typical questions
Effectiveness	**An effective transport system would work equally well for** different trips and users. Gendered societal roles, disabilities, class etc. create different mobility needs, Smart transport solutions should not privilege one group over another or create further inequalities.	What are the gendered dimensions in effective transport? Who is the SM effective for? What does effective look like when intersecting social categories are included and crossed
Affordability	Transport is not 'smart' if citizens cannot afford to use it. Affordability must be regarded for all forms of transport:	How is affordable being defined, and for whom, bearing in mind wage differentiations, household

[6] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2184

	Public transport solutions, smart cars, smart biking, and walking.	incomes and forced transport choices.
Attractiveness	**Attractive transport is** customizable and comfortable for a broad group of people. It should be clean, safe and convenient and consider the design of surrounding areas, such as bus stops and train stations, considering user differences in age, background, and gender.	What are the gendered dimensions in attractive transport? What does 'attractive' look like when more social categories are included, such as age and ethnicity? Women (and LGBTQ-persons) often feel unsafe waiting at dark bus stops, train stations and in deserted areas.
Sustainability	**Smart transport aims at reducing CO2 emissions** through the incorporation of new technologies, improving opportunities for use of green transport modes, more efficient and integrated services. This should include perspectives of gender and diversity.	What are the gendered dimensions in sustainable transport? Does the system offer sustainable transport solutions for various social groups? Are some groups more attracted to sustainable mobility solutions than others and do actions cater for these differences?
Inclusivity	**Inclusive transport solutions should promote equality, combat discrimination and enable all people to access amenities.**	Are people in different social groups able to use the transport solution? Are some groups more vulnerable and face discrimination in their daily use of transport than others? Have some groups been designed out of transport options.

The five dimensions provide guidelines for *how and when* to approach transport in terms of gender and diversity. Creating GaDAPs is a stepwise approach requiring consideration of:

- A definition of **what** the problem is.
- **What** methods should be addressed.
- **When** and **where** the activities take place.
- **Who** will be responsible for the activity.
- **Follow up** on action and **what remains** to be done.
- Set up an **updated** action plan.

The 10 TInnGO hubs[7] worked with members of their local TBEs to develop and implement GaDAPs.

Supporting discussions about intersectionality

Mobility patterns depend on many factors, where people live, what they earn, their caring responsibilities, as well as characteristics such as race, gender, sexuality, and age (Levin and Thoresson, 2020). Unequal access to transport contributes social and economic exclusion. Intersectional analysis shows how these factors overlap and influence transport mobility. Designers and transport planners need to ensure that they are not creating products and services which exclude certain groups by failing to understand different needs and requirements, e.g., not designing spaces/ramps for wheelchair users and prams, reducing overreliance on technology when latest devices may be incomprehensible, unaffordable or unusable by creating. The digital divide is a good example of the need to apply intersectional thinking to transport and smart city initiatives. Young designers and their friends are digital natives, as such they may rely on technological solutions and struggle to understand or have empathy towards laggards and late adopters (Woodcock, 2013). Examples of age, digital and economic exclusion include ‘pay by phone’ parking schemes and other cashless initiatives (Kale, 2020).

To assist in preliminary discussions of intersectionality, we developed the TInnGO Intersectionality Mobility Indicators (TIMI) (Figure 1 and downloadable from TInnGO web site). The spinning concentric discs help to visualise the intersectional nature of individual characteristics, structural aspects of transport poverty, and how they relate to mobility patterns. Where you live, work, go to school, shop or socialise is influenced by transport.

- The outer, orange ring contains structural and political factors of transport poverty and social exclusion
- The blue circles highlight intersectional characteristics on a more individual level which are traditionally associated with excluded groups (such as gender, ableness, ethnicity). Every person has a profile formed by these and other characteristics. These in turn interact with the structural factors.
- The green ring represents the 5 gender smart dimensions which need to be considered in the design of gender and diversity sensitive smart mobility products (Breengard et al, 2021).

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[7] See al Woodcock et al, ‘TinnGO living labs’ paper, this volume.

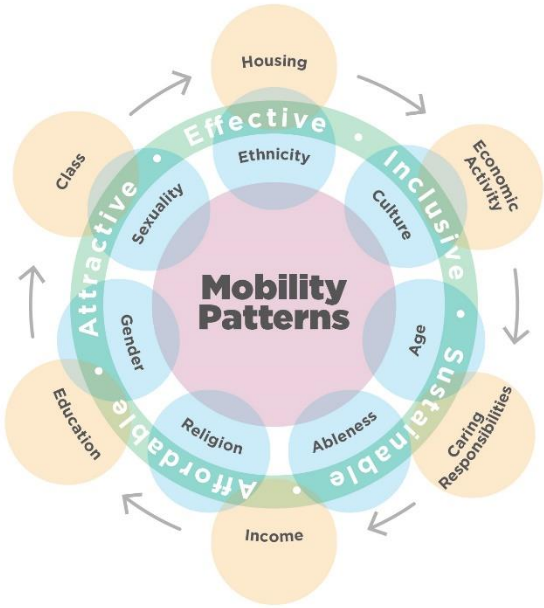

Figure 1. TInnGO Intersectional Mobility Indicators (TIMI) (Bridgman et al, 2022).

This downloadable tool is designed to prompt discussion but could also be used to discuss impact. It highlights how all systems need to be read together to foster equity-based policy solutions and the wider context in which smart mobility is placed.

Checklist to design and evaluate smart mobility products

The 5 gender smart dimensions were incorporated into the EEASI checklist to make gender- and diversity-smart thinking an *explicit* and prominent part of SM development. This differentiates it from generic 'usability' methods and assessment tools. It was developed to help design students and others understand and apply social and environment factors (such as United Nations Sustainable Development Goals) from receipt of the design brief to evaluation of concept designs.

Part C: Overall Assessment

This is intended to summarize how the product fits with its own defined goals and how far it meets 'Gender and diversity smart' criteria. The Evaluator should complete a rating based on the ratings per each indicator already completed.

Does the design meet its own goals?	Percent	Smiley	Notes
e.g. The e-scooter meets the design brief needs of appealing to young people and active, reasonably fit commuters who may choose to integrate use of an e-scooter into their daily commute from a train or bus hub.	*80%*		
e.g. the e-scooter could be an alternative to bringing a car into the city	*70%*		
Does the design meet the Gender & Diversity Smart goals - EAASI?			
1 - Effective Is the product effective?	43%		*Effective for those who can use it – speedy and anywhere within city*
2 - Attractive Is the product attractive to a wide range of users?	34%		*Attractive to certain groups of users, mainly younger persons, possibly more males, but not others*
3 - Affordable Is the product affordable to a wide range of users?	52%		*This is a Shared transport solution so affordable depending on charges for users and break even point for providers*
4 - Sustainable Is the product sustainable / does it encourage sustainable behaviour?	55%		*Good sustainability, as alternative to car travel, easy maintenance, OK so long as they are not stolen*
5 - Inclusive Is the product inclusive from the point of view of gender and diversity? From the point of view of Accessibility?	6%		***Not very inclusive**, does not support chained trips, useful only for those with fitness and confidence, appropriate clothing, minimal luggage, reported to have negative effects and even dangerous to some disabled and elder pedestrians. Not inclusive for people with disabilities.*

Key

Excellent (70 to100%)	Good (60-69%)	Satisfactory (50-59%)	Poor (40-49%)	Fails this indicator (0-39%)

Figure 2. EAASI Checklist summary page.

The tool is in 3 parts:

- Part A: product description with links to background material/market analysis, with prompts concerning the product goal, design purpose and USP, how the brief was generated, who the intended user group is, task context and perceived user needs.
- Part B: set of prompts for considering each of the 5 criteria in relation to specific travellers or characteristics.
- Part C: Qualitative overall evaluation and summary of each section (see Figure 2)

The checklist can be used to develop a brief or empathy for diverse user groups; to evaluate a concept or product to check how 'diversity or gender smart' it is through a 5-point rating scale. It has been iteratively developed and applied to the evaluation of number of designs on the Open Innovation Platform such as the Nurturepod^{TM} and 'Fido' shopping companion, with worked examples and templates available from the TInnGO website.

A systematic approach to understanding and plotting barriers to women's mobility

Woodcock applied the hexagonal spindle of ergonomics to transport design (e.g., Tovey et al (2015) and gender transport poverty (Iqbal et al, 2020) to combine results from different studies (e.g., surveys, literature review, ethnography, interviews) in ways that can be acted upon by stakeholders. In such representations the user is placed at the centre of the hexagon, and multiple factors which may inhibit their mobility are systematically broken down and divided between organisational (infrastructure and management), personal (social and individual) and contextual (task and design) issues. The rings move from immediate interactions, through different layers of the immediate environment, to macro level issues. Multiple barriers to mobility can occur in a journey from interacting with the immediate environment because of poorly designed interfaces, seat layout, lack of stairs and ramps through to organisational issues (such as lack of staff, poor customer support) and macro/ external level factors, such as corruption, lack of gender equity.

Figure 3 illustrates how the results from walking photo elicitation group interviews with young female students were distributed across the hexagon to show the different issues which inhibited walking to the university campus. This representation can form a starting point to planning solutions based on human factors issues, increase sense-making from observational data, and help to develop empathy by showing how others see the world.

Figure 3 groups the most frequently raised concerns (eg lighting, bridges) of female students walking back from the university. These are re-presented on the model, to show where they occur and which stakeholders could own the solutions, eg the car wash, lighting department.

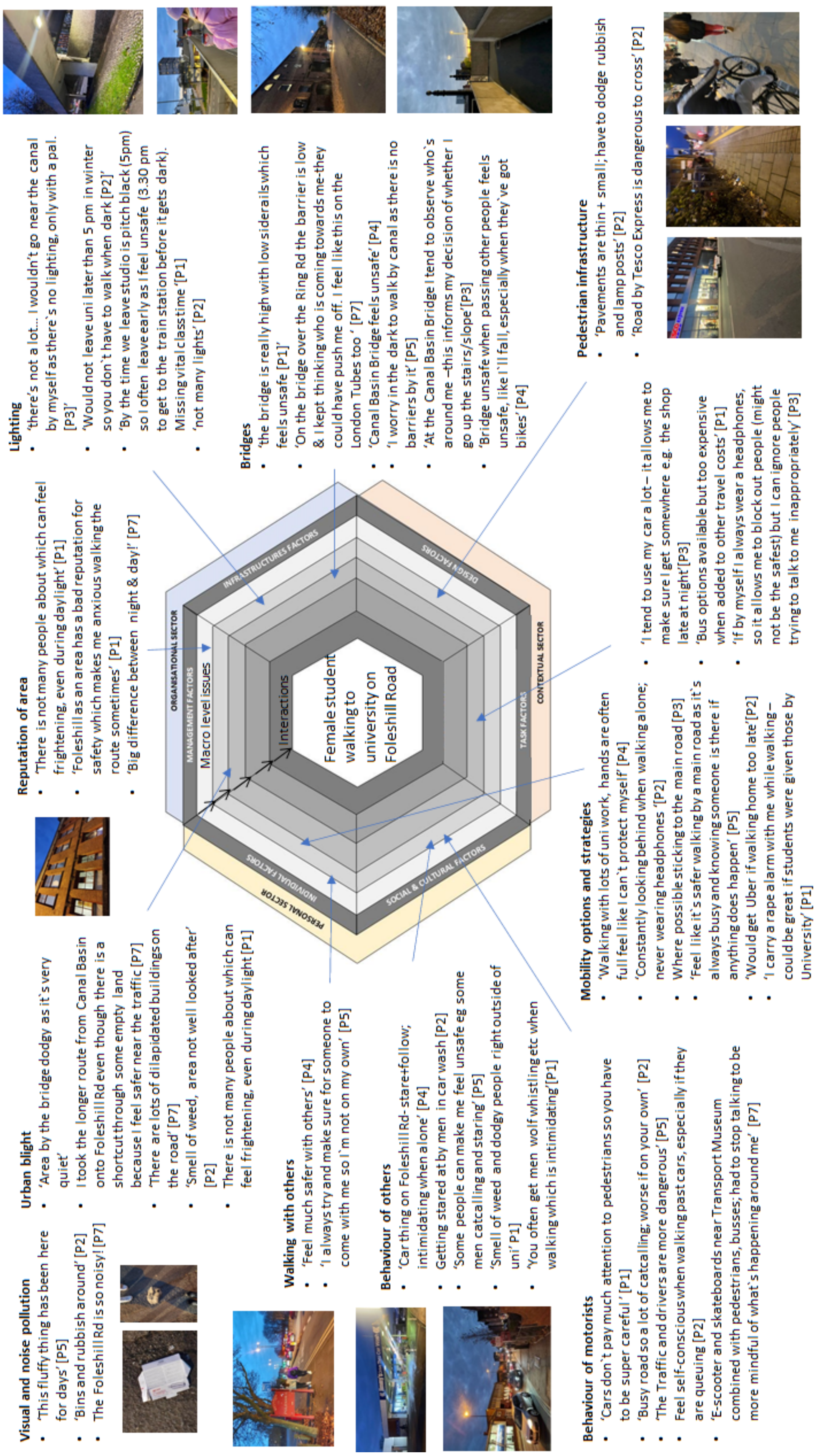

Figure 3. Results of a walking interview with female students.

Conclusions

The tools outlined in this paper were developed in response to a need for greater awareness of the underlying concepts used in the project and a comment from designers, when using low-fidelity simulations which may be paraphrased as ‘I feel the empathy, but how can I use that to inform my design’ (Woodock, 2019) revealing a need for additional tools.

Co-creation teams may be the best placed to deal with wicked problems and complex concepts. However, they need support in the reaching common understandings and developing empathy at the start of the process. This paper has presented practical tools for living Labs which could help in this. Future work is addressing how such tools can be added to the everyday practice of new designers and living labs,

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References

1. Banister, D. (2015), Great Cities and Their Traffic': Michael Thomson Revisited." Built Environment (1978-), 41, 3, 435–46, http://www.jstor.org/stable/44131927.
2. Breengaard, M.H., Christensen, H.R., Levin, L., Henriksson, M. (2021) Report on GaDAPs in gender smart mobility, D4.8 H2020 TInnGO project, downloadable from https://transportgenderobservatory.eu/wp-content/uploads/2021/11/D4.8.-Report-on-GaDAPs-in-GSM_FINAL.pdf
3. Bridgman, J., Woodcock, A., & Gut, K (2022). How can Gender Smart Mobility become a More Intersectional form of Mobility Justice. Paper presented at 5th International Conference on Gender Research, Aveiro, Portugal.
4. Christensen, H.R., Nexø, L.A., Pedersen, S. (2021) The Lure and limits of Smart Cars. Visual analysis of gender and diversity in car branding. 10th International Symposium on Travel Demand Management, 17/11/21 – 19/11/21.
5. Crenshaw, K. (1989) Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics, University of Chicago Legal Forum: Article 8.
6. EIT Urban Mobility (editor) (2021). EIT Urban Mobility Knowledge base for innovative solutions in urban mobility and living labs, Second edition, https://www.eiturbanmobility.eu/wp-content/uploads/2021/09/EITUrbanMobility_Living_labs_report_update_July2021-1.pdf
7. European Commission. (2020). Mobility & Transport https://ec.europa.eu/transport/themes/social/women-in-transport_en retrieved 15th July 2020
8. European Commission. (2020b). Sustainable and Smart Mobility Strategy – putting European transport on track for the future (COM (2020) 789 final). Brussels. Retrieved from https://ec.europa.eu/transport/sites/transport/files/legislation/com20200789.pdf
9. Faiz, K., Woodcock, A., McDonagh, D. and Iqbal, S. (2020). Applying a Systemic Approach to Gender Transport Poverty: Pakistan in Context, FormAkademisk, 13, 4.
10. Hankivsky, O., Grace, D., Hunting, G., Giesbrecht, M., Fridkin, A., Rudrum, S., Ferlatte, O. and Clark, N. (2014) An intersectionality-based policy analysis framework: critical reflections on a methodology for advancing equity. International Journal for Equity in Health, 13(1), p.119.
11. Iqbal, S. Woodcock, A. and Osmond, J. (2020). The effects of gender transport poverty in Karachi, Journal of Transport Geography, 84, 102677.
12. Kale, S. (2020). 'You can't pay cash here': how our newly cashless society harms the most vulnerable. The Guardian. https://www.theguardian.com/money/2020/jun/24/you-cant-pay-cash-here-how-cashless-society-harms-most-vulnerable
13. Lefebvre, H. (1996). Writings on Cities. Cambridge: Blackwell.
14. Levin, L. and Thoresson, K. (2020). Gender equality and 'smart' mobility: a need for planning to address the real needs of all citizens. In Priya Uteng, T., Christensen, H.R. & Levin, L. (Eds.). Gendering Smart Mobilities, pp. 143–161. Routledge, London.
15. Lucas, K. (2012). Transport and social exclusion: Where are we now? Transport Policy, 20, 105-113.
16. Lucas, K., Mattioli, G., Verlinghieri, E. and Guzman, A. (2016) Transport poverty and its adverse social consequences. In Proceedings of the Institution of Civil Engineers-Transport, 169, 3, 353-365.
17. Lynce, A.R., Kalakou, S., Medina, J.A., Costa, M., Adorean, C., Pirra, M., Calvo, M., Malandrino, C., Berman, L., Liotopolous, F. and Tamiakis, I. (2021). Modelling and forecasting of gender mobility behaviour for pilot cities, Deliverable 7.2: TInnGO project.
18. Magee, P., Woodcock, A., Gut, K., Saunders, J., Atkinson, P. and Bridgman, J., (2021). In pursuit of meaningful insight: Post-covid remote collaboration methodology and design as a provocation. In H Grierson, E Bohemia & L Buck (eds) DS 110: Proceedings of the 23rd International Conference on Engineering and Product Design Education (E&PDE 2021).
19. Maffi, S., Malgieri, P. and Di Bartoli, C. (2018), Gender equality and mobility: Mind the gap, CIVITAS WIKI. Retrieved from https://transportgenderobservatory.eu/resource/gender-equality-and-mobility-mind-the-gap/
20. Martens, K. (2016) Transport justice: Designing fair transportation systems. Routledge.
21. Pirra, M., Carboni, A. and Diana, M. (2020). Assessing Gender Gaps in Educational Provision, Research and Employment Opportunities in the Transport Sector at the

European Level. Education Sciences, 10, 123. DOI: https://doi.org/10.3390/educsci10050123
22. Pirra, M., Kalakou, S., Carboni, A., Costa, M., Diana, M., and Rita Lynce, A. (2021). A Preliminary Analysis on Gender Aspects in Transport Systems and Mobility Services: Presentation of a Survey Design. Special Issue Gender Issues in Transport and Mobility, Association for European Transport (AET) Conference ETC2020.
23. Preston, J. and Rajé, F. (2007) Accessibility, mobility and transport-related social exclusion. Journal of Transport Geography, 15,3, pp.151-160.
24. Sheller, M. (2018) Mobility justice: The politics of movement in the age of extremes, Verso Books
25. Singh, Y. J. (2019) Is smart mobility also gender-smart? Journal of Gender Studies, 1-15.
26. Titheridge, H., Mackett, R. L., Christie, N., Oviedo Hernández, D. and Ye, R. (2014). Transport and poverty: a review of the evidence.
27. Tovey, M. Woodcock, A. and Osmond, J. (Eds.) (2016) Designing Mobility and Transport Services: Developing traveller experience tools (1st ed.). Routledge. https://doi.org/10.4324/9781315587295
28. Rittel, H. W., and Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4(2), 155-169.
29. Uteng, T.P., Christensen, H.R. and Levin, L. (2020) Gendering Smart Mobilities, Routledge.
30. Woodcock, A. (2013). Laggards and late adopters. Who cares? In Proceedings of the Design Principles and Practices Conference http://designprinciplesandpractices.com/conference-archives/2013-conference
31. Woodcock, A. (2018). Social Impact Assessment Report, D7.3, H2020 CIVITAS SUITS, downloadable from https://www.suits-project.eu/reports/
32. Woodcock, A., and Christensen, H. (2022). Transport Innovation Gender Observatory. H2020RTR21 European Conference, Brussels, Belgium.
33. Woodcock, A., Osmond, J., Tovey, M., and McDonagh, D. (2019). Empathy Thresholds in Transport Design Students. Design and Technology Education, 24, 65-78.

Practitioner Presentation Paper

A Study on Planning of Preliminary Themes to Introduce Living Lab into the Residential Facilities of Retired Scientists and Engineers

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Abstract

As a case study of our Living Lab, we would like to introduce this study, conducted in 2021, on the planning of the preliminary themes for the introduction of Living Lab in residential facilities of retired scientists and engineers. Through the service design research for retired senior citizens, we would like to provide themes that can help in the development of projects for Living Lab, and also introduce our efforts to development of evaluation methods using Analytical Hierarchical Process (AHP) and evaluation results of alternative themes.

Keywords

Living Lab, Retired citizen, Residential facility, Service design, Analytic Hierarchical Process

Introduction

According to the Statistics Korea (2021), in South Korea, the proportion of the population over the age of 65 is predicted to exceed 20% in 2025 and 41% in 2051. This urgently calls for the preparation for an aging society. In particular, it is imperative the aged are allowed to pursue happy lives through the consideration of safety and convenience for their residential facilities. Simultaneously, it is equally important their experience and knowledge are utilized to create opportunities of contribution to the civil society.

In 2021, Our Living Lab won a contract from the government and performed a study on planning of establishing Living Lab in Science Village, a group residential facility for retired scientists and engineers of the governmental research institute. By introducing Living Lab's plan, we seek to introduce its endeavor to contribute to civil society while providing concurrent suggestions and implications for assisting of an aged society.

Methods

Through a preliminary survey targeting the residents of Science Village, the subjects of the interview who will represent the residents were selected. An in-depth interview was conducted concerning the perception of the Science Village, requirements, points for improvement, etc. Through a user-research based on this, five Living Lab themes were derived. To determine the priority order of the derived Living Lab themes, a 2-step evaluation model was set, and Analytic Hierarchy Process (AHP) analysis was conducted on 11 policy and Living Lab experts. The analysis requires very simple mathematical calculations, and therefore Microsoft Excel was used. Based on the evaluation model derived through the AHP, evaluation was carried out using a 9-point Likert scale on 5 Living Lab themes; based on this, the priority order of themes was derived.

Results

Table 1 is a summary of 16 key issues derived as a result of patterning and coding the issues and needs, which were derived from the in-depth interview of the participants according to the affinity diagram, and 5 Living Lab themes derived by aggregating them.

Table 1. Service key issues and Living Lab themes.

Service Key Issues	Living Lab Themes
· Organizing healthcare-centered programs · Utilizing the aged as research subjects · Providing senior-friendly methods for new technology utilization	Products and services related to mental and physical health
· Comfortable and joyous later years · Leisure programs customized to each senior	Products and services related to safe and convenient living
· Supporting facilities of various sizes and forms · Expanding the convenience of housekeeping-support services · Improving service facility by collecting tracked data	Products and services related to residential space and facilities
· Continuing research service for currently interested fields · Science education lecture service for adolescents · Providing incentives for the contribution of the retired · Contribution service reflecting the local society's characteristics · Contribution service through the subdivision of professionals	The retiree's wisdom communicator service
· Life suggestion service customized for individual seniors · Life suggestion service communicated with other members · Service to fulfill learning needs	Life planner service

Table 2 is a 2-step model based on the literature review related to the innovation theory, the European Network of Living Labs (ENoLL)'s Living Lab evaluation report (2020), etc. and is the result of 11 experts evaluating the importance per item through the AHP.

Table 2. Result of the experts' AHP analysis on the 2-step index model.

Step 1			Step 2			Compound Importance	
Step 1 Index	Importance	Rank	Step 2 Index	Importance	Rank	Importance	Rank
Policy appropriateness (Organization, Values)	0.3605	2	Degree of conformance to governmental policies	0.3109	2	0.1121	4
			Possibility of obtaining governmental support fund	0.4265	1	0.1538	2
			Possibility of creating shared values	0.2626	3	0.0947	8
Resource effectiveness (User& reality, Resources, Openness)	0.4095	1	Effectiveness of applying equipment and infrastructure	0.2667	2	0.1092	5
			Appropriateness of utilizing the residents' expertise	0.4802	1	0.1967	1
			Effectiveness of applying the Living Lab methodology	0.2531	3	0.1036	6
Operation diffusion effect (Future)	0.2299	3	Internal and external performance diffusion	0.4417	2	0.1015	7
			Securement of stable continuity	0.5583	1	0.1284	3

* Compound importance: the value of multiplying the values of step 1 and step 2

Table 3 is the result of evaluating the priority of five Living Lab themes based on the weighted value per index set with the AHP results.

Table 3. Result of evaluating the performance priority of Living Lab themes.

Living Lab themes	Policy appropriateness	Resource effectiveness	Operation diffusion effect	Mean	Rank
Products and services related to mental and physical health	7.55	7.18	7.36	7.36	1
Products and services related to safe and convenient living	7.12	7.09	7.14	7.12	2
Products and services related to residential space and facilities	6.67	7.18	7.05	6.96	3
Life planner service	6.58	7.27	6.64	6.83	4
The retiree's wisdom communicator service	6.7	6.85	6.59	6.71	5

Lessons learned and Conclusion

Through the study outcomes, Living Lab themes were derived and 2-step model and weighted value for evaluation were presented. As a result of evaluating based on these, the theme related to mental and physical health had the highest priority and the wisdom communication theme that actively utilizes the knowledge and experience of the retired indicated the lowest priority.

This may seem contradictory to the fact that experts considered appropriateness of utilizing the residents' expertise as the highest priority among the AHP evaluation criteria. However, at the same time, experts' interest in Living Lab themes is that the psychological and physical health problems of the elderly, which are essential aspects, and safe and happy lives are high priority. It can be inferred that the expertise of retired scientists and engineers may be more interested in helping to analyze and improve phenomena as science and technology than simply utilizing the expertise of each researcher's own area. At this point, it is expected that the interests of the elderly and the interests of Living Lab stakeholders will be satisfied to continuously utilize the scientific and technological expertise of the elderly. The findings of this study were not only proposed to the policy-makers, but also to be presented to research institutes. These will then be utilized for financial support of projects for adopting the Living Lab in future group residential facilities for the aged and deriving science and technology research themes to prepare for aging society.

Acknowledgement

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References

1. Statistics Korea (2021), Future Population Estimation 2020-2070, Retrieved from https://www.kostat.go.kr/
2. European Network of Living Labs (2020), Smart Safety Living Lab Evaluation Report 2020

Practitioner Presentation Paper

Informal arts and social activism approaches to STEM co-created with young people.

Authors

Clara Collett

Knowle West Media Centre

Abstract

Knowle West Media Centre presents, Future Legacy Project (FLP), a four-month creative STEAM (Science, Technology, Engineering, Arts and Maths) programme for young women and non-binary people aged 16-18 years old. Focusing on empowering participants to create digital social action campaigns whilst developing skills, knowledge and understanding of STEAM. FLP creates a space to explore social topics and issues that affect their lives and communities, whilst utilising the arts and creative technologies to create work they are passionate about. FLP is a STEAM programme; we have found that encouraging informal stem learning in a creative environment, boosts the participants confidence and self-esteem in believing that they can achieve their goals. During the presentation at OLLD 2022 we will be presenting our research and findings of the project and sharing our methods and approaches.

Keywords

STEAM, science, technology, engineering, arts, maths, creativity, women, non-binary, confidence, self-belief, making, mental health and wellbeing, co-creation, reflective practice, theory of change, KWMC, CYP, Future Legacy Project.

Introduction to KWMC and current climate.

Knowle West Media Centre has been based on the estate in Knowle West since 1996 and has continued to work for and with the local community to create positive change using innovative technologies, digital media, and the arts. Knowle West is situated in the Filwood ward in South Bristol. Of the 3,590 Children & Young People (CYP), 45% are classed as disadvantaged and experience the highest levels of 'NEETs (not in education or training) at 9.8% (Bristol 6.8%). CYP from Knowle West are nationally the least likely to attend higher education. This highlights the local inequalities in opportunity for CYP. The presentation we will be spotlighting at OLLD 2022 is Future Legacy Project (FLP).

FLP is holistic programme combining, skills, social activism, creativity, and well-being. FLP allows space to explore what mental wellbeing looks like through taking part in the 4-month programme, expanding networks, and learning new skills in making, tech and digital media. Since the pandemic we’ve found CYP confidence to be at an all-time low. Creating spaces like FLP allows CYP to build on their social and emotional development, whilst combating the impact of the pandemic.

Methodologies

A key methodology used is co-creation and expanding learning opportunities through partnership work with Stemettes, and funders: Children in Need, Wellcome Trust, and external evaluators Graphic Science. This deepens our research methods and introduces mentoring, peer research training and broadens the programme.

Stemettes is a social enterprise aiming to inspire and support young women and non-binary people into STEM, through engaging, informing and connecting the next generation and showcasing the diversity of people working in the industry. Together, KWMC and Stemettes, and participants, co-created the programme.

Working with external evaluators, we have embedded reflective practice throughout to monitor the difference being made. Through open discussions, surveys, peer-to-peer interviews, and diary room entries, we have a range of qualitative and quantitative data to share that evidences the direct impact of FLP.

The programme.

The participants are supported to create a strong peer community, find common ground through creative workshops, building self-belief and confidence to collaborate on digital social action campaigns. Including: Podcasting, Web Design, Photography, 3D Printing, Laser Cutting, Filmmaking, Digital Embroidery, Coaching, Panel Discussions, and Mental Wellbeing. Care and creativity are explored through the programme, introducing the 5 steps to mental health and wellbeing, and tying it in to the creative briefs set. When a CYP feels emotionally well, they're able to push themselves into stretch zone and have the confidence and ability to try new things and explore a wide range of opportunities.

We don't anticipate anyone to come out an expert in the technological disciplines on offer; our primary aim is to build confidence, well-being alongside encouraging a curiosity to learn new skills. We provide a space to comfortably explore tech and software in a non-judgmental space whereby they may not have had access before. One of our strengths is we work with CYP over a long time to develop a learning journey. Through a range of different ways; coaching sessions, mentoring, traineeships, and signposting to other programmes.

What to expect from the presentation.

We will share findings from FLP to demonstrate the effectiveness of KWMC's approach. We have insights to share about:

- The benefit of the co-creation process
- Interactive, reflective and evaluation tools,
- An informal arts and social activism approach to STEAM and mental wellbeing

We have produced positive results for both the participants and staff and can see how our innovative, creative, and thought-provoking work, co-created with CYP, has progressed the living labs practice of South Bristol.

Research In Progress Paper

The state of the art of Living Labs in Higher Education

Author

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Abstract

Living Lab Environments (LLE) are a relative new phenomenon, especially in higher education. There is no unambiguous definition of LLE in the literature and several LLE are discussed. Where traditional education takes place in a classroom (a controlled internal environment), LLE experiments in a real-life environment with all kinds of stakeholder groups needed. For higher education, this research explores whether this form of education in practice is appropriate by mapping the success and failure factors. Interviews with coordinators of labs and their experience with these labs will provide clues for future research.

Keywords

Smart cities, Stakeholders, Social change, Open innovation

Introduction

This progress paper details the progress on the success and fail factors of Living Lab Environments (LLE) in higher education. At present, three main messages can be communicated.

The Research

In the context of smart cities and high-tech innovations LLE have emerged as a relatively new phenomenon, especially in higher education. The first stage of this research was an exploratory study on the phenomenon and an overview definitions and contexts. Initially desk research was conducted, in order to collect case studies and reports, complemented with a literature search in the Business Source Ultimate (BSU) database. Follow up interviews with lab coordinators yielded insights into definitions and success and fail factors.

Message 1: Definitions in the Literature

Generally, LLE can be generally be described as experimental settings for public innovation different from the traditional, more controlled, internally settings for public innovation[1]. The labs are construed as a collaborative platform for research, experimentation, and collaboration in real-life context with stakeholders groups. Based on the analysis of several case studies, two distinctive features of LLE keep coming back: co-creation and a lifelike space for experimentation in a quadruple helix collaboration in the context of (technological) innovation; e.g. big data, digital sensors and robotization [2,3]. There is no unambiguous definition of LLE in the literature [3]. In fact, there are many types of LLE[4] like Semi-Realistic Environments, Real Life Environments and Network and Platforms[2,4].

The second part of the research was to examine how LLE are used in the context of higher education and the distinctive features that separate them from classroom education. With the help of subject librarians, a search strategy was developed. Special attention is given to the following topics: The problems LLE solves as opposed to classroom education and the consequences for the stakeholders involved. The literature on LLE in higher education turns out to be scarce.

Message 2: LLE in higher education

LLE are recognized as educational environments to prepare students in higher education for future roles and responsibilities in their future work environments; thus knowledge regarding the optimal embeddedness of higher education in living labs is of importance[1]. Living lab environments are a real life environment and students learn to work on innovative projects, tackling 'wicked problems' [5] in a multidisciplinary team. This sounds great, but there are many challenges ahead, especially regarding the vision on learning on higher education and assessing knowledge, skills and wider competences outside a stable laboratory environment, called a classroom. The current literature indicates that LLE are predominantly found in technical studies (e.g. build environments, computer sciences, engineering and health). Table 1 shows the differences between the traditional classroom and the LLE.

Table 1. Classroom versus Living Lab Environment.

Traditional classroom	**Living Lab Environment**
Controlled environment	Real life environment
Monodisciplinary	Multidisciplinary
Homogeneous groups	Heterogeneous groups
Standardized tests	Assessments
Grading scales	Professional judgement
Outcome is predetermined	Outcome(s) is/are not known in advance
Achievement of a learning outcome	Different stakes with different outcomes

The fact that we always learn in controlled classrooms is because of the massification of higher education which promotes standardization of education. Education in the classroom is often still characterized by lectures and tutorials. In the tutorials, students are trained to master the knowledge. Project education is a form in which the traditional classroom is superseded by having student work on a research question from the workfield or they get a case based on the real world. But still this happens within a controlled environment.

LLE arise within research centers because innovation need to be tested, but researchers also want to gauge the social relevance of their innovations by involving several stakeholders groups. Because everybody within the LLE has a new experience, everybody is learning in the real life environment each with their own goal. Alignment of curricula and fitting in a LLE is therefore a challenge. In the educational profiles Learning Outcomes are defined. These are related to the Calohee framework where Learning Outcomes for knowledge, skills, autonomy and responsibility (wider competences) are defined.[6] Calohee is an international framework to compare degree programs. Calohee is the follow-up to the Tuning method and integrates the two meta-frameworks for education classification within the European Union. The European Qualification Framework for life long learning (EQF) and the Qualification Framework for the European Higher Education Area (QF

EHEA). Further research should show whether the LO offers the possibility to be full-fledged environments for LLE.

The course programs are based on stable laboratory environments. New forms of education are not or hardly known among teachers and students in higher education. This new form is being explored and experimented with, especially in the context of research centers. The research centers have the task to actively engage educational programs in their research, as well as the creation of new learning environments.

Message 3: Success and fail factors of LLE in higher education

The third part of this research concerns a field study based on surveys and follow-up interviews, exploring preliminary success and fail factors of LLE in higher education in eight case studies. Special attention is given to: The roles and tasks of the stakeholders in the LLE; Collaborative arrangement between the stakeholders and the expectations of the interviewees regarding the future of LLE in higher education.

The first tentative observation is that LLE often take in the form of a minor (elective). Some courses allow students to do their thesis within such a minor or their internship. Table 2 shows the first observations of the success and fail factors of LLE in higher education.

Table 2. Preliminary success and fail factors of Living Lab Environment.

Success factors	**Fail factors**
Intrinsic motivation of students	Ignorance among students and teachers
Real life environment	Training profiles do not match
Everybody learns (collaboration high)	Too few skilled educators available
New form of learning in practice	Attribution of individual achievement(s)
Broad spectrum learning	Educators are ill prepared for their role
Wider competences can be trained	Recruiting eligible students
Adaptive learning in practice	Embedding in education still difficult

Summary of findings

The literature review shows that little or no research is known about the role of higher education in LLE. What does emerge is that all stakeholders learn in LLE, which makes it a rich learning environment for higher education. It concerns new (technological) innovations so that experience can be gained during the study. However, within higher education, practical learning is still carried out in a controlled internal environment which takes place within the university of applied sciences or at an organization.

The challenge for learning in LLE in higher education lies in sharpening the vision of learning and assess in practice. For the research centers, mapping out the different forms of LLE is supportive in this regard. Research centers and curriculum committees can thus explore possibilities. The aim is to develop an additional form of practical learning in an international context.

References

1. Heuvel, R., van den, Braun, S., Bruin, M., de & Daniels, R. A closer look at the role of higher education in lving lab: a scoping review. in 15 (2018).
2. Hossain, M., Leminen, S. & Westerlund, M. A Systematic Review of Living Lab Literature. J. Clean. Prod. 25 (2019).
3. Maas, Broek, J. van den B. & Deuten, H. Living Lab in Nederland, van open testfaciliteit tot levend lab. (2017).
4. Fuglsang, L., Vorre Hansen, A., Mergel, I. & Taivalsaari Rohnebaek, M. Living labs for Public Sector Innovation: an integrative Literature Review. Adm. Sci. 19 (2021) doi:10.3390.
5. Churchman, C. W. Wicked Problems. B-141-B146 (1967).
6. Wagenaar, R., Meer, van der, I., Beneitone, P., Essen, van, T. & Calabrese, M. V. Measuring and comparing achievements of learning outcomes in higher education (CALOHEE). (2018).
7.

Practitioner Presentation Paper

Act for the Green Transition – Gamification for Sustainability

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Abstract

The urgency to tackle the global climate crisis and the steep rise in energy costs have accelerated the European Commission plans to reach corporate climate neutrality by 2030. The European Green Deal and the recent adoption of the Greening the Commission Communication and Action Plan prove this commitment.

Though a more sustainable use of energy is crucial to fulfil the European Green Deal's commitment to accomplish the clean energy transition[1]and reach corporate climate neutrality, this cannot be pursued without the active involvement of citizens.

The European Commission's JRC Living Lab for testing Digital Energy Solutions has been addressing this challenge by researching and testing a gamification approach at one of its sites in Ispra, Italy, where collected energy consumption data highlighted the potential to improve energy use on site.

Gamification is the use of game-like elements in non-game contexts in order to engage and motivate people. However, the limited amount of research on the topic of gamification for sustainability is noteworthy.

The research aimed to assess whether a simple, low-cost, game-based approach could constitute a valuable tool to:

- Increase staff understanding of, and engagement in, energy use at their workplace;
- Change staff own energy use behaviour;
- Crowdsource new ideas fors marter energy use;

To this purpose, an online interactive gamification experience, called the Energy Dream Team (EDT), was co-created and developed over one year, and piloted at

[1] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

the Ispra site during October - December 2021.

The full 2,500 JRC Ispra staff was invited to propose smarter ways for enhancing energy use on site using a web-based platform built ad-hoc for the game. The gamification also presented mini-games, to keep active engagement throughout the experience.

The research used both quantitative and qualitative data collected at different stages through surveys, participation statistics, focus groups and individual interviews.

Almost 100 ideas were proposed, with the winning proposal planned for onsite implementation at research scale.

Between 70% and 75% of the end-of-game respondents:

- believe to have better understanding and knowledge of energy use on site.
- feel more engaged in the topic of energy use.
- intend to change to their own energy use habits as a result of the experience.

In February 2022, a two-hour speed game version of the EDT was developed for a corporate event among the 12 EMAS-registered EU institutions and agencies. The speed game has proven successful to inquire participants as to the replicability of the approach in their own organizations. A number of sessions have been delivered upon request to different European Institutions, including the European Court of Auditors and the European Council.

The learnings from the game have proven successful to evaluate its potential as a tool for environmental sustainability. The JRC senior management has requested the Living Lab to perform additional gamification sessions in other JRC sites with a view to integrating people-centric decision-making for environmental sustainability in the JRC daily business.

The tool has also been successfully tested with the local community of climate activists around Ispra (rete clima del Verbano).

Keywords

Science of motivation, engagement, entertainment, serious issues

Research In Progress Paper

Identifying Challenges of Food Living Labs in Food System Sustainability Transformation in Finland

Authors

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Abstract

Previous literature on living labs for food system sustainability mainly focuses on food production, agri-food systems as a whole, or the food-water-energy nexus. When studying possibilities of living labs to advance food system sustainability transformation, more attention should be paid to food culture, individual food consumption preferences and acceptance of certain foods (e.g. novel plant-based ingredients). Due to high volume of business and daily served meals, the food service industry has a critical role in a transition to sustainable diets. Venues where meals are served and consumed are a noteworthy interface to introduce sustainable food and eating solutions. In this study we aim to identify the potential challenges and needs perceived at two living labs on food service environments in Finland together with their quintuple helix actors. Findings will be based on thematic interviews and participatory focus group discussions. With this research study we pursue to scientific understanding of food system living labs, expanding from agri-food context towards consumers and citizens, their food choices, preferences and eating experience.

Keywords

Living lab, food service, food system, sustainability

Introduction

Food systems play a key role in the sustainability transitions that our planet is asking for. Planetary boundaries are at risk and strongly linked to the whole food chain, from food production to consumption and waste management (Willett et al. 2019). The concept of strong sustainability puts priority on ecological sustainability (Turner, 1993) and justifies limiting consumption of animal-based foods in reducing the risk of both poor diets and environmental degradation (Willett et al., 2019). Moreover, ensuring food security, reducing food waste and halting biodiversity loss are among greatest challenges of our times. Agenda 2030 for Sustainable Development requires UN Member States to tackle these challenges (UN, 2015). Food system sustainability transformation is thus imperative.

In socio-technical systems, environmental, social and economic impacts are interlinked, and the same goes for food systems. Actors operating within any such food system require new practices in problem-solving: participation, collaboration and capacity building to act in a transforming environment. One such practice is offered by the idea of living labs (LL), defined as *open innovation ecosystem based on systematic user co-creation, integrating research and innovation processes in real life settings* (ENoLL, 2017). LLs have been suggested to be promising in terms of resolving wicked problems provided that system thinking is incorporated (Zivkovic, 2018).

Previous LL literature dealing with food systems mainly focuses on agricultural production, agri-food systems (Gamache et al., 2020; McPhee et al., 2021) or food-water-energy nexus (Yan & Roggema, 2019; Wahl et al., 2021; Valencia et al., 2022). Food consumption patterns, food culture and acceptance of certain type of foods (e.g. novel plant-based ingredients) as well as offerings provided by food service and catering venues are limiting factors when adopting sustainable diets, but seem so far mostly neglected in LL literature. Due to remarkable volumes of food service business – number daily meals served and consumed – the food service sector has an important role in the sustainability transition. For example, in Finland the public food service sector provides annually over 380 million lunch meals e.g. in day care, schools and other educational organizations (Motiva, 2022). Ca. 40 % of Finnish employees consume food services at their working place canteens, if available (Valsta et al., 2018). Hospitality and catering industries, public and private food services, as well as other venues where ready-made food is served and consumed are thus a noteworthy interface to introduce sustainable food solutions. We underline the importance to cultivate sustainable innovation in food service businesses in specific ‘Food LL’ environments, and argue that co-producing knowledge with relevant actors is key.

Purpose of the Research

The EU-funded FUSILLI Project (*Fostering the Urban Food System Transformation through Innovative Living Labs Implementation*) aims for an integrated and safe holistic transition towards healthy, sustainable, secure, inclusive, equitable and cost-efficient food systems (CORDIS, 2020). This research is a part of FUSILLI Project aiming transformational change among collaboration and co-innovation in urban food system context.

We aim to reveal how LLs focusing on food service environments could solve their learning needs that arise while collaborating with their quintuple helix actors. The study design is transformative, in which researchers become part of community of food system actors and provide an opportunity for interventions aiming to shape transformative practises among and between related stakeholders (FIT4FOOD2030, 2021). Our particular interest is to steer the food service sector towards strong sustainability and the adoption of sustainable practices, such as implementing a planetary diet approach through co-innovation in the LLs. Planetary diet suggests limiting consumption of animal products and shifting to greater proportion of plant-based foods for both planetary and human health (Willett et al. 2019).

This paper describes the research-in-progress in which we aim to define current challenges and needs of ’Food LLs’ in order to eventually define strategies and tools to overcome challenges. Therefore, the purpose of this two-step research (Fig. 1) is to collect information about:

1. What kind of challenges and associated learning questions are present in ‘Food LLs’ in relation to their (urban) food system sustainability transformation related actions and activities?

2. What kind of strategies and tools can be identified to work on the (urban) food system sustainability transformation challenges as identified in the ‘Food LLs’?

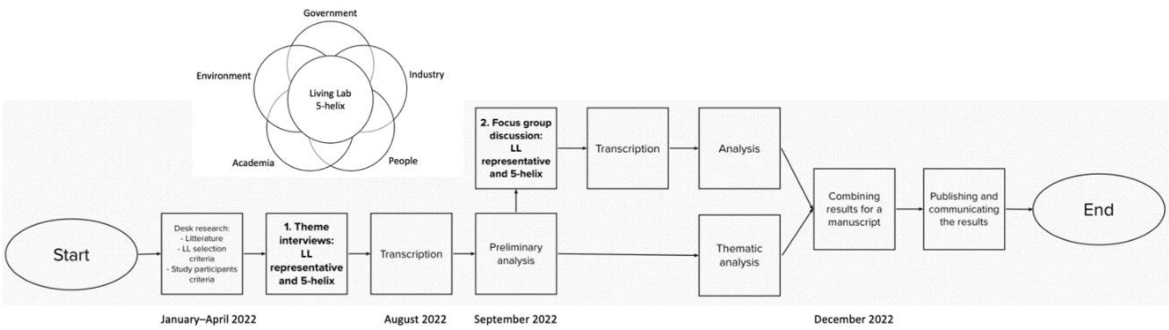

Figure 1. Process chart of data collection of each living lab and related 5-helix actors.

The methodology used to unravel challenges, learning questions, strategies and tools is semi-structured interviews, based on critical incident technique (CIT) (Chell, 1998). Study participants are asked to define their food sustainability transformation and LL activities and explain an activity-related challenge that they experience in that as well as strategies that they apply in an attempt to overcome this challenge. The challenge must be critically significant for the interviewee.

Adjacent participatory focus group discussions will be organized based on the pre-analysis of interview data per each LL-related actor individually. Eventually, a qualitative thematic analysis of transcripts, within case and cross-case comparisons will be conducted of all interviews and focus group sessions.

Currently we are focusing on two food living labs located in Finland and their quintuple helix actors (people, industry, government, academia and a representative of environment). It is possible to extend the focus and apply similar research design to other food living labs in Europe or beyond.

Current Stage of Progress

To gain deeper understanding on Living Labs acting particularly in food service area we conducted literature searches to understand previous research and possible knowledge gaps concerning living lab activities in the food and hospitality. Searches were accomplished in the spring 2022 in four databases with a focus of food science: Academic Search Complete, Web of Science, SCOPUS and CAB Abstracts. Searches were conducted with article title and keyword searches by using entries ‘living lab’, ‘innovation’, ‘food’, ‘food service’, ‘food system’, ‘transition’, and their synonyms.

A research plan with a detailed data management plan was compiled and does include a subjectivity statement, information sheet, privacy notice and an informed consent form. The research plan is compliant with responsible conduct of research based on the guidelines of The Finnish Advisory Board on Research Integrity.

We have conducted the desk research to find suitable ‘Food LLs’ fitting to criteria and further reach to quintuple helix actors of each LL. Study participants were contacted and interviewed. Currently we are thematically analysing the one-to-one interviews. We assume that in winter 2022 we will conduct focus group discussions and process the focus group data. We suppose to finalize the manuscript to publish results in the beginning of year 2023.

Conclusion

With this research study we pursue to widen scientific understanding of food system living labs from agri-food context towards consumers and citizens, eating experience and offerings provided by food service. The study will explore what kind of challenges food living labs and participating actors identify in the urban food system sustainability transformation. Eventually, we aim to find out strategies to overcome challenges and needs food and hospitality LLs are currently facing in their innovation and development processes.

Understanding of challenges and needs of ‘Food LLs’ will enable optimal premises for adopting strongly sustainable co-innovation in food service context. We explore how LL stakeholders could make an impact and who should take the lead. Further, the findings can be transferred into food service management practices and therefore providing sustainable solutions for citizens’ everyday eating. We also expect the findings to be valuable contribution to food service management education being policy guidance for its part and ensuring continuity via future leaders.

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References

1. Carayannis, E. G., Barth, T. D., & Campbell, D. F. (2012). The Quintuple Helix innovation model: Global warming as a challenge and driver for innovation. Journal of Innovation and Entrepreneurship, 1(1), 2–12. https://doi.org/10.1186/2192-5372-1-2
2. Chell, E. (1998). Critical incident technique. In Qualitative methods and analysis in organizational research: A practical guide. (pp. 51–72). Sage Publications Ltd.
3. CORDIS. (2020). Fostering the Urban food System Transformation through Innovative Living Labs Implementation | FUSILLI Project | Fact Sheet | H2020 | CORDIS | European Commission. Fostering the Urban Food System Transformation through Innovative Living Labs Implementation. https://cordis.europa.eu/project/id/101000717
4. ENoLL. (2017). What are Living Labs. European Network of Living Labs. https://enoll.org/about-us/
5. FIT4FOOD2030. (2021). Transformative interviewing, In a nutshell. FIT4FOOD2030 Knowledge Hub. https://knowledgehub.fit4food2030.eu/wp-content/uploads/2020/06/F4F_Educational_Module_Transformative_Interviewing.pdf
6. Gamache, G., Anglade, J., Feche, R., Barataud, F., Mignolet, C., & Coquil, X. (2020). Can living labs offer a pathway to support local agri-food sustainability transitions? Environmental Innovation and Societal Transitions, 37, 93–107. https://doi.org/10.1016/j.eist.2020.08.002
7. McPhee, C., Bancerz, M., Mambrini-Doudet, M., Chrétien, F., Huyghe, C., & Gracia-Garza, J. (2021). The defining characteristics of agroecosystem living labs. Sustainability (Switzerland), 13(4), 1–25. Scopus. https://doi.org/10.3390/su13041718
8. Motiva. (2022). Ruokapalvelut. https://www.motiva.fi/julkinen_sektori/kestavat_julkiset_hankinnat/tietopankki/ruokapalvelut
9. Turner, R. K. (1993). Sustainability—Principles and practice. Generic, 3–36.
10. UN. (2015). Transforming our World: The 2030 Agenda for Sustainable Development. United Nations. https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981
11. Valencia, A., Zhang, W., & Chang, N.-B. (2022). Sustainability transitions of urban food-energy-water-waste infrastructure: A living laboratory approach for circular economy. Resources, Conservation and Recycling, 177. Scopus. https://doi.org/10.1016/j.resconrec.2021.105991
12. Valsta, L., Kaartinen, N., Tapanainen, H., Männistö, S., & Sääksjärvi, K. (2018). Ravitsemus Suomessa: FinRavinto 2017. https://www.julkari.fi/handle/10024/137433
13. Wahl, D., Ness, B., & Wamsler, C. (2021). Implementing the urban food–water–energy nexus through urban laboratories: A systematic literature review. Sustainability Science, 16(2), 663–676. Scopus. https://doi.org/10.1007/s11625-020-00893-9
14. Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., … Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. The Lancet (British Edition); Lancet, 393(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4
15. Yan, W., & Roggema, R. (2019). Developing a design-led approach for the food-energy-water nexus in cities. Urban Planning, 4(1), 123–138. Scopus. https://doi.org/10.17645/up.v4i1.1739
16. Zivkovic, S. (2018). Systemic innovation labs: A lab for wicked problems. Social Enterprise Journal, 14(3), 348–366. https://doi.org/10.1108/SEJ-04-2018-0036

Research In Progress Paper

Urban Living Labs between theory and practice: a dialectal reading towards a cyclical hybrid performance model for value creation in context.

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Abstract

This paper aims at understanding ULLs from practice perspective in reference to different forms and theories on ULLs in literature. By doing so we can revisit and add to the theory and methodology of ULLs. The paper is based on comparison of three ULLs established in three cities in south Limburg in the Netherlands. First, it is noticed from the experiences developed in the three ULLs that applying ULL theory and methodology is not one to one as context challenges are crucial to be adapted to. Second, experiences show the need for new evaluation criteria for the process and value creation/impacts of ULLs. In this paper, we suggest the cyclical hybrid performance model consisting of the ULLs' level of maturity, type of end product and impacts and values created or destroyed and by the placemaking processes itself. The paper concludes with new insights that adds to the understanding of ULL practice.

Keywords

Urban Living Labs, Hybrid Model, Value Creation.

Introduction: Urban Living Labs, Placemaking and the SDGs

The United Nations Sustainable Development Goals (SDGs) are a global framework towards a better world in 2030 including provision of basic human needs and tackling complex societal challenges that require sustainability transitions and changes in current socio-technical system. According to Thacker et al. (2019) widespread diffusion of technological innovations and new infrastructures is essential for the achievement of many SDGs. In the urban sphere, sustainability transitions are about changes in markets, policy, culture, technologies, infrastructure as well as, and more and more recognized as such, in human behaviors and practices (see e.g. Voytenko et al., 2016 or Bulkeley et al., 2016). In fact, Markard et al. (2020) argue that sustainability *challenges* are global, while sustainability *transitions* happen on local level since on this level innovations and interactions between policymakers, firms, consumers, and civil society organizations are situated and understood by those involved.

This paper argues that the role of ULLs as an interesting tool to understand the local level for sustainability transitions. This transition is recognized in placemaking processes as they are not only concerned with the physical aspects of a place under study, but exist in relation to its historical, cultural, social, institutional, spatial and temporal dimensions while seeking transformation (Marrades et al., 2021). In this way, ULLs can be viewed as urban platforms that provide a learning arena within which the co-creation of diverse levels of innovation can be pursued between active stakeholders. The focus is on the learning process and urban experiments rather than achieving a pre-determined objective (Puerari et al., 2018). Urban experimentation is here seen as *''fluid, open-ended, contingent and political''* (Raven et al., 2017 p. 260) and centers people in the urban planning process and fosters the relation between those people and their places (Marrades et al., 2021). Consequently, ULLs are transdisciplinary in nature and advance 'place understanding' through a process of collaboration and interactive learning that is capable of meaningfully remake public space into places (Lorne, 2019), and that have the potential to contribute to urban sustainability transitions (Bulkeley et al., 2016). In the past few years we saw an evolution in the theory and practice of ULLs (see paragraph 2 for a brief overview). The existing models, however, are not always applicable to certain context due to the absence of the tools to operationalize them and at the same time to measure their impacts on value creation and value destruction, especially when placemaking is used in the place transformation process. The paper in the coming sections will highlights these gaps and a few insights from practice that can contribute to bridge this gap.

ULL literature framework developments

Gaps in the theoretical and methodological framework of ULLs

When examining current literature about (U)LLs, these remain based on either theoretical assumptions and explorations or based on case study reviews. The cases presented in literature present ULLs and placemaking processes on the dialogue and participation level of informing the end-users according to Arnstein (1969) or they are limited to market and product oriented trials where the focus is on outcomes and not the learning process per se to understand the local level where transitions may happen. Consequently, and in our view, ULLs are still too much viewed as a collection of projects rather than a process in itself to enhance collective place understanding by stakeholders engaged on local levels. Our argument here is not to say that these theories and models are wrong, but that the ULL community needs an operational ULL learning model to strengthen its position in neighbourhoods and their potential to overcome local urban sustainability challenges that link with the SDGs, especially in so-called vulnerable neighbourhoods in the Dutch context (Abujidi, Blezer and van de Weijer, 2021).

Two main questions emerged from our literature review and were established in the ULLs:

1. How to measure values created and/or destroyed by placemaking in ULLs?
2. What indicators are missing and still to be developed to measure the impacts of an ULL?

The other shortcoming from existing ULL theory and practice is on methodological level on how to link them to their context. The following question emerged:

3. How to apply the ULL in complex and extreme urban conditions yet with great socio-cultural potentials?

To answer the above mentioned questions, we first start with a brief overview of existing theory and models developed in ULL that we see able to link with placemaking. For now, we stay rather limited in depth, because it is about the main limitation we observed regarding the formulated questions which we try to address rather than explained or comparing the theories or models in depth ourselves. We refer to the mentioned references or current and recent literature reviews about ULLs literature, like Hossain et al. (2019), Chronéer et al. (2019) or Greve et al. (2020), if interested in more depth about the theories and models.

Brief overview of existing ULL theory and models

One of the very first attempts to distinct living labs (LLs) from other Test and

Experimentation Platforms in the private innovation literature is made by Ballon, Pierson and Delaere (2005) who highlight that LLs have an 'experimentation zone' and view end-users as 'co-producers'. They mention that LLs are experimentation environments in which technology is given shape in real life contexts and in which end-users are 'co-producers'.

A few years later, and after the Global Economic Crisis in 2008, first conceptions and models of ULLs started to emerge with new models that developed the governance and organizational structure of (U)LLs such as the three-layer model provided by Schuurman (2015) and the LL typologies first set-up by Leminen, Westerlund and Nyström (2012).

The three-layer model was set-up to bridge the open- and user innovation approaches in LLs resulting in three layers that constitute LLs: Macro, Meso and Micro. Respectively, the LL constellation (open innovation), the LL projects (open- and user innovation), and the LL methodology (user-innovation). Critically, Kalinauskaite et al. (2021) mention while trying to address the question on how to collaborate in LL settings, that the three layer model positions co-creation in the micro layer and therewith limiting the involvement of end-users in LLs. Consequently, Kalinauskaite et al. (2021) propose a transdisciplinary collaboration approach to systematically transfer co-creation from the micro to the meso and macro layers.

Parallel in time, Seppo Leminen in various scientific publications and with various authors between 2011 and 2015 (i.e. Westerlund & Leminen, 2011; Leminen et al., 2012; Leminen, 2013; Schuurman et al., 2016, and Bondarenko et al., 2019) developed five types of LLs (initially four) based on the stakeholders who drives the activities: Utilizer-driven, Provider-driven, Enabler-driven, User-driven and Researcher-driven (added later). They also positioned the initial four types according to their coordination approach (top-down and bottom-up) and their participation approach (exhalation and inhalation dominated).

In the meantime, the evolution of LLs and ULLs is also connected to time and space according to Blezer and Abujidi (2021) as ULLs emerged in the urban context to learn collectively about urban development as a long-term process while LLs emerged initially in the private sector innovation literature to enhance private product and service development in the short-term. This contradiction explains multiple challenges ULLs face today, like their financial sustainability (Gualandi and Romme, 2019), the redistribution of agency and risks (e.g. Burch et al., 2018) or their scalability, diffusion and impacts created (e.g. von Wirth et al., 2018).

Besides, ULLs explicitly build on the promises that *iteration* throughout the process continuously strengthen its possible impacts through stakeholder learning and innovation (see e.g. Puerari et al., 2018 or Steen and van Bueren, 2017). However, in practice a continuous search for limiting individual financial and political risks on the short-term among stakeholders hinders the ULL potentials and impacts in practice on the long-term (Blezer and Abujidi, 2021).

To wrap up, it can be said that in recent decades the theories and models of ULLs have increased and enhanced. However while much literature focusses on analyzing ULLs and their functioning often based on case study examples, there seems to be a lack of proper evaluation criteria for the iteration and learning during the process to improve performance of ULLs in practice. In fact, recently Overdiek and Genova (2021) also noticed that indeed (U)LLs still remain to their testing phase and reviewed current evaluation methods and tools stating that *''existing tools are quite managerial in their methods and aesthetics''* (p.3) and *''calls designers and social scientists to develop more playful, engaging and learning-oriented tools to evaluate living labs in the future''* (p.3).

Our argument here is that due to the historical development of LLs and ULLs, the realization and evaluation phases in ULLs remain sparse because the in-between evaluation criteria are not suitable for ULLs that aim for urban innovation with social impacts in comparison to the often preferred technological ones in LLs. Indeed, Mahmoud et al. (2021) and Overdiek and Genova (2021) emphasize the effect of the maturity and scope level of ULLs on its impacts and the need for more learning-oriented evaluation criteria to improve. Yet, it remains unclear how this may be achieved in practice.

Value creation: Maturity, Co-creation and Placemaking

Diverse ULLs use Placemaking as a tool to create values on diverse social, cultural, spatial and environmental dimensions. Placemaking conceptualizes how city sites are being constituted and transformed in a process which offers the opportunity to bridge exchange value (economic profits) and user value (daily life activities) since it is based on how local communities understand their place (Marrades et al., 2021). Within peacemaking processes, co-creation is also highlighted as an essential method to for the desired added values. Co creation here entails both co-design and co-production (Kalinauskaite et al., 2021). More critically, Ramaswamy and Ozcan (2018) provide a new perspective on the concept of co-creation by emphasizing on the ''value-in-interactional creation'' highlighting a shift of value created from activities to interactions. Placemaking in ULLs means that it is not the co-creation activities itself that provide the most value, but rather the interactions created with and between any experiencing actor in a 'place' that advances 'place understanding'. In a similar vein, Bosschaert (2022) emphasizes sustainability as a property in a socio-technical system. Therewith, the author underpins the importance of relations in a system rather than physical objects. In such a system, real sustainability can be created in a context through time and space (and on object, network and system level). Consequently, and according to Leclercq and Smit (2021), values on neighbourhood level then can be categorized and analyzed as cultural, social, economic, ecological and aesthetical that are being materialized in practice via sustainable use of local resources in a place: energy, water, waste, building materials and biota resource loops.

Based on our experiences (see below), we argue that value creation and therewith the performance in ULLs depends on four elements: 1) its maturity level 2) an inclusive co-creation process, 3) the level of placemaking on an appropriate urban scale, and 4) the impacts and values created. Note that these 4 may overlap and mutually influence each other in reality.

1. Maturity level refers to the level of negotiating, democracy and co-creation. Herein, the thoughts of Kalinauskaite et al. (2021) is extended that co-creation must indeed be placed at other layers of the three layer model to, in our view, ensure institutional alignment and embeddedness of ULLs. Besides, it refers to an equivalent yet shared and collective position of interest of stakeholders and citizens involved.

2. Inclusive co-creation process refers, first, to a certain degree of citizen (and other local stakeholders') power (Arnstein, 1969), and second, to the character of the co-creation process itself that allows for value creation. According to Ramaswamy and Ozcan (2020) and our experiences it is not the amount of co-creation activities that generate value, but the close level of interactions created in those co-creation activities that generate local value; both by learning together as well as making together (Puerari et al., 2018). For example, it is better to organize two activities like focus groups or neighbourhood tours in which many residents or stakeholders of a place interact and engage with each other compared to six activities in which less residents or stakeholders are involved. This switch in thinking is of crucial importance as it allows to see co-creation (and ULLs) not as a collection of projects that can be organized, but as a continuous process that through its interactions among local stakeholders generates value for that place it exists in. As such, more opportunities for informal co-creation, more diversity of co-creators and a variety in the intensity of activities and interactions is allowed for. This allows us to have a flexible process that makes it possible to make iterations needed in link to the co-creation process evaluation as well as better connect to local community ambitions and aspirations.

3. The level of placemaking refers to, first, the appropriate urban scale that an urban experiment is being carried out. The urban pixel can provide a good urban platform for small experiments that can be co-created and co-designed, implemented, monitored and evaluated with a good set of indicators for the

values created or destroyed by the interventions. Second, the gatekeepers in the urban pixel are crucial to the success or failure of urban experiments. The urban pixel is the local urban scale as understood by local stakeholders that constitute a certain area that one has a certain sense of belonging and identity to (Ellery, 2021). Gatekeepers are local individuals who in whatever way are able to mobilize others and/or resources or are able to provide stakeholders with local insights and information that enable urban experimentation. Both seem to be of crucial importance in ULLs to go beyond the dialogue phase according to our experiences.

4. The impacts and values created in link to the end products and process created through placemaking in the ULLs are important to its impacts and values created. It is both the form and type of the end product of the placemaking process that defines not only the success of placemaking but extends to define the success and nature of the ULL and its maturity. The end product can be minimal to an advice report, a participatory workshop or design scenarios. The ULL can reach its climax with fully-fledged process that ends with a co-created experiment or intervention that can be monitored and evaluated in terms of impacts and values created. Impacts are tangible outcomes on local level, like a physical short-term change in the place. Meanwhile values created are rather abstract contributions to strategic of higher level objectives, like the SDGs. The complete cycle is based on design thinking that is circular and that can repeat itself in scaling up activities.

We use the 4 highlighted indicators to evaluate our three ULLs in south Limburg in the following section.

ULL cases: Kerkrade, Maastricht and Heerlen

Below, three locations in our ULLs are described.

In ULL Kerkrade-West (2016-2019) a 10 week intensive student course and an annual design week was organized in the neighbourhood Kerkrade-West. The design week cycle projected transformative concepts on public space and was geared at bridging the gaps between experts and non-experts. Hence, the social aspects in a neighbourhood were centred and included building a shared notion of for example circularity on neighbourhood level. It addressed underexposed public spaces in the neighbourhood where a lot can be gained by means of simple improvements in three areas: Akerstraat, Gracht and Kaalheide.

CDKM>Maastricht (2019-2022) focused on working together on the development of vital and future-proof neighbourhoods in Maastricht, with focus on the Mariaberg (working-class district with many social rented houses) and Randwyck (residential neighborhoods plus campus with large-scale facilities) districts. Themes that were focused on in public space and the neighbourhoods are: sustainability and climate, participating and meeting, safe and clean, exercise and health. Next to the 10 week student course and the an annual design workshop, a continuous process with citizens and interdisciplinary students in both neighbourhoods was carried out throughout the year in monthly focus groups. Both locations were handled differently and are split up in the table below.

ULL Heerlen-Noord (2021-present) is the newest ULL that is built upon the previous experiences and applies and adjusts the three layer model by Schuurman (2015). It focuses on the Hoppersgraaf area, part of Heerlen-Noord. In the area, three projects are projected for the coming years as a result from the first annual design week: a social-cultural hub bridge connecter between the neighbourhood and the city centre (2023), a social hub in a refurbished textile fabric (2024), and the development of a nature based placemaking intervention in the Aurora flat courtyard (2022).

In the following table we list the main (preliminary) results of the three ULLs with the indicators from the previous sections combined with our own insights and experiences as well as connected to certain ULL theories, indicators or categories.

Table 1. Overview of the preliminary results of three ULL experiences.

Performance Indicator	Kerkrade-West	Maastricht Mariaberg	Maastricht Randwyck	Heerlen Hoppersgraaf	Source of the indicator
Urban scale	Neighborhood and public space	Neighborhood and public space	Neighborhood and public space	Public space and building	N/a
End products	Advice, designs	Advice, designs	Advice, designs	Advice, designs, intervention	Student competences learning and partner wishes
Themes	Social inclusion, vitality	Social inclusion, vitality, safety, health	Climate adaptation, social inclusion, identity, biodiversity	Climate adaptation, social inclusion, vitality, health, safety and circularity	Experienced local urban challenges

ULL stakeholder Roles a. Municipality b. Housing association c. Civil society organization d. Local community e. SURD f. Other	a. Enabler, Provider b. Provider c. - d. User e. Enabler, provider	a. Provider b. - c. Provider d. User e. Enabler, provider	a. Provider b. - c. University Maastricht; Provider. d. User e. Enabler, provider	a. - b. Enabler, Provider c. - d. User e. Enabler, Provider, Researcher f. Vista; Provider and local greenery company; Utilizer.	Based on Leminen, Westerlund and Nyström (2012) Options: Enabler, Provider, Utilizer, User and Researcher.
ULL typology	Provider- and Enabler-driven	Enabler-driven.	Enabler-driven.	Enabler- and User-driven.	Based on Leminen, Westerlund and Nyström (2012)
Gate keepers	Inhabitants	Civil society organization	Inhabitants and Municipality	Housing association	SURD experiences
Problem owner	Municipality	Municipality	Municipality	Municipality, Housing association and local community.	Experienced local urban challenges
Inclusive co-creation (activities and interactions)	Design week Learning and making together (only designs)	Design week and focus groups sessions Learning and making together (only designs)	Design week and focus group sessions Learning and making together (only designs)	Design week, Aurora Co-creation Days (pizza session, focus groups and walking tour) and Aurora Challenges design week. Learning and making together (design and urban intervention)	Activities: SURD experiences and integrating learning from before going editions Interactions: Learning and Making together (Puerari et al., 2018)

Level of placemaking	Social interaction, communication and dialogue.	Social interaction, culture & identity.	Social interaction, culture & identity, and communication and dialogue.	Social interaction, spatial experiences of cultural diversity, communication and dialogue, and implementation	Experienced local urban challenges
Maturity level	◔	◑	◑	◕	Related indexation based on experiences and evaluation.

Towards a cyclical hybrid performance model

In this paper, we addressed the operational model gap that we identified between ULL theory and practice, especially related to their evaluation and process indicators as well as operationalization and realized impacts and values created or destroyed in practice. Based on over 7 years of experiences and observations ourselves in ULLs, we claim that ULLs are and should not be seen as a collection of projects that aim to improve local urban environments. Rather, ULLs should be seen as urban platforms that can host 1) geographical coalitions between diverse scales and urban complexities [1], 2) theme-specific context coalitions to ensure an integral approach, and 3) as an shared-interest context coalition to complement and create synergies for value creation and sustainable transitions. As such, we emphasize that the value of ULLs not only comes from experiments or interventions that are being carried out, i.e. objectives reached or outcomes created, but merely so by the diverse levels of innovations and interactions contributed to between stakeholders on local levels where sustainability transitions happen according to Markard et al. (2020).

This perspective brings us to the practical illustration and cyclical hybrid performance model of ULLs in figure 1 and 2. We note that these are preliminary results in an ongoing process which are based on 7 years of experiences generated by the 3 ULL in South Limburg, the Netherlands. Therefore, it is still under experiment and open for discussion, adaptation and exchanging (or opposing) views.

[1] This may contradicts with out claim to focus on the Urban Pixel scale. The Urban Pixel for us is the starting scale to experiment and develop a fully-fledged placemaking process drawing on how local residents view their ‘place’. Meanwhile, we also see that the Urban Pixel may be capable of bridging local impacts with strategic values, hence, the ULL can extend to include multiple Urban Pixels with similar yet different characteristics in various respects.

Practical contribution and explanation

First, initiation of ULLs is based on a local urban challenge that active stakeholders acknowledge together as a starting point for the desired transformation. We call to include stakeholders from the quadruple helix with focus and close collaboration and active engagement of the local community and gatekeepers.

Second, the context should be well defined with its complex urban aspects on the urban pixel scale. This will facilitate defining the values that engaged stakeholders want to create and be aware of other values that can be destroyed in the process. For example, in the SUPERLOCAL[2] project in Kerkrade, the main focus of the project was the circular renovation of the social housing block to contribute to environmental values. In this process, social and spatial networks were disturbed during the process that caused social value destruction; an issue the project stakeholders didn't expect nor took into consideration.

Third, through a dialogue the context is better understood and challenges are well defined to manage expectations. Thus, the maturity of the ULL and its end products can be identified on more general and strategic level while leaving space in the ULL process to allow iterations that fit the needs in specific moments in time and space to adjust accordingly.

Fourth, contribution to sustainability transitions go hand in hand with impacts and values created. This adds to the complexity of the co-creation and co-designing process, however, is necessary. Where the developed experiments and interventions take place on local level and heavily depend on the availability of local resources, they may contribute to environmental or social values on strategic level. See Blezer, Abujidi and Sap (2022) for the example from our latest experiences in the ULL Heerlen.

Fifth, a regular and cyclic evaluation process is held with engaged stakeholders to learn from the experiences, improve performance and plan ahead.

Theoretical contribution

The cyclical hybrid performance models adds to current literature in two ways.

First, it emphasizes the cyclical character of ULLs through time and space, meaning its perspective changes from projects to the process. Herewith, we distinguish ourselves form the assumption that ULLs *are* or *carry out* projects and rather view them as the urban platform that continuously iterates the local context and from

[2] https://www.superlocal.eu/

which projects may result to address local urban challenges in various ways depending on the local impacts and strategic values desired.

Second, it highlights that if ULLs are there to create local impacts and strategic values it *must* include both the learning together and making together co-creation elements so that ULLs in practice are not limited to the dialogue phase. Therefore, an inclusive co-creation process is needed. Consequently, this means that the urban experiment or intervention is not an achievement in itself as a project but rather an integrated element in the whole cyclical process, and perhaps most crucial because it ensures the ULL to go beyond the dialogue phase, one must go through to generate local impacts and strategic values.

Hence, we conclude to say that ULLs in practice when applied for local neighbourhood development do not only generate impacts on local level, they can yet contribute to higher level strategic values. Therefore, ULLs must be both *organizational robust* and *context adaptive*. Respectively, a cyclical (at the least) multiple year foresight and (local) ambitions that can be created. This cyclic process should be being able to flexibly iterate with changes, adjustments so that newly identified and accumulated insights can be integrated in the process. Hence, longer term impacts, local ownership and positive values can be created.

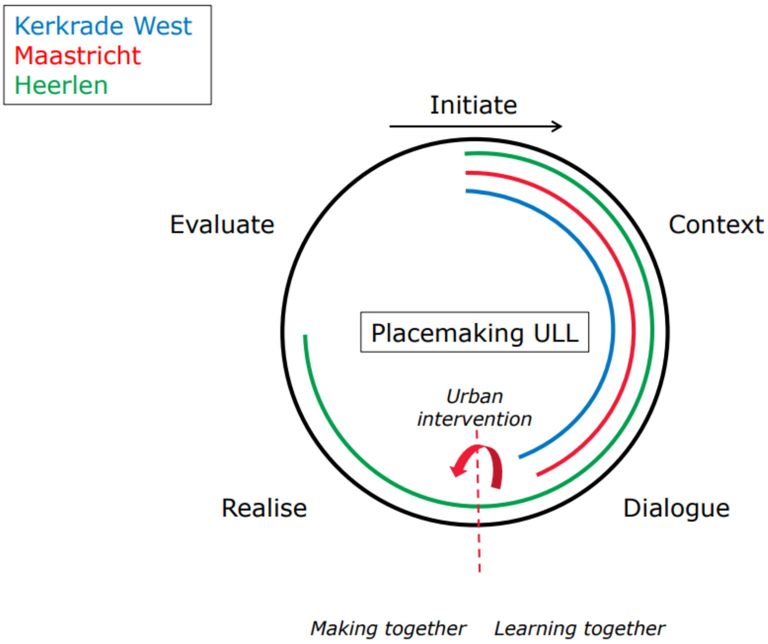

Figure 6. Cyclical Hybrid Performance Model 'from above'. It shows a one year cycle the ULL has gone through and the phases reached. Also, it emphases the crucial importance of the urban intervention to spring beyond the dialogue phase and bridge learning and making together in the co-creation process. Note that between the phases continuous iteration takes place. Source: SURD.

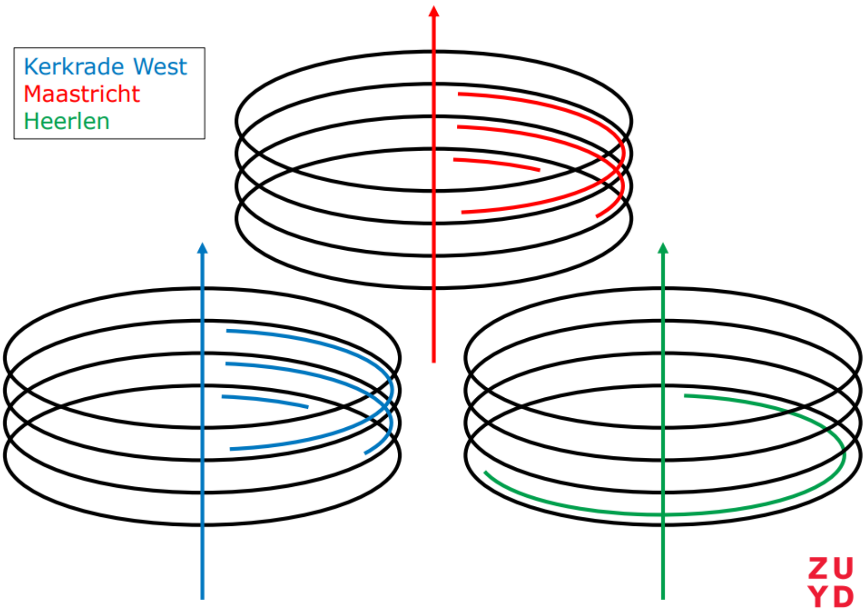

Figure 7. Cyclical Hybrid Performance Model 'from aside'. It shows the multiple year progression, starting from the lowest black cycle and going up annually. In Kerkrade and Maastricht we stayed to the dialogue phase after three years, only contributing with student designs and assignments. In Heerlen, we managed to go beyond the dialogue phase in the first year as a result of building upon our experiences and working according the proposed approach in this paper. Source: SURD.

References

1. Abujidi, N., Blezer, S. and van de Weijer, M. (2022). Placemaking in the Urban Living Lab Heerlen and Aurora flat courtyard intervention: learning towards urban vitality in vulnerable and cultural diverse neighbourhoods. Open Living Lab Days, Turin, Italy
2. Abujidi, N., Blezer, S. and van de Weijer, M. (2021). The Urban Living Lab as tool for introducing circularity in the everyday life of vulnerable neighbourhoods: Case study Kerkrade-West, the Netherlands. Digital Living Lab Days 2021 European Network of Living Labs, 2021. Online. https://issuu.com/enoll/docs/dlld_2021_-_proceedings (p.268)
3. Arnstein, S. R. (1969). A Ladder Of Citizen Participation. Journal of the American Institute of Planners, 35(4), 216–224. https://doi.org/10.1080/01944366908977225
4. Ballon, P., Pierson, J., & Delaere, S. (2005). Test and Experimentation Platforms for Broadband Innovation: Examining European Practice. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1331557
5. Blezer, S., Abujidi, N. and Sap, H. (2022). Placemaking in the Urban Living Lab Heerlen and Aurora flat courtyard intervention: learning towards urban vitality in vulnerable and cultural diverse neighbourhoods. Open Living Lab Days 2022 European Network of Living Labs, 2022. Turin, Italy. (under publication).
6. Blezer, S., & Abujidi, N. (2021). Urban Living Labs and Transformative Changes: A qualitative study to the triadic relationship between financing, stakeholder roles and outcomes of Urban Living Labs on their impact creation in the city of Groningen, the Netherlands. Technology Innovation Management Review, 11(9/10), 73–87. https://doi.org/10.22215/timreview/1466
7. Bondarenko, O., Schuurman, D. and De Kinderen, W. (2019) Workshop ‘From Local to Global – Scaling up your Living Lab Activities to a Sustainable Living Lab Organization: Experiences from City Pulse’, Open Living Lab Days 2019 Conference, Thessaloniki, Greece, September 2019.
8. Bosschaert, T. (2022, 18 januari). Symbiosis in Development (SiD). Except Integrated Sustainability B.V. Geraadpleegd op 3 augustus 2022, van https://except.eco/nl/knowledge/symbiosis-in-development-sid/
9. Bulkeley, H., Coenen, L., Frantzeskaki, N., Hartmann, C., Kronsell, A., Mai, L., Marvin, S., McCormick, K., van Steenbergen, F., & Voytenko P.Y. 2016. Urban Living Labs: governing urban sustainability transitions. Current Opinion in Environmental Sustainability, 22: 13-17. DOI: https://doi.org/10.1016/j.cosust.2017.02.003
10. Burch, S., Graham, A., & Mitchell, C. 2018. 11. Agency, Space and Partnerships: Exploring key dimensions of urban living labs in Vancouver, Canada. In Marvin, S., Bulkeley, H., Lindsay, M., McCormick, K. and Voytenko Palgan, Y. (Eds.), Urban Living Labs ExperimentingWith City Futures, Routledge: 189-209.
11. Chronéer, D., Ståhlbröst, A., & Habibipour, A. (2019). Urban Living Labs: Towards an Integrated Understanding of their Key Components. Technology Innovation Management Review, 9(3), 50–62. https://doi.org/10.22215/timreview/1224
12. Greve, K., Leminen, S., de Vita, R., & Westerlund, M. 2020. Unveiling the Diversity of Scholarly Debate on Living Labs: A bibliometric approach. International Journal of Innovation Management, 24(08), 2040003. DOI: https://doi.org/10.1142/s1363919620400034
13. Gualandi, E., & Romme, A.G. 2019. How to Make Living Labs More Financially Sustainable? Case Studies in Italy and the Netherlands. Engineering Management Research, 8(1), 11. DOI: https://doi.org/10.5539/emr.v8n1p11
14. Hossain, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. Journal of Cleaner Production, 213, 976–988. https://doi.org/10.1016/j.jclepro.2018.12.257
15. Kalinauskaite, I., Brankaert, R., Lu, Y., Bekker, T., Brombacher, A., & Vos, S. 2021. Facing Societal Challenges in Living Labs: Towards a Conceptual Framework to Facilitate Transdisciplinary Collaborations. Sustainability, 13(2), 614. DOI: https://doi.org/10.3390/su13020614
16. Leclercq, E. M., & Smit, M. J. (2021). Waardevolle wijken: Het creëren van waarde in wijken door het gezamenlijk sluiten van grondstofkringlopen. Delft University of Technology. https://research.tudelft.nl/en/publications/waardevolle-wijken-het-cre%C3%ABren-van-waarde-in-wijken-door-het-geza
17. Leminen, S. 2013. Coordination and Participation in Living Lab Networks. Technology Innovation Management Review, 3(11): 5-14. DOI: https://doi.org/10.22215/timreview740

18. Leminen, S., Westerlund, M., & Nyström, A.G. 2012. Living Labs as Open-Innovation Networks. Technology Innovation Management Review, 2(9): 6- 11. DOI: https://doi.org/10.22215/timreview/602
19. Lorne, C. (2019). The limits to openness: Co-working, design and social innovation in the neoliberal city. Environment and Planning A: Economy and Space, 52(4), 747–765. https://doi.org/10.1177/0308518x19876941
20. Mahmoud, I., Sejdullahu, I. and Morello, E. (2021). Milan's ULL co-design pathway to spread green roofs and walls throughout the city. Digital Living Lab Days 2021 European Network of Living Labs, 2021. Online. https://issuu.com/enoll/docs/dlld_2021_-_proceedings (p.288)
21. Markard, J., Geels, F. W., & Raven, R. (2020). Challenges in the acceleration of sustainability transitions. Environmental Research Letters, 15(8), 081001. https://doi.org/10.1088/1748-9326/ab9468
22. Marrades, R., Collin, P., Catanzaro, M., & Mussi, E. (2021). Planning from Failure: Transforming a Waterfront through Experimentation in a Placemaking Living Lab. Urban Planning, 6(1), 221–234. https://doi.org/10.17645/up.v6i1.3586
23. Overdiek, A., & Genova, M. (2021, november). Evaluating living labs? Methods and tools. The Hague University of Applied Sciences: The Hague. https://www.thehagueuniversity.com/docs/default-source/documenten-onderzoek/lectoraten/innovation-networks/evaluation-tools_methods_and_tools.pdf?sfvrsn=c843ed34_4
24. Puerari, E., De Koning, J., Von Wirth, T., Karré, P., Mulder, I., & Loorbach, D. (2018). Co-Creation Dynamics in Urban Living Labs. Sustainability, 10(6), 1893. https://doi.org/10.3390/su10061893
25. Ramaswamy, V., & Ozcan, K. (2018). What is co-creation? An interactional creation framework and its implications for value creation. Journal of Business Research, 84, 196–205. https://doi.org/10.1016/j.jbusres.2017.11.027
26. Raven, R., Sengers, F., Spaeth, P., Xie, L., Cheshmehzangi, A., & De Jong, M. (2019). Urban experimentation and institutional arrangements. European Planning Studies, 27(2), 258–281. https://doi.org/10.1080/09654313.2017.1393047
27. Schuurman, D. 2015. Bridging the Gap between Open and User Innovation? Exploring the value of Living Labs as a means to structure user contribution and manage distributed innovation. Ghent University and Vrije Universiteit Brussels. https://biblio.ugent.be/publication/7026155
28. Schuurman, D., Baccarne, B., Marez, L.D., Veeckman, C., & Ballon, P. 2016. Living Labs as Open Innovation Systems for Knowledge Exchange: solutions for sustainable innovation development. International Journal of Business Innovation and Research, 10(2/3), 322. DOI: https://doi.org/10.1504/ijbir.2016.074832
29. Steen, K., & Van Bueren, E. (2017). The Defining Characteristics of Urban Living Labs. Technology Innovation Management Review, 7(7), 21–33. https://doi.org/10.22215/timreview/1088
30. Thacker, S., Adshead, D., Fay, M., Hallegatte, S., Harvey, M., Meller, H., O'Regan, N., Rozenberg, J., Watkins, G., & Hall, J. W. (2019). Infrastructure for sustainable development. Nature Sustainability, 2(4), 324–331. https://doi.org/10.1038/s41893-019-0256-8
31. Von Wirth, T., Fuenfschilling, L., Frantzeskaki, N., & Coenen, L. (2018). Impacts of urban living labs on sustainability transitions: mechanisms and strategies for systemic change through experimentation. European Planning Studies, 27(2), 229–257. https://doi.org/10.1080/09654313.2018.1504895
32. Voytenko, Y., McCormick, K., Evans, J., & Schliwa, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: towards a research agenda. Journal of Cleaner Production, 123, 45–54. https://doi.org/10.1016/j.jclepro.2015.08.053
33. Westerlund, M., & Leminen, S. 2011. Managing the Challenges of Becoming an Open Innovation Company: Experiences from Living Labs. Technology Innovation Management Review, 1(1): 19-25. DOI: https://doi.org/10.22215/timreview489

Research In Progress Paper

Multi Agent System to design permeable cities for butterflies

Authors

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Abstract

Conserving biodiversity is a major 21st-century challenge, especially within urban areas. Indeed, cities are not planned to support biodiversity but a suitable management could sustain biodiversity. Butterflies are good bioindicator insect groups to understand possible mobility of pollinators. Thus, movement data of cabbage butterflies have been collected in Turin: 1019 butterflies have been marked and released and 465 events of recapture observed. In a multidisciplinary approach a team of biologists and physicists is trying to exploit such data in order to train a Multi Agent System (MAS), modeling known behavioral patterns of butterflies and their mobility. When validated, such a MAS could provide useful hints to policy makers and city managers suggesting those topologies and characteristics of green areas maximizing the permeability for butterflies of a green city. Every city could become a living lab in which new data from butterflies' mobility could act as a feedback of green areas planning and deployment, driving corrections and further deployments.

Keywords

Pollinator mobility; Nature-Based solutions; Urban mobility; Urban green areas; Multi agent system.

Introduction

Conserving biodiversity is a major 21st-century challenge (EU Biodiversity Strategy for 2030). Nowadays urban expansion is one of the global threats of biodiversity[1]. The scenarios are even more alarming if we consider the urban population trend in the next few years. Indeed, over 4 billion people (50% of global population) are now living in urban areas but 70% of the world's population is expected to live in urban areas by 2050[2].

Several species of pollinators are threatened, including butterflies[3]. Land use changes have been considered as one of the main drivers of butterfly decline[4][5], and urbanization is a major driver of land cover change worldwide[6] . Indeed, cities are not planned to support butterfly biodiversity but a suitable management of existing and new green areas - based on scientific observations - could improve butterfly mobility and thus support a healthy community[7] . Thus, a key point to sustain a resilient butterfly community within the city is the connection of suitable areas inside a permeable urban matrix.

The city of Turin is already the scene of projects aimed at the enhancement of the urban habitat for butterflies, since it is one of the four cities that joined the ProGIreg project in 2018. During this international project, founded by the European Commission under the Horizon 2020 programme, in the post-industrial area of the city there were implemented different NBS, which some of them (NBS 6 - Accessible Green Corridors, NBS 8 - Pollinators' Diversity) are focused on city permeability and resilience of pollinators in urban areas. The "Pollinators' Diversity" is a great example of Living Lab, that involves citizens' engagement creating, monitoring and promoting awareness of spaces in favor of pollinators.

In this project, we evaluate by means of Multi Agent Systems (MAS) which architectural and ecological factors (e.g. mowing frequency, dimension, location and relative distances of green areas) of the urban green areas, might affect butterfly mobility. MASs, a form of distributed artificial intelligence, are computerized systems composed of agents situated in an environment, where they can interact, among each other and with the environment itself, and behave independently and asynchronously [8]. The key advantage of the MAS approach is the emergence of collective patterns or social behaviors not explicitly modeled, but just consequences of (quite) simple behavioral rules at individual level.

In a living lab approach, coupled with a MAS, behavioral patterns of butterflies, both from the literature or observed in the field, can be exploited in order to program such agents to behave accordingly to their real-world counterparts, the butterflies. A MAS accounting for accurate data on the environment (buildings, roads, green areas and their botanic attributes) as well as butterflies' mobility, could be used in order to drive the evolution of existing green areas or the deployment of new ones in a city that could be treated as a living lab: the impact on butterflies' mobility of the green areas deployment would be treated as a feedback in the MAS learning process, allowing to optimize the predictions of the MAS in order to maximize the permeability of the city to butterflies, and to account for those aspects specific to each city (e.g.: temperature, humidity, winds, traffic patterns, rain patterns) that could not be accounted for by a general purpose model. This remarkable level of customisation of the MAS, thanks to the layered scheme of the environment described herewith, and the learning mechanisms exploiting data on living butterflies within the city, are to the authors' knowledge the most innovative aspects of this work.

Study area

The study area was located within Turin (Italy, 45°04'20.1"N 7°39'44.0"E). The municipality itself covers an area of 130km2. Within the urban area, we selected two sites. Site 1 is mainly an urban area with some small green areas (45°02'11.6"N 7°37'51.9"E; 30ha) while site2 is an urban area that includes also Parco Piemonte (45°00'34.0"N 7°37'34.7"E; 32ha; Fig. 1). Site 1 and Site 2 constitute thereby an example of an ideal real-life environment allowing us, according to an ULL approach, to collect new data and to validate the ensuing MAS.

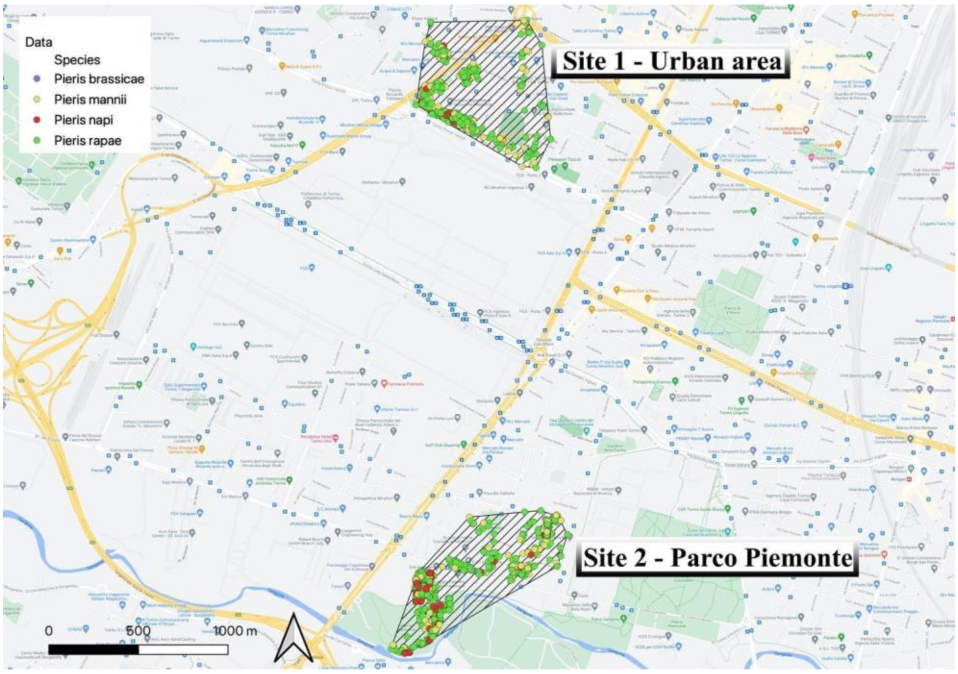

Figure 1. Map of the two study sites with the sampled individuals. It showed different colors for different species.

Data collection

We collected movement data on cabbage butterflies that are common in urban areas, widespread in Europe, mobile and generalists with large demographic densities: *Pieris rapae*, *P. brassicae*, *P. napi* and *P. mannii*. The species and the variables were chosen in order to study the flight behavior of urban butterflies, and allow the future MAS to have a clearer and more realistic vision of the city habitat. Environmental variables that are only suspected behavioral drivers were therefore also taken into consideration, and constitute the input to the model, clustered in layers describing the different attributes of the environment in the MAS: buildings, roads, green areas and their attributes, all geo-localized on the map of the city. The layered description of such environmental variables eases the investigation of the impact of the different variables on butterflies' mobility, and allows for a simplified customisation of the MAS for different cities.

The mobility of the species was investigated using the MRR (Mark, Release, Recapture) method from 20th July to 3rd September 2021, every day from 9:30 am to 4:30pm. 17 days spent in Site 2 Parco Piemonte area and 21 days in Site 1, urban area. Each butterfly was captured and individually marked with a consecutive number on the underside of the right hindwing using a non-toxic violet fine-tip permanent marker, and immediately released at the same location. Recaptures of previously marked butterflies were recorded separately. Before releasing each specimen, we recorded its individual number, sex, habitus, behaviour before netting, GPS position (Garmin® eTrex 20 with precision of±3 m) and time (date, hour) of the capture/recapture event. To evaluate mobility and behavior, we registered individuals that were captured more than once during the same day of activity.

Even if the largest species (P. brassicae) can cover a maximum distance of 12km[9], we did not find any individuals that from Site 1 arrived at Site 2 and vice versa (Fig.1).

Data recorded and model description

We marked 1019 butterflies and we recorded 465 events of recapture (Table 1). We have also collected some data on buildings, roads, trees, extension and types of green areas both by field observations and cartographic-GIS elaboration.

Table 1. Summary table of the Mark Release Recapture data. Data are divided by sites, species and sex of individuals. The recapture rate is also shown.

	Species	Sex	Capture (N)	Recapture (N)	Recapture (%)
Site 2 - Parco Piemonte	*Pieris rapae*	M	299	118	39,46
		F	148	50	33,78
		Tot	**461**	**173**	**37,53**
	Pieris mannii	M	34	11	32,35
		F	41	9	21,95
		Tot	**118**	**25**	**21,19**
	Pieris napi	M	24	6	25,00
		F	20	3	15,00
		Tot	**46**	**10**	**21,74**
	Pieris brassicae		2	0	0,00
		TOT	**627**	**208**	**33,17**
Site 1 - Urban area	*Pieris rapae*	M	219	166	75,80
		F	53	31	58,49
		Tot	**273**	**198**	**72,53**
	Pieris mannii	M	24	12	50,00
		F	53	23	43,40
		Tot	**97**	**37**	**38,14**
	Pieris napi	M	14	14	100,00
		F	6	6	100,00
		Tot	**22**	**22**	**100,00**
		TOT	**392**	**257**	**65,56**

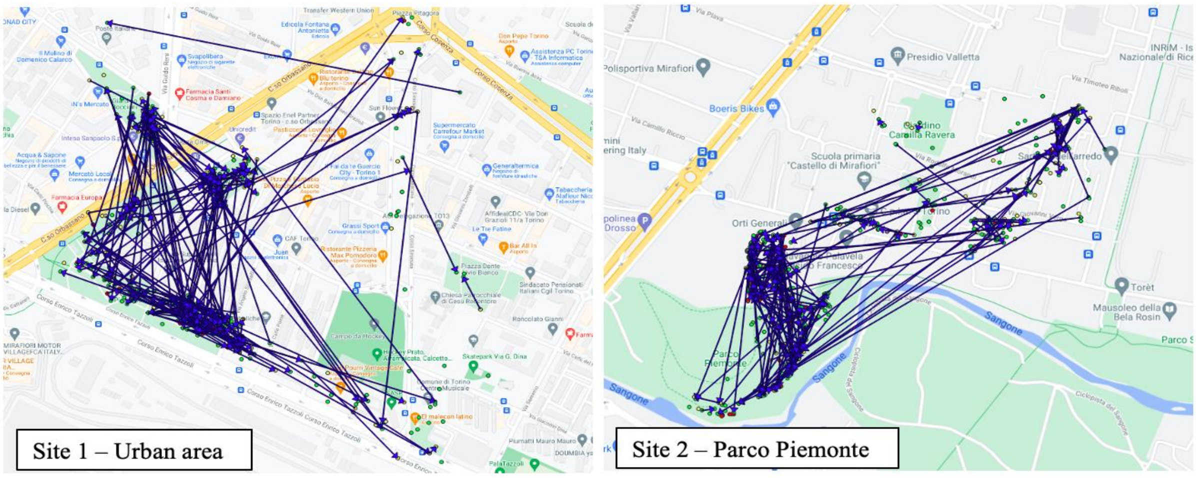

Figure 2. Maps that show the exact position of every captured and recaptured butterfly. The individuals recaptured one or more times here are shown as connected by an arrow that describes the general direction of the movement.

We are designing and we plan to train a MAS in order to model the mobility of butterflies within green cities, considering different topologies and characteristics of green areas. A MAS is based on the concept of agent, an autonomous entity situated in an environment acting independently, asynchronously and according to (quite simple) rules defined at individual level. The complexity of the system modeling the society of agents leads to the emergence of (eventually complex) macroscopic dynamics as a consequence of the individual behaviors[10].

In a multidisciplinary approach, a team of biologists and physicists is designing the individual reasoning scheme ruling agents' behaviors in order to implement known butterfly behavioral patterns from literature. Such agents are designed as reactive agents, ruled by a simple parametric behavioral subsunction scheme, and exploit the geo-localisation features of a GAMA[11] framework importing GIS and shapefiles with the relevant urban territory information (buildings, roads, trees, extension and types of green areas). The comparison of agents' mobility with the collected movement data for butterflies could allow for a supervised training of the agents' parametric behavioral subsunction scheme, in order to model butterfly mobility in a green city.

A new set of movement data collected in the near future could hence provide a validation set for the developed MAS. Once validated, the MAS could be exploited in order to predict the topology of the green areas in a city maximizing its permeability for butterflies.

We plan to investigate the impact of the environment attributes on butterflies' mobility, and to exploit the experimental collected data to perform a kind of learning of the distributed artificial intelligence embodied in the developed MAS. The layered description of the environment attributes allows for: a simplified customization of the MAS to each specific city it will be adopted by; a simplified adaptation of the environment description to the evolution of the green areas attributes and/or to the deployment of new ones; to search for a possible hierarchy within the environment attributes for their impact on butterflies' mobility.

Each campaign of data collection in the field can hence provide feedback to the MAS, acting as a series of learning stages. The city and its butterflies become hence key actors within the living lab the MAS is aiming to model.

The subsunction approach in the agents' implementation should make such a feedback scheme more feasible: agents' behaviors are as simple as possible, deploying to each agent the minimum degree of intelligence required to mimic data from the field or from literature. To some extent, the feedback on the MAS could impact in most cases just on the hierarchical order of the subsunction behaviors, or on a few of their parameters, without involving complex redesigning of the agents' individual intelligence.

Conclusion

The above mentioned collected movement data can provide a training set for Multi Agent Systems modeling the mobility of butterflies within a green city. The MAS can then be validated exploiting as a test set the movement data whose collection is planned in 2023.

Multiple running simulations selecting input values ranging in parameters space and the comparison of the MAS output with experimental data, are needed in order to test and validate our MAS.The MAS then, would help to identify which of the architectural and ecological variables plays a major role in the butterflies' dynamics and how they rule the pollinators' permeability within an urban environment.

Under the view of a Living Lab ecosystem, the results provided by the MAS could be used as guidelines to create a real-life environment, where the integration of research and innovation processes can be made. Ideally, the effects of this project would affect main stake-holders in the urban area of Turin: Users, Public actors (policy makers and city managers), Private actors and Knowledge institutes (researchers), through a co-creation approach in public–private–people partnerships[12]. From this innovative interdisciplinary approach to the urban ecology studies, policy makers and urban area managers (such as urban architects and landscaper) could integrate a new point of view in the planning operation of public green areas, about both structural and biological perspectives.

In order to succeed in this operation, a multi stake-holders approach is required. The actual users of the city (citizens) could join the research (held by the University of Turin) as well as the private little realities, such as in Parco Piemonte (site 2 of our project) and its community allotment. In the first case, a citizen science project based on monitoring urban pollinators fauna can improve interest about conservation of wildlife in an urban landscape. In the second case, the community allotment guided by the project “Orti Generali”, in which gardener citizens are involved as stake-holder in the adaptation of an abandoned urban green area to a sustainable garden, can even be integrated as stake-holders in the requalification of the area, under the light of pollinator conservation and permeability of ex-industrial area of the city. This approach based on integration of different users could be used in any urban allotment, by any user, in the city of Turin.

Turin can act as a case study, but the degree of customisation allowed by the selected design of the MAS would allow for the application of such an approach to any city, accounting for specific characteristics of its environment and, requiring a deeper level of customisation of the agents’ behaviors but not a redesign of the MAS, as well for different species of pollinators.

References

1. Seto, K. C., Güneralp, B., & Hutyra, L. R. (2012). Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. Proceedings of the National Academy of Sciences, 109(40), 16083-16088.
2. UNDESA, World Urbanization Prospects: 2018: Available online at: https://population.un.org/wup/Publications/Files/WUP2018-KeyFacts.pdf.
3. Bonelli, S., Casacci, L. P., Barbero, F., Cerrato, C., Dapporto, L., Sbordoni, V., ... & Balletto, E. (2018). The first red list of Italian butterflies. Insect Conservation and Diversity, 11(5), 506-521.
4. Thomas, J. A. (2016). Butterfly communities under threat. Science, 353(6296), 216-218.
5. Warren, M. S., Maes, D., van Swaay, C. A., Goffart, P., Van Dyck, H., Bourn, N. A., ... & Ellis, S. (2021). The decline of butterflies in Europe: Problems, significance, and possible solutions. Proceedings of the National Academy of Sciences, 118(2).
6. Grimm, N. B., Faeth, S. H., Golubiewski, N. E., Redman, C. L., Wu, J., Bai, X., & Briggs, J. M. (2008). Global change and the ecology of cities. Science, 319(5864), 756-760.
7. Baldock, K. C. (2020). Opportunities and threats for pollinator conservation in global towns and cities. Current opinion in insect science, 38, 63-71.
8. E.H. Durfee and J.S. Rosenschein, "Distributed Problem Solving and Multi-Agent Systems: Comparisons and Examples", Proc. 13th Int'l Distributed Artificial Intelligence Workshop, pp. 94-104, 1994.
9. Rowlings, Matt. "Large White." Pieris Brassicae - Field Notes. N.p., n.d. Web. 24 Oct. 2013
10. Wooldridge, M. (2009). An Introduction to MultiAgent Systems. Wiley Publishing
11. GAMA Platform website, http://gama-platform.org
12. Steen, Kris & van Bueren, Ellen. (2017). Urban Living Labs: A Living Lab Way of Working

Full Research Paper

Living lab research designs in Circular Economy projects: A multiple case study

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Abstract

Living lab approach has been suggested as a promising approach for co-creating and testing CE Business Models (CEBMs) in real-life settings with real end-users. However, in-depth analysis of living lab research designs in the context of circular economy projects are somewhat uncharted. European Commission H2020 funded project CIRC4Life, developing and demonstrating CEBMs in four industrial sectors, provided data for this multiple case study. Qualitative document analysis, interviews and an action research approach were applied to (1) identify living lab activities and map them (2) across the CE value chain and (3) innovation process phases at the project level and in five case companies. Key findings include (1) identification of the seven main method choices, (2) individual living lab activity tendency to address more than one CE phase at the same time, (3) devoting most efforts into very beginning and the end of the innovation process, and (4) three quarters of living lab activities grounded on single Quadruple Helix (QH) group and (5) dominant share of real end-user's representatives over other QH stakeholders. To conclude living lab research design choices are influenced by many factors, although some similarities were observed between case companies.

Keywords

circular economy; research design; circular economy business model; co-creation; concept test; pilot test; innovation management process; case study; circular economy value chain

Introduction

The European Network of Living Labs (ENoLL) – an international non-profit association promoting and enhancing user-driven innovation ecosystem – defines living lab as user-centred, open innovation ecosystem based on a systematic user co-creation approach, integrating research and innovation processes in real life communities and settings. In short, a living lab can be considered as “a design research methodology aimed at co-creating innovation through the involvement of aware users in a real-life setting” (Dell'Era et al, 2014). In Europe, living lab approach has been applied to develop circular economy (later CE) solutions within various industrial settings, especially with the help of Horizon 2020 funding (Santonen et al, 2017). However, only few case studies are focusing on analyzing living lab activities in the contexts of circular economy.

These prior studies have thematically focused on e.g. understanding relationships between the ecosystem actors (Engez et al, 2021), doing SWOT-analysis (Cuomo et al, 2021), evaluated living labs possible in sustainable rural development (Zavratnik et al, 2019), creating more sustainable buildings (Minunno et al, 2020) or experimenting re-usage of building materials (Rizzo et al, 2017). The studies directly addressing the living lab process and/or applied methods have remained at a very generic level without revealing any or very little details of the applied methods and their outcomes during different innovation process phases (Acke et al, 2030; Obersteg et al, 2020; Mazurek et al, 2021; Amenta et al, 2019). As a result, it can be argued that there is a need for further investigating what kind of research, co-creation and testing methods CE-related living lab projects can apply during the different CE and innovation process phases. Therefore, this multiple case study focuses on (1) mapping and describing living lab methods choices across the CE value chain and innovation process phases and (2) evaluating whether and how these choices vary between the phases. Consequently, the following research questions are defined:

- (RQ1) What kind of living lab activities are utilized when developing CEBMs?
- (RQ2) How living lab activities are divided between different CE phases?
- (RQ3) How living lab activities are divided between different innovation process phases?

This paper is structured as follows. After this introduction, circular economy value chain phases are described. Next the overall research design is presented and followed by the result section. Finally, results are discussed and reflected through the research questions, and finally, some conclusions are made.

Circular Economy Value Chain

In recent years the concept of circular economy has gained substantial interest among scholars and practitioners. Especially in Europe, CE is a rapidly growing trend due to the new actions plans such as The European Green Deal (European Commission., 2019). However, the scientific basis for the CE is still somewhat scattered and without a coherent definition (Korhonen, et al. 2018) while numerous definitions and dimensions for describing CE have been proposed (Kirchherr, et al. 2017). In simplified terms, the main idea in CE is to minimize required resources and waste generation, utilize cleaner technologies while maintaining the value of the products, materials, and resources for as long as possible (European Commission, 2015).

CE systems consist of multiple cycles and value chain phases, and utilize a combination of sharing/renting, repairing/refurbish, re-use, remanufacturing or recycling approaches, each having different types of strategies to *close* or *slow* the *loop* (Jørgensen & Pedersen, 2018; O'Brien et al, 2018; Hamari, 2016; Codagnone & Martens, 2016; King et al, 2006; Directive 2008/98/EC, 2008). *The slow loop* strategies focus on slowing material flows to increase products life extension, while *the closed loop* strategies are grounded on an ideology of recyclable design, in their aim in reducing waste generation to a minimum (Mestre & Cooper, 2017). In this article, a CE value chain (Figure 1) is defined according to Kalmykova et al, (2018), covering a number of interlinked life-cycle phases, each including different strategic choices.

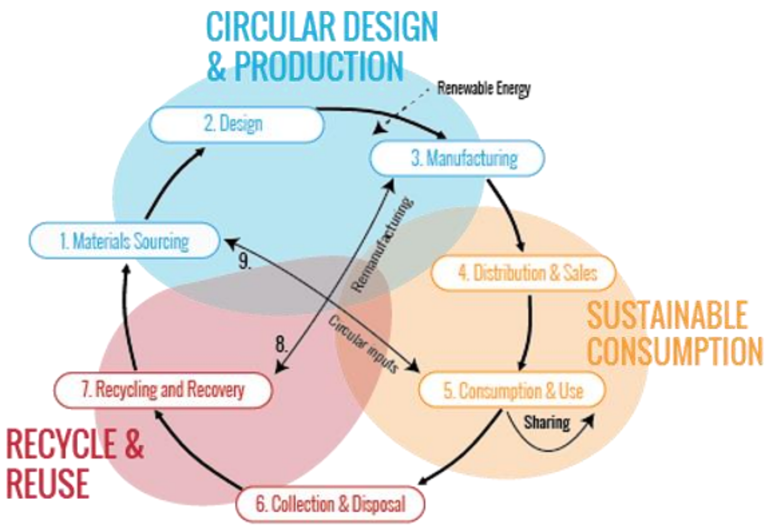


Figure 1. CE value chain phases.

As presented in Figure 1, CE value chain consists of the following phases: (1) material sourcing, (2) design, (3) manufacturing, (4) distribution & sales, (5) consumption & use and sharing, (6) collection & disposal, (7) recycling and recovery, (8) remanufacturing and (9) circular inputs. The first three phases focuses on re-designing the production and follow-up value chain phases to respect the sustainability. Sustainable consumption covering distribution & sales, consumption & use and sharing focuses enabling the logistics, sales and use of products and services in a way it minimizes the environmental impacts. Finally, recycle & reuse covers the phases in which old products are either repaired or remanufactured into new products, or turn into new raw materials.

Overall, companies must overcome various challenges to make the transition to CE and to develop their CE business models (later CEBMs) (Bressanelli et al, 2019; Bocken et al, 2104). Developing a CEBM requires ecosystem-wide orchestration and seamless collaboration between diverse groups of actors across the CE value chain, including the consumers (Parida et al, 2019). Therefore, managing CEBM development process calls out for tools, methods, and innovation process such as a living lab, which embrace multi-stakeholder collaboration, and offer a genuine possibility for all relevant stakeholders to make their voices heard.

Research design

Sample selection

CIRC4Life is a European Commission H2020 funded project developing and demonstrating CEBMs in four industrial sectors while utilizing the living lab approach, was selected as the core of the data collection. Consequently, the following five companies from four industrial sectors participating the project, formed the sample group (Yin, 2009) for this multiple case study:

- **LED1: Domestic LED lighting company** developing (1) a modular lamp design made from industrial scrap materials and minimizing product's environmental impact based on Life Cycle Assessment calculations, (2) an approach for proving eco-information at their online shop and (3) a take-back system to collect faulty products from their online shop consumers.
- **LED2: Industrial LED lighting company** developing (1) leasing service model and (2) a new modular lamp with a substantially better environmental impact
- **ELEC: Electronics recycling company** developing (1) a new intelligent bin-based waste collection system to collect unused electronic products from consumers and (2) an incentive scheme to reward consumers for recycling the unused electronic products
- **VEG: Vegetable farm** developing (1) organic apple juice from the discarded apples, and (2) a QR code enhanced eco-label indicator for presenting and comparing product's environmental impact at the retailer.
- **MEA: Meat supply chain company** developing (1) two new sustainable products while minimizing product's environmental impact based on Life

Cycle Assessment calculations, and (2) a QR code enhanced eco-label indicator for presenting and comparing product's environmental impact at the retailer.

It needs to be noted, that in the H2020 context the funding application already defines preliminary CEBM's for each of the companies, which set the operational and strategic boundaries for the development and testing activities.

Data collection

The longitudinal data collection started in May 2018 and continued into May 2021. The data and method triangulation were applied as follows. Qualitative document analysis (Bowen, 2009) was conducted to (1) identify the utilized living lab methods during (2) the various living lab innovation process phases and (3) in different CE value chain phases. For our research purposes, the following innovation process phase classification was utilized (adapted from Schuurman et al, 2016; Santonen, 2020; European Commission, 2017): **(IP1)** Concept creation, **(IP2)** Concept testing, **(IP3)** Mock-up testing, **(IP4)** Prototype testing, **(IP5)** Internal real-life testing and **(IP6)** External real-life testing. For CE phase classification framework proposed by Kalmykova et al, (2018) was utilized (Figure 1): **(P1)** Material sourcing, **(P2)** Design, **(P3)** Manufacturing, **(P4)** Distribution & sales, **(P5)** Consumption & use and sharing, **(P6)** Collection & disposal, **(P7)** Recycling & recovery, **(P8)** Remanufacturing, and **(P9)** Circular inputs.

The analyzed dataset consisted of the official project documentation including (1) living lab implementation plans, (2) reports on the individual living lab activities' results, and (3) the project deliverables describing the implementation of the company's demonstration case. At the end of the year 2020, when majority of the living lab activities were executed, the key stakeholders from each case company were also interviewed, excluding the vegetable micro farming (VEG). The aim of the semi-structured interviews was to clarify the objectives, living lab activities, outcomes, satisfaction, possible surprises, and challenges relating each individual living lab activity. All interviews were recorded, and summary reports were written. Finally, the authors of this study were also actively participating in designing and implementing the living lab activities, therefore this study can also be considered as an action research study (McNiff, 2013).

Results

Identification of the different living lab activity types

The first-pass document review was conducted to identify and categorize the different individual living lab activities conducted during the project, which led to the identification of the following seven activity categories:

1. ***Open Innovation Camp*** (later OIC) (Santonen et al, 2019) is a multi-day design sprint type of co-creation event in which a group of various stakeholders are developing solutions to the predefined challenges in a facilitated working environment by utilizing a variety of co-creation methods. The OIC highlights the systematic cross-fertilization of ideas and expertise derived from diverse participants (Santonen, 2016).

2. ***Open community involvement*** included various open access activities such as crowdsourcing (Estellés-Arolas et al, 2012) which is a process where a task(s) is delegated (i.e. outsourced) via an open call by using internet to a large group of people (i.e. crowd) who complete the task according to task description. Open Design Challenge was arranged to co-create eco-label, which can present products related sustainability information.

3. ***Real-life testing*** (also sometimes referred to as field test) is a process where quantitative and/or qualitative feedback is collected from the real target group in real-life settings by utilizing different data collection methods, to validate whether the solution is working as intended, identifying comparing actual and expected outputs and user reactions and/or to make decisions for further actions (Coorevits et al, 2018).

4. ***Facilitated testing*** is a process where quantitative and/or qualitative feedback is collected from a target group in a controlled setting (e.g. laboratory, simulation or another similar highly controlled setting) by using low-fidelity to hi-fidelity concepts/prototypes in order to evaluate developed solution feasibility, practical potential, acceptance, and/or make decisions for further development (Schuurman et al, 2016).

5. ***Co-creation workshop*** is a facilitated group activity to find solutions for a specific problem by gathering ideas and insights from workshop participants while using variety of collaborative development methods (Schuurman et al, 2016; Hagy et al, 2017).

6. ***Survey*** (Ramaswamy et al, 2018) is a data collection technique of gathering data from a sample of people in which a formal list of questions is prepared, and statistical methodologies are used for analysing the results. Online, telephone, and street/mall intercept surveys were utilized during the project.

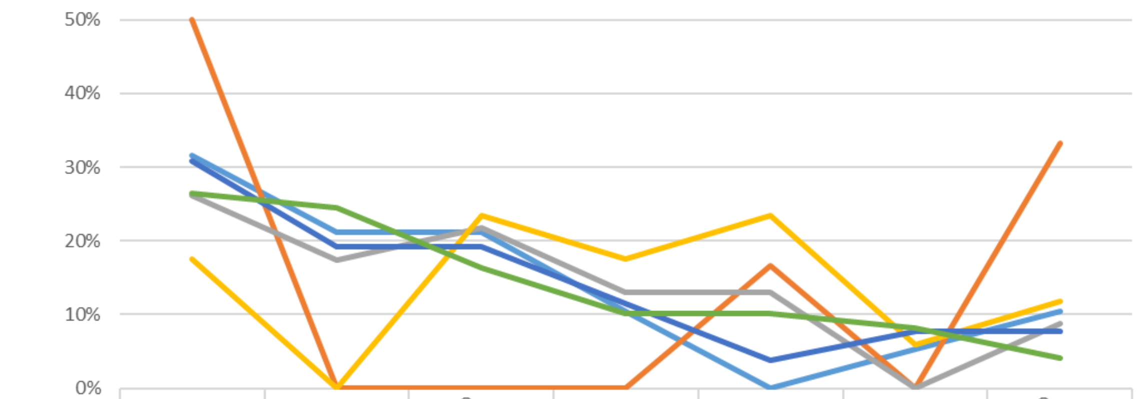
7. ***Interview*** (Fowler, 2013) is a qualitative data collection method taking place in an individual or a group setting (i.e. focus groups). Interviews follow either structured, semi-structured or unstructured interview approach and can be

conducted in face-to-face, telephone or computer-mediated online setting.

An overview by living lab activities by case companies

Figure 2 presents the relative share of different living lab activities implemented by each case company. Number of the each living lab activity by case companies is presented in Appendix Table 1.

The most popular activity within the project was **co-creation workshop** (N=13, 26.5% share of all living lab activities), while five of them were so-called ‘multi-partner workshops’, covering more than one case companies’ focus areas. In all, approximately one third of all the living lab activities were grounded on multi-partnership. The second most popular living lab activity was **facilitated testing** (N=12) representing 24.5% share of all activities. Merely one facilitated testing was grounded on a multi-partner approach and focused on testing the eco-point mobile application. **Open community involvement** was the third most popular approach (N=8, 16.3% of all activities) while half of them were implemented in multi-partner setup. **Surveys** (N=5, 10.2% share), **interviews** (N=5, 10.2% share) and **real-life testing** (N=4, 8.2% share) gained similar interest. All real-life tests were executed by a single company while 3 out of 5 surveys (60%) were following a multi-partner approach. One out of five interviews was a joint effort to define user preferences for mobile application. The least utilized approach was open innovation camp (OIC), in which all partners participated twice. All but one (i.e. VEG) of the case companies were favoring a workshop-dominant approach.

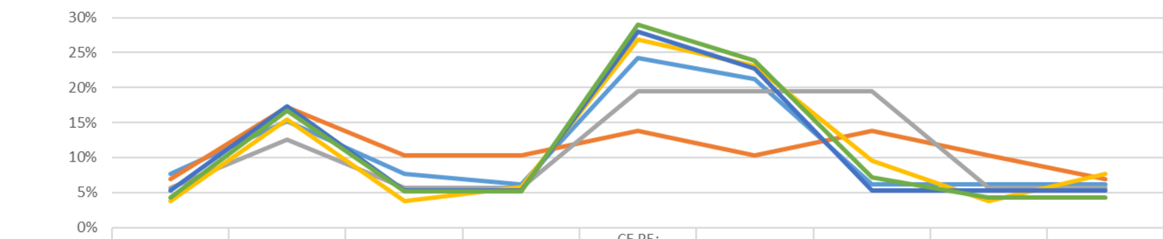


	Workshop	Facilitated testing	Open community involvement	Survey	Interview	Real-life testing	Open innovation camp
LED1	31,6 %	21,1 %	21,1 %	10,5 %	0,0 %	5,3 %	10,5 %
LED2	50,0 %	0,0 %	0,0 %	0,0 %	16,7 %	0,0 %	33,3 %
ELE	26,1 %	17,4 %	21,7 %	13,0 %	13,0 %	0,0 %	8,7 %
VEG	17,6 %	0,0 %	23,5 %	17,6 %	23,5 %	5,9 %	11,8 %
MEA	30,8 %	19,2 %	19,2 %	11,5 %	3,8 %	7,7 %	7,7 %
Total*	26,5 %	24,5 %	16,3 %	10,2 %	10,2 %	8,2 %	4,1 %

Figure 2. Relative share of the implemented living lab activities by case companies and living lab activity type. (* Total value indicates the number of different activities at the project level (i.e. some the activities were joint effort between multiple companies).

An overview by CE value chain phase activities by case companies

Figure 3 presents the relative share of different living lab activities in each CE value-chain phase by case companies. Number of the activities for each phase by case companies is presented in Appendix Table 2.



	CE P1: Material sourcing	CE P2: Design	CE P3: Manufacturing	CE P4: Distribution & sales	CE P5: Consumption & use and sharing	CE P6: Collection & disposal	CE P7: Recycling & recovery	CE P8: Re-manufacturing	CE P9: Circular inputs
LED1	7,6 %	15,2 %	7,6 %	6,1 %	24,2 %	21,2 %	6,1 %	6,1 %	6,1 %
LED2	6,9 %	17,2 %	10,3 %	10,3 %	13,8 %	10,3 %	13,8 %	10,3 %	6,9 %
ELEC	5,7 %	12,6 %	5,7 %	5,7 %	19,5 %	19,5 %	19,5 %	5,7 %	5,7 %
VEG	3,8 %	15,4 %	3,8 %	5,8 %	26,9 %	23,1 %	9,6 %	3,8 %	7,7 %
MEA	5,3 %	17,3 %	5,3 %	5,3 %	28,0 %	22,7 %	5,3 %	5,3 %	5,3 %
Total*	4,3 %	16,7 %	5,1 %	5,1 %	29,0 %	23,9 %	7,2 %	4,3 %	4,3 %

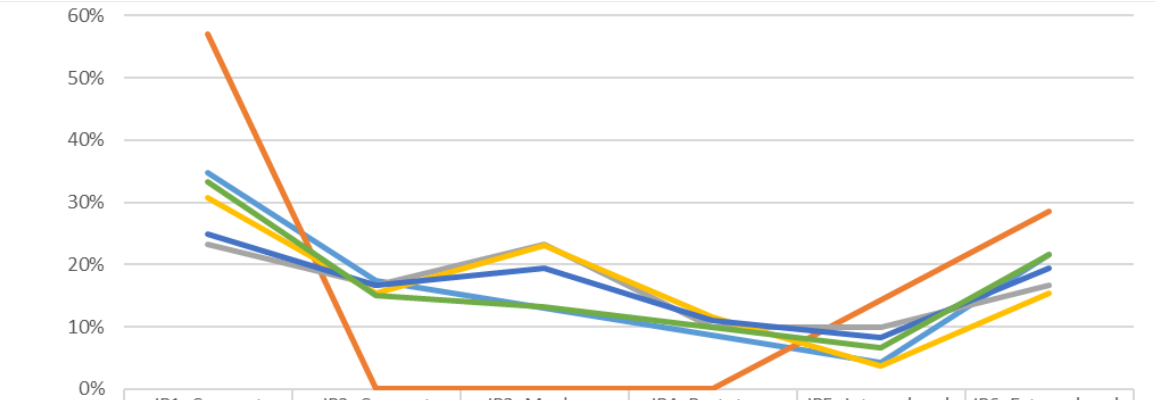
*Figure 3. Relative share of the implemented living lab activities by each case company and CE value chain phase. * Total value indicates the relative share number of different activities at the project level (i.e. some the activities were joint effort between multiple companies).*

The Figure 3 reveals a kind of two-humped camel in which (CEP5) **Consumption & use and sharing** (N=40, 29.0%) and (CEP6) **Collection and disposal** (N=33, 23.9%) formed the first hump. These phases were the two most addressed CE phase at the project activity level as well as the most popular choices among the case companies excluding the **LED2** company. The second hump, (CEP2) **Design** was **the third most** emphasized phase. Interestingly, most of the activities (79.6%) addressed more than one CE phase during the activity. This observation genuinely highlights a need to understand the seamless interaction between the CE phases when co-creating novel CE solutions. In most cases, two (N=23, 46.9%) or three (N=7, 14.3%) CE phases were addressed simultaneously. Open innovation camps and consortium level activities (N=5, 10.2%) were anomalies since during them all the CE phases were covered.

An overview by innovation process phases by case companies

Figure 4 presents the relative share of different living lab activities in each innovation process phase by case companies. Number of the activities for each phase by case companies is presented in Appendix Table 3.

At the project level, the opposite ends gained popularity. (IP1) **Concept creation** was the most popular innovation process phase, both, at the project and a company level (N=20, 33.3%). Industrial LED lighting company (LED2) devoted over half of their efforts in this phase (N=4, 57.1 percent) while the remaining companies followed more modest strategy: (LED1) N=8, 34.8%, (ELE) N=7, 23.3%, (VEG) N=8, 30.8%, and (MEA) N=9, 25.0%. At the project level, the second most popular (N=13, 21.7%) innovation process phase was (IP6) **real-life testing** (i.e. testing participants were beyond project consortium members or their employees). However, at the company level, either real-life testing or mock-up testing were the second most popular phases. Like in the previous CE phase analysis, **LED2** company followed their own path and basically omitted concept, mock-up, and prototype testing phases. **ELE** and **MEA** companies applied almost the same approach, the most popular phases being (IP1) and (IP6), and being followed by (IP3) mock-up testing, (IP2) concept testing, and (IP5) internal real-life testing.



	IP1: Concept creation	IP2: Concept testing	IP3: Mock-up testing	IP4: Prototype testing	IP5: Internal real-life testing	IP6: External real-life testing
LED1	34,8 %	17,4 %	13,0 %	8,7 %	4,3 %	21,7 %
LED2	57,1 %	0,0 %	0,0 %	0,0 %	14,3 %	28,6 %
ELE	23,3 %	16,7 %	23,3 %	10,0 %	10,0 %	16,7 %
VEG	30,8 %	15,4 %	23,1 %	11,5 %	3,8 %	15,4 %
MEA	25,0 %	16,7 %	19,4 %	11,1 %	8,3 %	19,4 %
Total*	33,3 %	15,0 %	13,3 %	10,0 %	6,7 %	21,7 %

Figure 4. The overview of the implemented living lab activities by each case company and innovation process phase. (Total value indicates the number of different activities at the project level (i.e. some the activities were joint effort between multiple companies).*

Discussion

Living lab activity type dicussion

The authors of this study had an active role in the case studies as a living lab 'orchestrator', being responsible for creating, maintaining, and updating the case-specific living lab action plans and supporting the overall execution. While these action plans and goal-specifications were produced by the living lab orchestrator in close cooperation with the case companies, the companies themselves made the final selection of the living lab activities and the decision of their overall contribution to the tasks. All case companies had merely minor or modest prior experience in co-creation and living lab approach, which influenced the research design choices. Therefore, the findings of this study show varying level of engagement among different case companies, as co-creation was perceived by the companies *as laborious process that required more resources from a company, than was initially expected*. It can be concluded that the living labs research design choices depend on several factors, including a company customer knowledge; understanding and acceptance of user-centered design and open innovation; knowledge and readiness of co-creation and iterative development and finally, ability to engage relevant stakeholders and to transfer the collected insights into development decisions.

Consequently, some of the initially proposed and planned living lab activities were discarded, either due a reluctance of a project partner, or due unexpected occurrences, such as COVID-19. In some of these situations', required mitigation actions were done by the living lab orchestrator taking a lead role and conducting activities separately from the case companies, or by re-developing and applying online methods instead of physical activities. Furthermore, some of the method choices, such as Open Innovation Camp (OIC), cannot be executed by a single SME company alone due significant cost factor, which should be noticed when interpreting the results.

CE value chain and stakeholder division discussion

Ca. 80 percent of all living lab activities addressed more than one CE phase. The most dominant and addressed "CE phase pair" was (CEP5) Consumption & use and sharing and (CEP6) Collection & disposal. This finding could be explained by the case companies' development objectives, which were associated either to sustainable product development (modular LED lamps, web shop, meat and farming products) or service systems (take-back scheme, electronic waste collection, eco-label, mobile eco-application). To secure the market acceptance, direct feedback from the end-users is required to make the solutions appealing. Moreover, in this case study, the companies focus was on consumer solutions, excluding LED2, which focused on business-to-business services. The mentioned development focus can also explain the quadruple helix stakeholder division, which emphasized consumer groups.

The division between multi-stakeholder activities (i.e. more than one quadruple helix group was present during the activity) and single stakeholder activities was in favor for single stakeholder events (N=13, 26.5 percent vs. N=36, 73.5 percent). The number of participants point of view, single stakeholder activities gathered much more participants than multi-stakeholder activities (N=2610, 86.8 percent of the all participants vs. N=397, 13.2 percent). As a result, the most dominant stakeholder group in the living lab activities (N=2718, 90.4 percent) were the consumers (a.k.a. end-users). The division between the remaining stakeholder groups was the following: Business partners (N=136, 4.5 percent), academia (N=130, 4.3 percent), and public authorities (N=23, 0.8 percent). In all, 3007 persons participated in the 49 different living lab activities.

The outcome of the CE phase division would have been significantly different if emphasis had been e.g. the development of (CEP1) material sourcing (CEP3) sustainable manufacturing processes, or (CEP9) circular inputs. It is pointed out that all the product development activities included life-cycle assessment (LCA) analysis, which formed a solid foundation to investigate the environmental and social impact of the proposed solution. For companies, these calculations were made by other consortium member, to whom the particular role was devoted. However, it can be argued that this study is giving a good representation of the living lab project research design in context of consumer products related CEBMs.

Innovation process phase discussion

(IP1) Concept creation became the most popular innovation process phase to execute living lab actives while the second most popular phase (IP6) real-life testing with externals. It is argued that strong emphasis on the first (IP1) Concept creation phase will pay out in the later stage, since already from the start, the proposed solution included end-user preferred features and functionalities. Consequently, if the concept includes end-user suggested features already in the early stages, it reaches required maturity level fasted and is more easily accepted. This reduces the need for multiple follow-up test in later phases. However, since early concepts typically do not allow any genuine interaction, sometimes it is difficult to reliable assess the usability or design, which also affect the acceptance. Therefore, also cost-effective mockups are a good way for experimenting different alternative development choices. Among the case companies' concept and mock-up test gained somewhat similar interest and were closely followed by prototype test. Before revealing the solutions to public testing, small scale real-life, facilitated tests were executed in secure environment to verify that everything was functioning well. In fact, multiple iterations were made since the solutions did not achieve user acceptance during the tests. This kind of innovation process is typical among living labs.

Conclusions

During this study, the following seven living lab method categories for developing CEBM were identified: a multi-day design sprint events, crowdsourcing based open community involvement, co-creation workshop, interview, survey as well as facilitated and real-life testing. Among these, workshop and facilitated testing appeared to be the most popular choices. Companies devoted most efforts on *Consumption & use and sharing* and *Collection & disposal* phases which both have direct interaction with final end-users. Importantly, most of the living lab activities addressed more than one CE phase. This observation emphasizes a need to understand the seamless interaction between the CE phases when co-creating novel CE solutions. The opposite ends of the innovation process gained most popularity. *Concept creation* focusing on co-creation of the solution at conceptual level gained the most attention and about one third of all activities were devoted on this phase. The second most popular innovation process phase was **real-life testing,** although some variation among companies were identified. Living lab theories often highlight the need of engaging different types of Quadruple Helix stakeholder groups. In fact, during the project three quarters of living lab activities were grounded on single Quadruple Helix in which real end-users representatives dominated over other stakeholders. It is argued that the division of the participants varies greatly based on the development target. Respectively, the outcome of the CE phase division would have been significantly different if the developed solutions would have been different. It can be argued that this study is giving a good representation of the living lab project research design in context of consumer products related CEBMs since all the companies targeting consumers followed very similar living lab strategy.

This study was grounded on one European Commission H2020 funded project, having a large 7.2 MEUR budget. Therefore, the outcomes of this study cannot be directly generalized to a living lab project solely funded by private SME companies. Furthermore, since the project partners shared collective outcomes, such as mobile application and eco-point label system, an individual consortium member did not have significant control over the decisions including an overall selection of living lab approaches in the project. The project duration spanned over 3 years and a significant part of the project was impacted by COVID-19. As a result, the original living lab plans had to be changed to favor online interaction. The living lab activity choices would have been different without the pandemic. Thus, the longitudinal data does not represent the optimal execution of a living lab project. Future studies should evaluate living lab activities distribution also in other industrial settings as well as look beyond circular economy settings. Replicating a similar analysis in various other project settings would help to increase our understanding how living lab project research designs are structured. The results of these analyses could be further reflected through the analysis of these projects' impacts and results to make future conclusions on preferable research design.

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References

1. Acke, A., Taelman, S.E. and Dewulf, J., (2020) A multi-stakeholder and interdisciplinary approach to waste management and circular economy: The case of Flanders and Ghent, Belgium. European Spatial Research and Policy, 27(2), pp.43-57.
2. Amenta, L., Attademo, A., Remøy, H., Berruti, G., Cerreta, M., Formato, E., Palestino, M.F. and Russo, M., (2019) Managing the transition towards circular metabolism: Living labs as a co-creation approach. SSOAR-Social Science Open Access Repository.
3. Bocken, N.M., Short, S.W., Rana, P. and Evans, S., (2014) A literature and practice review to develop sustainable business model archetypes. Journal of cleaner production, 65, pp.42-56.
4. Bowen, G.A., (2009). Document analysis as a qualitative research method. Qualitative research journal.
5. Bressanelli, G., Perona, M. and Saccani, N., (2019) Challenges in supply chain redesign for the Circular Economy: a literature review and a multiple case study. International Journal of Production Research, 57(23), pp.7395-7422.
6. Codagnone, C., Martens, B., 2016. Scoping the Sharing Economy: Origins, Definitions, Impact and Regulatory Issues. Institute for Prospective Technological Studies Digital Economy Working Paper, 1.
7. Coorevits, L., Georges, A. and Schuurman, D., (2018) A framework for field testing in living lab innovation projects. Technology Innovation Management Review, 8(12).
8. Cuomo, F., Lambiase, N. and Castagna, A., (2021) Living lab on sharing and circular economy: The case of Turin. Health Informatics Journal, 27(1)
9. Dell'Era, C. and Landoni, P., (2014) Living Lab: A methodology between user-centred design and participatory design. Creativity and Innovation Management, 23(2), pp.137-154.
10. Denzin, N.K. (1970). The research act: A theoretical introduction to sociological methods. Chicago: Aldine
11. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, OJ (2008) L 212/3
12. Engez, A., Leminen, S. and Aarikka-Stenroos, L., (2021) Urban Living Lab as a Circular Economy Ecosystem: Advancing Environmental Sustainability through Economic Value, Material, and Knowledge Flows. Sustainability 2021, 13, 2811.
13. Estellés-Arolas, E. and González-Ladrón-de-Guevara, F., (2012) Towards an integrated crowdsourcing definition. Journal of Information science, 38(2), pp.189-200.
14. European Commission (2017) EN HORIZON 2020 WORK PROGRAMME 2016 – 2017 20 . General Annexes (European Commission Decision C (2017) 2468 of 24 April 2017), Annex G, Technology Readiness Levels (TRL); 2017.
15. European Commission (EC). (2015) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Closing the Loop-An EU Action Plan for the Circular economy. COM 614/2; European Commission (EC): Brussels, Belgium, 2015.
16. European Commission., (2019) Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions–The European Green Deal. Document 52019DC0640, 640.
17. European Network of Living Labs (2021) Retrieved from: https://enoll.org/about-us/
18. Fowler Jr, F.J., (2013) Survey research methods. Sage publications.

19. Hagy, S., Morrison, G.M. and Elfstrand, P., (2017) Co-creation in living labs. In Living Labs (pp. 169-178). Springer, Cham.
20. Hamari, J., Sjöklint, M. and Ukkonen, A., (2016) The sharing economy: Why people participate in collaborative consumption. Journal of the association for information science and technology, 67(9), pp.2047-2059.
21. Huang, H., Su, D., Peng, W. and Wu, Y., (2020) Development of a Mobile Application System for Eco-Accounting. Sustainability, 12(22), p.9675.
22. Jørgensen S., Pedersen L.J.T., (2018) The Circular Rather than the Linear Economy. In: RESTART Sustainable Business Model Innovation. Palgrave Studies in Sustainable Business In Association with Future Earth. Palgrave Macmillan
23. Kalmykova, Y., Sadagopan, M. and Rosado, L., (2018) Circular economy–From review of theories and practices to development of implementation tools. Resources, conservation and recycling, 135, pp.190-201.
24. King, A.M., Burgess, S.C., Ijomah, W. and McMahon, C.A., (2006) Reducing waste: repair, recondition, remanufacture or recycle?. Sustainable development, 14(4), pp.257-267.
25. Kirchherr, J., Reike, D. and Hekkert, M., (2017) Conceptualizing the circular economy: An analysis of 114 definitions. Resources, conservation and recycling, 127, pp.221-232.
26. Korhonen, J., Honkasalo, A. and Seppälä, J., (2018) Circular economy: the concept and its limitations. Ecological economics, 143, pp.37-46.
27. Mazurek, D. and Czapiewski, K., (2021) What Solutions for Waste Management? Issues of Flows and Governance Exemplified by the Łódź Agglomeration (Poland). Energies, 14(12), p.3366.
28. McNiff, J., 2013. Action research: Principles and practice. Routledge.
29. Mestre, A., Cooper, T., (2017) Circular product design. A multiple loops life cycle design approach for the circular economy. The Design Journal, 20(sup1), pp.S1620-S1635.
30. Minunno, R., O'Grady, T., Morrison, G.M. and Gruner, R.L., (2020) Exploring environmental benefits of reuse and recycle practices: A circular economy case study of a modular building. Resources, Conservation and Recycling, 160, p.104855.
31. O'Brien, M., Doranova, A., Kably, N., Kong, M.A., Kern, O., Giljum, S. and Gözet, B., (2018) Eco-Innovation of products: Case studies and policy lessons from EU Member States for a product policy framework that contributes to a circular economy. Biannual Report.
32. Obersteg, A., Arlati, A. and Knieling, J., (2020) Making cities circular: Experiences from the living lab Hamburg-Altona. European Spatial Research and Policy, 27(2), pp.59-77.
33. Parida, V., Burström, T., Visnjic, I. and Wincent, J., (2019) Orchestrating industrial ecosystem in circular economy: A two-stage transformation model for large manufacturing companies. Journal of Business Research, 101, pp.715-725.
34. Qu, S.Q. and Dumay, J., (2011) The qualitative research interview. Qualitative research in accounting & management.
35. Ramaswamy, V. and Ozcan, K., (2018) What is co-creation? An interactional creation framework and its implications for value creation. Journal of Business Research, 84, pp.196-205.
36. Rizzo, S., Cappellaro, F., Accorsi, M., Orsini, F., Gianquinto, G. and Bonoli, A., 2017. Co-design for a circular approach in green technologies: adaptation of reused building material as growing substrate for soilless cultivation of lettuce (Lactuca sativa var. capitata). Environmental Engineering & Management Journal (EEMJ), 16(8).
37. Santonen, T. (2020). Circular Economy and Living labs: A multiple case study. In ISPIM Conference Proceedings (pp. 1-16). The International Society for Professional Innovation Management (ISPIM).
38. Santonen, T., (2016) Management of diversity in open innovation processes. In Open Innovation: A Multifaceted Perspective: Part II (pp. 631-658).
39. Santonen, T., Nevmerzhitskaya, J., Purola, A. and Haapaniemi, H., (2019) Open Innovation Camp (OIC)–A Tool For Solving Complex Problems Rapidly. In OpenLivingLab Days 2019 Conference Proceedings. European Network of Living Labs.
40. Santonen, T.; Creazzo, L.; Griffon, A. ;Bódi, Z. & Aversano, P., (2017) Cities as Living Labs – Increasing the impact of investment in the circular economy for sustainable cities. Brussels: European Commission.
41. Schuurman, D., De Marez, L. and Ballon, P., (2016) The impact of living lab methodology on open innovation contributions and outcomes. Technology Innovation Management Review, 6(1).

42. Yin, R. K. (2009). Case study research: Design and methods (Vol. 5). sage.
43. Zavratnik, V., Superina, A. and Stojmenova Duh, E., (2019) Living Labs for rural areas: Contextualization of Living Lab frameworks, concepts and practices. Sustainability, 11(14), p.3797.

Appendix

Table 1. Number of the living lab activities by case companies and living lab activity type.

Activity type	LED1	LED2	ELE	VEG	MEA	*Project total*
Workshop	6	3	6	3	8	*13*
Facilitated testing	4	0	4	0	5	*12*
Open community involvement	4	0	5	4	5	*8*
Survey	2	0	3	3	3	*5*
Interview	0	1	3	4	1	*5*
Real-life testing	1	0	0	1	2	*4*
Open innovation camp	2	2	2	2	2	*2*
Project total	*19*	*6*	*23*	*17*	*26*	*49*

Table 2. Number of the living lab activities by each case company and CE value chain phase.

CE value-chain phase	LED1	LED2	ELE	VEG	MEA	*Project total*
CE P1: Material sourcing	5	2	5	2	4	*6*
CE P2: Design	10	5	11	8	13	*23*
CE P3: Manu-facturing	5	3	5	2	4	*7*
CE P4: Distribution & sales	4	3	5	3	4	*7*
CE P5: Consumption & use and sharing	16	4	17	14	21	*40*
CE P6: Collection & disposal	14	3	17	12	17	*33*
CE P7: Recycling & recovery	4	4	17	5	4	*10*
CE P8: Re-manu-facturing	4	3	5	2	4	*6*
CE P9: Circular inputs	4	2	5	4	4	*6*
Project total	*66*	*29*	*87*	*52*	*75*	*138*

Table 3. Number of the living lab activities by each case company and innovation process phase.

Innovation process phase	**LED1**	**LED2**	**ELE**	**VEG**	**MEA**	***Project total***
IP1: Concept creation	8	4	7	8	9	*20*
IP2: Concept testing	4	0	5	4	6	*9*
IP3: Mock-up testing	3	0	7	6	7	*8*
IP4: Prototype testing	2	0	3	3	4	*6*
IP5: Internal real-life testing	1	1	3	1	3	*4*
IP6: External real-life testing	5	2	5	4	7	*13*
Project total	*23*	*7*	*30*	*26*	*36*	*60*

Full Research Paper

Codesigning with image prompts: working with culturally and linguistically diverse participants on sustainable solutions for smart cities

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Abstract

In our case study with the City of Casey's Living Lab, we explored the value of sustainable image prompts in 2 codesign workshops with culturally and linguistically diverse people. Three major findings were revealed: We found that participants kept discussions focused on the chosen image prompts suggesting designers need to pay careful consideration of image prompts in codesign activities. We found that image prompts revealed that people hold onto items they are attached to, even when they became worn and tattered, suggesting designers can consider including sentimental value in design solutions for sustainable ends. We found that image prompts reduced language misunderstandings between participants and disengagement with the activity, revealing the value in emphasising images over discussion with linguistically and culturally diverse people in codesign activities. We argue image prompts are valuable in codesign activities as they reduce verbal communication, creating enhanced engagement and deeper understanding of a topic especially where participants don't share the same language and/or cultural background. We caution codesigners to choose image prompts wisely as participant are fixated on the image in their discussions. We were surprised to learn sentimentality was an important factor for people on the topic of waste. Designers can learn from our lessons that including a sentimental value in the design of objects will appeal to people and may reduce waste in society.

Keywords

Codesign, interaction design, inclusive design, communication design, sustainability, multi-cultural contexts, communication of tacit knowledge, visual imagery for communication

Introduction

There has been a noticeable increase in the involvement of end-user research over the past 20 years, with the aim to create designs that answer end-user needs (Taffe 2017). Codesign allows stakeholders to reflect with situations to gather insights (Taffe 2018), and work with designers as “co-creators, rather than customers and users”, sharing their experiences in design processes (Steen 2011). As a result, codesign can empower communities by using their ideas and experiences to create solutions to their own problems, rather than creating outcomes based on designers’ assumptions.

Using co-design techniques to engage community members and designers throughout the design process can propel discussion. By providing participants with a greater understanding of other viewpoints, codesign can also reduce disagreements, produce better outcomes (Wilson et al. 2015) and provide a sense of ownership in the design, increasing the likelihood of its use (Hagen et al. 2012). However, the nature of co-design activities can influence participants’ willingness to engage with each other. Evaluation activities such as ranking concepts or ideas, for example, usually result in defensive or disengaged participants, where desires to avoid disagreement or avoid confrontation can often silence discussion, especially of negative traits (Taffe 2018). Taffe’s findings imply the value of comfort and freedom to contribute without fear of judgement are valuable in both motivating codesign engagement, and understanding stakeholder experiences. Additionally, Wilson et al. note that many co-design activities assume that participants can convey their ideas effectively (2015), which in culturally and linguistically diverse (CALD) communities cannot be guaranteed. Thus, codesign activities that rely heavily on verbal communication may limit engagement, as participants may not share a common language or cultural assumptions.

We worked with the City of Casey’s Living Lab (Casey Living Lab) hosted by a local council in Melbourne, Australia, to create co-design activities for workshops which can engage community members in finding ways to communicate their waste reduction initiatives. In a community survey done by the council, 52% of respondents placed environmental sustainability within their top three priorities, demonstrating its importance. As the City of Casey is a council with a significant CALD population that is expected to grow by 200,000 people over 20 years (City of Casey 2020), there is a need to manage ever-increasing levels of waste. Hence, the Casey Living Lab has embarked on several initiatives that have been shown to reduce waste and promote sustainability, including smart bins in public spaces, and data tracking of bin usage to reduce waste management costs (Luxford 2020). Education, particularly with the correct use of waste and recycling bins and the reduction of litter, is important to achieving the Casey Living Lab’s goals and decreasing the amount of material that reaches landfills (Rethink Your Waste! 2016).

Our research seeks to propose a series of activities which can bridge cultural and language barriers in co-design workshops, and can guide participants from defining a problem to synthesising potential solutions using waste management as a context.

We also discuss several case studies on codesign and waste disposal behaviours, showcasing best practice on how co-designed initiatives may influence community behaviour. The findings provide a basis for developing co-design activities, which are tested to determine the extent that our method motivates the discussion of ideas and potential solutions within the local community. Hence our research question is: What kinds of co-design activities are effective at bridging cultural and linguistic barriers to allow facilitators and other participants to understand stakeholders' tacit knowledge, for communication design outcomes?

Factors that Affect Consumer Sustainability Behaviour

Waste sorting behaviours tend to be influenced by several factors, one of which is awareness. For instance, Huda et al.'s study on mobile phone recycling procedures found that only 32% of participants knowing of the recycling program being studied, with 9% of people properly recycling their old electronics (2020), implying a connection between lack of awareness and incorrect disposal behaviours. Insufficient awareness may explain why many behavioural change programs rely on raising awareness of current actions. However, even when individuals are aware of issues, other factors often prevent action (Kirakozian 2016).

Previous behaviours also affect decision making around waste disposal (Xu et al. 2017). While adjusting decision-making patterns can be difficult as a result, encouraging people to repeat desired actions should increase the likelihood of favourable actions in the future. Efforts to change behaviour typically rely on providing information about correct behaviours or the consequences of failing to heed them, often resulting in minimal behavioural change. In the case of a plastic bag ban, no significant increase in plastic bag avoidance occurred until the negative reinforcement of said ban (Sharp et al. 2010).

Conversely, social influences including perceptions of social norms, intentions behind individuals' current actions, and the perceived extent of being in control affects waste disposal behaviours (Xu et al. 2017). The impact of social influences opens a potential solution, social nudges, defined by Thaler and Sunstein as an aspect that influences people's decisions without changing incentives or preventing access to options (2008), which implies that people can be driven to desired actions by making correct decisions easier, and incorrect decisions harder (Kirakozian 2016). Nagatsu describes how nudges may take place in practice, with the Texas, USA-based "Don't Mess With Texas" advertising campaign promoting the idea that people expect others to not litter on Texan highways. The campaign produced significant reductions in littering, with a 29% drop in waste in the first year of the campaign, and roadside waste reductions of 72% after six years (2015), with a possible reason being that behavioural change started from conformist individuals who sought to align with social norms, reaching out to more independent-minded people over time. While the study implies that nudges can change behaviour through influencing perceived social norms, understanding how people act and the optimal behaviours that would produce the greatest impact should be understood to ensure nudges are effective at causing desired changes.

Additionally, Gilal et al. found, in a study of recycling behaviours, that consumer interest and behavioural change "…can be better sustained through word-of-mouth engagement, online discussions and social networks", likely owing to how the methods leverage the communities around individuals. When word-of-mouth messages make people "…feel acknowledged and appreciated, or make them feel more competent, confident and capable of performing…" (2019, p. 13), individuals are more likely to recycle, implying that positive affirmations spread within communities can produce behavioural change – a possible social nudge. However, the factors that affect consumer sustainability behaviours differ based on the context that behaviours take place, thus codesign is valuable for understanding the extent of impacts and the effectiveness of potential solutions in a given context.

Effectiveness of Codesign in Generating Discussion and Creating Sustainability Outcomes

The effectiveness of codesigned solutions is influenced by the context in which codesign takes place. Codesign is useful for starting discussions between stakeholders, including community and council members, particularly with understanding the intentions and perceived social norms that drive their behaviours. As most design decisions are usually made near the beginning of the creative process (Kleinsmann, Valkenburg, and Buijs 2007), having codesign near the start of development is valuable to ensure insights are accounted for in decision making.

Successful codesign workshops often depend on end user engagement; one notable example is that asking people what they seek rarely result in deep consideration of a user's needs. Instead, generative methods that encourage creativity and reflection tend to motivate ideation among participants (Sanders 2000). Similarly, structured hands-on tasks such as building or creating something as a team can allow an outlet for creative ideas while seeming non-threatening, and tend to be more effective than whole-group brainstorms for ideation (Taffe 2018). Activities have the potential to gradually build up an understanding of issues, and enable participants to reflect on what they seek over time.

A waste management co-design workshop was run at the Agbogbloshie landfill in Accra, Ghana. Containing large amounts of electronic waste, it can be valuable if processed. However, typical recycling methods often release toxic chemicals, harming human health and the environment (Handel and Strazdus 2021). To address the issue, a co-design workshop was run with the Agbogbloshie site to optimise their processes and design a viable e-waste grinder to reduce the harms of e-waste processing. Owing to the COVID-19 pandemic, they could not meet with site workers or other community members. Therefore, discussions were held between a Ghana Institution of Engineering representative and people connected to the site. The representative then relayed this information to designers. While people could contribute to processes, the need to relay this through a third party reduces the ability for designers to respond to their needs (Handel and Strazdus 2021). This implies that allowing designers to directly collect information from codesign activities would be ideal, thus emphasising the need for direct communication rather than through intermediaries – suggesting that in the context of a CALD community workshop, using translators or interpreters to convey information may not be an effective means to allow engagement in workshops.

Instead, non-verbal communication strategies offer a potential solution to overcoming linguistic barriers. For instance, activities that involve making and doing can be helpful for people to express ideas without words, particularly for those who struggle with verbal communication (Moll et al. 2020) or between those who do not share a common language. However, the extent that activities relate to the design is important to ensure participant engagement. Wilson et al. in creating a co-design workshop for an aphasia (communication issues from brain injury) communication program, found that a charades game was more successful than a marshmallow-tower building game, as the former seemed more relevant to participants (2015). Workshop activities are more likely to engage CALD communities if they consider the context of the design and the participants, gradually build an understanding of the issue the design aims to solve, and engage participants with as few intermediaries as possible.

Casey Living Lab: Sustainable Casey and minimising waste

Our research aimed to answer how co-design can draw out the City of Casey's community's ideas and experiences around sustainability. These could be used to improve the Casey Living Lab's Smart City initiatives coordinated through their local Living Lab. Hence, the activities aim to visualise their Smart City Principles to residents, businesses and council members, thereby allowing them to discuss their experiences through several domains. These include:

- Shared Action and Leadership: Allowing everyone to play a role and add value to outcomes. This is achieved through digital and physical infrastructure.

- Future Ready: Understanding how present and emerging conditions can become meaningful for people, both now in in the future. This allows Smart City outcomes to assist the future needs of the Council and community effectively.
- Community Centred: Empowering communities through inclusive technologies and digital democracy methods, and ensuring smart city initiatives and communications answer community needs, rather than what others perceive them to be.
- Outcome Focused: Rather than using technology because it exists, it should be only used where it's effective. This toolkit therefore aims to find out what communication outcomes could be effective for the community.
- Sustainability: As a major aspect of Smart City Initiatives, sustainable growth forms the basis for future city planning. Smart technology and collected data can help promote sustainability. By involving community members in outcomes, communications can demonstrate to them and their peers how smart cities can be sustainable in their own lives (City of Casey 2020).

Given that activities can be an effective method to trigger discussions, each activity focused on a different subset of the above areas. These allowed Casey Living Lab to increase participation in their innovation workshops compared to discussions alone (which can result in people not knowing how to contribute).

Codesign process to develop community tools: activities and findings

We gathered groups of varying sizes (up to 5 people) to test each co-design activity in two separate trials, with the first focusing on waste management, and the second exploring sustainability more broadly.

The activities were developed over two separate workshop trials, henceforth called Workshop 1 and Workshop 2, with three activities tested:

- Trash-o-nary: This activity involved presenting a series of prompted drawings where participants visually conveyed their thoughts on the topic of waste reduction. The idea was to build an understanding of sustainability awareness.
- Emoji Evaluation: This activity aimed to Categorise pictorial prompts based on the topic of waste. Participants were asked to respond to the picture prompts with emojis to convey general feelings about imagery. Our aim was to understand and analyse the existing material.
- Build-a-Trashcot: Using selected items and images we aimed to build

communicative mascots with participants. This activity allowed synthesis of communicative outcomes from user understanding.

We sought to understand how effective each activity was in transferring participants' tacit knowledge into explicit knowledge. We aimed to optimise activities so they produced discussion around understanding waste disposal behaviours, and factors that motivate correct use of the Casey's waste reduction initiatives.

Activity 1: Prompted Drawings (Trash-o-nary)

Trash-o-nary is a codesign activity, based on the game of Pictionary. This activity was trialled in Workshop 1 and then improved and trialled again in Workshop 2. We used Pictionary's drawing and text game format to encourage participants to draw their ideas on waste and sustainability based on a series of prompts. It involved reading out a series of prompts and providing participants with 30 seconds to draw them (with 1 minute for the final prompt to account for consideration of ideas). After each, groups were given the opportunity to discuss with facilitators about what they drew and why.

Trash-o-nary aimed to motivate those with different languages and cultural backgrounds to participate. A 2015 study by Wilson et al. demonstrates the challenges codesign facilitators can face when people have difficulties in communicating with each other, which implies that discussions can be difficult for people who struggle to communicate in a common language. In our study we aimed to resolve this by allowing participants to communicate their thoughts visually in our Trash-o-nary game.

Trash-o-nary also aimed to support a dynamic environment where everyone could contribute new value to outcomes, and move from a surface-level understanding of sustainability to considering problems in their community and how possible solutions could resolve them. This was done to ensure participants remained comfortable with contributing. For example, people may be overwhelmed if asked for possible solutions first, and not know what to draw or discuss.

By placing this activity at the beginning of the workshop, it allows understanding of what and how people think about the topic of waste, while subsequent activities expand from these findings. This enables participants to think deeply about the issue before they extrapolate their views to future outcomes and communication solutions.

*Table 1. Prompts for Trash-o-nary ac*tivity. The instructions evolved over the two workshops.

Workshop 1 Prompts	Workshop 2 Prompts	Changes

What does waste mean to you? (30 secs) What does waste management mean to you? (30 secs)	Draw what sustainability means to you. (30 secs)	Asking what waste and waste management means as separate questions often produces similar answers. Questions are merged to allow a new prompt while keeping the activity as short as possible.
Draw the best thing about waste management. (30 secs)	Draw the most important thing in a sustainable future. (30 secs)	Asked about the “most important” aspect rather than the “best” aspect, which we found focuses participants on what they care about, rather than what they approve of.
	Draw how technology can make a more sustainable future. (30 secs)	Added a question on how technology can add to the topic, connecting this activity to Smart City initiatives.
Draw a problem with waste management in your community. (30 secs)	Draw a problem with sustainability in your community. (30 secs)	Only the topic was changed.
Draw something that will help you fix your previous problem. (1 minute)	Draw a way that technology could fix your problem. (1 minute)	Placed focus on technology to narrow the focus to Smart City initiatives.

Trash-o-nary started by asking participants to define the topic from a general level, before later prompts went into more detail. This ended with asking people to generate a sustainable solution based on a problem they found in their community, which required more time to allow them to consider potential solutions before selecting one to draw.

The success of the activity in generating discussion during Workshop 1 led to few changes being made to this activity in Workshop 2. However, the questions changed between the two rounds. This is a result of the project scope broadening from waste management to sustainability, and improvements in the flow of questions themselves.

Activity 2: Visual Image Discussion (Emoji Evaluation)

Workshop 1: Emoji Evaluation

Workshop 1's Emoji Evaluation activity began with the idea of discovering participants' reactions towards waste, which relied on pictures drawn from various internet sources. These were shown in an online meeting, as classes were online owing to long and strict COVID-19 lockdowns in Victoria, Australia. The activity aimed to determine participants' reactions and overall feelings to waste-related visual stimuli, by asking them to express how images made them feel using emojis – which provide a common language for people.

Initially, this activity aimed to understand reactions to waste alone, to determine motivations and barriers to current waste disposal. Using Collaborate Ultra (a video conferencing tool similar to Zoom), the activity was run with 5 slides shared on the main screen for all participants to see. Each image was waste related, with examples including plastic bags and bottles. Participants were asked to react with an emoji. Then participants were asked to quickly describe the reason for their reaction, as emojis themselves proved insufficient for people to express their thoughts. This issue implies that communication methods need to be versatile enough for people to convey tacit knowledge while allowing understanding by all participants.

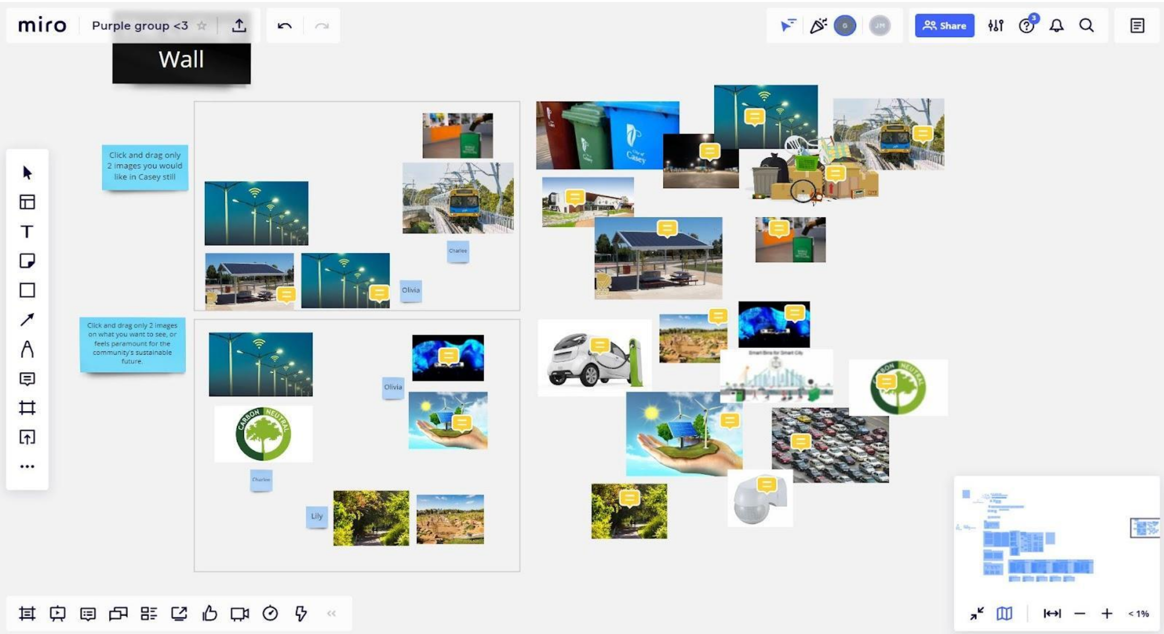

Figure 1. An example of the Emoji evaluation codesign activity conducted on Miro, an online whiteboard website. We asked participants to drag images, text, and other elements in a shared space. Pictures were selected by participants and used to generate discussion.

Workshop 2: Emoji Click 'n' Drag

Workshop 2's Click 'n' Drag activity was an online activity based in Miro (an online whiteboard service) due to COVID-19 lockdowns. It uses images split into two categories: current sustainability issues and solutions, and possible future solutions. Some examples include bins, waste, garbage trucks, hard rubbish collection and various technological solutions, both contemporary and futuristic.

The activity consists of discovering participants' reactions and emotions to said imagery and aims to create discussion on future sustainability perceptions and how solutions may fix issues in the long term. The Living Lab could then prioritise these solutions in their communications or implementation plans.

To run this activity, a link to the Miro board was sent to participants, who were asked to each click and drag 2 images for each of the prompts (current sustainability desires, and future desires respectively). After the pictures were chosen, each participant was asked to discuss why they chose their images, and how it made them feel. Instead of using emojis as a means of communication, the group was asked to discuss their reactions to the images by talking to each other based on how the images made them feel and what they would like to see in the future. While this approach succeeded in generating discussion and allowing them to express their experiences, this runs the risk of failing to engage those across a common language. Pictures may be able to bridge this gap partially, though a secondary means of communication may be required to fully resolve this, for instance, combining emojis with the ability to manipulate given pictures – though we were not able to test this.

Activity 3: Mascot Generation (Old Toy Mascot and Build-a-Trashcot)

Workshop 1: Old Toy Workshop

Workshop 1's activity, Old Toy Workshop, asked participants to evaluate old children's' toys to determine if people would throw out items that people are personally attached to. This aimed to understand the reasons behind 'hoarding' behaviour, as previous research found that consumers tended to store electronic waste rather than recycle it.

It involved displaying various worn-down toys to small groups (1-5 people) in Collaborate Ultra. Participants were asked to select from three multiple choice options in Collaborate's poll system (yes, no, or maybe). While this produced a variety of answers, discussions to elaborate on these tended to diverge from waste management behaviour. One individual pointed out, for instance, that there seemed to be little connection between old toys and e-waste, leading to confusion over the nature of the activity and a lack of meaningful data, thus affirming Wilson et al.'s point about the importance of activities being connected to design outcomes (2015).

To allow a wider set of meaningful answers, several improvements were added for further tests. These include expanding the range of poll options, and displaying electronic waste items instead of children's' toys. These efforts produced similar results to the first test. Additionally, e-waste items tended to produce similar answers and discussion throughout. One possible reason may be that people perceived few meaningful differences between items.

By displaying a variety of faulty or broken household objects, more meaningful discussion was created. It allowed an understanding of how people engage with objects, and how they would behave towards them. Participants also understood the connections between the activity and workshop goals, leading to greater trust between participants and facilitators. These tests demonstrate the importance of several aspects, including:

- The importance of interaction in an online space, such as through polls.
- Visual prompts being clear and relevant to workshop goals.
- Having a variety of prompts to allow focused discussion.

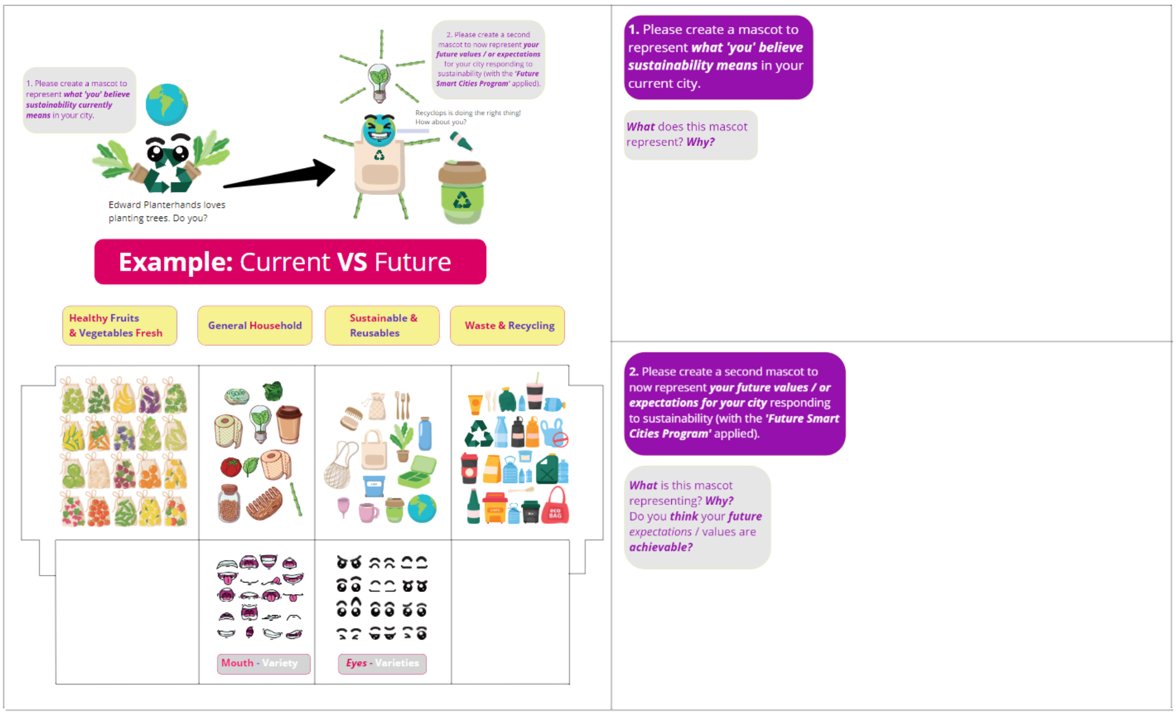

Figure 2. An example of the Old Toy Mascot codesign activity conducted on Miro board, aiming to provide instructions to allow semi-autonomous running of the below activity.

Workshop 2: Build-A-Trashcot

One of the major findings of Workshop 1 was that people tended to hold onto items they were attached to, even when they became worn and tattered. While considering the idea of solutions to overcome sentimentality, its tendency to reinforce storing outcomes opened a new possibility; generating sentimental value for sustainable ends.

This activity, therefore, aims to expand the interactivity and visual discussion aspects of Workshop 1's activity, while minimising the limited choice options and lack of focus it had.

Hence, the goal of this activity was to not only understand what will engage the community, but also create communication outcomes. These were used to raise awareness of negative behaviours and pivot sustainability values to encourage positive actions, and allow a greater understanding of how communication strategies can effectively convey the correct use of the City of Casey's smart bins and other Smart City initiatives.

This involved a selection of objects arranged in Miro, where participants in groups of 1-5 people were asked to each assemble mascots based on the following prompts:

1. Create a mascot to represent what you believe sustainability means in your current city.
2. Create a second mascot to represent your future values/expectations for your city.

These prompts were selected to give people the chance to distinguish current and future ideals in a visual manner. It can also determine any differences between them, and how they may be promoted in design outcomes. After this, participants are given the chance to discuss their mascots, and how they can be used to engage their communities, with findings from this useful for improving communication design outcomes.

Discussion

Three co-design activities around sustainable behaviour and waste management were tested and revised between the first and second workshops. By providing spaces for people to discuss their own experiences and knowledge, all three activities engaged our participants. Each activity produced discussion on different aspects of sustainability (existing ideals, sustainable futures, communication outcomes). However, how questions are framed changes the nature of discussion, with discussions about waste management tending to spawn discussion about consumer-facing waste infrastructure such as bins. Sustainability, in contrast, tends to focus on communal and future impacts, particularly in terms of preserving natural environments. Thus, participants' perceived definitions of given topics can affect discussions.

COVID-19 lockdowns meant that all activities were run online, but the activities facilitated effective communication despite this. However, issues with online whiteboard services often made activities where participants needed to move images more difficult. We found that the need to deal with these issues can make activities take more time than intended. Despite these, activities can still be useful for gathering data about community needs, and informing the values and communications that people are receptive to. The activities could be run in an offline space by gathering various craft materials and images of emojis to replace online functions.

Codesign, compared to traditional design methods, can reduce issues with outcomes (Wilson, Roper, Marshall et al. 2015) by allowing participants to raise concerns based on their experiences and ideals, rather than what designers perceive them to be. While codesign workshops often allow discussions, they often leave out those who struggle with verbal communication, or those without a common language. This is a major concern owing to the City of Casey's culturally and linguistically diverse community, which is partially addressed by our codesign activities – while images can enable communication of participants tacit knowledge, limitations exist around the need to use language to explain their meaning to other participants.

The findings also demonstrate how generative activities can be more effective than evaluation activities at engaging participants. Many activities in Workshop 1 initially struggled to engage people, as they often relied on evaluating existing items such as images or worn toys. Answers therefore tended to diverge from intended topics, or in the case of the latter activity, resulted in confusion and disengagement owing to perceived disconnection from waste management and sustainability topics - mirroring Taffe's findings that evaluation activities often silence discussion (2018). Conversely, generative methods that encourage creativity and reflection tend to encourage ideation among participants (Sanders 2000, cited in Wilson, Roper, Marshall et al. 2015), thereby motivating engagement and trust among participants. Workshop 2's codesign activities enabled participants to actively engage and discuss through visual means by drawing or manipulating items, mirroring several articles which show how generative tasks that allow for creativity can encourage ideation (Sanders 2000, cited in Wilson, Roper, Marshall et al. 2015) and provide a friendly atmosphere in co-design workshops (Taffe 2018).

As participants usually kept discussions within prompts, these often play a major role in shaping activity contexts. Sustainability prompts, therefore, ensure activities appear relevant to participants in a sustainability codesign workshop. Possible reasons for this include people being reluctant to diverge from prompts, or said prompts priming individuals to ignore aspects outside of them. Additionally, prompts that relate to the topic often play a large role in stopping disengagement.

For codesign to engage people across languages, we found aspects that can assist within these activities and in other co-design workshops. This research offers a contribution on the role of visual and mental images to communicate and transform tacit knowledge in explicit knowledge (Lin 2007). Through activities that involve making and doing, people can express ideas without words (Moll et al. 2020). Therefore, reducing verbal communication when possible is a potential method of reducing disengagement issues or misunderstandings between languages and/or cultures. Having community members define their own issues and solutions rather than imposing them may also be valuable for other activities where options are presented to others.

There are some limitations to our study. Owing to COVID-19, our codesign activities were run entirely online, meaning offline effectiveness has not been tested. Running activities in person may result in unexplained issues or benefits that are not discussed. In addition, our activities were conducted with small groups (around 5). Further research would be needed to test the activities for larger groups of participants. The COVID-19 lockdown conditions prevented any discussion with community members, which would be useful for further research. Using visuals and drawings to communicate ideas and experiences in a multi-cultural setting is a promising avenue for storytelling, future scenario building, mental images, and other interesting fields that we plan to explore.

Conclusion

This paper provides a managerial contribution for practitioners in living labs in the design of the interactions in a multicultural community setting, and explores the value of visual approaches to converting tacit knowledge to explicit knowledge. Activities that relied on evaluative approaches tended to result in disengaged participants, with generative activities often being effective at uncovering participants' lived experiences to facilitators and other participants.

In our codesign case study with the Casey Living Lab, we found that people tended to hold onto items they were attached to, even when they became worn and tattered, hence generating sentimental value for sustainable ends can be a potential solution. The workshop's ability to create discussion and form a potential outcome demonstrates the activities' usefulness in transferring participants tacit knowledge into explicit knowledge which can inform communication design solutions.

Though COVID-19 lockdowns ensured all activities were run online, the activities facilitated effective communication despite this. However, as participants usually kept discussion within prompts, they play a major role in shaping the context of activities and the information produced. We also found that participant's perceived definitions of given topics can influence discussion, hence participant perceptions should be considered when facilitating discussions. Additionally, issues with online whiteboard services often made activities where participants needed to manipulate images more difficult than in offline settings, and the need to deal with difficulties tended to increase the length of activities.

While visual approaches can partially bridge linguistic and cultural barriers, particularly as they provide shared discussion methods and can reduce disengagements and misunderstandings between participants, language is often still needed to explain the meaning of visuals.

References

1. City of Casey (2016) Rethink Your Waste! Waste Management Strategy 2016 – 2022, pp. 1-17.
2. Gilal, F. G. Zhang, J. Gilal, N. G. Gilal, R. G. (2019) Linking self-determined needs and word of mouth to consumer e-waste disposal behaviour: A test of basic psychological needs theory, Journal of Consumer Behavior, vol. 18, pp. 12-24.
3. Handel, L. Strazdus, S. (2021) Engineering Solutions for Ghana E-Waste Problems, Development Design Lab, pp. ii-xix.
4. Hagen, P. Collin, P. Metcalf, A. Nicholas, M. Rahilly, K. Swainston, N. (2012) Participatory Design of evidence-based online youth mental health promotion, intervention and treatment, Young and Well Cooperative Research Centre, Melbourne.
5. Huda, N. Islam, T. (2020) E-waste management practices in Australia, Handbook of Electronic Waste Management, pp. 553-576.
6. Kirakozian, A. (2016) One without the other? Behavioural and incentive policies for household waste management, Journal of Economic Studies, vol. 30 (3), pp. 526-551.
7. Kleinsmann, M. Valkenburg, R. Buijs, J. (2007). Why do(n't) actors in collaborative design understand each other? An empirical study towards a better understanding of collaborative design, CoDesign, vol. 3 (1), pp. 59–73.
8. Lin, CP (2007) To share or not to share: Modeling tacit knowledge sharing, its mediators and antecedents, Journal of Business Ethics, vol. 70, pp. 411-428.
9. Luxford, L. (2020) Matter, Casey sign contract to bring innovative waste sensing to Victoria, Matter, viewed 15th August 2021, <https://www.matter.city/casey-signs-contract>.
10. Moll, S. Wyndham-West, M. Mulvale, G. Park, S. Buettgen, A, Phoenix, M. Fleisig, R. Bruce, E. (2020) Are you really doing 'codesign'? Critical reflections when working with vulnerable populations, BMJ Open, vol. 10 (e038339), pp. 1-5.
11. Nagatsu, M. (2015) Social Nudges: Their Mechanisms and Justification, Review of Philosophy and Psychology, vol. 52 (6), pp. 481- 494.
12. Sanders, E. (2000) Generative Tools for Co-Designing. Collaborative Design, edited by Scrivener, S. Ball, L. & Woodcock A., pp. 3–12. London: Springer.
13. Sharp, A. Høj, S. Wheeler, M. (2010) Proscription and its impact on anti-consumption behaviour and attitudes: the case of plastic bags, Journal of Consumer Behaviour, vol. 9, pp. 470-484.
14. Steen, M. (2011) Tensions in human-centred design, Co-Design, vol. 7 (1), pp. 45-60.
15. Taffe, S. (2018) Generate don't evaluate: How can codesign benefit communication designers?, CoDesign, vol 14 (4), pp. 345-365.
16. Thaler, RH, & Sunstein, CR (2009) Nudge: Improving decisions about health, wealth, and happiness. Penguin.
17. Wilson, S. Roper, A. Marshall, J. Galliners, J. Devane, N. Booth, T. Woolf, C. (2015) Codesign for people with aphasia through tangible design languages, CoDesign, vol. 11 (1), pp. 21-34.
18. Xu, L. Ling, M. Lu, Y. Shen, M. (2017) Understanding household waste separation behaviour: Testing the roles of moral, past experience, and perceived policy effectiveness within the theory of planned behaviour, Sustainability, vol. 9 (625), pp. 1-27.

Sprint Research Session

Fridays, 22nd September

09:30-10:30 CEST

Sala Duomo

Practitioner Presentation Paper

Living Labs for scoping Digital Twins: introducing imec's Innovation Management approach

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Abstract

In our society we are confronted more and more with so-called 'wicked problems' such as climate change. A wicked problem is a social or cultural issue or concern that is difficult to explain and inherently impossible to solve. Living Labs are in an ideal position to help solving these wicked problems by breaking them down in smaller, specific challenges and solving these with the Living Lab stakeholders & stakeholders using the Living Lab methodology. One of these possible solutions that are generating more and more attention nowadays are Digital Twins. A local or 'Urban' Digital Twin is used to support decisions that pertain to the physical entity it is linked to (e.g. a city or a region). Combined with advances in AI and data modeling, Digital Twins offer an immense potential for decision support in policy making trying to deal with wicked problems. Creating a Digital Twin requires a lot of technical effort (data-related elements, software-related elements...) but also developing the 'right' functionalities suited to the needs of policy makers and other stakeholders. This requires a rigid scoping and iterative testing of the desired use cases. To tackle this need, imec has developed an Innovation Management approach consisting of four stages: Exploration, Validation, Definition and Implementation. During these stages, various co-creation and stakeholder engagement activities are undertaken to ensure the eventual solution is desirable (needs), feasible (technology & data) and viable (business model / business case). For each of the stages we developed 'checks' to see whether these three criteria are adequately investigated. Results of the different activities are mapped on our self developed Digital Twin canvas that contains the most important elements for scoping of the Digital Twin use case(s), linked to the three elements.

Keywords

Living Labs; Digital Twins; Digital Transformation; Public Sector Innovation; Data-driven Innovation; Smart Cities; Smart Data

Introduction

In our society we are confronted more and more with so-called 'wicked problems' such as climate change. These are broad issues where the involvement of a variety of stakeholders and the smart combination of various technological assets and data sources are required to generate possible solutions. A wicked problem is a social or cultural issue or concern that is difficult to explain and inherently impossible to solve. Examples of wicked problems in today's society include things like education design, financial crises, health care, hunger, income disparity, obesity, poverty, terrorism, and sustainability.

One of these possible solutions that are generating more and more attention nowadays are Digital Twins. A Digital Twin is a "virtual representation of a physical entity with a bi-directional communication link" (Coenen et al., 2021). One of the key terms in this definition is the bidirectional communication link, which can be split-up into a communication link from the physical entity to the Digital Twin and a communication link from the Digital Twin back to the physical entity. A local or 'Urban' Digital Twin is used to support decisions that pertain to the physical entity it is linked to (e.g. a city or a region). Combined with advances in AI and data modeling, Digital Twins offer an immense potential for decision support in policy making trying to deal with wicked problems. They offer the possibility to 259rototype and make simulations (what if-scenarios) with data from different domains (e.g. mobility and environmental parameters), thus enabling improved policy making. However, creating a Digital Twin requires a lot of technical effort (data-related elements, software-related elements…) but also developing the 'right' functionalities suited to the needs of policy makers and other stakeholders. This requires a rigid scoping and iterative testing of the desired use cases. Living Labs are in an ideal position to help solving these kind of wicked problems by breaking them down in smaller, specific challenges and solving these with the Living Lab stakeholders & stakeholders using the Living Lab methodology. This applies for digital twin use cases.

To tackle this, imec has developed an Innovation Management approach consisting of four stages: Exploration, Validation, Definition and Implementation. During these stages, various co-creation and stakeholder engagement activities are undertaken to ensure the eventual solution is desirable (needs), feasible (technology & data) and viable (business model / business case). For each of the stages we developed 'checks' to see whether these three criteria are adequately investigated. Results of the different activities are mapped on our self developed Digital Twin canvas that contains the most important elements for scoping of the Digital Twin use case(s), linked to the three elements.

Innovation Management approach

We distinguish four separate stages in the innovation management process of scoping, determining, and developing solutions to specific (wicked) problems.

These phases are:

Exploration: Explore and identify potential Digital Twin use cases relevant to the Living Lab's domain and list and prioritise them based on their value and feasibility.

Validation: In-depth definition of one Digital Twin use case and translation to functionalities, mock-ups and preliminary architecture. During this phase innovation and research activities are carried out to scope and validate the use case.

Definition: Translate the results into a phased and tangible project plan with architecture.

Implementation: Implementation and testing of the Digital Twin.

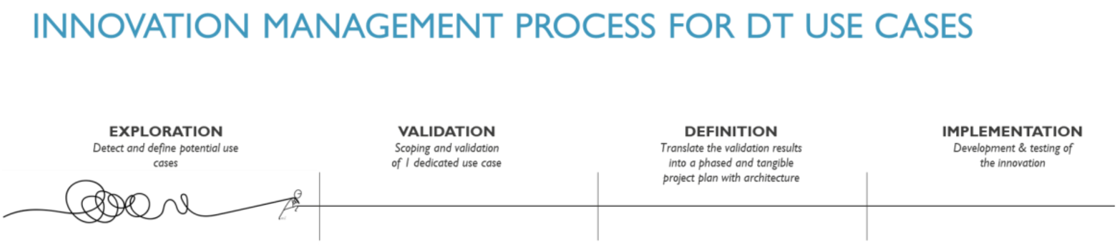

Figure 1. Innovation Management process.

To arrive at a comprehensive solution, three elements need to be balanced and investigated during the innovation management process:

Desirability: the degree to which there is an actual need or problem experienced by one or more users/stakeholders that have a high enough interest in solving it ('a problem worth solving')

Viability: the availability of resources to create a solution, which is also linked to the potential future business model of the solution ('is there a viable model to create and sustain the solution')

Feasibility: the degree to which a solution is technologically feasible ('are the required technologies and the various technical components stable enough, advanced enough and implementable within a reasonable amount of time')

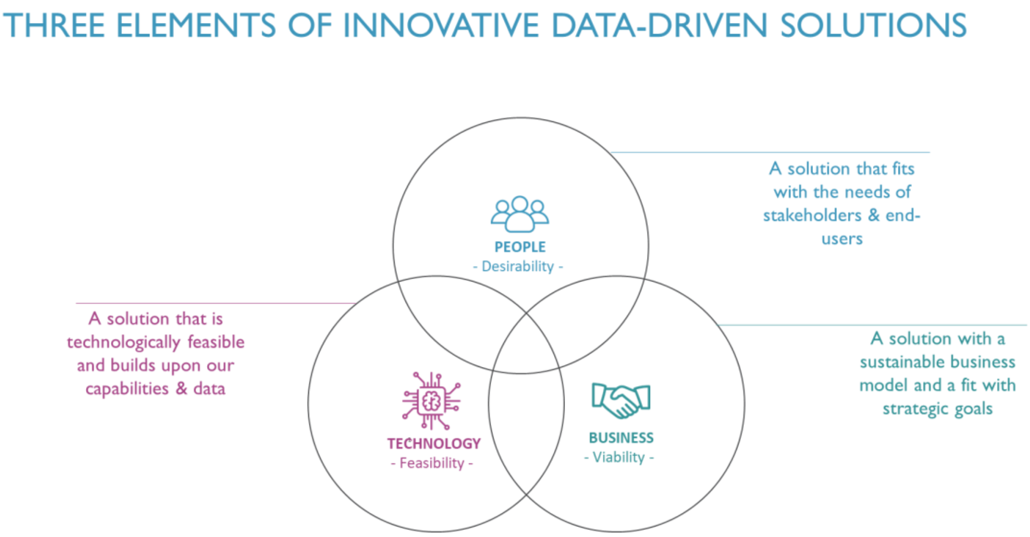

Figure 8. Three innovation elements.

When we combine the innovation management phases and the three innovation elements, this means that different innovation/research activities need to be carried out in each stage of the innovation management process to validate or 'check' for these three innovation elements were met.

For these 'checks' we developed a set of methods and tools, specific for the first three stages (Exploration, Validation and Definition), that can be used to perform these checks. These methods and tools are linked to the specific innovation outcome. In this case, we focus on Digital Twins. We define a Digital Twin as a "virtual representation of a physical entity with a bi-directional communication link" (Coenen et al., 2021). One of the key terms in this definition is the bidirectional communication link, which can be split-up into a communication link from the physical entity to the Digital Twin and a communication link from the Digital Twin back to the physical entity.

Digital Twin canvas

The process is structured using IMEC's Digital Twin innovation canvas that was systematically updated during the different stages of the sprint process (Validation stage). This digital twin canvas was developed based on the 'general' innovatrix canvas and methodology that was developed for innovation management in Living Lab projects (see Schuurman et al., 2019).

Main stakeholders				
Needs				
Current practices				
Current datasets / models				
Jobs-to-be-done				
Value creation				
Value capture				
Future datasets / models				
Barriers				

Figure 3. Digital Twin canvas.

The definitions of the canvas headings are as follows:

Main stakeholders

Who are the main stakeholders or users of the DT-solution? What are their main characteristics?

Needs

What are the needs of this stakeholder group? How are they affected by the threat? What is the impact of this need or threat and how do we prioritize them?

Current practices

What is their current behaviour? What tools or alternatives do they currently use? What is the baseline KPI of the need or threat?

Current datasets / models

What data or models do we currently have or use? Quality vs interpretation vs interoperability vs …

Jobs-to-be-done

What needs to be done in order to answer the need or neutralize the threat? What are the main ‘functions’ of the DT?

Value creation

What impact or value do we create with our DT-solution? What improvements are made against the baseline KPI?

Value capture

What value (monetary and non-monetary) do we (society/government/…) receive in return?

Future datasets / models

What could future datasets or models look like? Which data could lead to new opportunities? What new measures can be taken?

Barriers

What are the barriers for adoption, usage and market entry

The canvas is a way to help us understand our main stakeholders and users, structure our ideas and value proposition while maintaining the overall picture. It is a crucial tool in our philosophy: an assumption-based approach to innovation.

Exploration phase

During the first stage, the focus lies on detecting the most important needs or opportunities in order to build a digital twin use case in a later stage. This means the ‘problem’ domain is investigated, inventoried and prioritized. The goal is to get a clear picture of the current issues and problems in the target domain(s) and/or sectors where the project is focusing on. Besides these issues and problems, which we will refer to as ‘needs’, there are also ‘opportunities’ for innovation. The combination of ‘needs’ and ‘opportunities’ are the starting point or trigger of an innovation project and of the innovation management process.

In terms of methods and techniques, exploratory methods and tools are the way to go in this stage. This means expert and stakeholder interviews, desk research, trend analysis, ecosystem mapping… etc. are common techniques in this stage. As an end goal the idea is to arrive at a short list of problem statements are likely to be tackled with a digital twin solution. A problem statement typically has the form of “How might we… X … so user/stakeholder… Y … can improve/increase/speed up/… Z …”. An example from the Flemish water domain: “How might we AGGREGATE & ANALYSE WATER USAGE DATA FROM HOUSEHOLDS & FEED BACK RESULTS ON AN INDIVIDUAL BASIS so FLEMISH HOUSEHOLDS WITH A DIGITAL WATER METER can DECREASE THEIR DRINK WATER USAGE RESULTING IN 20% SAVINGS.

To attach priorities to these problem statements, we use a set of parameters to score the problem statements. This scoring can be done individually by the project partners or e.g. during a pitching session of the problems statement. An example of relevant parameters in digital twin use cases:

- Availability of data sources
- Quality of the data
- Aligns with objectives
- Technical complexity
- Impact on the needs

Moreover, at imec we also take into account whether a problem statement has at least the potential to generate a cross-domain digital twin use case and deals with an 264rototype that involves the quadruple helix as much as possible.

Validation phase

In this stage, we used a format named ‘Living Lab scoping sprint’ which is an adaptation of the so-called ‘Design Sprint’ (Knapp et al., 2016, [15]). This sprint format consists of five stages which form the word F.A.C.T.S. (as shown in the following diagram). These five stages run consecutively, and each has its own approach, deliverables and outcomes. Through the course of the five stages, the so-called ‘double diamond’ (Design Council [17]) of design thinking was followed, as we started from a concrete problem statement/use case that was first elaborated to come to a clear focus of which elements in the user/interaction journey would be tackled. When this was decided, the second ‘diamond’ opened up as different solutions and solution components were explored, in order to come to design decisions for the prototype that would be created and tested. As a result of this Living Lab scoping sprint, we generate a well described Digital Twin use case with specific functionalities and architecture, and with a prototype.

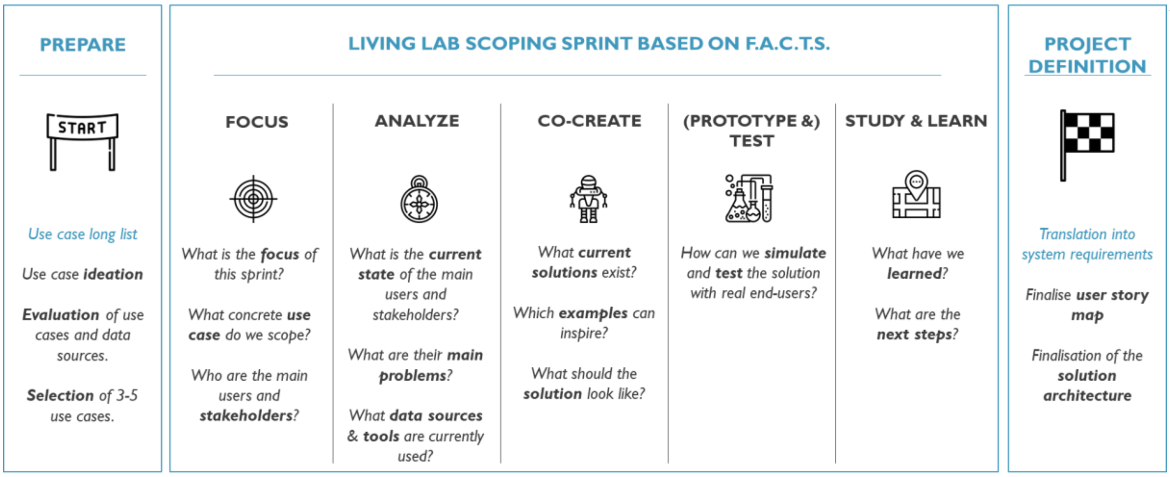

Figure 9*. Living Lab scoping sprint.*

Preparation

In preparation for the Living Lab scoping sprint, a dedicated sprint team was created. The team consisted of representatives of at least all actors in the steering committee. These representatives were assigned the following roles, based on their expertise and knowledge (+/- 5 dedicated people): Facilitator (leads the process), Decider (makes the final call when necessary), Domain expert (adds domain knowledge), User/stakeholder researcher (leads the user and stakeholder interactions including the testing). In digital twin cases, the following roles are also very useful: data & model expert (adds knowledge on the data and/or models to be used), Architect (adds technical knowhow on digital twin solutions), and the Designer / 265prototype (is able to generate testable mockups or prototypes).

Focus

In the FOCUS stage, the goal is to ‘laser focus’ on a single use case or a sequence of use cases that is connected in a single scenario. To this end, the digital twin canvas is filled out with the sprint team, including al knowledge there is on the chosen problem statement. For the most important users and stakeholders, the DT Innovatrix is filled out (a general rule of thumb, no more than 3 stakeholders were to be defined). The focus lies on the ‘current state’ elements of the canvas, as we are in the phase of listing assumptions regarding their current way of working. This means we specify the assumptions regarding needs, current practices (including tools that are currently used) and current data sets and models based on the earlier assessment exercise.

When all information is gathered from the sprint team and captured in the DT Innovatrix canvas, the key uncertainties are identified. These are the assumptions that are regarded as critical to investigate in the next stage of the sprint process.

As a final step in this stage, the information in the DT Innovatrix is complemented by carrying out some desk research and/or by contacting experts that could give additional information to complete the board.

Analyze

During this stage, key informants are interviewed in order to validate the assumptions and to get an informed view on the needs, current practices and available data assets and models. These key informants are recruited by the sprint team as representatives of the chosen focused user or stakeholder segments from the previous stage. These interviews follow more or less the following structure:

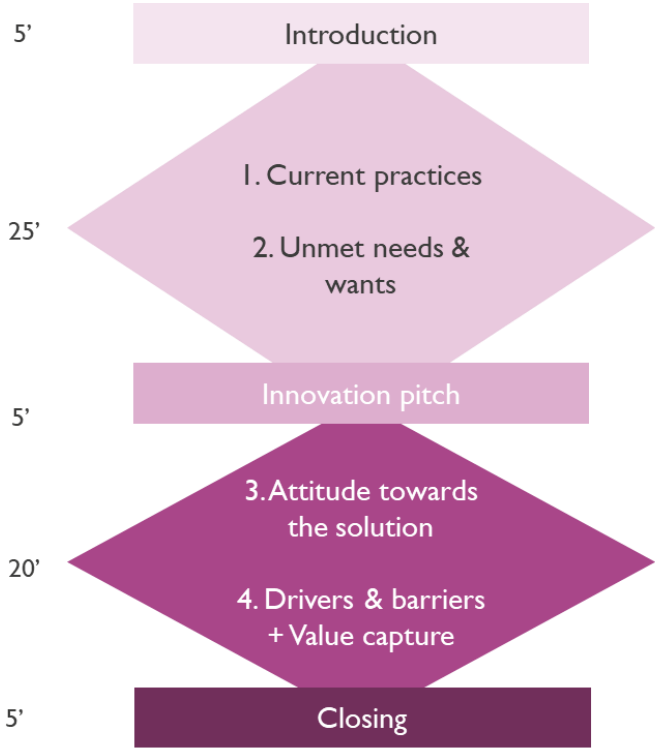

Figure 5. Interview structure.

Based on these interviews, the DT Innovatrix canvas is updated and an interaction journey of the 'current state' can be composed. This includes the users and their interactions with the current tools, systems and data sources/models in order to support their decision-making process. Based on the interviews, information on needs and wants, the main points for improvement are identified, together with elements in the current state that need to be integrated with the solution ('future state'), or that should be left untouched. An example of an interaction journey can be found below.

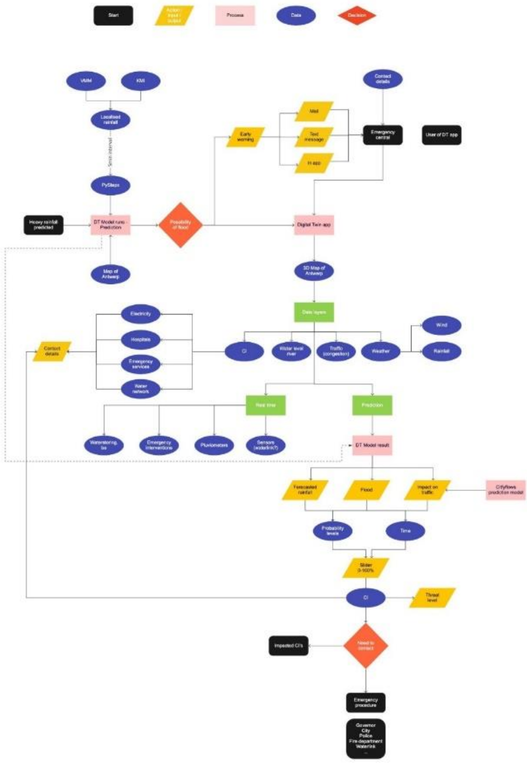

Figure 6. Interaction journey.

In addition, based on the interview information, an assessment of the current datasets and models is made. This is important information for the next stage of the process where the solution is co-created.

Co-Create

During the CO-CREATE phase, the focus shifts from the ‘problem’ to the ‘solution’, as in the previous stages the current practices, datasets & models, and the most urgent needs were identified, together with the main problem owners. This is the time to co-design potential solutions based on this information.

To facilitate out-of-the-box thinking and creativity, each sprint team member is asked to look for interesting examples (‘lightning demos’) inside and outside of their industry. These examples could be interesting functionalities, interactions or visualizations that could form part of their solution. Each member then presents their demos at the start of the co-creation session and explains what they thought was inspirational. After these presentations starts a round of creative sketching in which the main functionalities of the digital twin solution are gathered. After some rounds of voting and converging to one or a combined solution, these solutions are put into a story board. Story boarding is a visual exercise where the team makes a set of drawings each representing steps in the story (the process of a user interacting with their solution).

(Prototype &) Test

Based on the finished story boards and innovation sketches, the prototyper (see Preparation for more information on each role) creates a mock-up of the solution using visual design tools such as Sketch, Invision, Balsamiq or even Powerpoint. These mock-ups are created as clickable prototypes that visualize the most important information and visualizations that were defined in the co-create stage. The degree of detail depends on the importance of certain functionalities or 'jobs-to-be-done' defined by the users. See below for an example of such a prototype.

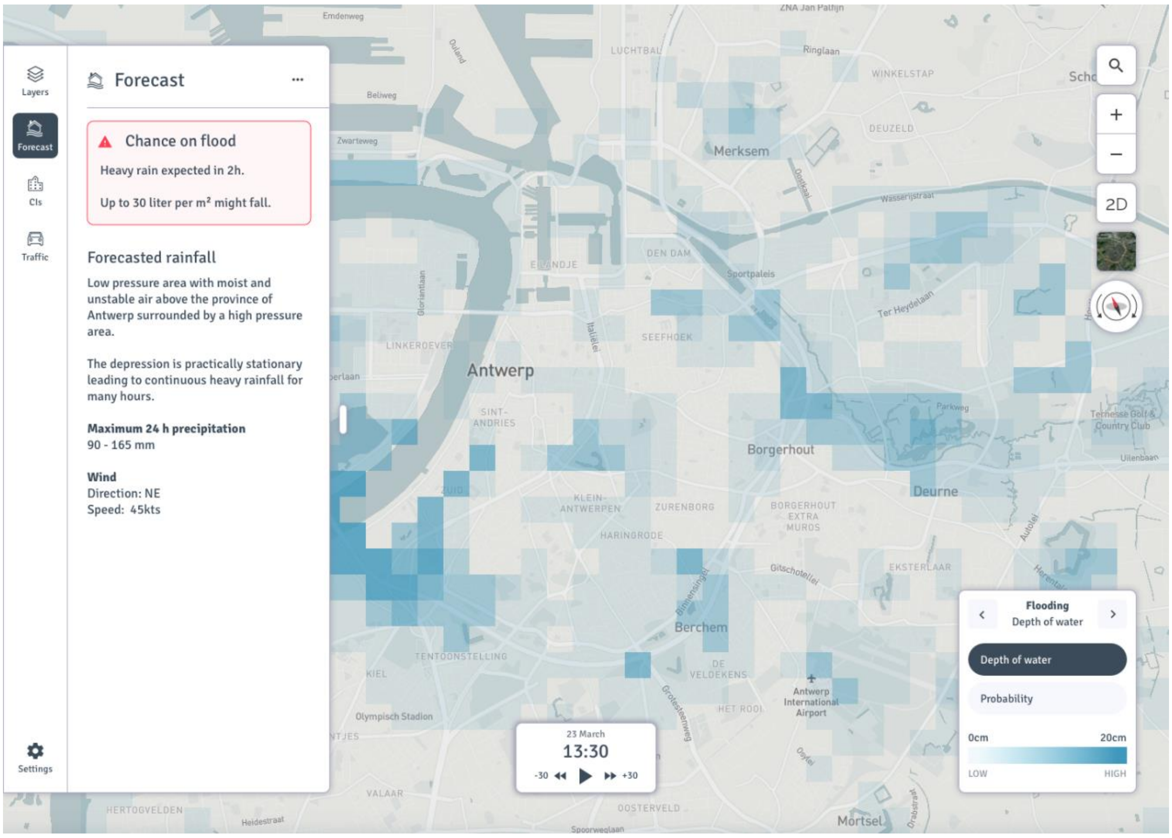

Figure 7. Digital Twin prototype.

This visual prototype is presented to +/- 5 users to gather feedback regarding their usage and their perceptions. Upfront a list of testing assumptions is defined together with criteria that should be met for validation. These testing hypotheses can be gathered from the digital twin canvas.

For the testing interviews, a topic guide is created that follows the defined scenarios for the solution. The concept test follows a think aloud principle, where the interviewee tells the interviewer what they are seeing, expecting and what their next step would be. For each step and element in the solution, specific outcomes are defined and where necessary specific questions are asked regarding the expectations and the actual user experience when using the prototype.

The interview setting needs to correspond as much as possible to the actual usage situation. Therefore, it is advised to carry out these testing interviews on site. Moreover, since interactions between stakeholders / users are often an important aspect of a digital twin scenario, it can be useful to carry out the testing interviews with multiple test users at the same time where the actual interactions are mimicked as much as possible. This is achieved by guiding them through a fictional, but realistic case where the prototyped solution is used as supporting material to improve the decision-making processes.

At the end of the testing interviews, users are asked to rate their experience with the solution and to estimate whether the solution might provide significant improvements when compared to the current state. If possible, the interviews are streamed live to the other members of the sprint team so they can also take notes and analyze the outcomes.

Summarizing, these testing interviews give a strong indication whether the detected needs and practices from the 'Analyze' stage can be met and significantly improved and give indications where the solution should be improved and/or iterated.

Study

All outputs from the previous phases are gathered, (re-) analyzed and used to update the different deliverables (Interaction Journey, Digital Twin canvas and the prototype). This helps to conclude the Living Lab scoping sprint and enables the 'definition' stage where the actual implementation of the solution would be planned.

The main activity is a workshop with all sprint participants to discuss the outcomes of the TEST-stage and what this means for the resulting digital twin. These implications are documented by creating an update of the Digital Twin innovation canvas.

The interaction journey is then updated based on the insights of the prototyping and testing. Elements that are regarded as unnecessary are removed while potential missing elements can be added. A reflection on the impact of the resulting solution is also added. The outcomes from the sprint and the resulting deliverables serve as input for the definition-stage.

Definition

In this phase, the insights and learnings from the Living Lab sprint are translated into a tangible and prioritised definition of the solution. The stakeholder requirements are captured in a format called user stories. To facilitate the definition, a User Story Mapping workshop is organized with the Living Lab sprint team. User Story Mapping is a visual exercise that helps define the work that will create the (most) desirable user experience. The session intends to create a dynamic outline of the stakeholder's (end-user's) journey and its interactions with the solution. This approach helps to evaluate which steps generate most benefit for the user and to prioritize what should be built. The output of this session will help direct the development of the Digital Twin architecture. User Story Mapping employs a concept of user stories. User stories are a natural language description of a requirement that capture the value created for the end user: As a [type of user], I want to [action] so that [benefit]. It is a (simplified) description of a requirement from an end-user perspective. It's an ideal format to communicate features of a software system between stakeholders, project team members and developers.

The Story Mapping exercise consists of ordering the user stories along two axes. The map arranges the user's activities along the horizontal axis, visualizing the behaviour of either the user or the system (often chronologically). Along the vertical axis, the stories represent increased sophistication and detail describing a certain feature, interaction, behaviour, or functionality. Since this is a group exercise, while the stories are being mapped, there is an opportunity to challenge and discuss, focusing on the overall goal of the user and the value created. Once the map is finished, a prioritization exercise should be held, to define what should be built first (e.g. MOSCOW-method).

The final stage includes the actual implementation of the resulting digital twin. This will be discussed in more detail in a follow-up paper.

References

1. Coenen, T., Walravens, N., Vannieuwenhuyze, J., Lefever, S., Michiels, P., Otjacques, B., & Degreef, G. (2021). Open Urban Digital Twins: insights in the current state of play. White paper – available at https://vlocavis.z6.web.core.windows.net/Urban%20Digital%20Twins.pdf
2. Schuurman, D., Herregodts, A. - L., Georges, A., & Rits, O. 2019. Innovation Management in Living Lab Projects: The Innovatrix Framework. Technology Innovation Management Review, 9(3): 63-73. http://doi.org/10.22215/timreview/1225
3. Knapp, J., Zeratsky, J., & Kowitz, B. (2016). Sprint. Bantam Press.

Practitioner Presentation Paper

A Regional Approach to Delivering and Evaluating Living Labs

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Abstract

A major challenge in developing inclusive and impactful living labs in diverse conurbations is co-ordinating a cohesive and coherent approach at regional levels. A lack of a co-ordinated approach can lead to regional inequalities in provision and opportunity for participants, as well as inefficiencies on the part of the providers, including the duplication of services and poor economies of scale in delivery.

These challenges are exacerbated when there are high levels of transience, mobility and diversity in the areas, but also when there is a history of competition and non-collaboration between local stakeholders in both receiving funding and delivering related projects.

The MiFriendly Cities programme was a 3 year initiative in the UK which aimed at developing innovative, community-led and sustainable approaches to enhancing the contribution of refugees and migrants across the region. This was funded in October 2017 by the European Union's Urban Innovation Fund. The programme represented a landmark intervention in terms of scale and breadth with regards to what has been previously attempted in both the UK and the EU.

MiFriendly Cities encouraged a collaborative approach to developing, testing and refining a regional living lab approach to strategically working with migrant and refugee groups in the area. Throughout the programme, an independent evaluation team worked with all partners using a mixed methods approach that was underpinned by a co-developed Theory of Change logic model. The aim here was to produce an evidence base for success and innovation in the programme, as well to document the testing of ideas, practices and projects which did not work well and which others in the future can learn from.

Central to the Theory of Change model for MiFriendly Cities was a strand of delivery

centred around partnership working by regional actors. The endgame of programme delivery and aspiration in relation to this strand is that approaches to migrant integration change for the better and that the volume, quality and efficacy of migrant support increases across the 3 cities. Here living lab approaches to co-creation such as citizen social science, refugee and migrant led journalism and reciprocal English language provision were core outcomes.

The evaluation demonstrated that local and regional leaders in migrant support and engagement sharing their learning and expertise lead to benefits for all partners and that as individual organisations, and as a collective, that their capabilities were enhanced and that their work becomes more collaborative, impactful and efficient over time. The evaluation also allowed for the testing of different models of delivery across the 3 cities to empirically study their impact, efficiency and legacy in order to inform future provision.

The lessons learned from MiFriendly Cities are of interest to practitioners and the public because they give a unique insight into the co-ordinated regional delivery of a living labs approach to refugee and migrant integration. The documenting and understanding of the lessons learned here, both positive and negative, can, and should inform future delivery of similar programmes and makes a case for scaled up, regional models of award and delivery.

Keywords

Regional, evaluation, evidence, efficiency, collaboration

Full Research Paper

TinnGO Living Labs

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Abstract

The Horizon Europe 2020 TInnGO (Transport Innovation Gender Observatory) project[1] aimed to facilitate the inclusion of women and underrepresented groups in smart mobility. Globally women form under 30% of the transport workforce. Significantly their travel needs are not met by current transport provision, despite evidence of different journeys and mobility concerns. Little research has been conducted on the inclusion of minority groups (such as those from BAME (Black, Asian, Minority and Ethnic communities and those with disabilities) – but a similar, if not poorer picture is likely. The design of future smart mobility is further skewed by the predominance of male transport designers and engineers.

The living lab approach has been shown to be effective in addressing mobility challenges. However, work with student designers and other stakeholders has highlighted barriers in the understanding and application of key underpinning concepts such as sustainability, diversity, intersectionality and empathy which might impede co-creation which may reduce design opportunities. To address this, TinnGO developed a series of tools to guide co-creation activities to increase empathy, understanding and use of intersectionality and design against UN Sustainable Development Goals for gender equality and sustainability.

Keywords

Intersectionality, sustainability, empathy, gender equality, transport, participatory methods

[1] https://www.tinngo.eu/

Introduction

Gender Smart Mobility (GSM) requires new services and vehicles, and the application of gender and diversity mainstreaming to create transport which is 'smart' because it is efficient and inclusive, not just technologically enabled. A smart transport system is not one that creates congestion, pollution, or destroys neighbourhoods, harms health and wellbeing, or creates transport poverty. Gender and diversity mainstreaming recognises the importance of applying intersectionality in creating fair and equitable transport services which can reduce the vulnerability of certain groups to social-exclusion related transport poverty.

Transport facilitates access to the labour market, healthcare, recreational and educational services. The emphasis on moving people to and from of city centres and servicing the car as a private mode of transport has fractured our cities, creating, pollution, congestion and unattractive urban landscapes (Banister, 2015). Current transport provision is not affordable or accessible to all, reducing life opportunities (Lucas, 2012). The recent emphasis on intersectionality (Crenshaw, 1989) has shown that many suffer multiple forms of transport poverty, leading to economic and social isolation (Uteng et al, 2020).

Although an integrated, fair and accessible transport system is key to social and economic development and justice, transport planning (and the wider Transport Business Ecosystem (TBE)) has focussed on the efficient movement of vehicles and the needs of the primary wage earner. As such those from already economically disadvantaged groups – i.e., women, elderly, people from BAME (Black, Asian, Minority and Ethnic) and LGBTQI+ communities, those with disabilities and on low incomes – are not served by current transport provision.

TinnGo has estimated (Lynce, et al, 2021) that current transport provision only meets the needs of a third of EU citizens; whilst Pirra et al (2021) demonstrated that the needs of women are not met by current transport provision. Owing to gendered roles in society women perform most household, caring and nurturing duties, even when in paid employment. As such their transport needs are different– they make shorter, more frequent journeys, temporally and geographically limited based on the demand of their non-paid roles (Maffi et al, 2018). Until recently such journeys were not measured or regarded by transport planning. They simply did not count. As such women are subjected to greater forms of transport poverty because of their gender – they may pay higher transport costs to feel safe, be denied access to private transport, or make longer journeys because transport services have not been designed to accommodate their 'non paid' activities (Faiz et al, 2020).

Since 2012, the principal author, in her capacity as Principal Investigator of 3 major EU transport related projects (FP7 METPEX, H2020 CIVITAS SUITS and H2020

TInnGO)[2] has heard that traditional hard to reach groups are still 'hard to reach'. This is espite growing evidence that citizen engagement leads to better end results, an increase in tools and case studies (e.g. ELTIS platform[3]) to support participation and co-creation, the requirements for citizen engagement to be embedded in Sustainable Urban Mobility Plans[4] and for drawing down funding,

The Transport Business Ecosystem (TBE) is still largely dominated by white, middle-class, middle-aged men, graduating from male dominated STEM disciplines who have little knowledge, understanding or empathy with those from different groups and their travel needs. Only 22-27% of women are employed in the sector (EC2020a), usually at lower grades; most of whom can point to or have experienced gender discrimination. As such there is a sizable communication gap between transport providers, operators and users of transport services (Tovey et al, 2016). Transport consultation processes and surveys may not be as extensive or empowering as expected (Woodcock, 2018) as they may fail to capture the detailed experiential insights needed to provide high-quality service offerings and vehicles which meet the needs of a diverse population, or there may be a lack of wherewithal on how to gain and use the information provided.

Smart Mobility (SM) is posited as a means of delivering key benefits such as a reduction in pollution, congestion, noise and costs, whilst increasing safety and improving transfer speed. These were only later expanded to include accessibility and social benefit, i.e., transport should be affordable for everyone and help provide a better quality of life. Descriptions of SM remain based around STEM and ICT innovations, reflecting a technological rather than social justice orientation. SM is marketed as a future in which mobility becomes a personalised, on demand service with greater consumer choice and new models of ownership. However, analysis of visual representations shows SM futures are technology led and exclusionary (Christensen et al, 2021).

This is unsurprising given SM's roots in STEM subjects such as computing, engineering, manufacturing and planning where gender imbalances are significant and pervasive (Pirra et al, 2020). Worryingly, a gender gap has already been recognised in SM in the UK and Nordic regions with studies revealing that most users are young, male and have higher incomes (Singh, 2019). SM entrants, such bike sharing and e-scooters schemes, are not designed for women with caring commitments, who may require child seats and storage for shopping. These groups are excluded when developers focus on early adopters. SM relies heavily on the use

[2] https://cordis.europa.eu/project/id/314354/reporting, https://www.suits-project.eu/
[3] https://www.eltis.org/
[4] https://www.eltis.org/mobility-plans/sump-process

of technology, using apps to access services which requires levels of digital literacy and ownership beyond the reach of certain demographics, such as those on low incomes and the elderly. So, whilst SM may advance choice and offer sustainable modes of transport, these advances will not be equally advantageous. This highlights a need for a deeper understanding and consideration of users with differing needs and abilities. If left unchecked, this trend will limit the opportunities for women's employment in SM and impact the type and inclusivity of future development in Smart Mobility innovations.

In line with Lefebvre (1996) TInnGO argued that a smart city cannot be smart if it is not founded on social justice and equity. It should be a space shaped according to inhabitant's needs, allowing all citizens to fully enjoy urban life with its services and advantages, and to take a role in its planning. Gender relevant aspects of a smart city - mobility, safety and security, employment and sustainability - have been identified as fields of action for the EU. However, progress is slow, impeded by lack of willingness or ability to adopt measures that would create a fairer system.

Intersectionality, Social and mobility Justice

Research in the areas of Mobility Justice (Sheller, 2018), Transport Justice (Martens, 2016) and Transport Poverty (Lucas et al, 2016) highlight the disparities in mobility and accessibility for citizens from disadvantaged backgrounds.

In relation to SM we would argue from a feminist perspective for an end to practices of discrimination and a redistribution of power relations so that citizens have a much stronger say in how such systems work and receive fair treatment. There is a clear issue around control of the SM sector, who influences/chooses how mobility is played out. Living labs provide opportunities for citizens to be engaged as members of the quadruple helix. However, efforts are needed to ensure equality in co-creation through shared understanding and tools to enable discussion/observations to rise above the anecdotal and effect real changes. The quadruple helix model provides a way of breaking down these power structures.

Intersectionality can advance the understanding of gender and transport through the inclusion of additional characteristics to show that transport needs depend on age, race, income and location. It posits that lives cannot be reduced to single characteristics, and experiences cannot be understood accurately if one factor is prioritised (Hankivsky et al., 2014). The interconnection of these structures creates intersectional disadvantage, creating an interdependent system of discrimination and disadvantage.

Transport related social exclusion has a significant impact for certain groups, i.e., disabled, elderly, low-income families, and women (Lucas, 2012). Research has shown the differential impacts of poor accessibility experienced by disadvantaged groups (Titheridge, et al.,2014) and identified socio demographic effects related to personal characteristics. Social exclusion is a constraints-based process which restricts the ability of certain individuals or groups to participate in the normal activities of the society in which they reside and has important spatial manifestations (Preston and Rajé, 2007). Faster modes of transport incur higher cost than slower more sustainable forms of transport, but access to faster modes offers access to wider opportunities within a given time.

Transport systems should be designed to alleviate poverty and enable all citizens to access the places they need. Titheridge et al (2014) recommended that in order to achieve such aspirations equity criteria should be developed and implemented to ensure that those marginalised in society have their needs met. This could improve the understanding of differing needs and enable more targeted approaches to improving mobility and accessibility.

The role of living labs in SM

Since 2006, living labs have been recognized by the EC as key tools for open innovation. In the EC Sustainable and Smart mobility strategy for Europe Urban Mobility, they are a recognised as way of transforming urban mobility by providing opportunities for cities, research, and industry to have a real involvement and commitment with citizens and guarantee the success of the European Green Deal.

The Urban Mobility Labs (EIT, 2021) aim to bring all the stakeholders involved in the development of the mobility product, service, or policy to one table, to enable the co-creation of a common perspective on key issues and opportunities. As such they can facilitate an open dialogue between all involved parties, aiming at a better understanding of other stakeholders` values, interests, challenges, and ideas. The EC Sustainable and Smart mobility strategy for Europe states that “citizens are and should remain a driving force of the transition”. Moreover, “a new pact is needed to bring together citizens in all their diversity, with national, regional, local authorities, civil society and industry working closely with the EU’s institutions and consultative bodies” (EC,2020b).

TInnGO established 10 mini living labs as beacons of engagement and data collection on gender and diversity sensitive smart mobility across Europe (Woodcock and Christensen, 2022). TInnGO’s tools described below relate to the need to develop common understanding at the start of co-creation activities, and to find ways of translating citizen insights into design actions.

The problem

Creating a paradigm shift in transport requires building capacity across the TBE, including designers of future transport, engineers and citizens, to enable them to create more gender and diversity sensitive smart mobility products.

As part of TInnGO, it was planned that design students would develop novel smart mobility solutions from design briefs set by 10 national hubs, relating to women's everyday mobility problems in multimodal end-to-end journeys (from planning to arrival)[5]. Topics included breastfeeding, carrying shopping, safety and security at bus stops, exercise, traveling with dependents, community-minded bus stops,planning and complaining about services (Magee et al, 2021).

Unfortunately, covid travel restrictions prohibited face-to-face co-creation activities and meant that the UK, TInnGO team served as proxies or expert witnesses, sharing their own experiences and there was reduced contact with other labs. However the severely restricted 12-month design activity showed that

- the concepts of 'gender', 'diversity sensitive' and 'smart mobility' were difficult for those new to the area.
- terms evolve as the industry and technology matures. For example, 'smart' once referred to technology enablement, vision zero, but can be flipped to refer to a system which reduces the need for travel; sustainable can refer to green transport, active forms of transport (walking and cycling) or the longevity of a scheme.
- Gender Action Plans, privileged gender over other categories and failed to recognise diversity, so we expanded 'Gender sensitive' to 'gender and diversity' (Breengard et al, 2021).
- The relationship between 'smart' and 'sustainable' is also poorly defined.
- Designers were overwhelmed by the need to consider intersectionality. Viewing people as belonging to a range of underrepresented groups, facing multiple challenges, led to dark places, in which designers struggled to create SM products which would deal with all the problems a person from a vulnerable group might face.

The design of seemingly stand alone, gender and diversity sensitive smart mobility innovations, such as child bicycle seats becomes complex - when decision making needs to be informed by experiences and lifestyles unfamiliar to designers, and their usage has to be considered in the wider context (e.g., bicycling culture,

[5] See design at https://oip.transportgenderobservatory.eu/ideas-lab

infrastructure, cost, weather). Many designs were service or systems oriented, relying on or requiring integration with other agents/devices/systems before being implemented.

Overview of tools and methods developed in TinnGO

Designing into this space requires an appreciation of its 'wickedness' (Rittel and Webber, 1973) requiring new ways of thinking. To address this we developed practical tools to support early co- creation processes to assist quadruple helix (Hasche et al 2020) agents (industry, government, academia, and users/civil society) achieve common understanding.

The following sections provide a brief overview of the TInnGO design tools. Although developed in the transport domain, these can be applied to other contexts to develop a more sophisticated understanding of the context in which innovations have to be developed. Examples and templates are available from the TInnGO web site.

Gender and Diversity Action Plans

Gender Action Planning (GAP) is a central pillar in European work for gender equality[6]. While gender is a recurrent cause of discrimination and inequality in the transport sector, other categories, such as disability and age, also play crucial roles in mobility barriers. Table 1 provides details of five key dimensions - affordability, effectiveness, attractiveness, sustainability, and inclusivity.

Table 1. The 5 dimensions of Gender and Diversity Action Plans.

Dimension	Rationale	Typical questions
Effectiveness	**An effective transport system would work equally well for** different trips and users. Gendered societal roles, disabilities, class etc. create different mobility needs, Smart transport solutions should not privilege one group over another or create further inequalities.	What are the gendered dimensions in effective transport? Who is the SM effective for? What does effective look like when intersecting social categories are included and crossed
Affordability	Transport is not 'smart' if citizens cannot afford to use it. Affordability must be regarded for all forms of transport: Public transport solutions, smart cars, smart biking, and walking.	How is affordable being defined, and for whom, bearing in mind wage differentiations, household incomes and forced transport choices.

[6] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2184

Attractiveness	**Attractive transport is** customizable and comfortable for a broad group of people. It should be clean, safe and convenient and consider the design of surrounding areas, such as bus stops and train stations, considering user differences in age, background, and gender.	What are the gendered dimensions in attractive transport? What does 'attractive' look like when more social categories are included, such as age and ethnicity? Women (and LGBTQ-persons) often feel unsafe waiting at dark bus stops, train stations and in deserted areas.
Sustainability	**Smart transport aims at reducing CO_2 emissions** through the incorporation of new technologies, improving opportunities for use of green transport modes, more efficient and integrated services. This should include perspectives of gender and diversity.	What are the gendered dimensions in sustainable transport? Does the system offer sustainable transport solutions for various social groups? Are some groups more attracted to sustainable mobility solutions than others and do actions cater for these differences?
Inclusivity	**Inclusive transport solutions should promote equality, combat discrimination and enable all people to access amenities.**	Are people in different social groups able to use the transport solution? Are some groups more vulnerable and face discrimination in their daily use of transport than others? Have some groups been designed out of transport options.

The five dimensions provide guidelines for *how and when* to approach transport in terms of gender and diversity. Creating GaDAPs is a stepwise approach requiring consideration of:

- A definition of **what** the problem is.
- **What** methods should be addressed.
- **When** and **where** the activities take place.
- **Who** will be responsible for the activity.
- **Follow up** on action and **what remains** to be done.
- Set up an **updated** action plan.

The 10 TInnGO hubs[7] worked with members of their local TBEs to develop and implement GaDAPs.

[7] See al Woodcock et al, 'TinnGO living labs' paper, this volume.

Supporting discussions about intersectionality

Mobility patterns depend on many factors, where people live, what they earn, their caring responsibilities, as well as characteristics such as race, gender, sexuality, and age (Levin and Thoresson, 2020). Unequal access to transport contributes social and economic exclusion. Intersectional analysis shows how these factors overlap and influence transport mobility. Designers and transport planners need to ensure that they are not creating products and services which exclude certain groups by failing to understand different needs and requirements, e.g., not designing spaces/ramps for wheelchair users and prams, reducing overreliance on technology when latest devices may be incomprehensible, unaffordable or unusable by creating. The digital divide is a good example of the need to apply intersectional thinking to transport and smart city initiatives. Young designers and their friends are digital natives, as such they may rely on technological solutions and struggle to understand or have empathy towards laggards and late adopters (Woodcock, 2013). Examples of age, digital and economic exclusion include 'pay by phone' parking schemes and other cashless initiatives (Kale, 2020).

To assist in preliminary discussions of intersectionality, we developed the TInnGO Intersectionality Mobility Indicators (TIMI) (Figure 1 and downloadable from TInnGO web site). The spinning concentric discs help to visualise the intersectional nature of individual characteristics, structural aspects of transport poverty, and how they relate to mobility patterns. Where you live, work, go to school, shop or socialise is influenced by transport.

- The outer, orange ring contains structural and political factors of transport poverty and social exclusion

- The blue circles highlight intersectional characteristics on a more individual level which are traditionally associated with excluded groups (such as gender, ableness, ethnicity). Every person has a profile formed by these and other characteristics. These in turn interact with the structural factors.

- The green ring represents the 5 gender smart dimensions which need to be considered in the design of gender and diversity sensitive smart mobility products (Breengard et al, 2021).

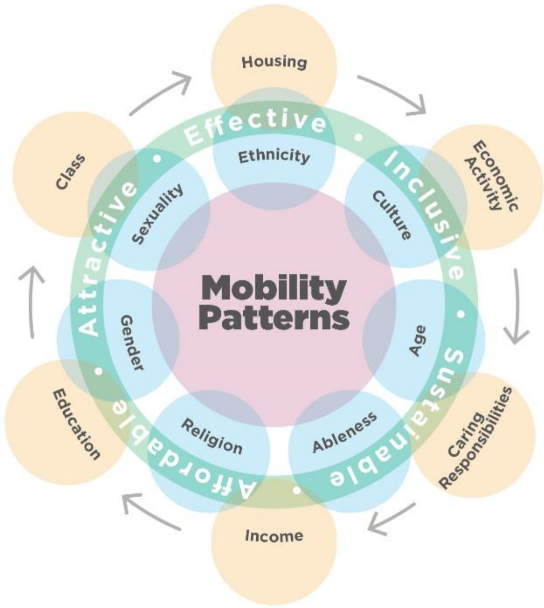

Figure 1. TInnGO Intersectional Mobility Indicators (TIMI) (Bridgman et al, 2022).

This downloadable tool is designed to prompt discussion but could also be used to discuss impact. It highlights how all systems need to be read together to foster equity-based policy solutions and the wider context in which smart mobility is placed.

Checklist to design and evaluate smart mobility products

The 5 gender smart dimensions were incorporated into the EEASI checklist to make gender- and diversity-smart thinking an *explicit* and prominent part of SM development. This differentiates it from generic 'usability' methods and assessment tools. It was developed to help design students and others understand and apply social and environment factors (such as United Nations Sustainable Development Goals) from receipt of the design brief to evaluation of concept designs.

Part C: Overall Assessment

This is intended to summarize how the product fits with its own defined goals and how far it meets 'Gender and diversity smart' criteria. The Evaluator should complete a rating based on the ratings per each indicator already completed.

Does the design meet its own goals?	Percent	Smiley	Notes
e.g. The e-scooter meets the design brief needs of appealing to young people and active, reasonably fit commuters who may choose to integrate use of an e-scooter into their daily commute from a train or bus hub.	*80%*	🙂	
e.g. the e-scooter could be an alternative to bringing a car into the city	*70%*	🙂	
Does the design meet the Gender & Diversity Smart goals - EAASI?			
1 - Effective Is the product effective?	43%	🙁	*Effective for those who can use it – speedy and anywhere within city*
2 - Attractive Is the product attractive to a wide range of users?	34%	☹️	*Attractive to certain groups of users, mainly younger persons, possibly more males, but not others*
3 - Affordable Is the product affordable to a wide range of users?	52%	😐	*This is a Shared transport solution so affordable depending on charges for users and break even point for providers*
4 - Sustainable Is the product sustainable / does it encourage sustainable behaviour?	55%	😐	*Good sustainability, as alternative to car travel, easy maintenance, OK so long as they are not stolen*
5 - Inclusive Is the product inclusive from the point of view of gender and diversity? From the point of view of Accessibility?	6%	☹️	***Not very inclusive**, does not support chained trips, useful only for those with fitness and confidence, appropriate clothing, minimal luggage, reported to have negative effects and even dangerous to some disabled and elder pedestrians. Not inclusive for people with disabilities.*

Key

Excellent (70 to100%)	Good (60-69%)	Satisfactory (50-59%)	Poor (40-49%)	Fails this indicator (0-39%)
🙂	🙂	😐	🙁	☹️

Figure 2. EAASI Checklist summary page.

The tool is in 3 parts:

- Part A: product description with links to background material/market analysis, with prompts concerning the product goal, design purpose and USP, how the brief was generated, who the intended user group is, task context and perceived user needs.
- Part B: set of prompts for considering each of the 5 criteria in relation to specific travellers or characteristics.
- Part C: Qualitative overall evaluation and summary of each section (see Figure 2)

The checklist can be used to develop a brief or empathy for diverse user groups; to evaluate a concept or product to check how 'diversity or gender smart' it is through a 5-point rating scale. It has been iteratively developed and applied to the evaluation of number of designs on the Open Innovation Platform such as the Nurturepod^{TM} and 'Fido' shopping companion, with worked examples and templates available from the TInnGO website.

A systematic approach to understanding and plotting barriers to women's mobility

Woodcock applied the hexagonal spindle of ergonomics to transport design (e.g., Tovey et al (2015) and gender transport poverty (Iqbal et al, 2020) to combine results from different studies (e.g., surveys, literature review, ethnography, interviews) in waysthta can be acted upon by stakeholders. In such representations the user is placed at the centre of the hexagon, and multiple factors which may inhibit their mobility are systematically broken down and divided between organisational (infrastructure and management), personal (social and individual) and contextual (task and design) issues. The rings move from immediate interactions, through different layers of the immediate environment, to macro level issues. Multiple barriers to mobility can occur in a journey from interacting with the immediate environment because of poorly designed interfaces, seat layout, lack of stairs and ramps through to organisational issues (such as lack of staff, poor customer support) and macro/ external level factors, such as corruption, lack of gender equity.

Figure 3 illustrates how the results from walking photo elicitation group interviews with young female students were distributed across the hexagon to show the different issues which inhibited walking to the university campus. This representation can form a starting point to planning solutions based on human factors issues, increase sense-making from observational data, and help to develop empathy by showing how others see the world.

Figure 3 groups the most frequently raised concerns (eg lighting, bridges) of female students walking back from the university. These are re-presented on the model, to show where they occur and which stakeholders could own the solutions, eg the car wash, lighting department.

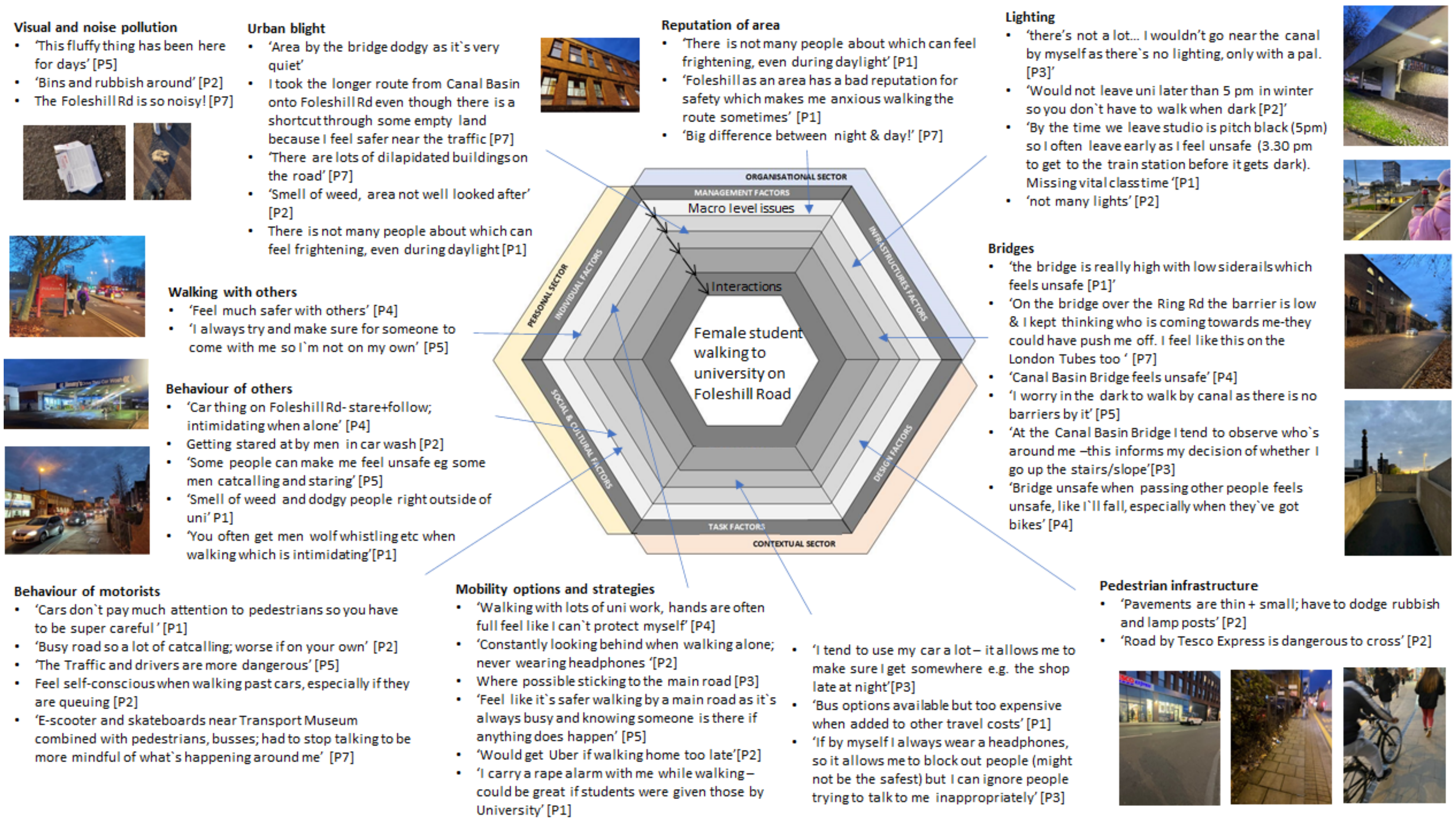

Figure 3: Results of a walking interview with female students.

Conclusions

The tools outlined in this paper were developed in response to a need for greater awareness of the underlying concepts used in the project and a comment from designers, when using low-fidelity simulations which may be paraphrased as ‘I feel the empathy, but how can I use that to inform my design’ (Woodock, 2019) revealing a need for additional tools.

Co-creation teams may be the best placed to deal with wicked problems and complex concepts. However, they need support in the reaching common understandings and developing empathy at the start of the process. This paper has presented practical tools for living Labs which could help in this. Future work is addressing how such tools can be added to the everyday practice of new designers and living labs.

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References

1. Banister, D. (2015), Great Cities and Their Traffic': Michael Thomson Revisited." Built Environment (1978-), 41, 3, 435–46, http://www.jstor.org/stable/44131927.
2. Breengaard, M.H., Christensen, H.R., Levin, L., Henriksson, M. (2021) Report on GaDAPs in gender smart mobility, D4.8 H2020 TInnGO project, downloadable from https://transportgenderobservatory.eu/wp-content/uploads/2021/11/D4.8.-Report-on-GaDAPs-in-GSM_FINAL.pdf
3. Bridgman, J., Woodcock, A., & Gut, K (2022). How can Gender Smart Mobility become a More Intersectional form of Mobility Justice. Paper presented at 5th International Conference on Gender Research, Aveiro, Portugal.
4. Christensen, H.R., Nexø, L.A., Pedersen, S. (2021) The Lure and limits of Smart Cars. Visual analysis of gender and diversity in car branding. 10th International Symposium on Travel Demand Management, 17/11/21 – 19/11/21.
5. Crenshaw, K. (1989) Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics, University of Chicago Legal Forum: Article 8.
6. EIT Urban Mobility (editor) (2021). EIT Urban Mobility Knowledge base for innovative solutions in urban mobility and living labs, Second edition, https://www.eiturbanmobility.eu/wp-content/uploads/2021/09/EITUrbanMobility_Living_labs_report_update_July2021-1.pdf
7. European Commission. (2020). Mobility & Transport https://ec.europa.eu/transport/themes/social/women-in-transport_en retrieved 15th July 2020
8. European Commission. (2020b). Sustainable and Smart Mobility Strategy – putting European transport on track for the future (COM (2020) 789 final). Brussels. Retrieved from https://ec.europa.eu/transport/sites/transport/files/legislation/com20200789.pdf
9. Faiz, K., Woodcock, A., McDonagh, D. and Iqbal, S. (2020). Applying a Systemic Approach to Gender Transport Poverty: Pakistan in Context, FormAkademisk, 13, 4.
10. Hankivsky, O., Grace, D., Hunting, G., Giesbrecht, M., Fridkin, A., Rudrum, S., Ferlatte, O. and Clark, N. (2014) An intersectionality-based policy analysis framework: critical reflections on a methodology for advancing equity. International Journal for Equity in Health, 13(1), p.119.
11. Iqbal, S. Woodcock, A. and Osmond, J. (2020). The effects of gender transport poverty in Karachi, Journal of Transport Geography, 84, 102677.
12. Kale, S. (2020). 'You can't pay cash here': how our newly cashless society harms the most vulnerable. The Guardian. https://www.theguardian.com/money/2020/jun/24/you-cant-pay-cash-here-how-cashless-society-harms-most-vulnerable
13. Lefebvre, H. (1996). Writings on Cities. Cambridge: Blackwell.
14. Levin, L. and Thoresson, K. (2020). Gender equality and 'smart' mobility: a need for planning to address the real needs of all citizens. In Priya Uteng, T., Christensen, H.R. & Levin, L. (Eds.). Gendering Smart Mobilities, pp. 143–161. Routledge, London.
15. Lucas, K. (2012). Transport and social exclusion: Where are we now? Transport Policy, 20, 105-113.
16. Lucas, K., Mattioli, G., Verlinghieri, E. and Guzman, A. (2016) Transport poverty and its adverse social consequences. In Proceedings of the Institution of Civil Engineers-Transport, 169, 3, 353-365.
17. Lynce, A.R., Kalakou, S., Medina, J.A., Costa, M., Adorean, C., Pirra, M., Calvo, M., Malandrino, C., Berman, L., Liotopolous, F. and Tamiakis, I. (2021). Modelling and forecasting of gender mobility behaviour for pilot cities, Deliverable 7.2: TInnGO project.
18. Magee, P., Woodcock, A., Gut, K., Saunders, J., Atkinson, P. and Bridgman, J., (2021). In pursuit of meaningful insight: Post-covid remote collaboration methodology and design as a provocation. In H Grierson, E Bohemia & L Buck (eds) DS 110: Proceedings of the 23rd International Conference on Engineering and Product Design Education (E&PDE 2021).
19. Maffi, S., Malgieri, P. and Di Bartoli, C. (2018), Gender equality and mobility: Mind the gap, CIVITAS WIKI. Retrieved from https://transportgenderobservatory.eu/resource/gender-equality-and-mobility-mind-the-gap/
20. Martens, K. (2016) Transport justice: Designing fair transportation systems. Routledge.
21. Pirra, M., Carboni, A. and Diana, M. (2020). Assessing Gender Gaps in Educational Provision, Research and Employment Opportunities in the Transport Sector at the European Level. Education Sciences, 10, 123. DOI: https://doi.org/10.3390/educsci10050123

22. Pirra, M., Kalakou, S., Carboni, A., Costa, M., Diana, M., and Rita Lynce, A. (2021). A Preliminary Analysis on Gender Aspects in Transport Systems and Mobility Services: Presentation of a Survey Design. Special Issue Gender Issues in Transport and Mobility, Association for European Transport (AET) Conference ETC2020.
23. Preston, J. and Rajé, F. (2007) Accessibility, mobility and transport-related social exclusion. Journal of Transport Geography, 15,3, pp.151-160.
24. Sheller, M. (2018) Mobility justice: The politics of movement in the age of extremes, Verso Books
25. Singh, Y. J. (2019) Is smart mobility also gender-smart? Journal of Gender Studies, 1-15.
26. Titheridge, H., Mackett, R. L., Christie, N., Oviedo Hernández, D. and Ye, R. (2014). Transport and poverty: a review of the evidence.
27. Tovey, M. Woodcock, A. and Osmond, J. (Eds.) (2016) Designing Mobility and Transport Services: Developing traveller experience tools (1st ed.). Routledge. https://doi.org/10.4324/9781315587295
28. Rittel, H. W., and Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4(2), 155-169.
29. Uteng, T.P., Christensen, H.R. and Levin, L. (2020) Gendering Smart Mobilities, Routledge.
30. Woodcock, A. (2013). Laggards and late adopters. Who cares? In Proceedings of the Design Principles and Practices Conference http://designprinciplesandpractices.com/conference-archives/2013-conference
31. Woodcock, A. (2018). Social Impact Assessment Report, D7.3, H2020 CIVITAS SUITS, downloadable from https://www.suits-project.eu/reports/
32. Woodcock, A., and Christensen, H. (2022). Transport Innovation Gender Observatory. H2020RTR21 European Conference, Brussels, Belgium.
33. Woodcock, A., Osmond, J., Tovey, M., and McDonagh, D. (2019). Empathy Thresholds in Transport Design Students. Design and Technology Education, 24, 65-78.

Research In Progress Paper

Learning within and across cities: the role of Living Labs

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Abstract

This paper reports work in progress in understanding how cities learn and the role of Living Labs and provides a brief overview of Living Labs as an arena for learning and innovation within and across cities. The literature on Living Labs highlights learning at many levels in a city, such as individual, communities and institutions. Learning occurs through city-scale experimentation, in social and collaborative settings, where the knowledge production has the potential to span beyond the life of the Living Labs. The experimentation arenas are also bases for innovation ecosystems. The aim of this paper is to provide an overview on how Living Labs can support learning and innovation within and across cities. Our preliminary results show that several authors describe Living Labs as a means of learning within cities. However, there is a limited understanding of how a city learns and very few authors discuss learning across cities.

Keywords

Living Labs, Learning within Cities, Learning across cities, Learning innovation ecosystems, knowledge transfer

Introduction

Learning in cities has been described in many ways. It has often been associated with the concept of Smart Cities where learning takes place in the city space, supported by technology [1], and as lifelong learning, where the citizens learn anytime and anywhere within a city [2]. Similarly, citizens engaging in co-design and co-creation processes has been described as a way that citizens and the public authorities and/or service providers learn about the wishes of the citizens [3]. Many authors describe Living Lab (LL) activities as learning and innovation processes at the city scale, e.g. [4].

Our research has focussed on understanding how cities learn within itself and from other cities. We consider cities as a learning and innovation ecosystem, which continuously learn from within itself and also from others. To be able to really understand how a city learns, we need to understand and clarify what we mean by a city – is that the citizens who reside in the city? Or is it the public authorities that govern the city, provide services and meet the needs of the people? Is it a combination of many entities? Our research on how cities learn within and across cities has identified LLs as an important approach that facilitates and support learning in cities. This paper reports our current findings.

The European Network of Living Labs [5] defines LLs as "user-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings" [5]. Several authors emphasise the role of users or citizens in co-creation activities, often supported by Information and Communication Technology (ICT), e.g. [3]. LLs have also been described as environments for involving users in innovation and development, to meet the innovation challenges faced by ICT [6]. More recently, the concepts of Urban Living Labs (ULL) has emerged, where LLs are considered as experimentation at the urban or the city scale, and recognises the importance of learning and feedback as a part of the innovation method as one of its main characteristics [7]. The creation of knowledge which is transferable to other contexts is considered as an essential element for urban transformations. This is indeed of utmost importance to learning within and across cities and requires a deeper understanding of how a city learns, who learns and how, the kinds of knowledge that is relevant and, equally importantly, the processes of knowledge creation and transfer. This is where we see the relevance of LLs for our research on understanding how cities learn both within itself as well as from other cities.

This paper describes work in progress. However, with the current focus on LLs as an environment for learning at the city scale, we saw value in sharing this work with the research community. The aim of this paper is thus to share our current findings on how LLs could support learning and innovation within and across cities. Our preliminary results show that several authors describe LLs as a means of learning within cities. However, there is a limited understanding of how a city learns and very few authors discuss learning across cities.

The rest of this paper is structured as follows: Section 2 provides a brief overview of learning and innovation in cities and learning cross cities and Section 3 summarises the paper.

Learning and Innovation in Living Labs

The success of LLs has been associated with the possibility to transfer knowledge across the different parties [8] and learning at the city scale has been in focus in the LL literature. The following sub-sections provide a brief overview of the literature.

Learning within cities

Several authors discuss learning in cities and LLs in the context of “Smart Cities”, a concept that is often associated with the use of technology. The concept of Human Smart Cities emphasise a citizen-driven, smart and inclusive environment in which citizens and the government engage in a dialogue [3]. Learning in a Human Smart City is further explored in [9], where they identified that learning happens at the individual, group and the institution levels. For example, through co-creation and engagement activities, individual citizens learn from one another and the city, as an institution, gains new insights and knowledge about its citizens and their needs and wishes.

LLs have been identified as the most appropriate instruments for cities to develop their smartness, which is enriched by the human driven application of citizen-centric and participatory co-creation methods for empowering and improving the lives of the citizens [4]. Furthermore, in LLs, learning happens as the result of distributed, collective experimentations. Learning takes place in public and social settings in transparent processes, where the learning is more encompassing than mere knowledge production.

Many authors describe LLs as experimentation in cities, where “real experimentation” is centred around a process of “learning by doing” and includes a multitude of actors from the public and private sectors [10]. In LLs, experimentation and learning happen in a transparent, collective and inclusive way [4]. The experimental and inclusive co-learning environment created by LLs also facilitate experiential learning [11]. LLs have also been recognised as a means to produce knowledge to a wider urban audience, and to support social learning [12] and multi-actor learning [13].

Innovation in cities

Tangible and intangible innovations have been identified among the many benefits of LLs [8]. LLs have been referred to as innovation systems, which also supports experiential learning, leading to a better understanding of the products, services and the process and how people use them [11]. LLs are considered arenas for experimentation at the city level, which creates a unique potential for innovation, to address the challenges in cities and communities in a practical manner [10]. The practice-based innovation environments created by LLs, where actors from several arenas participate and co-create, have been identified as some of their main potentials [14].

LLs have also been described in the context of open innovation ecosystems, where knowledge and technology flow among the actors of the LL, where the LL provides a focal point around which the actors can work together [15]. The authors consider LLs in the context of innovative product development and identify the different actors as utilisers, enablers, providers and users of the products. Cities were identified as the enabler in their case study. There is a wide body of literature that discuss LLs as innovation systems; however most of them focus on product development at an organisational level and not at the city scale, e.g. [16].

Learning across cities

LLs have also been described in the context of open innovation ecosystems, where knowledge and technology flow from and to, within and across LLs, in which the actors can work together, generating communities of interest. It is believed that the knowledge that is generated may transcend the boundaries of the specific LL in which the learning takes place [15]. LLs have been recognised as a method innovation for institutional activities and the city of Tallin has made attempts to learn from the experience of LLs in the city of Helsinki [17]. Interviews were conducted with actors in Helsinki, with a focus on knowledge transfer to Tallin. An outcome of this work has also revealed that it could also facilitate cross-border collaboration across cities and regions. However, there is limited access to such studies at the time of writing.

Summary and Future Work

This paper presents our current findings related to LLs as an arena for learning and innovation within and across cities. The literature on LLs highlights learning at many levels in a city, such as individual, communities and institutions. Learning occurs through city-scale experimentation, in social and collaborative settings, where the knowledge production has the potential to span beyond the life of the LL and its participants. The experimentation arenas are bases for innovation ecosystems. While LLs offer learning and innovation opportunities at the urban scale, how they overcome their problems and challenges are often lost. Most LLs appear to be one-off solutions and while individuals, groups and institutions learn from the co-creation activities within one city, the learning is not necessarily transferred to future situations within the same city or to another. Our work so far indicates that the literature on learning across cities is limited.

This paper reports work in progress in understanding how cities learn and the role of LLs. Hence, the literature that has been reviewed is limited. We plan to continue the literature review and conduct case studies to further understand how cities learn and how LLs and ICT support can be designed to support learning and innovation processes within and across cities.

References

1. Gianni, F. and M. Divitini, Technology-enhanced Smart City Learning: a Systematic Mapping of the Literature. Interaction Design and Architecture, Special issue on: Smart City Learning: Opportunities and Challenges, 2016(27): p. 28 - 43.
2. Sivo, M.D. and D. Ladiana, Towards a learning city the neighborhood lab and the lab net. Procedia - Social and Behavioral Sciences, 2010. 2(2): p. 5349-5356.
3. Oliveira, Á., M. Campolargo, and M. Martins, Human Smart Cities: A Human-Centric Model aiming at the wellbeing and quality of life of citizens, in eChallenges e-2014, P. Cunningham and M. Cunningham, Editors. 2014, IEEE.
4. Concilio, G. and F. Molinari, Living Labs and Urban Smartness: The Experimental Nature of Emerging Governance Models, in Handbook of Research on Social, Economic, and Environmental Sustainability in the Development of Smart Cities, A. Vesco and F. Ferrero, Editors. 2015, IGI Global: Hershey, PA, USA. p. 98-111.
5. ENoLL. European Network of Living Labs. [cited 2022 20 May]; Available from: https://enoll.org/about-us/.
6. Følstad, A., Living Labs for Innovation and Development of Information and Communication Technology: A Literature Review. Electronic Journal of Organizational Virtualness, 2008. 10: p. 99-131.
7. Urban Europe. Urban Living Labs in JPI Urban Europe. [cited 2022 20 May]; Available from: https://jpi-urbaneurope.eu/urbanlivinglabs/.
8. Hossain, M., S. Leminen, and M. Westerlund, A Systematic Review of Living Lab literature. Journal of Cleaner Production, 2019. 213: p. 976-988.
9. Petersen, S.A., M. Oliveira, and G. Concilio, Smart Neighbourhood Learning - the case of MyNeighbourhood. Interaction Design & Architecture, Special Issue on Smart City Learning: Opportunities and Challenges, 2016(27): p. 66 – 78.
10. Potjer, S. and M. Hajer, Learning with Cities, Learning for Cities. The Golden Opportunity of the Urban Agenda for the EU. 2016, Utrecht University: Urbaf Futures Studio.
11. Lehmann, V., M. Frangioni, and P. Dubé, Living Lab as knowledge system: an actual approach for managing urban service projects? Journal of Knowledge Management, 2015. 19(5): p. 1087 - 1107.
12. König, A. and J. Evans, Introduction: experimenting for sustainable development? Living laboratories, social learning and the role of the university, in Regenerative Sustainable Development of Universities and Cities. 2013, Edward Elgar Publishing.
13. Puerari, E., et al., Co-Creation Dynamics in Urban Living Labs. Sustainability, 2018. 10(6): p. 1893.
14. Concilio, G., Urban Living Labs: Opportunities in and for Planning, in Human Smart Cities. Urban and Landscape Perspectives, G. Concilio and F. Rizzo, Editors. 2016, Springer, Cham.
15. Schuurman, D., B. Baccarne, and L. De Marez, Living Labs as open innovation systems for knowledge exchange: solutions for sustainable innovation development. Int. J. Business Innovation and Research, 2016. 10(2/3): p. 322-340.
16. Katzy, B.R., K.S. Pawar, and K.-D. Thoben, Editorial: A Living Lab Research Agenda. Int. J. Product Development, 2012. 17(1/2).
17. Lepik, K.-L., E. Terk, and M. Krigul, Introducing Living Lab's Method as Knowledge Transfer from one Socio-Institutional Context to another: Evidence from Helsinki-Tallinn Cross-Border Region. Journal of Universal Computer Science, 2010. 16(8): p. 1089-1101.

Practitioner Presentation Paper

Blue growth economy: An integration program between the private sector, public funds, and stakeholders, promoting a social enterprise. Aquaponic systems as an economic development tool

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Abstract

“To support technological development activities aimed at solving scientific missions and challenges within the U.N Sustainable Development for 2030". With this premise, we propose, to meet the world's seafood needs, aquaculture production will increase by 46.4 million metric tons. Where 62% of seafood will come from aquaculture by 2030" (FAO).

FWF is a company dedicated to the production of fish and vegetables in a sustainable system that does not use any type of chemical substance harmful to human and animal health, in a system called Aquaponics. Aquaponics was developed to solve availability problems of organic matter for vegetable production, making profit on the produced material resulting from the fish creation. All products produced in this kind of system can be called organic food. Our proposal fits with almost all UN SDG priorities (figure).

Our target customer are single people, small and big companies that consume seafood/agriculture goods around the world. We aim to compete with aquaculture products and organic production.

We can focus on the local business development and also to big market surfaces, depending on the available capital of potential Franchised.

To keep the Decarbonization mission, we must guarantee that the consumer does not need to go outside to have fresh products, saving tons of Carbon emissions, also promoting training and well specialized workers to supply the local market.

As a result, the aquaponic systems available Products: Microgreens, Butterhead Lettuce, Baby Boc Choy, Culinary Basil, Leeks, Romaine Lettuce and Tilapia (Breeding Stock/ Fingerlings).

Keywords

Health food, decarbonizing, aquaponic, Organic, Societal impact, Environmental protection.

Switzerland prototype

Market adaptations and local demand

For the present case, we will adapt the species according to local consumers habits. During the Sustainability week organized by University of Geneva, we disseminate a questionnaire to the students in order to collect data to understand the local consumption habits. Also, combining data from EUMOFA reports to Switzerland most common sea/agrifood.

One of the deliverables of the project it helps the reinsertion of the long-time unemployment, young people, refugees and illegal immigrants. Our clients: Small and medium local businesses to promote local development and decarbonization, reducing the needs to transport food for far-away.

Our biggest competitors are products from certified aquaculture/ agriculture with an organic product stamp. Although we know, it is very difficult to certify the food safety of products found in natural water areas. Mainly due to the fact that EU Regulation agree that even the organic producers could use some chemicals on their cultures. However, our product will be differentiated because aquaponics guarantees 100% reliability in the absence of harmful substances to animal welfare and human health. Plus, promoting Decarbonization and local economy development: Bioeconomy.

We will apply a success case from USA and adapt to the European reality. We will transform our success model in an easy low-cost franchising, promoting a widespread business model around the world. Our projections are in one year, using a 40m^2 prototype, to produce fish/ agri products using the aquaponics method, estimated to produce about 3 tons of fish and 4 tons of vegetables per year, with a total investment can be around 200 K Euros.

Figure 1. FWF Europe meeting the UN Priorities.

Figure 2. Species cultivated in the Aquaponic mini systems.

References

1. FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome. https://doi.org/10.4060/ca9229en.
2. EUMOFA European Market Observatory for Fisheries and Aquaculture Products. Monthly Highlights | NO. 11/2017.Helvetica Neue 10pt.
3. EFSA. 2008. Food Safety considerations of animal welfare aspects of husbandry systems for farmed fish - Scientific opinion of the Panel on Biological Hazards. The EFSA Journal 867 1-24.
4. EU Comission. 2018. New organic regulation. Regulation (EU) 2018/848 – rules on the organic production and labelling of organic products (applies from 1 January 2022).
5. Research and Markets. 2020. European Fish and Seafood market report 2020: Includes historical (2013, 2017 & 2018) and forecast demand data.
6. Global Aquaculture Alliance. 2019. Seafood demand and aquaculture growth. 5p.
7. Global Aquaculture Alliance. 2021. Quantifying greenhouse gas emissions from global aquaculture. 6p.

Research In Progress Paper

Living Lab for small-scale public space interventions to tackle heat waves in Budapest

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Abstract

Anthropogenic climate change leads the average and extreme temperatures around the globe to rise. Especially urban centers with a high population density and sealed surface are gripped with extreme heat waves, leaving millions prone to the negative health impacts imposed through heat stress. In Europe, a continent which has known a mostly moderate climate for centuries, the severe heatwave in the summer of 2003 is estimated to have caused between 25.000 and 70.000 deaths in Western Europe (Sardon 2007). Especially the mortality of elderly people rises during a heat wave, but negative health effects are also visible for people with disabilities, children and pregnant women (Åström et al 2011).

In urban areas, there can generally be observed a heat island effect, meaning that the temperature in the city is significantly higher than in the rural surroundings. Though, research has shown that the heat island effect is not uninucleate, but particularly affects areas with low ventilation or vegetation (Clarke 1972). However, these are more often than not areas where vulnerable groups such as low-income households and immigrants live. Through gentrification, marginalization and exploding rental costs, disadvantaged groups and poor households are pushed to very heat-prone urban areas (Reid et al. 2009).

The research focuses on how Urban Living Labs can facilitate the involvement of these vulnerable and disadvantaged groups in small-scale public space interventions in order to define heatwave adaptation practices in Budapest, Hungary. Urban Living Labs are used to let vulnerable groups participate in policy-; decision-making processes and practices, thus, changing the existing power-relations and having a transformative aspect is indispensable. I build-up a project describing the necessary conditions in which a co-productive process such as a Living Lab can be beneficial in heatwave adaptation in Budapest. Building on the experience of previous heatwave adaptation processes and practices, using qualitative and quantitative research techniques I will

be able to describe which actors, when, where, under which circumstances should be invited for such collaboration. These details will be defined based on vulnerability assessment, expert interviews, Q-methodology research.

As it is still a research in progress, all contributions and constructive feedbacks are warmly-welcome.

Keywords

heatwave adaptation; small-scale public space intervention; inclusion; vulnerability assessment; Urban Living Lab

Introduction

Tackling heat waves by proper adaptation practices and policies is crucial from social, economic and environmental point of view as well. I argue that heatwaves are natural hazards, and the intensity, frequency and duration will be growing in the close future already, causing harmful health, economic and infrastructural impacts. The negative impacts are not and will not be distributed evenly between countries, continents but neither between residents within an urban area. With proper adaptation practices however, it is possible to reduce the destructive impacts of heatwaves. For creating such practices though it is indispensable to count with and on the vulnerable residents as well.

The complex challenge of global climate change and its consequences such as more frequent and more intense heatwaves in urban could raise thousands of questions. I am not aiming to find technical solutions that can help adaptation to heatwaves, neither finding world-wide usable adaptation practices. Heatwave adaptation processes have to be place-based, involving local residents with special attention to vulnerable groups (Bulkeley et al. 2013; T.Amorim-Maia et al. 2022).

The segments of heatwave adaptation on which my research will focus is how different stakeholders can cooperate for a more fair and equitable adaptation. Therefore, the main research question is:

How the Urban Living Lab approach can be applied for vulnerable groups for small-scale public space intervention to tackle heat wave adaptation in Budapest?

Co-productive adaptation

Building further on the necessity of the involvement of the residents and especially vulnerable residents in climate adaptation is coming from the necessity of creating adaptation practices and policies which do not deepen the already existing gap between different groups in the society. According to Malloy and Ashcraft the aim of a just climate adaptation is “systematically removing institutional barriers (implementation) that disproportionately burden some groups of people more than others (recognition), while simultaneously creating opportunity (capabilities) and reducing harm related to climate change (Malloy and Ashcraft 2020). Limited citizen involvement and engagement in adaption, implementation and evaluation as well as limited or tokenistic civil society participation is among the drivers of injustice in adaptation (T.Amorim-Maia et al. 2022). Not including vulnerable population in the adaptation process risks to fail efficiency of the whole adaptation process, on the other hand, reinforces already existing vulnerabilities among vulnerable social groups (Anguelovski et al. 2019).

Contrasting the need for empowerment and citizen involvement with the already described low risk perception regarding heatwaves there is a huge gap between the optimal and the available consideration. Thus, how can citizen participation, co-production or bottom-up initiatives be awaited in heatwave adaptation when they do not consider heatwaves as crucial risk? In which manners residents can be empowered for co-production?

Co-production is widely used in climate change adaptation, through which practitioners, researchers and residents collaborate to produce knowledge and actions, practices (Turek-Hankins et al. 2021). Co-production in this sense not only gives place vulnerable groups to participate in creating practices, but it brings closer decision-makers, scientists and residents (Lemos and Morehouse 2005). One aim of co-production in climate change adaptation is generating actionable knowledge, while the second is about the transformation of structures among society is science (Turek-Hankins et al. 2021).

The first identified objective includes the citizen involvement, including vulnerable groups, designing spaces and decisions with the inputs of residents as first-hand users. Transforming the relations opens the discussion towards democratizing science, power redistribution among different stakeholders, and broadening the meaning of decision-making. The latter definitely aims to transform existing power structures and represents a radical perspective, concerning long-term impacts as well. While the first one is more pragmatic, and understood differently among scholars. While some say it can lead to broader transformation especially concerning governance arrangements, others say it can reinforce existing power relations and inequalities (Harvey et al. 2019).

More scholars argue that climate change adaptation is a transformative social institution and instead of a weighing challenge they see it as an opportunity where socially and systemically vulnerable populations can gain power to shape decisions (Holland 2017; Adger 2016). In that sense the commitments from all parts have to address solidarity, place, well-being, fairness issues.

The concept of Urban Living Labs (ULL) is coming from the recognition of that wicked problems await tools and solutions that concern them in a systemic way and integrate wide-range of knowledge such as academic, non-academic or citizen (Laborgne et al. 2021). The ULL method facilitates the place-based knowledge co-creation among the participants, can contribute to innovation, and let breakthrough ideas to be tested.

Urban Living Labs have its characteristics from co-production and social innovation. That special experience is mostly undertaken in the co-design phase of co-production and the main objective of it is to get to know and take into consideration the user's point of view and experiences. These living labs experiences allow the participants to test place-based ideas and to specify and better understand wicked problems such as climate change adaptation.

In my understanding co-production and ULLs approach is crucial in order to let vulnerable groups participate in policy-; decision-making processes and practices, thus, changing the existing power-relations and having a transformative aspect is indispensable**.**

Heatwave perception

Studies often prove the fact that socially more vulnerable population lives in spatially more vulnerable areas within cities, such as space with high density and low green infrastructure availability. However, less studies speak about how the perception of heatwaves and social vulnerability correlate. An economic, infrastructural and health risk that is not precepted as crucial, for sure will not have a high-importance rank among residents. My question is though, is low heatwave risk perception can be explained by social vulnerability? Or is it the opposite due to the eider individual adaptation capacities by the well-off?

The perception research will be conducted with Q method. The Q methodology has both quantitative and qualitative characteristics and enables to understand the value and preference patterns that are produced by the respondents. The method does not answer the question of whether society has low or high risk perception regarding heatwaves, such hypotheses cannot be tested, but it does indicate the type of people we live with in a society, their subjective reality shows what kind of societies we live in.

Q methodology

The father of the Q-method is William Stephenson, a physicist and psychologist who developed the analytical technique in the 1930s. Although data is collected quantitatively, the method differs in many ways from traditional quantitative research methods. The point is not the high sample size, the survey can be conducted with a small number of respondents, and even with a small number of respondents, requires fewer respondents than the attitudinal adjustment, but this does not necessarily lose its representativeness. Thanks to the method, people's subjectivity becomes quantifiable and measurable. The method is based on correlation calculation and inverse factor analysis. Previously defined number of statements are phrased by the researchers which are thought to divide the respondents, or can be strong thoughts of an opinion leaders. Later, the participants have to evaluate these according to their preferences and based on their agreement or disagreement to it. The method is used to conduct researches on topics which are difficult to comprehend and are open to public discussion (Dryzek and Berejikian 1993).

The research method is less widespread in Hungary, but studies can be found, that have used it, such as the Social Distribution of Health Gains of Practicing Physicians attitudes towards the distribution of wealth. (Authors: László Gulácsi, Márta Péntek, Ottó Hajdu) Also limited number of research used Q method is conducted in the topic of climate change (Niemeyer et al. 2005; Lorenzoni et al. 2007). O'Neill and Nicholson-Cole used Q methodology to get to know people's perception regarded climate change risk (O'neill and Nicholson Cole 2009).

Statements

In this research 41 statements are defined because that number of statements enables the normal distribution during the analyses. Statements are related to the perceived relevance of heatwaves, individual adaptation practices, community adaptation practices and sensitivity. Respondents are selected from low-income households, vulnerable groups, as well as from wealthier populations. In the sample, there is an equal distribution of vulnerable and wealthier groups as well as in the age and gender composition. The statements are meant to be dividing, sometimes provocative in order to generate emotions and real opinion from the respondents, nevertheless, in the analysis the established groups will be able to divide by important arguments.

Individual adaptation	Community-based adaptation
Should I collect selectively, not produce rubbish, not go by plane, and even watch out for heat waves?	Adaptation is most effective at individual level
I have a tried and tested routine for heatwaves	They do not provide adequate information on adaptation practices
I do not significantly change my lifestyle in case of hot flashes	During heatwaves, it means a lot to share with my friends and neighbours the difficulties caused by the challenges
Adaptation at individual level is not expected	Heat waves are not particularly discussed among friends
In summer, you can only bear the heat with air conditioning	In summer, our elderly or sick relatives need much more attention
I am aware that air conditioning exacerbates the heat	Our urban public spaces are ready for heatwaves, mitigating their effects
Adapting to heat waves is an individual task	A fountain or a shady spot would also help in public spaces
Luckily I can afford to spend the summer by the water	Without adequate information, society will not be able to adapt effectively to the individual
I know exactly how to achieve the most comfortable temperature in our building (e.g. ventilation techniques, shading)	Scientists say everything and then nothing ever comes of it
If I could, I would install air conditioning in my apartment building	It would help a lot if heat alerts were communicated through several channels
	Drink a lot, avoid the sun, but no substantive knowledge base is provided by policymakers when communicating about the heat alert

Figure 10. Statements related to individual and community-based adaptation.

Relevance	Sensitivity
Besides viruses and war, climate change is a small problem	In summer, the city is unlivable
If climate change were a real threat, more government action would surely be taken	I am not afraid of the health effects of heatwaves
In winter people freeze to death on the streets, that's the real problem!	I miss the snow in winter more than disturb the summer heat
Heatwaves are a problem for 2-3 weeks a year, the real economic challenges should be given proper attention	I feel particularly vulnerable to heatwaves
Heat waves of increasing intensity and frequency have woken us up to the gravity and imminence of climate change.	I can do much less in the heat (e.g. work, sports)
Everyone is aware of the individual and community risks of heatwaves	Asphalt and dense urbanisation turn Budapest into a boiler room in summer
The biggest threat from heatwaves is health, everything else is negligible	In summer it's good to be as warm as possible
Heatwaves also carry psychological, economic and health risks	Summers used to be just as hot
Smaller problems are bigger than adapting to the heat	If the warming continues like this, there will never be snow in winter, and in summer the heat will be unbearable even on the waterfront
In Southern Europe and Africa, adaptation to heat waves is important, but we in the Carpathian Basin are protected from weather extremes	I was not even aware of the heatwaves until now

Figure 11. Statements related to percieved relevance and sensitivity.

The below pyramid form was at my help when doing fieldwork and gathering participants in the research. Based on this, participants had to evaluate each statement and allocate in one of the boxes according to their preferences. If someone completely agrees with the statement, it goes to a box 4, and in case of complete disagreement in a box -4. The challenging part of the filling of the pyramid usually comes at its end, when a statement should be placed in a box according to the participant's preference, however, there is no space anymore in that category. On this occasion the order has to be changed and it consumes more time and energy for the person.

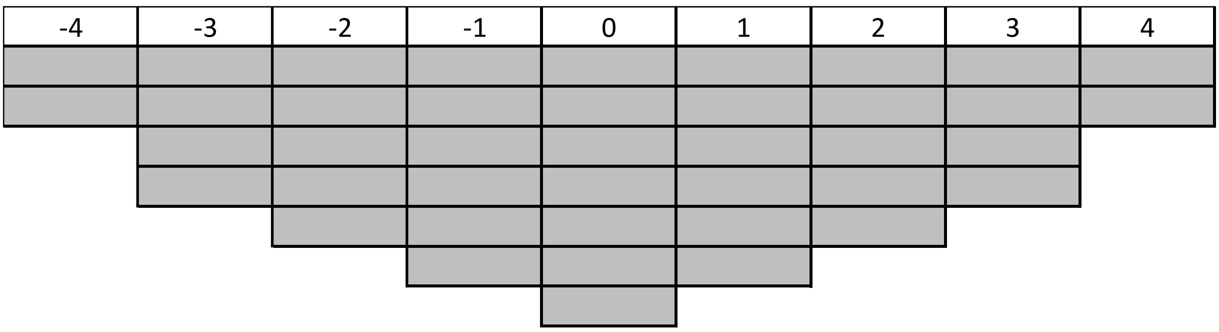

Figure 12. Pyramid helping the Q methodology.

Data collection

The data collection process is still ongoing and lasts from July 2022 until the end of August. This period was chosen due to the subject of the research. In this time of the year, heatwaves and adaptation receive a huge part of media communication, and people can feel the impacts of climate change in their own lives. As the research aims to understand the perception of the risk of heatwaves, another way of development of the discussion would be conducting the research in the same way during December. Then, it would surely have different results.

The location of the data collection takes place in strategic points of the city, such as in neighborhoods that have a vulnerable population in order to get in touch with respondents from various groups. Market halls, municipality, bibliotecas, playgrounds are the places where elderly, women, low-income household members can be reached. However, the engagement of people in a time-consuming research methodology is still challenging.

Conclusion

The presented research is still ongoing, and will consist of more part, not only the residents' perception. Conducting the vulnerability assessment, the perception assessment with the Q-methodology and the multidisciplinary interviews, a scientifically grounded Urban Living Lab will be projected in order to tackle heatwaves in Budapest. This practice will enrich the discussion of Urban Living Labs including a geographical part, Eastern Europe which is not typically can be described with innovative methodologies that are build on co-production. Moreover, it will give an answer to the question of how vulnerable groups should be involved in Urban Living Lab activities.

References

1. Adger, W. 2016. 'Place, Well-Being, and Fairness Shape Priorities for Adaptation to Climate Change'. Global Environmental Change 38. doi: 10.1016/j.gloenvcha.2016.03.009.
2. Amorim-Maia, Ana T., Isabelle Anguelovski, Eric Chu, and James Connolly. 2022. 'Intersectional Climate Justice: A Conceptual Pathway for Bridging Adaptation Planning, Transformative Action, and Social Equity'. Urban Climate 41:101053. doi: 10.1016/j.uclim.2021.101053.
3. Anguelovski, Isabelle, James J. T. Connolly, Hamil Pearsall, Galia Shokry, Melissa Checker, Juliana Maantay, Kenneth Gould, Tammy Lewis, Andrew Maroko, and J. Timmons Roberts. 2019. 'Why Green "Climate Gentrification" Threatens Poor and Vulnerable Populations'. Proceedings of the National Academy of Sciences 116(52):26139–43. doi: 10.1073/pnas.1920490117.
4. Åström, Daniel Oudin, Bertil Forsberg, and Joacim Rocklöv. 2011. 'Heat Wave Impact on Morbidity and Mortality in the Elderly Population: A Review of Recent Studies'. Maturitas 69(2):99–105. doi: 10.1016/j.maturitas.2011.03.008.
5. Bulkeley, H., and R. Tuts. 2013. 'Understanding Urban Vulnerability, Adaptation and Resilience in the Context of Climate Change.' Local Environment. 18(6):646–62.
6. Clarke, John F. 1972. 'Some Effects of the Urban Structure on Heat Mortality'. Environmental Research 5(1):93–104. doi: 10.1016/0013-9351(72)90023-0.
7. Dryzek, John S., and Jeffrey Berejikian. 1993. 'Reconstructive Democratic Theory'. The American Political Science Review 87(1):48–60. doi: 10.2307/2938955.
8. Harvey, Blane, Logan Cochrane, and Marissa Epp. 2019. 'Charting Knowledge Co-production Pathways in Climate and Development'. Environmental Policy and Governance. doi: 10.1002/eet.1834.
9. Holland, Breena. 2017. 'Procedural Justice in Local Climate Adaptation: Political Capabilities and Transformational Change'. Environmental Politics 26(3):391–412. doi: 10.1080/09644016.2017.1287625.
10. Laborgne, Pia, Epongue Ekille, Jochen Wendel, Andrea Pierce, Monika Heyder, Joanna Suchomska, Iulian Nichersu, Dragos Balaican, Krzysztof Ślebioda, Michał Wróblewski, and Wojciech Goszczynski. 2021. 'Urban Living Labs: How to Enable Inclusive Transdisciplinary Research?' Urban Transformations 3(1):11. doi: 10.1186/s42854-021-00026-0.
11. Lemos, Maria, and Barbara Morehouse. 2005. 'The Co-Production of Science and Policy in Integrated Climate Assessments'. Global Environmental Change 15:57–68. doi: 10.1016/j.gloenvcha.2004.09.004.
12. Lorenzoni, Irene, Sophie Day, and Lorraine Whitmarsh. 2007. 'Barriers Perceived to Engaging with Climate Change Among the UK Public and Their Policy Implications'. Global Environmental Change 17:445–59. doi: 10.1016/j.gloenvcha.2007.01.004.
13. Malloy, Jeffrey T., and Catherine M. Ashcraft. 2020. 'A Framework for Implementing Socially Just Climate Adaptation'. Climatic Change 160(1):1–14. doi: 10.1007/s10584-020-02705-6.
14. Niemeyer, Simon, Judith Petts, and Kersty Hobson. 2005. 'Rapid Climate Change and Society: Assessing Responses and Thresholds: Rapid Climate Change and Society'. Risk Analysis 25(6):1443–56. doi: 10.1111/j.1539-6924.2005.00691.x.
15. O'Neill, Saffron, and Sophie Nicholson-Cole. 2009. '"Fear Won't Do It": Promoting Positive Engagement With Climate Change Through Visual and Iconic Representations'. Science Communication 30(3):355–79. doi: 10.1177/1075547008329201.
16. Reid, Colleen E., Marie S. O'Neill, Carina J. Gronlund, Shannon J. Brines, Daniel G. Brown, Ana V. Diez-Roux, and Joel Schwartz. 2009. 'Mapping Community Determinants of Heat Vulnerability'. Environmental Health Perspectives 117(11):1730–36. doi: 10.1289/ehp.0900683.
17. Sardon, J. P. 2007. 'The 2003 Heat Wave'. Euro Surveillance: Bulletin Europeen Sur Les Maladies Transmissibles = European Communicable Disease Bulletin 12(3):226.
18. Turek-Hankins, Lynée L., Erin Coughlan de Perez, Giulia Scarpa, Raquel Ruiz-Diaz, Patricia Nayna Schwerdtle, Elphin Tom Joe, Eranga K. Galappaththi, Emma M. French, Stephanie E. Austin, Chandni Singh, Mariella Siña, A. R. Siders, Maarten K. van Aalst, Sienna Templeman, Abraham M. Nunbogu, Lea Berrang-Ford, Tanvi Agrawal, the Global Adaptation Mapping Initiative team, and Katharine J. Mach. 2021. 'Climate Change Adaptation to Extreme Heat: A Global Systematic Review of Implemented Action'. Oxford Open Climate Change 1(1):kgab005. doi: 10.1093/oxfclm/kgab005.

Research In Progress Paper

Butterfly conservation and social inclusion in Turin.

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Abstract

Citizen Science (CS) projects involve citizens in scientific research different ways i.e. providing species occurrences or applying standardised monitoring for species target groups. Nowadays CS has become important in biodiversity conservation for both filling scientific gaps and increasing awareness of people about environmental issues. Butterflies are particularly suitable for these projects because they are charismatic, bioindicators and easily identifiable. "Farfalle in ToUr" is a Citizen Science project in Turin, that aims to protect urban butterflies thanks to the help of users of Mental Health Centres (MHCs) supervised by two local social cooperatives. The project is part of proGIreg (Productive Green Infrastructure for Post-industrial Urban Regeneration) for which Turin is one of the four front-runner cities where Nature-Based Solutions are applied for the urban regeneration. Thanks to the interactions between MHC users, citizens, students, educators and researchers, the project aims to reduce the users' social stigma, increasing their inclusion, and to monitor butterflies along with making Turin more butterfly-friendly.

Keywords

Butterfly monitoring; Citizen Science; Green infrastructures; Mental health; Nature-Based Solutions; Urban regeneration.

Introduction

In recent years, Citizen Science (CS) projects, that involve citizens in scientific research, have rapidly increased across many scientific disciplines, including biodiversity conservation. The CS projects may increase the awareness of citizens on the local biodiversity through public engagement and science dissemination events (Vohland et al., 2021). On the other hand, citizens are very valuable for researchers, thanks to the large amount of data that they can provide and for enabling the realisation of scientific projects at large scale (Kobori et al., 2016). In several CS projects, butterflies are target species on which citizens collect data (Dennis et al., 2017). Indeed, they are charismatic, well-known and easy to identify (van Swaay et al., 2008). Moreover, butterflies are good bioindicators, particularly sensitive to environmental changes because of their rapid generation turnover. Butterfly different stages live in specific microhabitats, making them ideal indicators to investigate environmental pressures (Bonelli et al., 2011). For example, in Europe the Butterfly Monitoring Scheme aims to identify strategies to reverse butterfly decline investigating the population trends thanks to a standardised and shared sampling method: the Pollard Walk (Lewandowski et al., 2016; Roy et al., 2020).

Cities are not design to support butterfly biodiversity, but if green areas are correctly managed and connected, also thanks to Nature-Based Solutions (NBSs), they can support a resilient pollinator community (Baldock., 2020). Indeed, a network of green areas is crucial to avoid population isolation because little and isolated populations of butterflies could be more influenced by inbreeding, which contributes to species decrease (Saccheri et al., 1998).

Users of Mental Health Centres (MHCs) may improve their physical health and psychological disadvantages through being involved in physical activities, social recreation with creative pursuits (Penedo and Dahn, 2005; Iwasaki et al., 2010). Some studies have proven that community recreation programs where users are not identified as patients and they have the opportunities to participate in meaningful activities, are strongly beneficial for both mental health and social inclusion (Sells et al., 2006).

Farfalle in ToUr represents an innovation in the field of Citizen Science, combining the need of pollinator monitoring, especially butterflies, with the method expected by the latest European directives (Potts et al., 2020) and the need of MHCs users for rehabilitation activities such as the contact with nature, which it is known to have multiple benefits on people's health (Bratman et al., 2019).

Project description

Farfalle in ToUr, a Citizen Science project in Turin, aims to preserve urban butterflies thanks to the involvement of users of MHCs. The project follows a multidisciplinary approach that involve educators of social cooperatives, users of MHCs and researchers from the University of Turin in co-designed activities. It is interwoven with the H2020 project proGIreg (Productive Green Infrastructure for Post-industrial Urban Regeneration, Nature-Based-Solution) since 2018.

The project has two different aspects: scientific and social-educational ones. The scientific aims are to monitor butterflies, to favour their mobility and permeability across the city of Turin (NBS) and to increase knowledge on biodiversity conservation within urban areas. On the other hand, the social and educational aspects allow the users of different MHCs to establish new relationships with other citizens, and to take an active part in the society leading dissemination events, school activities and scientific butterfly monitoring. In this way, the project combines butterfly conservation with users' social inclusion, allowing them to feel more involved in society and active in the monitoring of butterflies (Bonelli et al., 2020; Leff et al., 2006).

Through Farfalle in ToUr we wanted to assess whether the increase in pollinator-friendly green areas in cities coincides with an increase in butterflies within urban areas. Furthermore, we would investigate the benefit that these activities can provide to the everyday life of MHCs users.

Methodology

The project has been developed using four main focuses:

1. Increasing of butterfly-friendly areas. Those areas were created in several parts of Turin. Some of them were created inside the spaces belonging to social cooperatives or schools, with the help of MHC users and students. The areas were created by planting native plants, supplied by local vivarium, that increase nectar sources and butterfly host plants.

2. Citizen Scientist education. The educational aim consists of both theoretical and practical lessons for users, focused on monitoring methods, anatomy, ecology, and identification of urban butterfly species.

3. Butterfly monitoring. Trained Citizen Scientists are involved in the monitoring of butterfly species. The monitoring of the species in the project's areas is carried out through standardised methods, such as semi-quantitative transects (Pollard transect) or a 15 minutes count at fixed points.

4. Dissemination. The dissemination events, which included also the school activities, had the aim to involve citizens and students in raising knowledge about environmental issues and pollinator (specifically butterfly) conservation. These events have been organized and carried out by users of social cooperatives and MHCs, supported by educators and researchers of the University. The goal was to increase children's

awareness of the environment and species conservation, through theoretical and practical activities. The website, the Facebook and Instagram pages have been used by people to be up-to-date on all the news about the project.

Results

Increasing of butterfly-friendly areas: Since 2014, despite the COVID-19 pandemic, there were created about 30 areas and oases for butterflies scattered throughout the city of Turin (Fig. 1). The creation of butterfly gardens was also let up due to the health emergency and restarted in 2022 with the installation of two new butterfly areas. In the same year, also private companies showed great interest in the project, expressing the will to create butterfly gardens in their headquarters. The collaboration has already been initiated and training sessions have already begun involving three users, three educators and five employees.

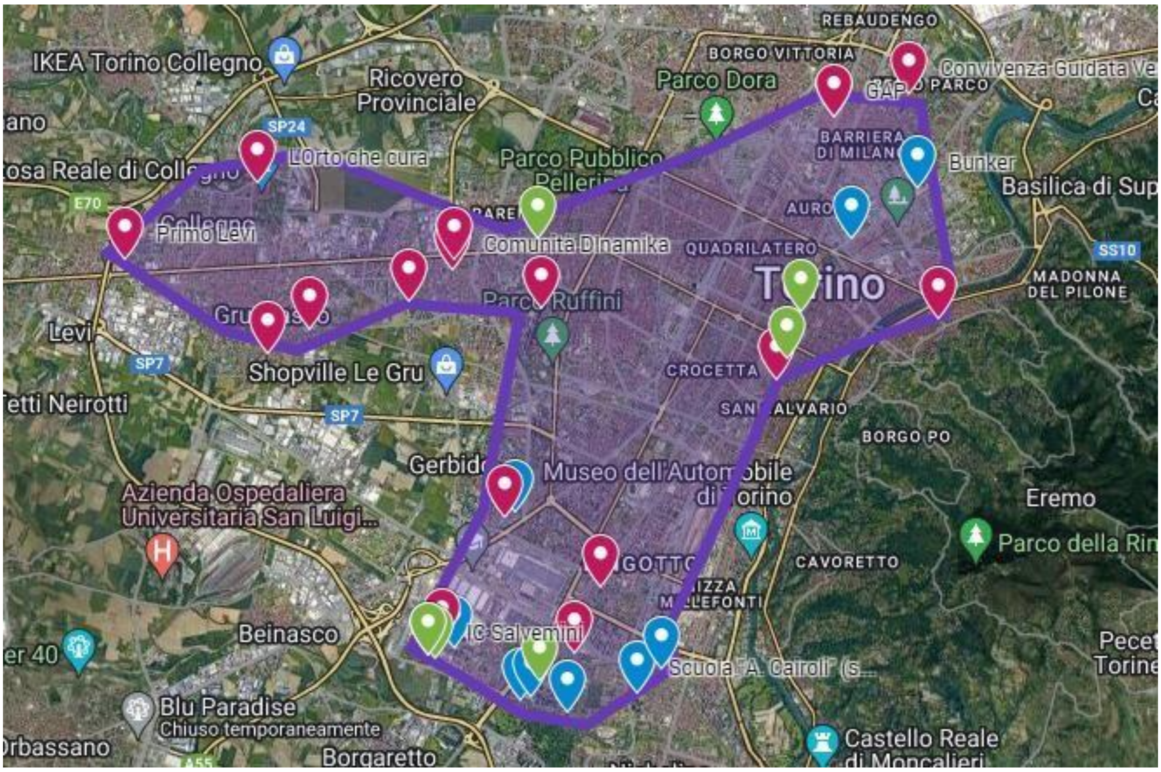

Figure 1. Butterfly gardens and areas in the city of Turin (www.farfalleintour.it).

Citizen Scientist education:

In total, 20 trained users from both social cooperatives and MHCs constitute the current scientific committee of the project, always supported by the University researchers and social cooperative educators. Among those trained users, six of them have been involved in school activities.

Butterfly monitoring:

The pollinators' monitoring has been carried out along two transects in the area of Piemonte Park (Fig. 2). In 2020, butterfly monitoring also involved areas where there were implemented Nature-Based solutions to increase pollinator-friendly areas and their mobility. Indeed, a green corridor within the city has been constructed as a Nature-Based Solution with the aim to connect two green areas within Turin. This corridor has been monitored in 2020 and 2021. During these monitoring 12 species have been detected.

Figure 2. Transects (T1 and T2) in Piemonte Park in Mirafiori South in Turin (Battisti et al., 2021).

The butterflies monitoring in this area took part since 2018 and it is still ongoing. Since 2018, there were detected 32 species of butterflies (Table 1 and Fig. 3). This monitoring allows to spot also an alien species, Cacyreus marshalli.

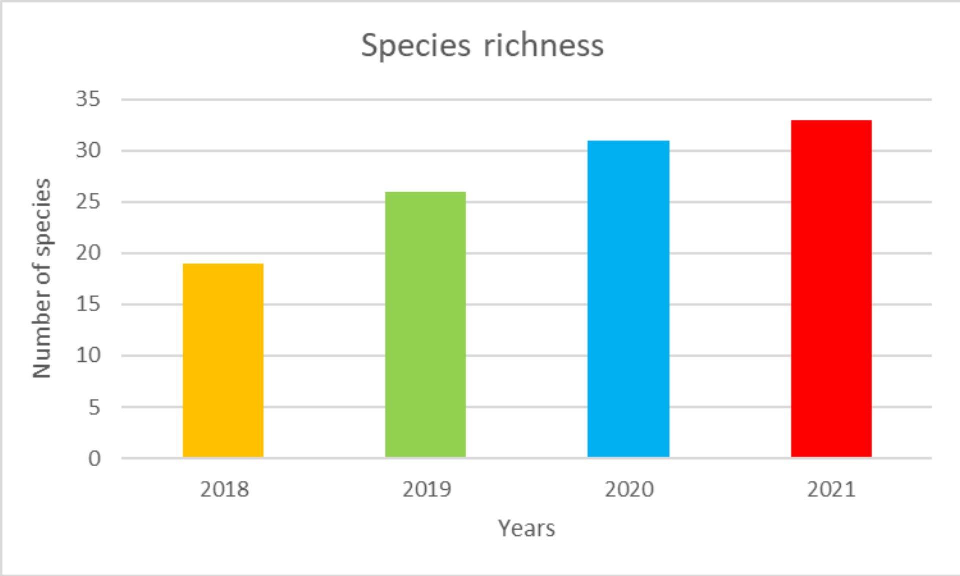

Figure 3. Butterfly species richness detected during the monitoring in Piemonte Park and ecological corridor in Turin.

We calculated two indices, Shannon and Evenness, which are well-known and comparable indices and provide information about species richness and the composition of the specie community. (Table 1 and Fig.3).

Table 1. Number of species of butterflies, Shannon index and Evenness index of the monitoring in Piemonte Park and ecological corridor in Turin.

	2018	**2019**	**2020**	**2021**
Species richness	19	26	22	32
Shannon	1,52	1,78	1,44	1,40
Evenness	0,70	0,78	0,78	0,16

Dissemination:

Nine dissemination events open to citizens have been organised on a local scale, including conferences, school and family parties, exhibitions, workshops, and drawing courses.

Social media communication has grown up so fast: since 2014, Farfalle in ToUr Facebook page has reached a community of 1586 followers. Also, the new-born Instagram page had a success reaching 65 followers in only one month after its launch.

Also, 10 school teachers and 200 children (aged between six and ten) participated, for a total of 94 hours of workshops. Specifically, the classes involved were divided in this way among years: in 2016 and 2017, six classes (128 children and 6 teachers) for 48 hours of activities: in 2019, four classes (37 children and two teachers) for 30 hours of activities. Due to the COVID-19 pandemic, all activities were suspended in schools and started again in April 2022, when one in-presence activity has been carried out in a school in Turin, involving 35 children and four teachers. Beginning and end-of-course tests demonstrated an overall improvement in children's knowledge both of butterfly biology and their anatomy.

Discussion and Conclusions

Since its start, the project has been an innovation in the field of Citizen Science because they comprise even social inclusions. On the other hand, NBSs, directly monitor through butterflies, make the city more permeable and thus more pollinator-friendly.

According to users, butterflies are the most suitable subjects for this project as they are a metaphor for changes because, thanks to the metamorphosis. In the same way, users pass from spending life in MHC to a dynamic life with many social interactions. Farfalle in ToUr shows some strengths and, at the same time, also some other points that can be improved. One of the strengths is the continuity that the users of the MHCs can ensure in monitoring, as the activities of Farfalle in ToUr are part of the users' own rehabilitation program.

In addition, the project can give patients the opportunity to increase their sense of agency, reduce the users' social stigma and consequentially improve their inclusion, because they gain the possibility to meet other people who share a similar situation, in spaces and environments linked to their everyday life (Trute et al., 1978; Leff et al., 2006).

The project participants themselves describe Farfalle in ToUr experience as rewarding, positive for the growth of their self-esteem and it allowed them to acquire new scientific skills and build new friendships relationships.

On the other hand, a critical point of the project is the difficulty in assessing the psycho-physical well-being that users gain from the project. This aspect is still being developed and it is planned to increase sociological surveys to better understand the benefits that the project could offer to users.

Moreover, this project collects data on urban butterfly communities, contributing to scientific research on their status and trends over years. Through this monitoring activities, we were able to assess the success of the pollinator-friendly NBSs that have been developed within Turin. In fact, thanks to the monitoring carried out within Farfalle in ToUr, we observed an increase in butterfly species within the urban areas sampled and affected by the greening measures.

Thus, the project has contributed, and will continue, to make the city of Turin more pollinator-friendly and also to raise awareness among its citizens on butterfly conservation.

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Any dissemination of results must indicate that it reflects only the author's view and that the Agency is not responsible for any use that may be made of the information it contains.

References

1. Baldock, K. C. (2020). Opportunities and threats for pollinator conservation in global towns and cities. Current opinion in insect science, 38, 63-71.
2. Battisti, L., Larcher, F., Vercelli, M., Bonelli, S., Martelli, F., Paradiso, F., Ferracini, C., Ribotta, L.
3. (2021). Nbs e biodiversità nelle aree urbane: il progetto proGIreg a Torino. Reticula 28/2021, 58-60.
4. Bonelli, S., Barbero, F., Casacci, L. P., Cerrato, C., Patricelli, D., Sala, M., ... & Verona, G. (2011). Butterfly Diversity in a Changing Scenario. Changing Diversity in Changing Environment, 99, 132.
5. Bonelli S., Martelli F.., Paradiso F., Ventresca A. L., Riganello A., Pollo T., Dall'Armellina F., & Gallino G., (2020). Diversity for Biodiversity: social inclusion and butterfly monitoring in a Citizen Science project. ECSA (European Citizen Science Association) Conference. Trieste, 6-10 September.
6. Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., De Vries, S., Flanders, J., ... & Daily,
7. G. C. (2019). Nature and mental health: An ecosystem service perspective. Science advances, 5(7), eaax0903.
8. Carozza, P. (2006). Principi di riabilitazione psichiatrica. Per un sistema di servizi orientato alla guarigione. FrancoAngeli.
9. Dennis, E. B., Morgan, B. J., Brereton, T. M., Roy, D. B., & Fox, R. (2017). Using citizen science butterfly counts to predict species population trends. Conservation biology, 31(6), 1350-1361.
10. Iwasaki, Y., Coyle, C. P., & Shank, J. W. (2010). Leisure as a context for active living, recovery, health and life quality for persons with mental illness in a global context. Health promotion international, 25(4), 483-494.
11. Kobori H., Dickinson J. L., Washitani I., Sakurai R., Amano T., Komatsu N., Kitamura W., Takagawa S., Koyama K., Ogawara T., Miller-Rushing A. J., (2015). Citizen science: a new approach to advance ecology, education and conservation. Ecological Research (2016) 31: 1-19. doi:10.1007/s11284-015-1314-y
12. Leff, J., & Warner, R. (2006). Social inclusion of people with mental illness. Cambridge University Press.
13. Lewandowski, E., J., Oberhauser, K., S. (2016). Butterfly Citizen Science Projects Support Conservation Activities among their Volunteers. Citizen Science: Theory and Practice, 1(1): 6, pp. 1– 8, DOI: http://dx.doi.org/10.5334/cstp.10
14. Litwiller, F., White, C., Gallant, K. A., Gilbert, R., Hutchinson, S., Hamilton-Hinch, B., & Lauckner, H. (2017). The benefits of recreation for the recovery and social inclusion of individuals with mental illness: An integrative review. Leisure Sciences, 39(1), 1-19.
15. Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. Current opinion in psychiatry, 18(2), 189-193.
16. Potts, Dauber, Hochkirch, Oteman, Roy, Ahnre, Biesmeier, Breeze, Carvell, Ferreira, Fitzpatrick, Isaac, Kuussaari, Ljubomirov, Maes, Ngo, Pardo, Polce, Quaranta, Settele, Sorg, Stefanescu, Vujic, 2020, Proposal for an EU Pollinator Monitoring Scheme, EUR 30416 EN, Publications Office of the European Union, Luxembourg.
17. Roy, D. B., Bourn, N., Collins, S., Dennis, E. B., Schmucki, R., Settele, J., ... & Wynhoff, I. (2020). Assessing Butterflies in Europe. Executive summary.
18. Saccheri, I., Kuussaari, M., Kankare, M., Vikman, P., Fortelius, W., & Hanski, I. (1998). Inbreeding and extinction in a butterfly metapopulation. Nature, 392(6675), 491-494
19. Sells, D., Borg, M., Marin, I., Mezzina, R., Topor, A., & Davidson, L. (2006). Arenas of recovery for persons with severe mental illness. Archives of Andrology, 9(1), 3-16
20. Senabre Hidalgo, E., Perelló, J., Becker, F., Bonhoure, I., Legris, M., & Cigarini, A. (2021). Participation and co-creation in citizen science. Chapter 11. In: Vohland K. et al. (Eds). 2021. The Science of Citizen Science. Springer. https://doi. org/10.1007/978-3-030-58278-4. pp: 199-218.
21. Trute B., loewen A., Public attitudes towards the mentally ill as a function of prior personal experience, in «Social Psychiatry», 1978, vol. 13, n. 2, pp. 79-84.
22. van Swaay, C. A., Nowicki, P., Settele, J., & Van Strien, A. J. (2008). Butterfly monitoring in Europe: methods, applications and perspectives. Biodiversity and Conservation, 17(14), 3455-3469.
23. World Health Organisation. (2008). mhGAP: Mental Health Gap Action Programme: scaling up care for mental, neurological and substance use disorders.

Full Research Paper

Creating A Serious Game Toolkit for a Smart City Living Lab

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Abstract

We present a case study where we co-designed a serious game toolkit for and in collaboration with a local council, a Smart City Living Lab, to promote collaboration between the council, property developers and community. Research shows the utility of serious board games to aid collaboration and creative problem-solving and design fiction to envision possible futures. A total of forty-two participants were engaged across a series of co-design workshops that applied activities that included serious board game design and design fiction. The results were analysed using Serious Board Games and design fiction frameworks. The design process used the topic of homelessness as the serious content for the game design. We illustrate how the final design integrates these elements, and how a gamification toolkit might support discussions, ideation and planning to issues such as homelessness and other problems through the generalisation of the final game design.

Keywords

Co-Design, Serious Board Games, Design Fiction, Homelessness, Gamification, Toolkit

Introduction

This paper reports on the codesign of a Smart City toolkit for the City of Casey Living Lab. This toolkit was developed as part of a Participatory Design unit within the Master of Design course run by Swinburne University of Technology, Melbourne, Australia. We present a process to create a codesign toolkit conceptualised as a serious board game for this local council.

Serious Games and Living Labs

Serious games have a purpose other than entertainment alone, such as education, investigation of an issue or idea generation. Serious games have been used in Living Labs and Smart City settings. Vicini et al. (2012, p. 204) state that "Serious games are a dynamic and effective tool to help users access and use new information in an enjoyable manner, providing an enrichment of skills and living experience to its users." (Garbe & Winkelmann, 2020). Moniz et al. (2022) used both serious card games and digital games in a Living Lab setting, noting their utility as cultural mapping and co-diagnostic tools for the cards and codesign for the digital tool and participatory design tools for both. Digital games are becoming more common such as 'My Green Space', a serious multiplayer game designed to change energy usage (Cowley et al., 2011) and Barcelona City Council's virtual reality game in which participants shape and explore the introduction of superblocks (Seve et al., 2022). Konstantinidis et al. (2021) taught students at Thess-AHALL codesign through a process that led to students designing and developing serious game web applications for Parkinson's patients. Board games have also been used. Slegers et al. developed a serious board game (2015, p. 1228) to investigate future train travel needs noting that the board game created a "...surprising and safe environment to share their thoughts and experiences in a group setting" for participants. Our research was conducted during the COVID-19 lockdown in Melbourne, Australia. While we had to conduct our toolkit online, we were interested in developing a toolkit that would enable people to build in-person relationships. For this reason, we focused on developing a Serious Board Game (SBG).

Serious Board Games

Serious Board Games effectively raise creativity, strengthen teamwork, and better engage other participants to solve complex problems (Patrício et al., 2018; Silveira, 2020). Several studies have identified that using board games in codesign also helps overcome the social barriers between different stakeholders across different fields (Alvarez et al., 2019; De Jans et al., 2017; Ma et al., 2019). The critical problem is that there is only a slight differentiation between board games as a codesign toolkit or means of entertainment (Sousa, 2021). SBGs bridge this gap by serving educational, research, and codesign purposes while maintaining entertainment elements (De Jans et al., 2017).

According to the Serious Board Game Design Assessment (SBGDA) framework, fiction and narrative elements from SBGs are essential factors in creating a relationship between the purpose of the codesign and the participants' perspectives (Ma et al., 2019; Sousa, 2021). Creating narratives using design fiction principles can trigger critical and solution-focused thinking (Blythe, 2017; Sousa, 2021). Design fiction suspends the disbelief in change and inspires discussion in social, political, and preferable futures (Ahmadpour et al., 2019). If design fiction can be integrated with SBG it might aid innovation and ideation; it could help to strengthen the trust between stakeholders as they will likely understand each other's points of view during the SBG process (Lyckvi et al., 2018; Ma et al., 2019). In contrast with that argument, several studies show that it is hard for the participant to familiarise themselves with the narrative from design fiction if it is too futuristic (Ahmadpour et al., 2019; Nägele et al., 2018). Using the design fiction methods alone is insufficient to ensure successful SBG design. A roleplaying element can help to immerse the participant in the fictional situation to enable discussions (Nägele et al., 2018).

In SBG design, there are two common approaches to role play: a completely different character or the person playing themselves (Nägele et al., 2018). Assigning roles to multiple participants can raise observational skills, remove the barriers to participants' knowledge, and help develop a creative mindset (Powell et al., 2020). Using the combination of roleplay and fiction in SBG creates many possibilities in the codesign process because the flexibility of the character enables more ideas from different participants (Nägele et al., 2018; Patricio et al., 2020). Alvarez et al. in (Leleu-Merviel et al., 2019) note the utility of Djaouti's generic serious game design model. The first step in this model is to define the serious game content.

Serious Game Content Homelessness

The over-arching challenge for the City of Casey Living Lab was to improve the relationship between the Council and housing developers. The City of Casey, aims to address homelessness as part of their city planning. Homelessness is a significant problem due to its complexity and diverse population in terms of age, gender, and background (Kwon, Boijen, 2012; Carnemolla & Skinner, 2021). Homelessness occurs for various reasons, including poor health, financial hardship, addiction, and relationship instability. Support is needed from a variety of stakeholders (Carnemolla & Skinner, 2021; Jarpe et al., 2019). However, connecting the different stakeholders to solve this problem requires a carefully planned process, as vulnerable community members engage in that collaboration (Jarpe et al., 2019).

Several studies show that codesign can engage homeless people and other stakeholders to combine their different perspectives and create plans that meet the needs of the homeless (Jarpe et al., 2019; Light & Seravalli, 2019; Mullins et al., 2021). A collaborative design process is considered effective because it lets other stakeholders emphasise and gain a deep understanding of the problem and realities without making any assumptions (Light & Seravalli, 2019). Moving from 'design for' to 'design with' also ensures the people experiencing homelessness are heard and valued, which motivates them to be involved in the project (Mullins et al., 2021; Tironi, 2018). Games, pictures, and probes are powerful design tools that trigger creativity and help participants visualise their ideas (Peters et al., 2020; Trischler et al., 2019).

Even though there was a lockdown and the student team would not be able to interact with homeless people, it was felt this was a worthy subject to tackle. It was planned that the game brought together the Council, developers and community members more broadly to understand differing perspectives and potential solutions, to create the toolkit and make some improvements.

Methodology

The methodology was developed based on Djaouti's generic serious game design model's four-step process (Leleu-Merviel et al., 2019).

1. Define the serious game content
2. Imagine a game
3. Create a prototype and
4. Evaluate effectiveness.

In addition to this, we used Alvarez et al. (in Leleu-Merviel et al., 2019) four utility model of design games:

- "Create a common design language;
- Promote a creative and exploratory attitude;
- Facilitate the vision and enact ‘what could be’;
- Help define the roles of interacting participants during a work session" (p236)

Leleu-Merviel et al. also note "the possibility to complete the codesign process if the design game is also the artifact to be designed" (p.240) which was the case in this project. The primary research was conducted through four codesign workshops to create prototypes similar to the approach used by Konstantinidis (2021) using codesign as the common design language (first utility function). During the workshops, unstructured interviews and observational research were conducted to get rich data from the participants.

The workshop design and analysis used the Serious Board Game Assessment (SBGA) (Ma et al., 2019) framework, which considers game mechanics, roleplay, aesthetics, framing, fiction and narrative for the other three utility functions.

The data was analysed using triangulation techniques to validate the findings. The data were categorised into two types, envisioning the future and reducing conflicting interests. Lastly, method triangulation was applied to understand the relationship between conflicting stakeholder interests and envisioning the future.

Methods and Findings

Forty-two respondents participated in the codesign workshops, aged between 20 and 60. Participants were drawn from the Council's Living Lab network, staff from a Smart City Institute and Master of Design students experienced with codesign. Owing to COVID-19 constraints, we conducted the workshops virtually, and we could not engage with people experiencing homelessness directly.

As noted above, the workshops built on each other; workshops one and two focused on problem definition and are presented together, followed by workshops three and four. We present the workshop approach, analysis and findings to aid the reader's flow through the development. The workshop steps are presented using serious board game elements.

The results for workshops 2 and 4 (5 minutes in the future part 1 and 2) were analysed using design fiction typology. The story written by the participants on the utopia and dystopia cards was analysed using colour coding to see the pattern of participant answers. From 5 Minutes in the Future Part 1, the answer was simplified into different keywords and then examined based on the prospect of envisioning the future (refer to Figure 1).

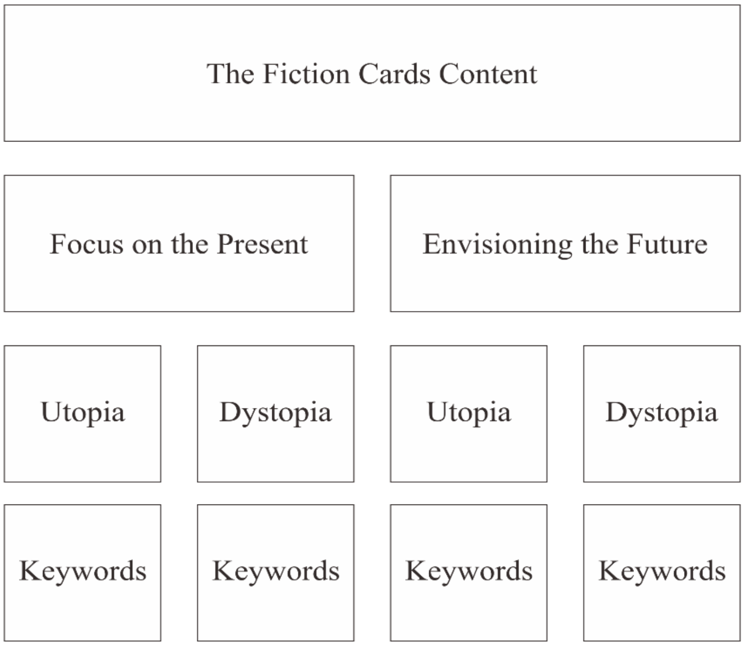

Figure 1. Design Fiction Analysis Framework.

The analysis focused on finding the keywords that can help generate more discussion about the future solution. Then for the second iteration of 5 Minutes in the future, the data was examined using design fiction typology to understand the narrative formulation aid the generation of innovative solutions. Specifically the Design Fiction Typology for Analysis Frameworks by Jensen & Vistisen (2017) was used.

The results from the roleplaying board game co-design activity (workshop 3), were analysed by categorising the participants' answers into five categories based on the big five personality trait factors in the SBGA-R (Sousa, 2021). From these personality categories, the traits of each stakeholder determined whether the roles show the pattern of problem-solving (suitable for progression innovation process), familiarity (suitable for expressing innovation process), or empathy (suitable for social innovation). The concept and the solution can be designed to accommodate the different personality traits, reduce conflict, promote empathy, and enhance communication during the discussion.

Workshops 1 and 2

Workshop 1 - A Home for the Homeless; Defining the Problem

Workshop 1 aimed to explore participants' perspectives about housing for homeless people and possible solutions. The other game SBGA elements are presented below.

Serious Board Game Elements	
Content Information	Participants receive information about what happens in the life of a homeless person seeking permanent accommodation
Mechanics	1. Each participant chooses a picture based on the question stated to them (Figure 2), and then they discuss their answers. 2. The participants collaborate to make an ideal city by placing the elements of the city (housing, infrastructure, environment, and facility) on the board (Figure 3)
Fiction and Narrative	There are two roles that participants use in this workshop. 1. Participants represent themselves and think as community members. 2. Participants try to immerse themselves in the roles of homeless people.
Aesthetic and Graphic	The visualisation is aided by using real-life photographs to represent the current situation. Then for the future desired situation, icons are used.
Framing	For all the workshops, we had a target range of adults between 20 and 60 years of age. We assumed no prior gaming skill or subject matter expertise. This age range was the case for all the subsequent workshops and is not repeated.

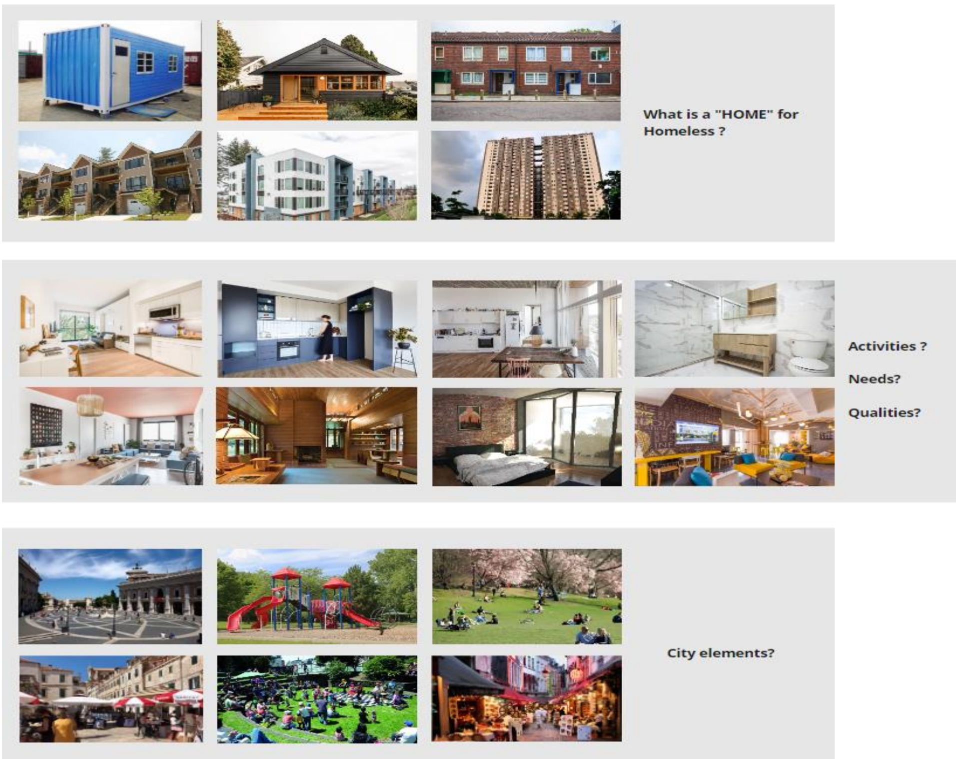

Figure 2. Question and Photo Collage.

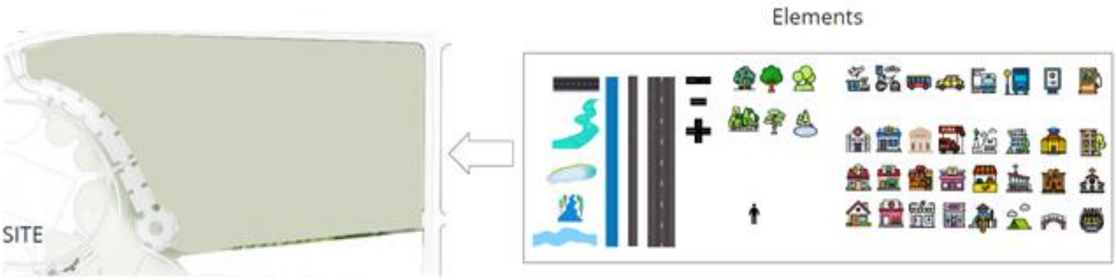

Figure 3. Build Your City.

Workshop 2 - 5 Minutes in the Future Part 1, Defining the Problem

This workshop aimed to understand participants' perceptions about the homelessness problem, specifically about the factors that can lead participants to think about future solutions.

Serious Board Game Elements	
Content Information	Participants did not get any information aside from using the toolkit as the primary goal of understand their initial perception.
Mechanics	1. Participants chose 1-3 different fiction cards about the situation in the future regarding homelessness. 2. Participants then got 5 minutes to answer the question they chose on the utopian (positive) or dystopian (negative) cards. 3. If needed, participants used to helper card to formulate their story.
Fiction and Narrative	There are three narratives participants chose from and associate the roles according to the situation in the cards (Figure 4). The narrative and the fiction scenario revolved around the homelessness topic that occur in the future and were created using design fiction principles.
Aesthetic and Graphic	There is no visualisation on the card aside from the written situation to let the participant imagine the future without boundaries.

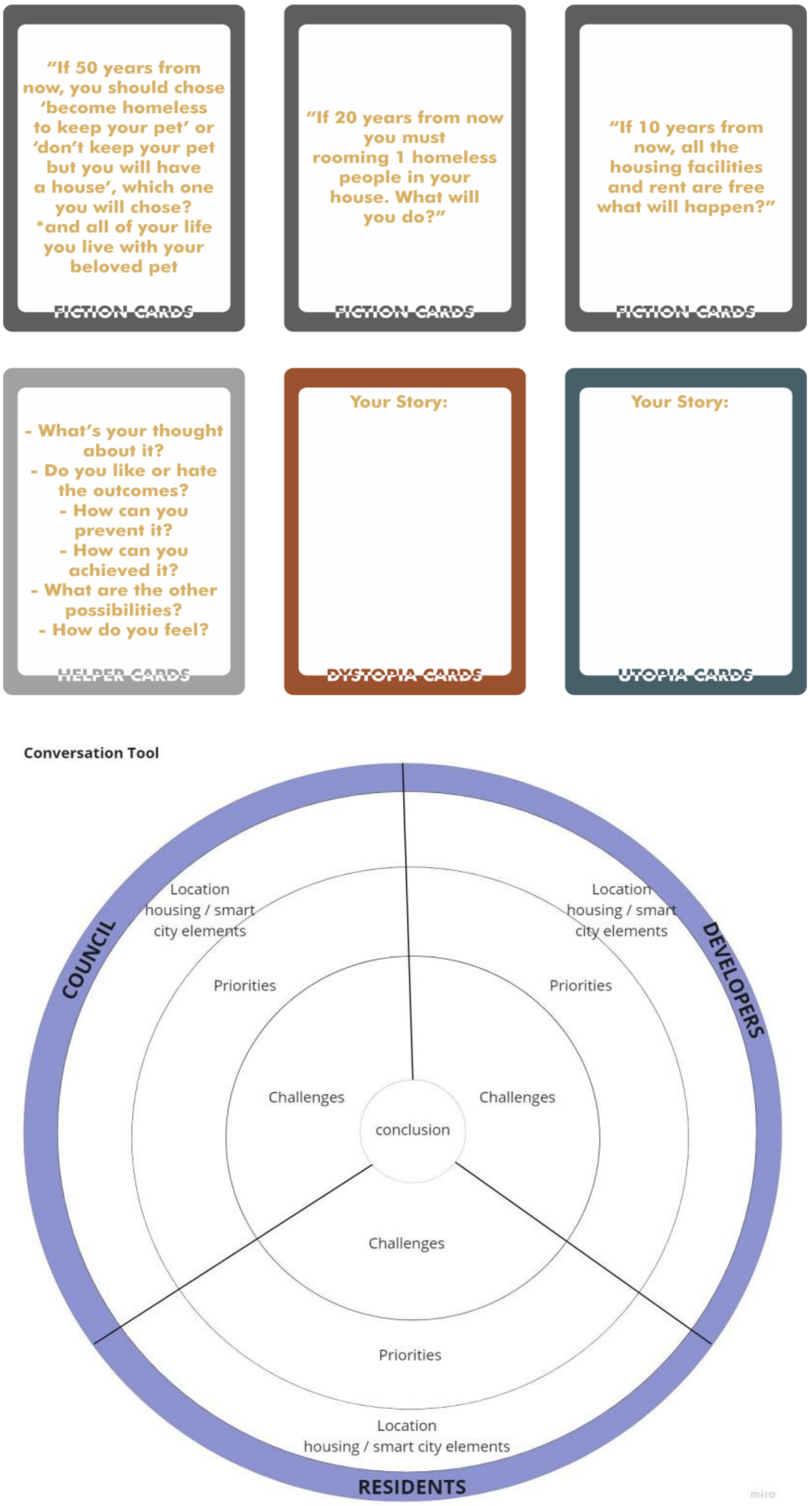

Figure 4. 5 Minutes in the Future Part 1.

Findings for workshops 1 and 2

The data highlighted the systemic integration of problems between government, stakeholders, community, and the homeless people in co-design workshop 1. The general perception of the participants shows that homeless people are often not exposed to the easy access to information about facilities and housing they can get. At the same time, there was some concern from five participants that the government and other stakeholders also did not get opinions from homeless people in assessing this problem. According to Mullins and Tironi, homeless people may not be comfortable enough in the participatory processes because they feel more like a subject rather than a partner in the solution process (Mullins et al., 2021; Tironi, 2018). Another finding from the observations during workshop 1, using visualisation and notes, could help lessen tension and awkwardness. Almost all participants found that the use of visualisation and notes made them more comfortable discussing their opinions and easier to represent their ideas. Participants tended to provide very general ideas because they merely answered from their standpoint.

In workshop 2, participants were more intrigued by the homelessness topics related to the community, such as financial and affordable lifestyles. This type of topic made participants engage more with the discussion rather than the topics about social matters. Social elements included individual safety, fairness, and neighbourhood. The least engaging topic regarding homelessness is the care system, trust, and people's perspective. These results (Figure 5) indicate that participants can generate more discussion and solutions from measurable topics. Participants are not comfortable enough to openly discuss something personal, such as trust, especially knowing that not all participants can accept their perspective.

From these findings, it is possible to hypothesise that to help the stakeholders generate innovative ideas, the toolkit must be accessible for all stakeholders and focus on the facts that can be discussed rather than ambiguous or non-measurable topics. At the same time, icons as visualisation tools and notes help participants engage more in discussion.

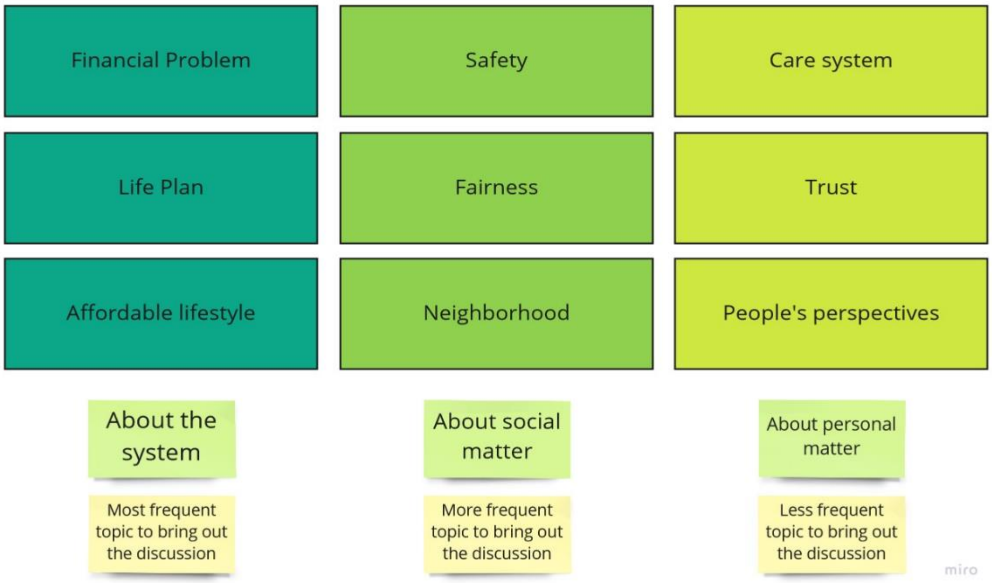

Figure 5. 5 Minutes in the Future Part I Findings.

Workshop 3 – Role Playing, Board Game, Concept Creation

This workshop's purpose was to generate conversations through role-playing with elements that helped to enrich the discussion between participants.

Serious Board Game Elements	
Content Information	Participants received descriptions of the roles of the community, council, and developers. Participants had a brief explanation about the problem and location they need to discuss.
Mechanics	1. Participants pick a role before starting. 2. Then participants chose the area to help homeless people, based on a topic discussion prompt. Each area has its different values. On the left and right sides of the board, Smart City and housing elements were placed to raise the participant's awareness. 3. The roulette board was used as a conversation tool to address their problems, sort them, and develop solutions (Figure 6).
Fiction and Narrative	There is a narrative about the homelessness problem they need to discuss, for example, housing, services, or prejudice towards homeless people. Participants were divided into three roles, council, developer, and community, so they might understand and empathise with different roles.

Aesthetic and Graphic	The visualisation on the board is the map and the colour code to help participants better understand the toolkit element and not hinder the discussion.

Findings for workshop 3

When stakeholders were given different priorities and challenges, they had conflicting interests in the game. However, even though each stakeholder had different personalities, the three assigned roles have the same personality traits in facing the challenge of homelessness. The Council and community roles have more empathy traits in their answers related to expression and related modes of engagement in the game. These empathetic traits enhance the creativity and suitability of the end-users needs. On the other hand, the developer role has problem-solving traits in their answers related to the progression model of engagement in the game, which focus on goals oriented (Zagalo, 2020). In some cases, there were some misconceptions about each other's roles and job distribution. Thus, a clear and detailed action plan was needed to share the responsibility and gain mutually beneficial outcomes.

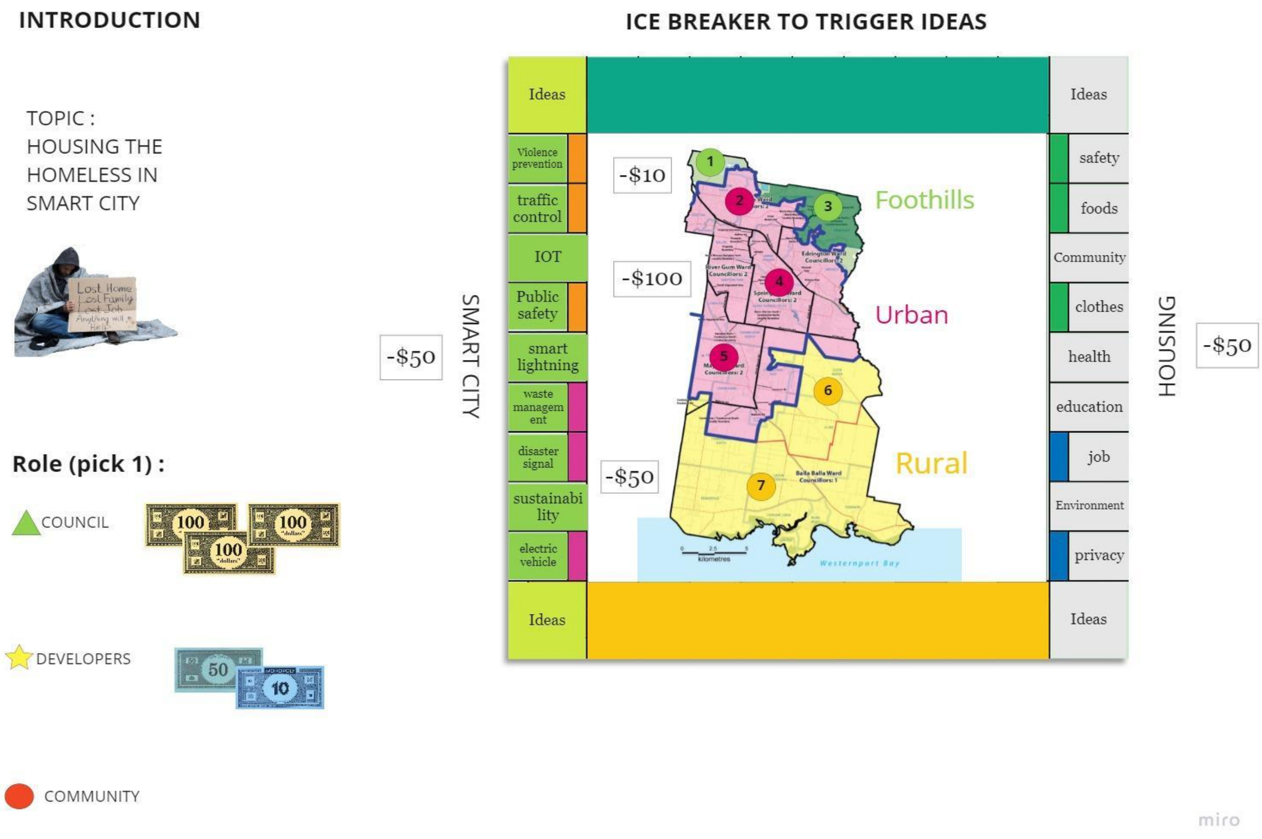

Figure 6. Roleplaying Board Game.

The board games and role-playing helped the participants to be immersed in the situation/role and should be used in the final toolkit. Iterative among stakeholders deepened understanding of each other's ideas. Elements of negotiation and mediation to find shared values allowed them to compromise and work toward a solution. A brief explanation of the problem also aided the generation of a reality-based ideas.

Workshop 4 - 5 Minutes in the Future Part II

The purpose was to formulate the trigger condition that helps generate innovative outcomes, focus on solutions, and empathise with other participants.

Seroius Board Game Elements	
Content Information	Participants did not get any information besides instructions on using the toolkit. The aim was to understand their initial perceptions of the game.
Mechanics	Participants then had five minutes to answer the question they have chosen on the utopia or dystopia card. The utopia cards for writing positive answers and the dystopia cards for negative answers.
Fiction and Narrative	There were six narratives participants chose from and associate their roles according to the situation in the cards (Figure 7). The roles are fixed as the council and developer. In this iteration, the council role brings empathy to the situation, and the developer role focuses on generating innovative solutions. The fiction cards were created using design fiction principles.
Aesthetic and Graphic	There is no visualisation on the card aside from the written situation to let the participant imagine the future without boundaries.

Figure 7. 5 Minutes in the Future Part II.

Findings for Workshop 4

Of 10 participants in co-design workshop 4, the two most popular choices were picked by the participants from the Fiction Cards. Six participants picked the epistemology-empathy, and four participants picked the apathy-ontology combination. The participants who picked the epistemology-empathy cards did so because they believed that the situations written on the cards could happen during the stated timeline. The participants who chose apathy-ontology stated that they want to change the situation written on the cards; and believe it is still possible to change the outcome.

Based on the answers from the utopia and dystopia cards highlighted, using the colour coding, there are five keywords' patterns constructed from the answer: measurable action, happening in the future, positive situation, human-oriented, and engaging. Then the keywords were matched with the design fiction typology to see which keywords could trigger innovatative ideas generation innovation, questioning and empathy. Based on that, measurable actions are the most suitable keywords. Positive solutions also produced with epistemology and empathy cards and future oriented sympathy cards, often prompted innovative outcomes (Figure 8).

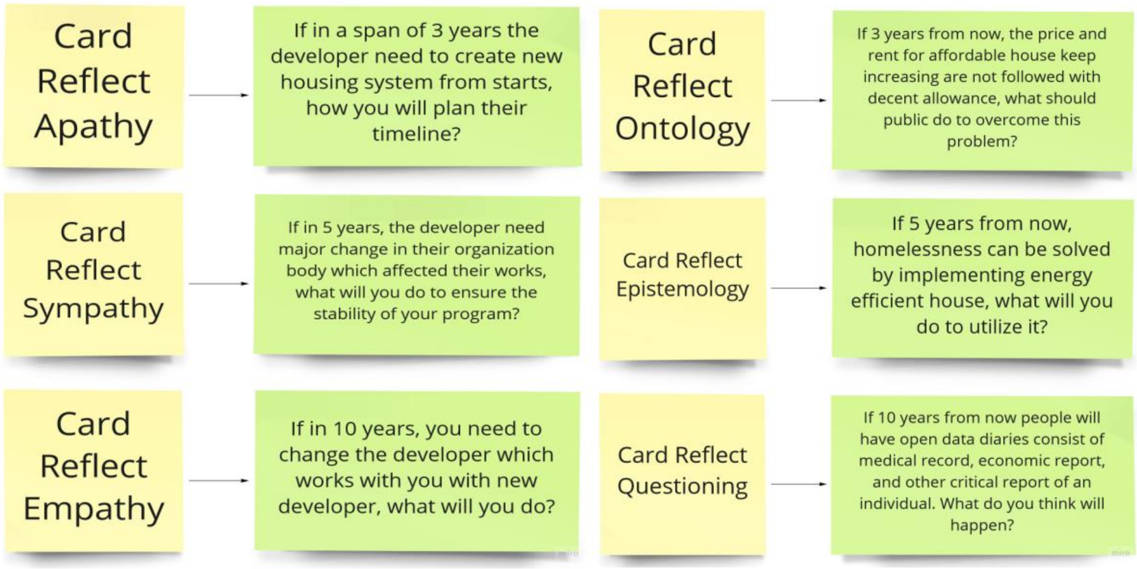

Figure 8. The Combination of Fiction Cards.

Findings Summary

Findings from Workshops 1 and 2 demonstrate that it was apparent that easy-to-use and illustrative toolkits are essential to engage with different stakeholders. The workshop's 3 findings indicate the conflicting point of view can be eased using board games and role-play by immersing participants in the situation and role. Iterative conversations also optimise the interaction among stakeholders to understand each other's ideas. A brief explanation of the issues, roles and locations also generated reality-based solutions. Workshop 4 found out that having a measurable topic is important to start the conversation more easily. These elements were incorporated into the final design.

Ideas about envisioning the future and thinking about long-term solutions emerged from all the findings. The fiction cards trigger future thinking, especially if combined with Smart City opportunities. The timeline board is suggested as an additional element to aid longer-term solutions ideation

Discussion

While it was necessary to choose serious content during the codesign stages to develop the serious board game elements. As the games developed, it became apparent that these elements could be abstracted to provide a game for various topics, scales and timelines within the overall objective of improving relationships between council and developers (Figure 9 and 10).

Figure 9. Final game design.

Participants would select the issue from topic coins or choose their own at the start of the game. A location on the map can be selected and placed in the map zone that they think is relevant to the topic. The maps used in the board game can be customised from the small neighbourhood to the city level. The maps represent the areas that need to be developed in urban planning by showing their zoning, density, and street level. The timeline may also be customised via tokens depending on the project. Participants can select characters they want to represent before the game starts. During play, participants use the trigger cards to select initial discussion domains. The current design has 16 trigger cards about the significant aspects and opportunities of the city. The helper cards prompt and enable discussion, understanding and ideation between participants. By choosing several cards, the participant may understand many perspectives about the possibilities and challenges of the selected topic. All the insights and ideas are recorded on the post-it notes to be further used as a future action plan. The future action plans are sorted into different time frames according to the urgency and sequence they need to be actioned.

Figure 10. Offline board game illustration.

The elements of this board game are designed to generate future-oriented innovation. This toolkit aims for flexibility by changing the maps, characters, cards, and even the topics.

Conclusion

This paper contributes to the growing literature on serious game design for cocreation by:

- Demonstrating a codesign approach to developing a serious game,
- Development of a serious game as a legitimate codesign artefact,
- Providing an approach to develop a game that can be made generic or cover many topics whilst maintaining the attributes of a serious game.

The game was developed online during the COVID-19 pandemic limiting its current use. Further research is required to use the game in offline contexts and with different topics to improve and validate the game design with different stakeholders not present during the game's development.

References

1. Ahmadpour, N., Pedell, S., Mayasari, A., & Beh, J. (2019). Co-creating and Assessing Future Wellbeing Technology Using Design Fiction. She Ji, 5(3), 209–230. https://doi.org/10.1016/j.sheji.2019.08.003
2. Alvarez, J., Irrmann, O., Djaouti, D., Taly, A., Rampnoux, O., & Sauvé, L. (2019). Design games and game design: Relations between design, codesign and serious games in adult education. From UXD to LivXD: Living EXperience Design, 229–253. https://doi.org/10.1002/9781119612254.ch11
3. Blythe, M. (2017). Research fiction: Storytelling, plot and design. Conference on Human Factors in Computing Systems - Proceedings, 2017-May, 5400–5411. https://doi.org/10.1145/3025453.3026023
4. Cowley, B., Moutinho, J. L., Bateman, C., & Oliveira, A. (2011). Learning principles and interaction design for “Green My Place”: A massively multiplayer serious game. Entertainment Computing, 2(2), 103–113. https://doi.org/10.1016/j.entcom.2011.01.001
5. Carnemolla, P., & Skinner, V. (2021). Outcomes Associated with Providing Secure, Stable, and Permanent Housing for People Who Have Been Homeless: An International Scoping Review. Journal of Planning Literature, 36(4), 508–525. https://doi.org/10.1177/08854122211012911
6. De Jans, S., Van Geit, K., Cauberghe, V., Hudders, L., & De Veirman, M. (2017). Using games to raise awareness: How to co-design serious mini-games? Computers and Education, 110, 77–87. https://doi.org/10.1016/j.compedu.2017.03.009
7. Garbe, J., & Winkelmann, R. (2020). Tipping Points for the Melting Antarctic Ice Sheet - Science in the News. Harvard University. http://sitn.hms.harvard.edu/flash/2020/tipping-points-for-the-melting-antarctic-ice-sheet/
8. Konstantinidis, E. I., Petsani, D., & Bamidis, P. D. (2021). Teaching university students co-creation and living lab methodologies through experiential learning activities and preparing them for RRI. Health Informatics Journal, 27(1). https://doi.org/10.1177/1460458221991204
9. Jarpe, M., Mosley, J. E., & Smith, B. T. (2019). Understanding the Collaborative Planning Process in Homeless Services: Networking, Advocacy, and Local Government Support May Reduce Service Gaps. Journal of Public Health Management and Practice, 25(3), 262–269. https://doi.org/10.1097/PHH.0000000000000812
10. Jensen, T., & Vistisen, P. (2017). Ethical Design Fiction. The ORBIT Journal, 1(2), 1–14. https://doi.org/10.29297/orbit.v1i2.56
11. Kwon, O., & Boeijen, A. Van. (2012). Co-designing an SMS service for London’s homeless people. Third Nordic Conference on Service Design and Service Innovation ServDes2012, 1(14), 1–14. http://www.ep.liu.se/ecp/067/015/ecp1267015.pdf
12. Leleu-Merviel, S., Schmitt, D., & Useille, P. (n.d.). From UXD to LivXD : living eXperience design.
13. Lee, Y. (2008). Design participation tactics: the challenges and new roles for designers in the co-design process. CoDesign, 4(1), 31–50. https://doi.org/10.1080/15710880701875613
14. Light, A., & Seravalli, A. (2019). The breakdown of the municipality as caring platform: lessons for co-design and co-learning in the age of platform capitalism. CoDesign, 15(3), 192–211. https://doi.org/10.1080/15710882.2019.1631354
15. Lyckvi, S., Roto, V., Buie, E., & Wu, Y. (2018). The role of design fiction in participatory design processes. ACM International Conference Proceeding Series, 976–979. https://doi.org/10.1145/3240167.3240258
16. Ma, Y., Vallet, F., Cluzel, F., & Yannou, B. (2019). Analysing the relevance of serious game elements for effectively teaching innovation processes. Proceedings of the International Conference on Engineering Design, ICED, 2019-August, 439–448. https://doi.org/10.1017/dsi.2019.47
17. Moniz, G. C., Andersson, I., Hilding-Hamann, K. E., Mateus, A., & Nunes, N. (2022). Inclusive Urban Regeneration with Citizens and Stakeholders: From Living Labs to the URBiNAT CoP (pp. 105–146). https://doi.org/10.1007/978-3-030-89525-9_5
18. Nägele, L. V., Ryöppy, M., & Wilde, D. (2018). PDFI: Participatory design fiction with vulnerable users. ACM International Conference Proceeding Series, 819–831. https://doi.org/10.1145/3240167.3240272

19. Patrício, R., Moreira, A. C., & Zurlo, F. (2018). Gamification approaches to the early stage of innovation. Creativity and Innovation Management, 27(4), 499–511. https://doi.org/10.1111/caim.12284
20. Patricio, R., Moreira, A., Zurlo, F., & Melazzini, M. (2020). Co-creation of new solutions through gamification: A collaborative innovation practice. Creativity and Innovation Management, July 2018, 1–15. https://doi.org/10.1111/caim.12356
21. Peters, D., Loke, L., & Ahmadpour, N. (2020). Toolkits, cards and games–a review of analogue tools for collaborative ideation. CoDesign, 00(00), 1–25. https://doi.org/10.1080/15710882.2020.1715444
22. Powell, L., Lambert, D., McGuigan, N., Prasad, A., & Lin, J. (2020). Fostering creativity in audit through co-created role-play. Accounting Education, 29(6), 605–639. https://doi.org/10.1080/09639284.2020.1838929
23. Seve, B., Redondo, E., & Sega, R. (2022). Urban co-creation taxonomy. Journal of Urban Design. https://doi.org/10.1080/13574809.2022.2053283
24. Silveira, M. S. (2020). Exploring Creativity and Learning through the Construction of (Non-Digital) Board Games in HCI Courses. Annual Conference on Innovation and Technology in Computer Science Education, ITiCSE, 246–251. https://doi.org/10.1145/3341525.3387374
25. Slegers, K., Ruelens, S., Vissers, J., & Duysburgh, P. (2015). Using game principles in UX research: A board game for eliciting future user needs. Conference on Human Factors in Computing Systems - Proceedings, 2015-April, 1225–1228. https://doi.org/10.1145/2702123.2702166
26. Sousa, M. (2021). Serious board games: Modding existing games for collaborative ideation processes. International Journal of Serious Games, 8(2), 129–147. https://doi.org/10.17083/ijsg.v8i2.405
27. Tironi, M. (2018). Speculative prototyping, frictions and counter-participation: A civic intervention with homeless individuals. Design Studies, 59, 117–138. https://doi.org/10.1016/j.destud.2018.05.003
28. Vicini, S., Bellini, S., & Sanna, A. (2012). The city of the future living lab. International Journal of Automation and Smart Technology, 2(3), 201–208. https://doi.org/10.5875/ausmt.v2i3.134
29. Zagalo, Nelson (2020). Engagement Design: Designing for Interaction Motivations , Spinger Nature

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