reviewed paper

A Systematic Living Lab Approach for Community Engagement for Urban Regeneration – the S.M.I.L.E. Methodology

Caroline Cheng, Judith Thomsen, Anandasivakumar Ekambaram

(Dr. Caroline Cheng, SINTEF Community, Strindveien 4,7034 Trondheim, Norway, caroline.cheng@sintef.no)
(Dr. Judith Thomsen, SINTEF Community, Strindveien 4,7034 Trondheim, Norway, judith.thomsen@sintef.no)
(Dr. Anandasivakumar Ekambaram, SINTEF Community, Strindveien 4,7034 Trondheim, Norway, siva@sintef.no)

DOI: 10.48494/REALCORP2026.4102

1 ABSTRACT

Community engagement and feedback has often been pinpointed as the weakest link in sustainable neighbourhood transformations. The living lab approach has been known as a promising methodology for engaging with multi-stakeholder groups in real-life contexts, yet studies have shown that engagement is rarely achieved in practice in many living labs. In this paper, we suggest it is helpful to take a process orientation to cut through the clutter of living lab literature, focusing on the "how" of establishing "living labs". We posit that it is most imperative in this process to put people in focus, foregrounding their specific needs, interaction, and wellbeing and channelling their competences and experiences towards urban regeneration.

Drawing inspiration from the literature that focuses on innovation-oriented living labs and based on a case study of organising and leading six living labs for community engagement in social renovation and energy transition in six European cities from 2022-2025, this paper will advance a methodology for establishing a living lab approach towards community engagement for urban regeneration. We suggest focusing on five phases to get going on the ground with the living lab networking approach– Scope, Map, Implement, Learn and Enhance – the S.M.I.L.E. methodology, What stands out from prevailing living lab approaches is Scope and Map. Scope foregrounds the importance of users (in their various roles) and the community. In this first step, a deep understanding of the citizens and community demographics regards citizens as catalysts of innovation and that their inputs can lead to better informed and robust outcomes in various measures and solutions. Map envisions all the actors relevant for the development of the socio-technical solutions and facilitates the possibility to review the congruence of their interests. Adopting the living lab approach requires thorough understanding of important actors' objectives and drivers, the alignment of operational processes, and establishment of open and collaborative culture. The S.M.I.L.E. methodology provides a pragmatic point of departure for a living lab facilitator responsible for engagement activities, whether newly set up and as an extension of ongoing programmes.

Keywords: Community engagement, Sustainable neighbourhood transformation, Living Lab approach, Stakeholder engagement, Deep renovation

INTRODUCTION

Decarbonising the urban built environment requires integrated innovations and solutions across climate mitigation, large scale renovation and urban greening. To meet the EU's ambitious climate and energy efficiency goals, the rate of deep building renovations must increase. In this regard, the interest in accelerating deep renovations on a neighbourhood scale has arisen as the adequate scale to adopt for essential solutions such as inclusion of renewable energy resources and decentralisation of energy production. In other words, going beyond the limits of the single building has become the more efficient and effective unit to work with. However, it has also been increasingly recognised that working on the larger neighbourhood scale is challenging as it requires integrated innovations and solutions involving multiple actors across different sectors (Sassenou et al. 2024). Indeed, stakeholder involvement, community engagement and feedback has often been pinpointed as the weakest link in sustainable neighbourhood transformations. Concomitantly, living labs have been known as a means to structure stakeholder and user involvement in innovation processes (Leminen et al. 2012, Almirall & Wareham 2011, Rizzo et al. 2021). However, in the rather young living lab research domain, there is no consensus yet regarding supporting theories and frameworks. This has resulted in a proliferation of projects and approaches carried out under the 'living lab' umbrella in a very loose sense that is not reaping the benefits of a living lab approach (Schuurman et al. 2013; Veeckman et al. 2013). In this paper, we distill our experience from planning six living labs for community engagement in social renovation and energy transition in six European cities. We

suggest it is helpful to take a process orientation to cut through the clutter of living lab literature, focusing on the "how" of establishing "living labs" as a promising platform for engaging with multi-stakeholder groups in real-life contexts.

This paper is organised as follows. We start with a review of relevant literature to understand the different types of living labs and specifically foreground the type of living lab focused towards multi-stakeholder collaboration and knowledge sharing. We do so to apply the living lab concept to community engagement efforts within the EU Green Deal project "ARV"[1] (https://greendeal-arv.eu/) which aims to demonstrate and validate attractive, resilient, and affordable solutions for a sustainable neighbourhood concept known as Climate Positive Circular Communities (CPCCs). The paper asks: How can a living lab approach be established for varying ambition levels of community engagement, communication and education towards sustainable neighbourhood transformations? Based on empirical insights from six demonstration communities with the ARV project, we advance a five-phase methodology for establishing a living lab approach towards community engagement for urban regeneration. We then discuss the implications of adopting a process orientation to living labs for research and practice before concluding the paper.

2 THEORY

This sections grounds the understanding of the living lab approach within the living lab literature focused on types of living labs, characteristics and outcomes, highlighting the need to establish a better understanding of how to plan and set up living labs in the practical sense. Based on the literature, the first sub-section presents a living lab typology to help make sense of the many types of living labs out there. Next, we review relevant literature looking for key dimensions that must be clearly defined and planned for when establishing a living lab. The third sub-section highlights variations in ambition levels in terms of community engagement, where metaphors such as "wheel of participation" have been used to characterise them.

2.1 Types of living labs

The living lab has been conceptualized as an environment (Ballon et al., 2005), a methodology or innovation approach (Bergvall-Kåreborn et al., 2009), an organization or an innovation intermediary (Schuurman et al., 2013), a network (Leminen and Westerlund, 2012), and a system (ENoLL – https://enoll.org/living-labs/). This lack of common consensus makes it difficult to advance research focused on living labs. To better understand the different typologies of living labs, a useful starting point is to distinguish between the American vs. European notion of living labs.

The first use of living labs in its present connotation was in MIT. This American notion of Living Labs describes a laboratory environment with all facilities of a regular home, optimized for multi-day or multi-week observational studies of single individuals and constructed to resemble a 'real' home as closely as possible (Schuurman et al., 2025). This American notion of Living Labs sees the Living Lab concept merely as a physical research facility that tries to overcome the artificial lab-context.

In Europe, the living lab movement has been gaining momentum since 2006 with the founding of ENoLL and the number of living labs has been growing (Schuurman et al., 2025). The overall aim of the ENoLL as an international federation of Living Labs is to support the creation of a dynamic innovation system throughout Europe. Two types of living labs can be distinguished within this European notion: living labs supporting context research and co-creation vs. living labs as extensions to testbeds (Følstad 2008). On the one hand, living labs supporting context research and co-creation would be based on an identified problem and focused on developing a solution in close interaction with end-users, or on the iterative finetuning of innovative products or services, tapping into the innovative capacity of test-users. On the other hand, living labs as extensions to testbeds describe testbeds (controlled network environments for test and validation) for e.g. ICT services (see Ballon et al. 2007).

According to Schuurman et al. (2013), a fourth type of living labs can be further distinguished. This final type is more focused towards multi-stakeholder collaboration and knowledge sharing, with less emphasis on developing and testing of new technologies and on deep end-user involvement. This fourth type of living lab are long-term and are intended to involve prolonged engagement with communities.

[1] ARV's meaning in Norwegian: "heritage" or "legacy"

2.2 Key dimensions for establishing an urban living lab

The living lab methodology has become a prominent approach in sustainable neighbourhood planning and development, often referred to as urban living labs.

Juujarvi and Pesso (2013) distinguish three types of urban living labs. First, urban areas can serve as technology-assisted research environments such that the living lab facilitators can collect feedback on products and services through webpages or sensor-based methods. Second, users can co-create urban artifacts and local services, such as communal yards, garden allotments or daycare services. Citizens are viewed as co-creators who contribute to designing and developing local services such as renovation processes. Third, an urban living lab can develop new kinds of urban planning using new tools and processes with the engagement of citizens. The goal is to facilitate vision-making of the area and planning processes, and increase the access and mutual learning of stakeholders. In this manner, the urban living lab can serve as a platform for stakeholders to participate in a neighbourhood's renovation initiatives and decision making.

One strand of living lab research positions living labs as a way to address the complex challenges of sustainable urban transitions and neighbourhood development through citizen engagement. When collecting the varieties of living lab definitions, Steen & Van Bueren (2017) structured them by defining four dimensions that must be clearly defined and planned for when establishing an urban LL:

- aim (a. innovation, b. formal learning for replication, c. for urban Living Labs: increasing urban sustainability)
- activities (a. development, b. co-creation, c. iteration),
- participants (a. public actors, private actors, users, knowledge institutes, b. decision-making power), and
- context (a. real-life use context).

In another study, based on empirical research from four living labs in Belgium and Finland, Veeckman et al. 2013 has discussed the characteristics and outcomes of living labs as a collaborative innovation approach and introduced a living lab pyramid to provide practical guidelines for organising living labs to foster user-centred innovations. The living lab pyramid framework consists of three pillars: living lab environment, living lab approach, and the innovation outcome. While one base of the pyramid anchors the living lab environment, considering technical infrastructure, ecosystem approach, level of openness, community, lifespan, scale, and real-world context, the other base of the pyramid secures the attention to the living lab approach, emphasizing evaluation, context research and user roles. The pinnacle of the pyramid addresses innovation outcomes, linking them to strategic intention, knowledge, resources, and partnerships.

Van Geenhuizen (2018) suggest attention should be given to both intended outcomes and unintended outcomes of living lab processes and results.

- Outcomes in the sense of intended outcomes include a better knowledge of user wishes and speeding up and bringing more solutions to market (e.g. Veeckman et al., 2013).
- Unintended outcomes may also happen. These include the absence of desired outcomes as well as adverse effects, and both are to a certain extent connected with bad predictability of influences and processes.

2.3 Mix of ambition levels for community engagement

Leminen et al. (2012) emphasize that living labs are open-innovation networks. Based on which actor drives the activities, living labs differ from one another in terms of activities, structure, organization, and coordination (Westerlund & Leminen, 2011). For example, living lab activities can be provider-driven when the innovation activities of the living lab aim to develop a solution for participants or other stakeholders, or have an educational purpose. Living lab activities can also enabler-driven, taking a bottom-up approach, when the activities focus on fulfilling the needs of a local community or association like improving the local social development where the living lab is located.

Nowadays, the Living Lab approach can be understood as an attempt to bridge the gap between multiple actors through directly involving them into the process of developing or transforming an urban neighbourhood (Steen & Van Bueren, 2017). However, a key finding of Steen & Van Bueren (2017)'s

review is that half of the living labs did not directly involve users, while the other half organised participation processes. It is apparent that engagement is challenging to achieve in practice in many living labs. Steen & Van Bueren, (2017) point out that the lack of participation may be a result of discrepancies between the methods used in practice and the ambitions of urban living labs defined in an early phase.

Arnstein`s ladder (1969) conceptualizes public involvement in decision-making as a hierarchy ranging from nonparticipation to full citizen involvement. However, studies have also put forth alternative frameworks to Arnstein's (1969) ladder, such as the wheel of participation (Davidson, 1998) as a more appropriate metaphor to deal with different levels of citizen engagement. The wheel promotes the appropriate level of community involvement to achieve clear objectives, without suggesting that the aim is always to climb to the top of the ladder. This wheel metaphor thus beckons the importance of a mix of engagement levels in living lab approaches to effectively channel citizens' experiences and competences.

Summing up

Taken together, to reap the benefits of living labs for collaboration and knowledge support activities, a systematic process orientation to the living lab concept is required. Living Lab facilitators working on the ground are in need of a simple methodology that is practical and easy to apply. Furthermore, a high degree of engagement is not always required to deliver change processes and implement sustainable solutions. The transformative potential of an urban living lab can also be realised with a low level of user involvement. As the literature points out, the 'higher level of engagement, the better' is not the aim. Instead, it is more important to consider the right form of engagement at the right time. This paper asks: How can a living lab approach be established for varying ambition levels of community engagement, communication and education towards sustainable neighbourhood transformations?

3 RESEARCH APPROACH

This section outlines the research approach. It is based on six living labs for community engagement focused on deep renovation. We draw on ongoing results from the EU Green Deal project 'ARV' (https://greendeal-arv.eu/) which aims to demonstrate and validate attractive, resilient, and affordable solutions for a sustainable neighbourhood concept known as "Climate Positive Circular Communities" (CPCCs).

A CPCC in the ARV project is defined as an urban area which aims to achieve net zero greenhouse gas emissions, enables energy flexibility, and promotes a circular economy and social sustainability. This novel concept focuses strongly on the interaction and integration between new and regenerated buildings, users, and energy systems, facilitated by ICT to provide attractive, resilient, and affordable solutions for citizens.

3.1 Purposeful sampling

To better understand the task of establishing a living lab approach for community engagement, purposeful sampling was relied upon. Purposeful sampling, or specifically criterion sampling, is widely used in qualitative research for the identification and selection of information-rich cases related to the phenomenon of interest (Creswell, 2009). A range of diverse strategies that can be used in purposeful sampling in accordance with different objectives (Palinkas et al. 2015).

Two widely used strategies for purposeful sampling include the identification of unusual phenomena from extreme cases as well as the identification of patterns of variation from heterogeneous cases. A third strategy can also include the simplification of the analysis and the emphasis on similarity from homogeneous cases or convenience sampling that emphasise collecting information from willing participants. While the first two strategies focus on describing the variability or dispersion of values, the third is used primarily to reduce the range of variation and identify similarities.

In line with this study's objective of increasing our understanding of how to establish a living lab approach for community engagement, we relied on the third strategy of purposeful sampling. This choice reflects our aim to deepen insight into the complexities of developing a living lab approach across the pilot sites and to provide detailed accounts of their contexts, aims, actors, and activities. This purposeful sampling strategy is particularly interesting where relationships between actors extend both horizontally, between organizations at the same level in the network context, and vertically from state to local stakeholders.

Various activites were carried out to interact, engage and collaborate with the multiple actors in the six demonstration communities in the ARV project during 2022-2025. These activites include, among other

things, stakeholder mapping, one-to-one meetings, workshops and events. Actvities conducted in the six demonstration communities were systematically registered in respective living lab logbooks over the four years. Furthermore, the community engagement activites were described and analysed in reports as a part of the deliverables for the ARV project.

3.2 Overview of cases

For this study, six pilot sites in different climate zones of Europe were used as cases. Within the EU Horizon 2020 project ARV, Climate Positive Circular Communities were designed and implemented in Oslo (Norway), Palma de Mallorca (Spain), Karviná (Czechia), Utrecht (Netherlands), Trento (Italy), and Sønderborg (Denmark), offering diverse contexts for examining living lab approaches to community engagement.

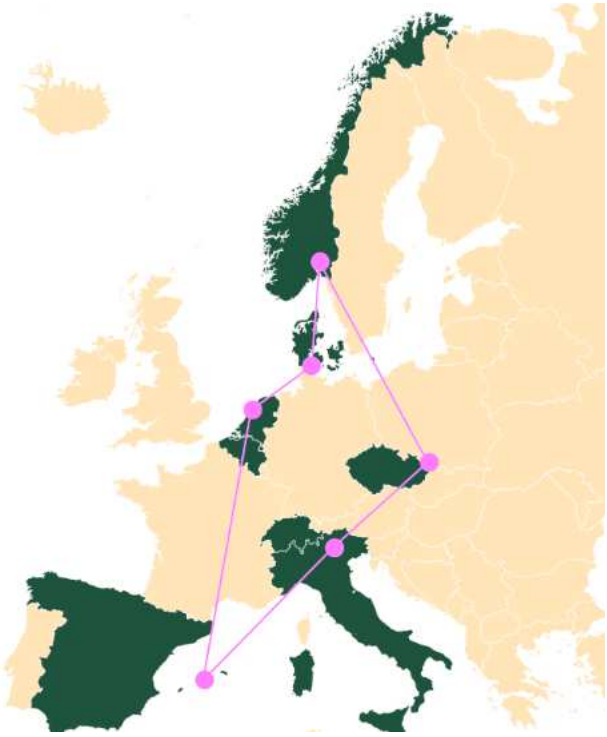

Fig. 1: Map of ARV demonstration sites in Oslo (Norway), Palma de Mallorca (Spain), Karviná (Czechia), Utrecht (Netherlands), Trento (Italy), and Sønderborg (Denmark)

4 FINDINGS

In a nutshell, the pilot sites encompass the development of a plus energy school and cultural area in a former industrial site in Oslo, Norway, energy upgrades of multi-family blocks with district heating in Sønderborg, Denmark, industrialized renovation of social housing in Utrecht, the Netherlands as well as in Trento, Italy, the transformation of an health care centre into a living lab for CPCC in Karvina, Czechia, and urban transformation of a city district in Palma de Mallorca, Spain.

Based on the place-based experiences of establishing a living lab approach for community engagement in the six pilot sites, we distill the most important aspects that stand out in its community engagement activities.

CPCC Demonstration Site (Neighbourhood)	**Understanding social contexts and embeddedness**	**Defining Goals and outcomes (the innovations)**	**Target groups to engage**	**What was learned**	**Enhance (what to do better next time wrt. Community Engagement)**
Oslo (Voldsløkka)	Location of the school bridging east and west Oslo; the need for a non-homogeneous façade appearance, and the highly ambitious energy goal for the building building-attached photovoltaic	Create awareness and understanding and hence acceptance and maintenance of these innovations/solutions BAPV and BIPV	Pupils of the secondary school (Voldsløkka school) and the culture school (Voldsløkka Culture Station) Building professionals	Long presentations on sustainability aspects did not attract the pupils.	Pupils liked contextualized and playful formats – such as climate bootcamps, board game co-creation, and prototyping – which helped translate abstract concepts into tangible understanding.

	(BAPV) and building-integrated photovoltaic (BIPV) panels on the East, West, and South façades, and on the roof. Outdoor stormwater solution.		Municipality planners		
Sonderborg	Cost-optimal design to reduce district heating return temperature[2] from substation systems in multi-flat buildings.	Tenants' usage of heating and radiator thermostats varied very much among apartments; activities were initiated to help the tenants to operate the radiators in an optimal way.	Tenants	Engaging representatives of residents (Green ambas-sadors) to help tenants using energy soluti-ons properly	Representatives of the housing organization visited each household to inform and engage the residents as a substitute for the green ambassador program.
Utrecht (Overvecht)	Social renovation process where the tenants are actively offered help before, during, and after renovation. Diffrent stake-holders were brought together.	These partners simultaneously implemented interventions to improve the tenants' conditions, such as work, mental support, healthcare, housing, social contacts, and finances. reduce renovation stress. Helps establish more trust in institutions and government in the neighbourhood.	Tenants Municipality actors	Multi-disciplinary coordination (housing, welfare and health workers) reduced tenant stress and prevented social issues. But, the colla-boraion needed time and effort, to create a common understanding.	To transfer the competence in the housing coorporation and the collaborative mechanisms among the social partners. In Overvecht, this alignment (multi-disciplinary coordination) has since become more efficient and has resulted in long-term collaboration that extends beyond the social renovation projects themselves.
Trento	End-users' perspectives have been addressed by a noise and dust perception campaign targeting the installation of the 'Renew Wall' kit vs. ETICS.	Cost optimization of the prefab kit vs. business-as-usual solutions	Tenants – elderly	Terminology "indoor comfort" By using existing communication channels and local dialect to communicate with and engage residents, the building manager made the residents to feel more comfortable and reassured and to build trust.	Using familiar means to communicate with tenants (especially when they are elderly people) will be a more effective way to engage them.
Karvina	Renovation of existing health care centre note context: region that has historically been built on coal mining) Health Centre –as an "educational building" (Note presence of vocal groups in the Czech Republic who are strongly opposed to the Green Deal and related sustainability topics)	Getting a building ready for PED development as an educational platform, and to stem outflow of young people	Centred on education and engagement of young citizens, particularly pupils aged 14 to 19. institutional stakeholders such as energy centres, schools, hospitals, and public service providers.	Spark interest in the topics of energy transition and sustainability and to foster a deeper connection between the youth and their region, with the broader ambition of motivating them to stay or return and contribute to local development Identified that long lectures to educate and encourage the youth to gain	To gather diverse perspectives on sustainability and identify potential roles for these institutions in future city projects. Youth: not overly technical tasks, importance of simplifying the content and incorporating more creative, hands-on elements for students to express their ideas. Institutional stakeholders: Projects must have specific, realistic goals,

[2] Reducing the district heating return temperatures from buildings allows the main district heating network to operate with a lower temperature level, which again allows the district heating company to utilize energy sources at a lower temperature level, enhancing the utilisation of energy produced by heat-pumps, excess heat from factories, cooling applications, data centres, etc. In Denmark, building users are economically rewarded if they can reduce the return temperature from their buildings back to the district heating network.

				knowledge on sustainability did not work well.	demonstrate cost-effectiveness, and offer a long-term vision. "The project format" (empowering pupils to shape their learning experience and to become co-creators of the solutions) has been chosen instead of long lectures.
Palma (64 homes initiative)	Attending to the buildings most in need of renovation which are often overlooked and not eligible for subsidy.	Affordability	Architect and engineer volunteers Residents – vulnerable segment	The construction company facilitated self-construction activities by the residents themselves. This has helped reduce costs, increase neighbourhood involvement and make viable a project that would otherwise have been economically unfeasible.	Focusing adequately on empowering residents / users can be beneficial.

Table 1: Components for establishing a living lab approach for community engagement

5 DISCUSSION

In this section, we discuss the type of living labs that best characterise the ARV living labs. We point out the most important components that living lab facilitators work with for establishing living lab activities. In our effort to channel the insights from the empirical material into a practical approach supporting community engagement, communication and education, we advance a five-phase methodology useful for getting community engagement activities up and running (whether new and as an extension of ongoing programmes). At the same time, we also point out the limitations of this methodology.

5.1 Living labs for multi-stakeholder collaboration and knowledge sharing

The ARV living lab activities have been focused on long-term collaboration and knowledge exchange. The activities in the Utrecht and Sonderborg demonstration sites are continuing existing programmes, while those of Oslo, Trento, Karvina and Palma are new programmes.However, long-term collaboration and knowledge exchange is hard to achieve if a living lab is project-based and unless there is a dedicated living lab facilitator.

In ARV, we observe that activities already embedded in stakeholders' established practices evolve quite differently from those introduced solely through the project. For example, Utrecht municipality had some headstart with working with the concept of social renovation and has collaborated with the housing associations prior to ARV. It also has the ambition to continue this work beyond the project period. Likewise, Sonderborg housing association has been working to deepen the trust with its tenants. In contrast, other demonstrations – such as Oslo – set up short term Living Lab activities that were created primarily to meet ARV's requirements. As a result, sustaining long term collaboration becomes challenging when enduring structures and organizational anchoring are not in place. We also observe that it is challenging to keep focus on the innovation outcomes once engagement activities take a life on its own.

Initial learnings point to the importance of identifying and prioritising the target groups to reach out to and establishing a deep understanding of the social context. Regarding target groups, at times, this can be planned such as the elderly residents in Trento. For Palma, the urgency and oppurtunity to reach out the a vulnerable segment of the neighbourhood presented itself when a building was no longer safe enough for pedestrians in its vicinity. As for social context, in Karvina, the understanding that a sizeable segmnet of the population in this region of Czech Republic are strongly opposed to the Green Deal and related sustainability topics is indispensable when planning and putting together the engagement activities.

The stakeholders that could make a difference also have to be systematically mapped out. In the case of Sonderborg, the district heating supplier is an important actor to enable the 'aftercooling concept', working in conjunction with the housing association.

The living lab facilitator is the instrumental actor for sustained interest and coordination of activities. A pragmatic approach to achieve a level of knowledge exchange commensurate with predefined goals makes the wheel metaphor appropriate for ARV living labs.

5.2 Five phase methodology: S.M.I.L.E.

Based on the insights from literature and the on-the-ground realities faced by ARV living labs, we propose a five-phase methodology to get community engagement activities up and running (whether new and as an extension of ongoing programmes). Community engagement is a difficult task, and some tools will be helpful to living lab facilitators and practitioners.

The diversity of the ARV demonstrations and the planned activities across the living labs demanded a coherent and structured approach for the living lab facilitators, practitioners and the researchers. As shown in Figure 2, a systematic process orientation to living labs can use five phases to get community engagement activities off the ground– Scope, Map, Implement, Learn and Enhance – the S.M.I.L.E. methodology. The idea of the SMILE methodology was developed to offer all project participants of ARV a common framework recipe for planning the activities, implementing them and reflecting on the results. Building on the key dimensions of living labs described by Steen and Van Bueren (2017), the S.M.I.L.E. methodology aims to operationalize these dimensions by providing a more concrete, step by step roadmap for designing, conducting, and following up living lab processes.

We outline each phase in more detail:

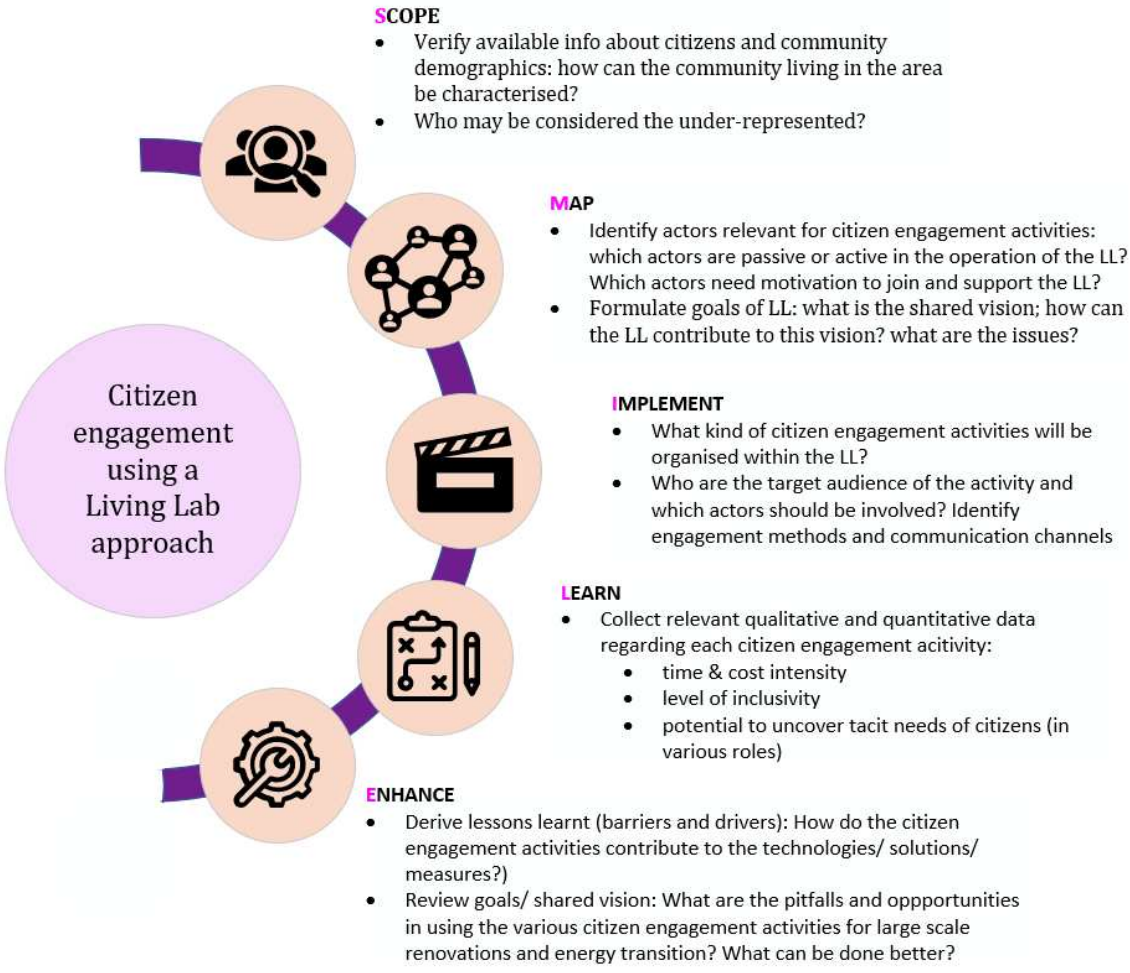

Fig. 2: The 5 phases of the S.M.I.L.E. methodology to reap the benefits of living labs for collaboration and knowledge support activities

Scope: In the first phase, Scope identifies the target groups. This foregrounds the users (in their various roles) and the community and focus the attention on the needs of the target groups within the community. In this first step, a deep understanding of the citizens and community demographics is essential to regard the selected target groups as catalysts of innovation and that their inputs can lead to better informed and robust outcomes in various measures and solutions. In addition, only when the citizens and the community living in the area has been characterized, the question of who may be considered as the under-represented or vulnerable can then be posed.

Map: In the second phase, Map tries to envision all the actors relevant for socio-technical innovation or solution in focus. This entails identifying and mapping out all the actors, their resources and goals. It should be noted that this is a dynamic picture that needs to be regularly reviewed. The Map phase then also involves formulating the goals of the living lab. Based on which actor drives the activities (living lab facilitator), the activities, structure, organization, and coordination can then be outlined. The living lab goals are also dependent on the main actor that drives the engagement activities.

Map allows the possibility to look at the dynamic picture of relevant actors and the goals of the living lab, reviewing their congruence. Afterall, adopting the living labs approach requires thorough understanding of important actors' objectives and drivers, the alignment of operational processes, and establishment of open and collaborative culture (Schaffers and Turkama, 2012).

Implement: In the Implement phase, citizen engagement activities (information-providing activities vs. co-creation activities) are being planned, organised, and rolled out. Various citizen engagement methods and digital tools as well as communication channels may be deployed associated with the activities. The important question to keep asking here is: Who are the target audience of the activity and which actors should be involved? How to gather their insights towards the innovation/solution?

Learn: The Learn phase will be evaluate the engagement activities, the use of various methods and tools (considering the innovation outcomes) and derive lessons.

Enhance: Building on the Learn phase, the Enhance phase will suggest enhancements on the effectiveness and efficiency of the engagement methods. The three important questions here are:

- How can the community engagement activities contribute to the awareness, undersrtanding and acceptance of social and technical solutions and measures related to sustainable transformation of urban communities?
- What are the opportunities (and pitfalls) in using the various citizen engagement tools for large scale renovations and energy transition?
- What can be done better in terms of community engagement, communication and education to increase the awareness and understanding and hence acceptance and maintenance of these solutions?

5.3 Community engagement for sustainable neighbourhood transformations – distinct contribution, limitations and unintended outcomes

Sustainable neighbourhood transformations are long-term initiatives. Working at this larger scale than the building level means involving multiple urban stakeholders such as landscape architects, the user community, making the task more complex and time-consuming. Map envisions all the actors relevant for the development of the socio-technical solutions and facilitates the possibility to review the congruence of their interests. Adopting the living lab approach requires thorough understanding of important actors' objectives and drivers, the alignment of operational processes, and establishment of open and collaborative culture. The S.M.I.L.E. methodology provides a pragmatic point of departure for a living lab facilitator responsible for engagement activities, whether new or an extension of ongoing programmes, towards development of innovations and solutions that support the decarbonisation of the urban built environment.

The S.M.I.L.E. methodology tries to establish a living lab approach that firmly anchors engagement activities in the local environment, considering technical infrastructure, ecosystem approach, level of openness, community, lifespan, scale, and real-world context. Sustainable neighbourhood transformations are local place-based initiatives that require ongoing formulation of challenges in its societal context. It tries to address concerns from researchers such as Roorda et al. (2014) that we should not bracket our research effort towards only focusing on the solutions and innovations while leaving out the context and underlying

systemic challenges and problems. The task of sustainable neighbourhood transformations is fraught with difficulty, and a practical tool like the SMILE methodology can be helpful to discourage working in silos but shape collaboration in a transdisciplinary fashion across topics, allowing for adaptability and reflection to find most effective ways of sharing knowledge, creating awareness and deepening the understanding of neighbourhood-scale interventions and developments.

The distinct contribution of the S.M.I.L.E. methodology is its simple, coherent and structured approach to get all CPCC living labs going in the 6 demo sites. With identifying target groups and their needs coupled with mapping relevant stakeholders at its core, the S.M.I.L.E. methodology can be considered a vital and fundamental preparatory measure for sustainable neighbourhood transformations. It is particularly suited for laying the groundwork for developing CPCCs – places where communities thrive, with low-carbon and energy-efficient building technologies, human-scale architecture, nature-based solutions and green-blue infrastructure, and inclusive public spaces.

However, a novel concept such as CPCCs is related to the notion that durable change has been achieved only when people's hearts and minds, their values and cultural practices, and the quality of relationships they have, are transformed. Engagement activites have both intended and unintended outcomes, and the S.M.I.L.E. methodology can be futher finetuned to address the absence of desired outcomes as well as adverse effects.

6 CONCLUDING REMARKS

This paper has advanced a practical five-phase methodology in order to reap the benefits of a living lab approach towards community engagement, communication and education for urban regeneration. The S.M.I.L.E. methodology puts people in focus, foregrounding their specific needs, interaction, and wellbeing, channelling their experiences to take positive steps towards acceptance of innovations and solutions that can support the decarbonisation of the urban built environment.

As living labs can be broadly interpreted as unique spaces where different types of innovators can interact and thus benefit from synergies, diversity and cross-pollination of ideas, a simple yet practical process-oriented approach can be useful for getting community engagement activities off the ground (whether new or an extension of ongoing place-based programmes). Offering a means to cut through the clutter of projects and approaches carried out under the 'living lab' umbrella, the S.M.I.L.E. methodology is particularly suited for living labs focused towards multi-stakeholder collaboration and knowledge sharing, and for initiatives pursuing the neighbourhood scale in deep renovations.

6.1 Research implications

Depending on the living lab facilitator who drives the activities, living labs differ from one another in terms of goals, activities, structure, organization, and coordination. Deploying engagement methods and tools will have to take this into consideration. Living lab facilitators and researchers contemplating innovation-oriented living labs need to consider the intended inputs and outcomes and reframe their engagement activities accordingly when relying on the S.M.I.L.E. methodology. Varying ambition levels of community engagement should be set to allocate resources accordingly.

6.2 Practical implications

A high degree of citizen engagement is not always required to deliver change processes and implement sustainable solutions. The transformative potential of an urban built environment can also be realised with a low level of user involvement, commensurate with the ambitions set for a particular target group. It is more useful to focus on target groups and their needs, consider their embeddedness, draw out their experiences and competences, and allow these to be channelled to the socio/ technical innovations that support sustainable neighbourhood transformations. Along this vein of thinking, the S.M.I.L.E. methodology can easily be understood and applied by living lab facilitators and practitioners. As the literature points out, the "higher level of engagement, the better" does not always hold true. Instead, it is more important to consider the right form of engagement at the right time for efficient allocation of resources.

7 ACKNOWLEDGEMENTS

The research conducted in this paper has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036723, ARV Project.

8 REFERENCES

Almirall, E. & Wareham, J.: Living Labs: arbiters of mid- and ground-level innovation. Technol. Anal. Strateg. Manag. 23, 87–102. https://doi.org/10.1080/09537325.2011.537110. 2011.

Arnstein, S. R.: A ladder of citizen participation. J. Am. Inst. Plann. 35, pp. 216–224. 1969.

Ballon, P.; Pierson, J.; Delaere, S.: Open Innovation Platforms For Broadband Services: Benchmarking European Practices. in 16th European Regional Conference, at Porto, Portugal. 2005.

Ballon, P.; Pierson, J.; Delaere, S.: Fostering innovation in networked communications: test and experimentation platforms for broadband systems. In Designing for networked communications: Strategies and development (pp. 137-166). IGI Global Scientific Publishing. 2007

Bervall-Kåreborn, B. & Ståhlbröst, A.: Living Lab: An Open and Citizen-Centric Approach for Innovation. International Journal of Innovation and Regional Development. January 2009.

Creswell, J. W.: Research Design: Qualitative, Quantitative, and Mixed Methods Approach (3rd ed.). Sage Publications, Inc. 2009.

Davidson, S.: Spinning the wheel of empowerment. Planning 3: 14-15. 1998.

ENoLL (European Network of Living Labs): https://enoll.org/living-labs/. Referred: January 2025.

Følstad, A.: Living Labs for Innovation and Development of Information and Communication Technology: a Literature Review. The Electronic Journal for Virtual Organizations and Networks. Special Issue on Living Labs, August 2008.

Juujärvi, S., & Pesso, K.: Actor Roles in an Urban Living Lab: What Can We Learn from Suurpelto, Finland?. Technology Innovation Management Review, 3(11), pp. 22-27. http://doi.org/10.22215/timreview/742. 2013.

Leminen, S. & Westerlund, M.: Towards innovation in living labs network. International Journal of Product Development, 17 (1-2), pp. 43-59. 2012

Leminen, S., Westerlund, M., Nyström, A.-G.: Living Labs as Open-Innovation Networks. Technology Innovation Management Review 7. 2012.

Palinkas L. A.; Horwitz S. M.; Green C. A.; Wisdom J. P.; Duan, N; Hoagwood, K.: Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. Adm Policy Ment Health, 42(5), pp. 533-44. 2015

Rizzo, A.; Habibipour, A.; Ståhlbröst, A.: Transformative thinking and urban Living Labs in planning practice: a critical review and ongoing case studies in Europe. Eur. Plan. Stud. 29, 1739–1757. https://doi.org/10.1080/09654313.2021.1911955. 2021.

Roorda, C.; Wittmayer, J.; Henneman, P.; Van Steenbergen, F.; Franstzeskaki, N.; Loorbach, D.: Transition Management in the Urban Context – Guidance manual, Creative Commons. 2014.

Sassenou, L-N.; Olivieri, L.; Olivieri, F.: Challenges for positive energy districts deployment: A systematic review. Renewable and Sustainable Energy Reviews, Volume 191. 2024.

Schaffers, H. & Turkama, P.: Living Labs for Cross-Border Systemic Innovation. Technol. Innov. Manag. Rev. 6. 2012.

Schuurman, D.; Mahr, D.; De Mares, L.; Ballon, P.: A Fourfold Typology of Living Labs: An empirical investigation amongst the ENoLL community. IEEE International Technology Management Conference, DOI:10.1109/ITMC.2013.7352697. June 2013.

Schuurman, D.; De Los Ríos White, M. I.; Desole, M.: Living Lab origins, developmenmts, and future perspectives (https://living-in.eu/sites/default/files/files/enoll-2025.-living-lab-origins-developments-and-future-perspectives.pdf), ENoLL, 2025.

Steen, K., & Van Bueren, E.: The defining characteristics of urban Living Labs. Technol. Innov. Manag. Rev. 7. 2017.

Van Geenhuizen, M.: A framework for the evaluation of living labs as boundary spanners in innovation. Environment and Planning C: Politics and Space, 36(7), 1280-1298. https://doi.org/10.1177/2399654417753623. 2018.

Veeckman, C.; Shuurman, D.; Leminen, S.; Westerlund, M.: et al.: Linking Living Lab Characteristics and Their Outcomes: Towards a Conceptual Framework. Technology Innovation Management Review, December 2013.

Westerlund, M. & Leminen, S.: Managing the challenges of becoming an open innovation company: experiences from living labs. Technology Innovation Management Review, pp. 19-25. October 2011.