Proceedings of the OpenLivingLab Days Conference 2024

"Living Labs Frontiers"

Driving systemic change through Soci(et)al Engagement, for real impact

European Network of Living Labs ivzw (ENoLL)

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This report is a compilation of the papers presented between the 25th and the 27th of September 2024, in the West University of Timişoara, as part of the OpenLivingLab Days conference.

The publications contained here are a result of the double-blinded peer review and evaluation procedure carried out between April and June of 2024 as part of the "Call for papers" responding to the theme of the OpenLivingLab Days 2024 conference:

"Living Labs frontiers. Driving systemic change through Soci(et)al Engagement, for real impact"

The conference had five different tracks forming the core of the event, including the research sessions:

- Living Labs for Grand Societal Challenges
- Living Labs for Policies, Governance, Collaboration, and Innovation Ecosystems
- Living Labs for Inclusive Soci(et)al Engagement
- Living Labs for Business and Emerging Technology
- Living Labs Operations, Methods, Tools, and Impacts

The "Call for papers" encouraged contributions from three different paper categories to stimulate a diverse participation of actors: 'Full Research Papers' refers to complete research with clear results, 'Research in Progress Papers' presenting relevant preliminary results and 'Innovation Presentation Outline' describing Living Lab practices and experiences.

To maintain full transparency in the evaluation process, all reviewers and submissions were anonymised to eliminate any bias. Once the evaluations were completed, reviewers' comments were carefully compiled and shared anonymously with the authors. This approach allowed authors to receive objective and constructive feedback, enabling them to refine and enhance their papers.

Acknowledgments

This publication is a collaborative effort of several individuals representing the European Network of Living Labs ivzw (ENoLL) and its network members.

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Top Contribution Research Session

Wednesday, 25th September 2024

During the Top Contribution Session at OpenLivingLab Days 2024, the most outstanding submissions to the conference were presented. Authors of the six highest-rated papers had the opportunity to present their research, showcasing cutting-edge ideas and practical insights within the living lab community. This session highlighted innovation and excellence, aiming to inspire further advancements in the field.

Full Research Paper

The Living Lab Modeler

A tool to leverage the activities and impact of your Living Lab

Authors

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Abstract

The Living Lab Modeler (LLM) is a web-based application that enables the digital representation of Living Labs (LLs) and the facilitation of their activities.

LLM is designed on the premise of LLs being user-centred innovation ecosystems that rely on multi-stakeholder collaboration to drive innovation. The LLM addresses commonly observed shortcomings in the operation of Living Labs, by providing a digital solution to support core LL (Living Labs) activities such as stakeholder management, activity tracking, outcome documentation, and reporting, including also more specialised modules that depict the interactions among the LL's 'ecosystem' entities. The first version of LLM was developed as part of the DESIRA H2020 project and tested with European LLs that sprang on the premise of DESIRA.

This paper presents the empirical observations and barriers identified that are related to the operation of LLs along with LL methodological and conceptual considerations, which have been the motivation for the development of the LLM. It also presents challenges related to the development and implementation of LLM, and illustrates the main design principles applied, and functionalities implemented for overcoming identified barriers. It provides a comprehensive outline of the multifaceted capabilities of the tool and showcasing its potential.

Key words

Living Lab operation, Living Lab management, digital tools and solutions, user-centred innovation ecosystems, co-creation methodologies

Introduction: Living Labs as user-centred ecosystems

The Living Labs (LLs) have become over the years a widely used approach and method for recording problems and developing solutions. Living Lab practitioners and theorists have attempted to classify Living Labs into various categories [Dutilleul et al., 2010, Ballon et al., 2018, ENoLL Catalogue 2023]. The differences in categorising the LLs stem from the distinct theoretical and conceptual angles that researchers and practitioners approach the LL methodology. There is also a broad diversity in terms of themes and application domains, in attempts to frame and further define the field.

Despite these differences between the various approaches, that are put forward as inherent in the concept, there is a common understanding that LLs are defined by active user involvement in the innovation process and employ a user-centred and design-driven methodology, often involving co-creation, real-life experimentation, and even prototyping. They have been largely used to co-design and foster tailored innovation outcomes that meet community needs, increase decision-making, enhance inclusivity, and facilitate knowledge transfer and capacity building [Niitamo et al., 2006]. Moreover, Living Labs are deployed to embed results in given contexts, and to further translate and scale up shared knowledge and collaboratively produced outcomes [Leminen et al.,2012].

Because Living Labs are user-centred ecosystems, they heavily rely on the active engagement and collaboration of various stakeholders to drive innovation. The multi-stakeholder engagement perquisite enables the cross-pollination of ideas, the sharing of resources and knowledge, and the alignment of varying interests across the participating actors. This collaborative approach is a fundamental block of the Living Lab methodology that enables LLs to address challenges that involve complex interactions among its constituting entities, towards a common goal [Schuurman et al 2016].

The structure of Living Labs also dictates the interplay of involved actors, which has shown a significant impact on the type of innovation outcomes they can achieve. Distributed structures can support multiple connections and interactions among a variety of actors, promoting radical innovation potential, while more centralized structures tend to foster incremental innovation outcomes [Deward & Dutton, 1986].

From another innovation theory perspective, Living Labs toggle between Open innovation schemes and user-centred innovation. LL’s can adopt characteristics and deploy activities that are both focused on sharing between/among the Living Lab stakeholders, and/or go beyond the Living Lab’s boundaries for new knowledge. In essence an LL can strive for the exploitation of internal (inside-out) and external (outside-in) pathways for Innovation [Gassmann & Enkel, 2004].

To reap the best of both worlds in terms of structure (distributed/centralised) and innovation pathways (open/ user generated) Living Labs should operate with a distributed system of innovation within a group of individuals and/or organizations that are centred on a unifying infrastructure. This way, the endeavour of innovation is no longer in the firm or left in the open but resides in the managed and supported LL participating community [Sawhney & Prandelli, 2000].

Untapped potential, despite increased presence of LLs

Over the past decades Living Labs have grown and evolved from a social experiment level into a proven and widely used innovation inducement concept that is supported by solid methodological guidelines for enabling bottom-up participatory design for innovative outcomes [Schuurman, 2015]. The ENoLL's public activity reports provide an indication on the upward trend of the usage of the LL methodology globally. Based on ENoLL's cited data the trajectory of Living Labs (LLs) usage has exhibited notable developments over the years. In 2014, the European Network of Living Labs (ENoLL) comprised 25 members with 340 accredited living labs. Subsequent years witnessed a substantial increase, with the number of living labs reaching 450 by 2019 and further rising to 469 in 2020. The progression continued in 2022, with ENoLL boasting 151 active members spanning 35 countries across 5 continents, a trend that persisted in 2023 with 155 active members in 37 countries [Ståhlbröst, 2013, ENoLL Activity Reports 2014-2022]. A similar trend is observed also in the area of the European Commission funded projects: only in the H2020 and Horizon Europe frameworks, there are more than 3.000 funded projects that implement Living Lab activities.

Undoubtedly, by deploying flexibility over the inertia of closed systems architecture, or bypassing the traditional risk averse R&D strategies dictated by the thorough exploration of market competencies, the open and user-centred LL innovation approach provides significant benefits to overcome societal or market barriers [Das et al., 2018]. Still, Living Labs face fundamental barriers that hinder the potential impact of innovation in their ecosystems. The maintenance of processes and operation, as well as the active stakeholder engagement in co-creation processes remains a challenging task. Valuable ideas and innovation potential that is created through the Living Labs is difficult to be harvested, does not survive the ending of the labs, is not exploited and, thus, is not "translated" into services and tools for the wellbeing of societies.

Moreover, in our work we came across with ambiguity in relation to the 'interpretation' of "What can be considered a Living Lab? Which are the critical factors that define it? Are there any encompassing rules that should apply across Living Labs? How can we facilitate the Living Lab's governance and administration?" The above commonly encountered problems in Living Lab practice, our observations from our work with LLs and the empirical knowledge shared from various researchers and practitioners, have led us in the pursuit of the following question "How can we support co-creation processes and help Living Labs overcome common barriers that are linked to their way of operation?"

The decision to provide a digital solution stemmed out of the observation of the role of digital platforms. Platforms have become important for product and technology development in a wide range of industries, the recent pervasive penetration of digital technology has elevated their importance especially in IT enabled products and services (Yoo et al.,2012). Digital platforms differ from applications in that their design context is subject to a wide range of change, because of their heterogeneous, growing user base and the constant addition of new IT capabilities and complements (Williams & Pollock, 2008; Hanseth & Lyytinen, 2010). Thus, the second question we tried to answer with the development of LLM was "Can this co-creation process benefit from the integration of digital technologies, considering their omnipresence in almost all aspects of our lives?".

Based on a combination of scientific literature and our working experience in setting up and operating LLs, we concluded in the following points perceived as recurring barriers for the successful implementation of LLs.

Supporting the LL fundament

LLs often lack clear focus and fail to establish spearheads to declare a distinguishable profile. Moreover, Living Labs could benefit from a supporting tool that allows a clear governance structure, strategic planning and clear KPI setting. LLs could benefit from an infrastructural LL environment to 'host' innovation and innovators.

Sustaining LL lifecycle and ensuring impact

Living labs are often set up on a project basis that also dictates their lifecycle. As a result, the built-up knowledge and expertise relies on the projects planning on efficient exploitation of results and planning of resources to ensure sustainability. For sustaining and exploiting results, LLs should move to a non-project centralised resource, providing repository services that help store, archive, and retain, the created knowledge, and sustaining the LL network of stakeholders, ensuring the long-term exploitation and use of results [Schuurman et al. 2016].

Evaluation & Assessment of outcomes

Building on the previous point, LLs also lack clear monitoring mechanisms to measure their impact and allow the evaluation of their outcomes or their mother-projects outcomes, past the funding period of these projects. LLs need a causal link between actions or decisions and effects, a causal link between various iterations of multi-stakeholder inputs and functional outputs, outcomes, and impacts [Ballon et al., 2018].

Scaling of impact

LLs often fail to externalise their actions and outcomes. This insular state hurts their visibility and impedes the extension of the Living Lab beyond its 'physical' boundaries directly tied with its core actors/actions. Limited visibility induces difficulties in allowing seamless stakeholder participation that in turn may also bring skewed inclusion methods during the co-creation process. LLs switchover to inward-looking systems restrain liaison opportunities and limit the scaling of their results and their potential impacts.

Our attempt to address all these issues has motivated us to design and develop a dedicated tool, that would help addressing these shortcomings and has been the driving force behind the Living Lab Modeler development.

The Living Lab Modeler (LLM) solution

LLM approach and general idea

The Living Lab Modeler is a web-based application that enables the digital re-creation of a Living Lab and facilitates and supports its activities in multifaceted ways.

The main premises of LLM stem from our perspectives on issues that hinder the sustainable LL operation and impede innovation process. By combining theory with practice-based design, we aimed at providing a solution that facilitates social interactions in an online environment. As such, for the design of the LLM, it was important to focus on diverse types of social interactions taking place in LLs at the physical world and try to instantiate those in an online setting.

The LLM's social interaction structure is based on the premise of three equally important components for the successful LL operation: a) Information sharing, b) collaboration, and c) collective action.

A) Information sharing

In LLM actors are enabled to generate their own content, creating resources available to wider groups, also to other LLs and not only to the one they participate in. This social interaction structure allows open sharing of information and encourages participation. The essential element is enabling the individual and independent actions of the users (LL administrator), where no form of collaboration is required. What ultimately emerges is an online space that aggregates valuable, for the related communities, resources with minimum formal rules enforcement or governance mechanism necessary.

The platform supports the diffusion of different predetermined types of information among members from different communities. Reciprocity is not required for this form of sharing-centred interaction, enabling individual relationships to take place among users.

B) Collaboration

LLM users are enabled to engage in activities that require group coordination. Collaboration is considered a more complex social interaction trait than information sharing, as it requires a greater alignment to serve the objectives of the LL. If collaboration is to be achieved in an online platform environment, it is imperative to coordinate the collaborative behaviour through governance mechanisms such as the enactment of distinct roles and rights conferring a hierarchical structure that allows for it. LLM aims to support collaboration among community members that share common objectives, values, and trust. A controlled reciprocity among users that contribute to the community 'discourse' is favoured. Admittance is based on self-selection, participation is free, and there is a low level of monitoring. Coordination is still horizontal and self-regulating even though it is hierarchical and formal aspect.

C) Collective action

LLM users are enabled to follow a common goal and abide by common rules established by the LL operation itself and supported by the platform. It represents a social interaction structure in which regulations are complex and close coordination is required.

LLM provides mechanisms for setting, and readjusting goals and for allowing controlled exchange among members. Collective action requires the creation of an environment where values, beliefs, and trust are fostered, and a high level of bilateral agreement is enabled. Membership is allowed upon selection forming individual online communities in which identified users are reinforced through the features that allow the group to work towards its common set goals. Coordination is carried out through mutual adjustments (reciprocity), while hierarchical and formal control is also allowed.

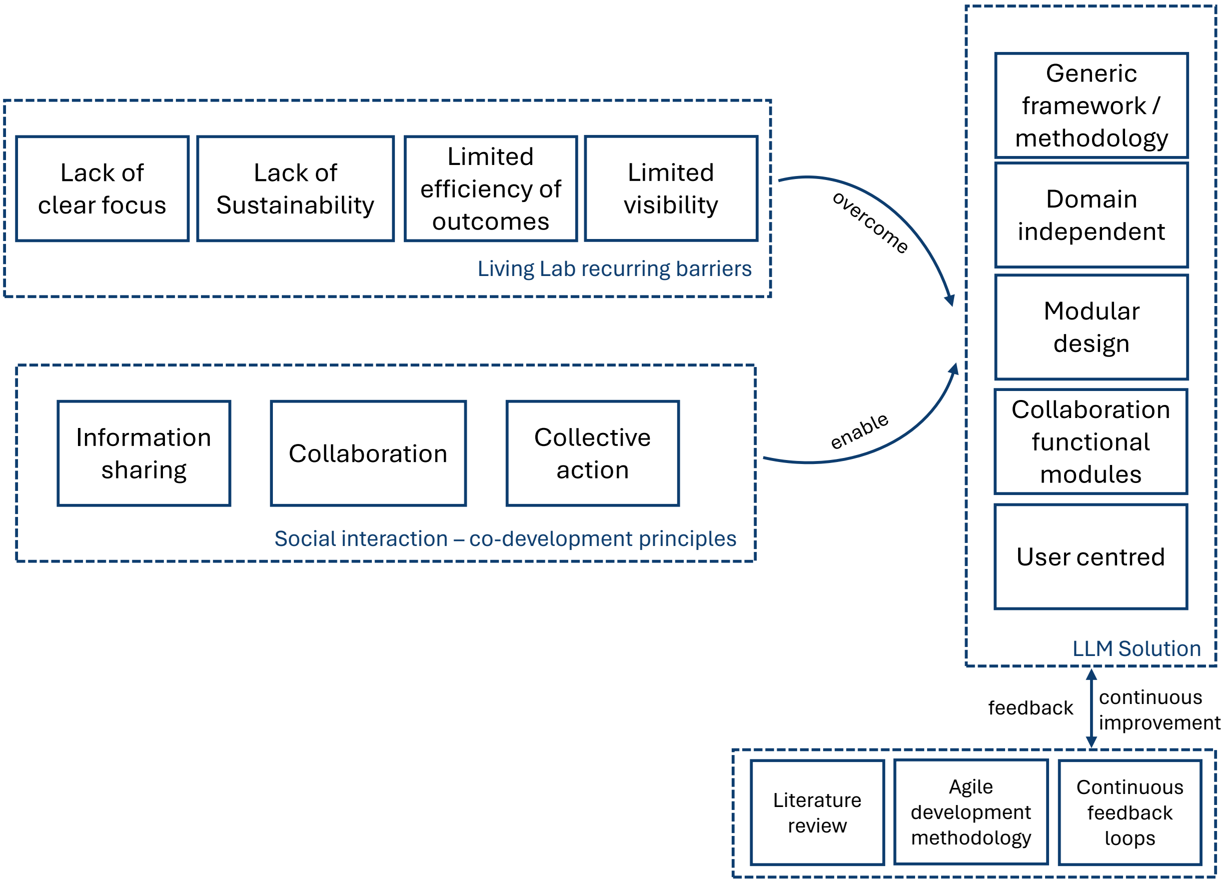

Figure 1. LLM conceptual approach and design

In summary, the Living Lab Modeler

- emphasises the importance of accurate and transparent reporting mechanisms within a LL,
- establishes a link between actions or decisions and effects, as well as facilitates iterations of multi-stakeholder inputs and functional outputs,
- operationalises innovation processes by providing capacities to deal with knowledge exploration, retention, and exploitation,
- provides increased degrees of freedom for the Living Lab's stakeholders / LL modelers end-users to self-define their roles and function both as, observers, respondents, or be involved on equal footing as co-creators in the innovation processes.

Challenges in design and development

A tool that aims to support stakeholders in co-creation processes must ensure that it serves the needs of the target groups it addresses. This must be reflected in the architectural design and the technical development choices.

The first set of challenge arises from the broad diversification of LLs, in terms of methodologies used, topics they focus on, stakeholders they engage and scope. We therefore had to design a versatile tool, capable to support all types of Living Labs, and thus, it had to be generic in design while incorporating the core aspects of various approaches. Connected to this challenge is the need to introduce diverse levels of information disclosure, respecting the various needs of the LLs. The LLM therefore differentiates between the private and public aspects of an LL, where some services are exclusive to members while other information is disseminated to the wider public.

The second set of challenges that had to be considered during the design phase deals with the incorporation of the business logic into the tool development. It is, thus, related to the sustainability and the ability of users to self-sustain the information and activities of their LL. It is important for such tools to allow users to easily access the tool and maintain or update the provided information. The tool design acknowledges that this needs to be balanced with the requirement for central administration to ensure the validity of the information made visible to end users.

Design principles

The LLM by design tries to bridge the gap of traditional information system design that are not being able to adequately address the social and interactive processes that take place in online communities (Walls et al.,1992; Huysman and Wulf, 2005). The LLM's design showcases a growing complexity since it aims to serve potentially heterogenous user needs while maintaining compatibility across its various components. The LLM's ability to create a variety of options for the user lies in the system's architecture. A modular architecture allows to map different elements based on their functions and specify de-coupled interfaces between these elements.

The LLM solution is designed to address the gaps and shortcomings identified in the operation and realisation of LLs. The LLM concept and functionality are based on the idea of supporting activities during the lifetime of the Living Labs and beyond their operation. It serves as an online tool that assists LL organizers and participants, as well as external users interested in the work produced by each LL.

The main design principles of LLM aim to create a framework that can accommodate and digitally represent any Living Lab, regardless of its application domain or offline methodology.

The theoretical underpinning of the LLM is the **active involvement of users** in the innovation process. The LLM was designed to facilitate user engagement through intuitive interfaces and functionalities that enable users to contribute to and benefit from the Living Lab activities. The tool s**upport**s **collaborative efforts** among various stakeholders by providing modules for real-time interaction, collaborative decision-making, and shared goal setting. LLM incorporates features that allow for seamless **interaction among different stakeholders**, ensuring that diverse perspectives are integrated into the innovation process.

The development process of LLM followed an iterative design approach, which allowed us to extract insights that drove the development of the tool towards a direction that addresses fundamental aspects of Living Lab operations and ensures that the tool evolved in response to actual needs and use cases.

This methodological approach allowed us to have a clear focus, utilising and analysing diverse sources. We incorporated results from existing literature, from received potential user feedback from LL stakeholders while also incorporated results from the analysis of empirical observations gathered from existing Living Labs, through the analysis of the LL's progress reporting, through actual in-person and online collaborative LL activities and also through questionnaire surveys that were directed in assessing the levels of digitisation across the 20 Living Labs of the DESIRA project, counting a total of 273 responses.

To ensure the robustness of our findings, we employed a filtering process to focus our analysis, deploying a methodological stepped approach guided by the following principles.

1. **Relevance and Specificity:** We identified and analysed the sources that explicitly mentioned specific keywords, phrases, or response options that directly relate with our research question of 'How to develop a useful and practical tool that helps Living Labs overcome common barriers linked with their way of operating.
2. **Data Quality:** In the filtering process we ensured that only relevant and complete responses were included, thereby improving the overall quality and integrity of the data.
3. **Contrasting and Triangulation:** We integrated findings of diverse sources and different types, comparing survey results with recurring themes that appeared on interviews and project reporting as well as results of relevant literature. This allowed us to inspect the level differentiation and enhance the robustness of our architectural design choices for the LLM.

LLM Architecture Design

The design of LLM includes a set of functional modules, which can be mandatory or optional. These modules encapsulate the available functionality and enable the selection and instantiation of a subset of modules for each LL, based on its modelling and representational needs. This modular design makes the application extensible and simplifies the implementation of new functional modules at a later stage.

The LLM utilises an abstract model for modelling the core entities of a Living Lab. This model allows LL facilitators to define custom attributes for each entity and add their distinguished entities, providing them with the freedom to customise their Living Lab and retrieve custom analytics.

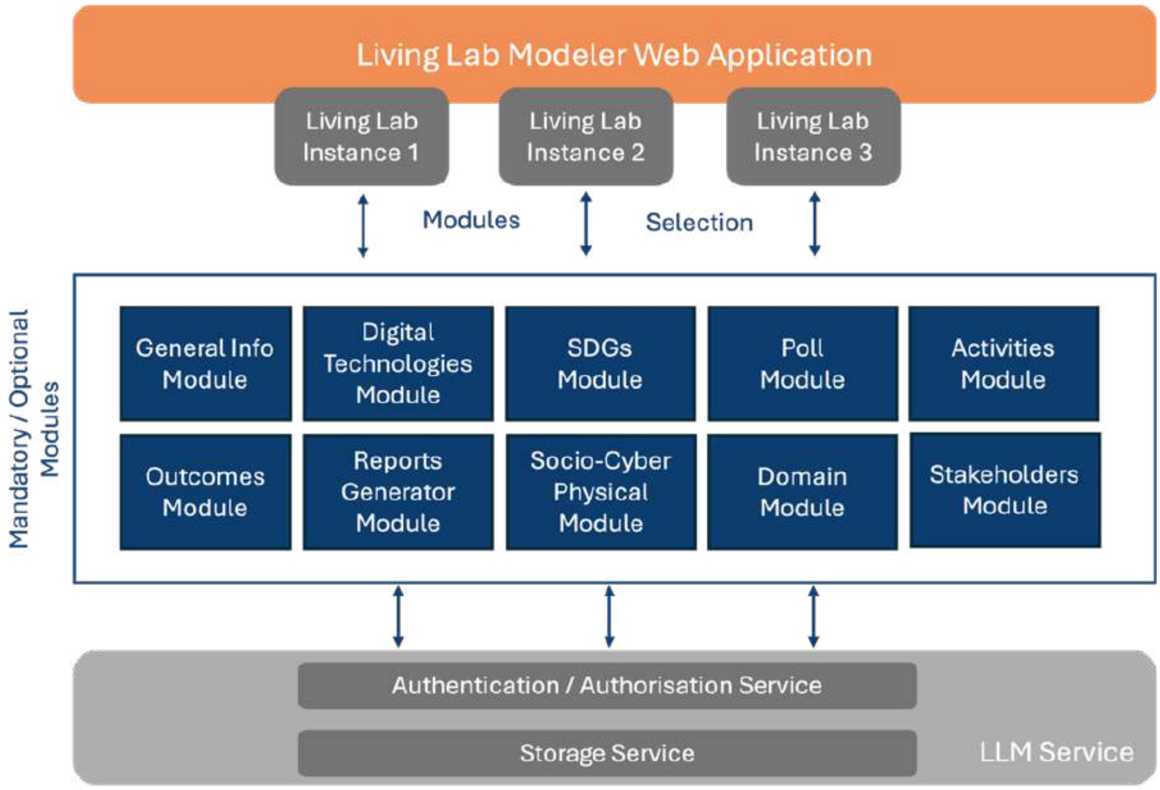

Figure 2. Living Lab Modeler Concept Diagram

LLM consists of a Web Application and a Back End Service; the Web Application depicts all views and information of the system where the Back End Service manages all related system information. Through the Web Application, LLM allows the LL creator to enable or disable the supported modules that are attached to each LL and encapsulate different pieces of functionality, which cover the 3 main aspects of LLM: Information sharing, collaboration and collective action as detailed above, in the LLM service side depending on his/her needs.

The Web Application

LLM allows the modelling of Living Labs through a Web Application. The application is available for both guest and authenticated users. Guest users can view the information for all public LLs, while authenticated users can ask to become members of a LL, access restricted information and, based on their role, edit the LLs they are managing. Figure 2 presents a sample of the application pages of existing Living Labs.

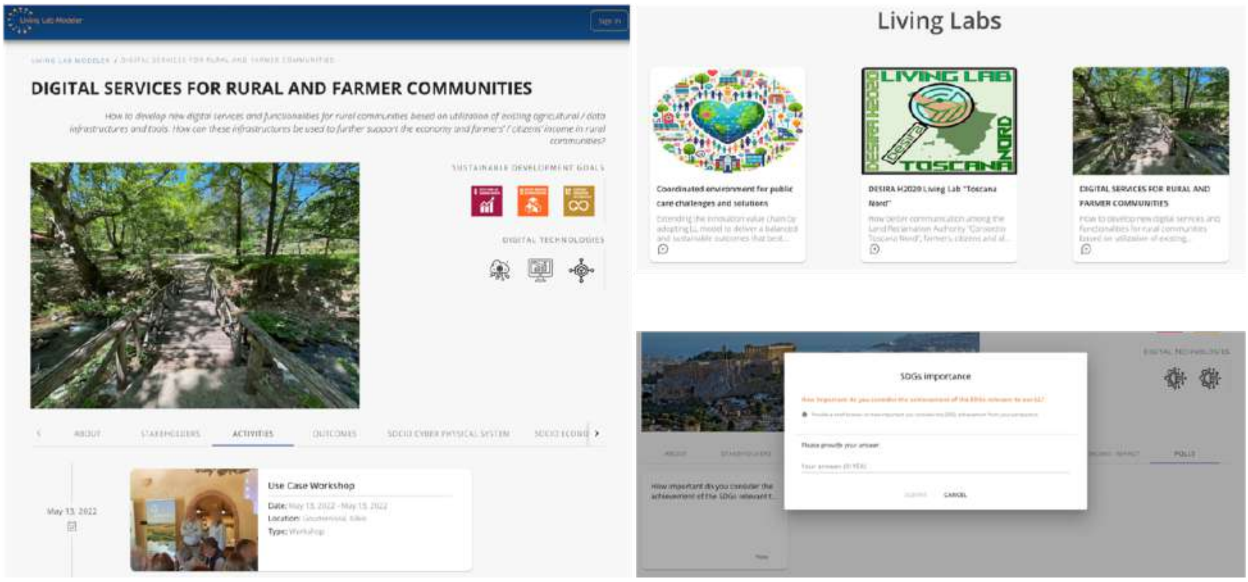

Figure 3. Living Lab Modeler - Sample views

The process of creating a LL through our application is designed to be straightforward and user-friendly. Authenticated users can easily create, organise, and update their own LL. It all begins with selecting and enabling the functional modules that best suit the LL's needs. From there, the user simply fills in the required information. The different modules can be completed in real-time as the LL activities unfold, or they can be based on the specific needs for actions that the application facilitates. The LL organiser has full control over the visibility of the LL, whether to make it public and accessible to a wider audience, or to keep it private and available to its members only.

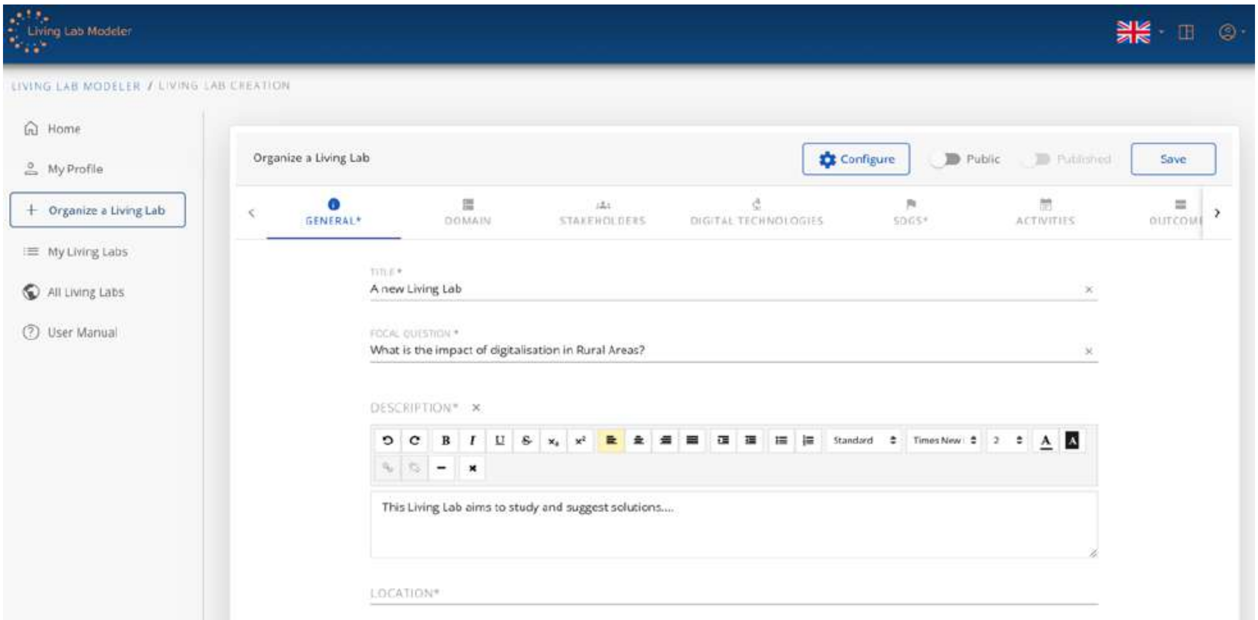

Figure 4. Creating a new Living Lab

The LLM Modules

Providing maximum level of view customisation per Living Lab to the users has been a major aim of the LLM. To achieve that, LLM functionality is enabled through a set of functional modules. A module is defined as a unit of functionality, which can be enabled or disabled by the LL organiser during its initialisation. Each module implements a different functionality of a LL and is reflected as a different view in the application side.

Modules, either mandatory or optional, can be instantiated by any LL. The mandatory modules are always enabled, while the optional ones reside on the LL's organiser selection. Each LL consists of **mandatory modules** such as the *General Description* (includes title, description, problem statement, location), *Domain* (selection of classification for various domains), *Stakeholders* (stakeholder mapping, descriptive information for each stakeholder, custom attributes' list), *Digital Technologies* (Digital Technologies frequently used by LLs, based on the work conducted within the H2020 DESIRA project, to identify digital technologies that can be game changers [Bacco et al., 2020]), *Sustainable Development Goals (SDGs)* (possibility to select the relevant SDGs), *Activities and Outcomes* (plan and keep track of activities & events), and some **non-mandatory modules**, which currently are the modules *Socio-Cyber-Physical System representation* (modelling of LL activities using a system-of-systems mindset, by defining the distinct entities and their interactions [Metta et al., 2022]) and *Poll* (enables the interaction with the members of a LL, through the activation of simple polls and open questions).

During the initialisation of a Living Lab, the user can view each module and select to use any of the non-mandatory ones. By encapsulating and extending different Living Lab functionality in our modules, it is easier to implement and extend our system in a step-by-step iterative manner, which allows to mitigate errors and enhance development. We modelled our Living Lab and modules in such a manner that the module-related data persist in case a user disables, stores and therefore re-enables the disabled module.

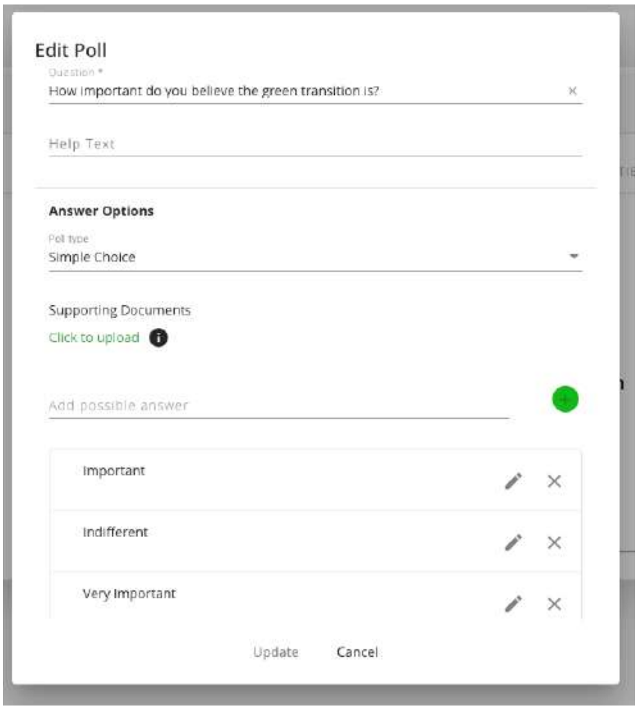

Figure 5. Poll creation / update to collect members' opinion

The LLM Service and user management

The LLM Service is responsible for incorporating all business logic of the LLM solution, along with managing all user information and LL data related to LLM. It is a multilingual application, supporting the implementation of LLs in their local language increasing the engagement of the local participants.

As depicted in Figure 2, it deploys the Storage and the Authentication/Authorization Service, which is responsible for verifying the identity of each user and then verifying the different user actions based on the roles and permissions of each user in the system and Living Lab level.

To ensure the appropriate user access, LLM implements a user management system of various levels. We introduced a permission sub-system, where views and actions are allowed or restricted to users that own different permissions. To further simplify user-permission functionality, we introduced different LLM System Roles in a way that new roles mapped with different permissions could be introduced at runtime, depending on the setup and the needs of each LL. We followed the previous approach also for restricting or allowing Living Lab material editing by different LL members, thus we introduced different Living Lab Roles mapped to specific permissions, that occur per Living Lab and user. This allows, among others, a user of the system to hold different LL roles in different Living Labs

The System Roles currently supported are the Administrator, the Living Lab Organiser, the Facilitator, and the LL Member. The LLM Administrator role has access to most LLM views and the living lab organiser functionality. The Organiser can create/edit his/her Living Labs, browse public Living Labs, and submit requests to join other Living Labs. Each user that creates a Living Lab has initially the Organiser LL role (for the freshly created Living Lab) and can manage the LL roles of the other participating LL members. A new member will be assigned the LL Member role until the Organiser/Facilitator changes the member's role to another one with more privileges; then the user can perform more actions on LL resources.

A user of the system can browse all the published Living Labs and request membership to a Living Lab in an easy and intuitive way; The Living Lab Organiser will be notified about the new potential member's join request and accept or refuse the request. Additionally, the Living Lab Organiser can decide to promote a member to a Facilitator allowing him/her to gain Living Lab information editing access.

Usage, user feedback and evaluation

The design and development of this tool followed an agile approach since its very first development phases. During the DESIRA H2020 project, continuous feedback on the designed functionalities has been received from the 20 Living Labs that had been operating during this project. This has been a valuable input, as the project partners had diverse backgrounds and covered various aspects and roles in the LL operation. The tool has been presented to the project partners and collaborating networks in several meetings, where feedback was received on both, the applied methodology and the available functionalities. After the first official release, the DESIRA's LL organisers were invited to exploit the tool and create the digital representation of their LL through LLM. During this phase, a feedback cycle took place, and several improvements had been implemented.

In the second version of the tool, LLM was extended to support additional features and functionalities and new domains of application. This version has been shared among the stakeholders' engagement team of our research centre, who are responsible for the coordination of numerous LLs in different domains as part of the participation in EU Research projects. The team was requested to freely use the tool, provide feedback and suggest additional functionalities.

Conclusions – next steps

This paper has introduced the Living Lab Modeler, a comprehensive tool designed to effectively manage Living Labs, providing a structured approach to optimise their functioning and outcomes. The first version of LLM had been realised and made available in the context of the H2020 DESIRA project, which setup and run LLs in 18 European countries. The solution has been tested and feedback has been given from these LLs, allowing us to validate the initial concept, design, and developed solution.

Moving forward, further validation and refinement of the tool through even broader real-world implementation and feedback loops are among the priorities for the development team. Efforts in this direction already take place, by implementing instances of the tool in both, ongoing research projects that involve LLs, as well as through the engagement in community-driven innovation activities. Feedback and suggestions have been received from this network and future developments and enhancements are already defined. These enhancements include new modules, including, but not limited to, a data repository for each LL, collaboration, and exchange of experiences among the different LLs, the design and visualisation of innovation pathways and the export of the LL information as an open dataset and publishing it to well-known open repositories that support and embrace the Open Science principles.

The field of innovation management is a dynamic one, with new methodologies and best practices constantly emerging. Therefore, continuous research and adaptation to evolving methodologies and best practices in the field of LL innovation management will be crucial for ensuring the LLM remains relevant and impactful in facilitating the success of Living Labs. Staying abreast of these developments and proactively incorporating relevant insights into the LLM is essential for its long-term relevance and effectiveness.

Additional plans include the exploring of avenues for integration with existing LL management frameworks and solutions, as this could enhance the tool's applicability and scalability. In this direction, the discussions taking place and the frameworks and methodological approaches being developed within networks and initiatives that organise and operate Living Labs, are of outmost importance for the further development of the Living Lab Modeler.

Acknowledgements

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Research-In-Progress Paper

Local Government Living Labs: An Australian Explanatory Case Study

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Abstract

We are promoting the broader adoption of the living lab concept by local government to build on established community linkages in co-creating stakeholder value. This paper presents an engagement model derived from the literature and records and reflects the experience of one Australian Local Government Authority (LGA) that has launched a series of living lab projects. The model considers four factors from a value co-creation perspective: the extent of engagement (the negotiated deal), the outcome(s) sought (the value proposition), partners and roles (creating and delivering stakeholder value) and the broader context (value-in-use realised). A LMS (MoodleCloud) was used as a data repository to both organise academic and field records collected and to share case learnings. The LGA community-engaged strategic planning process had identified a need to facilitate community action to achieve some of its goals and embraced the living lab concept following a successful pilot project. It has engaged with a university in co-design workshops to identify enhanced community engagement pathways and supported seven short circular economy deployment projects to both demonstrate benefits and identify ways the LGA might scale up its activities.

Key words

Living Labs, Local Government, Strategic alignment, Societal engagement, Value co-creation

Introduction

Living Labs are viewed as intermediaries or orchestrators in the broader innovation ecosystem connecting idea champions and those with resources that can facilitate idea development and deployment (e.g., ENoLL, 2022). They are established to focus on a complex regional issue and from that perspective commonly engage with local government authorities (LGAs). The role of these authorities varies according to community expectations, the value proposition offered and resources available to the authorities. Kronsell and Mukhtar-Landgren (2018) raised the question of how local government engagement with living labs might facilitate urban sustainability. Drawing on 50 case studies, they identified three potential LGA roles and suggested some generic instances:

1. promoter roles - (a) Initiation, calling upon other actors to participate, (b) allocation of economic resources / active participation in raising funding, (c) municipal leadership, and (d) related to established activities or commitments (urban planning, waste management, education)
2. enabler roles - (a) providing acting space for other actors (b) providing opportunities for collaboration (c) municipalities participate but do not have an explicit leading role, and (d) support via indirect provision of resources, e.g., buildings
3. partner roles - (a) participating in partnership on fairly equal terms, (b) shared leadership, (c) the importance of collaboration is emphasized, (d) municipality has a specific and explicit function that is unique for municipalities, and (e) partners are named

In this paper we explore the promoter role and focus on local government living lab engagement that may build on established community linkages, which is an emergent practice in our region of interest (Victoria, Australia). A combination of literature search and an in-depth local government program case study is being used to consider how this local initiative made business sense and how others may learn from it.

Some Observations from the Literature

Living labs are seen as innovation ecosystem actors at a macro-level that focus on open innovation at a micro-level (Amirall and Wareham, 2011; Gascó, 2017). Living labs may achieve co-created sustainable outcomes (e.g., Compagnucci et al, 2021) and provide a framework for user engagement (e.g., Habibipour, 2022). Arslan (2022) suggested that technological developments and the need for innovation to confront emergent challenges are unavoidable in municipalities and outlines the idea of a living lab ecosystem that viewed cities as an innovation laboratory. A study by Voytenko et al (2016) identified the following attributes of living labs: geographical embeddedness (the broader context), experimentation and learning activities, participation and user involvement arrangements, leadership and ownership, and evaluation and refinement of operations and outcomes. They suggest four topics to be considered when comparing urban living labs:

1. ways to operationalise the living lab approach
2. the type of living lab partnership and the role of research institutions
3. the types of challenges addressed
4. the role of sustainability, environment, and low carbon agenda in a living lab

They also suggest that "A key question warranting further research involves the extent to which this way of doing urban development extends beyond individual projects to become embedded in existing modes of governance". Hence this paper focuses on ways how outcomes and approaches - demonstrated for the CaseLL - can be adopted more broadly by LGAs and therefore more sustainable.

A model combining these viewpoints is presented in Figure 1.

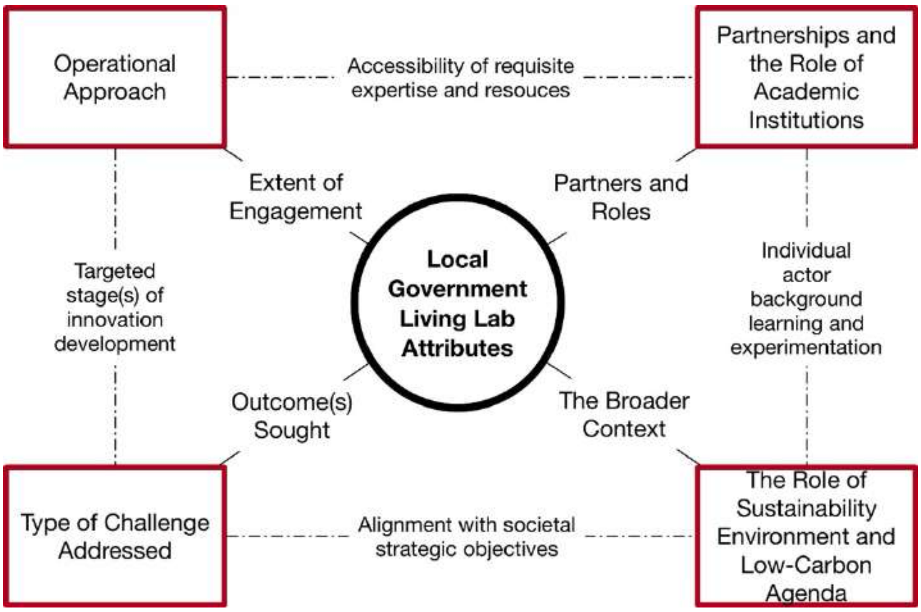

Figure 1. A characterisation of local government living lab attributes

Some specific research gaps relevant for this Case study noted in the literature were:

- Understanding generic local government living lab roles and potential interaction between them (Kronsell and Muhar-Landgren, 2018)
- Potential tensions if citizen engagement did not align with the expectation of democratic practices in value co-creation (Hansen and Fugslang, 2020)

- Interaction between current and future focus living labs (Brons et al, 2022)
- Potential issues in the use of open government source data as a contributor to innovation initiatives (Ruijer and Meijer, 2020)
- Scalability and sustainability of initiatives may be problematic (Gasco, 2017)

This led us to consider the research question 'how is local government engagement through a living lab initiative economically and environmentally sustainable?'

The Research Approach

Yin (2014) suggests that a case study approach is appropriate when investigating 'how' questions in a contemporary setting. The case was selected on the basis it had established the viability of a local government living lab in our area of interest and we could readily access data.

The CaseLL is a local government authority in Victoria, Australia in an outer south-eastern peri-urban area of Melbourne. It is Victoria's most populous municipality, with a June 2018 population exceeding 340,000. It has an area of 409 square kilometers (157.9 sq mi), and its population is expected to exceed 500,000 by 2040.

The CaseLL has a policy of information transparency, which allowed us to assemble a library of publicly available documents and video interviews covering a four-year period. An on-line Learning Management System (MoodleCloud) was used as a knowledge repository and discussion forum to enable other LGAs to adopt Living Lab solutions. A 'course' with multiple topics was created to facilitate discussion and to support subsequent broader sharing of our observations with other local governments. The attribute framework shown in figure 1 was used as an analysis tool to cluster the observations made and facilitate future comparison with other cases. We viewed the linkages shown in figure 1 as either two-way primary that could contribute to value co-creation (the radial connections) or two-way secondary (the peripheral connections) that could frame living lab context.

Findings to date

The Case LGA has worked with Circular Economy Victoria to create a strategic opportunities paper through the Collaborate to Thrive program (a social innovation program designed to help catalyse the conditions needed for a local circular innovation ecosystem to thrive), *"We recognise the role that a circular economy can play in supporting sustainable growth and providing future opportunities for our local economy. That is why one of our key objectives in the (Case LGA) Environment Strategy 2021-25 is to 'Contribute to a circular economy through waste management and resource recovery"* [Smart City Innovation Team member].

The Case LGA collaborates with other State municipalities through the Municipal Association Victoria which provides strategic goal discussion papers, access to bulk-buy customised insurance arrangement and renewable energy supply. It is a member of the Australian Smart Cities Association established in 2010 which represented more than 150 local government authorities supporting 12.6 million Australians. The overall findings are summarised in the context of the figure 1 model in figure 2.

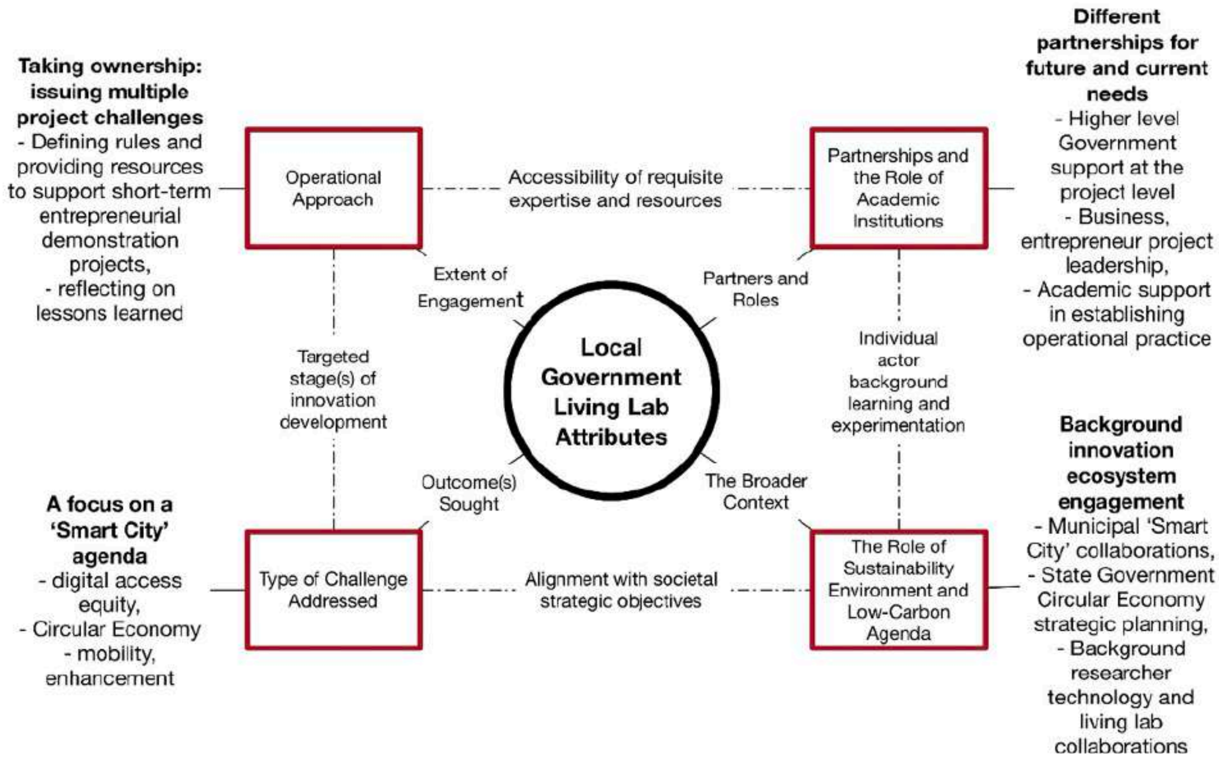

Figure 2. A summary of CaseLL findings

There is no explicit government support for living lab establishment and operation but there is some support of transformational change. Few Australian municipalities are engaged with living lab projects, and where it does happen this is in support of individual university living lab initiatives. Consistent with the observations of others (e.g., Sengupta and Sengupta, 2022) the CaseLL has adopted an umbrella 'smart city' agenda that includes but is not limited to digital technology adoption. In 2020, the CaseLL engaged with its residents, local businesses, partner organizations and employees through several online workshops and surveys to understand the smart city priorities across the community. These insights shaped the program and influenced the focus areas, principles, and approach to driving smart city action. To achieve these focus area objectives, a need to create an internal and external environment driven by community, partnerships, education, and innovation was identified. An on-line 'Smart City Launchpad' was established "*to coordinate and inspire smart city action that will build resilience, inclusion and sustainability in the region.*" The establishment of a living lab initiative supporting multiple projects was one action taken. Some other initiatives related to the use of smart sensors and the establishment of an open data exchange platform. An initial 12-month Digital Equity Living Lab (DELL) project focused on overcoming barriers to digital technology access in one suburb of the city. Outcomes were measured in terms of the extent of engagement, access provided, affordability and digital abilities developed. It was considered that

"*The DELL program has been a resounding success, showing that the (Case LGA) is a forward-thinking community that embraces collaboration and digital technologies. Through the DELL program, we have seen significant social, economic, and digital benefits for our community*" [Chair of Administrators, Case LGA]. This success led to the establishment of a larger, seven-project circular economy program. These projects were oriented towards innovation deployment building on established technology platforms. A separate set of early-stage ideation activities were undertaken in conjunction with a university experienced in living lab operations to identify potential future solutions to local challenges.

Discussion

The following discussion considers what makes business sense with higher levels of living lab engagement. We draw on the representation of business models in practice described by George and Bock (2011) as a configuration of value, transaction, and resource structures. Value structures include a core value proposition (outcome sought informed by environmental considerations), a negotiated deal (extent of engagement), value generation and delivery structures (provided by partners and roles), and value-in-use realised (impact in the broader context). In a living lab context these structures support the notion of value co-creation (e.g., Huag and Mergal, 2021). Transaction structures include those stimulating internal living lab activities (operations) and those stimulating quadruple helix partner activities, some of which may take place independent of the living lab. Resource structures (financial, knowledge, technology, and infrastructure) include those provided by the living lab and those provided to the living lab projects. Resources provided to the living lab projects may be derived from actor background initiatives, e.g., associated with partner granting schemes or with partner research activities.

Many living lab researchers focus on the foreground characteristics of living operations, represented in figure 1 as program planning and administration activities and program delivery activities, both moderated by the extent of engagement and other factors. Drawing on the case experience, we suggest that in establishing sustainable operations, attention needs to be given to associated background activities, shown in figure 2 as strategic planning and capability-building involving multiple stakeholders. There is a need to support learning that facilitates living lab engagement and to capture learning from living lab engagement (e.g., Fuglsang and Hansen, 2022) and this may be a topic for further research. The CaseLL focus is on various kinds of social innovation that may utilise technology as a platform to incrementally introduce transformational change. Figure 2 also implies that value-in-use is only realised when an innovation is taken up in a broader community. In many instances reported in the literature living labs established for research or technology diffusion purposes search for ways to engage with local government. In the case presented here it is a local government taking the initiative, drawing on technological resources to pursue social innovations.

Next Steps

The CaseLL program has only been in operation for three years and it is too early to tell if the projects funded will persist or be abandoned. But the LGA has been satisfied with the outcomes as a demonstration of what can be achieved and has launched an additional program seeking proposals that support citizens with mobility issues. In developing its strategic plan, the LGA has considered 500 public contributions. But pursuing some of these suggested LGA actions would be outside its normal service provision operations, so drawing on and enhancing the social capital established made sense. From a theory perspective, the case illustrates the potentially powerful combination of social capital and a simple business model in stimulating grassroots activity.

It is intended this case experience may support the launch of similar initiatives by other Australian LGAs by highlighting the benefits being realised, and that the grassroots entrepreneurial initiatives being facilitated can grow and deliver mutual benefit. It is intended that sharing the information we assembled in this case study as an on-line course may provide a demonstration of some practicalities to other LGAs and the practicality of this will be explored.

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Full Research Paper

Platform-level Living Lab Canvas: a tool to support the sustainable management of living labs for social transformation

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Abstract

This study focuses on living labs as ‘platforms for co-creation (i.e., platform-level living labs), in which multiple co-creation projects on diverse social issues are promoted through mutual interaction among them. The long-term operation of such a platform-level living lab is important for achieving social innovation and transformation through the living lab approach; however, methods and tools to support its sustainable management and operation have not been developed. Therefore, this study attempts to develop a canvas tool to support the sustainable operation and management of a platform-level living lab. It does so based on the qualitative analysis of data collected from in-depth interviews conducted with experts who have organized actual cases of long-term practicing platform-level living labs in Japan. We also conduct the case-based application of the developed canvas tool and find that the tool is useful in that it enables us to consider various perspectives that are important when setting up and managing a platform-level living lab. This study also provides a ‘starting point’ for further discussions on a methodology for the integrated use of multi-level canvases in the sustainable management of platform-level living labs.

Key words

Platform-level living lab, canvas tool, sustainable operation, urban living labs, social innovation, social transformation

Introduction

Living Labs have recently gained attention as an approach to social innovation and transformation toward a sustainable society [14,19, 41]. A bottom-up and long-term co-creation approach with citizens is important to achieve a social transformation that includes a change in people's mindset beyond just realizing technological innovation [41]. Social issues in a region or city are not a single issue, but rather multiple issues intertwined with various factors; this kind of problem is often referred to as a 'wicked problem [26]'. Scholars argue the importance of Urban Living Lab (ULL) as an approach to enable bottom-up and long-term co-creation aimed at tackling wicked problems. A ULL is defined as a forum for innovation in an urban setting integrating people as co-creators [5, 17, 25]. As this definition indicates, a ULL is regarded as a 'platform for co-creation' set up and continuously operates in a city or region, where multiple co-creation projects on diverse social issues are promoted through mutual interaction among them [8, 9]. In managing and operating such a co-creation platform, its sustainability is important for enabling the creation of comprehensive solutions and long-term actions for social transformation. However, most living lab initiatives are project based [14]; they are promoted based on a specific research budget and are subject to project duration constraints. Therefore, many scholars have indicated that long-term and sustainable living lab operations are major challenges in implementing innovation in society through a living lab approach [12, 20, 29, 30, 39]. In addition, although several practical tools (such as guidebooks and canvas) have been developed to support living lab practices [32, 40, 43], their focus is on project-level initiatives, rather than living labs as co-creation platforms.

To address this issue, this study develops a practical tool to support the sustainable management of such co-creation platforms. To this end, we conducted in-depth interviews with experts operating living labs as sustainable co-creation platforms and qualitatively analyzed the collected data. Based on these analyses, we have developed a 'canvas' tool to support the sustainable management of a living lab as a co-creation platform. We also demonstrate the use of the developed tool through case descriptions and discuss its usefulness and challenges.

Related works

Living labs for social transformation

Achieving social transformation requires not only innovation in technological systems but also the transformation of economic value flows and social systems [16]. In this context, ULLs that focus on transforming citizens' behavior and lifestyles through long-term and bottom-up citizen co-creation in a city or region are attracting attention [41]. A ULL often has multiple projects running concurrently within its umbrella; it thus functions as a platform for co-creation. For example, Enges et al. report that in a living lab initiative aimed at a circular economy ecosystem, projects in three dimensions (material flows, economic value flows, and knowledge flows) were implemented simultaneously and interacted with each other [8]. Ersoy and Bueren also report that three co-creation projects with different focuses were implemented under the umbrella of a ULL called 'City lab,' which considered a specific area of Amsterdam as a lab [9]. Beyond Europe, several similar cases have been reported in Japan. For example, in the Kamakura Living Lab [3] (a pioneer of living labs in Japan), projects have been implemented on various themes envisioned to create a new social system for a super-aged society. These include designing mobility services for local transportation, developing furniture for telework, and exploring new ways to use public spaces (e.g., parks). The Oyamachi Living Lab [28], located in the Oyamadai area, a local residential area in Tokyo, also includes projects on various themes such as the development of a well-being literacy education program for children, the creation of ideas to revitalize the local shopping street, and the design of cutting-edge childcare support services. In Oyamachi living lab, the citizens involved in each project participate while mutually influencing each other. As such, living labs for social transformation should function as open and engaged collective learning environments for social innovation, where stakeholders involved in multiple projects collaborate and influence each other [8].

Platform-level living labs

Schuurman proposes the 'living lab three-layer model' as a theoretical framework to structurally understand the living lab concept [31]. In this framework, a living lab is interpreted at three levels: macro, meso, and micro. The macro-level refers to the 'living Lab constellation consisting of organised stakeholders. Here, the main focus is the interaction and knowledge exchange among stakeholders in the living lab. The meso-level corresponds to the 'living lab innovation project,' which represents a co-creation project with specific goals and a predefined period (i.e. project duration). As Schuurman [31] shows in the case of the Flemish living lab initiative, multiple projects (i.e. meso-level living labs) are often implemented within a single macro-level living lab. The third level, micro-level, refers to the 'living lab methodology consisting of different research steps;' this corresponds to the dimensions of co-design and participatory design processes in each living lab project.

The cases of living labs for social transformation described in the previous section can be illustrated structurally using this three-layer model. For example, each living lab established in a city or region as a platform for co-creation (e.g. the City Lab, Kamakura

Living Lab, and Oyamachi Living Lab) corresponds to a macro-level (or platform-level) living lab; projects with specific themes (such as projects related to mobility services, furniture development, and public space usage in the Kamakura Living Lab) correspond to meso-level (or project-level) living labs. The co-creation process, including specific methods and workshops for each project, corresponds to the micro level. Thus, we capture a living lab for social transformation as a multi-layered structure based on the three-layer model. Especially, to discuss the sustainability of living lab initiatives, this study places strong emphasis on two levels: the platform level, which captures the holistic structure of living lab initiatives, and the project level, which includes multiple co-creation projects promoted on the platform layer (Figure 1).

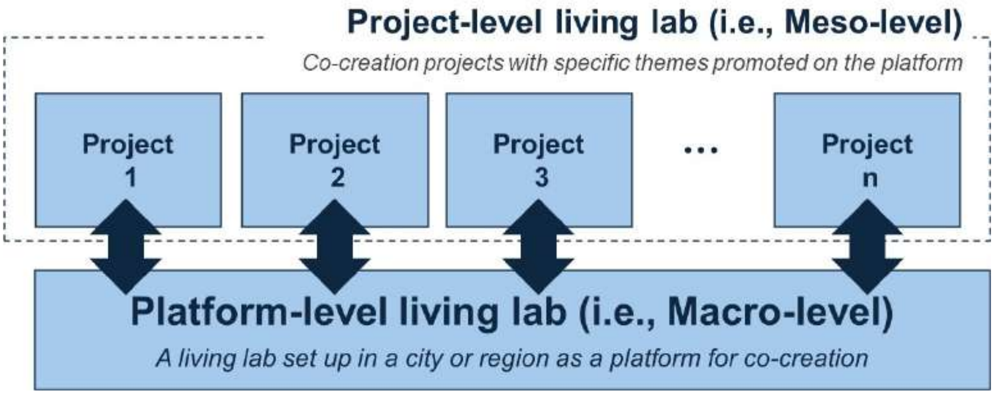

Figure 1. Platform-level and project level living labs

Tools to support living lab practices

Previous studies have developed various tools to support the setup and operation of living labs. In some large research projects on living labs conducted in Europe, one of their important deliverables were guidebooks to describe the living lab concepts and processes in an easy-to-understand manner [10, 13, 36-38]. Some of these guidebooks have been openly published by the ENoLL (European Network of Living Labs) community. As achievements beyond just a guidebook, the SISCODE project has published a practical tool that includes printable worksheets that can be used in various phases of a living lab [33]. Akasaka et al. have developed a self-assessment checklist to support the effective management of living lab projects [2].

One of the most useful tools to comprehensively support the setup as well as the operation and management of living labs is the ‘canvas’ tool. Canvas tools graphically represent a set of key elements related to the design and operation of a living lab project in the form of a canvas sheet. They enable practitioners to conceptually design the entire structure of a living lab project by filling each element in a canvas. A canvas sheet filled in at the very beginning of a living lab project represents the ‘hypotheses for the project operation [7]. Thus, by comparing this with data obtained through actual living lab operations, insights can be obtained to effectively improve and manage living lab projects. Several canvas tools have been developed in previous studies. For example, existing canvas tools that provide a comprehensive perspective on the setup and the operation of living lab projects include the ENoLL's 'living lab mapping canvas' [43] and the 'living lab canvas' introduced in [40]. Furthermore, in the field of co-design, a related research area with methodological similarities to the living lab approach, the 'Empathic Co-design Canvas' has been proposed to support the design and management of co-design projects [34]. Some other canvas tools focus on a specific perspective in living lab operations, such as 'Innovatrix' on innovation management processes [32], the 'LIAISON Business model canvas' on business model design [43], and the 'Governance Model Canvas' on project governance [43]. These tools were developed through the large-scale living lab projects in Europe and strongly reflect practical experiences and findings. In this sense, they correspond to the 'intermediate knowledge products [15]' or 'translational resources [6]' that embody theoretical and practical knowledge into the support tools for the living lab and co-design practices [34].

Some of these existing tools, such as the living lab canvas, Innovatrix and Empathic Co-design Canvas aim at designing and managing 'project-level' living labs. Meanwhile, the ENoLL's living lab mapping canvas includes both the platform-level (e.g. the overall stakeholder structure) and project-level elements (e.g. co-creation objectives and specific actions). This means that while the canvas can provide a comprehensive perspective, it is difficult to clearly separate the different layers - macro, meso and micro - in the discussion on living lab setup and operation. Other canvases (i.e. Governance Model Canvas and LIAISON Business model canvas) also seem to be available in both contexts of project- and platform-level; however, they only focus on specific aspects such as governance model or business model, not the holistic structure of living lab initiatives.

Research gap

The sustainable operation of platform-level living labs, where various projects (i.e. project-level living labs) are promoted and interrelated, is important for achieving social transformation. However, as many scholars have pointed out, living labs have a project-based nature [14] and that 'sustainable' management of living labs is one of the challenging but important issues to be addressed [12, 20, 29, 30, 39]. Furthermore, as mentioned in the previous section, several canvas tools have been developed to support the living lab practices, but tools that have a strong focus on the setup and operation of 'platform-level' living labs have not been discussed. Thus, methods and tools to support the sustainable operation and management of 'platform-level' living labs have not been developed. To address this research gap, this study develops a canvas tool to support the sustainable operation and management of platform-level living labs.

Method

Approach

Figure 2 shows an overview of this study's approach for developing a canvas tool to support the sustainable operation of platform-level living labs. We first selected cases of long-term practicing platform-level living labs in Japan. Subsequently, we investigated the selected cases. Following Merriam's case study approach [22, 42], we gathered qualitative data from multiple sources, including in-depth interviews with practitioners, academic papers, and web articles. In this study, we used interview data as the main data source for analysis; data from other sources were used as supplemental materials. We recorded and transcribed the interview data, which were then analysed using a qualitative text data analysis technique to extract the elements important for the sustainable operation of platform-level living labs. By structurally integrating the extracted elements, we developed a 'platform-level living lab canvas' as a novel tool to support the sustainable operation and management of platform-level living labs.

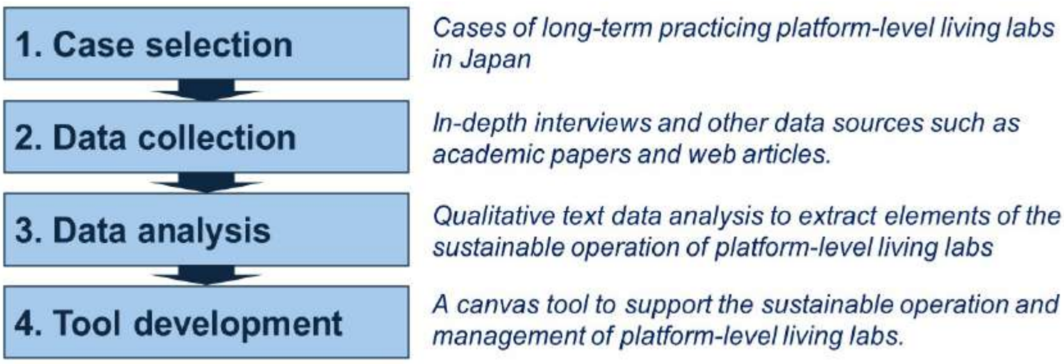

Figure 2. Overview of this study's approach

Case selection and data collection

For selecting the cases for in-depth interviews, we used the purposeful sampling method [24], which is a technique for conducting qualitative research by selecting information-rich cases for the most effective use of limited resources [25]. The purpose of the interviews was to obtain data on the practitioners' actual experiences and insights into the setup and sustainable operation of platform-level living labs. To this end, we first defined the platform-level living lab as 'a co-creation platform, which is operated in a specific city or region, where various co-creation projects are promoted under the collaboration among various stakeholders. We then selected living lab cases in Japan that fit this definition and had been operating for multiple years. A living lab manager, who managed the entire living lab initiative, was selected as the interviewee in each case. This was because the interviews were not conducted at the specific project level, but at the platform level. However, if a living lab manager recommended conducting surveys with other core members in their living lab, we conducted additional interviews. Consequently, we interviewed to seven practitioners using a semi-structured interview technique [4], each lasting 90 minutes. All interviews were recorded with the interviewees' consent.

Data analysis

We qualitatively analysed the interview data to extract the key elements of sustainable operation and management of platform-level living labs. We first transcribed all the recorded data and then coded the transcriptions based on the qualitative text analysis (QTA) methodology proposed by Kuckartz [18]. We used data-driven inductive coding, which allows for intuitive and flexible coding based on actual data, rather than deductive coding. After the transcribed texts were coded, they were semantically categorised into groups. We used the MAXQDA software [27] for this analysis.

Results

Data analysis results

As a result of the data analysis, we extracted eight categories of key elements that practitioners should consider for the sustainable operation and management of platform-level living labs. The extracted categories are (1) value, (2) vision, (3) field, (4) organising team, (5) infrastructure, (6) networking, (7) business model, and (8) projects. Categories (1) to (6) contain several 'key elements' as subcategories. In this study, 17 key elements were extracted, as listed in Table 1. The results include a wide variety of knowledge categories, among which (5) infrastructure, (6) networking, and (7) business models are components that strongly relate to the sustainable operation of co-creation platforms.

Tool development

Next, we integrated the extracted key elements to develop a canvas tool to support the sustainable operation of platform-level living labs. The overview of the developed tool, which is called the 'platform-level living lab canvas,' is shown in Figure 3.

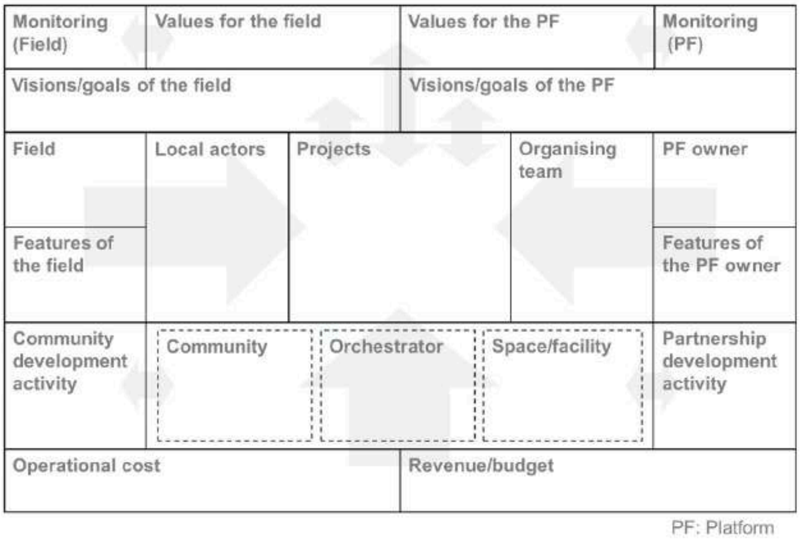

Figure 3. Platform-level living lab canvas`

This canvas consists of 20 items: 17 key elements, as explained in Table 1, and three additional items. Two of the three additional items are related to 'value monitoring.'

Table 1. Key elements for sustainable management of platform-level living labs

Category	Key elements	Description
Value	Values for the field	Values for the region/city created through the sustainable operation of the PF-level living lab
	Values for the PF	Values or benefits for the PF organising team created through the sustainable operation of the PF-level living lab
Vision	Visions/goals of the field	Visions or challenges to be solved in the region/city where the PF-level living lab is (or will be) set-up and operated
	Visions/goals of the PF	Visions and goals that represent what the PF organising team aims to achieve
Field	Field	The region/city where the PF-level living lab is (or will be) set-up and operated
	Features of the field	Geographical, cultural, resource, and urban features of the region/city where the PF-level living lab is (or will be) set-up and operated
	Local actors	Local actors (e.g., individuals, companies, organisations, associations, etc.) who are (or potentially will be) directly or indirectly involved in a PF-level living lab
Organising team	PF owner	The owner of the PF-level living lab
	Features of the PF owner	Features of the PF owner (e.g., their positioning, technologies, business, etc.)
	Organising team	Stakeholders (e.g., individuals, companies, organisations, associations, etc.) involved in and committed to the organising team of the PF-level living lab
Infra-structure	Community	Local communities in the region/city as the infrastructure of the PF-level living lab
	Orchestrator	A PF-level living lab manager who facilitates collaboration between different stakeholders and acts as an orchestrator to create new values for the region/city
	Space/facility	Places (e.g., physical space, digital space, and an activity base) and facilities (e.g., experimental equipment) that act as infrastructure for the PF-level living lab
Networking	Community development activity	Activities to maintain and expand the local communities as infrastructure of the PF-level living lab
	Partnership development activity	Activities to maintain and expand the relationships with companies and organisations outside the region/city committed to co-creation projects (i.e., project-level living labs) prompted in the PF-level living lab
Business model		A business model to realise the sustainable operation of the PF-level living lab
Projects		Co-creation projects that are promoted (or will be promoted, or should be promoted) within the PF-level living lab

Although elements related to value monitoring were rarely mentioned in the interviews conducted in this study, they are often included in other living lab canvas tools (e.g. Innovatrix, living lab mapping canvas, and living lab canvas) and are important in terms of the management of living lab initiatives. Therefore, we added two value-monitoring items in the developed canvas, such as 'monitoring (field)' and 'monitoring (PF),' to describe how to monitor values to the field (or citizen community) and living lab organisers. Furthermore, as the concept of 'business model' was too abstract for practitioners to fill out, we divided it into two sub-items such as 'cost' and 'revenue source,' based on the Business Model Canvas [23].

Figure 4 illustrates the positions of the eight categories listed in Table 1 within the developed canvas. As shown, the category 'projects' that represents the contents of various projects promoted in the platform is placed at the centre, and four categories related to the planning of the projects (i.e. 'visions,' 'field,' 'organising teams' and 'infrastructure') are placed around it. The elements related to the 'networking' category are placed next to the 'infrastructure' category, as they refer to activities to maintain and expand the community and corporate partners, which are parts of resources for project creation. Meanwhile, the 'business model' underpins the initiation and continuous operation of co-creation projects; 'values' are created as outcomes of various projects in a platform. To represent such positioning, elements related to the 'business model' were placed at the bottom of the canvas, and elements related to 'values' were at the top.

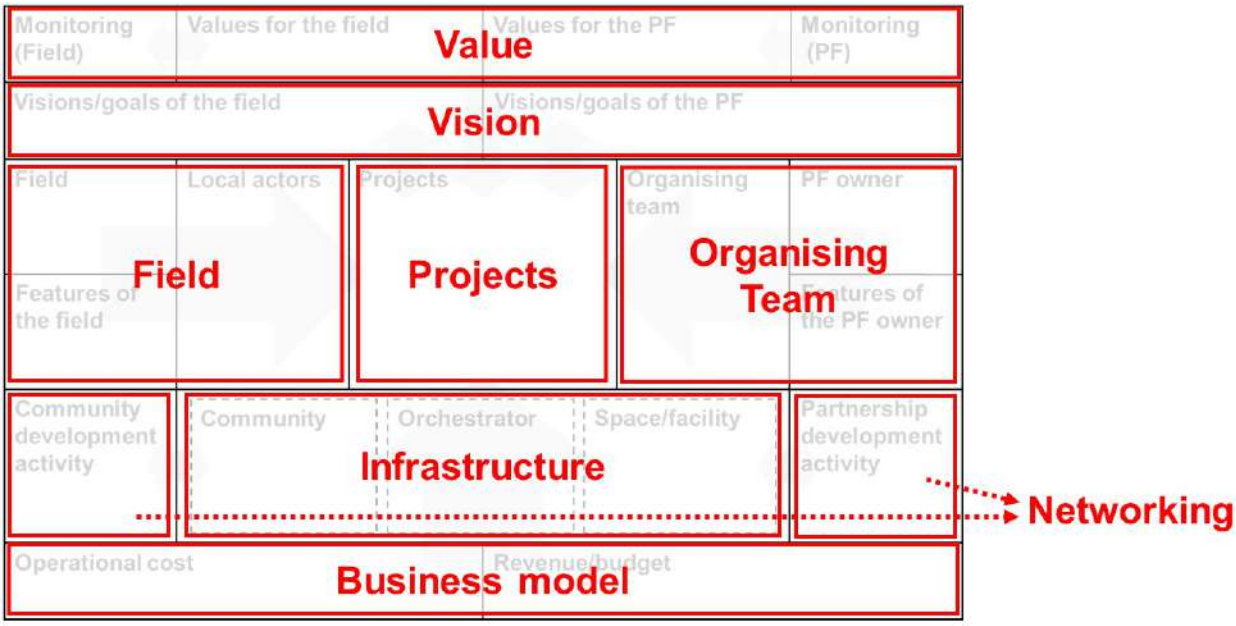

Figure 4. Mapping between the developed canvas and extracted eight categories

Usage of the canvas tool

Regarding the use of the developed canvas tool, there are no strict rules on the order in which the elements should be described. What is important is that the various stakeholders involved in the planning and operation of a platform-level living lab should collaboratively discuss and describe each element of the canvas. Some items, such as elements in the 'networking' category, are difficult to determine concretely in the beginning phase. Therefore, in the beginning, some items can be left blank; however, we recommend adding some annotations (e.g. 'To be discussed later.') in the blank space.

The developed canvas tool can be used in two phases: the setup phase (planning a new platform) and the management phase (reviewing and improving the ongoing platform). Ideally, the canvas should first be created as an initial hypothesis at the setup phase, and subsequently (i.e. in the operation phase), it should be used as discussion materials for the sustainable operation and management of the platform-level living lab.

When using a canvas, it is important to concretise and enrich its contents while conducting several co-creation projects. As mentioned above, the canvas includes elements that are difficult to describe concretely in the initial phase of a living lab setup. Further, there is a co-constitutional relationship between the platform-level and project-level living labs [1], where projects can be generated on the platform, and the platform is also expanded through the promotion of projects. Therefore, certain components of a platform-level living lab should be determined during project implementation. For example, a stakeholder or community that can collaborate at the platform level may sometimes be found through co-creation projects. It is thus important for the users of this canvas to follow an 'agile' process, which means that they concretise and enrich the platform components through project implementation rather than describing the complete structure from the beginning.

Case application

Example case

In this study, the developed canvas tool was applied to a platform-level living lab to identify its usefulness and challenges. The case used in this study was the Min-sta living lab, in which one of the authors was part of the organising team. The Min-sta living lab operates in the Kashiwa-no-ha area, one of Japan's most famous smart cities. This is a platform-level living lab as various co-creation projects (e.g. flail prevention, AI cameras, smart homes, and childcare support) have been promoted on the platform. The organising team of the platform-level living lab consists of a community management organisation (as the platform owner), the local municipality, an urban development company, and two research institutes. The owners of projects conducted in the platform of the Min-sta living lab have varied for each project and included community development organisations, research institutions, companies, and local governments. All projects have been promoted through the active participation of local citizen communities.

The Min-sta living lab started in April 2020 and has been operating for four years. In this case application, we used the developed canvas to describe the ‘current' structure of the ongoing platform, and not the plans for setting up a new living lab. The case application aimed to clarify answers to two questions: (1) Is the canvas tool helpful in visualizing the overall structure of the platform-level living lab, rather than other level (e.g. project-level) living labs?; (2) Is it possible for the canvas tool to provide some insights to improve the platform-level living lab? For the comparative analysis regarding question (1), we additionally described an example case of a project-level living lab by using an existing canvas tool — the Empathic Co-design Canvas.

Application results

Figure 5 presents the description results of an overview of the Min-sta living lab using the developed canvas. In this figure, the names of specific companies and organisations are anonymised. The light blue elements in the canvas are the components of the living lab described for each category, and the orange elements are annotated comments related to the risk factors and challenges we found while describing the canvas. Figure 6 shows the description results of a project-level living lab (a project related to smart home technologies) using the Empathic Co-design Canvas.

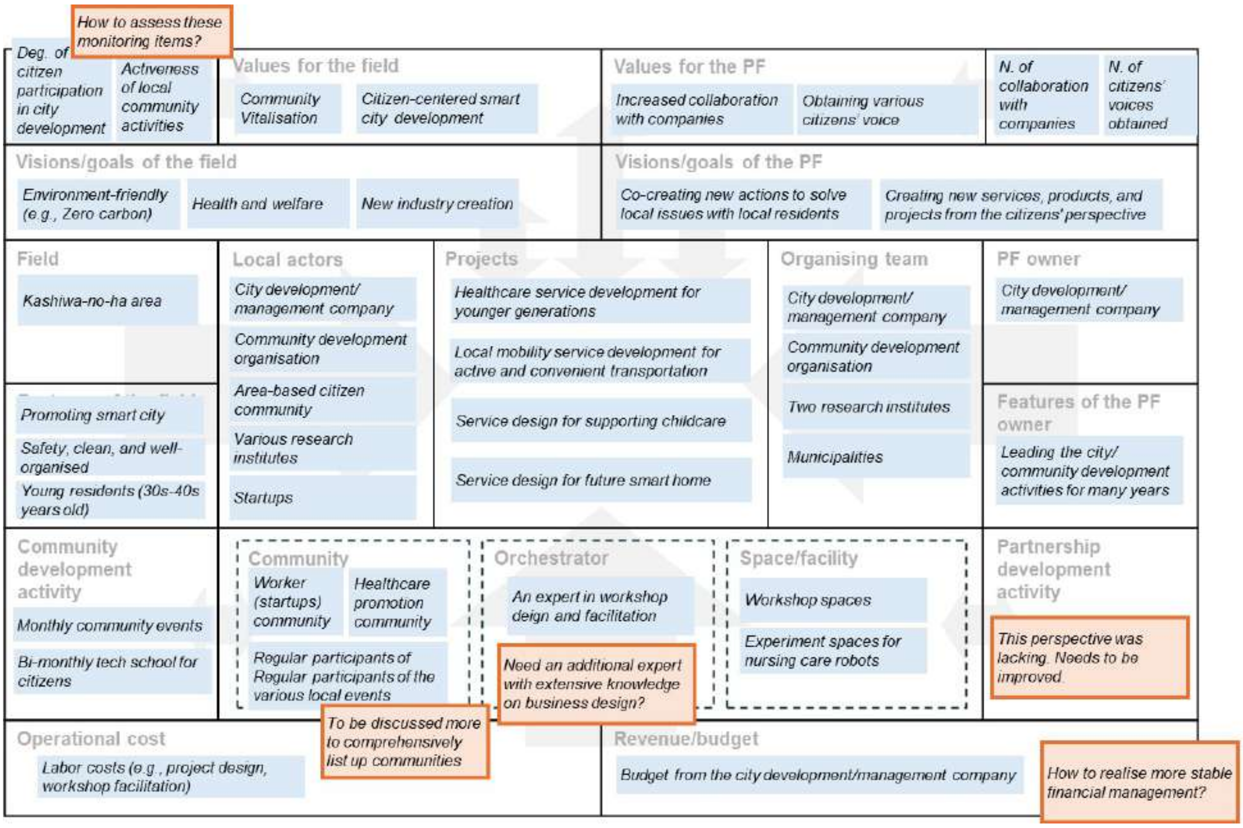

Figure 5. Results of case description using the developed canvas tool (platform-level)

Findings

Regarding question (1), comparing Figure 5 (the developed canvas of the platform level) and Figure 6 (an existing canvas of the project level), it is evident that the developed canvas comprehensively visualises and presents information specific to the management of the platform-level living lab, such as the stakeholder constellation (e.g. stakeholders in the organizational team and relevant local actors), achievements (e.g. goals and visions to be achieved and values to be created), and resource factors that support living lab operations (e.g. living lab infrastructure and business models).

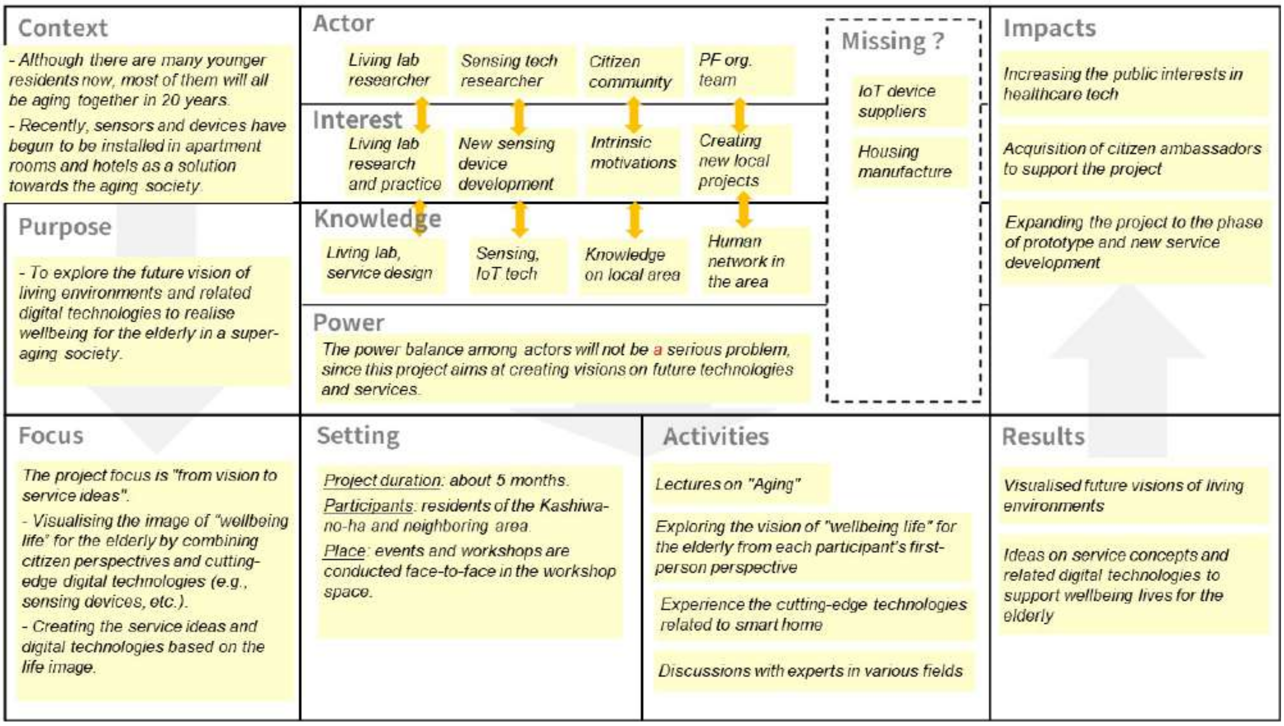

Figure 6. Results of case description using the existing canvas tools (project-level)

In contrast, the existing co-design canvas in Figure 6 is filled with information at the project level, such as specific themes and objectives to be tackled in one project and specific activities planned in the project duration. Thus, the results indicate that the dimensions of information addressed in the two canvases illustrated in Figures 5 and 6 are completely different; in particular, the developed canvas tool can visualise and present information specific to platform-level living labs, rather than the project-level information often addressed in existing canvas tools.

For question (2), we found from the results of the case application that the developed canvas tool can provide insights into how to improve the living lab operations. The annotated comments added in Figure 5 included the aspects from which we obtained new insights regarding living lab operations. For example, from the described canvas tool, we realised that the Min-sta living lab includes the lack of ‘networking’ activities to find new collaboration partners. Thus, the developed canvas tool enabled us to introspectively review the platform-level living lab from a broad perspective and discuss how to improve its operations.

Discussion

Contributions

The most important practical contribution of this study is the development of a platform-level living lab canvas based on the findings obtained through the in-depth investigation of actual cases. As discussed in Section 5.3, this canvas tool provides a holistic framework for visualising the overall structure of a platform-level living lab. This holistic visualisation has practical use, as it allows those with little experience in living lab practices to consider various perspectives that are important when setting up and managing a platform-level living lab. The case application also showed us that the canvas tool allowed practitioners to find their own missing perspectives and activities, thus gaining insights for improving living lab operations. Furthermore, the use of the canvas tool to describe living lab structures enables us to archive practitioners' thoughts and hypotheses. This visualisation is important for the sustainable management of living labs because it facilitates constructive discussions around the living lab operations. Therefore, we conclude that the developed tool is useful for the sustainable management of platform-level living labs and is expected to be applicable to various types of platforms, such as ULL [5, 17, 35] and Campus as LL [11, 21].

Next, we discuss the theoretical contributions of this study. As mentioned in Section 2.3, while previous living lab studies have developed methods and tools to support living labs practices, few studies have discussed the 'sustainability' (i.e. long-term operation) of 'platform-level' living labs. As for existing studies on 'platform-level' living labs, Schuurman [31] denotes these macro-level living labs as 'stakeholder constellations' and analyses it from the perspective of the stakeholder network and its collaboration mechanisms. Previous studies on the 'sustainability' of living labs have focused on analysing living lab business models [12, 29, 30]. In contrast, this study identified various elements that practitioners should consider for the sustainable operation of platform-level living labs. This was achieved through in-depth interviews with experienced practitioners and organising them into eight categories. The analysis results include perspectives that have rarely been discussed in previous studies, such as considering local characteristics, developing infrastructure for living lab practices, and conducting networking activities to find new corporate partners. Thus, this study makes theoretical contributions to the living lab research community by extracting a wide range of factors for the effective management of platform-level living labs and structurally organising them.

Supporting the integrated management of multi-level living labs

While the contributions of the canvas tool were discussed in the previous section, one more aspect to be discussed is the connection and integrated use of the platform-level (i.e. the developed tool) and project-level (i.e. existing tools) canvases.

Maintaining 'coherence' between projects and the platform is vital to effectively promote various co-creation projects on a platform. For example, living lab managers should consider whether the goals of each co-creation project are aligned with the platform-level goals and visions, and whether the outcomes of each project are consistent with the expected values of the platform. To this end, the integrated use of multi-level canvases, namely the developed platform-level canvas and the existing project-level canvas, is expected to be effective. For example, as shown in Figure 7, by simultaneously using multiple-level canvases, coherence between projects and platforms in terms of their purposes and outcomes can be considered. This integrated use of multi-level canvases enables us to design, operate, and manage living labs for social transformation by systematically considering the consistency among the different levels (i.e. three layers [31]) of the living labs. Having said that, this study has some limitations in realising such integrated use as we have not clarified its concrete procedures and not included the micro-level living lab in the focus of this study. Still, the development of a platform-level canvas in this study provides a significant 'starting point' for future discussions on their integrated use.

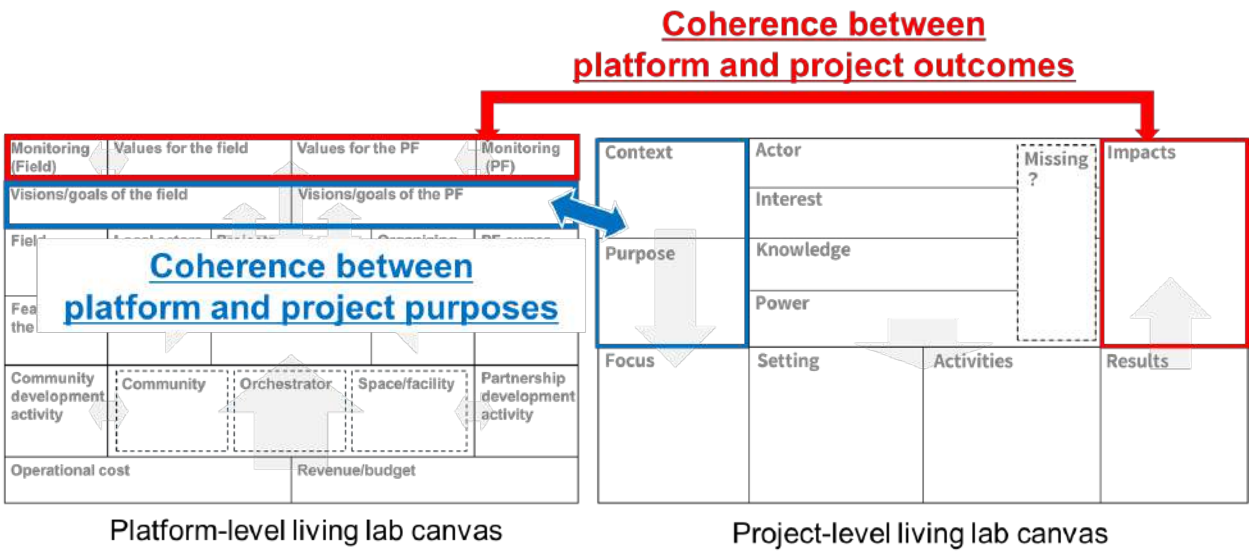

Figure 7. Relationship between platform-level and project-level canvases

Limitations

Although we applied the developed canvas tool to a Japanese case of a platform-level living lab, it was conducted as an illustrative description. Therefore, future studies will need to apply the canvas tool to support the actual setup and management activities of a platform-level living lab to deeply analyse its usefulness and the challenges in practice. Furthermore, one of the weaknesses of this study is the limited geographical context of data collection. We therefore should apply the proposed canvas tool not only to Japanese cases, but also to cases in other countries to verify the broader applicability of the tool.

Another limitation is that we have not developed a 'methodology' that provides detailed procedures for using the canvas tool. To enable the effective use of the canvas tool, further discussion on how to use it is strongly required. In this context, the methodology should include a procedure, such as the step-by-step guideline, for the integrated use of a multi-level canvas, as discussed in Section 6.2. In doing so, we aim to establish a comprehensive methodology for managing platform-level living labs by considering their relationships with the various project-level living labs promoted on the platform.

Conclusion

The long-term operation of a platform-level living lab is important for achieving social innovation and transformation through the living lab approach. However, methods and tools to support its sustainable management and operation have not been developed in the previous living lab studies. Therefore, this study attempted to develop a tool to support the sustainable operation and management of a platform-level living lab.

In this study, we first investigated cases of long-term practicing platform-level living labs and conducted in-depth interviews with the experts operating them. Based on the collected data, we then developed a canvas tool to support the sustainable management of platform-level living labs. Through a case application of the developed tool, we found it is useful in supporting the sustainable management of platform-level living labs in two points: (1) visualizing the holistic structure of platform-level living labs and (2) providing insights into how to improve the living lab operations. Furthermore, we also found that this study includes theoretical contributions as it identified and presented a wide range of factors of the effective management of platform-level living labs and provided a first step to develop a methodology of integrated management of multi-level living labs.

Future studies will include the application of the developed tool to actual practices of platform-level living labs in various areas and contexts to deeply investigate its usefulness and to verify its broader applicability. In addition, we will define relationships among components in different-level canvases to develop a methodology, including a step-by-step guideline, for the integrated use of multi-level living lab canvases.

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Research-In-Progress Paper

Unpacking the conditions leading to social innovation: Living Labs and the role of knowledge in co-creation networks

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Abstract

This research project questions what are the conditions under which co-creation networks develop social innovations in the context of grand challenges, and how do these conditions influence the tensions and practices of knowledge circulation in the co-creation process? The focus is on configurations of structural and collaborative conditions defining how diverse sources of knowledge inform the co-creation of social innovations. Theoretically, it builds on co-creation literature, network and collaborative governance theory, and boundary work, to identify the governance attributes of successful co-creations. Empirically, multisector European Living Labs are analysed, as relevant instances of networked co-creation. A mixed methods approach is employed, combining Social Network Analysis (SNA), Qualitative Comparative Analysis (QCA), and in-depth case studies. The project will deliver systematic empirical insights on how Living Labs facilitate the co-creation of social innovations in different sectors. It will also contribute to co-creation literature by conceptualising the role of knowledge in multistakeholder collaborations aimed at societal change and sustainability transitions.

Key words

Co-creation, Knowledge, Social innovation, Collaborative governance, Living labs, Network governance

Background

Knowledge and innovation play a central role in shaping the conditions to tackle grand societal challenges (e.g. climate change, social inclusion, water management, mobility, food security, etc.) (Schot & Steinmueller, 2018). Sustainability transitions research indicates that this requires the participation of different stakeholders in society to harness diverse sources of knowledge, expertise, and experience in developing collaborative and transformative innovations (Köhler, et al., 2019; Loorbach, et al., 2017).

Recent conceptual developments in collaborative governance research capture such aspiration (Ansell & Gash, 2007), like the co-creation approach, defined as "a process through which two or more public and private actors attempt to solve a shared problem, challenge, or task through a constructive exchange of different kinds of knowledge, resources, competences, and ideas that enhance the production of public value" (Torfing, et al., 2019, p. 802).

This process often takes place in collaborative platforms like Living Labs (Hossain, et al., 2019), acting as networked spaces for cooperative problem solving and innovative public value co-creation (Ansell & Torfing, 2021a; Haug & Mergel, 2021). Living Labs contribute to the co-creation of innovative solutions to support sustainability transitions by means of experimentation (von Wirth, et al., 2019), knowledge sharing and circulation (Puerari, et al., 2018) and enabling a better governance of collaborations in addressing societal challenges (Bulkeley, et al., 2016).

Research problem

In this context, the co-creation approach stresses that mutual learning and access to distributed knowledge are a central (Sørensen & Torfing, 2022), in the sense that the experience and expertise of different actors (e.g. citizens, entrepreneurs, researchers) is valuable for innovative problem solving (Ansell & Torfing, 2021a) and that knowledge circulation is a key factor for citizens to effectively engage in co-creation (Thomsen, 2017).

However, a permanent challenge is that of exclusion/inclusion of different knowledge sources, forms of understanding and views of the world, which usually defines the extent to which citizens and other actors participate in co-creation. It is often the case that the prevalence of specialised technical jargon or the tensions between experiential knowledge and technical expertise prevent citizens from engaging in collaboration processes (Brandsen, 2021). Furthermore, unbalanced knowledge interactions might explain participation fatigue and unbalanced power relations in co-creation (Cornips, et al., 2023; Koens, et al., 2024).

In some cases, professional expertise imposes and excludes citizens' knowledge, especially when public professionals perceive citizens' expertise as a challenge to their technical authority (Chauhan, et al., 2023). Competing conceptions of what is valid as evidence in co-creation underlie to these power imbalances, where technical expertise is perceived as more valid than citizens' experiential knowledge (Brown & Head, 2019). In other cases, citizen involvement and knowledge are used instrumentally to legitimise public interventions (Hofstad, et al., 2022). As such, more consideration is needed of different knowledge sources, including tacit community knowledge, to better inform co-creation processes.

While knowledge is a core element in co-creation, literature on the field can benefit from further understanding on how tacit knowledge is accessed (Bovaird & Loeffler, 2021) and how mutual learning comes about (Voorberg, et al., 2017; Osborne, et al., 2016). Also, more evidence is needed on what configurations of conditions define the way how knowledge is circulated and used in the co-creation of social innovations. Literature stresses the networked character of co-creation (Torfing, et al., 2021) and the fact that network features influence innovative outcomes (Provan & Kenis, 2007; Klijn & Koppenjan, 2015). However, in the case of Living Labs, the network analyses tend to focus on the role of actors, but there is little insight on their interactions, which may benefit from systematic techniques such as Social Network Analysis (Leminen, et al., 2016).

There is a growing body of literature on Living Labs as networked innovation spaces (Hossain, et al., 2019), yet sustainability transitions research is demanding for further inquiry on the "conditions, processes and pathways through which urban living labs and experiments emerge" (Köhler, et al., 2019, p. 15). In co-creation research some point out to the need of further understanding the "outcomes of co-creation/co-production as such and in relation to social innovation in particular" (Voorberg, et al., 2015, p. 1348). Others find that the focus often lies on the enablers and barriers to co-creation in general, with scarce evidence on how innovative outcomes are achieved (Rodriguez Müller, et al., 2021).

Focusing on sets of conditions will allow us to better grasp the underlying processes of knowledge circulation and use in co-creation that can lead to specific outcomes such as innovation, and addressing the case of Living Labs as relevant instances of networked co-creation platforms may allow us to further learn on this in the context of grand challenges.

Research scope

In view of the above, this research project analyses the role of knowledge in co-creation processes, focusing on networked patters of interaction in which knowledge circulates and the collaborative conditions shaping this. The main research question is what are the conditions under which co-creation networks develop social innovations in the context of grand challenges, and how do these conditions influence the tensions and practices of knowledge circulation in the co-creation process? We tackle this question by addressing three specific research questions:

- What are the network structures that enable knowledge circulation in the co-creation of social innovations?
- What configurations of structural and collaborative conditions facilitate knowledge circulation in the networked co-creation of social innovations?
- What are the causal mechanisms that explain how knowledge circulation contributes to the co-creation of social innovations?

Theoretically, we build on co-creation literature (Brandsen, et al., 2018; Ansell & Torfing, 2021b), exploring how knowledge and learning is conceptualised here; network and collaborative governance theory, identifying insights to further operationalise the notion of networked interactions (Provan & Kenis, 2007; Klijn & Koppenjan, 2015; Ansell & Gash, 2007); and boundary work (Gieryn, 1983; Star & Griesemer, 1989; Hoppe, 2010), to explore knowledge tensions and practices in collaboration processes.

Cases and methods

Empirically, we will address the case of European Living Labs, as illustrative instances of networked co-creation and collaborative governance in addressing societal challenges. Cases are selected following a Most Different Systems Design (MDSD), ensuring that the cases "differ as much as possible and yet do not differ on the phenomenon under investigation" (Sartori, 1991, p. 250), i.e., conducting co-creation activities to develop social innovations. Following a predefined selection criteria, we focus on 21 Living Labs in European countries with different public administration traditions (Belgium, the Netherlands, Greece, and Denmark) and across diverse sectors (e.g. health, agri-food, environment, mobility, commerce, multisector) with a current membership to the European Network of Living Labs (ENoLL) by December 2023.

Among the selected Living Labs, we will make an emphasis on the focal or (single) most important innovation developed by each of them (see OECD's Oslo Manual, 2018), as a relevant approach to gather in-depth qualitative data on co-created innovations

(Gesierich, 2024). Data is collected through documentary review and semi-structured interviews with relevant stakeholders in each Living Lab to gather their perceptions regarding the co-creation of social innovations.

We employ a mixed methods qualitative approach including Social Network Analysis (SNA) to describe the structures and patterns of interaction (Wasserman & Faust, 1994) in which knowledge circulates among actors that participate in Living Labs, Qualitative Comparative Analysis (QCA) to identify the configurations of conditions (Schneider & Rohlfing, 2013; Mello, 2021) leading to the co-creation of social innovations, and in-depth case studies to explore causal mechanisms (Yin, 2009) that explain the role of knowledge circulation in these processes.

Early findings and progress

At this stage of the project, a theory-driven literature review is being conducted on the role of knowledge in co-creation literature, setting the conceptual background to the next empirical stages of the research. This review aims at identifying lessons in literature to elaborate a framework to address the research question.

The review focuses on peer-reviewed international publications on co-production/co-creation addressing the issue of knowledge, expertise, learning, know-how and experience, published until 2023 in the area of social sciences, particularly in the public administration discipline. The search was conducted in Scopus on March 25, 2024. The 261 items obtained in the search were screened on title, abstract and journal, resulting in 99 publications were retained for full text screening. Our final sample comprises 50 publications (43 articles, 7 book chapters).

Our preliminary findings shed light on cognitive, relational, performative, and contextual aspects defining the role of knowledge in co-creation. Cognitive aspects refer to how knowledge is understood, often as a resource in the form of information that feeds into co-creation processes. Relational aspects highlight the interactive nature of knowledge in co-creation, as the result of multi-actor interplays. Performative aspects encompass actor's practices in co-creation, as well as knowledge related tensions rooted in perceived incompatibilities between knowledge sources. Finally, contextual conditions define the settings in which knowledge practices supporting circulation take place.

We build on these findings to outline an overarching heuristic capturing how the alignment between cognitive, relational, performative, and contextual conditions explains the way in which knowledge circulation in co-creation leads to the development of social innovations. This heuristic responds to the question of *what are the conditions under* *which knowledge circulation in co-creation networks leads to social innovations*.

Concluding remarks: next steps and expected contributions

This project analyses the role of knowledge in co-creation in the case of Living Labs, as a way to understand the conditions under which such initiatives lead to the networked development of social innovations to address societal challenges.

A literature review is being conducted to learn about how co-creation literature conceptualises the role of knowledge. Once finalised, the next steps of the project include further scoping work regarding the selected cases, as well as preparing data collection tools for Social Network Analysis (SNA) and Qualitative Comparative Analysis (QCA).

We expect to describe and explain the governance attributes and conditions that lead to successful collaborations and the role of knowledge circulation therein. We aim at producing systematic evidence on how knowledge is produced, circulated, and used in Living Labs to co-create social innovations to address societal challenges. This research will also contribute with a deeper conceptualisation on knowledge in co-creation, which remains underexplored in literature. As the co-creation approach is increasingly up taken by Living Labs across the region, this research also contributes to the promotion of co-creation in policymaking agendas of the European Union and how multiple actors, including citizens, can play a more informed role (see for example European Commission, 2023; 2022). It also positions Living Labs in the broader literature of co-creation and collaborative governance.

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Full Research Paper

Digital bother and burden in older age: a transnational LEGO® Serious Play® exploration

Exploring digital bother with Lego® Serious Play®

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Abstract

Bother and burden are terms associated with older persons in the management of a range of health conditions. As healthcare becomes more digitalized, older persons are encouraged to use digital health and wellbeing technologies to manage their own self-care. To date, however, there has been little examination of how bother, as distinct from burden, with such technologies may impact engagement with digital self-management of personal health and wellbeing. Using the LEGO® Serious Play® method, the concepts of bother and burden are examined with older persons in Ireland and Belgium. Findings have implications for the successful implementation of digital health technology solutions intended for use by older citizens as well as the use of the LEGO® Serious Play® method in living lab contexts.

Key words

Digital health, older persons, ageing, living lab, LEGO Serious Play

Background

The term 'bother' is often used by older persons in relation to ask for assistance from others, but its meaning is nuanced and varied by context. With the rapid digitalisation of society, and healthcare in particular, older persons are being encouraged to embrace new digital health and wellbeing technologies (DHWTs) for improved self-care. This requires ensuring such technologies are accessible and easy to use (Doyle et al., 2022). The concept of bother has been applied in clinical settings to examine patient experiences with various health conditions and treatments across cultures (Gawlicki et al., 2014). However, there has been little examination to date of how bother might influence engagement with DHWTs. At times conflated with the term burden, assuming older people mean they do not wish to be a burden when stating they do not wish to bother others, the two terms have differences. Synonyms for *bother* include worry, nuisance, inconvenience, trouble, irritate, and effort. Meanwhile, the meaning of *burden* includes: a heavy load or to encumber, impose, or place responsibility. Moreover, there has been no exploration of how the concepts of bother and burden may represent different or similar experiences for older end-users of DHWTs.

Language philosophers argue that the lived meaning of words can only be effectively understood within the real-world context where they are used (Wittzenstein, 1968; Austin, 1979). Living labs, as open innovation systems, explore solutions based on the real-world experiences of individuals. Arts-based methods are often used in living lab research. Such approaches can contribute multi-faceted insights by moving past rational-cognitive ways of knowing and communicating (Van der Varrt et al., 2018). Indeed, arts-based methods offer potential value when seeking answers to questions that may not be easily addressed using traditional qualitative research approaches. This is because symbolic aspects of individual experiences may be difficult to capture using traditional qualitative methods which rely on verbal or written competence (Comans & Hannes, 2017). Expression of individual experiences may also be suppressed through the process of consensus seeking inherent in group dynamics. As such, focus groups have limitations in the pursuit of discrete individual participant reflections. By contrast, arts-based methods can overcome hierarchical power imbalances that may influence expression and engagement of all participants. Such methods seek to valorise individual contributions, in group-based qualitative research seeking to explore perceptions and experiences (McCusker, 2020).

Since both terms, *bother* and *burden*, are often conflated in ordinary language use, each concept was examined separately using the LEGO® Serious Play® (LSP) method. An arts-based approach, LSP is partly underpinned by three, well-established and accepted theories. Theories of cognitive development and constructive play of Lev Vytosky (1962), who proposed that attention, sensation, memory and perception support language and the expression of thought. Further, Jean Piaget (Wadsworth, 1996), posited that personal understanding is derived from experience. Finally, the theory of constructivism (Papert and Harel 1991) argues that knowledge construction is enhanced and facilitated by engaging the individual in the active (and often playful) creation or construction of an artifact. Central to LSP is guiding participants to construct tangible representations of individual or shared concepts, encouraging expression of ideas, using LEGO® brick models as metaphors to guide communication (McCusker 2020). This is achieved as participants build three-dimensional models, using LEGO® bricks in response to specific facilitator questions, and subsequently explain their model through storytelling. This process necessitates use of metaphors to convert intangible concepts into concrete artifacts (LEGO® models). These models facilitate comprehensible communication of meaning and experiences. A strict hands-on-the-model approach to building and storytelling induces a state of concentration, involvement, and altered perception of time, referred to as being in a 'state of flow' (Czikszentmihaly 2014; Krizan & Nienaber 2024) that can overcome initial reluctance to engaging in such 'playful' activities. Using the LSP method, this study explores the conceptualisation of *bother* and *burden* by older persons, as perceptions about digital health and wellbeing technology (DHWT). The implications for DHWT use and adoption are also considered.

Methodology

Recruitment of participants, over 70 years of age, was from the research panels of living labs in Belgium and Ireland according to established inclusion criteria (Table 1). Participants were provided with a participant information leaflet about the study, in either Dutch or English, and afforded an opportunity to ask questions before providing informed consent. Participants could withdraw from the process at any time. One participant opted to discontinue building at the final stage of the workshop. Data for this participant is not included in the findings.

Table 1. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
• Ability to provide informed consent • Ability to communicate verbally in English or Dutch • Physical dexterity sufficient to use LEGO bricks	• Does not meet inclusion criteria • Cognitive decline sufficient to impair concentration during an extended activity.

A single workshop protocol was applied by the same primary facilitator (SCS) at both locations. Dutch-English translation of the presentation and participant responses was provided by a local co-facilitator (LB) in Belgium during the workshops. The LSP process can be applied to explore individual, joint or contextual identities (Krisnan & Nienaber 2024). This study used models to represent thoughts and subjectivities of participants to reveal insights on individual experiences.

Data Collection

Two LSP workshops were held with participants (n=15) in Belgium (BE) and two with participants (n=8) in Ireland (IE). LSP is a group-based methodology where participants are facilitated to express complex concepts or challenging topics using LEGO® bricks as symbols and metaphors. First, participants were encouraged to practice the physical assembly of a variety of brick forms. Next, from a LSP starter kit, each participant was guided to use bricks as metaphors, through a sequence of building and descriptive activities. The final building activity focussed on creating a model to express the participant's individual response to the question: What does bother/burden mean to you in the context of using digital health technologies? Bother was the focus of one group at each location and burden the focus of the other. The models created and each participant's explanation of their model were video recorded, without revealing participant identity. Images of all models by group are provided (Appendices A & B).

Data analysis

Audio recorded verbal descriptions of final models were transcribed verbatim. Transcriptions and video content, including both audio and visual components, were included in the dataset for analysis. Belgium workshop recordings were transcribed in Dutch using Word Dictate. A bilingual researcher (LB) reviewed the Dutch transcription against the audio recording of the session, to verify for both semantic and latent meaning accuracy. The transcripts were then translated into English, using Chat GPT. A bilingual researcher (LB) compared the English and Dutch transcripts for accuracy of translation from Dutch to English. The lead researcher and one of the bilingual researchers (LB) then met to review the transcripts and resolve any queries about word translations or meaning.

Thematic analysis of the dataset was conducted according to the steps outlined by Vaismoradi et al. (2016). Matrix analyses were conducted by country and group (Guetterman & James, 2023). First the transcripts were read and re-read to develop familiarity with the data. Initial reflections of meaningful and recurring ideas were noted. Next, transcript and audio-visual data were semantically coded into five code categories (concept, participant perspectives, participant characteristics, relationship, and metaphor codes). Two authors reviewed the first-round coding and an initial codebook was agreed. Next, semantic codes underwent a process of abstraction into themes including classification, comparison, labelling, definition, and description. Following theme identification, the authors distanced themselves from the data for at least one week before returning to review the stability of the initial themes.

As Dutch was the language of origin for participants in Belgium, the two bilingual authors (AJ & LB) checked the themes with the Dutch language transcripts. This was to ensure original meanings were reflected in the final themes and had not been altered during translation to English. Thereby themes were stabilised against the dataset. Likewise, non-verbal data (LEGO® models) were reviewed by all authors to verify interpretation. As social scientists, the authors note the influence of this perspective on interpretation of the data and definition of themes.

Ethics

Approval for the study was granted by the Research Ethics Committee at the institution of the lead author.

Results

Participants comprised men (n= 9) and women (n=12) who were seventy years of age or more. (70+). There were fifteen participants in Belgium and eight participants in Ireland (Table 2).

Table 2. Participant sex by group topic

Bother Group Participants (n = 10)	**Burden Group** Participants (n = 11)
BE01, male	BE09, male
BE02, male	BE10, female
BE03, female	BE11, male
BE05, male	BE12, female
BE06, female	BE13, female
BE07, female	BE14, male
IE21, male	BE15, female
IE24, female	IE22, female
IE27, female	IE23, male
IE29, female	IE26, female
	IE28, male

Findings from analysis of the LEGO® model stories are presented below according to identified themes. Descriptions are provided of bricks used as metaphors to represent conceptual elements. Where quotations are provided, the speaker is identified using: the workshop location (IE=Ireland, BE=Belgium) with a randomly assigned participant identification code, sex, and the workshop topic (bother or burden) in parenthesis e.g. (BE06, female, bother). Quotations from Belgian participants are provided in English, from the translated transcripts.

Experiences of bother and burden with DHWTs

From initial coding categories, participant perspectives indicated mostly positive expectations about the potential benefits of engaging with DHWTs, '*there is unlimited possibilities*' (IE27, female, bother). Furthermore, resilience was identified as a common characteristic, '*if you have the tools, then I think you can manage, and if not, you can ask for help*' (BE06, female, bother). However, participants believed a relationship exists between challenges using DHWTs and older age, '*…to us, the poor old people, we don't know exactly what is going on and what it* [technology] *is used for'* (BE05, male, bother). Therefore, despite openness and resilience, descriptions of bother and burden were readily provided as final LEGO® models were explained. Three interlocking themes were identified: technology use is experienced as a journey of challenges, engagement with technology highlights vulnerability, and how DHWTs meet expectations (Figure 1).

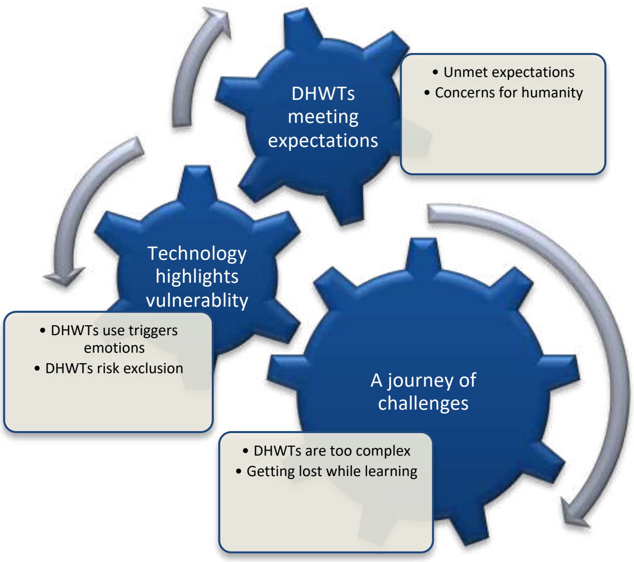

Figure 1. Themes and Sub-themes

Theme 1: Digital technology use is a journey of challenges

An overarching theme identified was that using digital technologies is experienced as a journey filled with challenges. Participants in both groups described the transitory nature of using DHWTs using descriptors such as a pathway, road, or journey. Metaphors used to depict the journey nature of using technology included long bricks to depict bridges and pathways between model elements. Bridges were particularly used as a metaphor in the workshops in Ireland. Here participants described the journey of engaging with DHWTs as transitioning from a pre-technology state to a technology-proficient state, '*I want to get a bridge from the old world to the new world and this new technology, that I don't know anything about*' (IE27, female, bother). However, this journey was described as presenting challenges in several ways.

The first of two sub-themes, is that participants experienced DHWTs as complex and reported a lack of understanding about how to use technology, '*It's hard to understand what is… how these things work, the logic of it*.' (BE05, male, bother). For those in the bother groups, finding solutions to challenges, without the necessary knowledge, was identified as a trigger for bother when model building, '*The bother was translating what was up here* [in head] *into the model. I felt I didn't have sufficient skills'* (IE27, female, bother). Lack of digital skills required regular effort to learn how to use new technologies, '*I am someone who often needs to be able to repeat and repeat, and if I don't use it, I lose it again'* (BE13, female, burden). Poor success in gaining digital proficiency was depicted in models as walls or barriers, representing obstacles to moving forward on the digital journey, *'…and this is the brick wall, when you are trying to* [use technology]' (IE23, male, burden).

The second sub-theme is being interrupted by technical issues during efforts to accomplish a task. Here, the metaphor of a path or journey continued with such interruptions equated to getting lost, *'there are side roads everywhere where I can go wrong'* (BE14, male, burden). Those in the Ireland bother group described making many changes to their models as they attempted to decide how to depict bother. The process of not knowing what to do and having to decide on a course of action was described as bothersome, '*well, they were just bridges to try something else. But they didn't work, so, were a bother*' (IE29, female, bother). By contrast, those in the burden groups were most concerned about repeatedly encountering challenges. This was equated with traveling without making any progress, '*This* [round black plate brick] *is trying to do something on technology. And you just go round in circles'* (IE23, male, burden). For others, engaging with DHWTs was presented as an obstruction and a mess, depicted using many colours and multiple disconnected or loosely connected components, '*that's all the mess you see here* [on the model]*. Those are side roads'* (BE14, male, burden). Such challenges were represented as problems for which a solution could not be easily found, '… [I] *have four little* [LEGO®] *heads and they still couldn't work it out!'* (IE29, female, bother).

Theme 2: Technology highlights vulnerability

Across both groups, uncertainty using DHWTs triggered a range of emotions associated with vulnerability. A matrix analysis of emotions by group, showed more content and a wider variation of emotions coded from those in the bother group including: annoyance, '*I don't know where I'm going with this. I'm really bothered with this. This is annoying me so much'* (IE21, male, bother); and frustration, '*These are all the possibilities that are there. But I did get myself a bit frustrated because I couldn't figure* [it] *out firstly'* (IE27, female, bother). Anxiety was also present,

'*there's a whole anxious feeling and anxiety, of being monitored. On many levels. If it's going to, perhaps, what it's going to portray, what it's going to show'* (IE24, female, bother).

Participants in Ireland were focussed on the personal experience of bother either with DHWTs or the bother of building the LEGO® model. However, one bother group participant in Belgium was more concerned by the overall digitalization of healthcare. This bother was expressed as a sense of gloominess, using only black and grey bricks as metaphors, '*I've worked in healthcare. The changes I see there, they hurt me. That's my gloom between grey and black. I would like to get rid of it* [technology in healthcare]*'* (BE03, female, bother). For this participant, digitalisation of healthcare represented a potential loss of highly valued interpersonal interaction in the provision of care. A range of circumstances triggered emotions associated with bother including: DHWT use challenges, unmet expectations, and the impact of technology on interpersonal communication in service experiences. By contrast, those in the burden group mainly expressed feeling either frustration or despair,

'*The frustration when you want to book a flight, book a train ticket, book whatever, and you end up going round in circles and other people are dependent on you to do it. That's the burden'* (IE23, male, burden).

However, for one Belgian participant whose worry was associated with bother, his model (a single white brick) represented a rejection of being bothered, *'You have enough food, you have a warm bed. You don't have to worry about things. Why bother?*' (BE01, male, bother).

The second sub-theme, under the theme of vulnerability, was concern about the ability to keep up with the constant changes in technology. Burden group participants explained this as worry. Model elements such as segmented strings and ladders were used to reflect the inability to accomplish some tasks using technology. Ladders were used to represent concerns about expected skill progression limitations, such as only being able to climb a few steps of the ladder, '*I just put the ladder there because I suddenly saw a tower. But in fact, this could be a side road that you take, and then you fall down, right?*' (BE14, male, burden). Self-directed lifelong learning was valued across participants in all groups, '*I always think that you should try to climb higher on the ladder and keep learning*' (BE06, female, burden). However, anxiety about keeping up with emerging DHWTs was evident, mainly in the burden group,

'*Now you have to use that app first to see if: 'is my blood pressure not too high'? Yes, then I might use that app, and then I have to use another app to make an appointment with the doctor because that can't be done by phone anymore, and so on…*' (BE14, male, burden).

Consequently, some participants feared that a time would come when they would need to decide whether to continue using technology, '*will I stop and give in or...*' (IE28, male, burden). One bother group participant reflected resignation that should this occur, he would be satisfied he had tried his best, '*I've made my attempt. It mightn't work but I'm fine about having tried'* (IE21, male, bother). However, participants in the burden groups were concerned that being unable to keep up with the pace of technological change would result in being excluded. For example, IE26 explained a tall tower of bricks in her model as representing the life restriction and exclusion that occurs when people are no longer able to sustain engagement with technologies. An example was given of a friend who only has access to two television stations and how this has restricted her life,

'*an awful lot of older people have shared to me that they couldn't be bothered with technology, how their life is affected as they get older, 'oh I couldn't be bothering asking people again* [to help with technology]*'* (IE26, female, burden).

Theme 3: DHWTs meeting expectations

Participants expressed expectations about what DHWTs should do and how technology should work. Overall, efficient data transfer, transparency of processes, and ease of use were identified as anticipated features of technology. These were represented in models as bridges, paths, connecting strips, and clear bricks. Even as reluctant users of DHWTs, willingness to use these technologies was predicated on an expectation of some benefit, '*You don't like being, having this monitor done, but same time there's also an element of, some good will come from it. That there will be accuracy'* (IE24, female, bother). However, for most participants these expectations were not being met. Frustration was expressed with poor information transfer between care professionals despite the implementation of digital technologies in healthcare settings, *'these are all your tests and god knows what* [selection of small bricks different colours and shapes]. *And this is just one wire* [connector] *to there, which is the test centre, which should by right be going into this computer over here and transmitted back here* [to originating doctor]. *The chain is actually quite good [as a metaphor] because everything doesn't come back in total* [from various tests]*…so you have broken information going back* [to the doctor]*'* (IE22, female, burden).

Those in the burden groups were more likely to represent ongoing difficulties as obstructing the ability to continue using DHWTs,

'*Even here* [on DHWT use journey]*, we can make mistakes, and it is finished. And again, we cannot go further. Therefore, all these things we receive, like watches and everything, are very difficult for us*' (BE11, male, burden).

Persistent difficulties in developing digital proficiency were considered commonplace for older persons, '*my friends who are 85 - 86 years old, they have taken I don't know how many courses, and they tell me, 'we know nothing''* (BE13, female, burden). Experienced challenges were linked to an expectation that DHWTs should make engaging with healthcare services easier, '*I also find it annoying that you need a different adapter for every device'* (BE02, male, bother). There was an expectation that end-user support should be forthcoming, as would have occurred when acquiring a new technology in the past, '*You don't get a booklet* [paper-based instruction manual] *anymore. You have to go to the computer...*' (BE13, female, burden). Despite bother and irritations, persistence in attempts to engage with DHWTs was deemed likely to continue. However, experiencing DHWTs as a burden was associated with a time when engagement would no longer be feasible.

Some participants were irritated that technology was not meeting their expectations. Others worried that if technology achieved promised functionality the result would be a diminishment of humanity. Such concerns were based on experiences as well as fears that DHWTs may replace human care provision and interactions,

'*The nursing staff, everyone has their computer. They stand at the door looking at the screen… ask the patient, I say, but they don't ask anything anymore. Everyone is staring at their screen'* (BE06, female, bother).

Participants talked of depending on others, especially family or neighbours, for help with technology. Nonetheless, concerns were expressed that such help may not always be forthcoming, as eventual self-sufficiency in digital proficiency was expected, '*I got on to him* [son] *and he was contrary. 'Mam, I showed you how to do this before. Press this button, that one, you should know how to do it now!''* (IE26, female, burden).

Such experiences generated worries about diminished community care and support,

'[Technology] *displaces normal interaction within society. Where people used to expect that others would take care of each other. Well, that doesn't happen anymore'* (BE03, female, bother).

Finally, for some, digitalisation of society represented a threat to the natural world. Using trees and blue glass bricks to represent nature, sky, and sea, participants cautioned that in a digital society we must be mindful to protect the environment.

Discussion

A range of challenges confound scaled implementation of DHWTs and uptake by older persons. Poor adoption is attributed to environmental conditions such as cost or internet connection, or individual characteristics such as cognitive ability or inadequate digital skills (Heponiemi et al. 2022). Older persons are also often assumed unwilling to use digital technologies more generally. Nonetheless, the resilience of older persons is reflected in persistence among this cohort who are increasingly using DHWTs to counter health and wellbeing challenges (Doyle et al., 2022). Indeed, despite technical difficulties experienced with DHWTs (Smith et al., 2022) older persons have been found willing to use digital technologies if supported to do so. Nonetheless, while largely open to the potential benefits, older persons find interacting with DHWTs to be bothersome in the first instance. There is also an expectation that using technologies will become excessively burdensome over time.

Bother and burden were both found to have an emotional basis. Largely due to repeated interruptions when trying to accomplish an objective using DHWTs, such as pressing the wrong button or 'getting lost' within an application. Bother was, therefore, characterised as a recurring phenomenon. Older persons equated DHWT use to taking a journey towards a moving destination, without directions. Such experiences triggered a range of emotional responses such as frustration, annoyance, fear, or self-doubt. Nonetheless, experiencing bother was not itself a factor in withdrawing from engagement with DHWTs. Indeed, the findings suggest that acceptance of the potential value of digital health and wellbeing solutions sufficiently motivated older users to persist in trying to use DHWTs, even when mildly bothered by them. However, as challenges continue to be experienced over time, and expectations about what DHWTs should be able to do are unmet, there is a risk of older persons experiencing technology use as excessively burdensome.

Engagement may continue for a time, even when DHWTs become a burden. However, the emotions associated with burden are more likely to reflect feeling pressurised to engage with technology while being unable to do so effectively.

Precarity in older age is a concept based on the uncertainty and vulnerability generated during times of significant transition (Gonyea and Grenier, 2021). Our findings show that the digitalisation of health and wellbeing care is experienced as a significant transition, not simply one of doing something differently but of traveling to ‘a new world’. Uncertainty is represented as not understanding or knowing how to negotiate the new digital world. Meanwhile, vulnerability is also reflected in concerns about unreliable transfer of the health data considered essential for effective decision making by primary healthcare professionals. Furthermore, awareness of personal vulnerability is compounded by concerns about ultimate digital exclusion if unable to gain or maintain digital proficiency. Uncertainty about personal ability to continue using DHWTs, raises concerns about personal vulnerability to exclusion from healthcare access, as use of technology reduces with age (Heponiemi et al., 2022).

Organisations seeking to implement DHWT use with older persons should consider actions to mitigate bother for older users. Such actions may postpone or avoid experiences of burden and potential disengagement from digital health interventions. Measures to achieve this were identified by participants in this study. Other researchers have offered related suggestions including simplification of DHWT interface and designs, widespread and ongoing digital skills training, clear instructions and training provided on DHWT use, and provision of support to respond to user queries (Frishammar et al., 2023; Heponiemi et al., 2022). Further collaborative research is warranted with older users of DHWTs to explore the findings from this study and develop specific measures to mitigate for digital bother and burden. Such research can then inform more effective design of DHWTS.

Finally, the LSP method provided a novel means for participants to convey their understanding of the concepts of bother and burden. Even with the same selection of over 150 bricks from which to choose, a core selection of brick forms was used by most participants. The use of similar bricks as similar metaphors by participants at both locations suggests LSP is both an effective tool for exploring such complex concepts and for interpretation and analysis. The concepts of journeys, (dis)connections, obstacles, confusion, isolation, and circular repetition were represented by recurring metaphors of bridges, connectors, towers, ladders, mixed colours, and circular plates. Further research is needed to examine how LSP can be used effectively to explore other topics with this and other cohorts of stakeholders.

Limitations

Central to the effectiveness of the LSP method is the verbal communication of individual ideas and insights in the form of storytelling from models built during the workshop. For this reason, Krizan & Nienaber (2024) argue that linguistic ability, of participants, is an important prerequisite for effective participation in LSP workshops. However, even when participants have the language proficiency to engage, the effectiveness of LSP as a research data collection method is predicated on the ability of the facilitator to understand the stories told by participants. It was a limitation of this study that the primary facilitator did not have proficiency in the Dutch language, used by participants in the Belgium workshops. However, in-workshop translation was provided by a co-facilitator and interpretation of audio recordings and transcripts facilitated by two bilingual authors. This attention to participant meaning not only provided direct linguistic translation but also added value since models were the starting point of the participant's story, thereby moving meaning beyond strictly words and speech. Collaborative interpretation of data ensured robust findings. Finally, the study was undertaken with a small homogeneous sample of self-selected living lab panel members, thereby limiting the generalisability of findings. Further research should replicate the study with a larger and diverse range of participants to explore how other groups reflect on and express the concepts of bother and burden.

Conclusions

The purpose of living lab research is to provide insights into real-world phenomena. The findings presented contribute to the current body of work on the experiences of DHWTs by older persons. This paper offers initial insights on the concept of bother, a poorly defined but widely used term in healthcare, but not yet explored in relation to DHWTs. These findings suggest further practical benefits for the inclusion of older persons in collaboration with DHWT designers and developers. Finally, this paper contributes to the limited body of work on the use of the LEGO® Serious Play® method to explore poorly defined and challenging concepts with older persons. Further research is needed on the application of the LSP method to other complex concepts explored in living lab studies and to explore other research applications of the LSP method.

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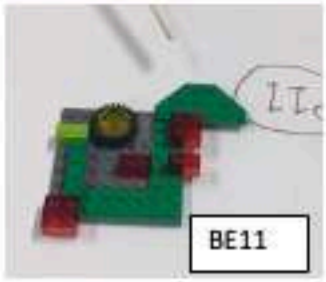
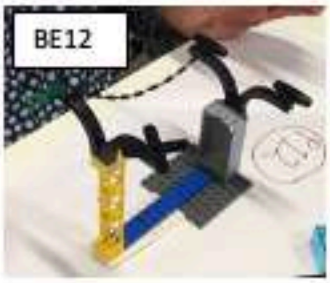
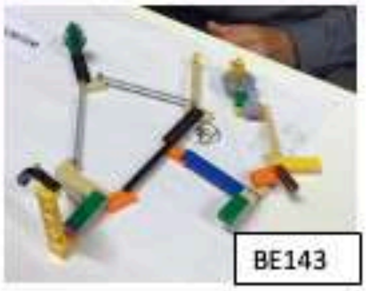
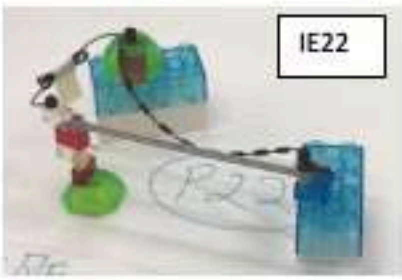
Appendix A

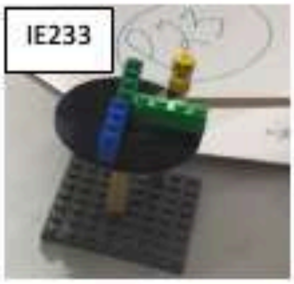
Burden Group Models

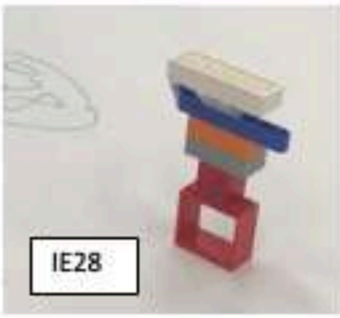






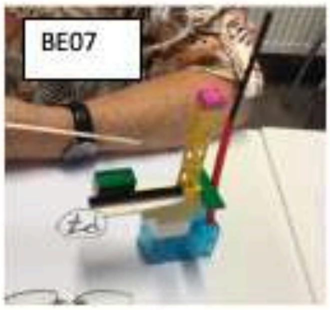


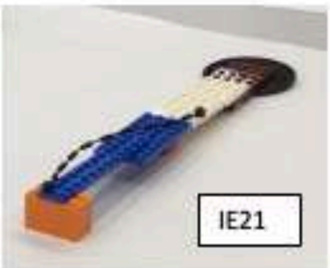


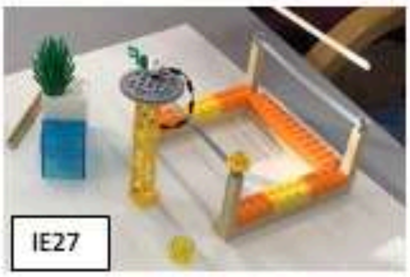


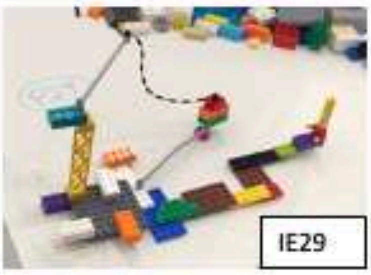
Appendix B

Bother Group Models









Research-In-Progress Paper

Urban Living Labs as a user-centered ecosystem: Spatial Persona as a Tool for Public Space Revitalization, the Case of Lange Jan Park in Heerlen

Authors

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Abstract

This study explores how socio-spatial power dynamics influence the identity and perception of public spaces within an Urban Living Lab setting. The research investigates Lange Jan Park in Heerlen's social dynamics, user perceptions, and existing power structures by combining methods like observations, qualitative research, co-creation, co-design activities, and mapping Lange Jan Park. The findings are used to create user and Spatial Persona, which are key in the design process. The study also involves a collaborative co-creation and co-design process to develop scenarios and interventions aimed at improving social interactions, addressing power imbalances, and changing negative perceptions. The Urban Living Lab model and its quintuple helix framework guide this process, encouraging active dialogue and meaningful outcomes.

Key words

Urban Living Lab, Quintuple Helix, Spatial Persona, Public Space Revitalization, Socio-Spatial Power Relations

Introduction

Public spaces serve as vital arenas for social interaction and community engagement within urban environments (Madanipour, 2018). They are also considered a vital part of cities that enhance healthy environments and human well-being (Blezer, Abujidi and Sap, 2024). However, the complex interplay of socio-spatial dynamics and power relations often influences the perception and utilization of these spaces (Iveson, 2013; Loukaitou-Sideris & Ehrenfeucht, 2016). Despite extensive research in this area, there are persistent gaps in understanding how these dynamics shape the identity and image of public spaces. Additionally, in contemporary urban settings, public spaces frequently encounter challenges such as social exclusion and the dominance of perceptions, narratives, and identities (Dellenbaugh et al., 2020). These challenges are compounded by unequal power dynamics, which can restrict access and perpetuate inequalities. Consequently, there is a pressing need to critically examine how socio-spatial dynamics and power structures influence the perception of public spaces (Mitchell, 2003) and how co-creative urban interventions can be a counter-narrative to mediate such power relations. This study, therefore, aims to address these gaps and needs by investigating the socio-spatial dynamics and power relations within Lange Jan (LJ) Park in Heerlen, utilizing a socially oriented Urban Living Lab framework. The primary objectives are to explore how such labs facilitate user-centered design proposals for public spaces and suggest employing a quintuple helix approach to address power differentials and promote inclusivity (See figure 1.). Consequently, exploring the co-creation and co-design of urban interventions that help mediate such relations and scale down the contestation of public spaces to foster diverse narratives, uses, and identities to co-exist.

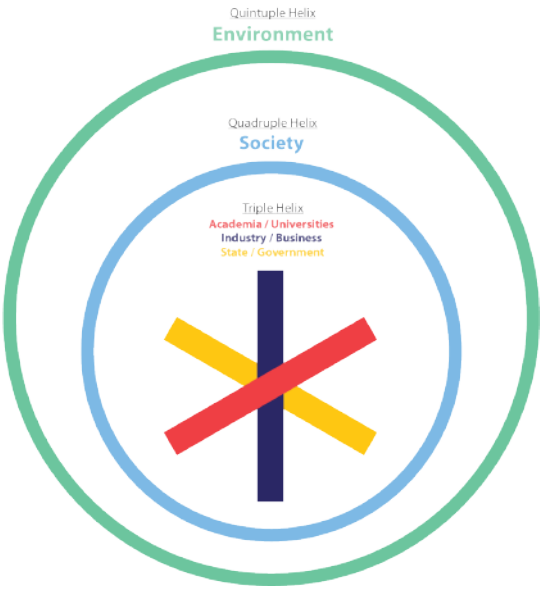

Figure 1. Diagram of Quintuple Helix

Socially Oriented Urban Living Labs

Urban Living Labs (ULLs) are popular instruments for finding solutions to urban challenges faced by cities (Blezer and Abujidi, 2021). While their normalization in cities is evident around the world, a lack of understanding of the characteristics and purpose of ULLs (Marvin et al., 2018). Consequently, diverse types of ULLs have been set up in practice to explore their feasibility for problem-solving and can be found back in literature, like challenge-based ULLs (Sjöholm and Trygg, 2024), organic, civic, and strategic ULLs (Marvin et al., 2018) or technology, transition, or citizen-driven ULLs (Morales et al., 2023). One of these types is the so-called ‘social ULL’ (Akasaka et al., 2023) and/or socially oriented ULL (Cognetti, 2023) which is of relevance for this paper.

Akasaka et al. (2023) explains that in social labs research, design, and innovation schemes are to foster socially acceptable implementation through cooperation with citizens. They add the perspective of ‘sustainable’ social ULL by emphasizing the need for a long-lasting scaffolding infrastructure. They conceptualize it as an urban infrastructure that continuously supports ULL activities while it is rooted in the local context, distinguishing the project-based operations of ‘normal’ LLs. Cognetti (2023) views socially oriented ULLs from a participatory planning perspective and elaborates that the social dimension of (urban) planning needs more emphasis in such labs. Herewith, the author refers to questioning the mechanisms of involvement and support of the most fragile profiles, often excluded from political processes.

It is exactly this perspective of socially oriented Urban Living Labs that we argue to be particularly important when reviewing socio-spatial dynamics and power relations within LJ Park-Heerlen. We aim to explore and uncover the hidden power relations present by making the invisible ones visible, i.e., engaging non-conventional urban actors that are typically marginalized and are not included in statistics, through (S.P).

Spatial Personas as user-centered approach for Urban Regeneration

Many cities and their public spaces have the challenge of developing such spaces to be inclusive and meet the diverse needs of communities. Consequently, understanding the diversity of user behaviors and needs is crucial for any urban intervention to revitalize public spaces. Diverse approaches have been used to develop such understanding with a growing interest in deploying so-called Spatial Persona (S.P) as a tool for revitalizing public spaces and advocating for user-centered design approaches.

In design thinking, user personas inspire (S.P) to depict archetypical users of a specific space based on demographic, psychographic, and behavioral traits. They give designers and urban planners insights into various user groups' needs, preferences, and behaviors within a given urban context.

Using (S.P) brings several benefits for revitalization endeavors in public spaces. First, it champions a user-centered approach, ensuring design interventions are tailored to specific needs and preferences. Second, (S.P) fosters communication and collaboration among stakeholders, nurturing consensus, and support for proposed changes. At the same time, challenges exist in employing (S.P). First, ensuring persona accuracy and representativeness is crucial, as they rely on generalizations and assumptions about user behavior. Second, maintaining persona relevance over time requires ongoing community engagement and regular updates to reflect changing demographics and preferences.

Context: Lang Jan Park - Heerlen

The neighborhood GMS in Heerlen-Noord is acknowledged by the National Government as one of the 16 priority neighborhoods in the Netherlands for its severe and urgent urban challenges, such as energy poverty, low literacy, and cultural diversity (Dutch Ministry of Internal Affairs Report, 2020). These urban challenges are chronic and have been deeply rooted in their local historical context, i.e., the coal mines closure in the 1960–1970s and consequent socio-urban challenges such as unemployment, low-income rates, aging population, and drug-related nuisance leading to a strong negative image (stigma) on the area. These socio-urban concerns have significant implications for public health equity and community well-being.

Within this context, there are diverse concentrations and clusters of multiple urban challenges. Such challenges are present in the LJ Park area surrounded by social housing blocks such as Aurora flat and other low-quality housing and governmental or public buildings.

Figure 2. Location of Lange Jan Park in Heerlen

Research objectives

Why:

To gain deeper insights into the socio-spatial dynamics and power relations that shape the perceived identity and image of L.J Park. These insights aim to empower the local community and various stakeholders to mediate and redefine the perception, image, and identity of the park. This will be achieved by designing strategies and interventions to transform the park into an inclusive and engaging public space.

How:

Using a multi-approach research methodology, including observations, qualitative research, co-creation and co-design, and urban analysis. The study aims to gather comprehensive data on how the park is utilized under different conditions and times, which will later be represented in (S.P).

Main Research Question:

How can an Urban Living Lab, based on the Quintuple Helix approach, facilitate increased social engagement through co-creation and co-design processes to transform the park into a more inclusive and engaging public space?

Sub-Research Question:

How does a tactical intervention in a public space influence the power relations and usage of that space?

Methodology and Process

Two researchers from the Smart Urban Redesign research center conducted fieldwork research, building on previous research and design workshops (See figure 3). The focus of the fieldwork was on the usage patterns, types, and demographic characteristics of users in L.J Park during the summer of 2023. The observation period was strategically chosen to include both a public holiday week and a regular week to capture potential variances in park usage. Data collection spanned four weeks:

- **Public Holiday Week:** Two weeks during the summer public holiday.
- **Regular Week:** Two weeks outside of any public holidays.

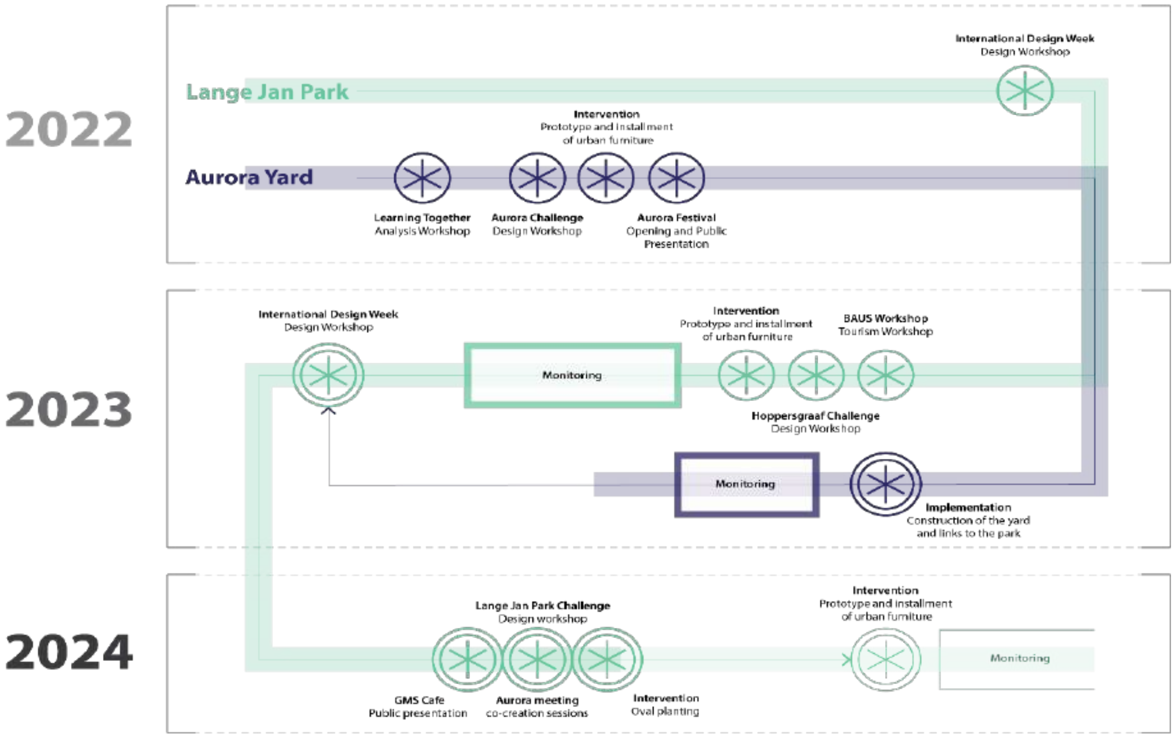

Figure 3. The co-creation and co-design process in ULL Heerlen

To ensure a robust dataset, observations were carried out as follows:

- **Regular Observations:** Every two hours from 09:00 to 21:00, for 10 minutes each session.
- **In-depth Observations:** One full day (09:00 to 19:00) to gain more qualitative and in-depth insights and to conduct interviews.

During each observation period, the following variables were systematically recorded:

- **Number of people passing by:** This included counting individuals moving through the park and noting their mobility directions.
- **Number of people using the park:** This included those engaged in activities within the park rather than just passing through.
- **Location of park users:** The specific areas within the park where individuals congregated or engaged in activities were mapped. (See figure 6.)
- **Estimated age category:** Users and passersby were categorized into estimated age groups: children (0-10), teenagers (10-19), adults (20-39), older adults (40-59), and seniors (60+)
- **Gender:** The gender distribution of both park users and passersby was recorded. (See figure 4.)

- **Weather conditions:** The weather at the time of each observation session was noted, including variables such as temperature and cloud cover.

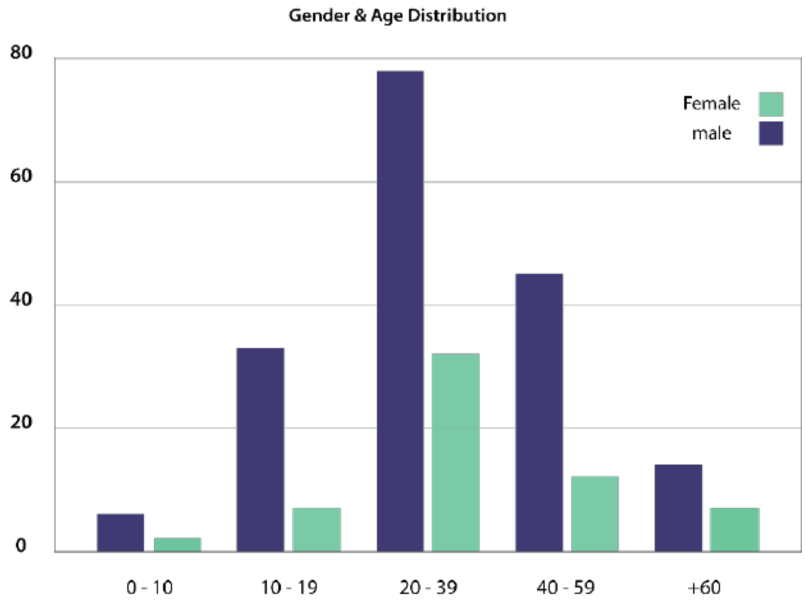

Figure 4. Gender and age distribution in Lange Jan Park

To enrich the quantitative data, semi-structured interviews (7 in total) were conducted during the in-depth observation day. These interviews aimed to capture the qualitative aspects of park usage, user perceptions, and ambitions. Conducted by the same researchers who made the observations, the interviews sought to build recognizability and trust with park visitors. The interview questions included:

- What are you doing in the park?
- What do you think of the park?
- Are you here often?
- What is your favorite spot in the park?
- Are you bothered by something in the park?

These interviews provided contextual insights and personal perspectives, enhancing the overall understanding of why, how, and when the park is used.

Insights from preliminary field work analysis

The translation of the observation and interviews into (S.P) is based on the park users' behaviours resulting in (8) personas and their affiliated sub-groups. These are using the park in different forms and producing subtle image and power relations. (See figures 5. & 6.)

There is intensive use of the park during summer days with approximately 580 by passer + other uses.

Supervising Persona

Subgroup	Age	Gender	Time	Facility
parents	20-40	female & male	afternoon	around sportscourt
police	diverse	male	all-day	near school, around ovals
teachers	diverse	male	morning and noon	near school, around ovals
community orga-nizer	60-80	male	all-day	going around the park but living in proximity
dog owner	40-80	female & male	morning and noon	around the park and near dogcourt

Figure 5. Categories used to define the spatial persona, e.g. for the supervising Persona

The S.P are divided according to age, gender, and the subsequent uses of the park one of the main categories is the type of use group between (chilling, by passers) category that produced the major stigma and perception of the park as unsafe, junkie concentration.

Nicole says: "*People say there are junkies in the park, but I don't mind. They don't hurt me. If you talk to them, you see everything is fine. They are only people. Generally,* people are afraid to talk to them." (Interview with researchers, July 2023)

Consequently, creating the main line of power relations main friction, and perception.

Other divisions are also presented as gender and age, creating another spatial pattern of the park user, where male dominance is noticed in diverse parts of the park. While the female presence is concentrated in one marginal part near the main street. The strategic location of the park is a node between diverse roads and surrounded by two social housing blocks, a school, and a governmental public building which gives the impression that the Park will be heavily used by diverse groups. The (S.P) demonstrated that the park is used as a transitional space, or short-stay space for many users due again to the perception and stigma of the park persona)[1].

[1] Non Dutch users are mainly workers from East European countries who live in the nearby room rentals. Within such living conditions, they use the park as their living room, socializing and relaxing space. The language barrier and this form of the park use produced a certain/negative i]mage and perception about them and the park as the interviews demonstrated.

The spatial concentration and movement flow of the diverse (S.P) show no social interaction between the diverse user groups. Consequently, hidden tension and power relations can be observed and expressed in interviews.

Though the Park is a highly contested space, at the same time, it presents a high potential space for more social interaction and engagement due to the high and rich diversity between its user groups.

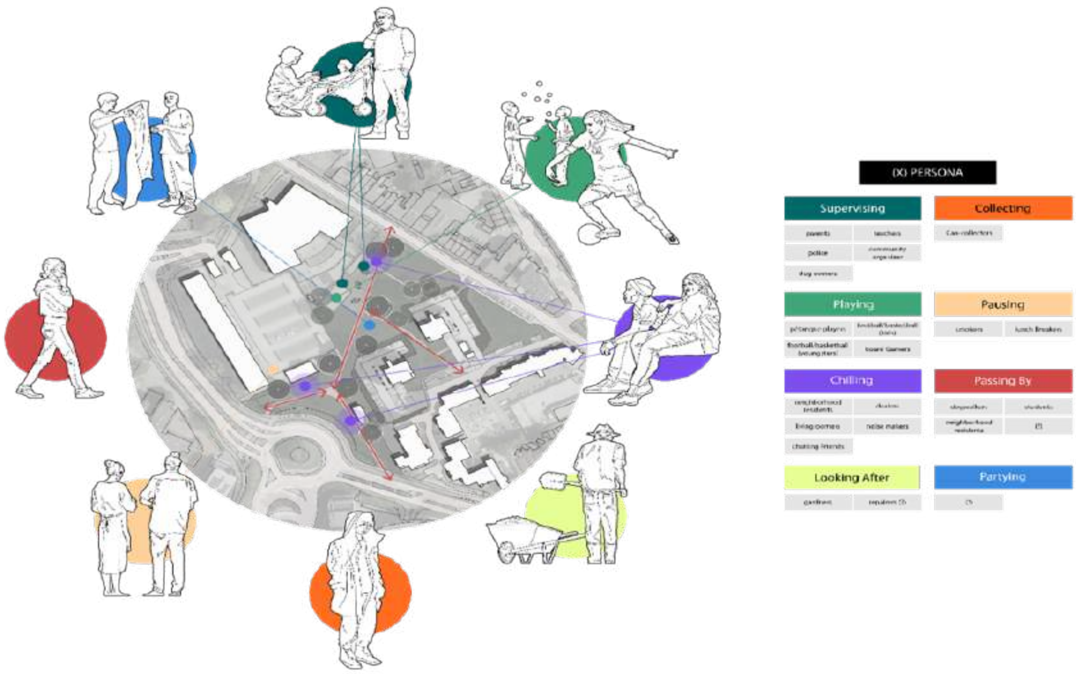

Figure 6. Concentration of eight spatial personas in the park

The outcome from this park analysis via the (S.P) and the wishes presented in the interviews to have better street furniture to facilitate more social encounters was the main input for a following co-creation, co design process with part of the (S.P) (supervising, passing by).

Ali says: “*There should be picnic tables in the park, because now you only sit with your backs or sides facing each other. If there is a table, we can also play games. We do not drink alcohol but do smoke joints. If we drink alcohol we would be fined.*”(interview with researchers, July ,2023)

The results of the co-design (infinity chair) are now in the process of realization. The monitoring process after realization will follow the same (S.P) method to see if the intervention assisted in mediating part of the power relations and the perception of the park and its users by also including them in the design process.

Concluding remarks and research innovation

Designers normally develop public space revitalization normally using conventual data collection that focuses on the public space physical characteristics. Consequently, the results of the design and their impacts are limited. From our research process in L.J Park we come with the following recommendations that also highlight the innovative addition of the research into ULL theory and methodology:

- Understanding a complex urban context requires a comprehensive analysis that goes beyond its physical characteristics.
- There is a need to combine diverse research and data collection methods to get better insights of the urban context. Using qualitative research from observations (type of use, etc.), interviews with quantitative research from users' profile (gender, age) intensity of use and users flows per location defined by day and time of use. Combining such methods with conventional urban analysis from physical and spatial characteristics of the public space provides in depth insights that are needed for any design scenarios.
- Data representation and visualization in Spatial Personas as a new method to understand the user's profile, interests and perception is an important tool for design scenarios.
- The data collection process should also be combined with intensive, and active engagement of relevant stakeholders connected to the site development and use. Engagement here goes beyond the typical participatory process promoted by ULL setting that sometimes is limited to informing. The engagement of actual and future users of the site brings more meaningful design proposals that can have better impacts of the design on the site future revitalization and can ensure better engagement and ownership by users.
- Moreover, in-depth insights into the rich diversity (that is not always taken into consideration) of users in public space offer an opportunity to include them and mitigate their conflicting views and power relations in a more engaging form via co-creation and codesign of strategies and interventions. For example, the co-creation process we created in L.J Park engaged the nearby pupils of the vocational secondary school who are part of the park users. Consequently, the development and the implementation of the end design (infinity chair) will also be executed by them. Consequently, more ownership of the park and new intervention can be foreseen.
- One fieldwork session was conducted in L.J Park during the summer break, which does not accurately represent park use throughout the year. Additionally, there

was not an opportunity to conduct enough interviews to obtain comprehensive results. To address this limitation, two more fieldwork sessions are planned for October 2024, with the aim of including a broader range of users, including migrants, women, and elderly people. The second fieldwork will be conducted after the implementation of the first experimental intervention, co-designed by a segment of the user group, which will enable the monitoring of its impact on perception, behavior, and power relations in the park.

This is research in progress. Not all results are final.

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Living Labs for Inclusive Soci(et)al Engagement

Wednesday, 25th September 2024

The "Living Labs for Inclusive Soci(et)al Engagement" session focused on showcasing how Living Labs act as platforms for fostering inclusivity and enhancing social engagement. It explored innovative approaches used to engage diverse communities, including marginalized and underserved groups, in the co-creation and implementation of solutions addressing societal challenges.

The session highlighted methodologies that prioritize user-centred design, inclusivity, and active stakeholder participation. It presented successful projects that have improved community cohesion, accessibility, and social well-being. The interactive format allowed participants to exchange best practices and tools, inspiring the use of living labs to build more inclusive and engaged societies.

Research-In-Progress Paper

Effect of PBL programs to introduce Living Labs for Local Social Problems

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Abstract

In this study, to introduce the Living Labs to an area where Living Labs have not yet been implemented as a method for solving local social problems characterized by a co-creation approach, we implement Project Based Learning (PBL) programs and examine the effect of them. In Japan, a variety of issues are emerging in local communities, such as declining and aging populations, dilapidated communities, and aging infrastructure. To solve these problems, "co-creation" among industry, academia, government is promoted. The Living Lab is considered to be an effective tool for this, but research on how to introduce it to a new area has not progressed sufficiently and needs to be considered. We compare the two Living Labs that have implemented, identify the elements necessary for the introduction, and propose a PBL program as an effective method for the introduction. We demonstrate the introduction of a Living Lab in Toyono-town, Osaka, and investigate its effectiveness.

Key words

Provider-driven Living Labs, PBL, Local Social Problems, Co-creation

Introduction

Living Labs, which have developed as a method of "open innovation" to create new value through a co-creation approach, are attracting attention in Japan. Living Labs are used not only to develop products and services for companies, but also as a method to solve problems faced by local society. In Japan, where the population is declining and aging, and government services are shrinking, residents, who are positioned as users in the Living Lab, need to take the initiative in solving the complex and diverse problems facing their communities. The Living Lab method is also effective for communities that are difficult to solve with a single discipline or theme. Although there are still few examples of living labs in Japan in the literature, there have been many activities called living labs in the past few years. On the other hand. It has been said that and that it is necessary to develop models that fit the cultural characteristics of the region since cultural factors in Japan influence social innovation (Taoka et al, 2016). Kimura (2021) mentioned that in Japan, there are differences in human characteristics and social systems from those in Europe, so it is highly likely that Living Labs will not work if it is based on the European case when it is operated. Even in the Uban Living Lab (ULL), which solves local problems through long-term citizen participation, the participation of diverse citizens is an issue, and the role of citizens is discussed (Akasaka and Nakatani, 2021). In Addition, in many current living labs, it is difficult to form sustainable and active communities (Miki and Sakakura, 2023).

Yasuoka et al. (2018) outline the Living Lab process from previous cases and describe the need for "dialogue and mutual understanding" in the initial stages of this process. When starting a Living Lab in a community, it is considered necessary to gain the understanding of the residents before starting the Living Lab, but the necessary methods prior to start-up are not specifically described. In this paper, the preparatory period prior to the launch of the Living Lab is described as “Phase 0”. By comparing the practical experience of Phase 0 in the two Living Labs, we discuss the Phase 0 necessary elements and propose an effective PBL program for this Phase 0. In addition, this PBL program be implemented in areas where Living Labs are newly introduced to investigate its effectiveness.

Insights through past practices

The concept of Living Labs is not clearly defined, and a wide variety of embodiments exist. Leminen et al. (2012) classify projects into four types in terms of the actors leading the project. They are utilizer-driven, enabler-driven, provider-driven, and user-driven. Provider-driven are intended to promote research and theory development and facilitate the discovery of solutions to specific problems. It is also a method that benefits all stakeholders but is considered difficult to engage users. In this study, we discuss the introduction of a provider-driven Living Lab led by university to solve local problems. The advantage of a university-led project is that it has human resources, including students, and the availability of experts in a variety of fields to address several different topics.

Living Labs led by Osaka University are implemented in two areas. The first one is at Yamatedai area in Ibaraki City. Yamatedai area was developed in 1978 as a new town located on the mountain side and is now an old town with an aging population. The second one is implemented at Sakishima area in Osaka City. Sakishima area is an artificial island with a mix of businesses and apartment complexes. This area is divided into two distinct areas: one with a younger generation and one with an aging population. These two different Living Labs have different environments, methods of phase 0 and member attributes. In Phase 0 of the Yamatedai area, a PBL program was implemented for university students, graduate students, and working adults. The flow of this program was as follows: after being divided into groups and learning design thinking, participants interviewed specific residents, identified issues, and presented their solutions to the residents (Fig. 1). The themes presented in this program were set as three local program themes (e.g., health, transportation, and community) in the Living Lab. At present, there is a collaborative effort involving the government, local residents, academic institutions, and businesses to implement Living Labs.

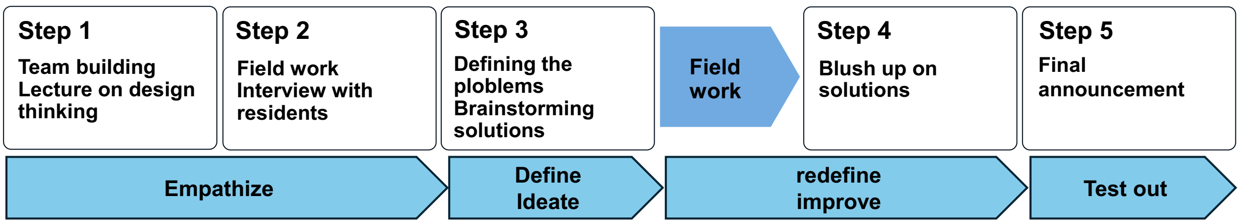

Figure 1. Flow of the PBL program

On the other hand, in Sakishima area, an experience-based event was held for residents. Many companies are based in the Sakishima area, and in cooperation with these companies, new technology experiences, facility tours, and lectures were provided. This event has increased the will of companies to utilize the Living Lab, but residents have not yet come to understand it. Both Living Labs were able to have contact with residents, but Engagement with residents was not high in Sakishima area. To examine the reasons, the two practical Phase 0 approaches were compared by Living Labs' methodological features. Five methodological characteristics of living labs have been identified (Akasaka and Kimura, 2017; Yasuoka et al., 2018; Kimura and Akasaka, 2018). Their reports list the following five:

(1) Hypothesis exploration approach
(2) Partnership with users
(3) Activities in real-life environment
(4) Mutual learning by the people involved
(5) Utilization of community

Table 1. Relationship between Phase 0 efforts of the two regions and methodological features

Area	Phase 0 practice	Hypothesis exploration approach	Partnership with users	Activities in real-life environment	Mutual learning by the people involved	Utilization of community
YMATEDAI	PBL program	explored the problem	Involvement with specific residents	In Yamatedai	Residents & University: Recognizing problems in the area	Utilized the local council, etc.
SAKISHIMA	Hands-on event	Adopted corporate hypothesis	Involvement with an unspecified number of residents	In Sakishima	Residents: Knowledge University: Use of Demonstration	Utilized the company-to-company community

Comparing the contents of Phase 0 with these five features, it was found that while local implementation (Feature 3) was common, the other four characteristics differed (Table 1). In Yamatedai, participants were able to use the existing community and conduct interviews to connect with specific residents. (Feature 2 and 5). In the process of issue exploration (Feature 1), the university members learned about the area, and this final presentation helped the residents become aware of the local problems (Feature 4). On the other hand, in the Sakishima area, the residents who participated in the event were an unspecified number of people, which may not have led to the development of relationships with residents to solve local social problems. Akasaka and Nakatani (2021) indicate that in the role of residents, citizens who are motivated to improve their community can be core members of a Living Lab. These findings suggest that the involvement of specific residents in the Phase 0 and mutual awareness of the local area influenced the subsequent development of Living Labs.

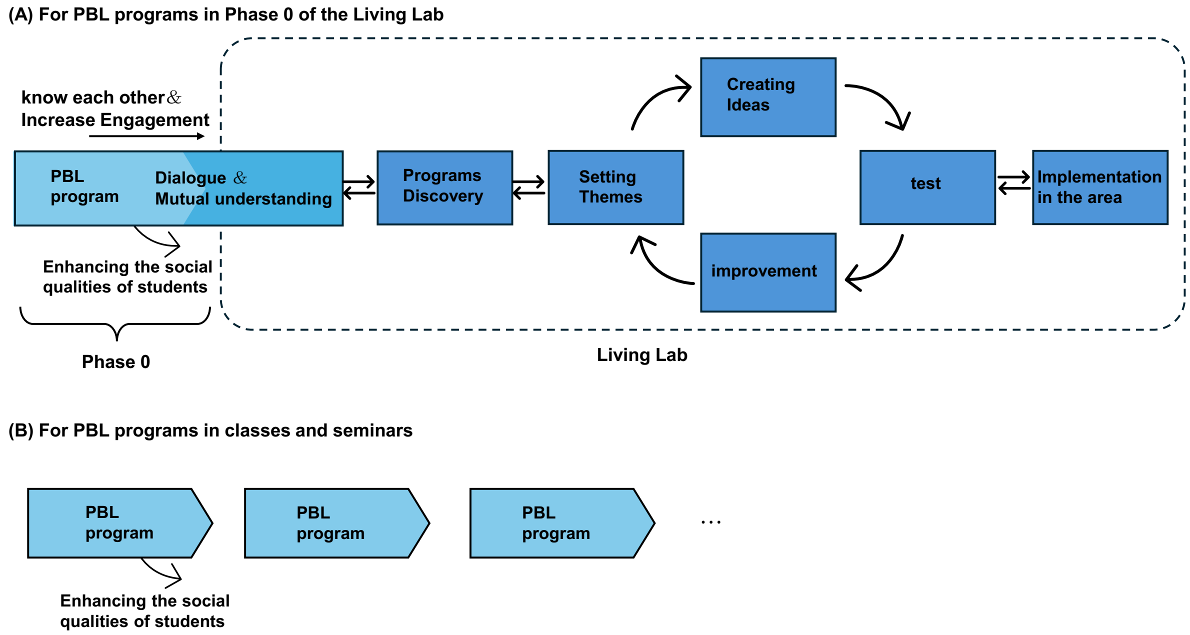

Figure 2. Differences between PBL programs conducted in Phase 0 of Living Labs and PBL program in classes

However, while PBL programs has its advantages, it also has its problems. PBL program is one type of active learning that many universities have implemented in class. Local social problems are often used as a theme of the class. Although the educational characteristic of PBL that addresses regional cooperation is the improvement of students' social qualities, the main purpose of PBL is often to improve students' abilities (Kusaka 2023), and there is a lack of continuity in activities to solve local social problems. The figure shows a long-term process diagram of a typical classroom PBL programs and that in phase 0 of Living Labs. The Living Lab process is based on the outline diagram of the process shown by Yasuoka et.al. (2018). In a typical classroom PBL program, students change every year, so the theme is likely to be reset, and problems might not be solved (Figure 2(B)). The PBL program in Phase 0 is not only a learning experience for students, but also creates a point of contact between the university and the residents and provides an opportunity for residents to become aware. It also contributes to the continuity of the activity since the goal is to connect it to a living lab (Figure 2(A)). To confirm the effectiveness of the PBL program, we tested it in a new living lab area.

Introduction of Living Labs to new area

Toyono-town in Osaka has an aging rate of 47.5% (Japan's national average is 28.7%), which is the percentage of the total population aged 65 and over in 2020. In addition, there are social problems such as aging infrastructure and transportation.

The introduction of a Living Labs was considered effective in Toyono-town, where complex issues are becoming apparent. However, since there was no understanding of Living Labs by the local government and no contact with the residents, it was decided to conduct a PBL program. The program was open to students from all universities and disciplines. The process was the same in Yamatedai described above (Fig 1). Contacts with residents were made through interviews and by attendance at the presentation. Interviews were conducted with residents who are engaged in community activities in Toyono-town.

Results of PBL Program Conduct

To investigate the effectiveness of the PBL program as Phase 0, Surveys were conducted with 18 residents and local government officials who attended the presentations, as well as with 11 students who participated in the program.

Table 2. Resistant and student survey results

	Question	Response		
		Yes	No	Neither
Resident (N=18)	Did your involvement in this initiative change your view of Toyono-town or make you aware of any changes?	16	1	1
Student (N=11)	Did you learn or realize anything from participating in this program?	10	-	1

	Question	Response					
		5	4	3	2	1	N/A
Resident (N=18)	Do you want to continue to be involved in community solutions efforts involving universities?	11	5	1	-	-	1
Student (N=11)	Do you want to continue to be involved in Toyono-Town efforts in the future??	9	1	1	-	-	-

Response : 5 = Strongly agree, 4 = Agree, 3 = Neither, 2 = Disagree, 1 = Strongly disagree

Descriptive responses were organized and summarized by sector (Table 3). First, the residents who participated in the presentations were found to be a diverse sector of community activists. Second, 16 of the 18 residents indicated that their involvement in the program had changed their views and awareness of the area, and 10 of the 11 students indicated that they had learned from the program (Table 2). The PBL program was a learning experience for both sides. It was found that residents rediscovered the attractiveness of their town and the characteristics of their area through the new perspectives and ideas of the students. Furthermore, 16 of the 18 residents and 9 of the 11 students indicated that they would like to continue to be involved in activities to solve social problems (Table 2). According to the residents' free descriptions, all sectors are willing to collaborate (Table 3). These results suggest that PBL programs are effective as catalysts for the introduction of living labs.

Table 3. Analysis of resident's comments by stakeholder

Stakeholder	Reasons why this program was good	What kind of Findings	How to be involved in the future
Local Government	· Because it can be a realistic initiative based on young people's ideas and inspiration · To be inspired by their flexible ideas. · To provide an incentive to the town's residents	· Tips for Problem Solving · Involvement of outsiders · Valuing young people's interest in the town	· Supporting programs and providing issues · Work together on anything
General Incorporated Association	· To hear the perspectives of young people.	· Reaffirming Residentiality	· cooperation · Working together on a project
Social welfare corporation	· Ideas and views unique to students were stimulating and helpful. · Expectations to break out of the current situation	· Residents notice things they would not otherwise notice. · Negative points are the town's strengths.	· Share opinions and put them into practice · Working together from issue exploration · Collaboration
Other residents	· To be able to have their opinions heard by the local government · To increase the town's relationship population	· Rediscovering the appeal of Toyono-town	· Working together to achieve this · Sharing issues · Any support

Conclusion and Next Steps

Based on the comparison of living lab practices in the two areas, it was considered effective to implement a program that includes elements of the methodological characteristics of Living Labs as indicated by Yasuoka et al. (2018) to introduce Living labs that solves local problems. This PBL program included all elements and provided learning for both parties. Moreover, it was found that the students' perspectives and ideas had a positive impact on the residents. It is conceivable that university students played a role in facilitating the connection between the university and the residents. In phase 0, It is also important to engage with specific residents who are involved in community activities, and we guess that they will be key persons in the future implementation of the Living Labs.

However, this study is ongoing. After Phase 0, the criteria for evolving it into a sustainable Living Labs have not yet been established. The methodology of the project will be developed by collecting data from each sector through the implementation of the Living Lab and conducting research on the transformative and sustainable impacts of each sector.

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Full Research Paper

Influencers of active engagement in living lab group activities: a transnational pilot study

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Abstract

Living lab methods depend on active engagement in activities to get real, lived experiences, views, and reactions. When setting up new user communities or collaborating across borders, living lab practitioners need to better understand how to optimize methods to ensure full and effective participant engagement. This study explored how to identify factors influencing how participants engage in living lab group activities. In Belgium, Ireland and Spain, new insights were collected regarding actual activities and facilitation approaches, activity format preferences of participants, as well as incentivisation for participant engagement. The findings have implications for group diversity, facilitator stance, and participation rewards. Establishing a safe and unbiased setting is crucial for a productive group meeting in living lab research, and this requires striking a balance between evidence-based methods for data collection and employing flexibility for adjustment to participant needs and preferences. The current pilot study improves the understanding of influencers of group dynamics and end-user preferences of living lab participants, providing an approach suitable for replication across other living lab settings to facilitate comprehension of local needs for tailored research protocols.

Key words

Cross-border research, group dynamics, user research, living labs, individual differences, inclusive engagement

Introduction

Living labs are open innovation systems where end users and other stakeholders collaborate in the exploration, co-creation, and evaluation of novel solutions (Ballon et al., 2018). Living labs have been operationalized in different ways, from environments (with a focus on real-life or multistakeholder aspects) to approaches or temporary projects (focusing on the user-centric methodology) (Ballon et al., 2018). Living lab research methods, such as in focus groups or co-design activities, often rely on interactions between individuals (De Witte et al., 2021). Such group interactions have many benefits, including efficiency, providing insight into diverging and converging opinions, promoting discussion, and contributing to rich (qualitative) insights (Greenwood et al., 2014; Liamputtong, 2011). Nonetheless, these activities can also be more vulnerable to the impact of individual differences. Social context, individual characteristics, or facilitator interventions can potentially influence participant behaviour and resulting study outcomes. Group interactions require a context where individuals feel comfortable and empowered to share their doubts and opinions, therefore, organising activities with individuals of a homogenous background has been advised (Greenwood et al., 2014). However, diversity in communities and environments is increasing and living lab activities aim to involve an inclusive and diverse user group. This means that creating safe spaces, where individuals from differing backgrounds are motivated to share their experience, is a key responsibility for living labs, panel managers, and facilitators.

What such a safe space should look like and how to facilitate a diverse user group to actively take part in living lab activities, will differ between populations and geographical regions. This implies that organizing effective inclusive activities in living labs or user communities requires gaining insight into user preferences and user behaviours. Increased international upscaling of living lab activities also comes with additional challenges of collecting data and insights from individuals with a different contextual background. International and European policies and initiatives promote research collaboration, knowledge transfer, and the scaling up of innovative solutions in various sectors from technology to healthcare. As a result, living lab and user-centred research is increasingly being performed in an international context because living labs can enhance comprehension of elements that influence the success of innovations across various social, environmental, and cultural settings (Mulder & Stappers, 2009).

The pace of innovation can be accelerated when ideas and resources are exchanged across borders. However, factors such as cultural traits as well as individual behavioural differences could also affect data gathered across different geographical areas and potentially skew interpretation of study results (De Witte et al., 2021; Im et al., 2004). The geographical area where services and products are launched can influence not only the innovation's requirements but also how the living lab research is conducted. Making sure regional disparities are considered in study design could enhance the reliability and representativeness of the results.

Previous research has already illustrated how differences between individuals and regions can influence active engagement in living lab activities. For example, Halcomb et al. (2007) linked both gender and age to group dynamics, a finding which is confirmed by others (Berge et al., 2016; De Witte et al., 2021; Thomas et al., 2024; Xie et al., 2014). The study by De Witte et al. (2021) additionally suggested that professional status and socio-economic status (SES) can affect engagement in living lab research and that preferred incentives for research contribution differ between regions. Many findings on individual differences are based on non-standardized or incidental observations, while data derived directly from end users, structured observations of living lab activities, and transnational comparisons remain scarce.

Therefore, the current contribution aims to fill this knowledge gap by providing a more structured and systematic approach to examine factors contributing to active engagement of living lab participants in different contexts or regions. This approach was piloted in three European countries. The approach specifically focuses on (1) actual behaviours in activities and facilitator approaches, (2) activity format preferences of participants, and (3) incentivisation and engagement of participants.

Methods

Based on previous work, an approach was designed to gather data about actual engagement and behaviour in group activities as well as end-user preferences for study design. This approach consists of a combination of self-report questionnaires living lab participants, complemented by observations of group sessions. The approach was then tested in collaboration with living labs in three European countries (Belgium, Spain, and Ireland).

End-user questionnaire

A questionnaire assesses end-user experiences in and preferences for participation in living lab group activities. Participants are asked about (1) their motivation for participation, (2) their attitude in group sessions (being polite and direct), (3) observed and preferred moderator style, and (4) how attributes of sessions and individuals would influence their participation (i.e., group size, gender, age, professional background, expertise, and ethnic background). Demographic information is also collected, including ethnicity and socio-economic status data, using the MacArthur SES ladder (Adler, Epel, Castellazzo, & Ickovics, 2000). Questionnaire completion took approximately 15 minutes in the pilot and could be done on paper or online using the Qualtrics survey software. The questionnaire was translated from English to Spanish and Dutch using a combination of AI-based translation (DeepL) and verification by local researchers to ensure comprehensibility and cultural accuracy.

Observational checklist

An observer is asked to describe the group and the facilitator (e.g., based on age, gender, and ethnicity) of an activity and to document the contribution of participants based on individual differences (gender, age, ethnicity, professional status, expertise). Additionally, the activities (e.g., asking open-ended questions), group atmosphere (formal – informal scale), and overall attitudes and behaviour of participants and facilitators were reported by the observer.

Pilot Recruitment

The living labs were invited to participate in the study by LiCalab through personally addressed e-mails, social media, and through open calls in networks, including the European Network of Living Labs (ENoLL). The participating living labs were asked to observe two group activities, which were already scheduled, and provide the participants with an additional questionnaire. The study relied on activities which were already planned to observe natural behaviour of participants and facilitators in a real activity (and not a fixed standardized protocol limiting inherent variability). There were no restrictions for the topic of the activity, but participants were required to be over 18 years old. The study was approved by the ethics committee of Thomas More University of Applied Sciences and INTRAS Ethics Committee.

Pilot Procedure

The living labs were provided with the protocol and selected two suitable pre-planned group activities and a living lab researcher to observe each activity. This observer could not be the main facilitator of the activity. The observer was provided with the observational checklist in preparation for the activity. After the activities, this checklist was completed online. The study was explained to participants prior to the activity and each participant provided written informed consent. The activity was conducted as planned and participants were provided with the end-user questionnaire for completion directly afterwards. Following data collection, frequency analyses and one-way ANOVAs were used to compare the responses from different regions.

Results

Description of the activities

The activities took place between October 2023 and March 2024 in Belgium (BE), Ireland (IE), and Spain (ES) with a total of 34 participants. Group sizes varied between 4 in Ireland and 8 in Belgium. Table 1 provides an overview of the characteristics of the activities and individuals. Groups were homogenous, and all groups contained male and female participants (53% females). Participants were citizens or end users mostly aged 55 or above (one young adult participated in an activity in Spain). Most participants were retired (Belgium, n = 13; Ireland, n = 8, Spain, n = 6). Five Spanish participants were still actively working. Participants ranked themselves on the SES ladder between 4 and 9, showing middle to high SES (BE M = 6.75; IE M = 6.75; ES M = 6.45). They were native speakers of the local language and were members of the predominant ethnic group in their region (white in Belgium and Ireland; Hispanic in Spain).

The activities each had 1 (Ireland) or 2 (Belgium and Spain) female facilitators (age varied between 27 and 58 years old). The same workshops were conducted in Belgium and Ireland by the same facilitator, supported by a local researcher for translation and co-facilitation in Belgium. Facilitators at all sites were experienced living lab practitioners. Refreshments were provided in all activities and three activities provided an additional reward.

Table 1. Activity descriptor

Activity ID[a]	Target group (group size) b	Activity type	Topic	Incentive
BE01	Persons aged >70 (n=6)	Workshop	Bother and digital health technologies	Book voucher
BE02	Persons aged >70 (n=8)	Workshop	Bother and digital health technologies	Book voucher
IE01	Persons aged >70 (n=4)	Workshop	Bother and digital health technologies	None
IE02	Persons aged >70 (=4)	Workshop	Bother and digital health technologies	None
ES01	General population (n=6)	Co-creation session	Recycling and reuse of electronic medical devices	Bookmarker
ES02	Persons aged >65 from an Experts by Experience group (n=6)	Co-creation session	Future of dual-tasking training assistants	None

[a] abbreviations: BE, Belgium; IE, Ireland, ES, Spain; [b] One Belgian female participant had incomplete self-report data, and one male Spanish participant did not complete the self-report questionnaire.

Activities and facilitator approaches

All activities used verbal exchange and (guided) group discussions, specific activity features are reported in Table 2. Arts-based activities included Lego Serious Play (Belgium & Ireland) and drawing or crafting (Spain). On a score of 0 (amicable, informal) to 100 (formal, serious), observers described the group atmosphere as very informal (mean of the rating of both activities: BE, *M* = 10; IE, *M* = 0; ES, *M* = 15). Observers were asked to rate to what extent participants were direct, polite, constructive, active, respectful, and sharing experiences. They rated them highly on all factors (*M* > 80 in all countries). In line with this, participants also reported themselves that they were both direct and polite (they did not rate the other attributes).

Table 2. Activity features

ID	Open discussion	Guided activity	Arts-based Activity	Collaborative Activity	Individual Activity	Product Demo/Test	Recording Method
BE01	No	Yes	Yes	No	Yes	No	Video & Participant notes
BE02	No	Yes	Yes	No	Yes	No	Video & Participant notes
IE01	No	Yes	Yes	No	Yes	No	Video & Participant notes
IE02	No	Yes	Yes	No	Yes	No	Video & Participant notes
ES01	Yes	Yes	Yes	Yes	No	Yes	Audio & participant notes
ES02	Yes	Yes	Yes	No	Yes	Yes	Audio & participant notes

The observers reported multiple interventions being used to a lesser or greater extent by the facilitators (Figure 1). Facilitators from Belgium and Ireland strongly relied on open-ended questions as opposed to closed questions. In Spain, open questions were also most common, but more closed questions were included in the activities (which can be linked to the topic and goal of the activity: a co-design dynamic with specifically designed exercises and materials). While the facilitators solely asked questions to the whole group in Ireland, addressing the whole group was combined with asking questions to individual participants in Belgium and Spain. In Spain, this approach was adopted to foster a more balanced participation, particularly as two participants in one of the groups were observed to dominate the discussion. Personal stories were shared by the facilitators in Belgium but less so in Spain. In Ireland, one activity included personal stories (rating of

95) while it was scarcely present in the other (rating of 5). All facilitators provided confirmation to participants very often (e.g., through nodding, paraphrasing). Facilitators regularly gave examples (to trigger discussion) and rarely interrupted participants (to gain clarity or maintain focus). Interruption was slightly more common in Spain, which could be related to the two dominant individuals mentioned above.

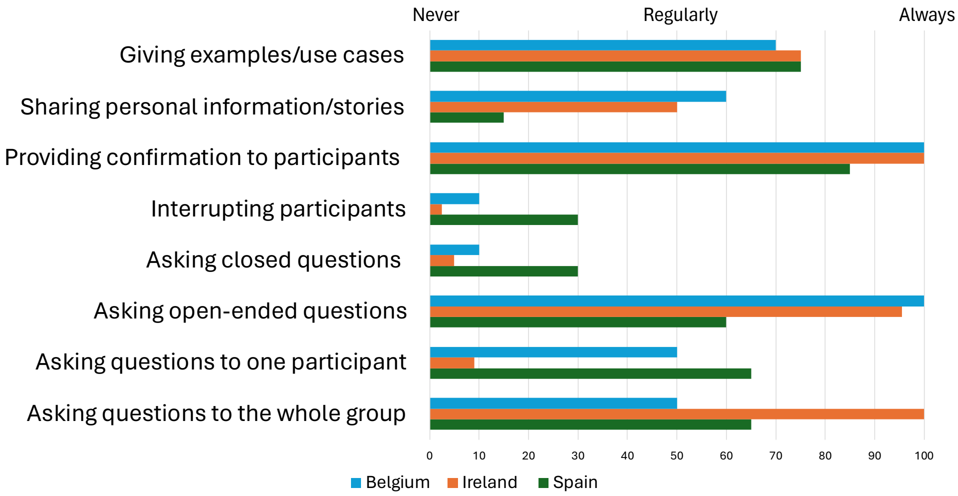

Figure 1. Prevalence of different facilitator interventions by country.
Note. Prevalence of interventions were scored on a scale from 0 (never) tot 100 (always). Differences between activities were small and the observations were therefore combined per country.

Facilitator approaches can be described in terms of implemented interventions and actions (Figure 1) but also in terms of their general moderating style. Facilitators can take a more authoritative or facilitating stance. An authoritative style consists of introducing new topics, asking direct questions, interrupting individuals to guide the process or asking for clarification. Interventions that are more facilitating can consist of letting the group dynamic influence the process and choice of topic, providing confirmation to participants (e.g., nodding), making sure participants are feeling good, taking a background position, etc... The facilitation or moderating style adopted was judged by participants on a scale ranging from 0 (a very authoritative style) to 100 (a totally facilitating style). On average, participants in Belgium identified a mixed moderating style (M = 50.54, SD = 22.12) while the moderating style in Ireland was identified as strongly facilitating (M = 89.38, SD = 11.48). In Spain, the moderating style was experienced as mostly facilitating by the participants (M = 71.50, SD = 24.95). The differences between the participants' ratings from the three regions are significant, F (2, 29) = 9.10, p <.001, despite the Belgian and Irish activities having the same primary facilitator. However, language translation in Belgium required a co-facilitator as translator, which could have provided a different facilitation dynamic in the activities. There were also differences between individual ratings of the moderating style, especially in participation from Belgium (range 22-81) and Spain (range 30-100).

Activity format preferences

Participants were asked whether certain activity design elements or characteristics of other group members influence their contribution to group activities. The findings are summarized in Table 3. For group size, around one third of participants reported that they are 'a little' to 'a lot' more active in smaller groups. There was little estimated influence of gender, age, professional background, and ethnicity. A subgroup of participants (n = 9) did state that a higher level of expertise of other group members reduced their engagement.

Table 3. Estimated influence of activity design elements and characteristics of co-participants

Influencing Factor	**Operationalisation**	**No influence**	**Reduced activity**	**Increased activity**
Group size	Smaller group size	BE: n = 11 IE: n = 6 ES: n = 6		BE: n = 3 IE: n = 2 ES: n = 5
	Larger group size	BE: n = 11 IE: n = 6 ES: n = 4	BE: n = 2 IE: n = 2 ES: n = 7	BE: n = 1
Gender	Same gender	BE: n = 13 IE: n = 8 ES: n = 10	BE: n = 1 ES: n = 1	
	Different gender	BE: n = 14 IE: n = 8 ES: n = 11		
Age	Older individuals	BE: n = 11 IE: n = 8 ES: n = 11	BE: n = 1	BE: n = 2
	Younger individuals	BE: n = 10 IE: n = 8 ES: n = 9	BE: n = 3 ES: n = 2	BE: n = 1 ES: n = 1
Topic Expertise	Individuals with more expertise	BE: n = 9 IE: n = 6 ES: n = 7	BE: n = 3 IE: n = 2 ES: n = 4	BE: n = 2
	Individuals with less expertise	BE: n = 11 IE: n = 6 ES: n = 9	BE: n = 2	BE: n = 1 IE: n = 2 ES: n = 2
Professional Background	Similar background	BE: n = 11 IE: n = 7 ES: n = 8	BE: n = 2 ES: n = 1	BE: n = 1 IE: n = 1 ES: n = 2
	Different background	BE: n = 12 IE: n = 7 ES: n = 10	BE: n = 1 IE: n = 1	BE: n = 1 ES: n = 1
Ethnicity	Similar ethnicity	BE: n = 12 IE: n = 7 ES: n = 11		IE: n = 1
	Different ethnicity	BE: n = 13 IE: n = 7 ES: n = 9	BE: n = 1 IE: n = 1	

[a] Two BE participants indicated that they did not know how a similar ethnicity of other group members influences them. [b] Two ES participants indicated that they did not know how a different ethnicity of other group members influences them.

While participants were asked to reflect on how these characteristics influence active engagement group activities, observers rated actual differences in contribution to the activity for some of the variables. The observer rating scale included questions to estimate the influence of gender, age, and expertise on the topic. In line with the self-reported impact of gender, observers reported a mean rating for the two activities of 50 (BE), 47.50 (IE), and 45 (ES) on a scale from increased contribution of men (0) to increased contribution of women (100). However, observers noted that (1) men were slightly more direct and worked more individually while woman were more modest, interacted more, and showed more vulnerability and reflection (activity BE01) and (2) men were slightly more talkative and detail-oriented than women in activity ES02. Ratings for age and expertise are not included since groups were homogenous in these factors.

The participants also indicated their preferred moderating style on a scale from 0 (a very authoritative style) to 100 (a totally facilitating style), which proved to be like the actual style they experienced in the activities. The Belgian participants were more favourable towards a mixed style including authoritative and facilitating interventions (*M*=44.54; *SD* = 17.58) while participants from Ireland and Spain had a preference towards a more facilitating style (*M*=86.88; *SD* = 11.00 and *M*=70.50; *SD* = 24.43 respectively). Inter-country differences are significant, $F(2, 28) = 13.44$, $p < .001$, but underlying variability in individual preferences is substantial in Belgium and Spain (Figure 2).

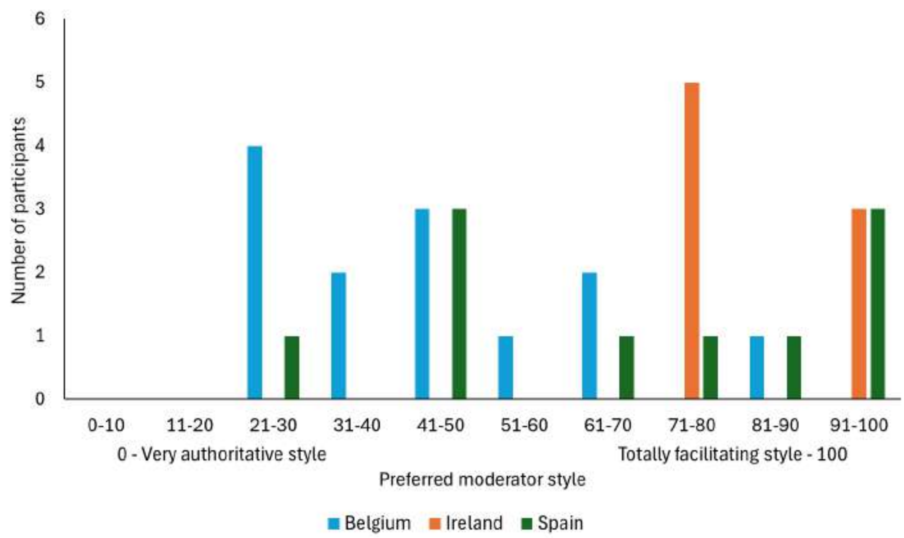

Figure 2. Preferred moderating style by the participants of the three countries.
Note. The bars represent the number of participants in each data range (the continuous rating scale offered to participants was divided up in categories for visualisation purposes).

Incentivization of participants

When participants were asked why they took part in the current activity, they mostly indicated that they did so for being able to help others or society (Belgium, *n* = 10; Ireland, *n* = 7; Spain, *n* = 4), for being interested in the topic or innovation (Belgium, *n* = 8; Ireland, *n* = 5; Spain, *n* = 5), or for learning new things (Belgium, *n* = 9; Ireland, *n* = 4; Spain, *n* = 3). Other motivations consisted of social contact (Belgium, *n* = 4; Ireland, *n* = 3; Spain, *n* = 2), or for being appreciated (Spain, *n* = 1). None of the participants reported that money or material reward was one of the reasons for participating in this activity. Table 3 provides an overview of the participants' ranking of the best rewards researchers can provide for taking part in such studies. Results are similar across countries. Again, intrinsic motivation and interest in the topic dominate with extrinsic motivators (such as money and material reward) of a lesser importance.

Table 3. Ranking of different potential rewards according to preference.

Rank	Belgium	Ireland	Spain
1	Being able to test and/or learn novel things	Being able to test and/or learn novel things	Being able to test and/or learn novel things
2	Social contact and/or being able to help	Report of the study outcome	Social contact and/or being able to help
3	Report of the study outcome	Social contact and/or being able to help	Report of the study outcome
4	Other material reward	Other material reward	Money / Other material reward*
5	Food and/or drinks	Food and/or drinks	
6	Money	Money	Food and/or drinks

Notes. * Shared rank

Discussion

Living lab methods depend on active engagement in activities to get real, lived experiences, views, and reactions. To collect these experiences and views, evidence-based methods from academic research are used (focus groups, workshops, interviews, testing etc). However, the methods are often adapted and implemented more flexibly since many living lab projects do not have an academic research objective but focus on more tangible outcomes such as product testing or community development projects. Here, the nature of participation can be even more paramount as the synergy yields the desired results. As such, living lab practitioners must understand how to adapt existing research methods for living lab purposes. Furthermore, as transnational living lab collaborations increase, with the continued growth of the European Network of Living Labs as well as a global proliferation of collaboration networks and clusters, living lab practitioners will need to adapt methods for transnational application for full and effective participant engagement.

This study explored how to identify factors which influence the way participants engage in living lab group activities, to enhance recruitment of participants and retention of living lab panel members for ongoing initiatives. Results show that participants from Belgium, Ireland and Spain show many similarities in their preferences and behaviour. Factors such as gender, age, and professional background are reported to only have a limited influence on participants' engagement in group activities. Level of expertise of other participants is also generally not a limiting factor, although a quarter of participants stated that a higher level of expertise of other group members would negatively impact their level of contribution in living lab activities. These preferences suggest that, at least for these participants, homogeneity in characteristics is not always necessary to promote open discussion in groups. This is encouraging since living lab activities aim to collect insights from an inclusive and diverse user group. In the current study, groups were small, but this is in line with participant preference, since for a third of participants a smaller group size promotes more active contribution in activities. When looking at previous literature, a sample size of approximately eight participants has been recommended for groups activities (Carlsen, & Glenton, 2011; Guest et al., 2017), but the nature of activities should inform the group size, the methods used, and the delivery style. Further research is needed to examine the most effective formats and activity delivery modalities for the range of projects engaged in by living labs.

This pilot study examined six activities from three European countries that included a range of elements requiring various forms of participant engagement. Which facilitator interventions are used in an activity will depend strongly on the activity types but can also be influenced by cross-cultural differences in communication style. Current facilitators addressed questions both to the whole group and to individual participants, to ensure that all voices were heard, thereby creating a respectful environment that valued everyone's contributions and experiences. However, there were also significant group differences in facilitator interventions and style. While a facilitating moderating style was mostly identified and preferred by participants from Ireland and Spain, Belgian participants preferred a more mixed style including interventions that more actively guide the process (i.e. a more authoritative style) as well as more supportive and facilitating interventions. They also experienced this mixed style in the current activity. Differences in experienced moderator style between Ireland and Belgium are remarkable since they shared the main facilitator. However, the facilitator instructions and interventions were translated by a local researcher and co-facilitator in the Belgian context, which can influence the style and content of communication. This discrepancy could also potentially highlight a cultural difference in expectations for or perceptions of authority and facilitation within group settings. Furthermore, perceived, and preferred moderating style is a very personal matter since large individual differences existed in Belgium and Spain. The impact of translation and perception of moderator styles is a relevant avenue for future research. Nevertheless, facilitators should be skilled, knowledgeable of the needs of their target group, and flexible to adjust to activity needs and specific (dominant) participant profiles.

Finally, whether and how to reward or incentivise participants is often a question for emerging living labs. All included activities provided refreshments but additional incentivization varied. In line with Almeida et al. (2020), Carrera et al. (2018) and De Witte et al. (2021), motivations to participate in activities are mostly of an intrinsic nature. Participants like to learn novel things and a receiving a report of findings from the activity was also identified as a relevant potential motivator. Many living labs do provide some sort of feedback, where permitted by project commissioners, for example through newsletters, social media, or on later gatherings or activities. However, there is scope for living labs to further explore and co-create effective methods of feedback to participants from activities. Additionally, for the participants in this study, the opportunity for social connection was an important motivator for participation. This has already been observed as important motivating factor for (older) persons contributing to living lab research (e.g., De Witte et al., 2021) and it also aligns with a study using an emic approach to understanding the values of Experts by Experience in Spain (Losada et al., 2024). This latter study highlighted the intrinsic motivations for participation among older adults, such as contributing to the common good, gaining esteem, and achieving self-realization. The work also underscored the importance of creating a safe and inclusive environment that fosters mutual respect and equality among participants. Additionally, the opportunity for social connection and meaningful feedback were critical motivators, suggesting that living labs should incorporate structured yet flexible participation frameworks to enhance engagement and the overall co-creation process.

Some limitations require discussion. Living lab group activities can vary significantly by purpose, composition, and methodology, which in turn can influence delivery format, moderating style, and individual participant behaviour. The small size and limited diversity of the current pilot study are limitations. This precludes making general conclusions or recommendations for the living lab community as a whole. However, the study has developed a workflow and data collection strategy which can be easily transferred to other living lab contexts within and beyond Europe to assess participant engagement across culturally diverse contexts. The findings of this approach can guide the design of future end-user activities regarding recruitment, incentivization, and moderation.

Conclusion

Establishing a safe and unbiased setting, where views and experiences can be freely exchanged, is crucial for a productive group meeting in living lab research. Using evidence-based methods for data collection, originating from academic research, is an important asset of transnational living lab research. However, flexibility as well as methodological rigour is required for adjustment to user needs and preferences as well as the collection of rich living lab data. Creating a safe setting requires knowledge on the preferences and behaviours of the user group, which can be part of initial warm welcome activities and needs assessment in both emerging and existing living lab user communities. The current pilot study findings contribute to the understanding of influencers of group dynamics and end-user preferences of living lab participants in three European countries. The approach used can be readily replicated in other living labsettings to facilitate comprehension of local needs for tailored research protocols.

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Research-In-Progress Paper

Co-Creative Filmmaking for Integration of User Perspectives in Living Lab Environments

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Abstract

Co-creative activities are an essential part of a user-centred Urban Living Lab (ULL) approach that values integrating user perspectives into an iterative design process to ensure the successful implementation of an effective, sustainable solution with the potential for long-term impact. Maintaining a constant integration of user voices throughout the process is one of the main challenges of this approach, where user engagement activities risk operating in parallel to the technical development of the solutions. In this paper, we present co-creative filmmaking as a way to bridge the gap between users and developers, creating a channel of communication that allows users to express their needs in a more direct and accessible manner.

The step-by-step co-creative filmmaking method we describe is rooted in experiences of setting up ULLs in the GREEN-LOG project. It requires handing over control to the users for deciding what is filmed and how to film it; invites users to participate in the post-production process; and overseeing the editing of the footage along with any additional material (including text, voice-over narration, animations, or any other digital effects). The goal is to provide opportunities for self-representation through audiovisual communication, to facilitate conversations between stakeholders across the ULL.

Key words

Co-Creative Filmmaking, Self-Representation, User-Driven Communication, Accessibility, Urban Living Lab, User-Centred Design

Introduction

A collaborative approach to filmmaking as a research method has been attempted in various contexts before, producing films ranging from ethnographic documentary work to scripted fiction films (Baumann et al, 2020; Jongsuksomsakul & Roebl, 2022). However, although there have been cases where user-generated social media content has been used as a method of user engagement in a Living Lab environment (Leminen et al, 2014; Ståhlbrøst et al, 2013), filmmaking is seldom used as a co-creative technique in this user-centred design context. In this paper, we propose co-creative filmmaking as a more inclusive and accessible method of integrating user perspectives in Urban Living Labs (ULL). We will be using our work in the GREEN-LOG project to exemplify how these co-creative films can be produced and used throughout the design process.

GREEN-LOG is an EU-funded project based in five ULLs across Europe that focuses on providing sustainable last-mile delivery solutions. The GREEN-LOG ULL focuses on urban and civic innovation through a quadruple helix of co-creation, facilitating spatially embodied collaboration between private entities and civil society to develop sustainable last-mile delivery solutions (see fig 1). A special emphasis will be placed on citizen engagement through co-creative activities to not only align the interests of the involved stakeholders but also empower citizen groups to exert influence and increase impact (Menny et al. 2018).

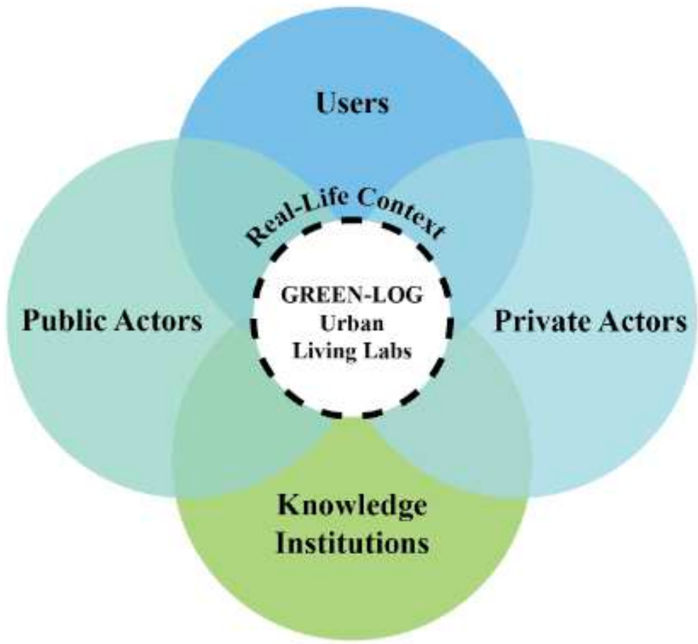

Figure 1. The GREEN-LOG ULL approach utilises a quadruple helix co-creation model to facilitate collaboration between private and public actors (including knowledge institutions and last-mile delivery users)

Through our engagement in the GREEN-LOG project, we have developed 'Co-creative filmmaking' to activate these ULL principles into practice, with an ambition to foster a deep understanding of user needs and values. By creating an opportunity for self-representation and establishing communication channels between various stakeholders through the resulting videos, user perspectives become integrated into the iterative design process inherent in the ULL approach to scoping, prototyping, implementation, and evaluation stages. In short, this technique is designed to consistently enable considerations of user perspectives and awareness of the wider context of their needs and barriers through collaborative means of video production.

This method is especially suited to people who may feel more comfortable in expressing themselves using alternative audiovisual methods, be it through sign language or through other non-verbal methods. It is meant to decrease the layers of interpretation through which their views are received and provide a direct means for expressing them and reviewing their own statements. The video format also retains the human element that often risks getting lost when translating user needs into a list of requirements to fulfil.

There have been several other projects that experimented with collaborative forms of audiovisual media production. Through these, we observed examples of potential methods from which we have drawn inspiration. For instance, including participants in the film production and post-production process has been attempted when creating collaborative ethnographic documentaries (Schrago 2024; Sullivan, 2024), as part of public health research (Baumann et al, 2020; Jongsuksomsakul & Roebl, 2022) or when using digital storytelling to amplify marginalised voices (Turpin et al, 2024; Tilche, 2022; Leino & Puumala, 2020; Alexandra, 2017).

Balaguer and Alberich-Pascual suggest a common concept to be used for such approaches and define it as 'a set of collective processes carried out around audiovisual creation, involving at least two clearly different parties' who share control or common access to the film production throughout the process. (2023, p.100) Our co-creative filmmaking approach would fall within this category, the two parties being the users and the researchers.

In a ULL context, researchers invite users, often citizens, to co-create, providing necessary materials and skills. They facilitate communication among stakeholders, adapting to user needs. Users on the other hand, need interest and commitment to the project if they are to assume directorial roles. Collectively defining how to go about meeting the project goals is an important aspect of inclusivity, involving users in the evaluation of the process as well. As Sullivan suggests, one must design in a way that is centred around the relationships being formed, gaining knowledge throughout the process instead of solely through the end-product. (2024, p.41) Jongsuksomsakul & Roebl support the creation of positive relationships between participants and recognise the responsibility of the researcher to listen to the concerns of the users and provide relevant information and resources accordingly. (2022, p. 3) Moreover, the relationship between researcher and user is inevitably reflected in the resulting film; Turpin et al noted how, although the researcher's experience played an active role, participants in their study still described their role as directorial in nature, remaining in control of their own narratives. (2024, p.14)

The Co-Creative Filmmaking Method for Living Labs

Our approach to co-creative filmmaking in ULL is based in the design ethnographic living lab model developed through the REBEL research program at Halmstad University (see for example Smith et al. 2024). The REBEL LL model (see fig 2) engages in future smart living and has a particular focus on developing innovative ethnographic techniques in the exploration and engagement phase of the co-creative human centred design process.

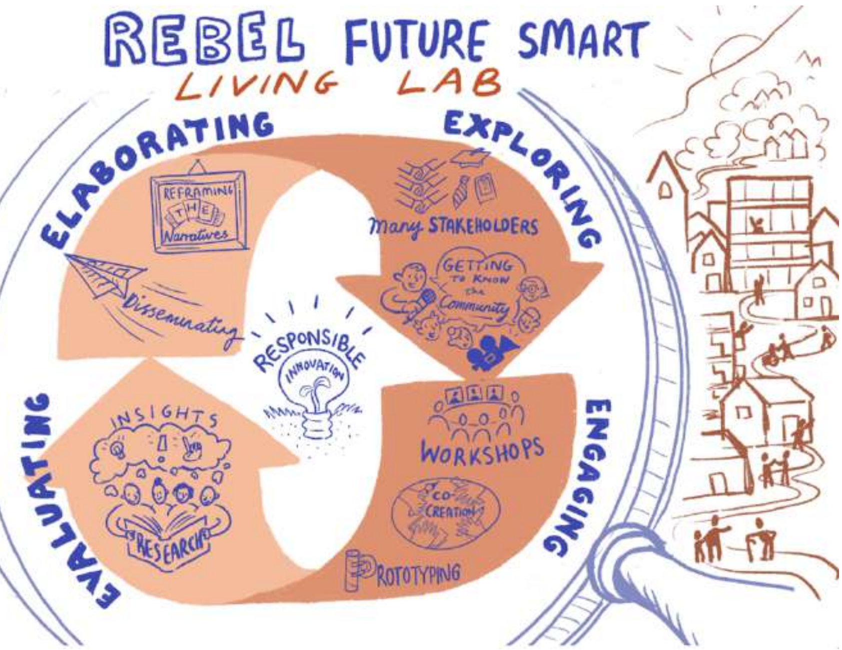

Figure 2. The REBEL future smart living lab model is developed in the REBEL research program at Halmstad University, Sweden.

The co-creative film-making method we demonstrate in this paper is being developed as part of the REBEL research program and is tailored to the ULL context in the GREEN-LOG project. We have begun testing the viability of the method by engaging with a courier from the e-bike delivery company of the GREEN-LOG ULL in Oxfordshire, who agreed to guide us through his usual delivery routine. The method is as follows:

Preparation - Prior to scheduling a filmmaking session, establishing the scope, and settling the goals of the activity together with the users is an important step to ensure that there is an alignment of aims and any concerns have the chance to be addressed beforehand. It is expected that users understand how this video will be distributed within the ULL and can suggest further uses of the film. Consent to appearing onscreen (and possibility to withdraw consent anytime) should be established, and an introduction to filmmaking basics should be made available for users with limited experience who intend to shoot footage themselves.

Production - The subject of the shoot, equipment setup, and camera roles are context-dependent and reliant on user interest and degree of participation. Some filming options for users include appearing onscreen and addressing the camera, be recorded while engaging in an activity, participate behind-the-scenes by directing the researcher who operates the camera, or using the camera themselves. Roles and ideas may change based on the events of the day.

During filming in Oxfordshire, the content was entirely determined by the courier, who chose to appear onscreen, explaining each step of his process (see fig 3). He would never address the camera or any imagined audience beyond it, and instead would speak directly to us as we recorded him. He talked openly about his experiences and did not express any concerns regarding how his image would be portrayed during the filming process.

Figure 3. The courier guiding us through his routine at the depot

Post-production - Unless the users express interest in editing the footage, the researchers should assume the editor role to minimise the effort required from the users, given that making the production process as easy as possible would encourage higher rates of participation. If more than one user is included in the video, then a group feedback session should be organised to ensure that users are satisfied with their representation in the wider context of the video containing multiple perspectives. Several opportunities for feedback should be offered, along with the ability for users to contact researchers at any point to request revisions.

We are currently in the post-production stage of the process for the Oxfordshire film, and a first draft has been created. We have now reached out, asking for feedback from the courier on any changes he would like to make (which could be communicated via text or via video call, with live edits made together). It is expected that a second version will be created as a result.

Dissemination- The resulting videos are intended to be shared internally among relevant stakeholders across the ULL(s) of the project. A feedback loop is also expected, meaning that users who participated in co-creative filmmaking must hear a response with progress updates about the project, thus being included as legitimate participants in the project. This two-way interaction should nurture trust, which would strengthen the interest to continue engaging long-term through multiple prototyping and implementation stages. Public dissemination would also be possible for the promotion and visibility of the project, but this would be a secondary goal that would require additional consent from participants.

Evaluation - Users are also included in assessing the success of the method. Feedback would be requested regarding how much they were able to express their views, how well they feel that their perspectives were considered, and how much of a difference they feel that they made overall. This would be supplemented by reflections and other forms of quantitative or qualitative assessment conducted by the researchers as well.

Potential Challenges

Although there is overlap between the roles of the two parties as they share filmmaking responsibilities, it has been noted that an imbalance of power can persist in collaborative audiovisual projects, and it is not erased simply by providing equal opportunities to participate. (Leino & Puumala, 2020, p. 791) The researcher is usually the one in control of and responsible for the resources and equipment necessary for video production, while users oftentimes do not have extensive filmmaking experience. This emerged during filming in Oxfordshire, where limited awareness of what would be visible or audible on camera was observed (see fig 4). These technical frictions could have been avoided by giving more thorough guidance on filmmaking fundamentals, to help bridge the gap for users with limited film experience.

Figure 4. Attempting to show his phone screen, which the camera could not pick up

In cases that involve multiple participants, conflicting points of view are likely to occur at some point in co-creative practices due to distinct backgrounds and differing motivations that may cause disagreements around film contents and style. (Schrago, 2024, p. 7; Tilche 2022, p.497) As such, preserving multiple perspectives is one of the main challenges of collaborative media production. (Sullivan 2024, p. 40) In addition, it is known to be a time-consuming activity requiring high levels of commitment and resources. (Leino & Puumala 2020, p.795; Baumann et al 2020, p.2260) Such challenges often discourage project leaders from opting for such methods due to concerns regarding efficiency. However, providing a more diverse range of users with the chance for self-representation is a more accessible alternative that prioritises user perspectives in exchange.

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Research-In-Progress Paper

Cultural Probes: A Pathway to Understanding Poverty and Debt Dynamics

Authors

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Abstract

Cultural probes have been a popular design research methodology, offering a creative and subjective method for gathering user insights. This research-in-progress paper discusses how they provide a participatory alternative to traditional ethnographic methods by overcoming accessibility barriers, building trust, and balancing power dynamics. The aim is to develop general guidelines for using cultural probes in urban living labs, enhancing co-creation, and ensuring more inclusive and effective interventions. To this end, this paper explores the application of cultural probes in urban living labs to understand citizen perspectives on poverty and debt. This context is especially interesting for this methodology as traditional poverty measures fail to address the multifaceted nature of poverty. Participatory definitions, which emphasize experiential and social norms, provide a culturally sensitive alternative. We outline the development of a cultural probe toolkit in this context and insights gained from the preliminary study results. These studies informed design refinements addressing language barriers and task clarity.

Key words

User-centred design, Cultural Probe, Urban Living Lab, Poverty and Debt

Research Purpose

Cultural probes have a rich history in Human-Computer Interaction (HCI) and participatory design research, evolving as a design-led approach to understanding users and their contexts (Gaver, Dunne, & Pacenti, 1999). Cultural probes offer the advantage of subjectively engaging research participants, leading to creative responses that can inspire new and unforeseen directions. Unlike traditional qualitative methods, which typically involve passive observation and interviews, cultural probes encourage participants to actively document and reflect on their daily lives by completing tasks or creating artefacts. Through this, they can gain deeper insights into their experiences, emotions, and aspirations (Thoring, Luippold, & Mueller, 2013; Gaver, Boucher, Pennington, & Walker, 2004). While cultural probes are a popular methodology in HCI focusing on design research, their potential for capturing a participant's perspective on social and urban topics including their needs, ideas, and beliefs remains underexplored. Berkovich (2009) proposed this approach, yet it has not garnered widespread adoption, with the emphasis remaining on design research.

This research project explores the effective adaptation of cultural probes within urban living lab (ULL) environments. Through this we aim to integrate citizens' perspectives into the co-creation and testing of solutions in ULLs, promoting meaningful societal engagement. This research, conducted in collaboration with the ELSA Lab for Poverty and Debt, aims to provide in-depth insights into developing support strategies addressing poverty and debt in the Netherlands, focusing on Heerlen. As part of our research, we aim to explore the design of the participatory activities of a cultural probe to operate effectively within the distinct socio-spatial dynamics of urban communities, especially vulnerable urban contexts to better inform the development of targeted interventions and support mechanisms in ULLs.

Urban Living Labs in Vulnerable Urban Contexts

Poverty remains a persistent challenge in modern cities, and it is a multidimensional phenomenon usually associated with a lack or deficiency of the necessities required for human survival and welfare (Wratten, 1995). Poverty is predominantly defined through standardised indicators such as income, consumption, and other social indicators like literacy or health, underscoring a quantitative approach to measuring poverty (Hagenaars, & de Vos, 1988; Wratten, 1995). These definitions usually fail to address the structural roots of poverty, as they have a limited understanding of its complexities. Consequently, emerging discourses challenge reliance on a common index favouring participatory definitions that provide an additional subjective account of poverty. In contrast, Wratten

(1995) argues that participatory definitions underscore one's experience and social norms in addressing poverty and prove to be culturally and socially sensitive, especially in vulnerable urban contexts in the Netherlands that are characterized by multi-scalar socio-spatial inequality (Petrović, Manley, & Van Ham, 2022; Noordhoff, 2008).

We believe that the Urban Living Labs (ULLs) show great promise in addressing poverty serving as dynamic ecosystems of co-creation that involve diverse stakeholders from academia, policymakers, the industry sector, and local communities and are locally embedded in the urban landscape. This facilitates the development of participatory definitions of poverty. However, there is a demand for innovative qualitative approaches that embrace cultural diversity and address power asymmetries that are often overlooked in traditional methods.

Cultural Probes as a Supplement to Ethnographic Research

Traditional research methods may present challenges or limitations when conducting research in sensitive settings (Celikoglu, Ogut, & Krippendorff, 2017). To overcome this, traditional ethnographic methods are often supplemented by applying empathic, experimental, or generative approaches in user studies such as cultural probes. This more participatory approach, enables users to share intimate details about their routines, preferences, and challenges, leading to an in-depth understanding of their needs and behaviours (Gaver, Boucher, Pennington, & Walker, 2004).

Initially introduced by a team of designers led by Bill Gaver (1991), cultural probes are open-ended and evocative tasks meant "to elicit inspirational responses from people" to collect fragmentary clues about their habits, routines, and values. Cultural probes aim to inspire design ideas, prioritizing subjective engagement and empathy, and opting to collect fragmented information rather than comprehensive data. Cultural probes provide participants with tools, such as daily dairies, maps, cameras, and postcards that encourage self-expression as they respond to specific tasks and questions and propel creativity to avoid generic responses (Thoring, Luippold, & Mueller, 2013; Celikoglu, Ogut, & Krippendorff, 2017). Since then, cultural probes have also been used as a methodological approach for conducting design research in sensitive settings, such as caregiving environments (Hensely-Schinkinger, Schorch, & Tellioğlu, 2018) or working with marginalized communities (Júdice, & Júdice, 2007).

Moreover, cultural probes provide a significant reduction in time and resource investment for researchers as participants receive cultural probes for independent exploration at their own pace within a designated timeframe. This leads to a more efficient data collection that can be upscaled easily, especially in circumstances where direct observation may be impractical or intrusive. This freedom enables research in culturally diverse contexts, ensuring that participants are not subject to presumptions biased by the researcher's own culture and context.

Cultural Probes in Vulnerable Urban Contexts

Integrating cultural probes within the framework of ULLs offers a promising approach to addressing poverty and debt. Additionally, our past work in vulnerable urban contexts highlighted persistent obstacles in engaging citizens in urban innovation processes, including the difficulty of ensuring broad accessibility and inclusivity, the importance of building and maintaining trust and the necessity of navigating power dynamics to ensure meaningful participation. Cultural probes are well-suited to overcome these barriers, and their methodological niche arises from:

1. **Overcoming barriers of accessibility and inclusivity:**
   Cultural probes provide a versatile and inclusive methodology for engaging citizens from diverse backgrounds and with varying levels of literacy or technological proficiency. Unlike traditional survey methods, which may pose barriers to participation for certain groups, cultural probes employ creative and expressive activities that accommodate different communication styles and preferences. By offering participants a range of activities such as photography, drawing, or storytelling, cultural probes enable individuals to convey their perspectives and experiences in ways that resonate with them. This approach helps to break down barriers to participation and ensures that a broader cross-section of the community can contribute to the co-creation process within ULLs.
2. **Building trust and managing expectations:**
   Cultural probes facilitate a more participatory and collaborative approach to research and innovation, which can help build trust between researchers, stakeholders, and citizens. By inviting participants to share their stories, insights, and concerns through culturally sensitive activities, cultural probes foster a sense of ownership and agency among individuals, thereby strengthening the bond of trust between them and the project organizers. By establishing a foundation of trust and transparency, cultural probes contribute to a more inclusive and effective co-creation process within ULLs.
3. **Balancing power dynamics and ensuring meaningful participation:**

   Cultural probes offer a bottom-up approach to research and innovation, allowing citizens to actively shape the agenda and direction of the project. By providing participants with the tools and space to express their perspectives and priorities, cultural probes empower individuals to challenge existing power dynamics and advocate for their own needs and interests. Moreover, the participatory nature of cultural probes promotes a more equitable distribution of decision-making authority, ensuring that marginalized voices are heard and valued within the co-creation process. Through activities such as collaborative storytelling or community mapping, cultural probes foster a sense of collective ownership and responsibility, leading to more meaningful and sustainable outcomes for all stakeholders involved in ULL initiatives.

The added value of using cultural probes in ULLs manifests in the learning domain as they can provide a layer of deep and subjective understanding of poverty and debt in the ULL learning arena that is crucial for making context-driven solutions. Additionally, they can empower local communities in vulnerable urban contexts by balancing power dynamics by exposing the people's perspective.

Research Progress

The development of our cultural probe will proceed through three phases before its adoption as an inquiry tool within the ULL. To effectively use cultural probes in addressing the barriers mentioned before and encountered in previous ULL research in sensitive settings and to ensure meaningful societal engagement in vulnerable urban contexts, the following steps are planned:

- A study round using the cultural probe method with a non-Dutch-speaking focus group.
- A study round using the cultural probe method with a Dutch-speaking focus group.
- Review the design decisions based on the results and outcome of the two study rounds to assess the potential of the task to provide new perspectives.

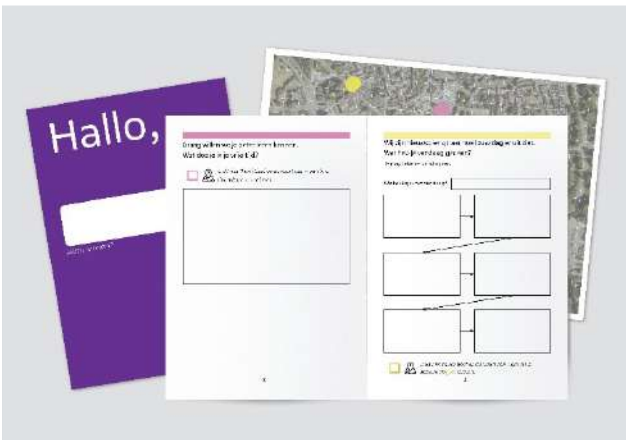

Figure 1. Cultural Probe's booklet used for the first study round

During the first study round, the cultural probe was prepared as an assignment booklet (Figure 1.) including six main activities, stickers, and a neighbourhood map for participants to pin their most visited places. (Table 1.) The booklet used simple, unambiguous language, and shared mental models, designed with legible fonts, symbols, and colours to avoid misconceptions. Additionally, they had a high paper and print quality to show participants the gravity of their contribution. They were distributed among a non-Dutch-speaking group of cross-border migrants in South Limburg. Initially, the booklet should have been filled over 2-3 weeks by the participants themselves, however, considering the language diversity of the participants and their unfamiliarity with their living neighbourhood, they had been filled in two workshop sessions with the help of supervisors.

Table 1. Booklet activities' categories, functions, and objectives

	Category	Function	Objective
Activity [1]	Open-ended-question	Documentation and Inspiration	Giving a personal account on participant's free time
Activity [2]	Journey Map	Documentation	Understanding participant's daily routine to assess the number of paid/free activities
Activity [3]	Social Contact	Documentation	Evaluating participant's social integration status/progress
Activity [4]	Open-ended-question	Documentation	Mapping the most visited neighbourhoods by participants to understand their socio-spatial dynamics
Activity [5]	Association Task	Documentation and Inspiration	Understanding participants attitude on different topics related to poverty and debt
Activity [6]	Open-ended-question	Documentation and Inspiration	Finding critical daily moments in which participant's relationship with money

The outcome of the first round guided our revision decisions by being more aware of the language barriers and improving map readability, and task clarity. The second study round is planned with a Dutch-speaking group in a community garden in Heerlen. We expect this target group to have less difficulty using the assignment booklets and maps due to language proficiency and familiarity with the area. However, a workshop will precede the study round to prepare the participants for using the cultural probes.

Finally, a comparative study of the two rounds will take place to refine the design decisions and their effectiveness in subjectively engaging participants in the research process, and whether cultural probes can offer new insights that that diverge from generic responses in conventional qualitative methods that bear added value in the ULL environment.

Research Future

The future steps of this research project are focused on the effective integration of cultural probes in ULL environment. To maintain societal engagement within ULLs, it is essential for stakeholders to actively make meaningful contributions over prolonged periods. This involvement is particularly critical when addressing complex social and urban issues such as poverty and debt. Cultural probes are promising tools that extend beyond appropriated "scientific" methodologies. They serve as instruments for storytelling using participants perspective on social and urban topics (Thoring, Luippold, & Mueller, 2013; Gaver, Boucher, Pennington, & Walker, 2004), thereby creating more opportunities for participation, especially for voices that are often less heard within collaboration eco-systems of ULLs.

As previously mentioned, the findings from this research will be instrumental in developing support strategies to address poverty and debt. Furthermore, these findings will also be utilized to create social guidelines for the responsible use and development of digital tools, including artificial intelligence, in sensitive settings. The researchers believe that cultural probes, as a methodological tool, can offer valuable insights that help mitigate the biases present in current language models used by public stakeholders, such as governments. This approach aims to promote a more inclusive digitalization of the built environment by ensuring that the voices and experiences of diverse communities are considered in the development and implementation of digital technologies.

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Innovation Presentation Outline

Spaces of contestation: the role of Living Labs in uncovering systemic inequalities

Authors

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Abstract

Scholars and legislators alike underline the importance of actively involving citizens in the energy transition. The shift towards a low carbon energy sector, however, does not ensure that the new system will be equitable and just. The inter- and transdisciplinary research project MEnergy - My energy transition develops innovative communication formats to promote the participation of people in the energy transition in Living Lab settings with different stakeholder groups. In this endeavor, it emerges how specific groups of people are excluded from materially contributing to the transformation of the energy sector. The aim of this presentation is to question the role of Living Labs as spaces in which the presence of different voices and experiences can lead to the emergence of systemic inequalities, and to discuss the responsibilities of these open innovation environments in addressing them when they exceed the scope of the project.

Key words

Energy Transition, Co-creation, Systemic Inequalities, Accessibility, Participation

Introduction

The inter- and transdisciplinary research project MEnergy – My energy transition, aims to collect citizens' perspectives and experiences, including gaps in knowledge, to develop innovative communication formats to inform citizens about the energy transition and its technologies, but more importantly, on what lines of action they can pursue to shape the transformation of the energy sector.

Methods and approaches

The research project is structured in three phases over three years: the first is aimed at understanding how people relate to the energy transition through co-creation workshops. The second phase focuses on designing concepts of communication based on the needs that emerged during the first phase. In the third and last phase, these concepts are developed, tested, and refined through a Living Lab approach in real world settings, such as schools, libraries, open events and even TikTok live streams. The evaluation of the testing sessions happens through participant observation field notes, flashlight questions, raw data collection and analytics, and written surveys compiled by participants.

Outcomes

During the first phase, 9 co-creation workshops were held in various settings, with 38 participants with diverse socio-economic backgrounds. Their experiences, perspectives and prejudices on the energy transition were collected by materialising this tacit knowledge by using cardboard houses, Playmobile props, and a matrix for classifying everyday actions related to energy consumption [1]. One of the outcomes from the co-creation phase was the collection of possible lines of action that were clustered in the category's efficiency, consistency, sufficiency, and multiplication, based on which strategy for sustainable development they fell under [1]. During the second phase of the research project, this collection constituted the base for the development of playful informative material, exploring different energy saving behaviors, efficiency measures to be taken in the household, and the acquisition of renewable energy infrastructure. In the last phase of the project, which is still underway at the time of writing, the informative material was tested in public libraries, schools, events and TikTok live streams following the Living Lab approach. The multiple testing venues made it possible to reach a diverse group of people, where it emerged that the same information and proposed lines of action were received very differently based on the participant's individual background.

For this analysis, it is important to highlight how some people did not feel addressed by the material focusing on renovation measures in buildings or acquiring photovoltaic panels and heat pumps. This feedback emerged mostly from participants coming from more socially disadvantaged backgrounds, who are often excluded from materially participating in the energy transition when it comes to acquiring renewable energy infrastructure or countering energy dispersion in the lived environment [2]. This leaves these people with sufficient measures, which are based on changing personal consumption patterns, a problematic strategy, since it puts the responsibility of the individual consumer, diverting attention from systemic and structural issues. [3] This lack of accessibility systematically excludes people with fewer financial means from taking up an active role in the energy transition.

It becomes crucial to question how these findings - that can transcend the scope of the project from which they emerge - can be addressed, evaluated, and passed on for further research. Under the lens of Agonistic Pluralism as intended by Carl DiSalvo, a Living Lab can thus become a space of political contestation in which the presence of different voices leads to the emergence of deeper inequalities. [4] In this sense, it is important to discuss the responsibility of Living Lab in acting upon emerging issues of injustices, and more specifically, what tools and options are available for addressing them.

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Living Labs for Grand Societal challenges

Wednesday, 25th September 2024

The "Living Lab for Grand Societ(a)l Challenges" session focused on leveraging the Living Lab methodology to address major societal and global challenges, such as climate change, digital inclusion, urbanisation, and health inequities. Participants explored how collaborative, user-centred innovation processes can be used to co-create, test, and implement solutions that respond effectively to these pressing issues.

This session showcased real-world examples where Living Labs have successfully engaged citizens, stakeholders, and public and private entities to drive impactful and sustainable outcomes. It fostered a space for exchanging ideas, best practices, and methodologies, providing valuable insights for participants who are interested in harnessing Living Labs as a tool for societal transformation.

Innovation Presentation Outline

Global Social Challenges and Local Responses: International Cooperation in Higher Education through Living Labs

Author

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Abstract

In the face of great societal challenges, the Institute for Poverty Alleviation, and International Development (IPAID), Yonsei University, South Korea started in 2022 a living lab-based cross-national/regional research project in the context of higher education. While this government-funded research project is ongoing, some emerging research outcomes have important implications in two respects. First, it shows how living labs can be an innovative pedagogic practice in higher education by allowing students to better understand and respond to global (social) issues and learn how other students in diverse local contexts approach social issues differently and at the same time similarly. Second, it offers various avenues for further international cooperation in education.

Key words

Living labs, Global Social Challenges, Pedagogy, International Education Cooperation, Civic-Minded Citizens

Grand Societal Challenges and Higher Education

Due to the immense societal challenges that humanity currently faces from climate change to demographic changes, we are forced to overcome our passivity and find alternative ways of dealing with these issues. Education is not an exception in this regard. Particularly, nurturing students to develop the ability to confront and meet societal challenges is increasingly important. Living labs can be innovatively adapted to higher education for this purpose (Shin & Cho 2023, Ch. 4). By learning by doing, in other words, by being involved in identifying local problems, investigating their causes and backgrounds as well as their connection with globality, understanding their wider implications, and designing solutions in cooperation with other students, often with the help of experts, students can strengthen their ability to become responsible and civic-minded citizens.

Bringing Living Labs to the Classroom

IPAID launched a research project in 2022 aiming to apply living labs to higher education to develop an innovative international pedagogic model. Living labs-based courses involve four different stages: first, the students identify local problems; second, they investigate why and how the problems they identify are important; third, they study further as a team the causes and backgrounds of the problems; fourth, they seek and design potential solutions to the problems. At the end of the semester, the students present their work as video recordings. These recordings are shared between partner universities. These processes have been run in parallel with partner universities - universities in South Korea, Vietnam, Indonesia, the Philippines, the USA, and Rwanda have run living lab-based classes. Pre- and post-surveys and semi-structured interviews with the students and educators were conducted to assess the transformative impact of living lab-based courses and draw on implications for international educational cooperation.

Results/Outcomes

Pre- and post-surveys and in-depth interviews were done with students to assess the pedagogic impacts of living lab-based courses. Emerging research outcomes suggest that most students stated that they developed a deeper understanding not only of their own priorities but also of what others in other national contexts think of as important social problems, and what solutions they come up with (Lee 2024; Shin & Lee 2024). Also, the students from different countries commonly addressed environmental issues and have shown their common endeavors to produce solutions that can help income opportunities of the local community at the same time. Furthermore, the results of semi-structured interviews suggest that they have become more interested in social and environmental issues around them (Shin & Lee 2024).

Significance and Key Messages

IPAID's research project and emerging outcomes demonstrate living labs' significant pedagogic effects, which can be translated into nurturing independent and actively engaged civic-minded citizens that are crucial to meet global societal challenges in the longer term. This shows that living labs are an effective tool to enhance teaching quality and develop a new international pedagogic model.

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Research-In-Progress Paper

Living Lab approaches in the energy transition and decarbonization context: overcoming barriers and seizing opportunities for sustainable innovation in the construction sector

Authors

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Abstract

In the context of the energy transition and industry decarbonization, the construction field has a big part to play. With over one third of global greenhouse gas emissions, it is urgent that this sector gets its current practices to evolve. Facing increasingly complex problems related to changing norms and regulations, material shortage, massive renovation needs, slow innovation integration and a very vast panel of stakeholders, the building sector needs methods and tools to manage and overcome these challenges. Living Lab approaches can be very effective at tackling such "wicked problems", but are currently underused in this specific field. The aim of this research is to find the barriers that hinder the use of these techniques, and which are the opportunities to be seized. Based on literature and field research (both on the academic and partner sides), a tailored support tool will be developed to help researchers successfully run projects using Living Lab methods and tools. This project aims to foster the use of Living Lab approaches and help reach greater sustainability and relevance of future projects in the built environment, all while guaranteeing a good life quality for the inhabitants.

Key words

Living Lab approaches, Construction sector, Multidisciplinary collaboration, Energy transition, Decarbonization

Introduction

In the context of the energy transition, academics, cities, and public administrations seem to have a growing interest in Living Labs. They have been popping up all over the world since the early 2000's with a noticeable increase taking place after 2015 [Schuurman & Leminen, 2021]. Despite their popularity, Living Labs face a number of challenges and their impact is still difficult to evaluate. Most of the existing assessment methods and frameworks focus on the functioning of the Living Lab itself and not on its wider impact [Bouwma et al., 2022]. As relevant research is currently done on the impact evaluation side, this paper aims to focus on the barriers and opportunities encountered by Living Lab approaches in the construction sector [Molinari et al., 2023]. With 37% of the global greenhouse gas emissions [United Nations Environment Programme, 2023] this specific field is a key player in the energy transition. The construction sector has its own specificities and constraints. It is strongly regulated by norms and standards, the acceptance and generalisation of innovation tend to be slow, it is a very cost driven and liberal market and is home to a large diversity of stakeholders. To significantly contribute to the Sustainable Development Goals in the fields of "Industry, innovation and infrastructures," "Sustainable cities and communities" but also "Good health and well-being" and "Affordable and clean energy" among others, the building actors must collaborate more effectively [Femenias & Hagbert, 2013]. Living Lab methodologies and tools can be very effective to address such "wicked problems" but are currently under exploited in this area [Malakhatka et al. 2021]. This research's goal is to assess the readiness of the construction field and the barriers and opportunities to be seized for the integration and use of Living Lab approaches. The level of awareness and skills of the scientists running Living Labs or projects using Living Lab approaches will also be studied. Recommendations and support tools or systems will be developed and tested.

Context

Located in Switzerland, the Smart Living Lab (SLL) is a research and development centre for the future of the built environment aiming to achieve energy efficiency, digital transformation, and well-being for its occupants. Interdisciplinary research projects are pursued with experiments carried out in real-life conditions. The SLL brings together the combined expertise of the Swiss Federal Institute of Technology Lausanne (EPFL), the School of Engineering and Architecture of Fribourg (HEIA-FR), and the University of Fribourg (UNIFR). The SLL has been housed on the Bluefactory site in Fribourg since 2014.

Starting construction in 2025, the future SLL building will not only house SLL staff, but it will also fully serve as a research infrastructure. Flexible, adaptable, and always at the cutting edge of innovation, it will be used to carry out experiments under real-life conditions. The building is an example of collaborative design in defiance of current standards and blockages with the aim of achieving the 2050 neutral carbon targets. The support process, as well as the future exploitation are run by an interdisciplinary group called BUILD with a hybrid mission set between research and operational practice.

Within the framework of the SWICE research project (Sustainable Well-being for the Individual and the Collectivity in the Energy transition) funded by the Swiss Federal Office for Energy (SFOE), researchers as well as economic and institutional actors teamed up with the SLL to join forces and advance current practices in the world of building and urban planning. In parallel to fundamental research being carried in SWICE, pilot and demonstration projects are particularly interesting for the application of the Living Lab approaches including co-creation involving multiple stakeholders (quadruple-helix concept) [Kristiaan et al. 2023].

In the SLL context, researchers regularly lead complex projects with multiple stakeholders including other academic institutions, start-ups and private companies, energy suppliers, professional associations, cities, and public administrations as well as citizens (Figure 1). The projects run over several years, which increases the challenge of keeping everyone involved as well as maintaining a tangible common goal. The construction sector is particularly prone to 'lock-in' with many strong barriers hindering the market uptake of sustainable innovations [Andersson & Rahe, 2017]. Researchers often face a certain inertia and lack of risk taking in this field and end users are rarely or only punctually integrated in the processes, which creates gaps between what is built and what is needed.

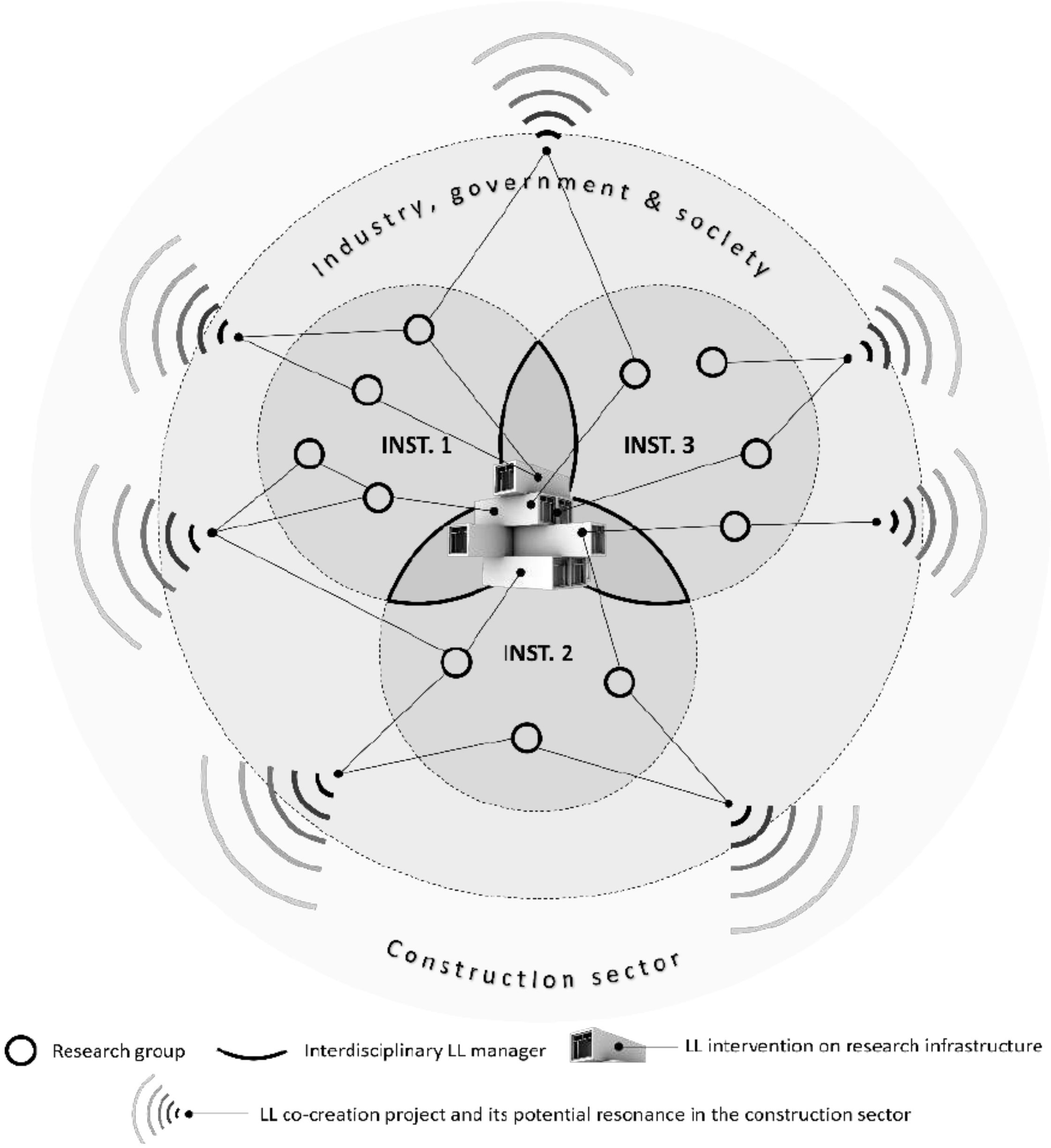

Figure 1. Schematic representation of the organization surrounding the Smart Living Lab's intervention, illustrating the multiple objectives and research groups involved. The diagram highlights the interfaces between various activities and the resonance, or technology transfer, to the construction sector.

Methodology

Two research questions were defined for this work:

- What are the socio-cultural aspects and specificities of the construction sector that constitute opportunities or obstacles for the use of Living Lab methodologies in the context of a transition towards sustainability?
- What are the needs of the different actors for a successful use and implementation of these methods and tools in their projects?

To answer these questions, a literature review and in-depth field research are being conducted. Using a design thinking approach, researchers of the SLL, mostly professors and PhD candidates of the HEIA-FR, were interviewed during the Spring 2024 to define their level of confidence and expertise regarding Living Lab approaches. Collected qualitative data includes auto evaluation of scientists' maturity regarding Living Lab methodologies, the frequency and type of projects in which these methods are used, the challenges and opportunities encountered, as well as the needed support to use these techniques more effectively in the research projects.

External partners and stakeholders, either recommended by researchers or part of the SLL ecosystem, are being interviewed in the second phase of this research that runs from June to August 2024. The aim of these interviews is to gather information about the readiness of the building sector to embrace Living Lab approaches, define the barriers and opportunities seen by the actors of the sector and evaluate how to increase awareness and leverage their capacity to integrate these approaches.

1st findings and next steps

During the first series of bilateral interviews a considerably uneven level of knowledge and awareness about Living Lab approaches can be noticed. Some researchers, mostly active in the mobility and urbanism fields, have a marked user centered and in real life approach, but rarely apply co-creation in their practice. Others, mostly engineers (civil, IT and mechanical) but also architects, are less familiar with the Living Lab concepts. A keen interest is shown towards the effective management of a wide range of stakeholders. The question of a greater impact and a better acceptation of the final solution is also regularly put on the forefront. On the other hand, elements like replicability, knowledge transfer, stakeholder selection, data management, communication and legal aspects are mentioned as challenges. Very few researchers seem to notice that even though lots of stakeholders are involved in their projects, co-creation is often missing. Even the most experimented scientists admit their lack of practical tools when it comes to creating and running co-creation workshops. Managing expectations and conflicts or information retention during workshops also tend to worry. Furthermore, it was mentioned that co-creation could put the research question and mission in peril. Users or other stakeholders might make the project evolve in a direction not the one intended by the researchers, challenging the project in terms of purpose, content, schedule, or financing. The projects run at the SLL are generally initiated by researchers, based on their knowledge of the field and informal exchanges with partners. It is rare that an in-depth need analysis is carried out in the field before defining project objectives and deliverables. This tends to bias the co-creation phase. Another element that can lead to a bias during the project is the researcher's double role. They tend to be both field experts and Living Lab managers, which can become difficult in certain situations.

During the Summer 2024, further interviews will be conducted with construction companies, investment funds, public administrations, and municipalities as well as professional association representatives to have a full picture of the barriers and opportunities faced by the construction sector when tackling sustainability questions while considering the use of Living Lab methods.

After completing the literature review and interviews, an environmental analysis will be conducted. This will highlight the areas of development with a strong potential and where Living Lab methods are most suitable and impactful. This will lead to the development of a ‘support prototype’ during the Fall 2024. The main goal of this prototype is to assist the researchers in effectively implementing Living Lab methodologies in their projects. This will add value, increase their research's effect, and generate more benefits for society. The prototype will be tested through iteration and regular feedback collected to reach an effective tool useful in practice. Depending on the needs gathered during the interviews, this prototype may take the form of an introduction workshop, recommendations, a coaching program, and/or a toolbox.

Conclusion

This research aims to determine how ready the construction sector is to embrace Living Lab approaches. Are these methods relevant in this context? Who are the key players who can insufflate such ideas? How can researchers or Living Lab managers trigger them? What do researchers need to be more confident in leading Living Labs? Those are the questions answered in the following steps of this research.

By focusing on a very specific market segment; the regional construction and real estate ecosystem in the energy transition context, this research activates an entire network. Interviewing a multitude of stakeholders, meeting them in their reality is already acting on the system and accelerating the intake of innovation.

Although some biases are to be taken into consideration, like the interviewee selection, which are for most part members of the SLL network, this research also opens new potential research questions. Who are the key actors in the construction sector who can make the change happen and reach the energy transition objectives? How do the governance and validation processes influence the end results in this specific area? How great is the distance between society, power, and money?

Once the external stakeholders interviewed and their interest and influence mapped out, recommendations will be emitted on where Living Lab methods are most valuable and appropriate.

It is essential to define who in the construction field has the highest interest in using Living Lab approaches and for which reasons. Only then will it be clear how to activate and work with them. Understanding the benefits seen through the eyes of these key stakeholders will define the type of implication but also the support needed by the researchers.

By trying to understand both sides: the specificities of the construction field as well as the needs of the researchers, this project aims to better define the opportunities for the use of Living Lab approaches in the decarbonization context and help reach a greater sustainability and relevance of future projects in the build environment.

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Research-In-Progress Paper

Living labs for socio-technical innovation: co-designing practical solutions for sustainable water management and pollution reduction

Authors

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Abstract

Water scarcity and pollution are critical global challenges, especially pronounced in Mediterranean coastal regions due to overexploitation and pollution. Conventional management approaches have often fallen short, highlighting the need for innovative, collaborative strategies. Living labs, as transdisciplinary research, and open innovation ecosystems, show promise in co-creating sustainable water management solutions. This paper presents empirical evidence from a rural living lab initiative focusing on sustainable water management. Drawing on two PRIMA-funded projects, the study showcases how living labs can foster social learning and co-design of technical and governance innovation in socio-ecological systems. Results show that, through stakeholder engagement and participatory workshops, the living lab facilitated multi-stakeholder collaboration and the co-design of tailored practical solutions for sustainable water management and pollution reduction. However, challenges in the governance and long-term sustainability of the living lab persist, emphasising the need for continued research on the topic.

Keywords

Living labs, sustainable water management, innovative governance, co-creation, socio-ecological systems, community-based approach

Introduction

The Mediterranean region faces significant water challenges driven by rapid population growth, urbanisation, industrial and agricultural expansion, and the impacts of climate change (MedECC, 2020). Coastal areas are particularly affected, with overexploitation, salinisation, and pollution threatening ecosystems and communities. Systemic, multi-actor approaches are essential to ensure sustainable water use and resilience against future uncertainties (Benson et al., 2020; Ison et al., 2011).

Living labs have emerged as a promising approach for promoting collaborative, transdisciplinary research that not only advances academic knowledge but also delivers societal impact (Water Europe, 2023; European Commission, 2024). A growing body of literature is highlighting their potential for facilitating co-production and open innovation ecosystems for sustainable water management (Bouma et al., 2022; Brils and Maring, 2023; Moreira et al., 2022). However, gaps remain in the conceptualisation and operationalisation of living labs. Ceseracciu et al. (2023) highlight a semantic stretch leading to conceptual and methodological confusion, while Hossain et al. (2019) identify key shortcomings in living lab implementation, including complex governance, difficult user recruitment, and time and scalability constraints. Moreover, evidence of living labs' impacts remains limited (Ballon et al., 2018; Black et al., 2023), with a focus primarily on technical outcomes and insufficient attention to conflict and power dynamics (Alamanos et al., 2022). The literature also tends to concentrate on urban settings, with rural applications being relatively underexplored and presenting unique challenges (Potter et al., 2022; Trivellas et al., 2023).

This study contributes to addressing these gaps by presenting empirical evidence from a rural living lab developed within the broader context of two consecutive PRIMA-funded projects: Sustain-COAST (https://www.sustain-coast.tuc.gr) and OurMED (https://www.ourmed.eu/). It explores how living labs can create new social learning spaces for co-designing innovative technical solutions and fostering collective governance while addressing both technical and socio-cultural dimensions, thus enhancing the understanding of living labs in diverse socio-ecological systems.

Methodology

The case study area

The Arborea Plain (Sardinia, Italy) was transformed from a malaria-infested swamp into a major agricultural hub through extensive land reclamation in the early 20th century. Managed by a cooperative system comprising over 200 dairy farms across 5,000 hectares, the plain is surrounded by Ramsar Convention-protected marsh wetlands. Arborea faces critical sustainability issues in water resource management, particularly groundwater nitrate pollution and phosphorus-induced eutrophication in surrounding wetlands, largely due to intensive farming practices. In 2005, the area was designated a "Nitrate Vulnerable Zone" (NVZ) following the EU Nitrate Directive. Despite ongoing compliance efforts, nitrate levels persistently exceed the recommended limit of 50 mg L-1 (Ghiglieri et al., 2016). The region is also grappling with significant demographic and generational shifts in agriculture, balancing economic growth with environmental conservation.

The living lab approach

The living lab was developed as a community-based co-researching initiative (Wibeck et al., 2022). It serves both as a dynamic long-lasting space for social learning and open innovation ("living"), and as a set of experimental sites for co-designing field experiments through stakeholder engagement and modelling exercises ("laboratory"). The approach integrates local knowledge with techno-scientific expertise (Allain et al., 2020; Curry and Kirwan, 2014) to develop tailored socio-technical solutions while mediating socio-environmental conflicts and promoting collective governance (Figure 1).

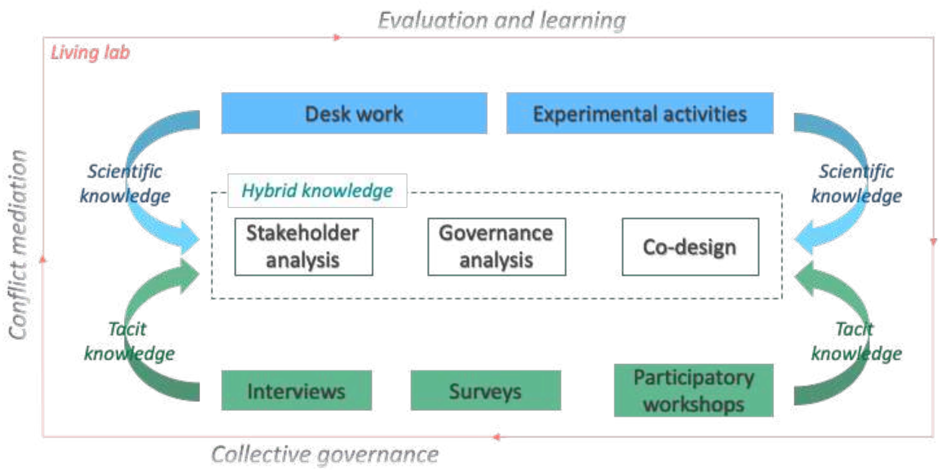

Figure 1. Conceptual design for the living lab approach

Stakeholder and governance analysis

The stakeholder mapping and governance analysis were conducted through desk review and semi-structured interviews. Special attention was given to traditionally marginalised stakeholders like the elderly, women, and youth. This analysis informed participant selection for subsequent workshops.

Participatory workshops

Participatory workshops were designed to foster multi-stakeholder collaboration, align priorities, and co-create solutions for nitrate pollution and other water challenges. The latest workshop, held in Arborea in April 2024, involved diverse stakeholders including water agencies, local authorities, farmer and fisherman cooperatives, and research institutions. Before the workshop, participants completed a survey to map ongoing initiatives related to sustainable water management and pollution mitigation. This was pivotal for gaining a comprehensive understanding of the current efforts and potential areas of alignment and collaboration. Prior to the workshop, participants completed a survey to map ongoing initiatives related to sustainable water management and pollution mitigation. During the workshop, a collaborative digital mind map was created using Miro's mind mapmaker (https://miro.com/mind-map/), facilitating structured capture of stakeholder ideas. A facilitator guided discussions on sustainable pathways to address water quality issues, focusing on nitrate pollution.

Results

During the workshop, approximately 30 ongoing or recent initiatives in the NVZ were mapped, engaging over 50 stakeholders from private and public organisations. This revealed the extensive resources dedicated to these efforts and underscored the need to reduce fragmentation through improved collaboration, aiming to enhance water resource quality. Stakeholders actively participated, providing diverse perspectives and local insights. Stakeholders contributed diverse perspectives and local insights, leading to key outputs such as stakeholder maps (Figure 2), collaborative mind maps (Figure 3), and a draft roadmap for sustainable nitrate pollution solutions.

Conflicting visions about needs and priorities emerged, revealing both apparent and latent conflicts among stakeholders. A significant divergence was observed between environmental agencies, which were concerned with water pollution and potential European Commission sanctions for non-compliance, and local cooperatives focused on the crisis in dairy farming due to generational turnover issues and substantial investments. A Dairy Cooperative representative remarked, "*Nitrate pollution is being resolved by driving the abandonment of agriculture*," pointing out the unprecedented rate of livestock farm closures and the potential loss of over half the cooperative farms in the coming years. These diverging visions impact the prioritisation of actions.

The living lab has facilitated new spaces for dialogue between stakeholders, integrating socio-technical discussions with visionary conversations about the future of the rural community. This approach is fostering learning and raising awareness of the complexities involved. As a public administrator noted, "*The water district agency is probably learning that things are far more complex than just applying an EU directive*."

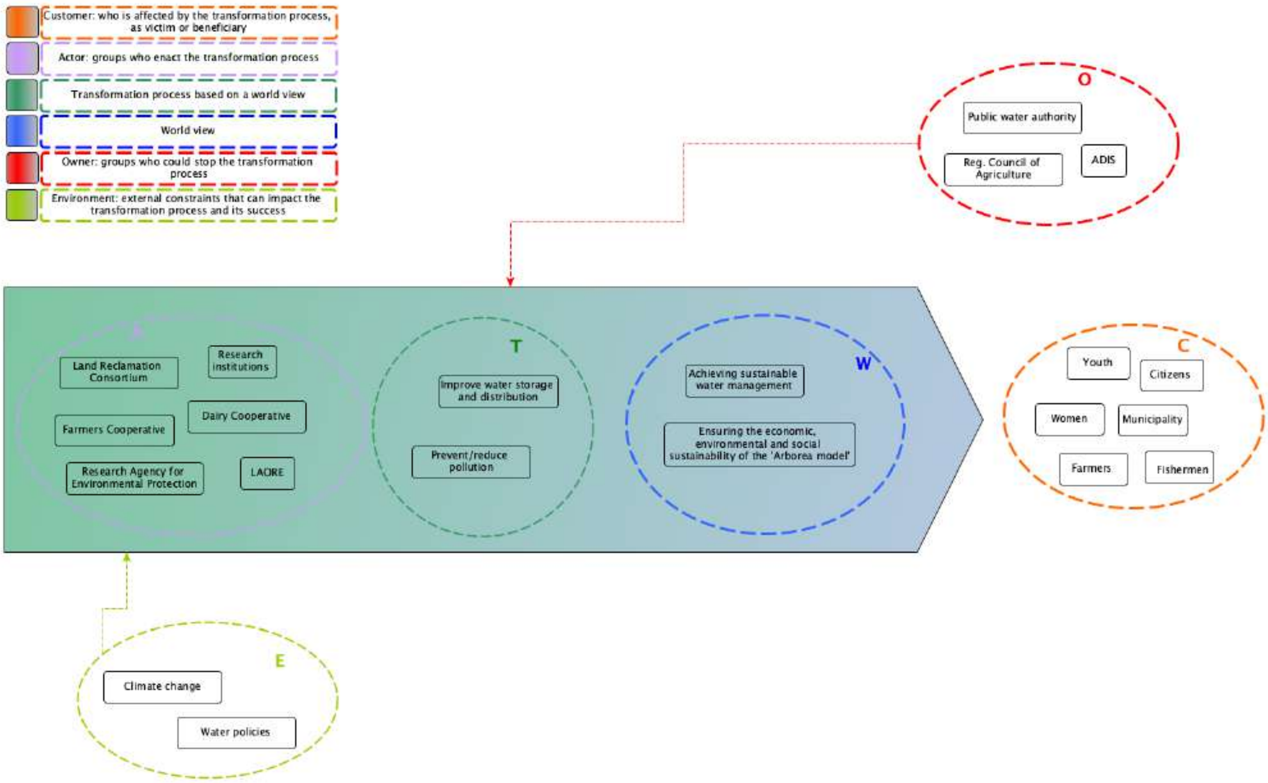

Figure 2. Stakeholder map based on the CATWOE framework (Checkland & Scholes, 1990)

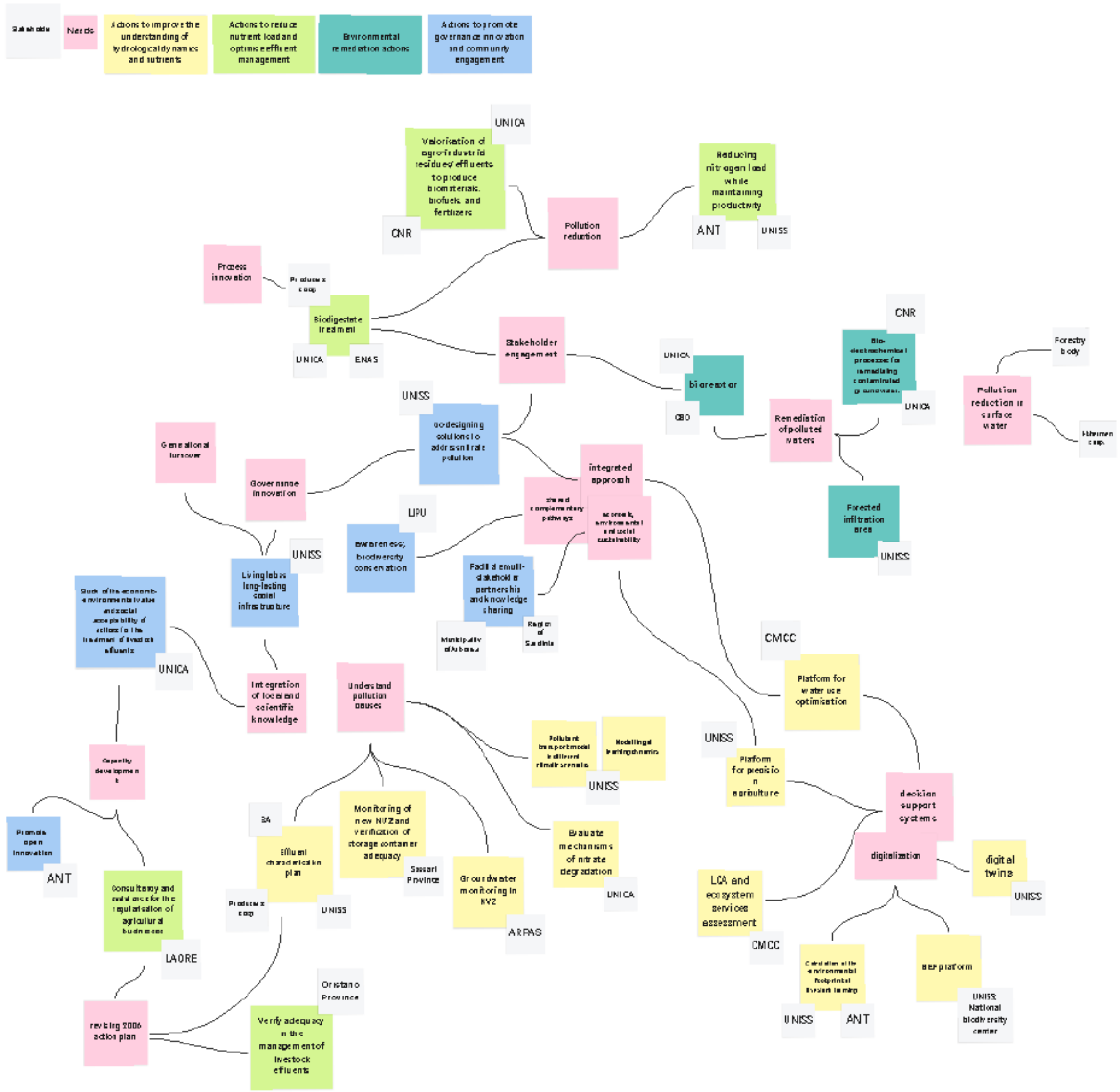

Figure 3. Collaborative mind map

The proactive participation of stakeholders in the co-design process was critical. Their collective input helped identify and test various options for mitigating nitrate pollution, which were clustered into four groups:

1. Initiatives and studies aimed at better understanding hydrological and nutrient dynamics at district and farm scales: soil infiltration assessments, hydrogeological models, and coastal forest management.
2. "Upstream" actions to reduce nutrient loads and optimise effluents storage and management, such as ammonia stripping from animal effluents, struvite crystallisation from the liquid fraction of effluent bio-digestates and enhancing animal diet efficiency.

3. "Downstream" environmental remediation actions to remove nitrates from groundwater, including forest infiltration areas, anaerobic bioreactors, and thermochemical treatments.
4. Actions aimed at promoting collective governance, community activation, and community awareness.

Discussion

Our research highlights the significant role of living labs in co-designing technical and governance solutions with stakeholders, resulting in more efficient and tailored interventions. By integrating stakeholder priorities and constraints into the process, living labs adhere to the principles of co-creation and social learning (Ison et al., 2015; Mauser et al., 2013; Wibeck et al., 2022), providing fresh perspectives for examining environmental issues and uncovering innovative solutions. These social learning environments within living labs allow stakeholders to deconstruct issues and co-design solutions that combine scientific and local knowledge.

Our study reveals that living labs provide a forum for open dialogue and compromise, resulting in a comprehensive strategy for managing water resources. The diversity of perspectives enhanced the process, ensuring the proposed solutions were technically sound and socially appropriate. Additionally, clustering the solutions into diagnostic, upstream, downstream, and governance actions demonstrated a holistic approach to dealing with nitrate pollution, considering both preventive and mitigating measures. This strategy also underscores the significance of integrating socio-economic factors into water management.

By embedding scientific research with real-world contexts, the proposed approach aligns with the principles of adaptive management emphasising flexibility and learning (Pahl-Wostl, 2008). The co-researching approach fostered a bottom-up demand for continued collaboration between the local and scientific communities, which is crucial for sustaining the living lab beyond the project's duration. This echoes findings from the scientific literature that call for a deeper understanding of participation and recognition of stakeholder agency and power (Collins and Ison, 2009; Hermesse et al., 2014). Our research thus adds to the existing body of knowledge by providing empirical evidence of the practical application of these principles.

Although the living lab approach has shown promise, several methodological and practical challenges were encountered. Ensuring long-term commitment from stakeholders was a significant challenge. Our findings indicate that a high sense of urgency among stakeholders is crucial for developing a shared purpose and increasing their willingness to participate, which aligns with previous research on the topic (Potters et al., 2022). Additionally, evidence suggested that engaging marginalized groups is critical for capturing a wide range of insights and ensuring inclusivity, although it requires targeted efforts and tailored engagement strategies. Awareness-raising actions that engage younger generations are critical to ensuring the development of rural communities and aligning social, economic, and environmental dimensions of sustainability.

Moreover, challenges remain in overcoming silo approaches and ensuring that ecological and social process dynamics are monitored as structurally coupled. Our results indicate that technological solutions alone might be ineffective if socio-cultural and economic contextual factors are not considered. This aligns with integrated frameworks for addressing socio-ecological systems, which emphasize a holistic approach that considers both ecological and social components (Folke et al., 2005; Ostrom, 2009).

Living lab governance also posed challenges. While it was recognised by participants that the living lab facilitated a shared understanding of priorities and needs as well as the co-design of actionable pathways to address water quality concerns, ambiguity remained regarding who should take long-term responsibility for facilitating the living laboratory process. The literature emphasises the need for clear governance structures and dedicated facilitators to sustain living laboratory initiatives (Hossain et al., 2019; Potters et al., 2022). Without a designated entity to oversee and coordinate efforts, the risk of fragmentation and inefficiency increases, undermining the potential benefits of collaborative approaches. Moreover, we argue that transparent communication channels and conflict resolution mechanisms are necessary to ensure the process does not exacerbate existing biases and power asymmetries (Marshall et al., 2018).

Conclusions

The Arborea living lab exemplifies the potential of living labs in creating new social learning spaces for co-designing socio-technical innovation in rural socio-ecological systems. Beyond supporting the notion that living labs can facilitate the co-creation of solutions that are technically and socially robust, this contributes to the scientific discourse on living labs by broadening their conceptual and practical applications to rural contexts. Moreover, it highlights the need for a nuanced understanding of power dynamics and governance challenges within living labs, addressing a gap in the existing literature.

The findings have wider implications for similar socio-ecological systems. However, the scalability of living labs, ensuring their long-term sustainability, and integrating them into formal governance structures remain key areas for further research. Longitudinal studies tracking the outcomes of living labs over extended periods would provide valuable insights into their long-term effectiveness and sustainability.

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Innovation Presentation Outline

Sidi Amor Water Living Lab: A Mediterranean Hub for Sustainable Water Innovation

Authors

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Abstract

The underuse of treated wastewater and limited awareness of water scarcity persist despite the resource's scarcity, largely due to inadequate communication among water stakeholders. To address this, the Sidi Amor Living Lab engages diverse stakeholders in collaborative innovation. Located in Tunisia's Sidi Amor peri-urban region, it tackles social and environmental challenges through multi-stakeholder participation, co-creation and action-research. Its innovation process spans exploration, experimentation, and evaluation phases. Results include improved wastewater management, sustainable agriculture, and ecosystem restoration, alongside community empowerment and policy influence. To enhance its impact, the Living Lab aims to join the ENoLL Network.

Key words

Wastewater Reuse, ecosystem restoration and climate change, Sustainable Water Management, Living Lab

The main problem statement(s)

The underuse of treated wastewater (TWW) and the lack of awareness of water scarcity, despite severe water shortages, is primarily due to a significant lack of communication among stakeholders. Additionally, the quality of the TWW provided by sewage treatment plants in Tunisia is too poor for agricultural use.

As a result, state incentive policies are not applied, and the results of scientific research, although favorable, are neither put into practice nor valued.

This issue could be resolved by establishing an integrative structure. This Water living laboratory would enable effective collaboration among various stakeholders, increase awareness, and facilitate the implementation of policies while optimizing the results of scientific research.

Methods/approach used

The GDA Sidi Amor, exemplifies these challenges of wastewater underuse. The local wastewater treatment plant provides only secondary treatment, resulting in medium-quality water that requires additional tertiary treatment. As a result, farmers are reluctant to use this water for irrigation, leading to its discharge into the Raoued Sea.

Since 2014, the Water Living Lab, part of GDA, has used a methodology to tackle challenges through projects focused on the tertiary treatment and reuse of TWW. Key characteristics include multi-stakeholder participation. Co-creation is central, with regular meetings, brainstorming, and workshops for collaborative innovation. The lab emphasizes real-life settings, ensuring that solutions are implemented and tested in real-world contexts. Active user engagement is crucial, involving users throughout the process. A multi-method approach, incorporating action research, agile, and design thinking, is utilized. The lab also focuses on technology-enhanced water education, fostering the sharing of creative skills and valuing farmers' knowledge.

The innovation development follows three main phases: Exploration, Experimentation, and Evaluation.

Results/Outcomes

The key results are summarized below:

1. **The Sidi Amor TWW Reuse Pilot** (see figure 1) plays a crucial role in cleaning up the Raoued Sea, providing water for farming and restoring ecosystems. It includes:

- A tertiary treatment plant (520 m^3/day)
- Pumping station (3 m^3/s capacity) and irrigation system
- Nanofiltration and reverse osmosis desalination system
- Aquaponic system
- Constructed wetland
- Water quality control laboratory
- Training center
- Demonstration agricultural plots (7.5 ha)

2. **Stakeholder Cluster:** A diverse network that (see figure 2):

- Advances coordination for TWW reuse;
- Promotes research-action;
- Empowers local communities;
- Inspires entrepreneurship and influences policies for Tunisia's Water Reuse.

3. **Training sessions** for better awareness, enhanced skills and Nurturing of entrepreneurial initiatives (See figure 3).

Sidi Amor wastewater reuse pilot basin

Water Quality Control Laboratory

Training center

Nanofiltration and reverse osmosis desalination system

constructed wetland

Aquaponic system

Ecoflo biofilter for domestic wastewater treatment

UV wastewater treatment system

ONAS wastewater treatment plant

Figure 6. Sidi Amor Innovative Pilot Platform for wastewater treatment and reuse

Figure 7. Sidi Amor Water LIVING LAB Stakeholders

Figure 3. Wastewater treatment and reuse training sessions

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Innovation Presentation Outline

THETIDA – Living Labs for inclusive and innovative climate risk monitoring of cultural heritage

Authors

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Abstract

The THETIDA Horizon Europe project addresses the pressing need to protect coastal and underwater cultural heritage from the threats of climate change. It aims to develop and validate an integrated risk assessment and protection system through participatory processes. This paper delves into the transformative potential of Living Labs that serve as multi-stakeholder platforms to engage stakeholders and citizens in data collection and decision-making processes while placing sociocultural values in the core of risk monitoring. The THETIDA Living Lab (LL) methodology is being implemented in seven pilot sites across diverse European climates, revealing challenges in stakeholder engagement and the testing of a crowdsourcing mobile application. The study emphasizes the importance of inclusive decision-making and adaptation strategies, facilitated by a toolkit of tested methods adaptable to local contexts. Through training workshops and stakeholder feedback derived during the LL dialogues, this research contributes to understanding climate impacts on heritage and informs inclusive and sustainable multi-hazard and risk monitoring practices.

Key words

Climate change, risk monitoring, coastal heritage, underwater heritage, Living Lab, crowdsourcing

Outline

Climate change can pose serious threats to people's livelihoods, connected communities, and cultural heritage. Heritage embodies tangible (i.e., historic sites, cities, and landscapes) and intangible (i.e., cultural practices, traditions, and local knowledge) assets to which communities attach value and meaning to, and that are vulnerable to the impacts of climate change (1). Stakeholder and citizen engagement in multi-hazard and risk monitoring, preparedness, and management efforts is essential for identifying and mitigating such threats, as well as fostering inclusive and sustainable adaptation measures to protect and preserve heritage sites (2, 3).

The THETIDA Horizon Europe project aims to develop, test and validate an integrated multiple heritage risk assessment and protection system for underwater and coastal heritage sites across Europe with evidence-based monitoring frameworks, innovative tools and through participatory and crowdsourcing processes (4). This research aims to harness the full potential of Living Labs that function as multi-stakeholder platforms bringing together scientists, citizens and other relevant stakeholders in co-design and co-creation processes to engage them in data collection through crowdsourcing and to include their diverse views, reflections and priorities concerning heritage for multi-hazard and risk monitoring.

This paper presents the preliminary results of developing and testing the THETIDA Living Lab (LL) methodology, which has been implemented in seven demonstration sites across distinct European climate zones. The LL dialogues aim at assessing the values and impacts posed to the sites, as well as future scenario making and building roadmaps for inclusive and innovative multi-hazard and climate risk monitoring. A LL toolkit has been developed that compiles different sets of tested methods adaptable to local contexts that have been tested and validated in the demonstration sites. For instance, site excursions and talk shows have been employed in the coastal landscapes of the Markermeer area in the Netherlands that brought together local authorities, experts, and residents together to co-create future scenarios regarding the reinforcement of the existing dikes, the water management systems. Additionally, a novel crowdsourcing tool, an immersive mobile application that exploits Augmented Reality (AR) technology, has also been co-designed, and tested during some LL dialogues (5). For example, the AR visual demonstrating how the Svalbard coal cableway station will be immersed in water due to rapid coastal erosion and sea level rise contributes to raising awareness on this remote heritage site and facilitates discussions concerning its risk monitoring and protection.

Results highlight diverse understandings of climate impacts, challenges and needs to be addressed. Insights and feedback are discussed in terms of strengths and weaknesses that are unique to the site, as well as the LL methods and tools employed. Such exercises are increasingly needed to customize participatory methods adapted to fit integrated multiple hazard assessment tools and strengthen sustainable and inclusive pathways for cultural heritage management (6). Overall, these processes will contribute to better understanding of the complexity of climate impacts on heritage and inform inclusive and sustainable multi-hazard and risk monitoring practices.

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Mixed session

Thursday, 26th September 2024

The Mixed Session was thoughtfully curated to bring together a unique selection of contributions that span multiple conference themes, fostering an environment of cross-disciplinary exploration and enriched dialogue. This session combines work from areas including Grand Societal Challenges, Policies, Governance, Collaboration and Innovation Ecosystems, Inclusive Soci(et)al Engagement, Business and Emerging Technology, and Living Labs Operations, Methods, Tools, and Impact. By intentionally merging these topics, the session is designed to inspire diverse perspectives, encourage meaningful discussions, and uncover synergies that might not emerge within single-themed sessions. The Mixed Session underscores the interconnected role of Living Labs in addressing complex societal issues and strengthens collaboration and knowledge sharing across various fields.

Full Research Paper

Living labs changing the everyday lives of participants: Cognitive, affective, and conative empowerment

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Abstract

Living labs involving consumers help design new products addressing the user needs but also spur personal consequences for participants. The paper analyses living labs focused on co-creation of new food products in the EIT Food RIS Consumer Engagement Labs project, implemented in 14 European countries with 42 consumer teams, 2019-2020. Based on interviews with facilitators and participating consumers, the study provides insights into changes in lives of participants, resulting from the living labs experience, analysed through the lenses of cognitive, affective, and conative empowerment. Conation (a drive towards purposeful, goal-oriented actions) is considered a particularly important trigger for personal changes of living labs participants.

Key words

living lab, co-creation, empowerment, new product development, conative empowerment

Introduction

Living labs offer collaborative opportunities for experimentation and mutual learning, facilitate the creation of new solutions and stimulate social and technological transformations. Analyses of living labs results, consequences and impacts tend to focus on tangible outcomes (incl. products and services designed and implemented), economic benefits (relevant for profit-seeking stakeholders) as well as broader societal or environmental impacts. Little is known about personal consequences of living labs for their participants, and this paper aims to address this important knowledge gap. It analyses the experiences of consumers – participants of food-related living labs. Consumers, seen as experts in their daily lives, can contribute to the creative processes in living labs by exploring their own needs and providing insights into their consumption practices. At the same time, by engaging in living labs, the participants break away from their routines. This challenges social norms and cultural conventions, potentially inducing far-ranging behavioural modifications.

The study aims to address the following research question:

RQ1. How do participants of living labs interpret their behavioural changes following the participation?

RQ2. What manifestations of empowerment could be observed among participants of living labs?

The paper proposes a framework to analyse the personal consequences of living labs reported by individual participants, revolving around the tripartite construct of empowerment.

Literature review

Living labs offer opportunities for creation, sharing and exploitation of knowledge through collective experimentation and learning processes (Voytenko et al., 2016) enclosed in physical or virtual interaction spaces. The labs processes leverage sociotechnical resources, collaboration among stakeholders and ability to replicate key characteristics of the real life context in which innovative products and services are designed, prototyped and implemented (see e.g.: Leminen et al., 2021; ENoLL, 2020), with a view to stimulate social and technical transformations (Evans & Karvonen, 2011, p. 126). Participants leverage their knowledge as “experts in their own daily life” who join the creative process with the intention to “break out of their daily life” (Brons et al., 2022, p. 3) through the deconstruction of their needs and available alternatives, deviation from standard behaviours, design and integration (Scott et al., 2012, p. 286). This opens up opportunities for living labs "reconfiguring everyday practices from the viewpoint of challenging the social norms and cultural conventions" (Laakso et al., 2022, p. 273).

Living labs rely on **co-creation**, interpreted as iterative design of innovations with multiple groups of stakeholders (ENoLL, 2020), who tend to include users (customers) and suppliers (producers). Co-creation is a widely described trend in interactions between a company and its customers that result in ideas, designs or acceptance of products or services (Ramaswamy & Ozcan, 2018). Producers can become more sensitive to the diversity of needs of their users (von Hippel, 2005, p. 33), and benefit from novel and useful product ideas (Kristensson et al., 2002; Poetz & Schreier, 2012; Nishikawa et al., 2013). Some co-creation initiatives are organised in the online environment (see e.g. Bettiga et al., 2018; Chen et al., 2022), but face-to-face interactions in the format of living labs support more in-depth, longer-lasting engagement.

Typical objectives of co-creation include the generation of new ideas and designs, refinement of existing products or services, and creation of entirely new market offerings (Bhalla 2014). Living labs generate new products (Dell'Era et al., 2018) but also intangible innovations (including new knowledge, ideas and concepts) as well as incremental improvements to previously known solutions (Hossain et al. 2019, p. 984-985). Living labs might thus result in new knowledge for product and service development, solutions to everyday problems of users, as well as insights that induce changes in strategies or operations of companies (Compagnucci et al., 2021, p. 5). The innovative results of living labs stimulate the increases in usability, performance, compatibility and influence (Leminen & Westerlund, 2012, p. 47). They ensure a better fit with the needs of users through product innovativeness (Fang, 2008) or better product performance and cost improvements (Hoyer et al., 2010, p. 292). The innovation outcomes could be analysed in terms of their acceptability for users, feasibility for companies, successful adoption, appropriateness to address the identified problem, fidelity to the living lab protocol, implementation cost and subsequent market penetration (Zipfel et al., 2022, p. 3). Looking through the lens of the Responsible Research and Innovation, the outcomes could be contrasted with the core values of ethical acceptability, environmental sustainability and social desirability (Van Geenhuizen, 2019, p. 7), with living labs offering particularly promising potential to address divergent interests and unequal power distribution among stakeholders (Van Geenhuizen, 2019, p. 7). While innovation and development remain the most frequently declared benefits in living labs publications (Paskaleva & Cooper, 2021, p. 6), the evidence of their quantity and quality remains scarce, and critical evaluations are complicated by the vested interests of major stakeholders including sponsors expecting positive publicity (Paskaleva & Cooper, 2021, p. 6).

De Vita and De Vita (2021) offer a systematic overview of measurable outcomes of living labs projects, looking at outcomes related to the innovative results (market acceptance, price acceptability, exposure, product testing and market intelligence) and outcomes linked to the living labs process, methods and interpersonal relations (legitimisation for R&D efforts of companies, testing of new methods and networking among participants).

Of particular interest seem the living labs outcomes derived personally by the labs participants that would go beyond the creation of value for users (development of creative results that address the needs of participants) (Stahlbröst, 2012, p. 63). The experience of co-creation is expected to induce personal transformations (Kristensen, 2009), and the typically identified outcomes are: satisfaction, learning, creative thinking, engagement and empowerment (Martínez-Canas et al., 2016, p. 11). Outcomes of living labs for their participants reported in previous publications include **cognitive benefits**: acquisition of knowledge and better understanding of a subject matter (Veckman & Temmerman, 2021, p. 10), buildup of competences (Haug & Mergel, 2021, p. 13). **Psychological benefits** encompass: the satisfaction resulting from personal experiences (Thomas et al., 2024), hedonic benefits (Lee & Kim, 2018), enhanced self-image and sense of belonging (Bhalla, 2014, p. 24), psychological connection with the thematic area of the process (Teresa & de Matos, 2023, p. 9), empowerment of participants who gain confidence in themselves, realizing they have competences, knowledge and governance structures as a community (Campos & Marín-González, 2023, p. 12) and have successfully demonstrated their ability to contribute towards the creative results and self-reflect (Bouwma et al., 2022, p. 15). This in turn drives the sense of agency (Cohen et al., 2024, p. 329) and the willingness to play active roles as citizens (Veckman & Temmerman, 2021, p. 11). **Social benefits** derived from the participation in living labs are: personal interactions and team dynamics (Magadley & Birdi, 2009), as well as peer networking (Haug & Mergel, 2021, p. 13) and social integration (Lee & Kim, 2018). Finally, previous studies identified also **behavioural changes** in participants' daily practices (Veckman & Temmerman, 2021, p. 11).

Personal consequences of living labs are difficult to explore, owing to methodological challenges: the co-creation processes in living labs are time-constrained, while their consequences are experienced by the former participants after multiple months. In contrast to the above-mentioned publications discussing labs outcomes, the present study offered an unique opportunity to repeatedly engage with the same groups of consumers, who participated in the living labs, and reported the changes they had observed in their lives following the creative endeavour. In this paper, we aim to explore how the experiences of living labs influence the personal lives of participating consumers. The article offers a novel framework to analyse these personal outcomes through the lenses of the **empowerment** of the living labs participants: the process of enhancing one's control over her or his life thanks to increased knowledge, confidence and agency. Empowerment could be analysed on three levels: **cognitive empowerment** (related to the enhanced understanding and knowledge), **affective empowerment** (positive emotional outcomes) and **conative empowerment** (related to behavioural consequences) (Harrison & Waite, 2015, p. 510-512).

The cognitive empowerment is related to acquisition of new knowledge and learning new skills. It might be linked to the collective dimensions of the living labs and the opportunities to learn from peers, enabled by interactions within the labs (it's worth noting that this is a specific feature of co-creation implemented in the format of living labs, but not all reported cases of co-creation document contexts involving team dynamics, as co-creation can also be implemented as online submission of ideas, without face-to-face communication among creatively empowered individuals). Teamwork in the living lab stimulates the emergence of team cognition and shared mental models, with consumers enhancing their reciprocal knowledge, understanding and awareness (Driskell et al., 2018, p. 441).

On the **affective** level, the living labs co-creation deepens the participants' relations with focal products and companies (Sjödin & Krisensson, 2012, p. 197; Atakan et al., 2014, p. 451), but the newly formed attitudes might also extend to product categories in general, e.g. various types of foods. The time investment enhances the personal connection (Mogilner & Aaker, 2009) and the emotional significance of the process (Atakan et al., 2014, p. 451) so that the decision to participate in a living lab can be linked to satisfaction (Vega-Vazques et al., 2013) and affective empowerment.

Positive experiences on the **affective** level, especially when the participants observe surprising results or affirmative reactions of other people (Reis, 1980, p. 237), enhance the participants' self-awareness and self-efficacy: the expectations of one's own ability to cope in specific situations, particularly when faced with obstacles (Bandura, 1977, p. 194). For living labs participants, the **self-efficacy** becomes an important source of empowerment, reinforced through the experiences of successfully mastering specific tasks (Füller et al., 2009, p. 74-75). Of particular relevance appears the creative self-efficacy, which is rooted in the beliefs about one's ability to produce novel outcomes (Tierney & Farmer, 2002; Puente-Díaz, 2016), exercised through opportunities for experiential creation (Dahl & Moreau, 2007, p. 358). Observations of one's own successful performance in living labs co-creation processes would thus fortify the creative self-efficacy.

The self-efficacy could flourish if the co-creation participants enjoy the **individual agency and autonomy** – the ability to decide about directions of their endeavours (Engström & Elg, 2015, p. 513). The importance of autonomy is rooted in the self-determination theory (Ryan & Deci, 2000), which considers it a key innate psychological need, alongside the needs for competence and relatedness, essential for ensuring that the acting individuals can put their competence to adequate uses (Ryan & Deci, 2000, p. 68-70). The autonomous performance of tasks enables living labs participants to experience self-efficacy (Füller et al., 2009, p. 75), and the sense of autonomy may be linked to the possession of specific assets, needed to successfully complete the creative tasks (Zwass, 2010, p. 14). In particular, creative tasks without predefined outcomes offer opportunities to exercise one's autonomy and further result in satisfaction and empowerment (Dahl & Moreau, 2007, p. 360-362).

Self-production reflects one's personality, offers opportunities for self-expression and achievement of emotional satisfaction that extend beyond the co-created outcomes (Atakan et al., 2014, p. 451-452). These benefits link directly to previously discussed dimensions of affective empowerment, as the strengthened self-efficacy brings about broader attitudinal changes. Once participants contribute their own resources, their engagement increases gradually (Jaakkola & Alexander, 2014, p. 255). Participants might also derive personal satisfaction linked to transcendent motives: their sense of stewardship or altruism (Martínez-Canas et al., 2016, p. 8), which could be explained by behavioural patterns widely researched as customer voluntary performance (Bettencourt, 1997; Rosenbaum & Massiah, 2007) or customer citizenship (Groth, 2005).

An interesting aspect of living labs participation, overlooked by previous studies, refers to the **conative empowerment**, which together with the cognitive and affective dimensions (Harrison & Waite, 2015, p. 510-512) forms a **tripartite structure of consequences related to knowledge, emotions and action** (Hilgard, 1980). The **conation** signifies proactive drives towards purposeful or goal-oriented action, with specific behavioural intent. It focuses on conscious and purposeful action, intentionally performed by the individual, which differs from habits and routines, discussed by the theories of practice (Warde, 2014).

Methods and sources

The study analyses the research material collected in the EIT Food RIS Consumer Engagement Labs project, funded by the European Institute of Innovation and Technology based on Horizon 2020 and Horizon Europe programs and coordinated by University of Warsaw. It focuses on food-related living labs, carried out between 2019 and 2020 in 14

European countries, with 42 consumer teams. Each lab followed a similar format, aimed at co-creation of new food products. Besides consumers, labs involved facilitators from a local scientific organisation and a food producer, responsible for development of a resulting product. The creative processes lasted several weeks, with comparable sequences of steps, implemented by facilitators. The techniques enabled participants to explore their preferences and existing products, and unleash their creative potential to develop new product proposals.

The paper is based on qualitative analyses of interviews with: (1) 42 facilitators of labs in 14 countries, conducted 2-12 months after the labs, (2) 12 randomly selected consumers participating in the lab in Poland, conducted 6 months after the co-creation sessions. Both sets of interviews explored personal experiences related to the labs and followed pre-defined scripts with open ended questions, aimed at enticing in-depth discussions. The lab selected for participant interviews engaged older adults, aged 65 or more, ensuring heterogeneity of gender, educational backgrounds, places of residence and patterns of food-related behaviours. Older consumers are influenced by distinctive biological, psychological, social, economic and cultural factors (Giacalone et al., 2016; van der Zanden et al., 2014), but are not typical participants of co-creation or living labs (Lu et al., 2017).

The collected qualitative material was transcribed and coded using QDA Miner software, starting with axial coding using codebook defined by the research team, carried out by two independently working experts (focused on types of consequences and behaviours), and followed by the subsequent more detailed in-vivo coding and exploratory analysis by two co-authors of this paper (looking at inductively identified patterns, informed by the occurrence frequency of selected themes).

Results

Interviews with facilitators

The EIT Food RIS Consumer Engagement Labs methodology differs from the conventional model of co-creation as “work-like” consumer activities under corporate supervision (Dujarier, 2016, p. 555). The creative process of the Consumer Engagement Labs is orchestrated by university scientists, with involvement of consumers and companies representatives (Klincewicz et al., 2023). As actors responsible for stimulating the participants’ motivation (Klincewicz et al., 2024) and managing the teamwork dynamics during the labs process, facilitators have become careful observers of how the methodology impacts the participants’ perception of their own roles and positions in the process. The analysis of interviews with facilitators of 14 labs processes provides

background information about the participants empowerment and **sets the stage for analysing its cognitive, affective, and conative dimensions**.

The facilitators indicated the importance of the elements of living labs methodology that offers **opportunities for acquiring new knowledge.** Especially, **teamwork** triggered the **exchange of ideas and opinions**, as well as **peer learning**: "All of them (participants) said that they learn[ed] about something, that they didn't knew before. Some of them at the end said that they would think about change[ing] something in their everyday nutrition habits. They were, I think, influenced by the others." [F20] The facilitator observes the **interconnection between the cognitive and conative aspects of empowerment** (learning something new and changing everyday nutrition habits).

Of particular value were those elements of labs that required **learning new technologies and skills**. Aa an example, a tool used during some of the sessions was the video conferencing platform Zoom, new to the participants: "I realized throughout the workshop, which is also very obvious, that they were super proud of themselves for being able to use Zoom. It was a different application and it was in English, so they were sort of in showing off to the grandchildren, saying 'Hey, I'm using Zoom now'. Some even showed their grandchildren and said 'My grandchildren just visited me, look, say hi'. And that was a big achievement for most of them. So it was also like unrelated (to the topic of the labs sessions) part, but at the same time we really felt that it really made them happy. We even made a manual for them how to meet afterwards and Zoom." [F22] As observed by the quoted facilitator, learning how to use the app was considered an **achievement and a source of satisfaction**, and contributed to the **affective empowerment**.

Wide range of labs exercises provided **opportunities for experiential creation** and encouraged participants to strengthen their **self-efficacy**. As a facilitator puts it: "Some people, clearly those older people, felt confident in an uncomfortable situation." [F01] Facilitators, knowing the educational and professional background of participants and cooperating with them throughout many hours of the labs process, were able to identify the importance of creative tasks: "In my team I had members that usually have… They don't have a bachelor degree or master degree so they are simple people. That's why, they probably never in their lives before were in this position to give a presentation in front of the audience." [F07] As facilitators indicate, the participants were able to **observe their own successful performance** (also when **surpassing their perceived limitations**), to experience their **abilities to cope in challenging situations** (Bandura, 1977, p. 194), and to **provide valuable solutions and produce novel outcomes** (Tierney & Farmer, 2002; Puente-Díaz, 2016).

According to the experiences of facilitators, the consumers' **satisfaction with their own performance** was linked to the **open communication with stakeholders** participating in the process (companies' employees, facilitators, peers): "People were very positive about the fact that the company participated in the meeting and justified it in such a way that it proves that companies want to listen to the voice of older people, which could have been a bit earlier, I don't know, neglected, inaudible, and so on, so in my opinion it was so stimulating for the participants and a little self-esteem building." [F40] The participation of the companies' employees and the **respective atmosphere of discussion**, with **genuine interest in consumer opinions and insights** on the side of the companies' representatives and facilitators, provided ground for **affective empowerment** of participating consumers.

Facilitators of labs reported putting efforts **into acknowledging the relevant knowledge and experiences of participants**, as well as their **assets needed to successfully complete the tasks** (cf. Zwass, 2010, p. 14). The labs methodology acknowledged the participants' knowledge and experiences and provided space for **autonomous performance of tasks**, with **participants contributing resources and insights**. A facilitator gave an interesting example of an **initiative** of a participant, showing his **engagement in the task accomplishment**: "One of the gentlemen, he wasn't from my group, but when he presented presentation for his team, he explained that he even calculated the exact weight of the products from the shopping list. He calculated, that the weight will be around 8 kilograms, from the shopping list. And he thought, that for their persona, she was female, it would be very difficult to […] carry these 8 kilograms. So it just blowed my mind, because this person […] actually spend a lot of time to process the information, to think about it and to see." [F21] Another thought-provoking example showed that the participants' engagement manifested itself not only in their dedication to the best performance of the task, but also in **time investment** and **emotional attachment developed thanks to the exercises' design**: "when we talked day by day, day by day about Stefcio (persona – a fictional consumer discussed during the sessions), one of the talkative participants […] told us that after the seminar, after the sessions, she […] (talked) to her husband about Stefcio, about his needs, about his way of living, his specific habits. Even dreamed one of the evenings, even dreamed about Stefcio. After that her husband started to be a little bit jealous, asking her, who is this Stefcio? Is it an imaginary or (actual) person? 'What are you doing on this computer every day, from 1 to 3?' (laughter)." [F21]

As indicated by facilitators, the **affective empowerment** of the consumers had also been stimulated by **received feedback about their inputs**: "Really that moment of feedback was almost a celebration. It was really a very important moment for the group." [F15]. As facilitators observed, **the company's feedback about the tasks fulfilled by the participating consumers**, followed by the **information about the further steps of the process**, provided the participants authentic experience of **respective, equal and partner treatment in communication** and exchange of knowledge and ideas: "what they really liked is that there was the discussion, people were asking them questions. They really enjoyed that someone cares about what they think and what is their opinion, how they see it." [F22]; "I think they were happy somebody listened to their opinion. […] Because if they feel: 'okay, it's just another kind of information collection and nothing (new) came up', I think it's not very good (approach). That's why (we worked on) how we can keep the circulation that they got some feedback: 'okay, something happened – yes, your opinion is very important' and something will happen with this information (that they collected). That's the key message for us as a researcher – how can we do that." [F29] Moreover, **expressions of gratitude for the efforts** were recognised as a nice gesture confirming that the successful and valuable performance of participants.

Interviews with facilitators shed a light on the potential implications of labs for the participants, especially of the **cognitive** and **affective aspects**, because facilitators were able to observe **changes in knowledge and attitudes** of participants during the labs process. The **design of living labs** can influence the **creative self-efficacy** and **emotional attachment** of the participating consumers, and consequently, their **cognitive**, **affective and conative empowerment**. Figure 1 summarises the observed by facilitators elements of labs process that leverage consumer self-efficacy and empowerment.

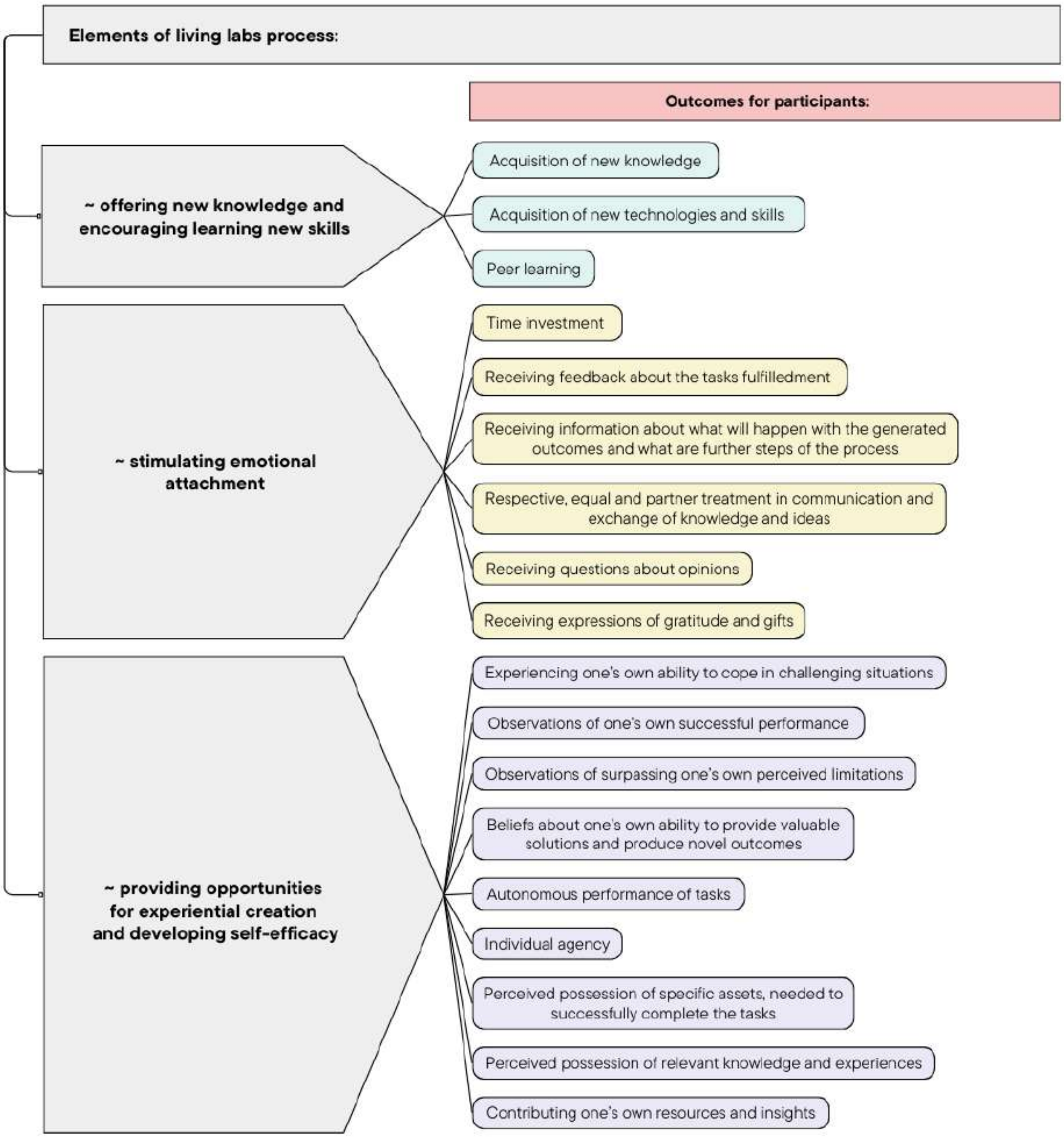

Figure 1. Elements of living labs process leveraging the empowerment of participants. Source: own elaboration

The analysis of facilitator interviews corroborates previous studies that highlighted the role of **self-efficacy as a driver of empowerment** (Darbha et al., 2021; Dekhili & Hallem, 2020; Yakhlef & Nordin, 2021), alongside the importance of knowledge, participation and engagement in co-creation (Chou & Yuan, 2015; Tartaglione et al., 2018). The facilitators had limited overview of the behavioural changes after the labs, so the conative empowerment of participants is more extensively elaborated based on the interviews with consumers who participated in the labs.

Interviews with consumers

The interviews with consumers provided rich insights into personal consequences of their labs participation. Results of the coding and analysis are presented in Figures 2-4, which identify types of self-reported changes, the coverage (occurrence frequency - share of reporting consumers) and sample excerpts of interviews (numbers in bracket indicate the interviewee).

Cognitive empowerment of participants (Figure 2) relates to the acquisition of new knowledge and their enhanced sovereignty as consumers. New knowledge and skills were pre-conditions for the other types of empowerment. Importantly, the labs did not specifically focus on various themes identified by participants such as nutritional values of food so could not directly influence dietary changes but team discussions and creative tasks might have acted as triggers, sensitizing participants to these important issues. Teamwork and peer learning increased the consumer sovereignty and facilitated the informal transfer of knowledge during the living labs. Cognitive empowerment is linked to enhanced knowledge, consumer sovereignty and self-awareness, and is manifested by better information seeking and planning, which induce further behavioural changes.

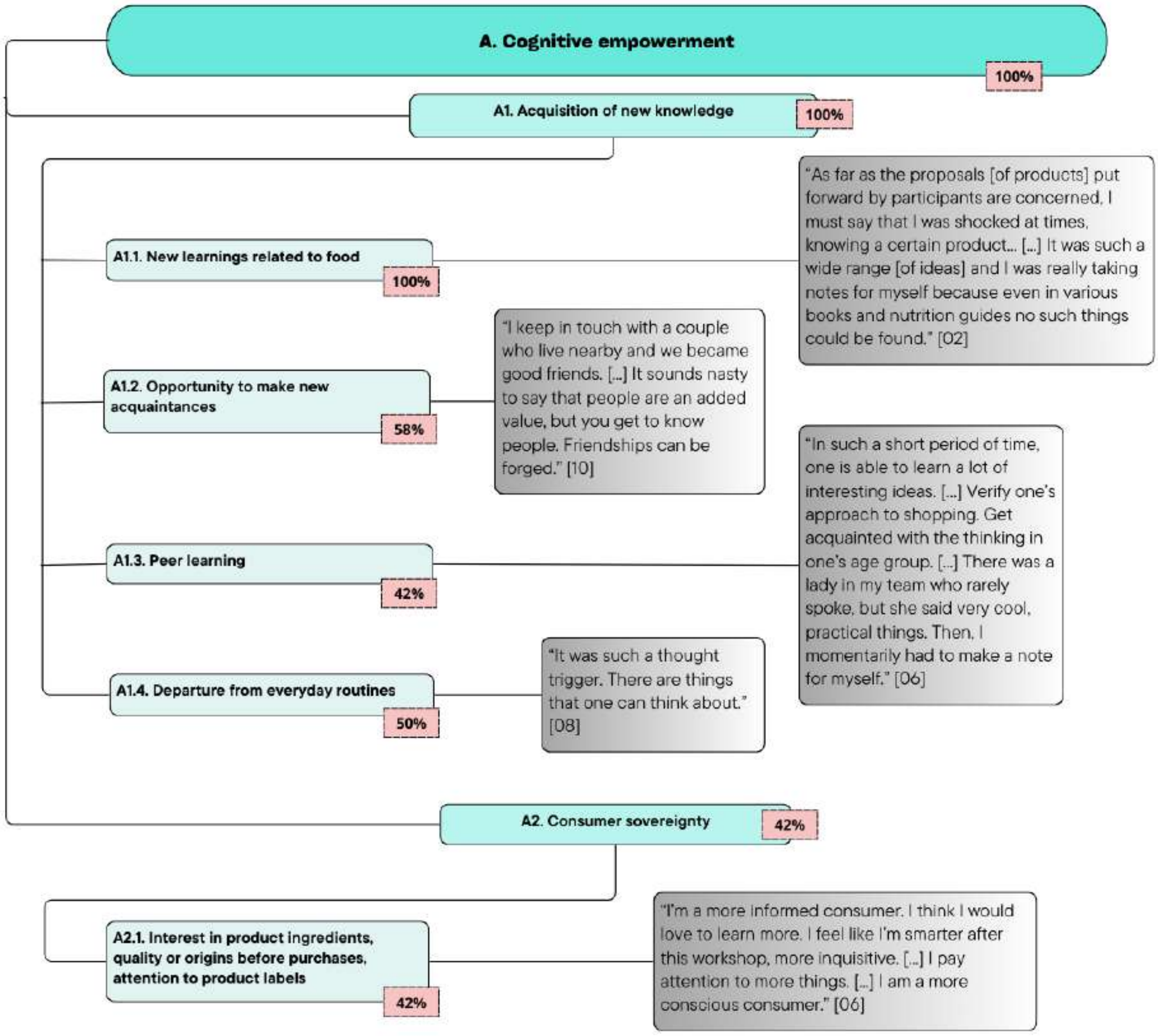

Figure 2. Cognitive empowerment of living labs participants (includes quotes from interviews and occurrence frequency of each theme). Source: own elaboration.

Affective empowerment (Figure 3) concerns majority of participants (some interviewees avoided any emotionally charged utterances, hence the affective aspects were not confirmed for them). Participants indicated positive attitudinal changes towards the living labs process and other participants, but also enhanced self-esteem and creative self-efficacy, giving them courage to experiment and supporting beliefs that they have become more creative and skilful in the matters of food. Several consumers afraid of certain foods reported the ability to overcome their fears and to cope with food neophobia. These aspects pave way for further behavioural (conative) changes by shaping attitudes towards food, including courage that drives the propensity to experiment.

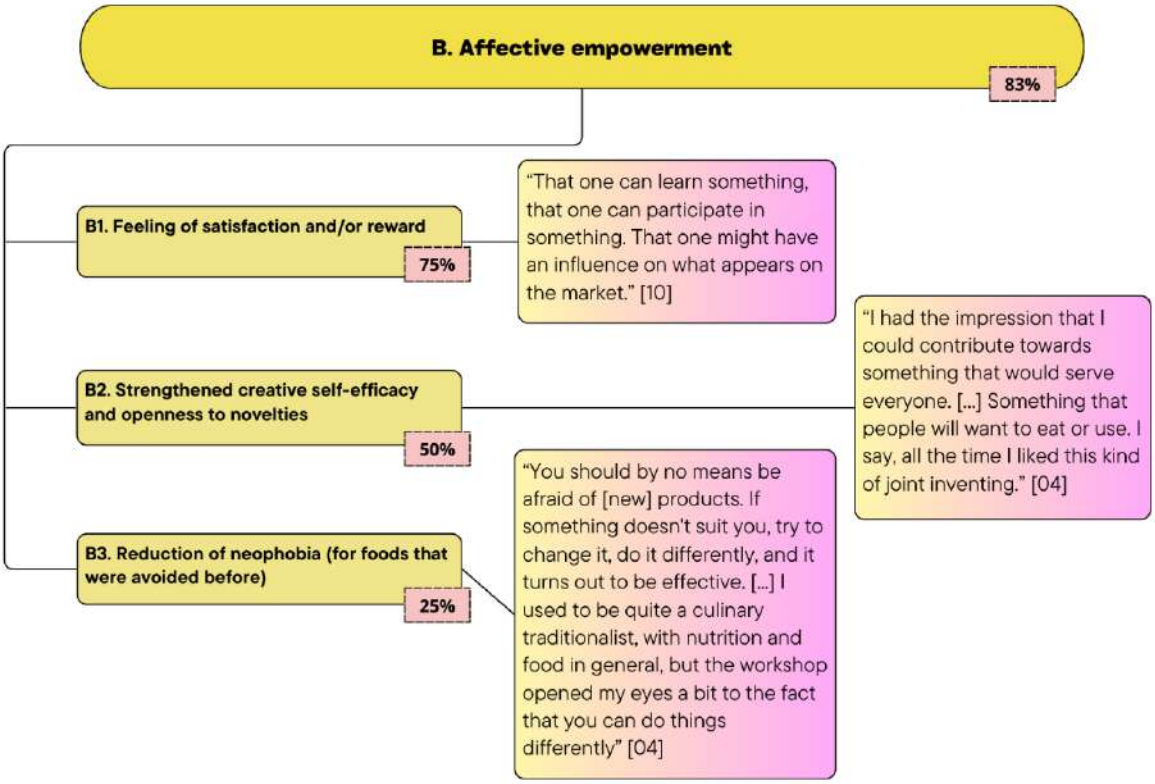

Figure 3. Affective empowerment of living labs participants (includes quotes from interviews and occurrence frequency of each theme). Source: own elaboration.

Conative empowerment (empowerment to purposeful actions) (Figure 4) was a particularly important element of experiences reported by participants and this differs from the results of interviews with facilitators (who had limited access to these aspects of experiences of participants, since the conative dimension could only be observed ex-post, after the conclusion of the living labs). Participants reported multiple types of changes in their lives, which were interpreted as manifestations of a newly acquired self-confidence ("I am an expert in the matters of my life") and of an improved lifestyle ("I am a healthier and happier consumer"). Figure 4 reveals an extensive list of reported behavioural changes, ranging from approaches to shopping, types of purchased products, planning and execution of meals, up to the life satisfaction resulting from the aesthetic dimension of food consumption.

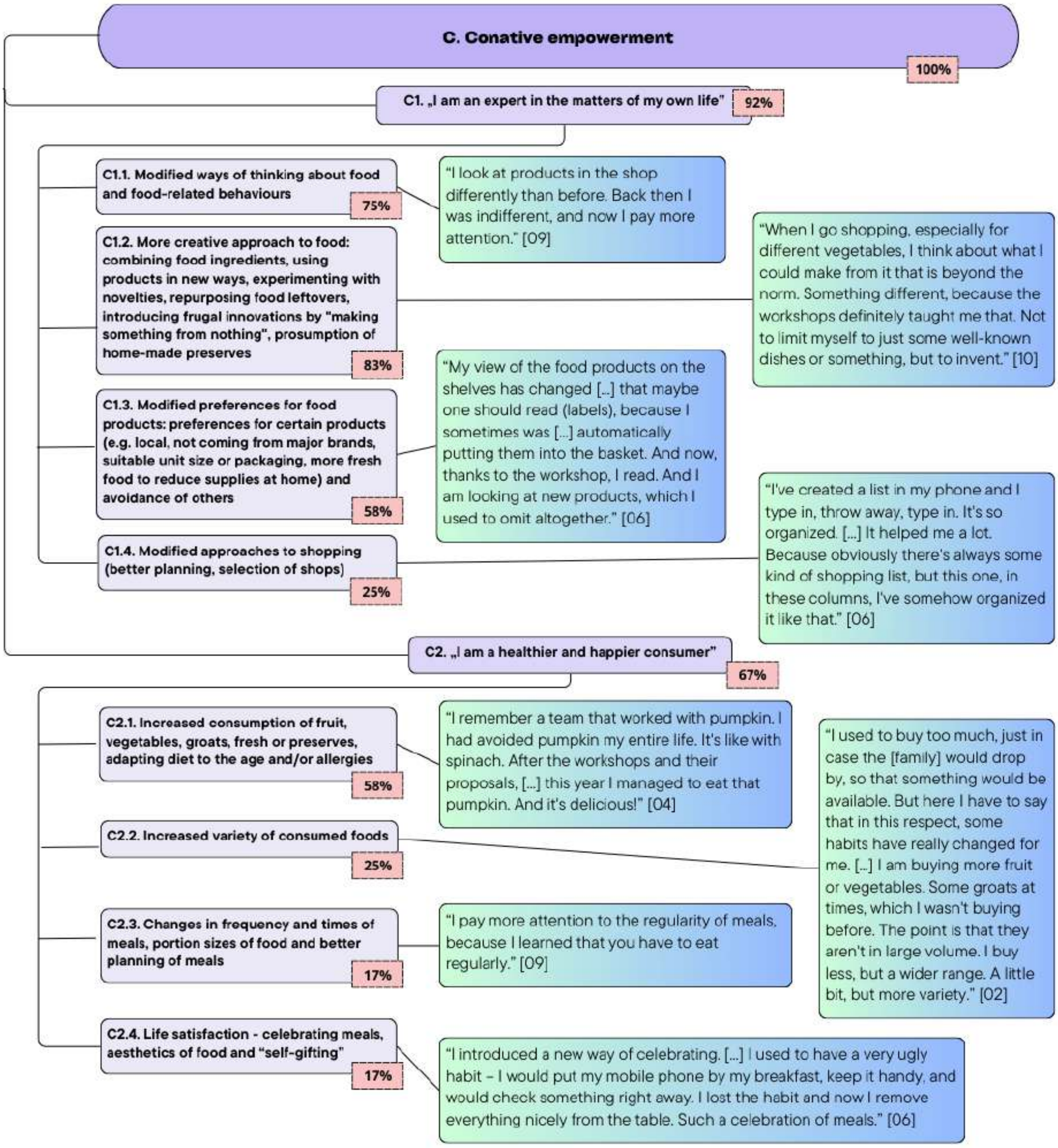

Figure 4. Conative empowerment of living labs participants (includes quotes from interviews and occurrence frequency of each theme). Source: own elaboration.

Discussion

The analysis of individual interpretations of experiences related to living labs participation confirms the importance of three interconnected types of empowerment: cognitive, affective and conative. This tri-partite model was used in studies of consumer behaviours (Harrison and Waite 2015, Nguyen et al. 2020) but in the context of living labs, the conative component appears to be the central category, with purposeful actions resulting from the newly acquired knowledge and the emotional involvement. Figure 5 summarises the observed manifestations of empowerment, indicating the occurrence frequency (share of participants reporting a given outcome).

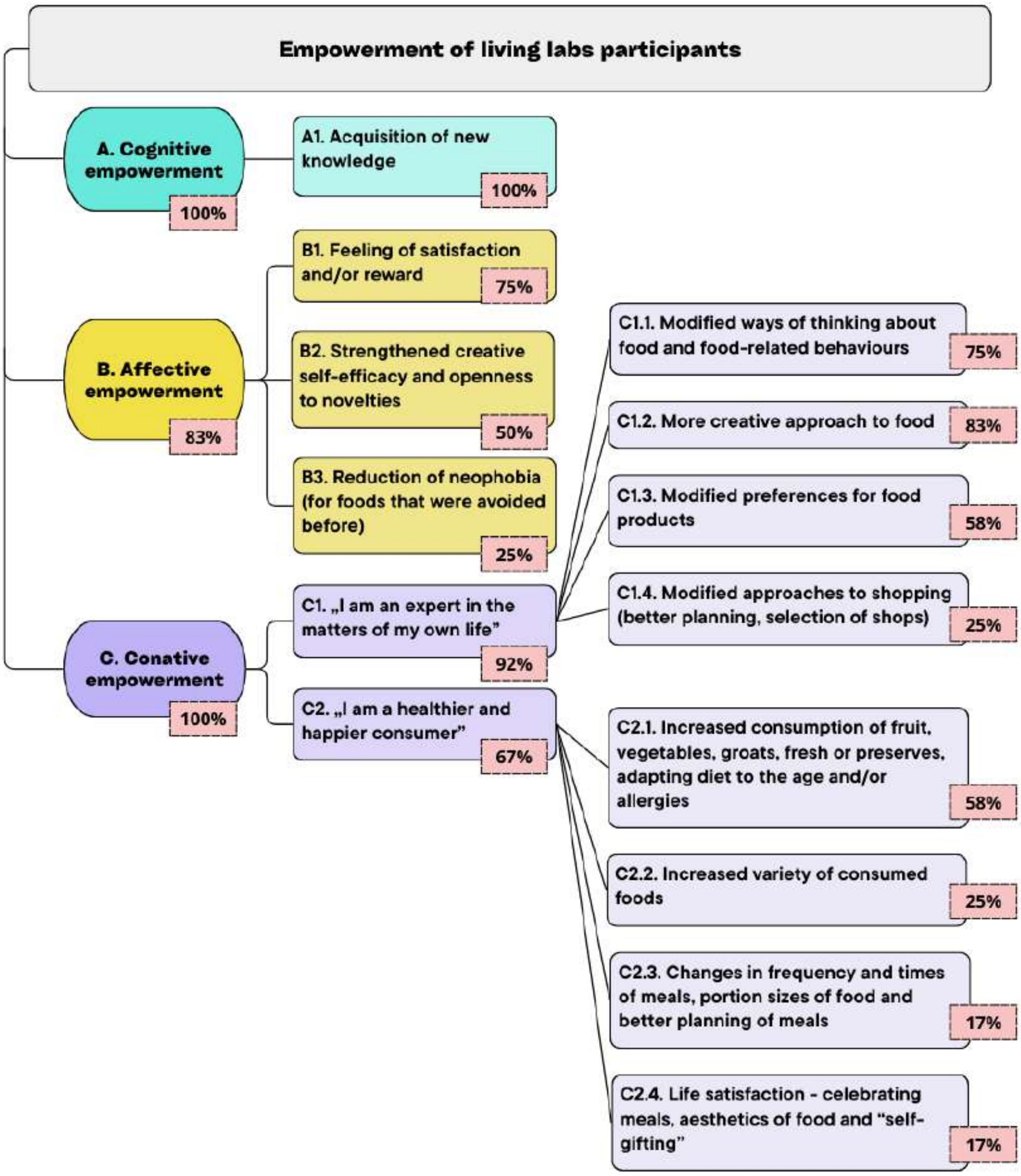

Figure 5. Empowerment of living labs participants (includes quotes from interviews and occurrence frequency of each theme). Source: own elaboration.

The study offers important theoretical insights that will be presented as 3 propositions, supported by the analysis of the qualitative material.

Proposition 1: Living labs can influence the creative self-efficacy of participants, enhancing their empowerment and inducing subsequent behavioural changes.

Various environmental conditions influence the outcomes of living labs, and certain conditions could be directly controlled by the organizers. In the studied living labs process, the organizers ensured positive experiences of participants, enhancing their self-confidence through acknowledgement of competence and creative self-efficacy. Such experiences have been found to contribute to the consumer's identity, pride and self-respect (Moisander et al., 2013, p. 224-225). The unleashed creativity of participants can yield positive results (such as new product ideas) and also have longer-ranging behavioural consequences. The conative empowerment can further explain the well-being outcomes, observed in other studies of co-creation (Sharma et al., 2017). The studied consumers declared their increased openness to novelties and experimenting. Accordingly, their task orientation during the creative process enhanced their ability to set and attain goals in everyday life through increased self-confidence in one's own abilities and mobilisation.

Proposition 2: Conative empowerment amplifies the effects of cognitive and affective empowerment on the behaviours of living labs participants.

Three elements of empowerment presented in Figure 5 are closely intertwined, with their results blended in the behaviours observed or described by consumers participating in the research. The conative element of empowerment (empowerment to purposeful actions) is a pivotal one, channelling the positive energy developed by means of the cognitive and affective engagement, linking knowledge and emotions to action, and thus influencing everyday behaviours.

Conation was stimulated by the collective experience of living labs, which provided opportunities for autonomous actions, learning and self-efficacy. Cognitive empowerment results in broadened knowledge, self-awareness and enhanced understanding, leading to conative consequences, such as information seeking and planning, more attentive shopping or modified food choices. Affective empowerment influences attitudes towards the living labs, product types, and self-image, translating into propensity to experiment, voluntary simplicity (Ballantine & Creery, 2010) or self-gifting behaviours (Mortimer et al., 2015). The conative empowerment can further explain the well-being outcomes, observed in other studies of co-creation (Sharma et al., 2017) through newly acquired meanings and creative self-expression. The findings are aligned with previous studies that confirmed the importance of knowledge, participation and engagement in co-creation as drivers of empowerment (Chou & Yuan, 2015; Tartaglione et al., 2018), alongside the role of self-efficacy (Darbha et al., 2021; Dekhili & Hallem, 2020; Yakhlef & Nordin, 2021).

Proposition 3: Behavioural changes of living labs participants result from a combination of empowerment and mimetic behaviours.

Conative empowerment, accompanied by the cognitive and affective empowerment, was not the only source of behavioural changes self-reported by participants. Some changes were rather results of mimesis: imitation of attitudes and courses of action taken by other participants of the living labs process. The mimetic behaviours made participants follow examples set by peers (team members in living labs). The living labs encounters offer opportunities to exchange knowledge, share ideas about the use of food ingredients, recipes or other tips, and some of them were considered useful by participants who acted upon them after the creative process.

Closing remarks

Living labs participants may become conatively empowered to act in new and better ways, and acknowledge these changes in their lives after the experiences of creative labs processes. The conative empowerment synergically complements the cognitive and affective empowerment. Cognitively empowered participants are more confident in putting the newly acquired knowledge and skills to practical uses, and might even feel as experts in the subject matter of the living labs. For example, participants of food-related living labs report changes in food-related behaviours when planning, purchasing, preparing and consuming food in their everyday lives. Owing to the self-efficacy, participants become more confident in their own knowledge and expertise, but potentially also more opinionated (especially if the alleged "expert" knowledge is not necessarily flawless). Affective empowerment allows participants in turn to lead more satisfactory life, enjoy happy moments and modify daily activities to make them more rewarding and enjoyable. Cognitive and affective dimensions interact with the conative empowerment, and importantly the changes not only concern the narrowly-defined subject matter of the living labs (e.g. specific product category, brand, interventions of the labs) but much broader conative consequences for various aspects of participants' everyday lives.

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Innovation Presentation Outline

Tracking and presenting living lab activities in real time: the use of living plans and activity visualization in a Swiss research consortium

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Abstract

The number of studies on living labs (LLs) has been rapidly growing over the last few years, offering a series of conceptualizations, theories and best practices aiming at emphasizing their transformative potential and unique value regarding sustainability issues. LLs have notably been praised for utilizing co-creation processes, experimental and innovative approaches embedded in real-life settings [1, 2, 3, 4]. Further developments are, however, needed in assessing LL development and results: [5] point to the absence of consistent assessment framework available to LL practitioners, while [6] highlight the general lack of reporting efforts. Clear and consistent reporting and assessment of LL activities is necessary to improve knowledge transfer between different LLs, detect potential conflicts and synergies, and identify success and failure factors.

Key words

Methodology, Assessment, Theory of change, Living plan

Main problem statement

The number of studies on living labs (LLs) has been rapidly growing over the last few years, offering a series of conceptualizations, theories and best practices aiming at emphasizing their transformative potential and unique value regarding sustainability issues. LLs have notably been praised for utilizing co-creation processes, experimental and innovative approaches embedded in real-life settings [1, 2, 3, 4]. Further developments are, however, needed in assessing LL development and results: [5] point to the absence of consistent assessment framework available to LL practitioners, while [6] highlight the general lack of reporting efforts. Clear and consistent reporting and assessment of LL activities is necessary to improve knowledge transfer between different LLs, detect potential conflicts and synergies, and identify success and failure factors.

Methods

Two tools were developed based on the results of a literature review as well as practical experience from previous LL projects, and using a mix of primary, self-reported primary and secondary data obtained from the research teams and LLs engaged in the SWICE project, a transdisciplinary research consortium exploring solutions for the Swiss energy transition. The first tool, LL living plans, are co-created living documents based on theories of change developed by each LL, showing ongoing interventions and core organizational characteristics. The second tool, LL Meta Action Plans, provides a graphical depiction of the spatial, temporal, and methodological dimensions of completed, ongoing and planned LL activities across the project. The objective behind their use is twofold: determining the consistency of the gathered information via triangulation of data and evaluating the capability of LLs to plan and assess their activities while accounting for various time horizons and different stakeholders' objectives and needs. While conceptually similar tools have been developed in previous work, the presented tools and in particular their joint application by a broader panel of stakeholders is, to our knowledge, unique in a setting like SWICE.

Results

The initial results are based on observations from a 12-month period in which the tools were used by six Swiss LLs participating in the SWICE project, including a broad range of stakeholders, at varying stages of development. Several key insights were obtained: firstly, the proposed methodologies (living plan & meta-action plan) are sufficiently flexible to be applied to a heterogeneous group of LLs. Secondly, it is therefore very useful not only to monitor what is happening in LLs, but also for LLs to continuously exchange knowledge and experiences on successes and challenges, as well as strategies and approaches deployed to address the latter. Thirdly, the living plan and meta-action plan tend to trigger reflexive processes within LLs, facilitating a better inclusion of non-academic stakeholders, and more realistic expectations in terms of results (distinction between outputs / outcomes and impacts).

Lessons learned

Assessment of LLs is currently underdeveloped, both from a conceptual and a methodological perspective. The two presented tools are effective means for tracking individual LLs and providing synthesized data on a LLs development status and activities; with further improvement necessary for tracking inter-LL relationships and impacts. While initial results are promising, further monitoring as well as dissemination to a broader stakeholder group will be necessary to provide a more complete picture of the tools' effectiveness and improvement needs. The tools are already available to interested non-project actors, while the final versions will be disseminated in the public domain as part of the SWICE LL toolbox, targeted at Swiss and international LL actors and engaged stakeholders.

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Research-In-Progress Paper

The small campus facing grand societal challenges: case study of the Campus Living Lab

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Abstract

This article presents a case study of the Campus Living Lab (CaLiLab) at the Jagiellonian University in Krakow, focusing on its role in addressing grand societal challenges through innovative, interdisciplinary, and community-driven projects. Campus living labs, situated within higher education institutions, utilize campuses as experimental grounds for developing solutions to complex issues. This study examines CaLiLab's approach to achieving specific Sustainable Development Goals (SDGs) like quality education and sustainable urban development. By analyzing pilot projects and applying qualitative content analysis of project documentation, correspondence, and observation notes, we explore the methodologies used, particularly the quintuple helix model that includes the natural environment as a stakeholder. The findings highlight CaLiLab's innovative practices, fostering interdisciplinary collaboration and effective community engagement, and provide valuable insights into the practical applications of living labs. This research contributes to the broader understanding of how academic environments can effectively address grand societal challenges through dynamic and collaborative ecosystem.

Key words

Grand societal challenges, campus living lab, case study, Sustainable Development Goals, Quintuple Helix Model

Introduction

The increasing complexity of global issues necessitates new approaches to solving wicked problems. Grand societal challenges (GSCs) are intricate, multi-layered issues that require coordinated efforts across public, private, and non-profit sectors to be effectively addressed (Voegtlin, Scherer, Stahl, and Hawn, 2022). Challenges such as climate change, demographic shifts, diminishing natural resources, and food security are critical to humanity's future. While large-scale, supra-national efforts are essential, smaller, targeted initiatives also play a crucial role in addressing specific aspects of these problems.

This article highlights one such initiative: the Campus Living Lab (CaLiLab) at the Jagiellonian University in Krakow. Campus living labs, situated within higher education institutions, use their campuses as testing grounds for innovative solutions. According to Verhoef and Bossert (2019), this approach extends beyond traditional problem-solving methods or management strategies. It requires time, a shift in mindset, and sustained focus, making it particularly effective for tackling complex issues.

Our study aims to explore how campus living labs, like CaLiLab, identify and solve grand societal challenges. Using a qualitative case study methodology, we examine the pilot projects implemented by CaLiLab teams. Through content analysis of project documentation, correspondence, and observation notes, we identify key areas of change that guide these projects' objectives.

This paper explores the unique contributions and innovative practices of CaLiLab, emphasizing interdisciplinary collaboration and community engagement. By employing the quintuple helix model, which includes the natural environment as a stakeholder, CaLiLab demonstrates a holistic approach to addressing GSCs. This model supports interdisciplinary efforts and provides practical, scalable solutions that can be adapted to various contexts. The findings contribute to the living lab field by offering insights into best practices and methods for tackling GSCs within academic settings. By leveraging the campus as a microcosm of broader societal issues, CaLiLab fosters an environment where theoretical research and practical application converge, resulting in actionable outcomes that benefit both the university and the wider community.

Campus living labs

Living laboratories within universities started to appear in the last decades. A unique subset of these living labs operates directly on university campuses, utilizing the campus setting as a platform for testing novel solutions and products. In this scenario, the campus setting functions as a microcosm of wider society, providing a space for the exploration and trial of innovative ideas (Martek et al., 2022). Campus living labs play a crucial role in fostering interdisciplinary collaboration, experiential learning, and the co-creation of knowledge between academia and society (Evans et al. 2015). They act as cooperative environments where researchers, students, and stakeholders from diverse fields collaborate to devise, experiment with, and put into action solutions for real-life problems. As written by Nyborg et al. (2023), in the past, universities constructed specific laboratories for conducting experiments under controlled conditions. However, they now utilize their campuses, faculty, and students as integral components of the experimentation process. Universities have evolved beyond merely housing laboratories; they have become laboratories in their own right, engaged in collaborative relationships aimed at co-creation (Nyborg et al., 2023). According to Verhoef et al. (2019) because of their substantial land holdings, large staff and student populations, and their influence within both local and global communities, universities wield considerable environmental and social influence. Moreover, there is a robust push for universities to take the lead in steering society toward a more sustainable future. This involves enhancing the sustainability of their physical infrastructure and operational practices, as well as fulfilling their198rganizates (Verhoef et al, 2019).

Campus living labs address a wide range of complex problems. They undertake projects related to social, technological, and business innovations. They solve both micro-problems within local communities and confront grand societal challenges. In the subsequent part of the article, we will present examples of various projects whose outcomes have the potential for scalable solutions.

Methodology

To address the research question—How do campus living labs identify and solve grand challenges? — we employed a case study strategy focusing on the Campus Living Lab (CaLiLab) at the Jagiellonian University. The case study method is particularly suited for exploring complex, real-world issues within their specific contexts (Stake, 2008). The CaLiLab serves as the primary case, with embedded cases of its pilot projects providing additional insights.

The pilot projects were selected through a competitive procedure following a call for projects that align with the mission and strategic areas of the CaLiLab. The selection process ensured that the chosen projects would contribute to the CaLiLab's vision of being an open collaborative space aimed at improving community well-being through useful research and co-created solutions for a better future. The strategic areas of focus include smart blue-green campuses and inclusive social and business innovations.

We conducted detailed analyses of four pilot projects within the CaLiLab:

1. Neurodiversity at the 600th Anniversary Campus: This project focused on creating inclusive academic spaces for neurodiverse individuals, using design thinking and stakeholder engagement.
2. To Mow or Not to Mow? This initiative explored the ecological and socio-economic impacts of lawn maintenance practices, integrating advanced design methods and developing an educational mobile application.
3. Blue-Green Infrastructure in Urban Landscapes: The project evaluated the environmental and social benefits of blue-green infrastructure, emphasizing sustainable urban development.
4. Inclusive Public Space – Connector: This project aimed to create inclusive public spaces that cater to diverse physical and mental abilities, employing collaborative design processes.

We collected data through multiple sources to ensure a comprehensive understanding of the CaLiLab's initiatives and their impact. The primary methods of data collection included:

- Project Documents and Correspondence: Analysis of internal documents and email correspondence provided insights into the decision-making processes and interactions among stakeholders.
- Observation Notes: Observational data were collected during project meetings, workshops, and implementation phases. These notes offered a real-time perspective on the projects' progress and stakeholder engagement.

The collected data were analysed using qualitative content analysis, focusing on identifying key themes and patterns related to the identification and solution of grand societal challenges. The analysis was guided by the following parameters:

Innovation and Methodologies:

- Identification of innovative practices and methodologies used in the pilot projects, including design thinking, service design, and the quintuple helix model.
- Examination of how these methodologies were applied to address specific SDGs (Sustainable Development Goals). Interdisciplinary Collaboration:
- Analysis of the collaboration between different academic disciplines and external stakeholders.
- Exploration of how interdisciplinary approaches contributed to the identification and solution of GSCs.
- Community Engagement:
- Evaluation of the strategies used to engage community members and other stakeholders.
- Assessment of the impact of community engagement on project outcomes and sustainability.
- Integration of the Natural Environment:
- Investigation of how the CaLiLab incorporated the natural environment as a stakeholder in the co-creation process.
- Analysis of the environmental impact and sustainability of the pilot projects.

Findings

The qualitative content analysis of the CaLiLab pilot projects reveals key themes and patterns related to the identification and solution of grand societal challenges (GSCs) through innovative methodologies, interdisciplinary collaboration, community engagement, and environmental integration.

Innovation and Methodologies: The pilot projects implemented by CaLiLab prominently feature innovative methodologies such as design thinking, service design, and the quintuple helix model. For instance, the "Neurodiversity at the 600th Anniversary Campus" project applied design thinking to create inclusive academic spaces, addressing the specific needs of neurodiverse individuals. Similarly, the "To Mow or Not to Mow?" project leveraged the quintuple helix model, integrating stakeholder feedback to develop a mobile app for sustainable lawn management, which also serves as an educational tool. These methodologies were effectively applied to address specific Sustainable Development Goals (SDGs), including health and well-being, sustainable cities, and climate action, by developing practical and scalable solutions that address both social and environmental challenges.

Interdisciplinary Collaboration: Interdisciplinary collaboration emerged as a critical factor in these projects' success. The integration of various academic disciplines and external stakeholders, such as local communities, public organizations, and private sector partners, facilitated the co-creation of solutions tailored to complex societal issues. For example, the "Blue- Green Infrastructure" project combined expertise in environmental science, urban planning, and socio-economic studies to develop sustainable infrastructure that enhances urban resilience. This collaboration was instrumental in identifying and solving GSCs, demonstrating the value of interdisciplinary approaches in tackling multifaceted challenges.

Community engagement was central to the CaLiLab's approach, with all projects emphasizing active involvement from local communities and stakeholders. Strategies such as participatory workshops, stakeholder interviews, and focus groups were used extensively to gather diverse perspectives and ensure that the solutions developed were relevant and inclusive. For example, the "Inclusive Public Space – Connector" project engaged community members, including people with disabilities and migrants, through collaborative design processes, allowing their input to shape the final outcome. Educational and awareness campaigns further complemented these efforts by informing the community about project goals and fos“ering broader understan–ing and su”port. This comprehensive engagement not only enhanced the relevance and impact of the projects but also contributed to their sustainability by fostering a strong sense of ownership and commitment among stakeholders.

Integration of the Natural Environment: The CaLiLab projects also incorporated the natural environment as a key stakeholder in the co-creation process. The "To Mow or Not to Mow?" project, for example, focused on the ecological impacts of lawn maintenance practices, promoting biodiversity and sustainable land use. Similarly, the "Blue-Green Infrastructure" project utilized local natural resources and native plant species to enhance the201rganizatio”al sustainability of urban landscapes. These efforts underscore the importance of considering environmental impacts in the design and implementation of solutions to GSCs.

Discussion and conclusion

The Campus Living Lab (CaLiLab) at the Jagiellonian University exemplifies how academic institutions can address grand societal challenges (GSCs) through innovative and collaborative approaches. By utilizing the campus as a microcosm for broader societal issues, CaLiLab fosters an environment where theoretical research and practical application intersect, leading to actionable outcomes that benefit both the university and the wider community. The diverse projects within CaLiLab demonstrate the potential of living labs to generate impactful solutions that extend beyond academia, addressing complex issues such as sustainability, inclusivity, and urban resilience (Filho et al., 2020).

A central element of CaLiLab's approach has been its emphasis on broad interdisciplinary collaboration. It has enabled the integration of various academic disciplines and community stakeholders, fostering a holistic understanding of GSCs. The evolution of the quadruple helix model into a quintuple helix by incorporating the natural environment as a legitimate stakeholder further enriches the co-creation process. This comprehensive model ensures that diverse perspectives contribute to the development of sustainable and inclusive solutions, promoting a culture of inclusivity across the campus and beyond (Verhoef & Bossert, 2019; Nyborg et al., 2023).

Moreover, CaLiLab's projects embrace ongoing global changes, identifying opportunities for positive transformation rather than resisting them. This mindset is essential for tackling GSCs, as it allows for the identification and harnessing of potential impacts that can drive sustainable development and community resilience. The development of digital solutions to disseminate findings and best practices highlights how living labs can effectively communicate scientific knowledge to the public, democratizing access to information and encouraging sustainable practices within the community (Verhoef et al., 2019). In conclusion, campus based living labs may showcase the transformative potential of living labs in addressing GSCs, offering a robust framework for fostering innovation, sustainability, and community well-being in academic settings.

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Research-In-Progress Paper

Fostering inclusive engagement and transformation in Urban Living Labs: "Education in Living Labs: Participatory Skills for Sustainable Urban Governance" research project

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Abstract

Inclusive engagement is pivotal in fostering urban resilience and sustainable development. The "Education in Living Labs: Participatory Skills for Sustainable Urban Governance (PS-U-GO)" project engages diverse stakeholders, particularly young people, in collaborative urban planning through the establishment of Urban Living Labs in four European cities. The methodology of PS-U-GO Urban Living Labs, synthesized from literature and empirical studies, emphasizes inclusivity and adaptability, employing a flexible six-step process across three phases to facilitate transformation within involved communities and contexts. Central to the project is stakeholder participation, with strategies designed to accommodate diverse needs and preferences, ensuring sustained involvement, particularly among young people. By integrating bottom-up and top-down approaches, fostering trust, and providing opportunities for co-creation, PS-U-GO aims to empower stakeholders, enhance democratic participation, and implement sustainable urban solutions. The project underscores the importance of tailoring strategies to local contexts, nurturing a sense of ownership and belonging, and ensuring that all voices are not only heard but also valued in urban decision-making processes.

Key words

ULLs, inclusive citizen engagement, inclusive participation, diverse representation, social sustainability

Introduction

Inclusion in decision-making and urban planning is vital for urban resilience (Lopez De Asiain & Díaz-García, 2020; Esteban, 2020). Social sustainability and a sense of belonging are crucial for community well-being and sustainable development (Colantonio, 2010). Effective urban governance requires collaboration among stakeholders, with academia, government, and civil society adopting new roles to emphasize civic engagement. Cross-sector collaboration is key to innovative solutions and equipping future planners with the skills needed for co-creation and sustainable urban governance.

Living Labs (LLs), defined as "sites devised to design, test, and learn from social and technical innovation in real time" (Marvin et al., 2018, p.1), foster collaborative co-creation in urban environments. They involve research organizations, public institutions, the private sector, and community stakeholders (Liedtke et al., 2012). Urban Living Labs (ULLs) emphasize inclusive and profound stakeholder engagement, promoting transdisciplinary collaboration and inclusive research. This approach enhances inclusivity and equity, ensuring diverse representation and amplifying voices across varied societal groups, contributing to transformative urban innovations.

While ULLs serve specific goals each time, they are also open processes with uncertain outcomes, and a transformative potential regarding the nature of urban governance, they constitute "policy of experimentation" that encourages specific urban conditions as part of the shift in how society responds to urban challenges (Evans, 2016; Bulkeley et al., 2016). However, not all ULLs equally realize their transformative potential; their effectiveness is influenced by the design, practices, procedures, organization, social networks, expectations, and learning methods within them (McCormick and Hartmann, 2017).

Within this framework, PS-U-GO project (https://www.psugo.eu/) is developed by a consortium of six partners (University of Cyprus, Brandenburg Technical University Cottbus-Senftenberg, National Research Council, Social Fringe: interesting untold stories, Palermo Urban Solutions Hub, and Urban Foxes) and an associate partner (AESOP Thematic Group "Public Spaces and Urban Cultures"). PS-U-GO aims to explore how inclusive participation, fruitful dialogue, knowledge, and experience exchange, and understanding of shared values can lead to the transformation of diverse social and cultural contexts and communities. To achieve this, it plans to design, implement, and evaluate a series of ULLs in four participating cities: Nicosia, Petralia Sottana (Palermo), Cottbus, and Naples. These labs will involve stakeholders of the quadruple helix to collaboratively address specific urban issues and experiment with solutions and ideas in real-life settings. Solutions will draw from recent and ongoing experiences covering social and governance innovation, placemaking, sustainable mobility, citizen empowerment, and inclusive practices, addressing certain gaps and elaborating current successes.

In response to the existing needs for responsive urban planning that promotes a sense of belonging and social sustainability, PS-U-GO will enable transformation through the implementation and testing of a collaborative, multidimensional approach, involving the quadruple helix, focusing on inclusive engagement, and utilizing a cross-sectoral perspective to teaching and learning in public urban environments. PS-U-GO addresses the necessity for a documented framework to systematically record initiatives and foster long-term relationships among stakeholders. Its ULLs focus on youth engagement, promoting pedagogic innovation, cross-sectoral collaboration, and skill development, empowering students, educators, professionals, and citizens, enhancing democratic participation, and building capacity to implement sustainable urban solutions.

A particular emphasis is placed on engaging youth who are usually misrepresented and fostering inclusivity by involving diverse community members in a fun, co-creation process. PS-U-GO will include students and citizens giving them significant voice to assert their roles in city decision-making. Recognizing their role as future citizens, professionals, and authorities, the project aims to establish a framework where they can realize their potentials as responsible, critical, and environmentally conscious city ambassadors, willing and capable of taking constructive action to improve their neighbourhoods and cities. Through dialogue and sharing, the project seeks to promote and systematize collaboration among individuals with diverse cultural or social backgrounds and enhance appreciation for people's values, beliefs, cultures, and lifestyles by highlighting the local and historical heritage of each community as an integral and significant part of the built environment. This approach addresses contemporary urban challenges, enhances social sustainability and inclusivity, and fosters a sense of belonging.

Methodology of PS-U-GO ULLs

The methodology of PS-U-GO ULLs is based on gathered knowledge from literature review, empirical case studies, and methodologies already used by the project partners. It aims to provide a process that can amplify diverse voices, ensuring a broad representation in every phase. It suggests a six-step process, developed in three phases, flexible enough to adapt to the unique contexts of each of the four locations, ensuring a comparable implementation and evaluation (Figure 1):

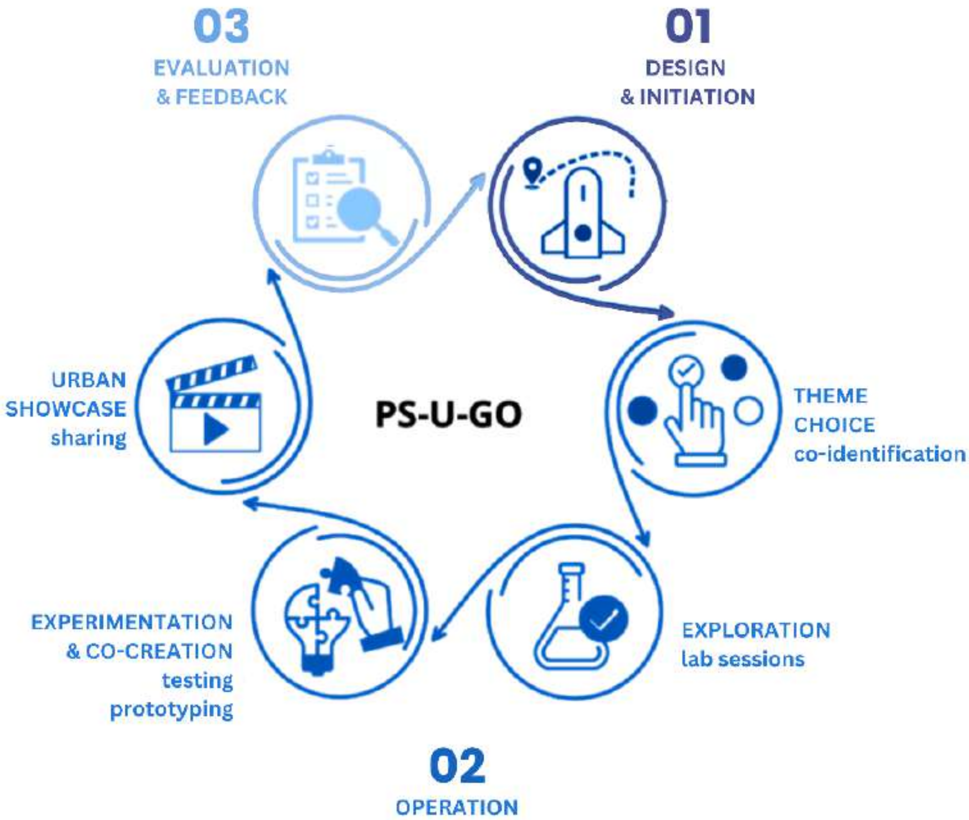

Figure 1. PS-U-GO ULLs six-step process developed in three phases.

- PHASE 1: DESIGN AND INITIATION:

  Aim: To understand the context, orient the theme, initiate a general scope and vision.

- PHASE 2: OPERATION:

  - Theme choice: Co-identification of existing needs and opportunities, prioritizing youth.
    Aim: To choose (a) theme(s) or topic(s), based on the number of the participants.
  - Co-exploration: Lab sessions about the theme, reflection in action involving on-site explorations and urban masterclasses, supported by (an) external(s) 0expert(s).
    Aim: To acquire new knowledge and experience and co-develop draft ideas/ scenarios leading to a common vision of positive urban action.
  - Experimentation and co-creation: Co-creation, testing or prototyping (if needed), supported by (an) external(s) creative expert(s) (if needed).
    Aim: To produce the expected outcome(s).
  - Urban showcase: Sharing of the creative process and outcome with the public.
    Aim: To communicate and share the new knowledge produced in an understandable, direct, and creative way.

- PHASE 3: EVALUATION AND FEEDBACK:

  Aim: To collect feedback from the participants and stakeholders, useful for the process, methodology and outcomes improvement. Some of the key metrics/ indicators regarding the implementation of the ULLs are the number of implemented educational and training activities within ULLs, number of new collective actions and/or entrepreneurial/ innovative projects enabled by the implemented ULLs, number of new collaborations among the partners and stakeholders, formal and informal feedback from participants.

Each PS-U-GO ULL can adapt this cycle to its local context, objectives, and stakeholders, extending or condensing it as needed. Also, each one can adapt this process, maintaining fixed phases and steps but allowing flexibility in selecting methods, involving stakeholders, and setting specific goals in each phase based on the context.

This 6-step methodology will begin implementation in December 2024 and continue until October 2025. The first step, design, and initiation are currently being developed by the four partners implementing the ULLs. A deliverable regarding the ULLs' structure in each city will be completed by November 2024. From January 2024 until the start of the implementation phase, deliverables and activities related to the project's pedagogical framework for ULLs, ULL methodology, and validation framework will be finalized. In parallel with the implementation, two training events on participatory approaches for public spaces will be held, and independent qualitative research reflecting on Living Labs implementation will be conducted.

Inclusive engagement and transformation

Stakeholder participation can be described as "a process in which individuals, groups, and organizations actively engage in making decisions that impact them" (Reed, 2008, p.2418). The involvement of diverse stakeholders is considered a crucial characteristic of ULLs for effectively addressing urban sustainability challenges (Voytenko et al., 2016). Inclusive participation and engagement are vital for the project's ULLs to ensure that diverse perspectives, needs, and ideas are heard and to give voice to young people, often excluded or underrepresented in urban decision-making processes.

For Menny et al. (2018), co-creation represents the highest level of involvement, empowering citizens to participate equally in decision-making. While achieving co-creation is not always realized, it is more common during the implementation phase and depends on ULL leadership and objectives. The idea that co-creation alone ensures successful ULLs is debatable, so employing diverse methods and integrating various levels of participation is crucial (Menny et al., 2018). It is important to determine the appropriate form and timing of involvement, blending bottom-up and top-down approaches (Juujäsrvi and Lund, 2016). Haufe et al. (2017) emphasizes reaching co-decision while providing transparent information to sustain participants' interest. Bergvall-Kåreborn and Ståhlbröst (2009) highlight that early user involvement is essential for ULL success, allowing users to shape the process actively.

Based on the above, and with further review of the various protocols and frameworks provided by EnoLL, the stakeholders' engagement strategy was synthesized, with some guidelines regarding the participation tools, to ensure inclusive engagement and participation during PS-U-GO ULLs, with an emphasis on young people participation.

The aim is to ensure an open initial engagement and recruitment strategy by employing open calls through diverse communication channels (traditional media, posters and in-person events, social media) leveraging existing networks with a snowball effect, and involving actors from the quadruple helix to represent various stakeholder groups, vital in each area. Building trust and strong relationships is important, by using a language that is accessible to all, allowing sufficient time for discussion and exchange, and fostering an environment of mutual respect. Additionally, a stable and sustained engagement is aimed, by emphasizing continuous communication and collaborative organization and dissemination of activities and outcomes. When possible, it is a goal to remunerate participants for their time, effort, and expertise, facilitating enjoyability by providing food and offering EU mobilities linked to the topic. Furthermore, stakeholders and experts will be engaged at different stages of the process, depending on the themes and challenges that arise, to ensure their meaningful involvement and contribution.

The participation methods (Table 1) are chosen to Integrate various levels of involvement throughout different phases of the project, aiming to achieve co-decision by emphasizing early-stage user involvement. The priority is youth engagement, acknowledging that not all stakeholders will participate at the same level or frequency, incorporating fun and playful elements to enhance engagement and non-formal learning. To accommodate diverse levels of accessibility and technological comfort, a mix of online and in-person activities is provided, ensuring participants can engage in ways that suit their needs and preferences. Each method is aligned with the project's phases and tailored to fit the goals of each phase, such as idea generation, prototype testing, and feedback collection. This comprehensive approach allows partners to select the methods that best suit their specific goals, contexts, and stakeholders, ensuring inclusive and effective participation throughout the ULL process, with adjustments made based on project needs and stakeholder preferences while maintaining core engagement principles.

Table 1. Participation methods for Operation phase.

METHOD	DESCRIPTION	AIMS	FORMAT
Theme choice: To choose (a) theme(s) or topic(s).			
SWOT Analysis	• Can be used in relation to a/some focus area(s) • In groups/ All	• Identification of Strengths, Weaknesses, Opportunities and Threats • Definition of the most important issues and topics	• In person or • Blended using Miro or Canva
Mindmap	• Visualisation of topics, their associations, and relations • In groups	• Capturing and organising ideas, placing links between ideas • Identification of topics, subtopics and themes that need to be explored by making them visual	• In person or • Blended using Miro or Canva
Multivoting	• Interactive voting process • In groups/ All	• Achieving consensus on themes based on personal preferences	• In person or online depending on the technique, using Opinionx
Exploration: To acquire new knowledge and experience and co-develop draft ideas/ scenarios leading to a common vision of positive urban action.			
Initial Situational Analysis (I.S.A.) using City Expedition	• Sensory exploration of urban environment through interactive and fun activities • In small groups, walking in the area	• Team building • Sensory exploration of urban environment • Identification of current knowledge	• In person
Collaborative mapping using Participatory Mapping	• Map making process using guiding questions by a facilitator to include more information • In small groups	• Identification how different stakeholders perceive the relationship between places and people in a specific context and over time	• In person or • Blended using
Masterclass	• An expert guides the participants to answers	• Answering any questions arisen, learning	• In person
Brainwriting	• Anonymously brainstorming ideas/ options based on a question/ issue • In small groups	• Sharing ideas, achieving consensus, and reflecting • Expressing views of people who may feel uncomfortable to do it	• In person
Lego Serious Play	• Game, building solutions with Lego bricks based on specific questions/ issues • In groups of 5 people	• Building, sharing, reflecting, thinking, and learning with 3d models	• In person

Experimentation and co-creation: To produce the expected outcome(s).			
Thematic workshop	• Co-production workshop	• Structuring alternative way • Realisation of solution(s)	• In person
Creative experts	• Co-creating with creative experts and/ or partners	• Creation of an impactful creative output	• In person
Blink testing	• 5 second blink test • Large group/ All	• Determining if first impressions are on point regarding the purpose, main elements, target audience and quality of design	• In person or online using Five second test
Prototyping	• Prototyping and experiment with solutions	• Testing and fine-tuning the design into a prototype	• In person
Urban showcase: To communicate and share the new knowledge produced in an understandable, direct, and creative way.			
Public event	• Public event with the involvement of all the stakeholders (e.g. a walk etc.)	• Promotion and communication of the results	• In person or • Hybrid
Thematic workshop/ session	• Workshops to showcase the creative process and outcomes through a creative session (e.g. storytelling etc.)	• Sharing with the public in a fun and interactive way • Collecting informal feedback/ impressions	• In person

Discussion

The collaborative nature of ULLs underscores the significance of inclusive participation, serving as platforms for diverse stakeholders engaging in co-creation and experimentation, as highlighted by Marvin et al. (2018) and Liedtke et al. (2012). Yet, achieving meaningful participation necessitates adaptation to varying local contexts and cultures and a meticulously developed strategy for the design, operation, and evaluation of ULLs. The PS-U-GO methodology prioritizes inclusive participation of young people to empower them to engage in urban decision-making in the long-term. It encompasses fun and flexible engagement strategies and participation methods for knowledge co-creation, exemplifies adaptability, while accommodating differing levels of accessibility and engagement. By integrating a blend of bottom-up and top-down approaches, fostering trust, and providing opportunities for co-creation, the project aims to ensure that all voices are heard and moreover valued. Ultimately, the success of urban initiatives hinges on the capacity to tailor strategies for the distinct needs and preferences of each community, thereby nurturing a sense of ownership and belonging among stakeholders.

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Research-In-Progress Paper

Instruments for Implementing Systemic Change to Foster Climate Transitions in European Cities

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Abstract

Emerging climate transition trends in the European context witness a systemic approach beyond the conventional centring of efforts solely on technological solutions for greenhouse gas (GHG) emission reduction. The systemic approach, core to the European Union's 2030 Climate Neutral Mission draws from extant literature to encompass both top-down and bottom-up perspectives towards climate neutrality, underscoring the importance of determinants such as trans-disciplinarity and experimentation. This paper presents instruments and tools developed for European cities within the EU-funded project, NetZeroCities, which aims to support a systemic approach to climate neutrality by 2030. These include the Climate City Contract concept and template (CCC), and the Climate Transition Map, which are presented and analysed through the lens of Organisational Innovativeness. These two innovative instruments 213rganiza in the NetZeroCities project present several potential determinants of 213rganizational innovativeness discussed in extant literature: administrative intensity, complexity, functional differentiation, internal communication, managerial attitude toward change, professionalism, slack resources, 213rganizational, technical capacity, absorptive capacity for new knowledge, and receptive context for change.

Key words

Systemic Change; Systemic Approach, Organisational Innovativeness (OI), Climate Neutrality, Public Administration Innovation

Introduction: Why climate neutrality requires systemic innovation

Conventional technological and linear top-down approaches have proven insufficient to tackle the grand challenge of climate neutrality (Underdal, 2010; Repo and Matschoss, 2019) 214rganizatio the need for a systemic approach to climate action (Scorza & Santopietro, 2021). Systemic changes are necessary to radically reshape socio-technical systems (Geels, 2019) for more sustainable norms, such as environmental behavioural norms and attitudes within a system (Jans, 2021; Nolan et al., 2008). Yet, systemic innovation is complex and difficult to understand, implement, and assess, especially in complex urban settings. While technological advancements

are crucial drivers in combating climate change, alone, they are insufficient in reaching the required pace of change. Attention is turning towards emerging forms of innovation in response to the gap between systemic climate action and comprehensive environmental governance. Recent research and practical advancements indicate a shift towards integrating and fostering bottom-up approaches to achieve climate neutrality (Diepenmaat et al., 2020), such as social innovation (Bresciani et al., 2022) and citizen engagement (Huttunen et al., 2022), which complement ongoing conventional efforts.

From a trans-disciplinary lens extending beyond sustainability sciences, the shift towards a systemic approach establishes a pragmatist point of view of wicked problems which acknowledges multi-dimensional complexities (Buchanan, 1992; Bijl-Brouwer & Malcolm, 2020). Theoretical constructs from Organisational Innovation research (Baldridge & Burnham, 1975) provide a significant framework to examine the systemic intricacies of climate transitions. We contextualise such constructs within an evidential practice found in the evolving NetZeroCities project (European Commission, 2021), the largest project on earth supporting cities to become climate-neutral, as part of the European Union's Mission of 100 smart carbon-neutral cities by 2030.

The NetZeroCities project aims to support European cities to reach climate neutrality with a systemic innovation approach, integrating multiple levers of change (including social innovation, stakeholders' participation, learning, policies, technologies, etc.); however, for public administrators, the challenge of understanding and undertaking a systemic multi-layered approach in their cities requires competences, resources and 214rganizational skills to aggregate and collaborate with disciplinary teams within the city's public administration and beyond. The NetZeroCities project offers several instruments, tools, and resources for supporting public administrators in developing systemic plans that foster climate neutrality including a knowledge repository with case studies and methodologies, and ad-hoc support for cities. This paper discusses two such instruments, the Climate City Contract, and the Transition Map, which both display determinants of Organisational Innovativeness.

Climate Transitions from an Organisational Innovativeness Lens

Rind (1999) states that a *“complex system is one in which there are multiple interactions between many different components”*, which makes it apt to describe the climate system. Taking a systemic approach to fostering climate neutrality in cities creates an innovative urban ecosystem and produces multi-dimensional impacts (Anderson, 1993) within networks and organisations. *Organisational Innovativeness (OI)* is a concept that guides exploring how processes, models, and products can be supported and propagated across a system experiencing change, and we propose can be harnessed to analyse how two specific tools support systemic change at the urban level.

A systemic approach shows evidence of *innovativeness* as an ongoing demonstration of adopting innovative behaviour/outcomes over time (Subramanian et al., 1996), the boundary-spanning nature of which is most likely to be assimilated within the system when certain determinant features are present. *Organisational Innovativeness* determinants shown in Table 1, are primarily a group of structural variables, along with instances of process, resource, and cultural variables (Damanpour, 1991). These determinants interact in “complex, unpredictable, and non-generalisable” ways and must be viewed as a system (not as isolated variables) when discussed (Greenhalgh et al., 2004, p. 606).

Table 1. Impact of Structural and Non-Structural Determinants on Organisational Innovativeness (Positive/Significant Relations). Adapted from Damanour, 1991; Greenhalgh et al., 2004

Potential Determinants	Definition
Structural	
Administrative intensity	Indicator of administrative overhead.
Complexity	“Specialisation,” “functional differentiation,” and “professionalism.”
External communication	Degree of organisation members’ involvement and participation in extra organisational professional activities.
Functional differentiation	The extent to which it is divided into different units.
Internal communication	The extent of communication among organisational units.
Managerial attitude toward change	The extent to which managers or members of the dominant coalition favour change.
Professionalism	Professional knowledge of an organisation’s members.
Slack resources	Reflects an organisation’s resources beyond minimal requirements to maintain operations.
Specialisation	The number of an organisation’s specialities.
Technical capacity	Reflects an organisation’s technical resources and technical potential.
Non-Structural	
Absorptive Capacity for New Knowledge	An organisation that is systematically able to identify, capture, interpret, share, reframe, and recodify new knowledge; to link it with its own existing knowledge base; and to put it to appropriate use will be better able to assimilate innovations, especially those that include technologies.
Receptive Context for Change	Ability to embrace new ideas and face the prospect of change.

These features within an organisation correlate with the successful assimilation of innovations, such as a systemic approach to climate transition. The innovative ecosystem of the EU NetZeroCities project utilises open living labs with European cities committed to the mission of engaging stakeholders in active participation when co-creating climate action plans and materials. In this paper, we highlight the existence of *Organisational Innovativeness* determinants as evidence of a systemic approach within the foundational instruments of these urban labs.

NetZeroCities: Fostering a Systemic Approach towards Climate Neutrality in European Cities

Cities that are supported by the NetZeroCities (NZC) project are provided with guidance for addressing the needs of public administrations in their climate-neutral journeys (Fig. 1). The tools provided support cities in co-designing their climate action plans through Climate City Contracts or CCCs (Shabb & McCormick, 2023). It also enables alignment with the NetZeroCities Theory of Change (Chaudhary et al., 2022), which provides a systemic overview of the impact pathways of the cities' climate actions through a monitoring, evaluating, and learning framework (Chaudhary et al., 2022; Neumann et al., 2022).

Climate City Contract and Climate Transition Map

A Climate City Contract is a policy instrument that enables cities to plan their 2030 carbon-neutral vision and action plans with a systemic approach that includes not only technological solutions but also participatory approaches and social innovation. Specifically, a Climate City contract is composed of an Action Plan (AP), an Investment Plan (IP) and a Commitments document (Fig. 1). The NetZeroCities project provides Mission Cities (i.e., cities which are selected to participate in *the EU Mission for 100 climate-neutral and smart cities by 2030* and receive tailor-made advice and support to achieve climate neutrality) with a CCC template (which was co-created with cities through expert panels).

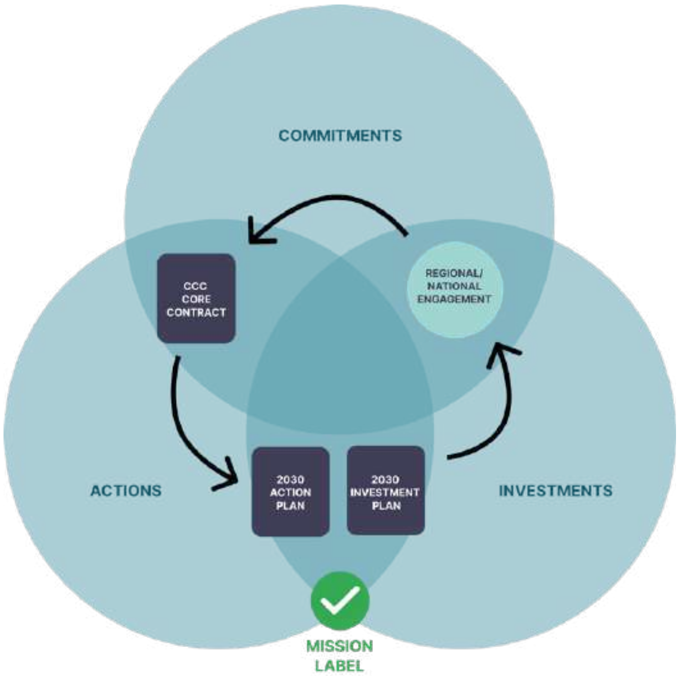

Figure 8. Climate City Contract (CCC) Concept (Adapted from: https://netzerocities.app/QR-CCC)

Functioning simultaneously as a planning document, policy instrument, and process, the CCC is designed to co-create new ways of collaborative working with local, regional, and national stakeholders to reach climate neutrality in the city by 2030 (European Commission, 2021).

The Climate Transition Map (Fisher et al., 2021) is the visual representation of the NetZeroCities approach, which has been developed in the NetZeroCities project to support cities in understanding and deploying a systemic and experimental approach to provide a framework which captures essential steps of the process (Fig. 2). The first three steps of *building a strong mandate*, *understanding the system,* and *co-designing a portfolio of actions* (Fig. 2) are particularly crucial for cities to be aligned with the NZC mission. The Climate Transition Map is available as an interactive tool on the NetZeroCities platform and supports identifying relevant content for each phase. It guides the mission cities to develop their CCCs (especially in terms of co-designing a portfolio of actions) and then implement them.

Figure 9. Climate Transition Map (European Commission, 2021; https://netzerocities.app/ClimateTransitionMap)

Organisational Innovativeness Determinants in the Climate City Contract and Climate Transition Map

Developing a Climate City Contract (CCC) in the context of NetZeroCities can lead Mission cities to Organisational Innovativeness thanks to the determinants of complexity, external communication, functional differentiation, internal differentiation, professionalism, specialisation, and technical capacity, which are acquired by cities' public administrations when iteratively developing their CCC with the NetZeroCities advisors and specialists' groups. Managerial attitude toward change is demonstrated through public administrators' ability to aggregate the necessary knowledge and resources within their cities for being able to answer all the sections of a Climate City Contract. Non-structural Organisational Innovativeness is innately present in the CCCs; absorptive capacity for new knowledge is fundamental to the Action Plan, which is guided by the NZC Theory of Change (Chaudhary et al., 2022) and Transition Map. As an iterative process, the CCC is a receptive context for change, which creates the ability to embrace new ideas and implement change.

In the process section of the Transition Map, the first three steps (build a strong mandate, understand the system, and co-design a portfolio) show Organisational Innovativeness determinants of complexity, external communication, functional differentiation, internal communication, specialisation, and technical capacity with a systemic vision. Step four (take action) shows the technical capacity and receptive context for change emerging in a real-world application. Step five (learn & reflect) depends on multi-stakeholder collaboration and co-creation enabled by external communication and internal communication about complexity, as it moves onto step six (make it the new normal), which guides users through the receptive context for change.

Discussion and Conclusions

Addressing the multifaceted challenges of the climate crisis requires a systemic approach to climate action, considering the inadequacy of conventional top-down compartmentalised approaches. However, the complexity involved in understanding, implementing, and assessing systemic innovation, calls for multi-dimensional perspectives that extend beyond sustainability science.

Through the lens of Organisational Innovativeness (OI), we have outlined how two instruments utilised by European cities, specifically the Climate City Contracts and the NZC Transition Map, can potentially lead public administration transition teams to foster organisational change within their cities toward systemic change. Furthermore, emerging evidence of the determinants of OI within instruments and tools of a systemic approach towards climate neutrality paves the way for future research to focus on analysing transition teams' internal dynamics and collecting evidence for the proposed effects of theory testing.

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Full Research Paper

Testing & Experimentation Facilities: Exploring the link with AI Regulatory Sandboxes, Living Labs & AI Testbeds

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Abstract

The current surge in AI innovations is gaining increased momentum and attention from both enthusiastic early adopters and concerned stakeholders. The European Commission aims to lead in this rapidly evolving field by implementing legal constraints to prevent potential negative consequences while also helping European AI innovators compete globally. To balance strict legislation with the encouragement of innovation, four sector-specific Testing-and-Experimentation Facilities (TEFs) were launched in 2023. These TEFs serve as specialized, large-scale sites where technology providers across Europe can test and experiment with advanced AI solutions in real-world environments. In the literature, these new innovation facilities are linked to three established concepts: regulatory sandboxes, Living Labs, and testbeds.

This paper focuses on CitCom.ai, one of the four operational TEFs, which aims to bridge the gap between AI innovators and the development of smart, sustainable cities and communities. Through a three-part triangulation study, we explore the connection between TEFs and other innovation concepts, the alignment between AI innovators' needs and the TEF service offerings, and the actual usage of these services in running or planned experiments at various TEF sites.

Our findings reveal that TEFs incorporate elements of regulatory sandboxes, Living Labs, and testbeds. Currently, services related to testbeds are the most frequently utilized in experiments. However, AI innovators have expressed the greatest need for regulatory sandbox services, indicating a mismatch between what is offered and what is needed. This suggests that initiatives are required to address this imbalance, particularly in the provision of AI regulatory sandbox services, to ensure TEFs fulfil their intended roles and meet their initial promises.

Key words

Artificial Intelligence, TEFs, AI Regulatory Sandboxes, Living Labs, Testbeds, Experimentation

Introduction

The European Union has been leading the way towards regulating the current wave of Artificial Intelligence (AI) research and development (Truby et al., 2022). The rationale behind these initiatives is to provide AI innovators with clear instructions and requirements on the usage, implementation, and deployment of AI applications. As an outcome, a minimal degree of trustworthiness and transparency is desired, as well as mitigating the risks of undesirable outcomes from these AI applications. Concurrently, the EU aims to minimize administrative and financial barriers for AI innovators, particularly small and medium-sized enterprises (SMEs), recognizing that AI innovation in Europe is predominantly driven by these SMEs.

As these are two seemingly opposite goals, the EU also decided to establish several concurrent actions and initiatives to achieve both. One of the most prominent instruments are the so-called Testing and Experimentation Facilities (TEFs). These TEFs are defined as specialized large-scale reference sites open to all technology providers across Europe to test and experiment at scale state-of-the art AI solutions, including both soft- and hardware products and services, e.g. robots, in real-world environments.

In this paper, we focus on CitCom.ai, one of four TEFs in operation, that aims to bridge the gap between smart, sustainable cities, and communities on one hand and the AI innovators on the other. The goal of CitCom.ai is to create TEF sites that run commercial AI experimentation, testing and validation across different locations in Europe. These sites can take the shape of a private company, a public entity, or a mix of both. The main goal is validation in real conditions of novel, next-generation, AI-powered robotics and AI-based automation, decision-support, and decision-making tools. This is done by offering services to AI innovators that provide solutions for (smart) cities and their communities.

To position the role of these TEFs, three innovation concepts have been mentioned in the literature to fill this gap: AI regulatory sandboxes, Living Labs, and AI testbeds (Buocz et al., 2023). However, as these TEFs are still very much in a start-up phase looking for their own positioning, service offering and target customer definition, research is needed to assess whether these TEFs are able to help realizing the EU's double goal: increasing the trustworthiness, transparency and security of AI solutions, and lowering the legal and administrative barriers for AI innovators in general and SMEs in particular.

Therefore, in this paper we want to explore the relation between TEFs and the three linked innovation concepts: AI regulatory sandboxes, Living Labs, and AI testbeds.

In order to investigate the potential role and positioning of TEFs in the European AI landscape, we adopted a qualitative triangulation design consisting of three data collection methods: an interview study among AI innovators, an analysis of the current service catalogue in the light of the three innovation concepts, and an analysis of the current usage of these services in planned or executing experiments. This design allows us to converge towards an initial understanding of TEFs by combining data from multiple methods and data sources.

TEFs in the context of the AI act & AI innovation

The EU wants to be a frontrunner in terms of the innovative development and application of Artificial Intelligence. To achieve this, the European Commission (2024) launched its AI strategy. This strategy consisted of a package, launched in April 2021, which included communication on fostering a European approach to AI, a review of the Coordinated Plan on Artificial Intelligence (with EU Member States), and a regulatory framework proposal on artificial intelligence and relevant impact assessment.

This strategy has four main goals:

- enabling the development and uptake of AI in the EU;
- becoming the place where AI thrives from the lab to the market;
- ensuring that AI works for people and is a force for good in society;
- building strategic leadership in high-impact sectors.

A main instrument, which is mentioned before as part of the regulatory framework proposal, is the so-called AI Act. This is the first-ever legal framework on AI, which addresses the risks of AI and positions Europe to play a leading role globally. The AI Act aims to provide AI developers and deployers with clear requirements and obligations regarding specific uses of AI. At the same time, the regulation seeks to reduce administrative and financial burdens for business, in particular for small and medium-sized enterprises (SMEs).

The AI Act is part of a wider package of policy measures to support the development of trustworthy AI, which also includes the AI Innovation Package and the Coordinated Plan on AI. Together, these measures will guarantee the safety and fundamental rights of people and businesses when it comes to AI. This is intended to strengthen uptake, investment, and innovation in AI across the EU.

The AI Act ensures that Europeans can trust what AI has to offer. While most AI systems pose limited to no risk and can contribute to solving many societal challenges, certain AI systems create risks that we must address to avoid undesirable outcomes. Examples of such outcomes range from a chatbot from an airline company causing damage due to lies, the overflow of AI-generated information causing disinformation, an LLM hallucinating court cases, or the misappropriation of personalities' image and voice for commercial use. This European approach responds to the current state of AI regulation, which has mostly been managed on an ad hoc basis through individual member state laws and resolutions from various European Parliament committees (Truby et al., 2022). These actions are deemed necessary as there is more and more debate regarding AI and potential high-risk activities because of its nature. Currently, the discussion is mostly dealing with types of liability to be imposed under different conditions and circumstances.

The European Commission Proposal includes a risk-based approach to AI to determine how AI should be regulated in different cases. The proposal is for four categories of risk (Truby et al., 2022):

1. Unacceptable risk, which is banned in the EU.
2. High risk, which means that human health and safety or fundamental rights are endangered – mandatory requirements will be imposed on these types of AI, and they will be assessed to make sure that they comply.
3. Limited risk, which imposes requirements for transparency in certaincircumstances so users know they are interacting with a machine.
4. Minimal risk, which allows other types of applications to be legally developed.

To make these large and complex ambitions a reality, the EC, together with the Member States, is co-funding TEFs to support AI developers in bringing trustworthy AI to the market more efficiently and facilitate its uptake in Europe. This is done via the Digital Europe Programme 2023-2024 via a Coordination and Support action (CSA) with the application of a cross-sector perspective to all existing sectorial Testing and Experimentation Facilities (TEFs). The selected TEFs started on January 1st, 2023, and focus on the following high-impact sectors:

– Agri-Food: “agrifoodTEF”
– Healthcare: “TEF-Health”
– Manufacturing: “AI-MATTERS”
– Smart Cities & Communities: “Citcom.AI”

Co-funding between the European Commission (through the Digital Europe Programme) and the Member States will support the TEFs for five years with budgets between EUR 40-60 million per project. TEFs are specialized large-scale reference sites open to all technology providers across Europe to test and experiment at scale state-of-the art AI solutions, including both soft-and hardware products and services, e.g. robots, in real-world environments. These large-scale reference testing and experimentation facilities will offer a combination of physical and virtual facilities in which technology providers can get support to test their latest AI-based soft- and hardware technologies in real-world environments. This will include support for full integration, testing and experimentation of latest AI-based technologies to solve issues/improve solutions in a given application sector, including validation and demonstration. TEFs can also support market surveillance authorities and national competent authorities for both controlled testing of AI solutions, as well as direct collaboration with AI regulatory sandboxes. TEFs will be an important part of building the AI ecosystem of excellence and trust to support Europe’s strategic leadership in AI. Limited literature is available to describe the nature and outlook of these TEFs, but they are stated to share common ground with concepts such as Living Labs, testbeds, and AI Regulatory Sandboxes (Buocz et al., 2023).

Regulatory sandboxes, Testbeds & Living Labs

AI Regulatory sandboxes

A regulatory sandbox is a tool allowing businesses to explore and experiment with new and innovative products, services, or business models under a regulator's supervision, providing innovators with incentives to test their innovations in a controlled environment. This in turn allows regulators to better understand the technology and fosters consumer choice in the long run. Establishing AI regulatory sandboxes on the EU member state level is an explicit part of the AI Act with as objective to reach a balance between innovation and regulation (Yordanova, 2019; Truby et al., 2022; Buocz et al., 2023). An AI regulatory sandbox creates an environment in which AI solutions can be tested and evaluated in order to increase reliability, trust, and acceptable risk assessment, which is facilitated by two main elements: specific procedures, involving support from experts and relevant authorities, and two-way communication between the AI innovators and the legal authority in order to reduce the burden on innovation while imposing relevant legal constraints to improve the adequacy and minimize the potential risks of AI innovation (Yordanova, 2019).

However, according to Buocz et al. (2023), to date only limited guidelines are available on how to implement, operate, or even describe the procedures of these AI regulatory sandboxes, while there remain several legal issues that are unresolved.

One of the main issues is that the current text blurs jurisdictional boundaries between the EU and member states which in turn raises concerns of legality and equal treatment for AI innovators and creates liability risks.

Moreover, in the current proposal the AI regulatory sandboxes are not necessarily uniform among the member states which creates confusion and uncertainty in the market, which is the opposite of the intention (Truby et al., 2022). Yordanova & Bertels (2024) add that the current guidelines explicitly emphasize the possibility of multi-jurisdictional regulatory sandboxes. The fact that the service lacks the standardization associated with regulation makes regulatory sandbox activities unfit for cross-border provision of services (Truby et al., 2022). Therefore, as a conclusion there are currently more questions than answers on how to regulate AI, and AI regulatory sandboxes could be a cornerstone to build uniform regulation, but in the current guidelines this is not the case yet (Yordanova & Bertels, 2024). Summarizing, multiple questions remain unanswered (Truby et al., 2022): How to deal with testing of AI innovations in multiple member states? How to transfer the lessons learned from one national testing site to another national testing site? How to easily replicate tests and experiments in different European countries?

Living Labs & AI

Living Labs, recognized by the European Network of Living Labs (ENoLL) as 'Open Innovation Ecosystems' have emerged as dynamic innovation intermediaries. Based on iterative feedback processes, Living Labs aim at creating sustainable impact and provide real-life environments for testing and co-creating innovations (Leminen, Westerlund, and Nyström, 2012). To this end, they orchestrate stakeholder networks across the Quadruple Helix, involving government, research institutes, companies, and citizens. This orchestration occurs at multiple levels, with a specific focus on the organizational level, where they manage, monitor, and coordinate different LL projects (Schuurman, 2015). In their early days, LLs were mostly linked to ICT innovation, with a heavy emphasis on the European context of these evolutions (Eriksson, Niitamo, and Kulkki, 2005).

In the light of these evolutions, the current Testing & Experimentation Facilities share a lot of common ground with these early Living Labs, where 'ICT innovation' can be replaced by 'AI innovation.' As AI is a hot topic in innovation research, policy making and beyond, it is maybe surprising that in the context of Living Labs, not a lot of research attention has been dedicated to the combination of both. In the literature, we find examples of AI among healthy ageing Living Labs (Rauschenberg et al., 2021) and AI applications in Urban Living Labs (see e.g. Nguyen et al., 2022 and Frey et al., 2022).

The closest account of the role of Living Labs for AI innovation can be found in the work of Vilarino (2022), but this is mostly an exploration and plea for the pivotal role Living Labs should play in the context of Digital Transformation and AI innovation, focusing on the social and societal impact of AI, rather than a study that analyses the actual impact of Living Labs on AI.

When we look into practical examples where AI and Living Labs are combined, we find a majority of AI applications in the context of university research groups that want to combine and extend their technological capabilities in a more societal context (e.g. the AI Living Lab at the Brunel University London) or AI as enabler in specific domains, without Living Labs having a specific focus on AI itself (see www.openlivinglabs.eu).

However, all these research and practitioner examples deal with Living Labs linked to a single location or organization. This differs quite significantly with the concept of TEFs where the facility consists of multiple TEF sites spread across Europe with different service offerings and even different legal entities. In this regard, there are a few studies that explored the multifaceted roles of LLs within innovation ecosystems or networks. For instance, Gamidullaeva (2018) envisions LLs as crucial innovation intermediaries, fostering extensive networks and ensuring continuous integration. They adopt a critical role in coordinating innovation activities among multiple actors at the systemic level, eliminating barriers, and harmonizing the efforts of ecosystem participation. Within TEFs, this ecosystem should be regarded as the whole of Europe.

Testbeds & AI

A testbed is a platform for conducting rigorous, transparent, and replicable testing of scientific theories, computing tools, and new technologies. The term is used across many disciplines to describe experimental research and new product development platforms and environments. A typical testbed could include software, hardware, and networking components. In the context of AI, there is a long tradition of setting-up and using testbeds. For example, a report from 1995 describes the development and demonstration of the Advanced Artificial Intelligence Technology Testbed (AAITT), a structured development paradigm and associated toolkit supporting the design, analysis, integration, evaluation, and execution of large-scale, complex, distributed systems, composed of knowledge-based and conventional components, in the context of various United States Air Force domains. In this report, a testbed is defined as a facility that provides tools for experimenting with software system configurations in order to optimize performance and solutions (Zapriala et al., 1995). There is an abundance of studies describing testbed settings that make use of AI, for example in the context of 5G and 6G connectivity (e.g. Nahum et al., 2020 & Wang et al., 2023). There are fewer studies that report on testbeds for AI innovation in the context of cities. One example is a study by Meta et al. (2021) where the camp Nou stadium in Barcelona is used as a testbed for an Urban Digital Twin by using AI methods and techniques. However, the study mainly described the set-up and ambitions of this setting without a lot of data on outcomes or learnings yet.

Method

To investigate the potential role and positioning of TEFs in the European AI landscape, linked to the three discussed innovation concepts, we adopted a qualitative triangulation design. We chose the CitCom.ai TEF on smart cities and communities as case study and used three data collection methods: an expert interview study, an analysis of the current service catalogue in the light of regulatory sandboxes, Living Labs and testbeds, and an analysis of the current usage of these services in planned or executing experiments. This design allows to converge towards an initial understanding of TEFs in general and the CitCom.ai TEF in particular by combining data from multiple methods and data sources (Flick, 2004).

For the expert interview study, we selected 14 representatives from relevant organizations. Both the public and private sector were targeted, as both sectors can participate in the TEF as customers, adopters, users, researchers, etc. Once a participant agreed to be interviewed, they were requested to sign an informed consent form that provided further details on the data anonymized data processing. Table 1 gives an overview of the participants. The goal of the interviews was twofold:

- Get a good understanding of the hurdles AI innovators experience to reach commercialization by focusing on their needs and challenges for AI deployment in the smart city context.
- Discover, define, and validate predefined assumptions on the optimal set of services that should be offered through the TEF to tackle the above needs and challenges.

Table 1. Participants in the interviews and their main activities

Participant	Category	Main activities
Agoria	Federation	Agoria includes over 2,000 member companies from the manufacturing, digital, and telecom industries, with 70% being small and medium-sized enterprises (SMEs).
BeMobile	Large enterprise	BeMobile has evolved into a comprehensive smart mobility company, providing solutions for every sector of the mobility industry (e.g., logistics firms, tolling operators, original equipment manufacturers (OEMs), government bodies, port authorities, and parking operators).
Cevi	Large enterprise	Cevi is a major player in the Flemish IT market, specializing in building modern and reliable computer systems, primarily for public institutions (provincial governments, municipalities, Public Centres for Social Welfare, libraries, etc.), but also for other companies.
Curaevia	Start-up	CuraeVia helps organizations move towards a better, more sustainable customer journey with the aid of their Mobility as a Service (MaaS) software.
Digitaal Vlaanderen	Flemish government	Digital Flanders is the digital partner for Flemish and local governments. They implement digital transformation projects and guide governments through every step of the process.
Eurocities	Federation	Eurocities is the premier network of major European cities, encompassing over 200 large cities as members from both inside and outside the European Union. It serves as a collaborative hub where local governments convene to exchange ideas and collaborate on initiatives that drive positive change.
Hub.brussels	Brussels goverment	hub.brussels orchestrates and energizes various thematic networks of companies, working collaboratively to transform Brussels into the most vibrant, inspiring, and promising region for entrepreneurship.
IDLab	Academic research group	IDLab centers its research on internet technologies and data science. They create technologies that surpass current solutions in communication subsystems, high-speed and low-power networking, distributed computing and multimedia processing, as well as machine learning, artificial intelligence, and web semantics.
Mpact	Non-profit	Mpact strives to enhance mobility systems to be more efficient and accessible by adopting the principle of 'doing more with less'.
Paradigm.brussels	Brussels government	Paradigm is the go-to IT partner in the Brussels-Capital Region, capable of handling any task related to computer development, IT support, telematics, and cartography.
Roadeo	Start-up	RoadEO is creating a worldwide platform for monitoring and predicting road quality, which advises public road authorities and commercial construction companies on the optimal timing and location for road maintenance.
Smartends	Start-up	SmartEnds combines IoT software and hardware to transform the waste management industry. Their leading product, BrighterBins, utilizes advanced technology and highly optimized sensors to facilitate smart waste management.
NMBS/SNCB	National railway company of Belgium	NMBS/SNCB is the public railway operator and manages the freight (B-Cargo) and passenger services.
Univrses	Start-up	Univrses is committed to enhancing urban infrastructure through the application of computer vision and machine learning technologies.

A comprehensive topic guide was developed to ensure uniformity in the interviews while providing enough flexibility for detailed discussions. The approach of semi-structured interviews by use of a topic guide is supported by literature (Bernard, 2006). The topic guide is added as addendum to this paper.

The responses from the interviews were transcribed, coded, and categorized to identify distinct statements, themes, and keywords. Subsequently, the frequency of these statements was calculated by counting their occurrences. This frequency serves as an indicator of the level of attention given to specific topics, practices, or challenges. This method of coding and counting is commonly employed as a systematic technique in qualitative research (Elliott, 2018).

As a second method, we analysed the current service catalogue of CitCom.ai and linked them to the characteristics of the three discussed innovation concepts: regulatory sandboxes, Living Labs, and testbeds. We did this by comparing the elements mentioned on the CitCom.ai website where the service catalogue is presented to the characteristics that were discussed in our literature review. This deductive approach allowed us to link the seven service categories to the three innovation concepts.

Finally, we also collected data from all 16 CitCom.ai TEF sites on the experiments they were planning or executing. This was collected via a template that questioned the usage of (technical) infrastructure, the (planned) service(s) to be delivered to the customer, the type of customer, the TRL-level of the AI solution, the stakeholders involved, etc. The content of the template was discussed and iterated during three workshops that took place in the context of the project together with all site owners and other stakeholders involved in the CitCom.ai project. Unclarities were discussed and resolved, and feedback was considered to clarify the different elements from the template.

These templates will be used during the entire duration of the project and will be updated when the status of the experiment changes. For this analysis, we have used the data collected from the 26 first experiment templates. For this study, we counted the different services that were mentioned in the experiment templates and looked at the popularity of the seven service categories. Coupled to the previous exercise, this enabled us to identify the popularity of the service categories linked to the three innovation concepts.

Results

Interview study

The expert interview study, that was carried out with the participants having no prior knowledge of the CitCom.ai TEF, revealed the following barriers and enablers, ranked first, second, and third:

1. **Barrier: Innovation aversion**

Cities and communities often lack expertise in data, technology, and AI, leading to a slow and unclear decision-making process for adopting innovations.

Enabler: Innovation support

Cities and communities would benefit from enhanced support in innovation, which would improve their risk mitigation and reduce their ‘fear of innovation.’

2. Barrier: Data silos

Today, data is often scattered, unstructured, and fragmented across silos, which restricts the potential for innovation.

Enabler: Common data(sharing) standardizations and frameworks

Common standards and frameworks would enhance data interoperability and maturity, which are crucial for advancing AI innovation.

3. Barrier: Complex regulations

A lot of stakeholders struggle to understand, comply, and keep up with regulations, such as GDPR (General Data Protection Regulation), the data act, the AI act, etc.

Enabler: Regulatory support

AI innovators require assistance to navigate through national and EU legislation, particularly as new directives have emerged in response to advancements in AI technology.

Based on the feedback of the interviewees, the following initial CitCom.ai services were ranked, with the most desired service category ranked first:

1. Guidance to understand EU legal framework
2. Providing a regulatory sandbox
3. Access to real-life TEF data
4. Algorithm training using real life TEF data
5. Algorithm validation in a real environment
6. Data requirements mapping

The ‘data hunting for required data sets' service was not ranked as this was not desired by the participants. Additionally, they mentioned three more services that were missing from the initial predefined set of services:

- Matchmaking process between AI innovators, cities, and communities
- Community building to foster data sharing and trust
- Improving data and algorithm maturity, quality, and interoperability

Moreover, the participants also proposed as a condition to use TEF services that the datasets on offer are integrated, maintained and monitored.

Service category segmentation

Based on the interview study and on input from the operators of the 16 TEF sites, a new service catalogue was created. These 16 TEF sites are spread across Europe (Denmark, Finland, Sweden, Belgium, the Netherlands, Luxembourg, France, Spain, Italy, and Poland) and have a different focus, set-up, and characteristics. The differences between the TEF sites are intended to increase the possibilities for real-life validation and maximize the value proposition which in return will increase customer satisfaction for the CitCom.ai TEF overall. Some of the TEF sites promote themselves as active Living Labs (e.g. DOLL - the Danish Living Lab for smart and sustainable urban innovation) and already deliver services, whereas others are research institutes or RTO's, of which some also already offer services, and finally there are organizations linked to a municipality, which mostly do not offer paying services themselves. Multiple organizations can offer services on a TEF site. However, a service provider is not necessarily a TEF site. A TEF site consists of at least one testing zone, being a physical location where experiments take place or that is studied or affected by the experiment, usually located in a city, with experiments taking place, affecting, or studying the real environment. For more low-level TRL experiments, this testing zone can be a more lab-like environment (e.g. the dynamic vision lab of DTI, Denmark) or in specifically constructed testbeds that are closed for the general public (e.g. the autonomous vehicle test track at UTAC, France). Usually, there will be specific datasets available linked to the testing zone. A TEF site is usually linked to and situated in a city or municipality. The local ecosystem of a TEF site includes all the actors and their interactions linked to the specific topic or focus of that site. At least one of these actors owns datasets that can be used in experiments. Depending on the type of site, the TEF site can offer different services based on the AI Innovators' needs. Some of the TEF sites support the AI Innovators going from TRL 6-7, whereas others offer services that are more fitting from TRL level 7-8 or even TRL 8-9. Officially, TEFs are established to offer services only from TRL level 6 or higher (European Commission, 2023).

The inputs of the interview study were used to categorize the long list of services that were proposed by the TEF sites. Based on a deductive segmentation exercise, the following seven service categories have been proposed to reflect the capabilities and service offering of the 16 TEF sites:

Table 2. TEF service categories – see also www.citcom.ai

1. PHYSICAL FACILITY SERVICES Physical services enable AI innovators to test in city infrastructure with guidance, street closure, and installation support, reducing deployment time and advancing Technology Readiness Levels (TRL). A select group of nodes facilitates faster collaboration by streamlining the interaction between AI innovators and cities. Access to real infrastructure enhances TRL by validating solutions against real-life scenarios. Citizen engagement involves ecosystem participation for tailored testing and validation.	**2. VIRTUAL FACILITY SERVICES** Virtual facility services provide easy access to computing resources, supporting remote experiments and real-time data analysis. This accelerates solution validation, advancing Technology Readiness Levels.
3. ALGORITHM CREATION & VALIDATION Algorithm creation and validation services can be offered in collaboration with AI innovators. The co-created algorithms can validate others in a feedback loop, involving data collection, storage, preprocessing, machine learning frameworks, model training, evaluation, hyperparameter tuning, deployment, scalability, and monitoring. The process prioritizes security, privacy, and continuous improvement through a feedback loop, ensuring effective and efficient AI algorithm development aligned with specific project requirements and preferences. The comprehensive approach addresses data quality, infrastructure, and performance metrics, promoting seamless integration, encryption, and access control, enhancing the deployment and performance of AI algorithms.	**4. COMPLIANCE & ETHICS ASSISTANCE** Compliance assistance involves audits, program development, and training to mitigate risks, with experts adapting practices to regulatory changes. Ethics assistance promotes ethical behavior, guiding data use and developing codes of conduct. These efforts play a key role in proactive risk management, limiting legal and ethical risks, regulatory violations, and financial losses. These services are crucial for understanding and complying with evolving EU landscape requirements. In virtual facility services, security and compliance prioritize data protection through robust measures like encryption, access controls, and authentication.
5. IMPACT ASSESSMENT This service category focuses on the desirability and viability of AI innovation. While most TEF services assess feasibility, there is a crucial need to evaluate the actual impact on the environment, stakeholders, and end-users. Desirability relates to meeting stakeholder needs and solving problems, while viability considers the business model, revenue generation, costs, and benefits. TEF sites excel in answering these questions by tapping into local ecosystems, facilitating contact with relevant stakeholders, and addressing parameters linked to impact and outcomes.	**6. OPPORTUNITY ASSESSMENT & SCOPING** Services that help identify opportunities, define innovation scope, and align stakeholders, while also mitigating risks by evaluating financial viability, technical feasibility, and cities' needs. Namely: understanding target audiences, assessing organizational viability, and evaluating technical feasibility. Various activities are conducted based on idea maturity and customer requirements, including exploring, co-creating, and validating solutions to prepare for experiments. These services - focusing on customer needs and maturity, range from (i) idea exploration, understanding problems, assessing resources (ii) co-creation to characterize solutions and (iii) preparatory activities to select the best technical approach, including data, infrastructure, and expertise needs.
7. ECOSYSTEM ENGAGEMENT They focus on creating a collaborative platform dedicated to AI innovation that brings together researchers, academics, institutions, industry partners, and other stakeholders. The goal is to facilitate knowledge exchange, collaboration on research & development projects, and the development of a vibrant R&D community. Suppliers can showcase their technology and AI expertise, backed by capital investors looking for opportunities beyond state of the art. Cities and other potential buyers can share their interests by presenting real-life use cases for which they seek technology innovations.	

When we look back at the three innovation concepts, the first three service categories can be linked to the AI testbed. Within an AI testbed, the focus is put on rigorous, transparent, and replicable testing of new technology with a typical testbed consisting of software, hardware, and networking components. This clearly applies to services related to physical facilities such as sensors, city infrastructure, etc. The same goes for services related to virtual facilities such as High-Performance Computers, local Digital Twins… Thirdly, algorithm creation and validation is a service category that can also be associated with testbeds as the emphasis is on quality assessment, performance metrics… etc.

The fourth service category, compliance & ethics assistance, is clearly in line with the AI regulatory sandbox concept. This service category is all about (legal) compliance, risk assessment and codes of conduct for ethical AI that complies with the EU regulation. However, in the literature review we already found out that the current legislation is not ready yet for effective implementation all over Europe and that some critical barriers still exist.

The remaining three service categories clearly go beyond a purely technical testing of the feasibility of the AI innovation or the compliance with regulatory requirements. Impact assessment looks at the actual impact of the innovation for stakeholders, whereas ecosystem engagement-services are intended to involve these stakeholders in the innovation process, be it in earlier stages to discover opportunities or in later stages to assess market potential. Finally, opportunity assessment and scoping refer to co-creating new AI innovations, possible after ecosystem engagement, and scoping the actual experiment that will run in the TEF. As already appears from the terminology, these final three categories link strongly to Living Labs with their emphasis on active stakeholder engagement and co-creation with the intention to create AI innovation that is desirable with a viable business case.

As a final step, we used the coded services from the experiment templates filled out by the TEF site owners. Based on the first 26 experiments that were logged in the respective templates we get a first impression on the nature and outlook of these experiments, and of the popularity of the service categories and the link with the concepts related to TEFs.

In the 26 first logged experiments, we already discover some interesting tendencies. First, in terms of TRL of the tested solution, we label the majority (N=15) as 'experiment' (TRL 5-6). The category 'test' (TRL 6-7) is mentioned 4 times and the category 'validation' (TRL 7-9) 7 times. This is an indication that the current TEF cases are still situated mostly in the experimental TRL-levels that are facilitated by TEFs. In terms of the main 'customer' of the experiments, half mentions SME's (N=13), followed by 236ublicc sector (N=6), academia (N=5) and large enterprises (N=2). This is already in line with the assumed target group of the TEFs, which are mostly aimed at SMEs. However, other customer groups also seem to have potential.

In total, 53 services are listed within these 26 experiments, which makes a mean of just over 2 services per experiment. Eight experiments only list one service, and two experiments contain 6 services.

Table 3. Number of services per service category

Link to concept	*Service category*	*Number of times mentioned*
TESTBED SERVICES	1A. VIRTUAL FACILITY SERVICES	17
	1B. ALGORITHM CREATION & VALIDATION	10
	1C. PHYSICAL FACILITY SERVICES	8
LIVING LAB SERVICES	2A. OPPORTUNITY ASSESSMENT & SCOPING	6
	2B. ECOSYSTEM ENGAGEMENT	5
	2C. IMPACT ASSESSMENT	5
REG SB SERVICES	3A. COMPLIANCE & ETHICS ASSISTANCE	2

In terms of frequency, ‘VIRTUAL FACILITY SERVICES’ is clearly the most offered service with 17 experiments. ‘ALGORITHM CREATION & VALIDATION’ and ‘PHYSICAL FACILITY SERVICES’ are the second and third most offered service categories, with respectively 10 and 8 experiments. As we discussed in the previous paragraphs, these three service categories are in line with the AI testbed concept, and in the context of what the TEFs want to achieve, they seem a core offering towards AI innovators. Based on these numbers, there is demand as well as an offering for these service categories.

The next three service categories have very similar numbers: OPPORTUNITY ASSESSMENT & SCOPING (6), ECOSYSTEM ENGAGEMENT (5) and IMPACT ASSESSMENT (5). Again, this is perfectly in line with the innovation concept which they are all three linked to: Living Labs. These three service categories can be regarded as an attempt to link AI solutions with actual needs and (wicked) problems of cities and communities, and assessing whether they actually deliver, whereas the first three service categories could be linked mainly to the technical feasibility of the AI solution and apply more to the AI innovator only.

The final service category, ‘COMPLIANCE & ETHICS ASSISTANCE,’ has the lowest number of occurrences with only two experiments. This category is clearly linked to the final concept: AI regulatory sandboxes. In a way, it does not come as a surprise that this category is the least developed right now as the different member states are still in the process of setting-up regulatory sandboxes. The AI act specific regulation passed only recently. This will prompt many AI providers to seek assistance in understanding and applying this regulation. In the future we foresee that these types of services, and specifically the ‘regulatory learning’ (Gonzalez Torres & Sawhney, 2023), will become a very important part of the value proposition of the TEFs, especially as our expert interview study revealed that this type of services was one of the most mentioned and needed.

Conclusion

Within our research, we discovered that three more established innovation concepts can be linked to the newly established TEFs: regulatory sandboxes, Living Labs, and testbeds. Based on the actual service offering in the 16 different TEF sites of CitCom.ai and on the current popularity of these service categories in the first 26 defined experiments, the TEF is mainly operating as a testbed with 'technical' services making up the majority of the current experiments in preparation or executing mode. However, the results of the expert interviews clearly indicated the need for 'regulatory' services, which stresses the potential role of TEFs for regulatory support and sandboxes, although these services are almost absent in the current experiments.

Additionally, the results showed that several services were missing from the predefined set: community building and matchmaking, which should tackle the 'innovation aversion' barrier; and improving maturity, quality, and interoperability, which should tackle the 'data silos' barrier.

Finally, we observe a clear need for any potential combination of the available services in the TEFs, showing the added value of grouping those services into a modular single point of access.

Therefore, our research demonstrates that TEFs can play a vital role for AI innovators as trusted intermediaries and innovation incubators, but that getting the regulatory aspects clear and implemented in their service offering is crucial. This also positions TEFs in a driving seat for the definition and implementation of the AI regulatory sandboxes. The fact that different sites in different member states work together and in sync in these TEFs holds a lot of potential to overcome some of the current hurdles within the AI act surrounding the establishment of these regulatory sandboxes. However, the fact that these sandboxes are not yet in place also puts a large risk on the potential success and scaling of the current TEF service offering. Without these sandboxes, international scaling and cross-border experiments are a lot harder to accomplish, so we suggest dedicating time and resources to figure out the establishment and service offering of the AI regulatory sandboxes via the 16 TEF sites in their respective countries. However, we believe that the upcoming Coordination Support Action on Regulatory Sandboxes (see European Commission, 2024b), as well as other similar initiatives within the TEF's and interested working groups, will allow interesting approaches and development on AI regulatory sandboxes novel implementations and operationalization.

Future research should look on the evolution of this TEF but should also consider the establishment and evolution of the other sectorial TEFs. More input is needed regarding market needs, the success of the different service categories and the legal implementations of AI regulatory sandboxes. We believe that more of this kind of research, which is very closely following the current European developments and evolutions, is needed to increase the chances of a successful implementation and operation of TEFs in the European AI ecosystem.

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Addendum – topic guide

The interview was organized into four sections, each progressively introducing the concept of TEFs:

1. Introduction

First, a short introduction of the interviewers and the CitCom.ai project was given, detailing the research objectives and the reasons for seeking the interviewee's input. The goal was to get a better understanding of the interviewee's expertise and their position within their organization.

2. Barriers and enablers

To get insight in the current practices and challenges, the following questions were asked:

a. What are your current practices to train, test & validate your AI solutions?

What are the main challenges today in the mobility industry from your point of view?
What role do you see AI play in resolving these issues?

Next, the interviewers inquired about which services should be implemented in the CitCom.ai TEF to address the previously mentioned needs, ensuring the questions were posed without interviewer suggestions to minimize bias.

3. Innovation confrontation

In this section the concept of TEFs, and the scope of the CitCom.ai TEF specifically, was introduced. The interviewer explained the role of the TEF as an orchestrator that fosters collaboration between AI innovators and cities by offering services. The following characteristics of the CitCom.ai TEF were highlighted:

a. A one-stop-shop for companies to improve their processes, products or services using digital technologies.

A facilitator for the validation of novel AI-driven services in real-life environments before their further massive deployment
Expertise centre for the design and the implementation of AI testing methodologies in real-world environments

Here again, the interviewees were asked to reflect on the solutions to their challenges, but this time focusing on the following predefined TEF services:

a. Providing a regulatory sandbox

Guidance to understand EU legal framework

Data hunting for required data sets

Access to real life TEF data

Data requirements mapping

Algorithm training using real life TEF data

Algorithm validation in a real environment

Wrap up and conclusions

The interview was concluded with an opportunity for the interviewees to offer additional insights or takeaways that were not yet discussed.

Living Labs for Business and Emerging Technologies

Thursday, 26th September 2024

"Living Labs for Business and Emerging Technologies" was a session focused on exploring how Living Labs can drive business innovation and the development of new technologies. The session highlighted collaborative methodologies that Living Labs employ to integrate user feedback, real-world testing environments, and multidisciplinary expertise into the design and deployment of cutting-edge technologies.

This session emphasised the role of Living Labs in supporting startups, SMEs, and larger corporations in testing business models and emerging solutions, creating a space where innovation is accelerated through iterative co-creation. The session brought together experts and practitioners to discuss how Living Labs can bridge the gap between technological advancements and market needs, fostering sustainable and impactful business growth.

Research-In-Prrogress Paper

The Dynamics of Innovation Networks in Lab-formats: A System-Theoretical Approach

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Abstract

This research investigates the dynamics of interactions within innovation networks, using the practical example of a Lab. The focus is on analyzing how various actors within the network interact and the impacts of these interactions on the innovation process. Niklas Luhmann's systems theory serves as the theoretical foundation, enabling an understanding of the complexity and emergent phenomena within these networks. The study employs qualitative methods, including semi-structured interviews with key actors in two Lab projects. Preliminary results suggest that transdisciplinary collaboration and open network structures are crucial for successful innovation. Detailed examination of interaction patterns and emergent phenomena within these labs highlights the importance of flexible structures and open communication channels. This study aims to contribute to a broader understanding of collaborative environments in innovation networks and provide practical recommendations for enhancing the effectiveness of Lab-formats.

Key words

System Theory, Innovation Networks, Collaboration, Emergent Phenomena

Introduction

Living Labs are vibrant ecosystems where stakeholders from academia, industry, and civil society collaborate to foster innovation. These platforms effectively integrate real-time user experiences, enhancing the innovation process (Bjögvinsson et al., 2012). System theory provides a valuable framework for examining these complex interactions and their impact on innovation dynamics (Leminen et al., 2012). This study explores how structural and communicative patterns within Labs facilitate or hinder collaborative innovation efforts, focusing on emergent phenomena that often dictate project trajectories (Westerlund & Leminen, 2011; Schuurman et al., 2015).

Living Labs serve as real-world environments for testing and experimenting with theories and applications in innovative ways. These labs promote social and sustainable innovations by involving a variety of stakeholders in the innovation process (Bjögvinsson et al., 2012). The participatory approach enables direct feedback from end-users, developing products and services aligned with users' needs and expectations.

Given that our study focuses on a Fab Lab, it is essential to highlight the similarities between Living Labs and Fab Labs and how these environments can be integrated. Both foster open, collaborative environments where innovation emerges through interdisciplinary collaboration and direct user involvement. While Living Labs integrate real user scenarios into the innovation process, Fab Labs provide the technical infrastructure and expertise to practically implement these innovations. In the context of our study, it becomes evident that Fab Labs can serve as physical spaces within Living Labs where users can prototype and test their ideas. This was particularly highlighted in the project with Ginsburg e.V., where 3D-printed replicas and audio information for visually impaired individuals were developed. By leveraging the resources and expertise available in the Fab Lab, practical solutions were created, tested, and iteratively improved in real user environments.

The challenge in managing such interdisciplinary collaborations lies in coordinating the diverse interests and objectives of stakeholders. System theory views Labs as complex adaptive systems where various elements and actors interact (Luhmann, 1995). This perspective helps understand the dynamic processes that occur within Labs and provides strategies to make them more effective. A crucial aspect of Labs is their ability to foster emergent phenomena. Emergent phenomena are unexpected outcomes from the collaboration of different participants. These phenomena are often innovative and can open new possibilities for developing and improving products and services. Fostering such emergences requires flexible structures and open communication channels (Schuurman et al., 2015).

To capture and understand these emergent phenomena and associated innovation dynamics, a deep analysis of the structural and communicative patterns within Labs is necessary. Our study aims to identify specific mechanisms that enhance creativity and productivity in these unique innovation environments and develop recommendations on increasing the efficiency and effectiveness of Labs through targeted structural and communicative adjustments.

Methodology

Research Sample

This study employs a qualitative research approach, focusing on the application of systems theory and innovation networks in real-world settings. Data triangulation, involving interviews, academic theses, and online data, ensures comprehensive research validation (Eisenhardt, 1989; Flick, 2011). The deductive research method analyses results based on existing theories. Semi-structured interviews with various actors involved in innovation projects were conducted.

The study revolves around two consecutive innovation projects at Fab Lab in Siegen. These projects, spanning two years, focused on cultural promotion and accessibility for visually impaired individuals. The first project, in collaboration with Ginsburg e.V., involved creating 3D-printed replicas of excavated shards enhanced with conductive filament to provide audio information upon touch. A subsequent student research project further developed this prototype. The second project, initiated by the Siegerland museum, aims to make 2D art accessible to visually impaired individuals by converting paintings into 3D forms with audio playback features upon touch.

These projects were selected for their reflection of trans disciplinarity and open innovation culture in Labs. The open collaboration in the shard project significantly influenced the initiation of the 2D art project, involving actors previously unconnected to the original innovation project.

To analyse these projects within the context of System Theory, interviews were conducted with key participants, including the Fab Lab Siegen leader, the curator and digital manager of the Siegerland museum, a student researcher, and a volunteer from Ginsburg e.V. These participants represent the following roles: the head of the innovation environment (Fab Lab Siegen leader), heritage and culture (curator and digital manager), higher education and research (student researcher), and hands-on practitioners (volunteer from Ginsburg e.V.). This selection ensures that all critical perspectives and roles are covered, providing a comprehensive understanding of the dynamics within the innovation projects.

The research adheres to qualitative research criteria of transparency, intersubjectivity, and scope (Mey & Ruppel, 2018; Mayring, 2018), ensuring validity, reliability, and objectivity. The study aims for reproducibility in similar Labs and innovation projects by providing detailed methodology and including interview transcripts and guidelines. Intersubjectivity is maintained through critical discussion of interview results, acknowledging potential for varying interpretations.

Data Collection

The study involved interviewing fifteen individuals actively engaged in the innovation projects at the Lab. These participants were chosen for their direct involvement and were interviewed using a semi-structured guide focusing on the innovation project, the Fab Lab, and collaboration with other actors.

The first five interviews, conducted between January 27 and March 10, 2024, included seven in-person and one online session via Webex. The Webex interview was in English to accommodate a non-German speaking participant and was later translated into German for consistency. The in-person interviews were held at the Fab Lab, the Siegerland museum office and near Ginsburg.

Eighteen questions were posed to the participants, categorized into four groups:

1. Questions about understanding the Lab concept and its role in innovation networks.
2. Questions for the system-theoretical analysis of Labs.
3. Questions regarding the significance of interactions and emergences in innovation networks.
4. Questions about practical implementation and challenges in Labs.

Data Analysis

The analysis of the interviews is based on Mayring's qualitative structured content analysis method (Mayring, 1994). This involved axial coding of the interviews, where categories and coding segments were developed using the underlying theory of System Theory and Innovation Networks.

To facilitate the coding and evaluation of the transcribed interviews, MAXQDA, a qualitative data analysis software, was utilized. This coding schema allowed for a structured approach to analysing the interviews, enabling the researchers to systematically extract and interpret relevant information.

Our ongoing research has conducted eight of the planned fifteen semi-structured interviews with diverse stakeholders. These interviews have already started to shed light on the complex, nuanced interactions that drive innovation in these unique settings. As the study progresses, we expect to uncover more in-depth insights into the experiences, challenges, and unexpected outcomes that participants encounter within the innovation ecosystem.

The semi-structured nature of the interviews provides a flexible yet consistent framework for gathering data, allowing participants to freely express their thoughts and experiences. This approach effectively explores specific areas of interest, such as collaboration dynamics within the Labs and emergent phenomena significantly influencing project trajectories.

The thematic analysis of the interview data, following Mayring's structured content analysis approach, is expected to reveal distinct patterns and themes aligning with the theoretical framework provided by system theory. This analysis will categorize the data into various themes that reflect the key aspects of collaboration and innovation within the Labs, such as the importance of transdisciplinary approaches and the synergy between different stakeholders. These themes will enrich our understanding of how Labs operate and highlight the practical implications for future innovation projects.

Expected Results

Emerging insights from the initial interviews highlight the pivotal role of the Lab network in promoting collaboration and innovation. Interviewees underscored the significant contributions of machinery, expertise, and networking opportunities provided by the Labs. These resources have notably enhanced the ability to bring in additional expertise and resources for various projects. Universally, respondents recognized the Fab Lab as a critical venue for advancing innovations, appreciating its openness, accessibility to machines, and expertise. This environment is seen as a hub for materializing ideas and facilitating start-up initiatives, inviting participation from the entire community, and fostering an atmosphere of co-development.

Furthermore, the innovation process within these Labs is perceived as an emergent phenomenon, often evolving in unexpected ways due to dynamic interactions within the network. Participants noted that the absence of hierarchical structures supports an open exchange of ideas and resources, which is crucial for nurturing the innovative spirit of the Labs. These interactions frequently lead to the creation of successful prototypes and subsequent innovation projects, significantly influenced by the relationships and transdisciplinary nature that characterize the Fab Lab environment.

Our ongoing analysis reveals several key findings:

1. Synergies and Relationships:

   The interviews revealed that synergies between actors in the Lab are formed through the diverse expertise of participants. These relationships and interactions are foundational for the innovation process, as they facilitate problem-solving and idea generation. Respondents described the working environment as collegial and friendly, which enhances communication and interaction, crucial for the effectiveness of the innovation network.
2. Emergent Phenomena:

   The study identified emergent phenomena as a significant aspect of the Lab environment. For example, one interviewee mentioned how initial plans and agreements often evolve through interactions, leading to the development of new project ideas and working methods that were not initially anticipated. These emergent phenomena are driven by the spontaneous and often serendipitous interactions among participants.
3. System Theory Perspective:

   Analysing the Lab network through the lens of system theory, it becomes evident that the network operates as a complex adaptive system. The dynamic interactions and relationships within the network are essential for sustaining its innovation processes. The study emphasizes the importance of maintaining open and supportive relationships, as these are critical for fostering a culture of collaboration and innovation.
4. Challenges and Opportunities:

   While the benefits of the Lab approach are clear, managing such interdisciplinary collaborations presents challenges. These include coordinating diverse interests and objectives and ensuring the availability of necessary resources and external expertise. Despite these challenges, the Labs' flexible structures and open communication channels are vital for harnessing emergent phenomena and driving innovation.

As we continue to conduct interviews and analyse the data, we expect to further elucidate how these dynamics contribute to successful innovation projects. The final results will provide a comprehensive overview of the factors that facilitate or hinder innovation within Labs. This will include detailed discussions on the synergy between players, the importance of maintaining open and supportive relationships, and the critical role of an inclusive environment that encourages diversity and openness to change.

In summary, our ongoing research is poised to offer significant insights into the mechanisms of interaction, communication, and emergence within Labs. These insights are expected to be instrumental in shaping future strategies for managing and optimizing these collaborative environments, ultimately enhancing their efficacy in fostering innovative projects.

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Research-In-Progress Paper

Designing Smart Communication Platform with Living Labs: Crafting Innovative Urban Environments

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Abstract

Living Labs prioritize demand-driven innovation and have developed into an effective methodology addressing challenges in urban development, society, technology, and the economy. However, Living Labs still face challenges like stakeholder rewards, business connection difficulties, excessive flexibility, repeated issues, and redundant resource investments. This paper presents a Smart Communication Platform (SCP) as city innovation methodology to address inherent limitations of Living Labs, analysing its five-year application in Daegu, South Korea, and providing implications. SCP Developed through Korea's Smart City Innovation Growth Engine and Solution in Our Society Lab projects, SCP facilitates citizen scientists and private companies in problem-solving while scaling up proven solutions.

We validated our research questions through significant results at each stage of SCP. For a sustainable innovative urban environment, citizen scientists and urban problem banks are essential preparatory steps. The SCP model helps secure new market opportunities (sustainability), minimize redundant resource and budget investments (reproducibility), and accelerate decision-making (innovativeness)

Key words

Participation Modeling, Smart Communication Platform, Citizen Science, Permissioning City, Solution in Our Society (SOS) Lab

Introduction & Research Questions

Innovation is vital in addressing critical challenges in cities, society, technology, and the economy. Living Labs represent a multi-contextual R&D methodology that emphasizes demand-driven innovation rather than purely technology-driven advancements (Eriksson et al., 2006). It is designed to overcome the limitations of the traditional Triple Helix Model, where industry, universities, and governments seek to foster innovation through network-based entropy (Leydesdorff, 2012). Instead, it expands to a Quadruple (or Multiple) Helix Model by incorporating end users as key stakeholders. Adopted since 2006 in European society as an innovation methodology, Living Labs have proven effective solutions in tackling sustainability issues facing societies, cities, and the entire planet, going beyond technology and research and development (Compagnucci, 2021). By enhancing density of governance and involvement in decision making, testing solutions in real-world contexts, and refining prototypes through feedback, Living Labs empower stakeholders to accurately define problems and increase solution efficacy and participant satisfaction (Kim et al., 2019). In today's complex social and economic landscape, Living Labs naturally make the impact and facilitate adaptability of businesses, cities, communities, technologies, and government policies (Ståhlbröst, 2008).

However, despite their notable successes, Living Labs continue to face challenges such as an unclear reward system, weak business connections, excessive flexibility, repetition of identical issues, and redundant resource investments (Habibipour, 2018, Kim et al., 2020; Lupp, 2021).

In this paper, we aim to develop a framework that enables Living Labs to sustain innovation at city and regional levels, transcending individual project success. Our research questions include:

- What preparation processes and tasks are necessary to establish a smart, sustainable innovation environment in cities through Living Labs?
- How can we consistently manage the innovation process for urban issues while effectively reducing redundant resource investments?
- Can Living Lab participants enhance their degree of satisfaction while helping participating companies and research institutes establish business connections?

Literature Review & Methodology Design

Our research employs participatory modeling, an inductive method for addressing governance, smart cities, sustainability, and regional development. This involves designing models, developing, and implementing them, and analyzing the results

(Anthony Jnr, 2023; Hedelin et al., 2017; Halbe et al., 2020; Voinov, 2017). Cities thrive through creativity, openness, diversity, civic engagement, and innovation (Landry, 2008; Florida 2004; Glaeser, 2011; Portney, 2005). Citizen participation is key to solving urban challenges, while governance transformation requires collaboration. Urban challenges offer businesses a chance to identify market gaps and test new products (Kim, 2020). Living Labs facilitate urban innovation and have been adopted in cities like Amsterdam (Steen & van Bueren, 2017), Helsinki (Mustonen et al., 2017), and Berlin (Paulick-Thiel, 2021). However, fundamental issues persist with living labs, such as difficulties in establishing business connections, repetition of identical issues, and challenges in systematically managing information sharing on problems and solution processes.

Our research methodology is an inductive method where we design models and apply them to actual projects to verify the results and performance. We designed the "Smart Communication Platform (SCP)," a specific city innovation management framework tailored to Korean culture and circumstances, applicable at both the city and regional levels. We envisioned a framework that would scale individual project results into business opportunities, identify urban challenges as starting points for value creation, and consistently train and secure citizen scientists to tackle these challenges. The specific components that constitute the SCP are as follows:

1. **Innovation Seeds:** This module is the first stage of smart communication, designed to engage and train citizens to become citizen scientists while fostering a problem-focused community through specialized training programs. A citizen scientist is a community-minded individual who contributes to research by sharing data and facilities, raising new questions, co-creating a scientific culture, and helping others solve problems through crowdsourcing and collective intelligence (OECD, 2022; Serrano, 2013; Ceccaroni et al., 2023; Kalil, 2015).
2. **Urban Problem Bank:** This module defines diverse urban problems using citizen-friendly language, capturing them in document form. The Urban Problem Discovery Team (Citizen Scientists), composed of individuals from various backgrounds, ages, and statuses, identifies these problems. They receive training to identify Problems and work with experts and administrators to design solutions collaboratively (Kim et al., 2020). By ensuring participant representativeness, issuing certificates signed by the mayor to those who complete the training, and providing information about the problem-solving process, citizens can cultivate a strong sense of ownership in addressing problems (Arnstein, 1969; Horgan and Dimitrijevic, 2020).

3. **Code for City:** This involves civic organizations creating solutions to problems defined by the Urban Problem Bank. **The Public Data Lab**, comprising citizens and developers, identifies the data needed for solutions. **Civic hacking Action** uses this data to develop practical programs, while **the Code for City Accretor** secures private/public funding for problem-solving activities (Sarpangal, 2021; Schrimmer, 2016).

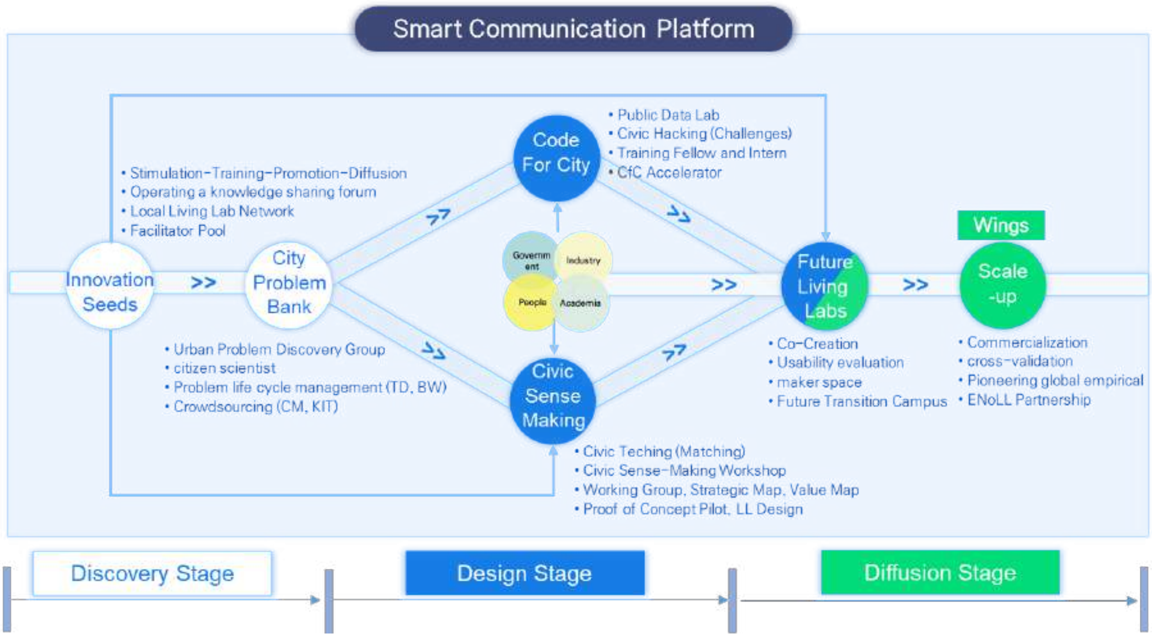

Figure 10. The Process of Smart Communication Platform (SCP)

4. **Civic Sense Making:** In this process, companies and research institutions develop solutions for the Urban Problem Bank. Civic sense activities consist of refining the proposed ideas, creating a strategy map, value map, and proof of concept. The working group designs a Living Lab for implementing the solution in a specific space (De Rosa et al., 2021).
5. **Future Living Lab**: This stage involves developing concrete solutions in real-life settings. The solutions are refined through repeated experimentation, incorporating the results of usability evaluations conducted by citizens and end users (Dias, M.S. et al., 2015).
6. **Living Lab Scale-up**: Solutions validated through the Living Labs are disseminated citywide or to other cities to promote cross-verification. This stage also supports commercialization efforts by companies and research institutions (Leminen, 2013; Schuurman, 2015; Schuurman et al, 2016).

Modeling & Data Findings

We developed the model for the Smart Communication Platform (SCP) based on two projects: the Smart City Innovation Growth Engine Project sponsored by the Ministry of Land, Infrastructure and Transport (2018-2022) and the SOS (Solution in Our Society) Labs Project sponsored by the Ministry of Science and ICT (2017-2023). The aim was to establish a people-oriented and data-centered smart city. This project viewed smart cities not as a collection of advanced technological services but as tailored future cities where societal, economic, cultural, environmental, and human components interconnect.

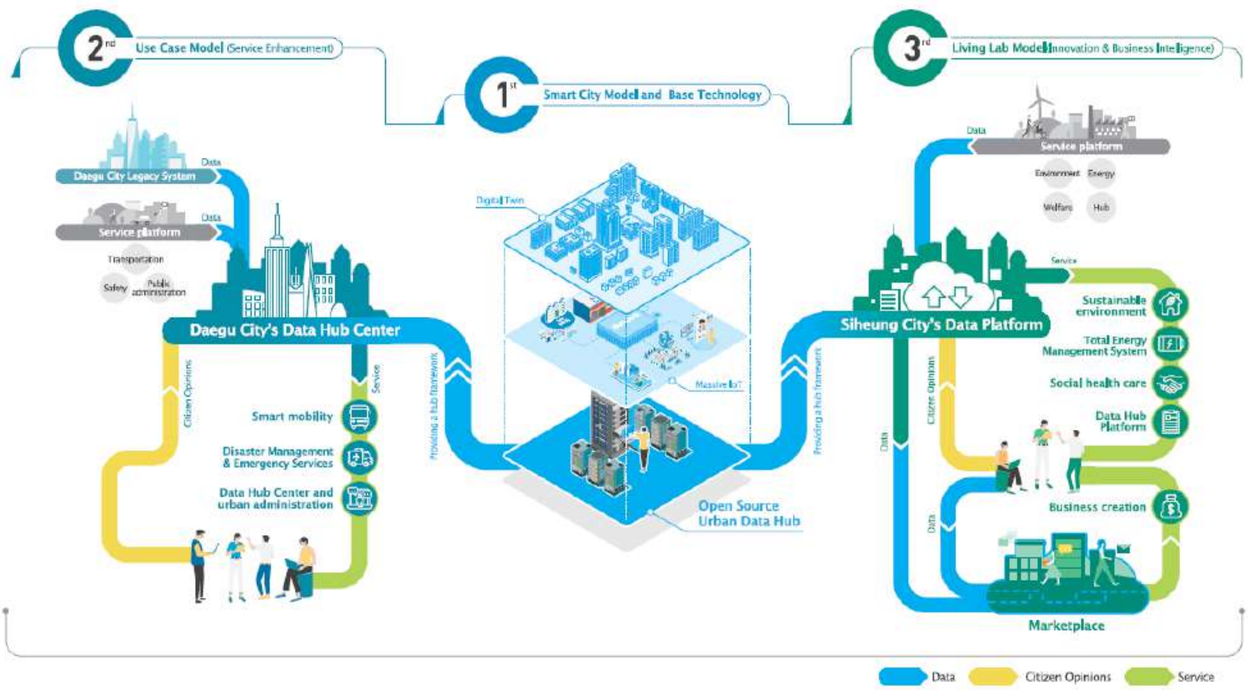

Figure 11. the Concept of Smart City Innovation Growth Engine Program (2018-2022, MoLIT)

We designed and applied a sustainable SCP to develop people(citizen)-centred smart city technologies and services in the areas of transportation, administration, and safety, focusing on Daegu, the project's demonstration city. Our approach is not just to develop products and services using living labs, but to build an environment that can create a sustainable impact based on citizens and data in the city even after the project is completed.

From 2019 to 2022, Daegu City identified 50 urban problems. Those resolved problems through the Living Lab process are archived in the <Urban Problems Museum> as part of the city's history. In the long term, the city aims to regularly update and maintain a repository of 100 urban problems. The Urban Problem Bank will be accessible to everyone in the city through a dashboard available anytime, anywhere.

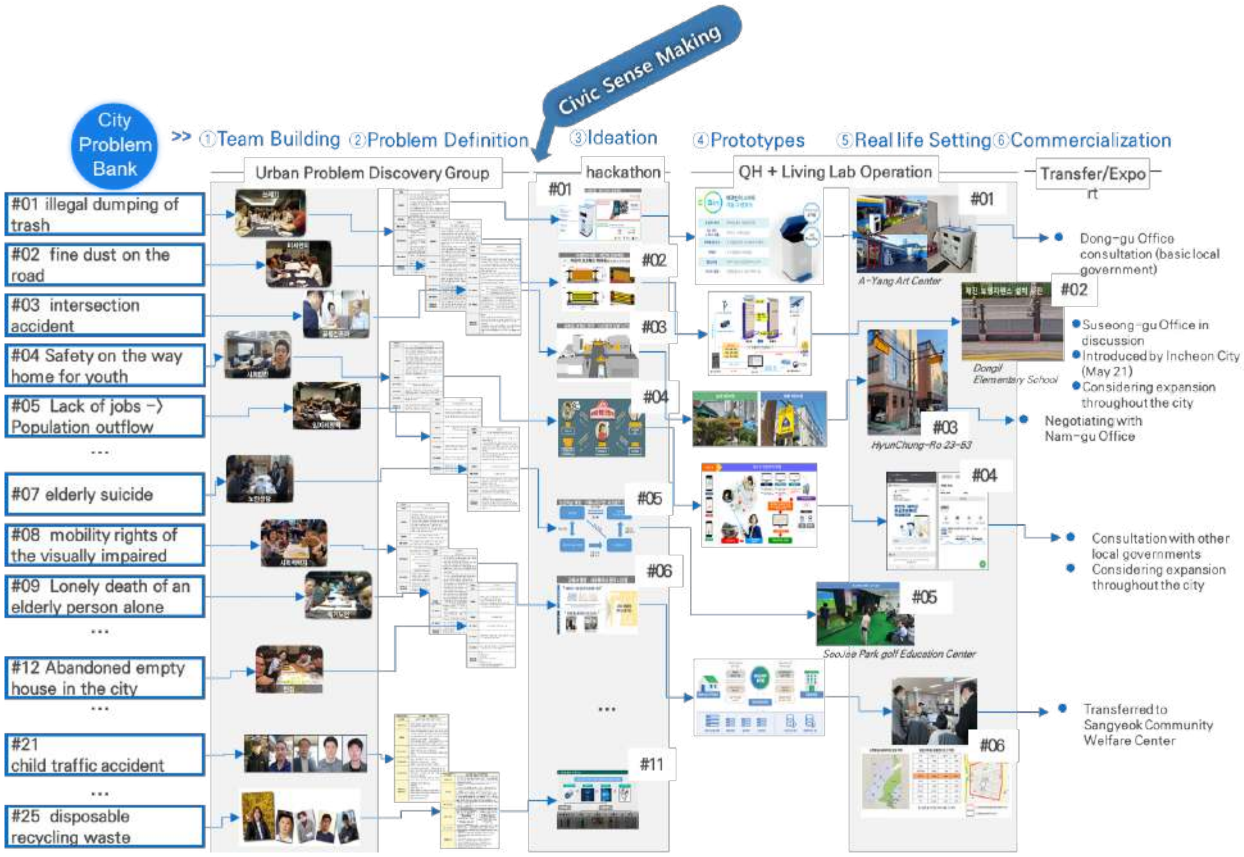

Figure 3. Urban problem-solving process using the SCP platform

Proposals submitted by social organizations, private companies, and research institutes undergo review and refinement by a working group. Once approved, the city administration allocates experimental funding based on project characteristics. Prototypes are tested in real-life settings by citizens and end users for usability following the Living Lab model. Usability indicators are predefined during the Civic Sense Making process when reviewing proposals.

Results and Discussion

Between 2019 and 2022, Daegu trained 473 of the 3,000 previously identified Innovation Seeds, and the mayor appointed 213 of them as citizen scientists. The 10-week training program included basic urban education, awareness of urban problems, field practice, and design thinking-based problem definition and idea creation for each field.

The Smart Communication Platform accelerates the development of products and services through Living Lab-based usability evaluations and enables cross-verification with international cities via scale-up programs (Table 1). The development speed for these products was reduced by 80% on average, and their quality was enhanced through data and usability evaluations from real users.

Table 1. Representative Products and Services Developed Based on SCP

Product & Service	Specification
Safety Service for Youth (2020)	Developed by Data Bank Systems, this service ensures the safety of young people on their way home.
Fine dust isolation wall (2020)	Next E&M's solution reduces urban fine dust.
Resource Circulation Robot (2022)	Eight Tech created this robot to automate recyclable sorting from household waste.
In-Wheel Autonomous Assistance Wheelchair (2022)	Developed by Incheon National University to aid the socially disadvantaged.
AI-Based Mobile Robot for the Elderly (2023)	Infinix created this to assist elderly individuals living alone.

Daegu has expanded markets by cross-validating services with Amsterdam and Glasgow, earning recognition as a Bloomberg "Champion City" with the Permissioning City model (Manwaring, 2019; Catapult, 2023; Bloomberg Cities Network, 2021).

We have found that the Smart Communication Platform offers the following advantages to overcome the limitations of living labs:

1. **Shared Innovation Process:** Private companies explored new market opportunities through problem definitions in the City Problem Bank. The city administration reduced redundant investments in resources and increased the speed of decision-making to tackle problems.
2. **Civil Society Engagement:** Civil society organizations detected shifts in solution priorities using the Urban Problem Bank dashboard. This enabled them to shape the qualitative direction of civic activities.
3. **Efficient Problem-Solving:** The City Problem Bank improved solution access by offering version-specific prototypes, activity data, stakeholder lists, and contact information from the problem-solving process. This minimized redundant investments in similar problems and enhanced solution delivery.
4. **Accelerated Innovation:** Cities achieved greater sustainability, reproducibility, and speed in innovation. Tested and validated products/services were linked to subsequent businesses, helping to create a market.
5. **Citizen Empowerment**: Around 500 citizen scientists addressed urban problems with a high sense of pride and a new perspective, fostering a "city of innovation."
6. **Innovative Urban Environment:** An urban environment emerged where any citizen can identify issues, form stakeholder communities, apply problem definitions and solution models, and continuously refine their approach to problem-solving.

Conclusion and Further Research

Despite the potential of living labs, problems like unclear compensation, challenges connecting business and urban problems, and redundant resource investments. SCP provides a framework to continually identify and solve urban problems, ensuring sustained innovation. We validated our research questions; Innovation seeds, urban problem banks, and citizen scientists are required in preparatory steps for a sustainable innovation environment while ensuring value creation. SCP provides citizen satisfaction and market expansion for participating companies and research institutions. We discovered that a sustainable innovation environment necessitates innovation seeds, urban problem banks, and citizen scientists, alongside the continuous management of value creation through urban problem banks.

For future research, we aim to expand our exploration of the SCP framework in two key directions: enhancing the SCP Platform and stabilizing it. These initiatives will offer valuable insights into the stabilization of the SCP, enabling it to create lasting impacts through living labs and to cultivate an environment where innovation is effortless and seamless in cities and communities.

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Full Research Paper

What Could Possibly Go Wrong? Exploring Challenges of Living Lab Methodology in Publishing Applications.

Authors

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Abstract

This paper addresses the main research question: what are the challenges for implementing a living lab approach in innovation projects? To answer this question we first conducted a literature review on the definition, advantages and pitfalls of living labs. Then, we discuss the living lab approach as set-up in the *anonymized* project. During the implementation of the living lab approach within this project three main challenges surfaced: (1) knowledge on market and stakeholder needs in the proposal phase, (2) use of terminology in recruitment efforts, (3) implementation of stakeholder insights in technological development cycles via user requirements.

Key words

Innovation projects, Living Lab methodology, Stakeholder involvement, Challenges

Introduction

Organisations increasingly face more complex challenges and rapid industry changes. As a result, previously used methods of internal research and development processes have had to give way to a more collaborative and open form of working (Bogers et al, 2017; Leminen, Nyström & Westerlund, 2020; Leminen, Rajahonka & Westerlund, 2017). Thus, Living Labs have gained popularity amongst researchers, policymakers and practitioners as a tool for practical and collaborative innovation in various industries (Hossain, Leminen & Westerlund, 2019; Paskaleva, Cooper, Linde, Peterson & Götz, 2015; Schuurman, De Marez & Ballon, 2015). Living Labs offer a cooperative setting for innovation in both public and private sectors (Criado et al., 2020; Greve, Jonas, Neely & Möslein, 2020). They are defined as "a design research methodology aimed at co-creating innovation through the involvement of aware users in a real-life setting" (Dell'Era & Landoni, 2014, p.139). The Living Lab approach was implemented in the *anonymized* project. This is a specific type of innovation project *(anonymized)* to support innovation in European markets. The consortium of these projects consists of universities, technical developers and industry partners, with the aim to combine research and development in a given area. In this project, the aim was to modernise and innovate the European book publishing industry by delivering new enriched media experiences. To this end, two products were developed following the Living Lab approach, an immersive book and a data visualisation tool. The first product consists of an immersive reading app for readers as well as a tool for writers to create a story and include multi-media content, such as video, images and 3D-audio, to make the story more immersive and engaging. The second product consists of a dashboard that aims to present publishers with big data insights from online communities, such as platforms for readers and fan fiction platforms. This product analyses the community data and visualises various data points for publishers to gather insights on - amongst others - the authors, fandoms mentioned in the stories, emotions present in comment sections, and reactions to these stories. [2]
While implementing the living lab methodology in the *anonymized* project, we did encounter several pitfalls. Hence, the aim of the paper is to discuss the challenges faced in implementing the living lab methodology in innovation projects and formulate strategies to overcome these challenges. Thereby the paper contributes to the research on challenges when implementing a living lab approach. To do so, the theoretical framework first defines living labs and addresses advantages and pitfalls. Then, we discuss the set-up of the living lab approach for the *anonymized* project in the methodology. Within this

[2] Aside from these products, another focus of the project was on prosumer business models, immersive book experiences, and mobile immersive book experiences. But, these products/innovations were not developed using the Living Lab approach, and are therefore not included in this paper.

project specifically, we implemented a living lab approach involving relevant stakeholders in the development of an immersive reading application and a data dashboard. The approach consisted of 4 phases, including a pre-pilot phase to gain understanding of the stakeholders' needs and practices and 3 pilot phases to co-create and evaluate the developed products iteratively. In the result section, we highlight the three main challenges we encountered during the project. Finally, the discussion points toward possible mitigation strategies for each of the lessons learned. To conclude, we summarise the results and bring together the pitfalls as defined through the literature review and in the result section.

Definition and benefits of a living lab methodology

In this section, we focus on defining living labs, and the advantages and pitfalls of implementing a living lab approach in innovation projects.

Innovation projects are complex and multidisciplinary in nature. In particular, business, technological, and end-user perspectives must be brought together (Braet & Verhaert, 2007). For example, from the technological perspective, the focus will be on optimising technological functionalities. From the business perspective, adding economic value is the priority. But ultimately, end-user perception will be a decisive factor in evaluating a product or service (Braet & Verhaert, 2007; Herstatt & Verworn, 2004). Only by merging these three perspectives, an innovation project can succeed (Braet & Verhaert, 2007) and therefore a multidisciplinary approach is needed (Ballon & Schuurman, 2015). Living Labs are a suitable approach to this as they give more power to the stakeholders, by including them in the early stages of the development process (Nesti, 2017; Paskaleva & Cooper, 2021).

Literature shows that there are multiple definitions of Living Labs. Dell'Era and Landoni (2014, p.139) defined a Living Lab as “a design research methodology aimed at co-creating innovation through the involvement of aware users in a real-life setting”. Furthermore, Eriksson, Niitamo, and Kulkki (2005, p. 4) defined Living Lab as “a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real-life contexts”. From these definitions, we identify two key elements: there is a real-life testing environment and users are consciously and actively involved in the innovation process. In addition, Ballon and Schuurman (2015) further refine the definition by specifying ‘users’ as multi-stakeholder participation involving technology providers, institutional actors and professional or residential end-users. For Ballon and Schuurman (2015), ‘involvement’ in a Living Lab context consists of a multi-method approach, meaning that methods and tools from ethnography, psychology, sociology and strategic management are combined. Finally, they indicate that in a Living Lab approach, co-creation should focus on iterations of design cycles with different stakeholder groups.

Living Labs can be classified based on which actor drives the activities. Leminen, Westerlund and Nyström (2012) distinguish four types of Living Labs: utilizer-driven, enabler-driven, provider-driven and user-driven. Utilizers are companies that launch and promote testing grounds to develop their businesses. The focus is on developing and testing products and services. Living labs initialised by enablers are typically public sector projects that pursue social improvements. Development work builds on regional or social needs. Provider-driven Living labs are aimed at promoting research and theory development, increasing knowledge creation, and finding solutions to specific problems. User-driven Living labs are set up by user communities and focus on the daily problems of users. The goal is to unravel specific problems that align with the values and requests of users and their communities. Keeping in mind the description of the different types of Living Labs, the project contains characteristics of multiple categories (provider- and utilizer-driven). For example, there are technical and industrial partners who need to demonstrate exploitation and interest from the market after the project ends, while from the Living Lab perspective, researchers provide the necessary expertise in user research.

Considering the advantages of the Living Lab method, Living Labs aim to develop a product or service that is validated with and by the relevant user groups and fits with their needs and expectations, maximising the chances for successful uptake. Combining business, technology and end-user perspectives provides the most complete set of requirements to meet the needs of each stakeholder (Braet & Verhaert, 2007). Furthermore, by involving stakeholders early in the development process, deep underlying values and new use cases can be discovered. This allows decision-makers to make adjustments early in the development and production phase (Lie, van Paassen & Witteveen, 2023). The real-life testing in the natural context of the use case also allows for the identification of real future user practices and patterns.

Pitfalls in setting up Living Labs

Using a Living Lab methodology also brings some pitfalls. First, Living Labs face technological challenges. Products created at Living Labs are rarely seen as a disruptive innovation, because they do not generate results that significantly disrupt the market. This results in companies being less inclined to improve their products through Living Labs (Nesti, 2017). Second, the involvement of all relevant stakeholder groups is necessary, but not always easy to accomplish, particularly when it concerns specific target groups (e.g. in medical contexts or with very specific professional profiles). In addition, the start of a Living Lab involves testing a beta version of the application. This causes many users to be annoyed by usability problems (Åström, Ruoppila, Ertiö, Karlsson & Thiel, 2015). This is also in line with another critical point, which is that the engagement and long-lasting commitment of users proves to be difficult, resulting in not getting enough testers to evaluate the innovation (Nesti, 2017). Access to a minimum set of recurring users is highly important when setting up a Living Lab, so no accumulated knowledge is lost (Veeckman, Schuurman, Leminen & Westerlund, 2013).

Another challenge relates to trust. It appears that many citizens/users and decision makers within Living Labs have little confidence that their opinion really matters for the development of the innovations (Åström et al., 2015). Veeckman et al. (2013) therefore address that there needs to be a minimum level of openness. It is crucial to gather various perspectives to achieve successful innovation and business opportunities. All relevant stakeholders in the design and development process must be able to express their opinions. Diverse stakeholders need to be brought together and collaborate even if they have different interests (Veeckman et al., 2013). This can be linked to the Innovation Binder Approach (Jacobs et al., 2014). This approach can help promote interdisciplinary teamwork and ensure that all necessary parties are aligned and working together towards a common goal from the start of the innovation project. The Innovation Binder Approach aims to combine technical, social and business perspectives where every opinion matters. Accordingly, Veeckman et al. (2013) also state that Living Labs built on a clear strategic intention will lead to shared motives for collaboration which is essential for a successful implementation of the Living Lab methodology.

Methodology

The results presented below are lessons learned from the *anonymized* project. The methodology used in this project was a Living Lab approach, as this allowed for co-creating solutions with the users, who were defined in an early stage as '*prosumers'* (a term encompassing readers, fan fiction writers, and amateur writers) as well as local (European) publishers. Each proof of concept would be developed and tested by the iterative involvement of stakeholders throughout the project, thus taking into account their needs and expectations. Through various feedback loops, the technology would be iteratively fine-tuned based on the feedback obtained, utilising a multi-stakeholder approach, through qualitative and quantitative data. Although different methods were used during the different phases, the same user groups were addressed for the different applications.

The first nine months of the project served as a preparatory phase, laying the foundation for the project. This preparatory phase focused on gathering initial user requirements from the relevant stakeholders, as well as gathering insights on their current practices and expectations. This phase was followed by three pilot phases, each with different focuses and aims, all reaching a larger number of users (see figure 1).

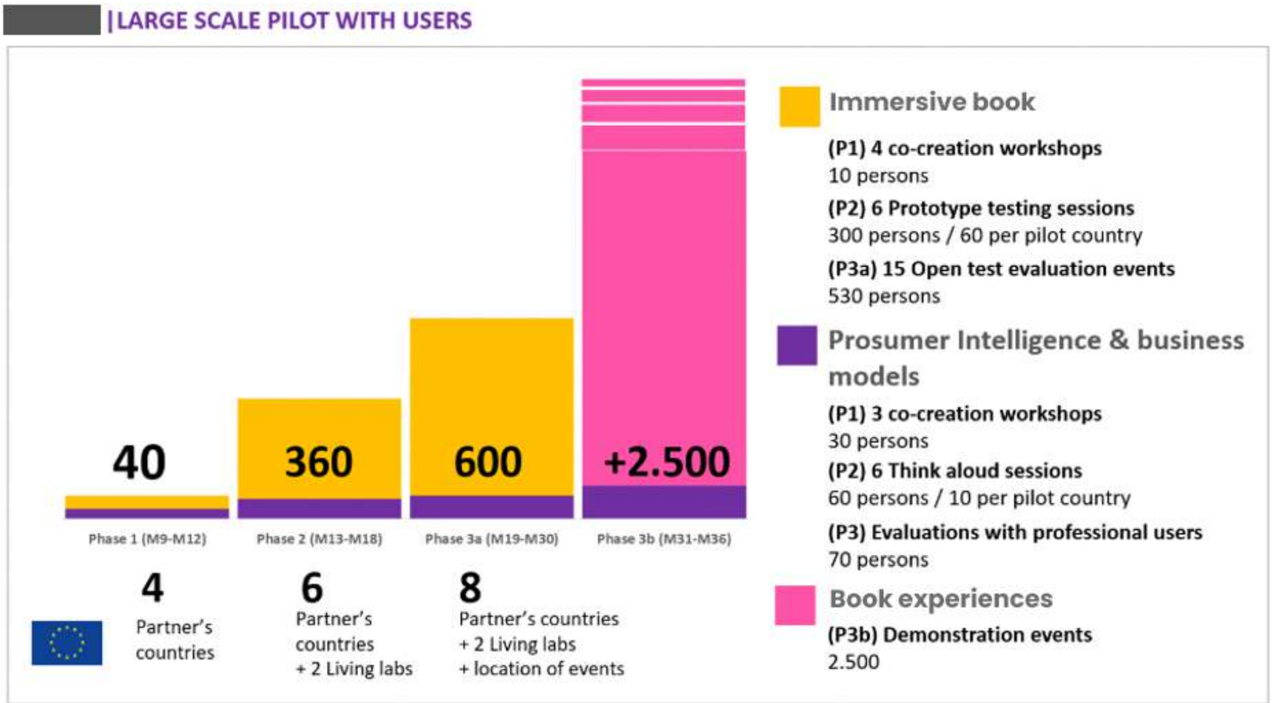

Figure 1. Overview of the Living Lab phases

The pre-pilot phase and pilot phase 1, focused on gathering insights into current practices in the publishing industry to create and update an initial set of user requirements. As presented in table 1, the first pilot phase also included various research activities for each of the different products developed within the project, such as co-creation workshops and survey evaluations. The second pilot phase built upon the results and insights gathered from the preparatory and first pilot phase and aimed to further update the user requirements. As in the first pilot phase, a mixed-method approach was used, in which activities such as individual think-aloud sessions, combined with in-depth interviews, and survey evaluations were conducted. In the third pilot phase, the research activities aimed to gather feedback on the near-final version of the products. During this phase, research activities consisted of interviews, workshops, and evaluation surveys. Looking at the number of participants, especially finding participants to test the PIT proved difficult. Particularly in pilot phase 2 and pilot phase 3, the intended number of participants for the PIT was not reached.

Table 1. Overview of activities in each pilot phase

	Project Products (stakeholders)		
Pilot Phase	**Book Player (prosumers, readers, sellers)**	**Book Creator (writers)**	**Data visualisation tool (publishers)**
Phase 1 (paper mock-ups and proxy technologies)	Three online co-creation workshops: 31 participants	2 online co-creation workshops: 13 participants	2 co-creation workshops: 11 participants 2 interviews Survey evaluations: 20 respondents
Phase 2 (Clickable mockups and prototypes)	Survey evaluations: 266 responses	Survey evaluations: 12 responses	Survey evaluations Think-aloud session In-depth interviews 32 participants
Phase 3 (Near-final version of products)	Survey evaluations: 553 responses	2 workshops: 23 participants Survey evaluations: 199 respondents	6 in-depth interviews 1 workshop: 18 participants Survey evaluations: 15 responses

As we aim to shed light on the pitfalls of implementing a Living Lab Methodology within the specific setting of this project, the next section does not discuss the evaluation of the developed products in detail. We reflect on the different challenges we encountered while implementing the Living Lab approach and discuss specific evaluation results when relevant in this context.

Results: Understanding the challenges for a successful implementation of the Living Lab methodology

In this section, we reflect on the lessons learned from applying a Living Lab methodology in the project. First, we examine the insights gained from engaging with the market and industry, stressing the importance of thoroughly understanding needs, priorities, available data, and community resources of the industry, preferably already in the proposal phase. Next, the definition of *prosumer* is discussed, here we focus on the challenges of recruiting and identifying the right users for a product or service when the concept may not be immediately clear to them. Finally, we tackle the difficulties of communication and alignment with technical partners, where we share insights into the challenges of translating user feedback into technical improvements in innovation projects.

Differing assumptions about project objectives

At the beginning of any project, it is important to thoroughly understand the needs and concerns of stakeholders, the market they operate in, legislative constraints, and their available resources. In this project, the proposal defined that the project would utilise openly accessible data from fanfiction communities to demonstrate the toolkit dashboard, enabling the technical partners to configure the data analysis and visualisation tool. It was assumed that this fan fiction data would be both relevant to publishers for insights into online *prosumer* communities and serve as a fitting tool to showcase the type of analysis and visualisations the dashboard could offer to publishers to analyse what is going on in their own communities.

Interviews conducted with professional users and publishers during the pre-pilot phase revealed that there was a genuine interest in gaining insights from online reading communities, also acknowledging that there is a shortage of accessible data to predict trends. Respondents expressed a desire for information on and access to data depicting trending topics, as current decisions on future publications usually are based on past sales data. Participants mentioned throughout the pilot phases: *"[...] I think the past sales of books or the past comments of books indicate the trends for future publishing initiatives. We do that with sales, but we don't predict it with consumer information."* (Publisher EU MS A, pilot phase 1), *"I don't know if it's like this everywhere, but in [country] we don't have access to many numbers from the market… there's no independent organism that would give you the numbers from the market. So we are always trying to like magically know what is happening around us."* (Publisher 5, pilot phase 3).

However, several challenges emerged throughout the project's lifespan. In the pre-pilot phases, a significant gap became apparent between what publishers considered relevant communities and the fanfiction platforms that were identified as the main community in the project. Fan fiction enthusiasts and writers were consistently described as 'not representative of the reading community' and 'not relevant to my business as a publisher' during the pilots. For instance, one pivotal argument made during workshops in pilot phase 1, was that the fan fiction platform does not represent book buyers. Participants stated that this is because fan fiction platforms, such as Wattpad, mostly consist of fantasy content, which would not be representative of the general market since there are other genres that customers are interested in besides fantasy. An example given was the German market where readers generally are interested in crime, thus the data from fan fiction platforms would not be considered representative. Another factor that, according to the publishers, made fan fiction data less relevant was the belief that it would offer limited value to smaller publishers, mainly due to the dominance of major IPs, such as

Harry Potter. They also indicated that variables such as resource constraints in managing these types of communities, potential misdirection of original IP, as well as the need for insights relevant to specific countries or languages, make these fanfiction platforms less interesting to European publishers.

Due to the lack of interest in fanfiction communities among publishers, the recruitment of publishers for evaluations and demonstrations of the data visualisation tool turned out to be difficult, particularly because of the choice to include fan fiction data. The type of data that publishers used were both in-house and third-party data (such as sales data, reading data, data on rates of consumption, general market data, etc.), but it became evident that they lacked their own online communities and did not have access to data suitable for the dashboard. The issues with data accessibility, respondents pointed out, was due to the data being scattered over different sources, which complicated the decision-making process in publishing decisions. Also, many of the publishers involved in the workshops were not keen on starting and managing their own communities online due to the high cost of managing a platform and low return in terms of quality content or relevant insights. To try and bridge this gap, we looked into different options, but even where community data was available through the project's consortium partners or social media, GDPR-restrictions and existing privacy policies prevented its use. In contrast, it was often mentioned that publishers were in need of a dashboard that allowed them to compare third party data with respect to relevant markets, as the data they have access to is often fragmented.

<u>What's in a name? Recruitment of '*prosumers*'</u>

The concept of *prosumers* is not new; Alvin Toffler coined the term in 1980 to encompass the dual roles of producing and consuming content (Toffler, 1980). *Prosumers* have since then been further defined as individuals who merge these roles, voluntarily contributing to existing content creatively and actively without direct economic incentives (Ritzer & Miles, 2018; Ritzer & Jurgenson, 2010). By means of this dual role, *prosumers* can shape and enhance the content landscape by contributing their own unique insights and ideas. In the context of this project, the concept was understood as describing individuals with the potential for collaboration and value co-creation, which in turn benefit various markets and industries. The aim was to create a platform for sustainable collaboration that benefitted both *prosumers* and the European publishing industry. *Prosumers* were further identified as authors, influencers, entrepreneurs, beta-testers, and early adopters.

Despite the term's usefulness within the project's consortium, it often confused external stakeholders, which led to recruitment challenges. The term '*prosumer'* was also used as the project's tagline, and was therefore predominantly shown and seen in our booths at events (see picture 1). A common question received during events from passers-by was what the term actually meant, since it was not familiar to them. They found the term confusing since it was so broad, and thus they would not identify with it, even though they would identify as e.g. self-publishers or amateur (fiction) writers. Participants did not identify with the term *prosumer*, thus leading us to adjust our communication strategy to avoid confusion, e.g. by referring to 'readers' or 'writers' instead. Changing the terminology helped us to better reach our target audience, thus facilitating smoother engagement and collaboration with these communities.

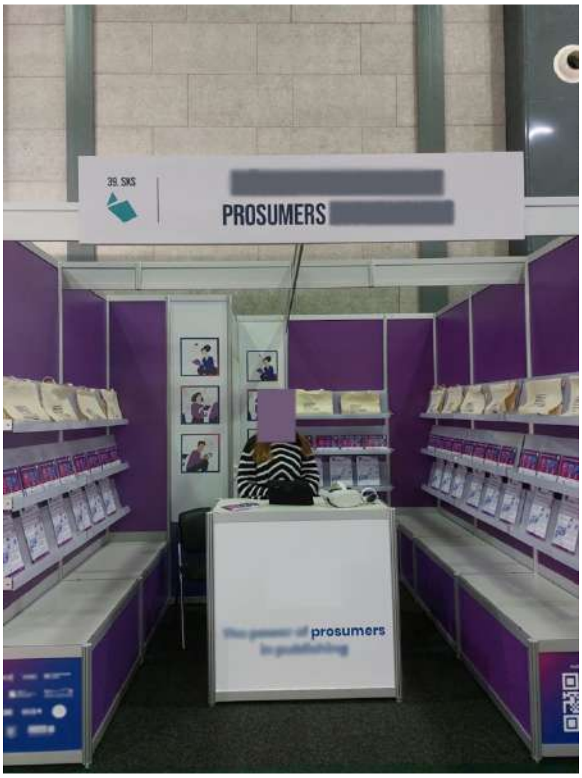

Figure 1. The project booth

Interviews with publishing industry professionals revealed that participants distinguished between self-publishers and *prosumers*, emphasising the motivations and ambitions of each type of creator. For instance, self-publishers typically aspire to become professional writers, own their intellectual property rights, and are empowered by the self-publishing business model and platforms, e.g. the Kindle. In contrast, *prosumers,* such as fanfiction writers, contribute to content creation out of passion, without intending to monetize their work. As mentioned above, this was often associated with low-quality content by publishing professionals.

In contrast, respondents from the fan fiction community who participated in our study did define themselves as *prosumers* in the strict definition, but did not use the term themselves. They indicated that what defines them as a *prosumer* are the varied motivations for writing and reading fan fiction. These motivations include a deep love for certain media content, where writers and readers are heavily invested in a story and wish to continue the experience. Additionally, frustration with the direction of a story often prompts readers or authors to write their own versions, altering the course of the story to suit their preferences. Consequently, respondents expect fan fiction to offer less polished content compared to professionally published books, which also makes it more accessible: *"[...] readers like the fan fiction community because it's so easily accessible and everything, and that's why people like it and why there are so many people reading it"* (Gaby, fanfic group interview, preparatory phase). Additionally, they value fan fiction for its flexibility in working out alternative storylines, expanding a story by adding more characters, and in creating new relationships between characters. This focus on character and relationship development, they mean, makes fan fiction uniquely engaging for the community, despite the perceived lack of professional finish.

<u>Communication is key: how to bridge user requirements and technological implementation?</u>

The iterative approach of co-creation and development presents several challenges, in particular when it comes to ensuring clear communication on research outcomes for user needs, requirements and evaluation of the developed products. Within the project, several factors increased the challenges for aligning user insights with technological innovation.

Despite multiple attempts to communicate the results for technological development through various channels, such as project meetings - online and face-to-face - as well as updates added to the project's sharepoint, there was still a gap in follow-up actions. The following factors increased difficulties in communicating and following up on the integration of user feedback: (1) Within a Horizon 2020 project, tasks and work packages share their results via intermediate and final deliverables. Rather than planning the user involvement deliverables in line with the iterative cycles, the consortium opted for one final deliverable. Consequently, the outcomes were mostly communicated via meetings and draft versions on the projects' sharepoint. This gave the impression that the results were preliminary and not yet to be taken into account. Additionally, updates on user requirements shared on platforms like sharepoint might not be highlighted adequately or followed up on as expected, thus important details can potentially be overlooked. (2) A major issue that made this difficult within the project was the circumstantial changes in project management and personnel working on the technological development. Although no one is specifically at fault here, it did result in a lack of consistent follow-up. In combination with the aforementioned lack of official deliverables, this made it more difficult to keep the priorities raised by relevant stakeholders on the agenda for technological development. (3) In addition, some partners indicated a lack of experience with user-centred design methods, which led to a lack of awareness regarding the outcomes of the process such as relevant user needs and requirements. Also, as partners involved in these projects are focused on their own tasks and milestones, the integration of the user needs and user requirements might not be on their radar as a priority.

Discussion: strategies and recommendations to prevent and overcome pitfalls

In this discussion, we present mitigation strategies for each of the challenges raised above. First, understanding the market and its needs poses a challenge due to the assumptions made during the proposal phase. Consortium members must envision beyond what can be labelled as 'the fuzzy front end of innovation' (Herstatt & Verworn, 2004; Braet & Verhaert, 2007). It is paramount to align project goals of technical innovation with stakeholder needs. While some stakeholders are represented in the consortium, this does not always suffice for a deep understanding of industry practices and needs. Also, it is often impossible to conduct in-depth research before the start of a project. Therefore, in the early stages, project partners must engage with relevant stakeholders, keeping an open mind about the technology and services being developed. The consortium should then adjust the project's goals and methods to align with stakeholder needs.

A useful method for these purposes is the Innovation Binder Approach. This approach aims to create a space where stakeholders from different disciplines or backgrounds, e.g. technological developers and Living Lab researchers, can come together to more effectively collaborate, ensuring that everyone is on the same page and are working toward the same goal (Jacobs et al., 2014). This way, choices made throughout a project's lifetime will be made on a more collaborative basis, interdependencies within the consortium will become clearer, and documentation of processes and decisions made during the project lifetime can be used to reflect upon how the goals have been worked towards. As such, the Innovation Binder Approach can also be seen as a solution for aligning technological development with living lab outcomes. However, aligning stakeholders can be time consuming and many of the projects have a limited timespan. Therefore, we argue that using project management tools to consistently track outcomes such as user requirements and technological development progress can significantly improve mutual understanding and prioritisation.

Additionally, when it comes to recruitment and communication strategies to reach out to the relevant stakeholders, it is important to align communication efforts with the target audience so they can identify with e.g. the call for participation. Specifically for industry stakeholders, it needs to be clear what the value proposition of the project and/or product is to convince them to participate or even engage in the long term. Finally, allowing for trial and error is a good thing, and it might be helpful to re-evaluate communication effectiveness after each iteration.

Conclusion

Living labs are known for fostering the development of reliable innovations that are rooted in deep understanding of the needs and practices of relevant user groups and stakeholders. Research on the advantages of living labs highlights how the living lab approach allows for early adjustment in the development process, empowerment of stakeholders, and validation by user groups. Research has also identified a limited number of pitfalls to consider when implementing a living lab approach. These challenges refer to the (lack of) disruptiveness of the outcomes, engagement of users, alignment of stakeholders, building trust, and testing with beta versions of a technology. This paper contributes to the research on challenges when implementing a living lab approach, by presenting the challenges encountered within the project. Figure 2 shows an overview of the challenges listed in literature, categorised, and complemented by the challenges found during the project.

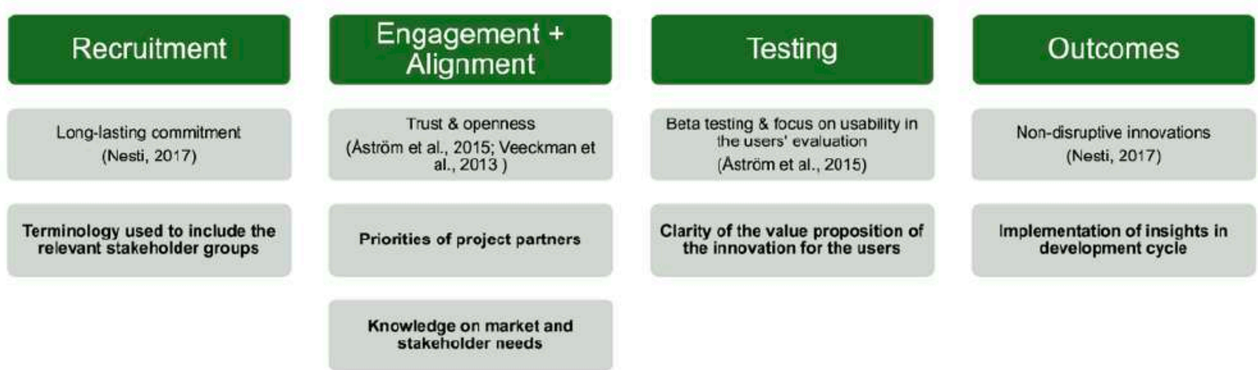

Figure 2. Combined overview of challenges in implementing Living Lab methodologies

The experience within this project confirmed that alignment of stakeholders and deep knowledge on the market and industry are key to bridge the gap between stakeholders' needs and living lab outcomes. However, we add to the challenge of realigning project goals to newly discovered, challenging or even contradicting needs when they surface in the early stages of the project. We also found challenges when communicating with different user groups, due to the projects' focus on '*prosumers*'. In addition, we describe the challenges in aligning priorities between project partners when it comes to integrating the results of the co-creation and evaluation activities with users into the technological development. Thus, the following three lessons learned were identified:

- **Lesson 1:** Some assumptions that were made during the proposal phase proved to be false. A better understanding of the market, stakeholder needs and practices before the start of the project or a reorientation after the first doubts were raised in the pre-pilot phase would have been a huge benefit to the development of the project products.
- **Lesson 2:** Even though the term prosumer was used correctly in the communication of the project, it led to too much confusion among professional publishers as well as fan fiction and amateur writers. This led to unclarity and a lack of interest in participating in the workshops organised within the living labs, and confusion among the audience attending the project booth at conferences and events.
- **Lesson 3:** The outcomes of the stakeholder and user workshops are not always on the project partners' priority list. Communicating clearly about the outcomes of the stakeholder involvement, discussing in-depth the implications and implementation of the results in the iterative development phases is paramount to ensure follow-up.

Mitigation strategies we identified in this paper include: following specific approaches to align stakeholders as well as project partners, such as the Innovation Binder Approach, setting up project management tools to track progress and integration of the outcomes of the user workshops in the development cycle, and reviewing and adjusting communication strategies during and after each iteration with stakeholders. Future work should investigate how the implementation of alignment methods such as the Innovation Binder Approach might have an impact on the challenges of the Living Lab methodology. This might prove important in exploring the ways in which different techniques and processes could improve the early mitigation of challenges and contradicting assumptions emerging throughout a project's lifespan.

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Innovation Presentation Outilne

RECHARGING Business Models of Cultural Heritage Organisations in Living Labs

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Abstract

The Covid-19 pandemic underscored the critical role of cultural heritage organisations (CHOs) in connecting people through innovative engagement. CHOs can create social, cultural, and economic value by enabling participation and co-creation, but a major challenge is capitalising on this value by integrating participatory practices across organisations' value chains.

This research explores the potential for museums to adopt a Living Lab approach in co-creating innovative business models with their value network to improve CHOs' (financial) resilience and bring mutual benefits to all engaged stakeholders. By combining a systematic literature review with primary and secondary data analysis, the study develops and tests a model of Living Labs as catalysts for Participatory Business Models (PBMs) within the RECHARGE project. The results of this research provide a definition and a framework of participatory business model(-making), propose a theoretical model of Living Labs as catalysts of PBMs for CHOs, and reveal bottlenecks and improvement opportunities of the model tested against the workflow of museums experimenting with their business models in Living Labs. This framework informs the activation of multiple living labs within CHOs that act as catalysts to develop, implement, and innovate replicable participatory business models to foster resilience and innovation.

Keywords

Living Labs, Participatory Business Models, Cultural Heritage Organisations, Museums

Main problem statement(s)

In the aftermath of the COVID-19 crises, increasing high competition for funding and budget cuts to the cultural fields called for Cultural Heritage Organisations (CHOs) to diversify and innovate their business models in collaboration with their network of stakeholders (Prokůpek, Loots & Betzler, 2023). CHOs, such as museums, libraries, and archives, offer avenues of participation and co-creation for multiple stakeholders with potential social, cultural, environmental, and economic value; however, participatory activities are often implemented on a project basis. Therefore, it is challenging to capture and capitalise on such value in the long term by integrating stakeholders' participation across CHOs' operations. This research aims to develop and test Participatory Business Models (PBMs) that leverage Living Labs to create sustainable social, cultural, and economic value for diverse stakeholders, including but not limited to museums, local communities, artisans, tech companies, and policymakers. The RECHARGE project, which focuses on these challenges, serves as a testing ground for these models.

Methods/approach used

This research explores the potential of Living Labs as catalysts of Participatory Business Models (PBM) for CHOs by building and testing a PBM-making model against practices of Living Labs within the RECHARGE project. First, the model is developed through a systematic review of interdisciplinary Participatory Business Models literature to understand its variable and required elements. Second, the model and its common challenges are tested against current practices through secondary data analysis. Third, a processes-oriented definition of Living Labs (Rosetti and Navarrete, 2024) is used to explore how their spatial dynamics can shape the development and implementation of innovative participatory business models for CHOs. Lastly, we compare the resulting theoretical model with the workflow of 9 Cultural Living Labs experimenting with Participatory Business Models within the RECHARGE project via observations, meeting notes, and conversations.

Results/outcomes

Results (1) provide a definition of Participatory Business Models and a framework for Participatory Business Model-making and present the metaphor of a "recipe" (required elements) and "ingredients" (variable elements) that make up an optimal process; (2) propose a theoretical model of Living Labs as catalysts of Participatory Business Models that can guide practices of CHOs, and actors beyond the field; (3) a framework for Participatory Business Models, defining the cultural value chain, that CHOs can adopt to create sustainable value for their stakeholders such as enhanced community engagement and diversified revenue streams, that is replicable in different cultural, geographical and economic contexts. (4) show overlaps and divergences between the theoretical model and the RECHARGE Living Labs workflow, based on 9 currently engaged sites, highlighting bottlenecks, and revealing improvement opportunities for future co-creation cycles and for the refinement of the model.

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Research-In-Progress Paper

Music360: Assessing the true Value of Music

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Abstract

The online music economy has become the largest source of revenue for the music industry, but for many less-famous artists, live and background music remains the main source of income. Royalties generated by music usage in these environments are often not distributed based on actual music usage, creating an unfair distribution system.

The MUSIC360 project aims at generating information about the usage of background music and providing a model to conceptualise and measure the economical and societal value of music. The platform developed will collect data at a fine-grained level through five national Living Labs and a European one.

This paper introduces the project goals, objectives, and strategy (with a special emphasis on the Living Labs) to propose a new method for the sustainable development of Culture and Creativity, specifically the music sector, at a national and European level. It presents the way in which these Living Labs will be used to contribute to the transition towards a fair and transparent royalties distribution solution that promotes social justice and a more diverse and resilient music ecosystem and enables fairer policymaking and more accurate royalty distribution through information about the real usage of background music.

Key words

Background music, value, music metadata, neighbouring rights, author rights, royalties

Introduction

The largest source of revenue for the music industry, at least since 2017, is streaming (IFPI, 2018). This benefits a few large labels and superstar artists, who collect most of the royalties, leaving behind a very long tail of creative entities who can barely make a living with the music they make. For the latter, live and background music is the main source of income and accounts, on average, for 28% of the royalty collection (CISAC, 2020). Background music played in shops, bars, restaurants, and other venues, contributes to the retail revenue, and increases the well-being of both staff and customers (Milliman, 1982; Ovalie, 2019; Chen et al., 2022). Other venues include hospitals, in which benefits towards the health of the patients have long been demonstrated (Golden et al., 2021; Chen, Chang, Chow & Ma, 2021; Preti & Welch, 2012). The royalties these usages generate are distributed using reference data such as the top radio stations in a country or projections from small datasets of live performances, creating an unfair distribution system in which up to 63% of unique tracks do not generate royalties for their usage (BMAT, 2018).

To develop a competitive, fair, and sustainable European music ecosystem, new methodologies that provide quantitative, qualitative, and statistical analyses at the national and EU levels are needed. These methodologies allow conceptualisation and measurement of the economical and societal value of music thanks to reliable and comparable data on actual music usage.

The MUSIC360 project

The Horizon Europe project Music360 is developing a digital platform to collect data that can leverage the stakeholder engagement of all the quadruple helix actors to analyse and represent the value of music for researchers (academia), professional users of background music (private and public sector), the right holders (private organisations and citizens), and policy makers (public institutions such as the EC) to understand their requirements and design the platform with their help. A portal is being developed that, depending on the kind of stakeholder, can be used to dig into the value of specific recordings and works. The project also pays attention to the non-monetary value of music, such as societal value and therapeutic value. A digital ecosystem and dashboard are under development, and the project is structured in an iterative approach to allow for rapid prototyping, testing, and feedback to reach sustainability, so the Music360 platform continues to exist after the project finishes. The project features five national living labs, and one cross-European living lab.

Living Labs

To validate the Music360 field solution and make sure it satisfies the needs of the music ecosystem, the project is organised around living labs, to identify requirements and test the technical feasibility, business model and governance structure. A living lab is a user-centred innovation ecosystem wherein various stakeholders contribute to innovation in a public-private-people partnership (Almirall & Wareham, 2011). Our labs consist of five national living labs that cooperate within the Music360 project, as well as an EU living lab that provides coordination across the national labs, so that experiments can be replicated in different countries and are coherent, using a strong taxonomy (Petsani et al, 2024). In this way, a sustainable open innovation ecosystem is created. In each Living Lab, precise music usage data will be collected in venues by installing audio recognition devices equipped with music fingerprinting technology. This music fingerprinting will be followed by data matching and metadata pairing, as well as data enrichment to evaluate the music in terms of parameters such as style, genre, speed, bpm, language… This data will be analysed together with the data collected from music users, staff members, and clients to extract information regarding its real monetary and non-monetary value.

The living labs will elicit requirements and test the solutions of Music360. The consortium will involve the quadruple helix by bringing together music rights users (bars, restaurants, shops) and right holders (artists, text & songwriters, composers), music and music-tech companies, academic partners, and the EC as a government agency. Each living lab will perform a national and EU level ecosystem analysis. Business modelling and governance design will be performed, that is being developed within the project.

Finnish Living Lab: Staff and Customer emotions due to music and impact on behaviour within a shopping centre. This living lab will investigate the effect of music on staff and customer emotions in venues. The underlying assumption is that positive emotions result in higher sales. An extension of this research is the relation of emotions of customers to changed customer behaviour, e.g. the decision to buy a product or the decision to stay longer.

Dutch Living Lab: This living lab complements the Finnish Living Lab and studies the effect of specific music on customer behaviour, specifically the sales of products and services. This replicates the work of the Finnish lab but in a cosmetic chain store, to see if there are any regional and/or cultural differences and evaluating the influence of the type of music (fast or slow), and whether the staff could choose the playlist or whether it was imposed.

Irish Living Lab. This Living Lab will also concentrate on Staff and Customer emotions due to music and its impact on their behaviour and will emulate the activities defined in the context of the hotel and restaurant industry. The language aspect will also be included, studying the influence of Iris or English language music.

Spanish Living Lab. Part of this living lab is like the previous three but focuses on a chain of supermarkets to explore cultural and social values. We will investigate the non-monetary value of music and will study the influence of the song's language on the customer experience. Additionally, it will include a specific study on the therapeutic benefits of live music performances and the societal impact of traditional music in a Christian and Moors festival.

Portuguese Living Lab: It concentrates on the fair distribution of revenues based on detailed music usage data. The Portuguese living lab has four main goals: (1) to understand which music is played in venues; (2) to measure its intensity of usage and compare it to the use in radio and television broadcasting services; (3) to compare the distribution of revenues based on radio and TV broadcasting with distribution based on measurements in the living lab; (4) to construct a heat map that will allow rights holders to understand the magnitude of the usage of their music on radio, TV and in venues. This will allow the right holders to incorporate data-driven strategies to increase revenue of their music. This will be key towards a fair distribution model of music rights based on actual usage of musical works and the consortium will advocate for regulatory changes in the royalty distribution system at both national and European levels.

EU Living lab. We will later perform a coordinated test of the Platform in the five national living labs through transnational collaboration, that will result in the EU living lab. Thus, we aim to create an open innovation system for the European music industry that provides a basis for comparison for the similar living labs, and integrate the specific findings in health, cultural heritage, and royalties' distribution to provide a complete picture of the background music royalties ecosystem. The data analysis will be performed by market research bureaus and two universities. They will work in close collaboration, so a similar methodology is applied in each Living Lab. This will allow us to consider the specificity of each country and Living Lab while maintaining a homogeneity necessary for the joint analysis of the results, and the integration in the European Living Lab, asking comparable questions and collecting comparable feedback. In particular, the commonalities of the different countries and business sectors will be synchronised through common variables (such as music language, beat per minute, genre, but also music metadata, customer loyalty, store indexed revenue value, employee satisfaction…), research methods, and analysis tools. Public results will be stored in the same open data repositories, using the same data structures, so that supra-national analyses can be done.

This approach is novel in several ways:

1. It replicates activities in several countries before aggregating them according to the common aspects, while leveraging their specificities,
2. It builds a new framework to quantify and qualify the value of music, since an in-depth literature review has brought forward that most theories were defined for goods other than music. A multidimensional approach was designed with values interlinked and variables depending on the listener's experience. Behavioural value has a direct influence on economic value, as many behavioural responses result in financial gains or losses for stakeholders, and the project has established a music value matrix.
3. A methodology has been developed with a set of variables that will be analysed through the feedback collected from the quadruple helix stakeholders during the Living Labs. The individuals and users will be involved in the co-creation process since the feedback will be collected not only on the project specificities but also on methodology, so the following iterations are improved through their feedback.
4. The consortium brings a unique view and knowledge depth through the involvement of 5 CMOs and a music tech company with a unique set of data and metadata in the industry, that will be leverage in the analysis of the value from the most granular level (play-by-play) to aggregation at an international level.
5. The analysis of the living lab will affect the industry from a high-level perspective (how to best use music) to a low-level perspective (how to distribute royalties on a day-to-day basis to individual creators), as well as society on health (music therapy) and cultural heritage (traditional music usage in local traditions) aspects.

The data collection strategy will consider potential differences between individuals of different genders, such as biometric statistics, vision, or statistical habits. The data will be disaggregated and analysed by gender whenever relevant and possible. Age, ethnic group, and other relevant intersectional factors will also be considered in the data aspects of the project. As a result, in Music360, all activities to be developed will aim at being gender-neutral, contributing to the EU Gender Equality Strategy 2020-2025.

Conclusion

With the proposed set-up, the Living Labs will provide (i) a validation mechanism for the research findings on the actual usage of background music, (ii) on the data collection methods. From all these research activities and living lab experiments, a new conceptual model will be developed, to understand and measure the economical and societal value of music. The Horizon Europe MUSIC360 project will contribute to the transition towards a more equitable and transparent royalty distribution system, promoting social justice and a more diverse and resilient music ecosystem, thus contributing to the sustainable development of European culture and creativity. The consortium will conduct a long-term impact analysis of the implemented model to evaluate its sustainability and effectiveness over time.

Acknowledgement

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Living Lab Operations, Methods, Tools, and Impacts

Thursday, 26th September 2024

The "Living Lab Operations, Methods, Tools, and Impacts" session was designed to explore the various operational aspects and methodologies employed within living labs. This session highlighted the tools and frameworks used to facilitate collaborative innovation and stakeholder engagement in real-world environments. Participants examined different operational models, showcasing how living labs can effectively respond to societal challenges through participatory design and experimentation.

The discussion included case studies demonstrating the tangible impacts of living labs on communities and the broader implications for policy and governance. By focusing on best practices and innovative tools, the session aimed to provide valuable insights into the effectiveness of living labs in driving social innovation and improving community resilience. Participants were encouraged to share their experiences and engage in meaningful discussions, fostering a collaborative learning environment.

Innovation Presentation Outline

Trial Troops to engage residents in Helsinki Innovation Districts

Authors

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Abstract

Here we present a systematic model to reach and engage citizens in district urban labs for various innovation projects. The citizen innovation pool, Trial Troops, is one of the tools for urban innovators used in the Helsinki Innovation Districts[1)], run by Forum Virium Helsinki. It offers residents the opportunity to participate in various urban lab activities as informants, co-creators, lead users, and testers. Trial Troops provides multiple benefits for the stakeholders in district level urban labs throughout the value chain. In the future, the focus is shifting towards visualising and combining data on district level to gain deeper understanding of the users and phenomenon data.

With this paper, we want to open an exchange on best practices to support continuous and systematic citizen engagement within district living labs.

Key words

Citizen pool, District urban lab, Citizen engagement, Participation, Public awareness on smart city development

Outline

A citizen pool is a community-based model to engage residents interested in the urban lab topics and activities. The model enables citizen interaction and participation in co-design processes or as test users in the pilots. In 2019, the activities started in Helsinki with 200 residents. Since then, Helsinkians have been able to join the Trial Troops, with 550 members today.

The Trial Troops have participated in various projects and activities during the past few years. Some examples include a survey on citizen attitudes on the use of drones[2], participation of elderly in urban planning[)] and test users for agile pilots in several district urban labs. Next, we aim to engage the vulnerable groups in the CommuniCity project pilots in Helsinki during spring 2025.

A dedicated resource manages the citizen pool, supporting projects in recruiting and engaging residents. Additionally, Community Managers in key Helsinki Innovation District projects work locally to boost participation.

The Trial Troops model consists of 4 main activities:

- **Informing participants:** Regular newsletter about current projects and activities in the districts with opportunities to participate.
- **Recruiting new users:** Project-based campaigns to activate users such as surveys or invitations to workshops. Social media expands outreach to new potential participants.
- **Rewarding of participants:** While some high-engagement participation may offer nominal rewards, the primary focus is on creating a meaningful experience for all.
- **Feedback on activities:** Prompt feedback for participants both directly and through social media channels.

Trial Troops provides multiple benefits for the stakeholders in district level urban labs throughout the value chain:

- **Improved citizen engagement:** Testing innovative services and technologies provides valuable feedback for SMEs and/or city divisions. This fosters a collaborative environment where residents feel involved in shaping their district's future.
- **Enhanced innovation:** A dedicated user base helps identify strengths, weaknesses, and areas for improvement leading into more effective and user-friendly place-based innovations. This feeds into the urban development initiatives and strengthens the local community.

- **Increased public awareness:** Participation raises awareness among citizens about new initiatives and technologies. This can lead to broader public support and understanding of the future plans and advancements. In district level urban labs, it also supports the attractiveness of the district, and thus the municipality's goals.

The Trial Troops have been adapted to versatile environments and users: the first activities targeted residents in the novel smart city districts such as Kalasatama and Jätkäsaari, but today the focus has moved to suburban regeneration districts and especially vulnerable groups. This serves Helsinki's positive discrimination strategy and suburban regeneration, which is being executed in selected areas from 2020 to 2035. However, this requires a wider range of engagement methods and tools. Examples include digital feedback tools linked to location data from elderly people, used to improve accessibility of urban environments. Furthermore, enablers for encounters such as placemaking that we have tested in the Helsinki Innovation Districts.

In the future the focus is shifting on visualising and combining data on district level to gain deeper understanding of the users and phenomenon data.

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LIVING LABS FRONTIERS
Driving systemic change through Soci(et)al Engagement, for real impact

Research-In-Progress Paper

Creating a Sense of Community Among Stakeholders of a New Living Lab by Mapping Local Risk in Daily Commutes

Authors

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Abstract

This article introduces the first ongoing participatory research study of Mouvedis Living Lab that focuses on current and future mobility issues (transition) and their impact on accident rates. Objectives are to develop a better understanding of the risk areas during daily commute in a medium-sized town (South of France) and to create a sense of community among stakeholders. Risk in local travel will be explored from the viewpoints of car drivers, users of (electrically assisted) bicycles, electric scooters, and other decarbonized light individual modes, and from actors and decision-makers in public action concerning travel safety and local urban planning. Group interviews will be done using an innovative method of participatory mapping representations and practices. Different risk indicators will be collected and incremented by GIS to result in an integrative participatory mapping. Thus, the location of sensitive sectors or specific sections (street, route...) of the road environment will consider the city as it is designed, experienced, and perceived, and will be analyzed regarding locally known recorded occurrences of accidents. It will be a useful tool for prioritizing preliminary themes for upcoming action research.

Key words

Participatory Mapping, Mobility, Daily Commute Safety, Travel Risk, Urban Living Labs, Community Empowerment

Introduction

Context

This article presents the first ongoing participatory research study of Mouvedis Living Lab. Mouvedis means in the Provençal language: mobile, movable, and motional and is an acronym[3] that stands for mobility modes, city uses, sustainable, inclusive, and safe environment. This living lab is based in Salon-de-Provence (South of France), a medium-sized town (D'Alessandro et al. 2021). The specific territorial characteristics of medium-sized towns and their governance systems can complicate actions in favor of mobility transition and road safety. Mobility peculiarities in medium-sized French towns include a significant urban sprawl, a predominance of car use, a public transport offer that is often insufficient and complex, many people going home for lunch, as well as significant parking problems (Cerema, 2019). It is necessary to identify a territory's specific issues related to diverse types of mobility, to provide useful knowledge to support public action at a time when the challenges of climate and environmental transition are numerous and affect all sectors of housing, transport, and industry. Implementing a transition strategy towards safe, sustainable mobility must be considered in its territorial context.

Salon-de-Provence is one of the nine development hubs of the Aix-Marseille metropolitan area. As such, the city's vocation is to be an interconnection node in the future metropolitan intercity transport network and to organize a local public transport network to limit car travel. In addition, to meet the growing demand from its population, the city wishes to support the use of bicycles by providing users with good conditions of comfort and safety (cycling links, electric bike rental services, relevant and acceptable facilities, efficient solutions for speed moderation and road sharing, etc.). This is why Mouvedis focuses on current and future mobility issues and their impact on accident rates, at the juncture of urban planning choices, technological and digital developments in travel, and individual and collective rationalities and their socio-cognitive determinants in mobility practices. Overall, it represents an opportunity to support and enlighten local public policies towards sustainable territorial and socio-ecological transition.

As a Living Lab, Mouvedis focuses on user-centered design and co-creative innovation bringing together different stakeholders according to the quadruple helix model (Aggarwal & Sindakis, 2022; Schütz et al., 2019). Actors not traditionally involved in the innovation loop will be integrated as often as possible (Merino-Barbancho et al., 2023). On a local level, this concerns those involved in environmental concerns and the social and solidarity

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[3] In French language, MOUVEDIS is the acronym for Mobilités, Usages de la Ville, Environnement Durable, Inclusif et Sûr

economy (Perret, 2023). It is important to involve stakeholders from the Metropole's territorial coherence plan (*Schéma de Cohérence Territoriale,* SCOT) who are integrating climate and environmental transition issues into the design of a sustainable development project (Projet d'Aménagement et de Développement Durable (PADD). Integrating such stakeholders into the innovation process will enable us to extend the model of knowledge production to five-helix. The introduction of the Quintuple Helix considers the environment as an entity, promoting the characteristics of social ecology and the natural interactions between actors and their context and environment to make innovation ecosystems more operational (Carayannis, Grigoroudis, Campbell, Meissner, Stamati, 2018). In other words, tackle societal challenges such as climate change, we need to focus more on the quality of co-creation between the 4 helices in these processes and include aspects related to the natural environment of society and the economy, the socio-ecological transition, and social ecology as a fifth helix (see quintuple helix innovation, by Carayannis, Barth, Campbell, 2012).

The call for proposal

Mouvedis is part of the City Fab project – "Sustainable City Factory" of Gustave Eiffel University. City Fab has received a grant from the "ExcellencES" call (Fourth Future Investment Program) carried out by the French National Research Agency. Through City Fab, the aim is to support the trajectory of territories in facing the challenges of transitions (energy, ecological, economic, and social) for the cities of the future by articulating action research, training, and the dissemination of knowledge by integrating and engaging businesses, local authorities, and residents.

Aims

This first participatory study by Mouvedis aims to lay the foundations for the activities of this new Living Lab and for the planning of the preliminary themes for upcoming action research. At a first level, one objective is to better understand the areas at risk in this territory in travel safety. The general hypothesis is that, when it comes to travel safety and risk, there are gaps in cognitive (Weill-Fassina et al. 1993; Haas, 2004) and social (Abric, 2016) representations between the various actors of the urban ecosystem (different users, stakeholders, local decision-makers, etc.). The hypothesis is that these gaps in representation generate inconsistencies and/or conflicts between types of users or in relation to infrastructure and traffic planning (driving and interaction behaviors) or between different public decision-makings, which are the source of dysfunctions such as accident rate and the identification of problem areas. At another level, the aim is to form a community of stakeholders and create a sense of belonging, commitment, and empowerment (Kowaltowski and al., 2024; Bacqué & Biewener, 2015; Aventin & Sadokh, 2022).

Methodology

Sample

In the current study, risk in local travel will be explored from the viewpoints of car drivers, users of decarbonized light individual modes, and actors and decision-makers in public action concerning travel safety and local urban planning. Thus, volunteer car users living in one of the city's 7 outlying municipalities will be asked to give their views on their weekly commutes linked to daily life (work, schooling, shopping) with Salon-de-Provence as an intermediate or final destination (Figure 1). Other car drivers who are residents of Salon-de-Provence will be questioned about their weekly journeys to or from the surrounding municipalities. Users of bicycles, electrically assisted bicycles, electric scooters, and other decarbonized light individual modes will also be invited to take part in the survey about their weekly journeys within Salon-de-Provence and to/from the peripheral municipalities. Finally, participants are also expected from local decision-makers in the field of safety and urban planning, such as road safety advisors (elected representatives or volunteers), local authority technicians, town councilors, municipal police officers, firefighters, transport operators (public service concessions), and bus drivers alongside delivery drivers and road haulage drivers in the private sector.

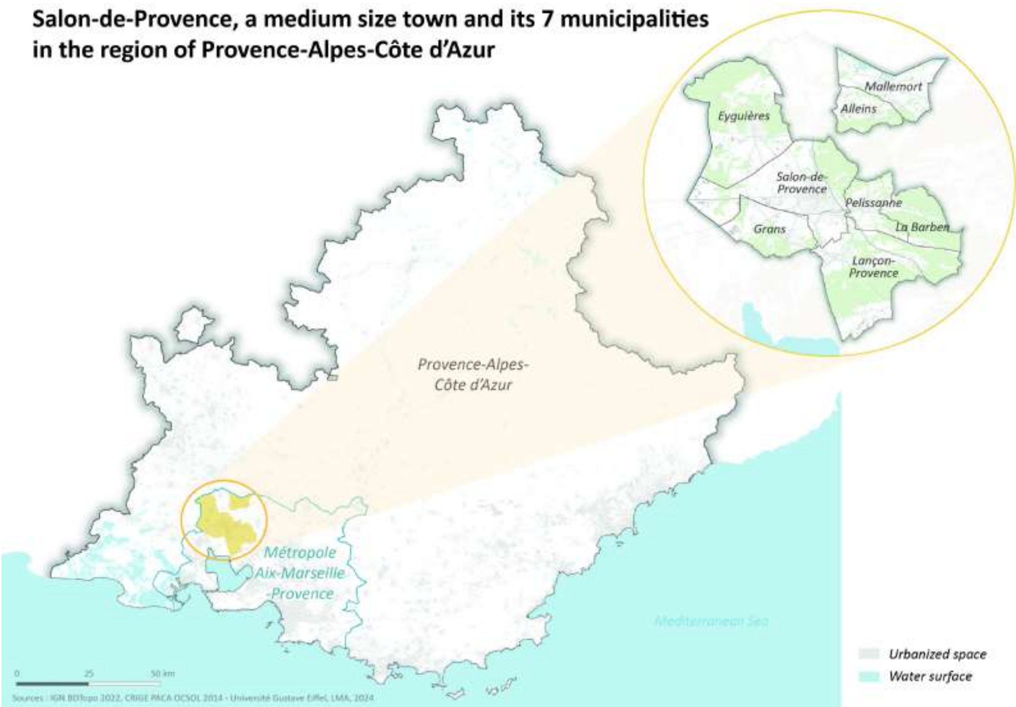

Figure 1. Salon-de-Provence a medium size town ant its 7 municipalities

Procedure

Focus groups will be conducted incrementally to characterize the difficulties encountered by car drivers in interacting with other users (car drivers, drivers of two-wheelers, buses, lorries, bicycles, and other decarbonized light individual modes). Other group sessions will be devoted to identifying the difficulties encountered by users of bicycles, electrically assisted bicycles, and other decarbonized light individual modes in interacting with each other and with other users of motorized vehicles (car drivers, drivers of two-wheelers, buses, and lorries). Lastly, focus groups will be held with decision-makers in the fields of safety and urban planning to explore their perceptions and experiences of these interaction difficulties for all these types of users. In addition, all these group interviews will aim to characterize driving practices considered unsafe and those considered safe, whether linked to the road infrastructure or not, to question the reported occurrences of accidents, near-accidents, and incidents in the area as experienced by drivers, passengers or witnesses, and to locate the places where these difficulties, practices, and occurrences are expressed (Figure 2).

Materials

The group interviews will be conducted using an innovative method of participatory mapping of representations and practices (Lefebvre et al., 2017), which draws on interdisciplinarity as recommended for tackling major societal challenges (OECD, 2020). This method is based on the principles of participatory science (Bell et al. 2017; Bradbury, 2015) and combines data collection techniques from the humanities and social sciences with digital science techniques. Data is collected systematically and rigorously between groups by a psychologist, a cartographer/geographer, and an accident specialist (experts in in-depth accident studies or urban planners). Moderation and data collection will be based on a customized interview guide and the direct use of a geographic information system (GIS). This is an information system designed to collect, store, process, analyze, manage, and present all types of spatial and geographical data (Mericskay, 2011; Palsky, 2013).

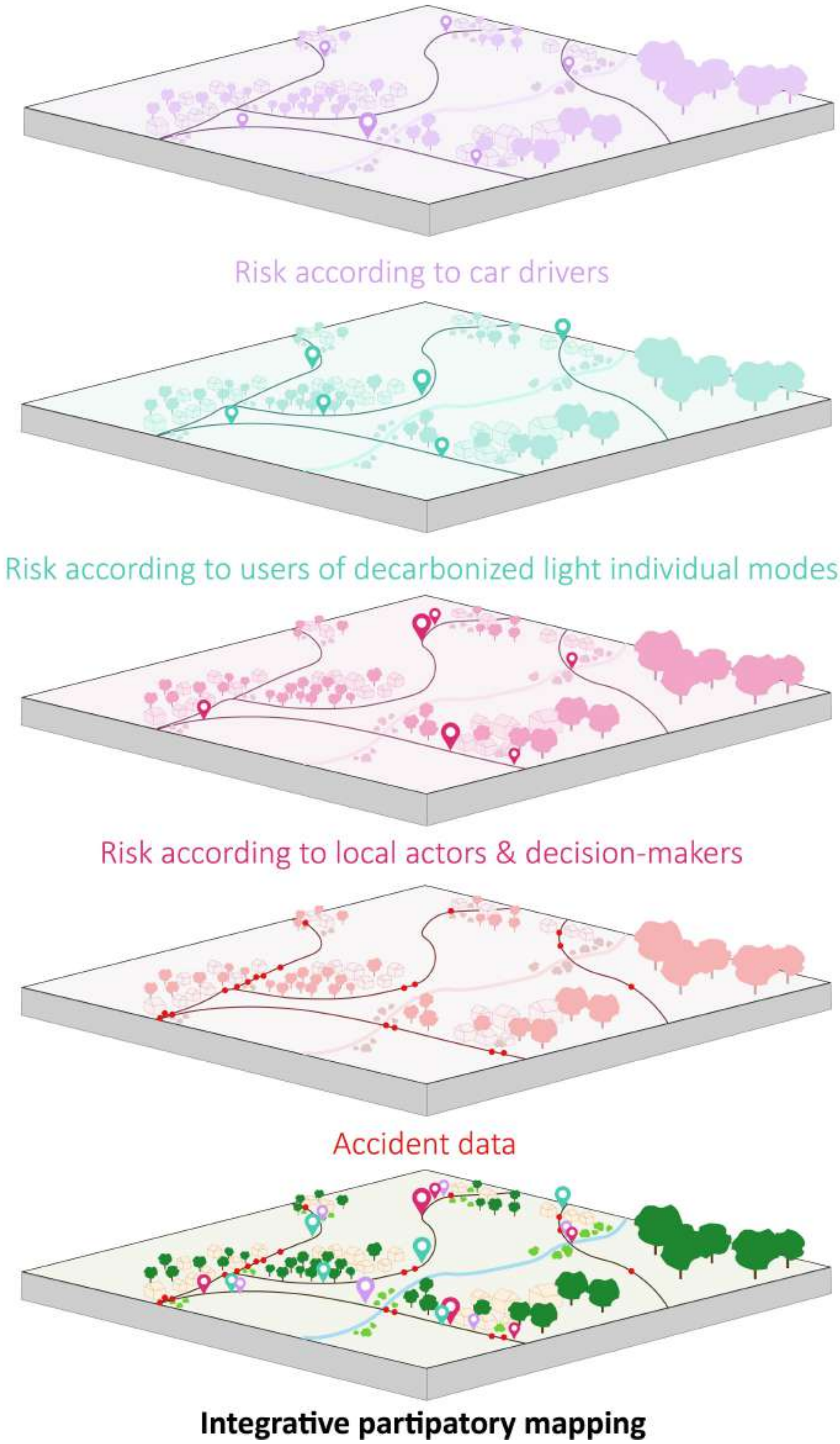

Figure 2. Participatory mapping on the risk of travel within a territory

Data collection and analysis

All the different risk indicators collected for this medium-sized city area will be incremented by GIS to result in an integrative participatory mapping (Arnaud, 2020). According to the principle of a heat map, risk areas can be identified in the territory in terms of travel and their safety as well as more precise axes (street, route, etc.). Thus, the location of sensitive sections or sectors of the road environment will consider the city as it is designed, experienced, and perceived, and will be analyzed with regard to locally known recorded occurrences of accidents: from in-depth accident databases of the territory established by the Laboratory of Accidents Mechanisms Analysis (Figure 3) and from The French Annual Databases of Injury Road Traffic Accidents. Notably, Sharda et al (2016) demonstrated that the location of behaviors is an important predictor of the location of collisions. The cross-referencing of this accidentological and experiential data from users and road safety stakeholders in this territory will be discriminated against according to the diverse types of users interacting during travel and according to journeys within the city of Salon-de-Provence and those to/from peripheral municipalities.

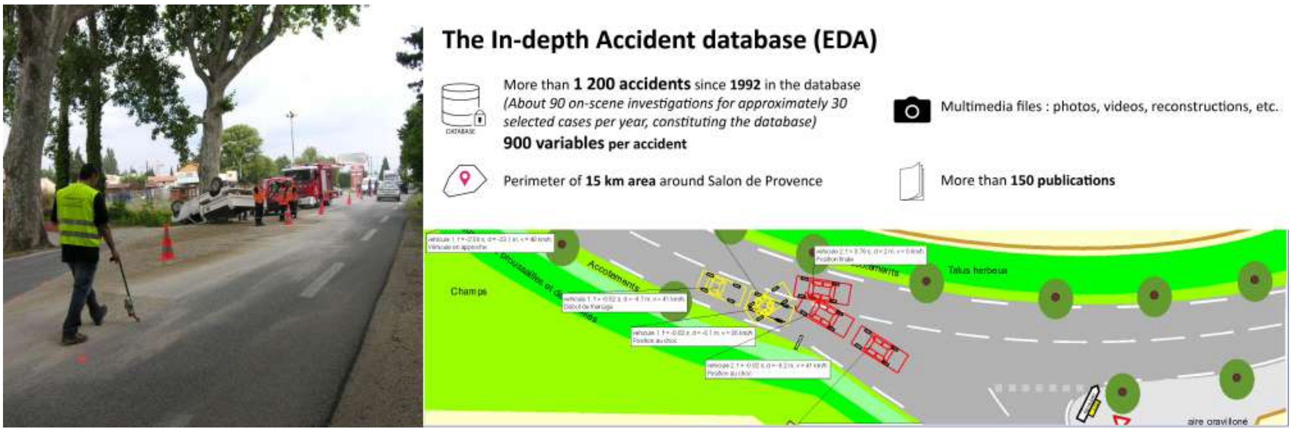

Figure 3. In-depth accident databases of the territory established by the Laboratory of Accidents Mechanisms Analysis

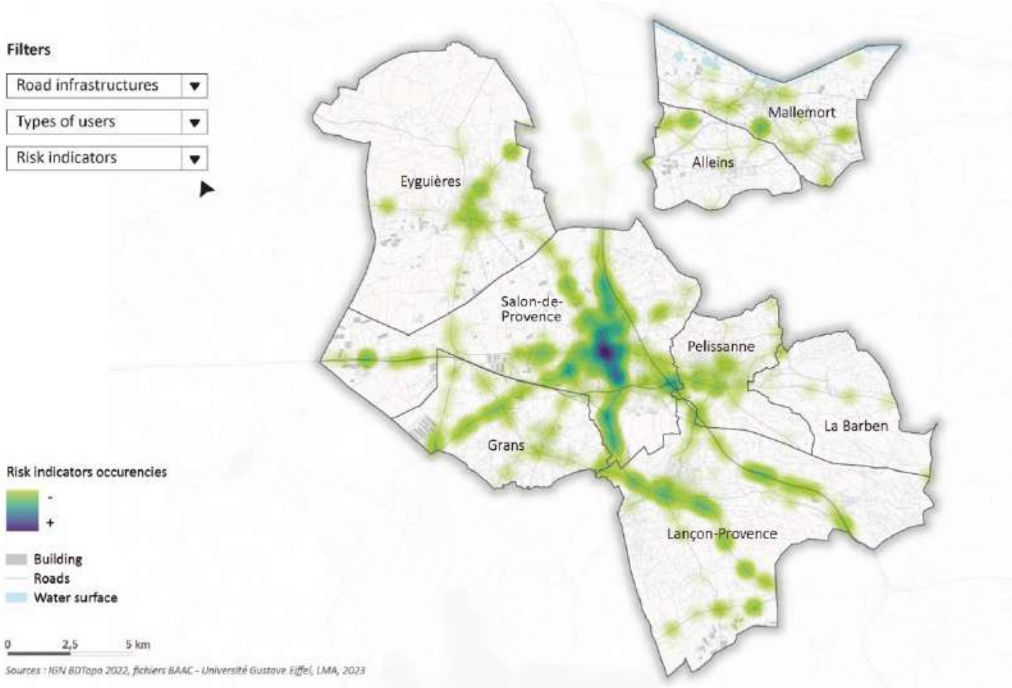

Figure 4. Expected findings: Heat map of risk areas in the territory in terms of travel and their safety

Expected Findings and Conclusion

One of the benefits of this mapping is that it provides access to each other's points of view (Figure 2) and makes the stakeholders in this ecosystem (citizens, politicians, economic representatives, etc.) aware of the risks and needs in terms of mobility and travel safety and its impact on people and the environment. To this end, the knowledge resulting from this integrative mapping of local travel risks (Figure 4) will be shared at public feedback meetings open to all. Another interest is to establish an issue paper for prioritizing the problem-situations that will be the subject of Mouvedis' first action-research projects (Taba & Bagra, 2024; Wittmayer and al., 2014). In particular, the aim is to initiate a stage of co-design of solutions to reduce the impact of car-dependent journeys (intermodality, car-pooling, etc.) and support low-carbon modes of transport, as well as travel safety, while integrating local constraints and preserving resources, biodiversity, and natural and agricultural areas. What is more, this participative, incremental map can be periodically updated. It will be a useful tool for guiding and supporting the arbitrations of the region's public and private economic players, by taking a close look at the interactions between Salon-de-Provence and the small surrounding neighboring municipalities nearby. Ultimately, this project aims to replicate the approach beyond this single experimental area. It could be the subject of a methodological guide for transfer to other territories.

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Research-In-Progress Paper

How to stage and assess processes of co-creation in Living Labs: A Design Ethnographic approach

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Abstract

Urban Living Labs (ULLs) operate in dynamic environments, often facing challenges in assessing social impacts due to the complexity and diversity of urban contexts. Overall, this research-in-progress paper underscores the importance of integrating qualitative methods to complement traditional assessments, ensuring that the social dimensions of urban innovation are adequately addressed. Specifically, it explores the application of a design ethnographic approach to staging and assessing co-creation processes in ULLs. It details the implementation of this methodology in the Horizon Europe GREEN-LOG project, which aims to develop sustainable urban and periurban delivery solutions through a series of ULLs across Europe. The authors argue that design ethnography, with its emphasis on participatory research and deep engagement with stakeholders, provides a richer, more holistic framework for process-oriented assessment of social impacts. This approach involves evaluators actively participating in co-creation from the outset, fostering iterative feedback loops that refine both the ULLs processes and future interventions.

Key words

Design ethnography, social impact, impact assessment, urban living lab, co-creation

Introduction

Despite the recent increase in studies exploring the notion of impact assessment in Living Labs (e.g. Engels et al., 2019), assessing the social impacts generated by these projects remains challenging (Ballon et al., 2018; Hodson et al., 2023). Paskaleva and Cooper (2021, p. 8) argue that the operationalization and outcomes of Living Labs remain poorly understood primarily due to a lack of focus on implementing and reporting performance evaluations. The complexity arises because Urban Living Labs (ULL) operate in urban spaces characterised by high levels of social diversity, and contextual uncertainty, where countless activities and behaviours occur, making it challenging to predetermine and scale social synergies and interactions (Aquilué et al., 2021, p. 6). Additionally, as suggested by Ballon (2018), ULLs involve an iterative and interactive cycle of activities, hence, the social impacts and learning insights emerge without clear pre-definition.

This iterative, participatory and messy nature of ULLs requires a continuous and situated approach to analysing, predicting, evaluating, reflecting on, and – consequently – managing the intended and unintended consequences of planned interventions & solutions and the social change processes they invoke (Vanclay, 2002, p. 190). Global indexes like the Lisbon Ranking and Digital Economy & Society Index include social indicators but miss nuances captured by social impact assessments. Drawing from the work of Gupta et al. (2019), the evaluation of social impacts using quantifiable indicators tends to oversimplify complex phenomena, since it obscures the situated, contextual, and qualitative nature of these impacts, which are often unintended, intangible, subjective, and context-dependent. In addition, competing priorities—such as enthusiasm for opportunities generated by smart technologies (Trivellato, 2017, p. 338) or strategic objectives (e.g., the ones set in the Grant Agreement of the EU projects) (Cerinšek et al., 2022)—can overshadow social goals and marginalize the perspectives of certain stakeholders, especially the marginalized groups.

With this in mind, we argue that design ethnography (Pink et al., 2022) is particularly well-suited for assessing social impacts in ULL contexts, and aligns with the key principles of Living Lab methodologies, which sit at the nexus of user-centred and participatory design (Dell'Era & Landoni, 2014). Design ethnography is a research approach that combines principles from anthropology and design to immerse and understand how people interact with products, services, and environments. The methods include (but are not limited to) site visits, open-ended interviews & discussions, participant observation, co-creation workshops, photo and video documentation, sensory walks. Our approach implements ethnography-based participatory research and multi-faceted engagement with the stakeholders involved in the ULL to build up empathic understanding of the complexity of urban spaces, while collaboratively discovering and analysing their practices, routines, needs, desires, barriers, success factors, and potential unknowns. Compared to conventional practices that primarily rely on quantitative social impact assessments (see Hodson et al., 2023), the key distinctive added value of the design ethnographic approach is that evaluators are not merely independent "arm-chair" observers. They directly engage in iterative co-design from the very beginning, making the formative assessment a natural and integral part of the overall ULL development process. By focusing on both, expected and unexpected implications of living labs processes, social impact analysis as a co-creative practice can help ULLs to understand the possible and uncertain futures (Pink et al., 2022; Akama et al., 2019) and fully capture how diverse stakeholders experience and value ULL interventions.

Staging and assessing social impacts in GREEN-LOG urban living labs

Our design ethnographic approach, initially developed through the AHA I (2018) and AHA II (2020) projects, is now being advanced to include a process-oriented methodology for assessing social impacts in the Horizon Europe co-funded GREEN-LOG project (2022). In short, this project aims to deploy a co-creative and collaborative approach to develop Logistics-as-a-Service platforms for interconnected city logistics, automated delivery concepts utilizing autonomous vehicles and delivery droids, cargo-bike-based innovations for sustainable micro-consolidation, and multimodal parcel deliveries that integrate public transportation. The approach is deployed and validated in five Urban Living Labs: Athens, Barcelona, Flanders (Ghent, Leuven, and Mechelen), Oxfordshire and Ispra. In relation to envisioned social impacts, the GREEN-LOG qualitative social impact assessment will focus on three key categories: (1) increased public awareness of sustainable urban delivery solutions; (2) acceptance of sustainable urban delivery solutions; and (3) improved neighbourhood life quality.

The initial steps of facilitating the set-up of the GREEN-LOG ULLs were organised so that we could engage in in-depth understanding of the ULL social, physical, and societal contexts, as well as explore and define who the primary users of the delivery solutions would be. This was staged to create a qualitative baseline for coming assessments while scoping the ULL aims and identifying the core teams and key stakeholders. Figure 1 illustrates the overall methodological framework for staging and assessing co-creation processes in urban living labs, with design ethnographic methods being integrated at its core.

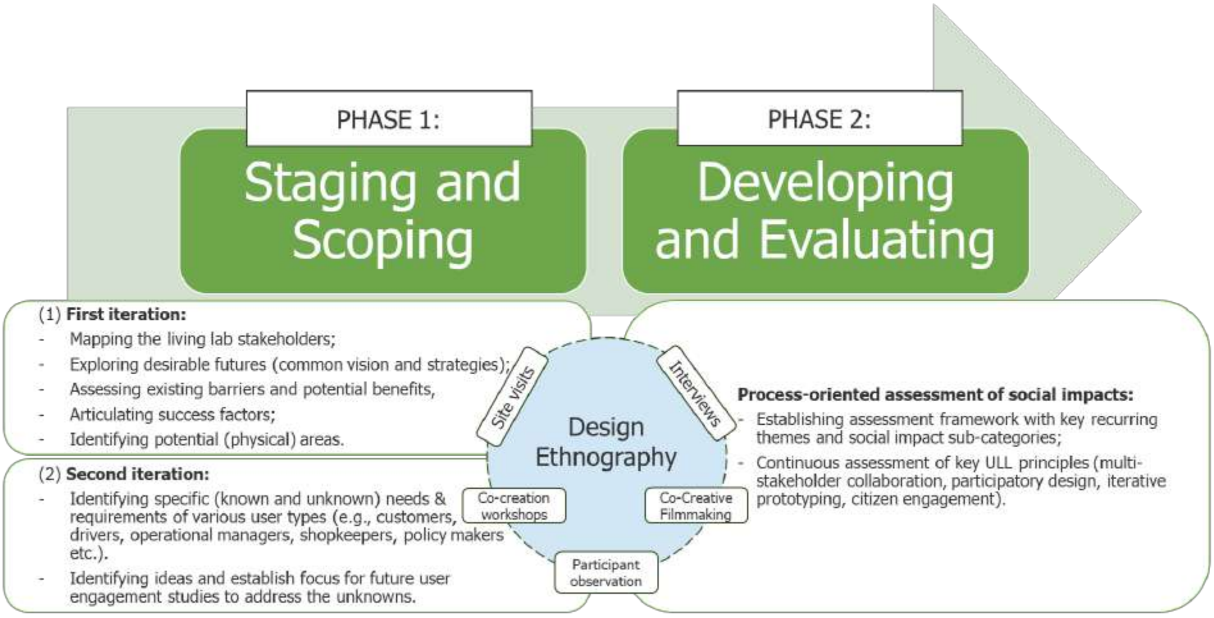


Figure 1. Methodological framework for staging and assessing co-creation processes in urban living labs The following section outlines the two phases of the methodology more in detail. Phase 1 has already been completed, spanning from January 2023 to June 2024 (18 months). Phase 2 represents ongoing research, beginning in July 2024 and continuing until May 2026 (27 months).

Phase 1: Staging and Scoping

Phase 1 activities involved two iterations of establishing the participatory design framework, akin to what Smith and Iversen (2018, pp. 10–11) define as "scoping." The first iteration involved engaging with Living Lab stakeholders and facilitating co-creative activities to jointly articulate local requirements, barriers, and opportunities; exploring potential futures; synthesizing diverse goals, interests, and agendas into a common vision; and develop strategies aligned with the objectives and aspirations of the GREEN-LOG ULLs (see Figure 2). It also implied the crucial task of identifying the core project team stakeholders, the involved team, and the informed team in each ULL, as well as pointing out the physical areas in which the delivery solutions would be developed (see Figure 3). This first iteration involved conducting interviews with ULL leaders and core teams, setting up digital co-creation workshops both within and across ULLs to identify specificities and similarities within and between ULLs.

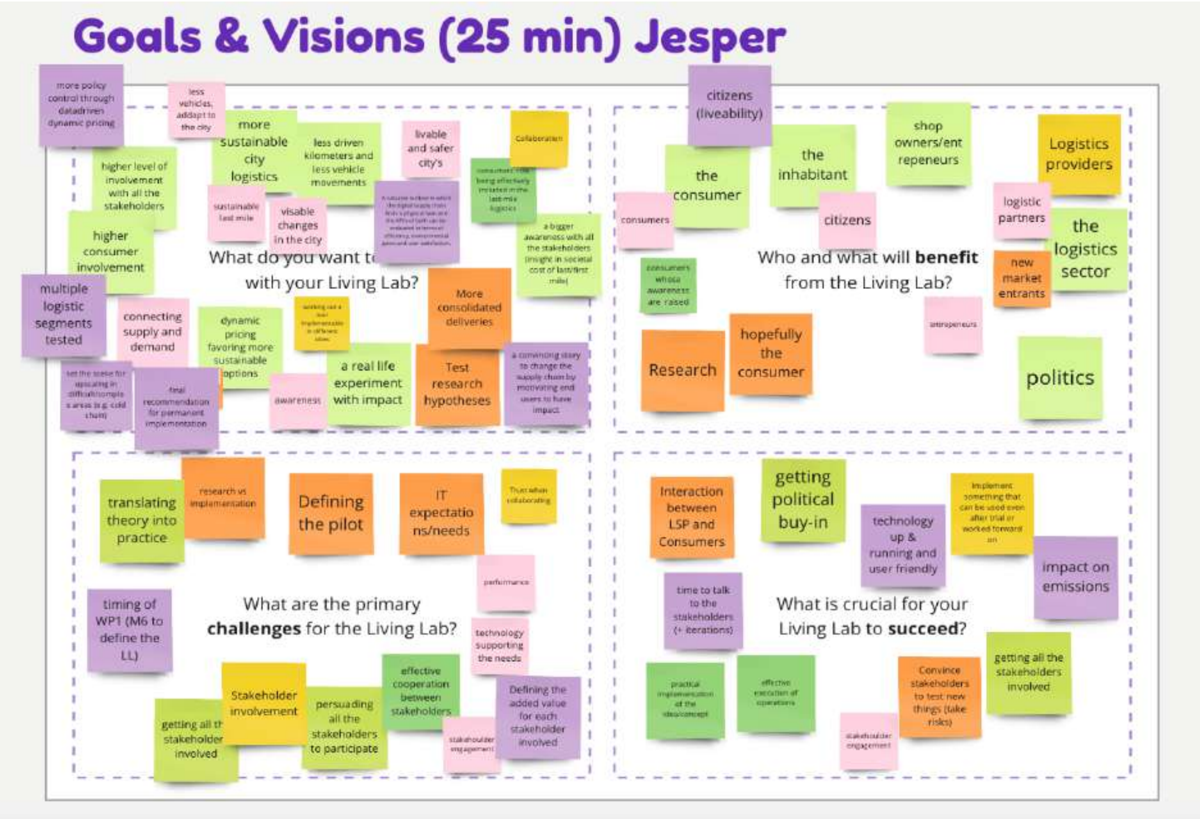


Figure 2. One of the very first scoping activities from digital workshop with ULL Flanders core team in March 2023 (Month 3 of the GREEN-LOG project)

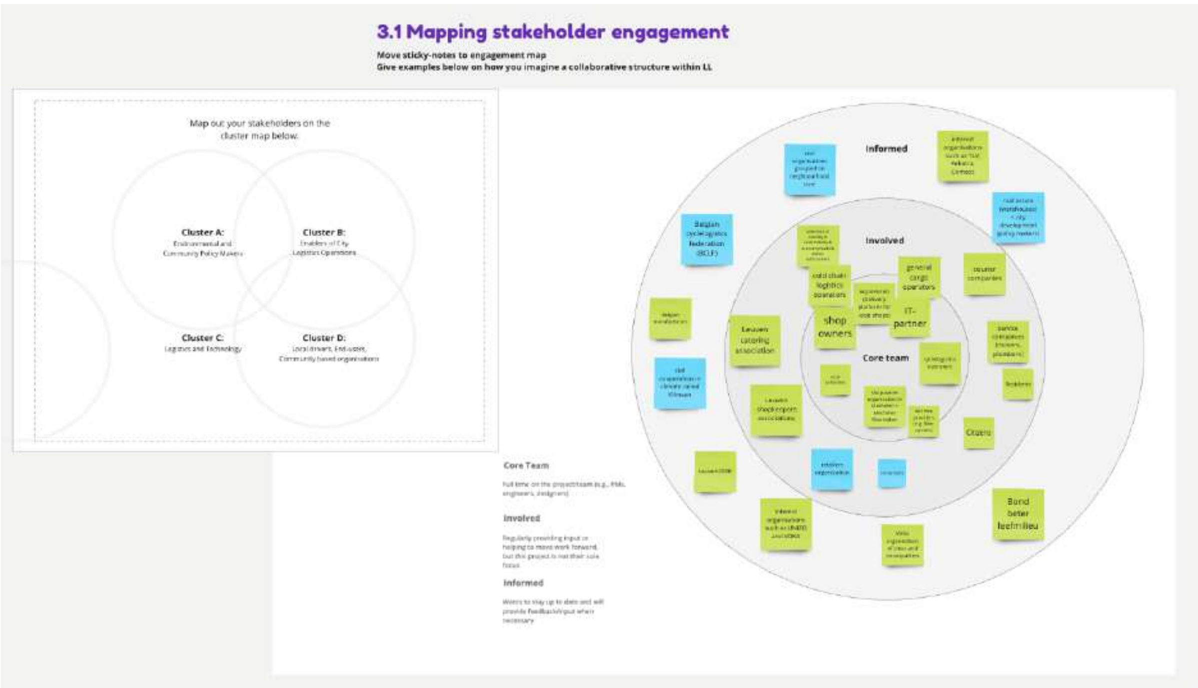


Figure 3. Identifying the stakeholders and organising them into teams in digital workshop with ULL Flanders in March 2023 (Month 3 of the GREEN-LOG project)

Overall, this first set of co-creative activities established a qualitative baseline for discussions with technology developers involved in the project. Through these discussions, the ULLs were able to tweak and develop their delivery solutions in response to the opportunities provided by the project. While the first co-design iteration focused on assessing the existing barriers and seizing opportunities within the ULLs, the second iteration identified the specific requirements of various user types involved in the use case scenarios for delivery solutions in each Living Lab, including customers, drivers, operational managers, shopkeepers, policy makers, and the broader citizens (Figure 4). In addition to detailing Living Lab users and their (un)known needs, the second iteration results aim to describe contextual specifics (also in Figure 4), and to identify ideas and establish focus for further user engagement studies addressing the unknowns (Figure 5).

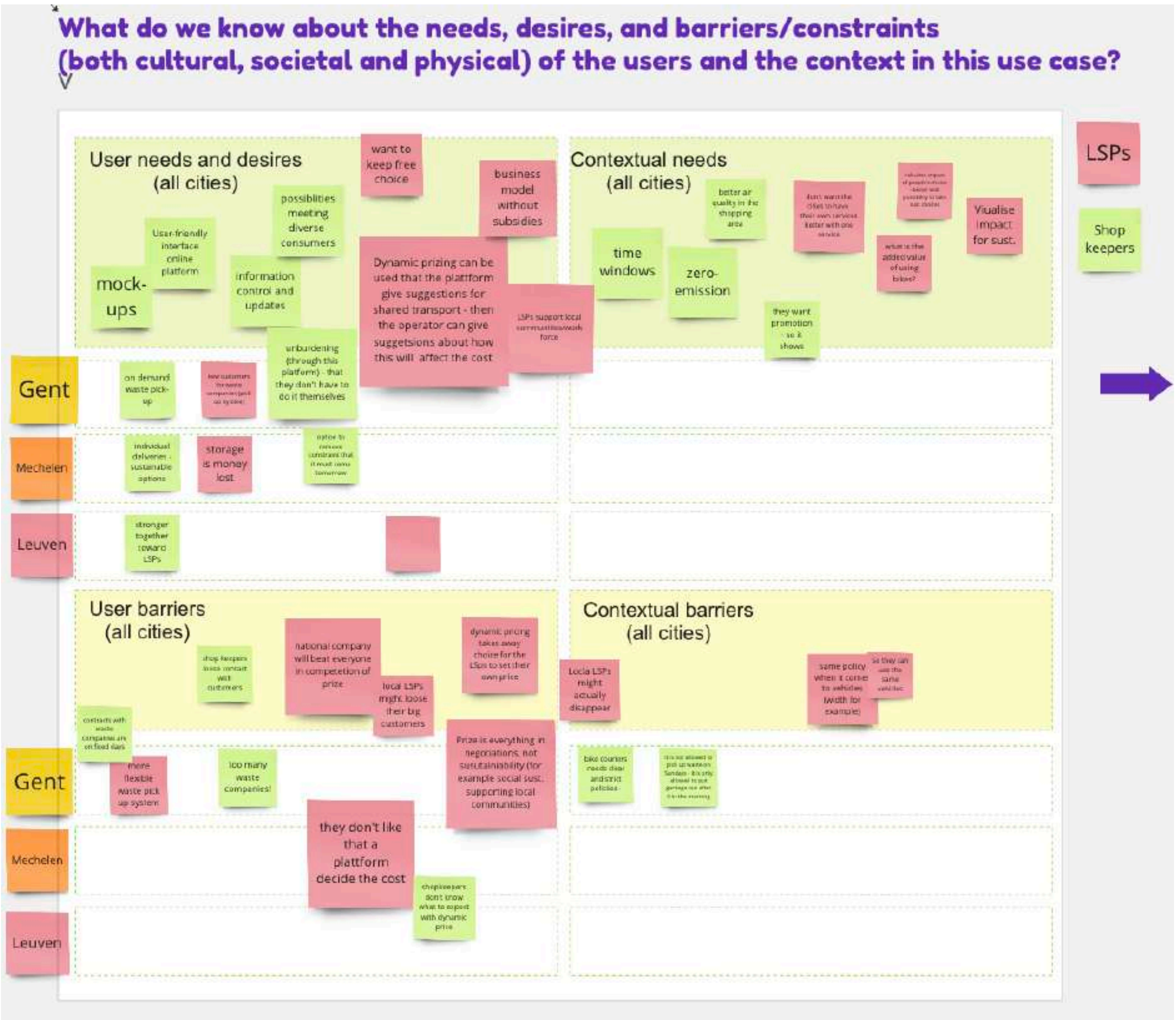


Figure 4. Screenshot of digital co-creative exercise with LL Flanders in the second iteration of ULL requirements in March 2024 (Month 15 of the GREEN-LOG project)

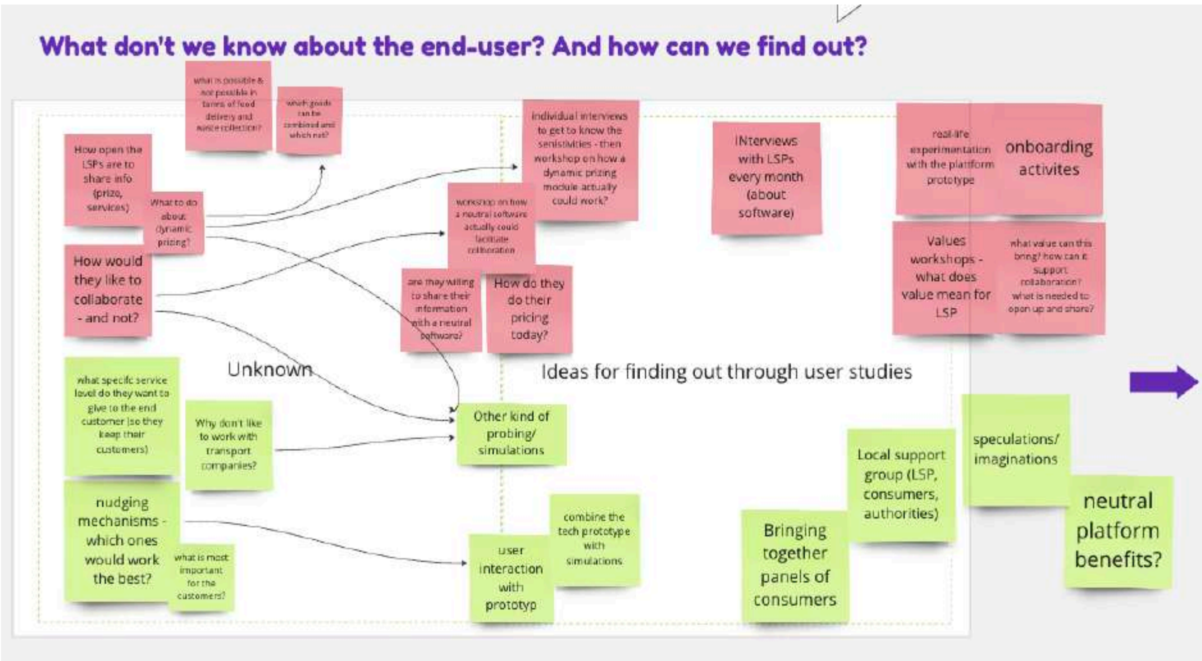


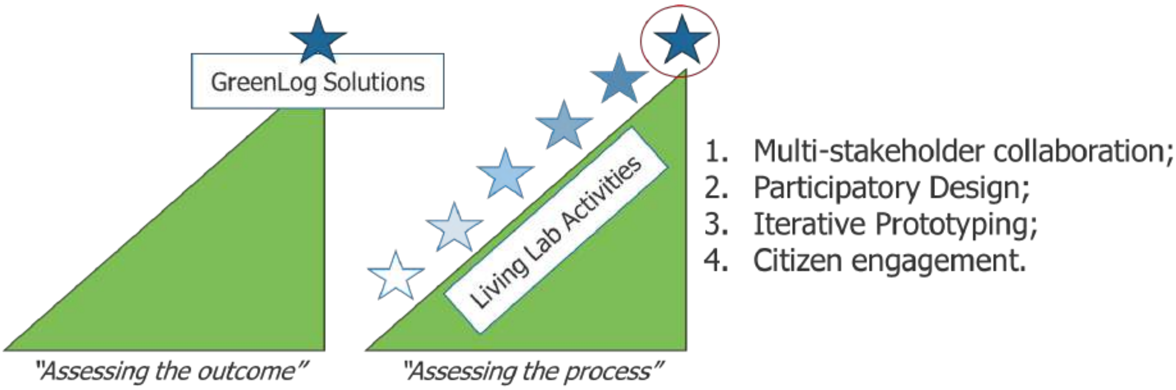
Figure 5. Co-creative exercise with LL Flanders to identify unknowns to establish focus in coming user engagements in March 2024 (Month 15 of the GREEN-LOG project).

This second iteration produced a list of key requirements for each ULL, along with a list of common, more general friction points encountered in implementing these types of delivery solutions. As a baseline, these results will inform the assessment framework in the second phase, aiding to identify key recurring themes, issues, and specific social impact sub-categories, as well as understanding contextual differences and similarities between ULLs.

Phase 2: Developing and Evaluating

The Phase 2 suggests that to effectively assess and understand the social impacts, the evaluation methodology should not only assess the outcomes but also examine the processes within the ULLs themselves (see the top part of the Figure 6, which indicates that in addition to GreenLog solutions we also need to concentrate on the processes and activities that lead to these solutions). Therefore, in addition to evaluating the impacts of living lab delivery solutions, the methodology should include assessment of key living lab principles as implemented in the different GREEN-LOG ULL pilot sites during demonstrations, namely the level of interdisciplinary & multi-stakeholder collaboration; user- centric participatory design; iterative prototyping, and citizen engagement (see Figure 6) – providing iterative feedback loops into the development processes.

The method will involve continuous interaction with Living Lab core teams and identified users, primarily through open-ended interviews and co-creation workshops, as well as local fieldwork in living lab pilot sites. The latter will be based on participant observation of user/citizen-engagement activities organized by Living Lab core teams, interviews, and co-design activities such as co-creative filmmaking with Living Lab stakeholders and user communities (Balaguer & Alberich-Pascual, 2024).



	Solution-oriented assessment		Process-oriented assessment	
Social Impacts	**Quantitative Measurement**	**Quantitative Methodology**	**Qualitative Measurement**	**Qualitative Methodology**
Increased public awareness of sustainable urban delivery solutions	Percentage of people who are aware of sustainable delivery solutions		The level of user/citizen engagement activities in the Living Lab settings.	Interaction with primary users identified by Living Lab core teams (interviews & co-design activities).
Acceptance of sustainable urban delivery solutions	Percentage of people who show acceptance of the delivery solutions	Survey Analysis	The level of user-centric design & iterative prototyping in Living Labs.	Interactions with Living Lab core teams (interviews & co-design activities).
Improved neighbourhood life quality	Change on the citizens' satisfaction score of living in the neighborhood compared to base scenario		The level of user/citizen engagement activities in Living Labs.	Local fieldwork in Living Lab pilot sites (participant observation, interviews, collaborative video documentation).

Figure 6. Solution-oriented and Process-oriented Assessment of Social Impacts in GREEN-LOG Project.

Conclusion

In this Research-In-Progress paper, we draw from concepts of social impact assessment (e.g. Hodson et al., 2023; Aquilué et al., 2021; Trivellato, 2017; Vanclay, 2002) and design ethnography (e.g. Pink et al., 2022; Smith & Iversen, 2018) to argue that these perspectives are necessary for urban living labs to be socially inclusive, equitable, sustainable, and responsive to citizens' needs. We observe that overall, there is a lack of evaluation of both, living lab processes and social impacts, and argue that all these approaches—subjective and objective, qualitative and quantitative, studying what is directly and indirectly linked to projects and including a variety of stakeholder perspectives—are needed to understand the effects of ULL projects on the people involved. In addition to more widely used quantitative, solution-oriented evaluation, we believe that the proposed process-oriented design-ethnographic approach has the potential to generate rich, context-specific data for understanding the social impacts, and building "narratives of change" for ULL projects. These narratives describe, conceptualize, and communicate how change occurs within a specific ULL context, thereby helping to make sense of the complex processes and dynamics that lead to social, organizational, or individual transformation.

Finally, we anticipate that the assessment insights will create learning opportunities – helping designers, planners, and tech developers to understand and make informed decisions in a co-creative manner within the established “protagonist community” (Smith & Iversen, 2018, p. 32). This is the community of key ULL stakeholders that plays a central role in initiating, driving, and experiencing change or transformation within a particular ULL context. This involves discussions, alignment activities, and strategies within the project that are uncertain, complex, and beyond the immediate scope of the core research focus or strategic objectives set in the Project Proposal or Grant Agreement.

Acknowledgement

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Full Research Paper

Design Ethnographic Toolkits in Living Labs

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Abstract

This paper explores the role of toolkits and their material characteristics as a vehicle for generating impact through sustaining insights and ways of working from Living Labs. Using toolkits to sustain findings within Living Labs is not new, but literature concerning their characteristics and expectations by Living Lab actors is scarce. The paper outlines the primary role toolkits play concerning co-learning in Living Labs, how they can be designed through a reflective design ethnographic practice and highlights essential characteristics of toolkits when used to sustain findings into other contexts. This is done by reflecting on the design of two different toolkits focused on the design of future smart mobility services from a facilitator perspective, as well as interviewing stakeholders from the public and private sectors regarding their expectations of the role and characteristics of said toolkits.

Key words

Toolkits, Methods, Sustaining, Engagement, Design Ethnography, Mobility

Introduction

Living Labs are often characterised as a vibrant collaboration focused on sustainability, co-creation, and community engagement (Bergvall-Kåreborn, Ihlström Eriksson, Ståhlbröst, & Svensson, 2009; Chronéer, Ståhlbröst, & Habibipour, 2019). However, when investigating the impact of a Living Lab, the impact tends to be measured through quantitative means, often relating to uptake or commercial success, rather than the potential impact of a Living Lab as an approach to collective exploration and learning. Traditionally, sustaining in Living Labs can be described based on its ability to continuously explore, ideate, conceptualise, develop, and evaluate digital service innovations while sustaining impact over time. This includes aspects such as the ability to engage a wide array of stakeholders and users to sustain continuous involvement and build strong partnerships (Chronéer et al., 2019). Sustaining can also be related to the Living Lab's ability to scale, be flexible and adapt to change over time (Ebbesson, Lund, & Smith, 2024).

In this paper, we shift away from purely looking at the potential success of a service or product as a measure of impact. Instead, we shift the focus towards looking at the potential to sustain insights and ways of working in a Living Lab beyond the Living Lab through the design and use of toolkits. Thereby looking at the potential impact the Living Lab has as a collective for sustaining co-learning.

The idea of communicating findings from a Living Lab, or the methodology of Living Labs as a type of toolkit is not a new idea, ranging from handbooks (Habibipour, Ståhlbröst, Zalokar, & Vaittinen, 2020) to more tangible tools which can support either co-designing artefacts (Veeckman & Van Der Graaf, 2015) or exploration (Kalverkamp, Hauge, & Thoben, 2013). However, what is less researched is the expectations that other stakeholder partners have of these toolkits and how they should be designed to sustain co-learning. Therefore, this paper pays specific attention to the question of How can toolkits be designed to sustain co-learning in Living Labs? The paper draws upon lessons learnt from two collaborations between academia and the public and private sector, focused on the design of future smart mobility services and interviews with stakeholders in these collaborations.

Literature

Sustaining in Living Labs can be characterised as maintaining continuous operation through various innovation phases. However, sustaining is also characterised as the ability to design and implement technologies and services that remain relevant over time and create sustainable social change (Bødker, Dindler, Iversen, & Smith, 2022; Smith &

Iversen, 2018). One critical aspect of sustaining is the engagement of a wide array of stakeholders and users. This engagement is vital for sustaining continuous involvement, as it fosters ownership and community around the lab's projects. Stakeholders can include local governments, academic institutions, private companies, non-profit organisations, and citizens. Building strong partnerships with these groups can facilitate knowledge exchange, provide valuable feedback, and drive collaborative efforts towards common goals (Bergvall-Kåreborn et al., 2009). In the beginning era of Living Labs, these partnerships were often modelled as a triple helix. However, in recent years, many Living Labs have been modelled as quadruple or quintuple helixes, emphasising a commitment to including the environment – or planet as an important stakeholder (Baccarne et al., 2016). Given the multitude of perspectives in Living Lab processes, flexibility and adaptability have been identified as important characteristics for sustaining in Living Labs (Ebbesson et al., 2024). These characteristics include, for example, the ability to adopt or develop new methodologies and toolkits to support exploration, futurizing, knowledge exchanges, incorporating emerging technologies, and (re-)evaluating user needs and market demands.

The idea of communicating findings from a Living Lab or the methodology of Living Labs as a type of toolkit is not a new idea, ranging from handbooks (Habibipour et al., 2020) to more tangible tools which can support either co-designing artefacts (Veeckman & Van Der Graaf, 2015) or exploration (Kalverkamp et al., 2013). Different tools and toolkits play an important role in design, as they afford framing or reframing problems, allow externalisation of insights, provide frameworks for visualising problems and solutions, unlock dormant knowledge, and equip teams for learning about peoples' experiences (Freach, 2018; Peters, Loke, & Ahmadpour, 2021). Through a review of 76 different design tools, Peters et al. (2021) suggest that design tools tend to consist of the following types: methods, prompts, components, concepts, stories, embodiment, and construction.

Design tools and toolkits enable designerly inquiry through supporting perception, conception, externalization, knowing-through-action, and mediation, making these artefacts excellent tools for designers (Dalsgaard, 2017). However, through a design ethnographic approach (Pink et al., 2022), the use of tools and methods in the hands of a design researcher or facilitator can also play a crucial role in co-learning, as design researchers and other partners in a Living Lab engage in joint problem solving to address challenges. In the context of design ethnography in a Living Lab, the careful *design of* and *experimentation with* different tools become a vehicle for co-learning as partners in the Living Lab meet across boundaries and the relational expertise (Dindler & Iversen, 2014) of the design researcher or facilitator supporting these processes become key.

Given the important role that design tools and toolkits play as a vehicle for co-learning during the Living Lab and the potential of bringing tools beyond the Living Lab as a way to increase impact and scaling, the remainder of this paper will reflect upon the design, use, and dissemination of two design ethnographic toolkits, aimed to support co-learning through co-design in the context of future mobility services.

Method

The paper draws upon reflections concerning developing and designing two toolkits to support co-design and co-learning during and after a Living Lab end. The two toolkits were developed in separate research projects using a design ethnographic approach (Pink et al., 2022). The design ethnographic approach provided the research team with an overarching framework to balance working with rich, situated, and qualitative data as well as with future-making through a participatory co-learning approach in the context of multi-stakeholder collaborations (Ebbesson, 2022; Raats et al., 2023).

The two projects studied in this paper were organised as collaborations between the public and private sectors (i.e., automotive companies and city representatives). The AHA II project featured extensive collaborations with local citizen communities and was formally positioned as an Urban Living Lab. The OSMaaS project primarily consisted of a collaboration between representatives from a Swedish municipality and several private companies in the context of automotive and digital services. In both projects, the academic partner, which the authors of this paper represent, acted as the glue that facilitated and organised most of the interfaces between all involved actors.

From an empirical data and analytical standpoint, the paper draws upon reflections from the authors. These reflections are based on the authors' experiences of staging design ethnographic approaches. These approaches played an active part in the co-design of both the methodology used within each case and in the co-design of the toolkits through continuous exploration and adjustments of both methods and possibilities with the toolkits. In addition to these reflections, we also used interview data from each case focused on stakeholders' needs and expectations concerning method and toolkit development (see Table 1).

Table 1. Interview Study Respondents

Case	Respondents
AHA II	2 City partners, 2 Automotive partners.
OSMaaS	3 Automotive partners, 1 IT Consultancy partner, 2 City partners, 2 Research team partners.

When analysing the interview material, we used an inductive approach to understand how stakeholders perceive the characteristics, challenges, and opportunities for introducing novel methodology during and after collaborations with the research team. The inductive approach followed the steps of thematic analysis (Braun & Clarke, 2006) by developing codes and themes central to the research question.

Ethical considerations were made to ensure the involved participants' integrity, respect, and safety. These considerations included utilising informed consent, where participants were informed of the research purpose, methods, and their right to withdraw their consent. It also entailed maintaining privacy and confidentiality, ensuring that personal data were protected and anonymised.

The Anatomy of Design Ethnographic Toolkits

In this section, we provide an overview of two toolkits developed in two different projects within the same application area focused on co-learning, exploration, and design of future mobility services.

The AHA II Toolkit

The AHA II Urban Living Lab was staged as a collaboration between Halmstad University, two Swedish Cities, an automotive manufacturer, and public transport actors from each city. During the duration of the Urban Living Lab, we worked extensively with building citizen communities in two different neighbourhoods in each city. Based on our experience working with this diverse set of stakeholders in the Living Lab and our co-learning journey, we developed a toolkit that we both used during the Living Lab and packaged as a delivery when the project and Living Lab were finalised.

The AHA II Toolkit consists of a method book consisting of summaries of ethnographic fieldwork and novel methods based on design ethnographic work. Furthermore, the method book covers reframing – that is, ways to reframe and challenge dominant mobility agendas and perspectives. The method book, therefore, records and reflects the work put into the Urban Living Lab by researchers and other Living Lab partners.

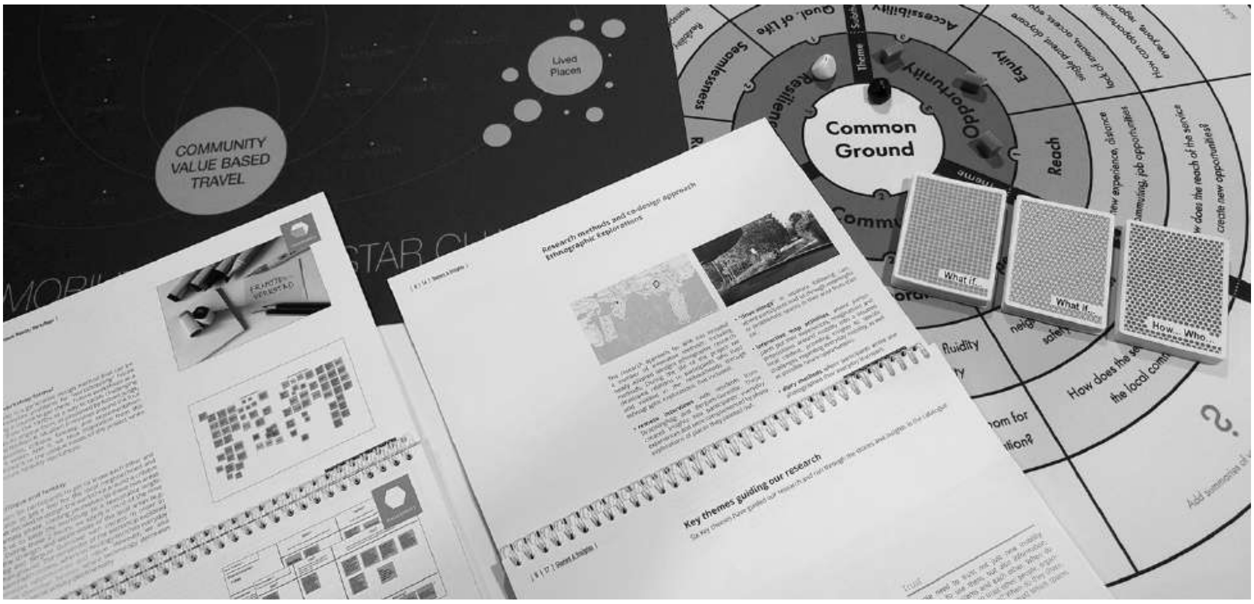

Figure 1. The AHA II Toolkit

The method book acts as a response to the needs voiced by public- and private-sector actors through our ongoing work together in the Urban Living Lab. Additionally, it provides a way for the research group in the Living Lab to vocalise a response to what we perceived as a mobility culture focused on dominant industry narratives rather than the needs voiced by our citizen communities in the Urban Living Lab. The method book, therefore, acts on two levels: firstly, it addresses challenges explicitly voiced by the formal partners in the Urban Living Lab, and secondly, it addresses challenges identified by the research team throughout their work facilitating interfaces between public- and private sector and citizen communities.

AHA II was set up with dual goals: to explore future mobility services as well as to develop new approaches for doing so. Therefore, there were strong expectations to develop a methodology which could help both the public and private sectors approach mobility services in novel ways. From the partnering cities, there was an expressed need for methods and other tools which could help their urban planners shape the mobility services of the future through, for example, guidelines or scenarios. During the joint work in the Urban Living Lab, the city partners also highlighted how the Living Lab introduced new ways of gathering and especially analysing data concerning citizens and their context.

“This [ethnographic analysis and fieldwork] provides us with a different angle than what I see when the municipality is having a dialogue with citizens. We have more restrictions […] and end up with a lot of information we can’t manage” – City Actor

Therefore, an important co-learning of the Urban Living Lab was methodologies which could help the city approach their citizens in new and novel ways that go beyond what the city is capable of today, both concerning ways of engaging and ways of making sense of the data.

The private sector stakeholders, primarily the automotive manufacturer, also had needs and wants concerning the toolkit. The primary need was expressed as futurizing methods which go beyond what current methods address, including "traditional" ethnography and fieldwork. A stakeholder from the automotive manufacturer put it as:

"It is hard to put individuals in a situation 5-10 years into the future, to explore the needs they might have in the future." Automotive Company Actor

In the ULL we addressed this methodological shortcoming by working with a design ethnographic approach focused on deep contextual understanding and futurizing through co-learning. This resulted in developing methods specifically focused on bridging different stakeholder groups as they engaged with the ethnographic and future-oriented materials. An example of this can be seen in the Common Ground Game (see Figure 2).

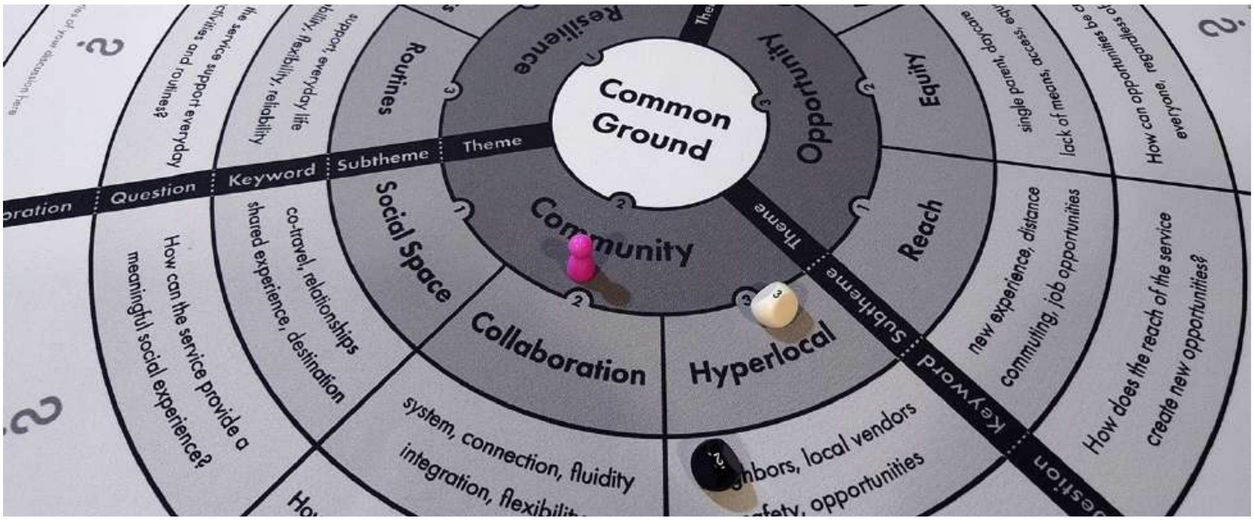

Figure 2. The Common Ground Game

The Common Ground Game helped make social values, captured through design ethnographic workshops, more tangible by allowing stakeholders in the Living Lab to explore them together through a playful game focused on the co-design of services, thereby opening up a space for co-learning and co-appropriation.

We also perceived a difference in terms of perspective and readiness between the public and private sector stakeholders. The public city actors from the cities were quite focused on the need for tools to help them grapple with challenges in the present. In comparison, the private sector actors seemed to have more experience in working designedly. They, therefore, seemed to put more trust in the process through a philosophy of “we learn, just by being a part of it,” highlighting how working together with researchers and other stakeholders opened up spaces for both co-learning and networking.

The OSMaaS Toolkit

The OSMaaS project was staged as a collaboration between Halmstad University, three automotive actors, and an IT consultancy firm. During the collaboration, we also involved public sector actors through the co-design of Mobility-as-a-Service concepts and service ideas. The project specifically focused on the design of future mobility services in relation to Mobility-as-a-Service platforms and challenges related to futurizing and collaboration.

During the OSMaaS project we designed, used, and iterated several different canvases and other tools which supported co-learning and co-design within OSMaaS. In OSMaaS, we also utilised several of the methods and tools developed within the AHA II project, which could inspire and act as a foundation for co-learning and method development in OSMaaS. When the project was finalised, these canvases and tools were packaged as a toolkit and made openly available for project stakeholders and other actors. The toolkit is still a work in progress, but currently consists of:

- Method Book: Aimed at communicating the design process & methods.
- Case Descriptions: Communicating case contexts and service concepts.
- Design Ethnographic Films: Communicating rich reframing.
- Openly Accessible code to enable continued development of services.
- Open explorative prototypes to support continued exploration.

We view the OSMaaS Toolkit (see Figure 3) as an assemblage of artefacts that together constitute the whole of the project's effort with the aim to scale findings and provide room for continued co-design and co-learning. The artefacts have a wide range of potential uses, addressing diverse types of stakeholders to provide multiple vantage points for engaging with the material. The method book and case descriptions might provide inspiration for a project leader, decision maker or stakeholder from the private sector. In contrast, the code base will be a more appropriate entry point for a programmer from the same organisation. The design ethnographic films can be used to shift perspectives needed to grapple with mobility challenges in novel ways. Finally, the explorative prototypes can be used as a starting point for exploring challenging themes concerning mobility.

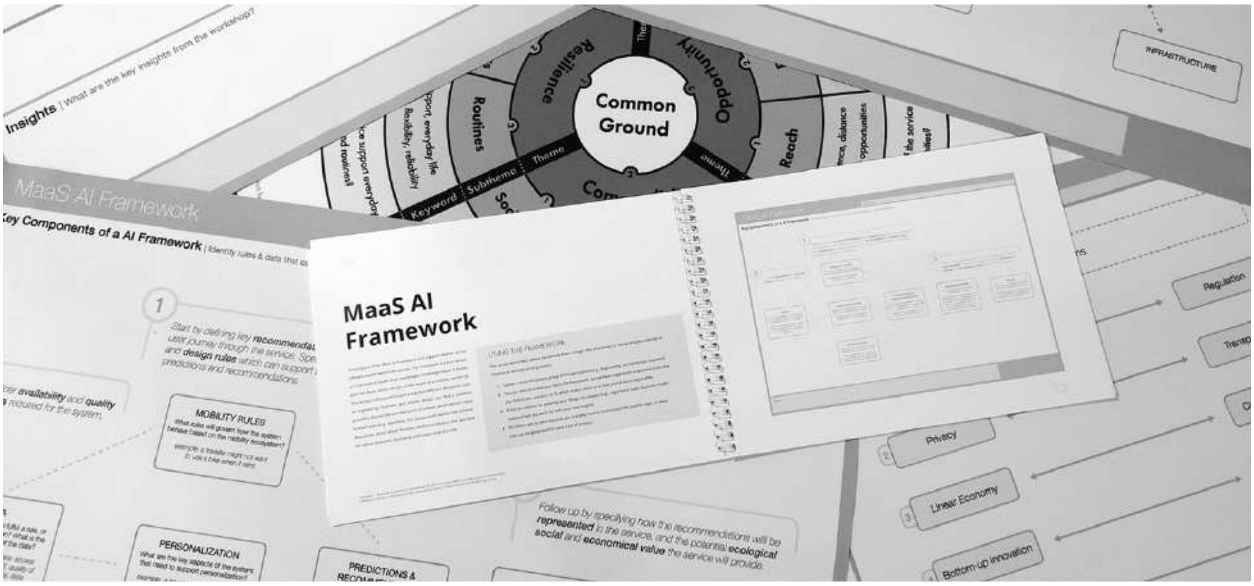

Figure 3. The OSMaaS Toolkit

The idea to view the toolkit as an assemblage of artefacts with different vantage points is based on our collaborative co-learning throughout the OSMaaS project, where we have continually worked together with partners from the public and private sector to address challenges relating to the design of future Mobility-as-a-Service platforms. The toolkit thereby constitutes our response to the challenges we were faced with when facilitating and organising interfaces for co-learning.

The focus of the OSMaaS project was to find ways for the actors to collaborate to design an open Mobility-as-a-Service platform. Initially, the project did not specifically focus on developing methods as a part of its outcome; however, as the project progressed, more emphasis was put on methodology development as the team gradually learned about friction and conceptual divides that needed to be bridged.

As the toolkit started to mature, we had an ongoing dialogue with our partners in OSMaaS to tease out what the toolkit should focus on, how it should be designed, and how it should be packaged to be engaging. An important lesson here was the importance of considering the maturity or readiness of the stakeholder to engage with specific tools or methods in a toolkit. A development strategist from our public partner specifically noted how methods might not be enough and always run the risk of not being useful if the right expertise is lacking.

"For methods to be a strong output from a Living Lab, there is also a need to support the methodologies through facilitation of workshops and concrete work; otherwise, there is a risk it turns into a shelf warmer" – Development Strategist, City Actor

Furthermore, according to our partners, another key aspect was the ability for methods to be easily implemented into everyday work and existing routines. However, this was also seen as a great challenge, as the readiness for adopting new ways of working or specific tools was not always in place, according to the development strategist.

Our private partners echoed this sentiment and argued for the need for time and dedication to adapt and use new methods. This was also partly the reason behind the decision to treat the toolkit as an assemblage where different tools can act in a modular way and address specific challenges and specific target groups. For example, an openly accessible code base might be a great fit for a developer. In contrast, a strategist or urban planner might find a rich case description or a design ethnographic film communicating reframings more useful. However, it is also important that these different tools focus on communication and value, are designed carefully, and hit their mark. One of our automotive partners tried to capture this sentiment and phrased it as:

"For example, through case videos, nice productions, where the focus on communication is razor sharp, and this needs to be budgeted for, often you do this with your phone yourself, but there needs to be a budget for this." – Automotive Company Actor

The way of working was compared to how academics at a conference have 12 minutes to communicate something, where the focus needs to be as sharp as a razor blade. The respondent argued that this thinking should also be applied here.

A final reflection from our partners was the need for the tools in the toolkit to be highly flexible in terms of suggesting alternative routes towards reaching a goal, to provide room for flexibility, breaking away from norms, and/or finding new ways forward. The need for pluralism, as expressed by our partners, was something we strived for throughout both cases. A tangible example of how this influenced our work can be illustrated by the explorative prototype we co-designed – the Privacy Hub (see Figure 4).

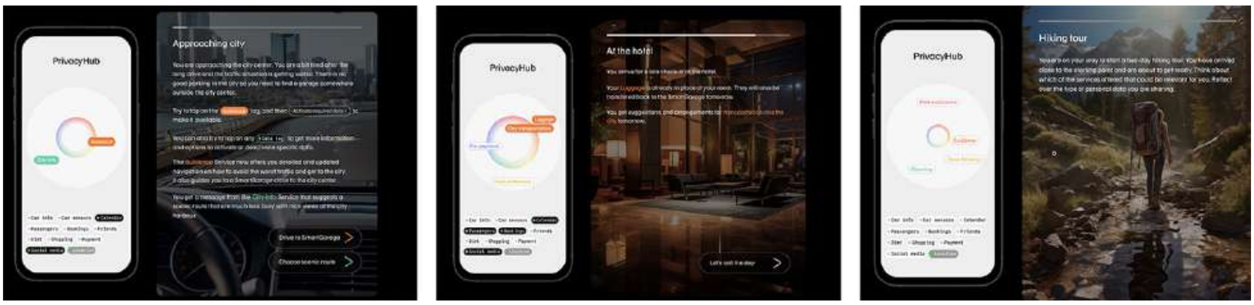

Figure 4. The Privacy Hub

The Privacy Hub was designed as a probe that could support co-learning concerning two areas our partners found challenging: data privacy and integrity. To support flexibility, the probe was designed with a tutorial to allow untrained facilitators to use the probe. Furthermore, the different contexts that the probe explored could easily be changed. The probe, therefore, introduced a novel way for our partners to explore and co-learn about the future.

Discussion

In this paper, we recognise that sustaining co-learning is essential to Living Labs. It enables a shift from a project outcome perspective towards a broader impact perspective, considering important aspects such as, e.g. sustainable social change (Bødker et al., 2022). We argue that a design ethnographic approach (Pink et al., 2022) to Living Labs, utilising design tools and toolkits, is a way forward to balance co-learning with the ability to drive collaborative efforts in Living Labs towards common goals and innovative solutions (Bergvall-Kåreborn et al., 2009; Chronéer et al., 2019).

Based on our design ethnographic approach focused on co-learning along with public and private sector stakeholders and citizen communities, we can trace specific needs and wants of toolkits and implications for the research and design of these types of toolkits. Firstly, the stakeholders in both cases specifically sought tools to help them address what we refer to as future-making - the ability to explore what mobility services might look like in the future. This specific need makes a design ethnographic approach (Pink et al., 2022) particularly fitting for experimenting with design tools since design ethnography as a methodology is well equipped for supporting the exploration of emergent technology. Furthermore, they also sought ways to address new types of challenges in novel ways by working with new perspectives which were novel to the partners (e.g. new social, economic, or ecological challenges) in a pluralistic fashion, where multiple perspectives can compete (see Figure. 5). This drew on the potential of using design tools to allow framing problems from multiple perspectives (Peters et al., 2021), a challenge the stakeholders have in common with most quadruple or quintuple helix initiatives, be it a Living Lab or not (Baccarne et al., 2016).

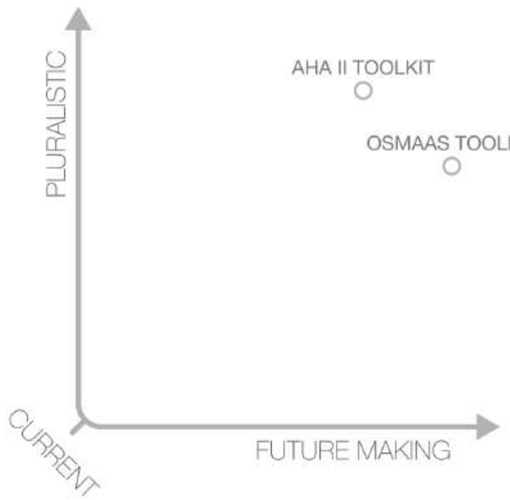

Figure 5. Scope of a Design Ethnographic Toolkit.

What perspectives, methods, or tools to introduce is, however, not always a given, as different stakeholders struggle with different issues. For example, Peters et al. (2021) suggest multiple ways and shapes in which tools can support co-design. In our experience, the aim and shape of the tools depend on each case's unique characteristics. Therefore, even the design process of a co-design toolkit relies on a process of exploration and mutual co-learning. However, it is also through this explorative process that we, as design researchers, must take a reactive role. This is accomplished by sometimes smoothening out friction and sometimes adding friction by bringing in novel perspectives to help *reframe* and challenge the status quo, which otherwise might trap partners in such a way that they become blind to potential solutions. Finally, sometimes, it simply comes down to helping people talk by building *bridges*. Together, these ways of working form the basis of the toolkits used to support co-learning through the experimentation of methods, facilitation, and changing perspectives. The remainder of the discussion will reflect on these two ways of working (i.e., reframing and bridges).

The applied design ethnographic approach to Living Lab collaboration relies on a reframing practice that invites the participants from public and private actors to move beyond taken-for-granted ideas within their own organisations to step into a common ground of explorations and joint understandings of local values (Smith et al., 2024; Brodersen et al., 2023). Reframing practices are commonly used in strategic and creative activities to encourage looking at a problem from different angles and to enable new solutions and approaches to emerge. From a design ethnographic perspective, this means taking people's everyday lives and routines seriously in Living Lab innovation to create realistic discussions on how future solutions can be played out. One obvious example from the AHA II project is how the ethnographic research invited a reframing of people from being either 'users' (as in industrial discourse) or 'citizens' from a public perspective into being just people struggling to get their everyday lives together. This small but fundamental shift in mindset disrupted what was taken for granted about ‘user studies’ respectively ‘citizen dialogues’ as engaging activities in the different stakeholder practices. From a mobility perspective, this also enabled the actors to critically reflect on the well-established idea that one main requirement for transport from work to home was time efficiency. This idea could be contested through the design ethnographic understandings that developed through qualitative methods of the first mile in travel in the Living Lab area to instead be reframed from a time efficient transport from work to home to be foundational social. This reframing was prompted through visualisations in the AHA II toolkit (see Figure 6). To us, the reframing practice, therefore, becomes an important cornerstone of addressing quadruple- and quintuple-helix perspectives (Baccarne et al., 2016), as the focus on local values helps participants to gain a new vantage point, where they can step out of their established cultural scripts.

Figure 6. Detail from the toolkit to prompt a reframing session on what is important for people on the first mile of their travel in the Living Lab environment (designed and published with permission from JodyPrody)

Much of the actual design of the canvas materials for the toolkit in the OSMaas project relied on what we refer to as *bridging*, that is, the use of canvases to create scaffolds or externalisations (Peters et al., 2021), which can help different expert groups meet in the middle. A practical example of this was the creation of a canvas focused on AI-powered services. Initially, we started with a conceptual model of an AI-based recommendation system. Our technical design team created the model, and the granularity of the model and concepts used in the framework were tightly linked to engineering. To design an engaging canvas, we bridged the model by decreasing the granularity of the model and adding additional themes (e.g., themes focused on service design and sustainability). The canvas thereafter helped turn the model into a tool that no longer "belonged" to either one discipline. Instead, it became a tool where experts with diverse backgrounds could meet. In other words, the toolkits enabled the stakeholders to widen and exchange perspectives, resulting in new insights. In hindsight, writing about the experience of designing the canvas can be described as a straightforward process. However, in practice, the canvas was a result of continuous iteration and trial and error, where multiple versions of the conceptual model were tried and tuned based on the output of the workshops and reflections from the facilitating design researchers.

The final example of ways of working is a combination of reframing and bridging. In practice, reframing and bridging are rarely separated, and our work with the Common Ground Game method can serve as an illustration of this dynamic. Through the design of the Common Ground Game, we blended the notion of reframing what value means in a future mobility setting by providing a strong focus on social values and sustainability, and the way we achieved this reframing was by creating a framework which could help scaffold co-learning about context, with diverse stakeholder groups through game mechanics. A detailed account of how the framework was designed can be found elsewhere (Ebbesson, 2022). In brief, the design of the tool involved fieldwork through future workshops with citizen groups, which then were designed into a workshop game experience, which were then evaluated and iterated until it achieved both reframing and bridging.

These descriptions of working with design ethnography as a vehicle for co-learning in a Living Lab can be conceptualised as a continuous layered process, where you, as a design researcher or facilitator, oscillate between two layers. The first layer concerns addressing and acting upon needs expressed by stakeholders and other parties in the now. The second layer concerns always being ready to act upon hunches and insights discovered during the co-learning process, which can provide clues for how to scaffold and support fruitful co-learning (i.e., to support reframing and building bridges). We identify this skill as an important ability of a facilitator, relating to or expanding to the notion of relational expertise (Dindler & Iversen, 2014) as a core skill for a facilitator of co-design. The important role a trained and skilled design researcher or facilitator plays did not go unnoticed by our partners in AHA II and OSMaaS, as we can trace in their concerns regarding the importance of having skilled support when transitioning parts of the toolkits beyond the Living Lab. However, herein also lies a dual pedagogical and designerly challenge going forward. The challenge concerns the ability to support engaged Living Labs partners in improving their proficiency in working in more designerly ways to prepare them to become ambassadors that "walk the walk" beyond the Living Lab, while also designing tools that are inviting and sustain important findings from the Living Lab, without being intimidating (e.g., The Privacy Hub example). The toolkit, as a deliverable from a Living Lab, therefore, goes beyond merely being a summary of methods. It is an invitation for continued co-learning based on extensive empirical and practical work. It is, therefore, time we treat it as such and live as we learn through both the production of new, engaging, and novel toolkits as well as the utilisation of already existing toolkits.

Conclusion

In this article we set out to address the research question of: How can toolkits be designed to sustain co-learning in Living Labs?

Through examination of two toolkits and reflection concerning how these were co-designed, we conclude that the design of toolkits as part of an impactful deliverable from a Living Lab initiative benefits from focusing on reframing and bridging through continuous co-learning processes in Living Labs oriented towards pluralism and future making.

We outline this process as consisting of two layers, where the design researcher oscillates between addressing expressed needs by stakeholders and making informed decisions which can scaffold and support co-learning by introducing novel perspectives and methodology.

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Research-In-Progress Paper

Co-designing Innovative Nature-Based Solutions for Sustainable Land and Water Management: insights from the SALAM-MED Living Labs

Exploring the effectiveness of Causal Loop Diagrams to co-design Innovative Nature-Based Solutions

Authors

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Abstract

The Living Lab approach is gaining popularity as a way to stimulate the co-design of innovative nature-based solutions (NBSs) to improve the resilience of endangered Mediterranean dryland socio-ecological systems and to restore degraded ecosystems in lands arid and hyper-arid. However, the socio-ecological complexity of the rural and agricultural contexts of the Mediterranean presents specific potential and constraints that have been considered by six Living Labs in the context of SALAM-MED PRIMA project. Since the stakeholder mapping phase and then in the co-design of the NBSs, the Living Labs have been designed as spaces to generate lasting learning processes and tailored methodological approaches have been adopted to empower local stakeholders and support the scaling-out of NBSs.

Key words

Co-design, Nature Based Solutions, Living Lab, participatory governance, land and water management, socio-ecological system

Introduction

Nature Based Solutions (NBSs) are innovative actions that - either inspired or supported by nature (EC, 2015), offer systemic responses to the challenges of sustainable development. Increasingly relevant in EU policies, NBS (Nature Based Solutions) are promoted to achieve multiple goals and incorporate multiple economic, environmental, and social benefits and costs by influencing the well-being of different stakeholders. The innovative nature of many NBS makes difficult to have evidence about solution to be designed and require an additional envisioning effort to declinate the solution in different future scenarios and according to different perspectives. Previous research demonstrates that the higher the number of services and stakeholder groups targeted, the lower the capacity to maximize the delivery of each service and simultaneously fulfil the specific needs of all stakeholders (Coletta et al. 2021; Lupp et al.2021). The socio-ecological complexity of Mediterranean rural and agricultural contexts presents specific potential and constraints for adopting and adapting the LL (Living Labs) approach and reveals further difficulties for a real and effective bottom-up approach (Yousefi and Ewert, 2023; Zingraff-Hamed et al., 2020). In this context, this work aims to provide answers to the following research questions: Which stakeholders are or should be part of a co-design and implementation of NBS? Which approach/methodological tools can support the process of understanding the different perspectives, developing a collective view of the challenges, and identifying potential innovation pathways? Could a shared framework for evaluation facilitate a more inclusive and long-lasting potential innovation pathways?

Material and Methods

Living Lab experience in SALAM-MED project

“Sustainable Approaches to LAnd and water Management in MEditerranean Drylands” is a 3-year RIA project funded under the PRIMA 2021 program started in April 2022. It builds upon an interdisciplinary network of 15 partners from 8 MED countries including research organisations, NGOs, small and medium enterprises, and international organizations, with long-standing collaborative activities across the MED.

SALAM-MED aims at co-designing, testing, validating, and implementing an array of advanced technologies and management NBSs to improve the hydrological ecosystem services of MED dryland socio-ecological systems. They include water harvesting technologies - crop cultivation in wadi rivers (Egypt) and subsurface water retention in pastoral argan forests (Morocco) -, managed aquifer recharge (Tunisia), management of native forests and silvo-pastoral systems (Spain, Morocco, Italy), and integrated management of olive groves (Greece), plant phenotyping and symbiotic plant promoting microbial consortia to increase plant water use efficiency, drought resilience and productivity (Italy, Egypt, Morocco).

SALAM-MED promotes co-innovation through six Living Labs (LLs) where innovative NBSs are co-designed through an inclusive social learning process to integrate traditional and scientific knowledge. The participatory process strengthens the resilience of rural communities by creating new business opportunities particularly for youth and women while the scaling out of SALAM-MED outcomes will be enabled through different actions and strategies: vegetation/hydrological/system dynamics modelling and climate change impact assessment scenarios; extended cost-benefit analysis; capacity building and science-policy interface actions.

Despite being different in terms of context and focus, all SALAM-MED LLs present the five characteristics identified by the European Network on Living Labs (ENoLL): multi-method approach, multi-stakeholder participation; active user engagement; real-life setting; co-creation.

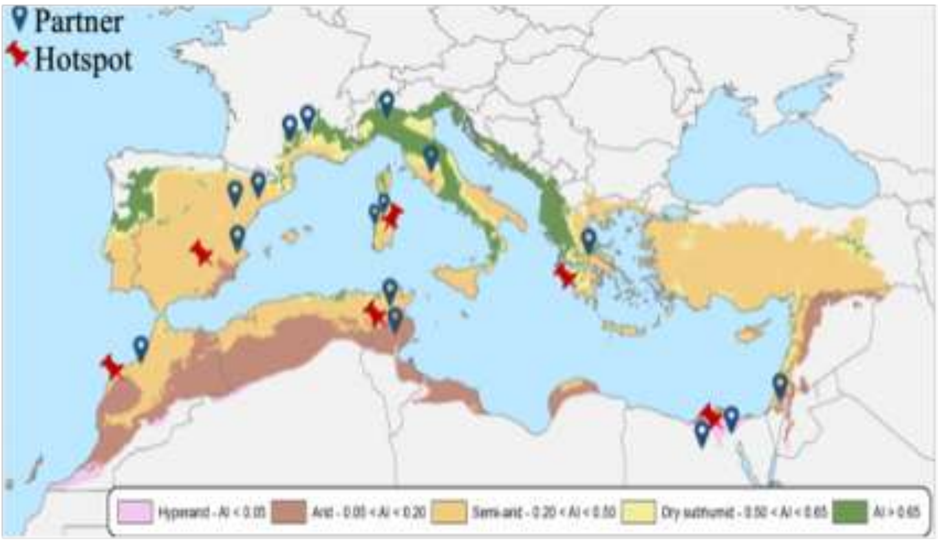


Figure 1. Partners and hotspots of SALAM-MED project

From the Mind Map to the Causal Loop Diagram: design thinking for co-creation

After the stakeholder mapping and analysis (Scardigno et al., 2022), a theory of change was identified to map out future innovation pathways and role of the different actors involved.

The co-creation process is structured within the framework of design thinking as a method to practically and creatively address complex and undefined problems, following a systemic perspective to appreciate multiple viewpoints, and incorporating a reflective monitoring approach (Ison et al., 2014; Ison and Blackmore, 2014; Leminen et al., 2012).

Among the several tools available in co-creation processes – spray diagrams; scenario-ing exercises, (Ison et al. 2014; Rickards et al. 2014), pathways approach (Wise et al., 2014; Cradock-Henry et al., 2021) – we focus on the co-development of Causal Loop Diagrams (CLDs), (Lane, 2008; Morecroft, 1982). CLDs are used to describe and analyse perspectives from different stakeholders; to develop a collective view of the challenges and identify potential solutions and innovation pathways; to create a common understanding within each LL and a common framework for evaluation within and across the LLs (Tiller et al., 2021). Moreover, CLDs provide links between variables that can be later transformed to quantified System Dynamics Models (SDM) for scenario analysis and for decision-support-making (Maneas, 2023).

Following an iterative process (Tiller et al., 2021), a first LL event was organised to provide the space for discussions among researchers and stakeholders, with the aim to grasp the main bio-geo-physical and socio-economic settings – and their connections – into a participatory mind map (MM). The process provided the base for a common understanding among the different stakeholders, while the generated MMs provided the graphical representation of the context-specific challenges.

After the workshop, the MMs were digitized by using the VenSim simulation software, and they were further processed to translate case specific social-ecological components into ecosystem services (Maes et al., 2020; Díaz et al., 2015). The aim of this exercise was twofold: to provide a common language across the different countries, thus allow comparisons between the case studies, and to allow the integration of socio-ecological metrics, and their interconnections with the suggested NBSs at a case study level. The last step of this process was to transform the MMs into CLDs by adding signs (plus or minus) to denote the nature of interaction between the variables.

During the second LL event, the generated CLDs were presented and discussed with stakeholders who were asked to validate their structure, by providing feedback on the nature of interaction between the variables, and their applicability in exploring business opportunities aligned with soil, water, and biodiversity conservation objectives.

Results and discussion

Development of CLDs

Seven LL workshops were held from February to June 2023, bringing together all the main types of stakeholders: government, citizens, academia, and industry. The 4 components of the quadruple helix are not present in all countries and have different relevance with a very low component of civil society in Italy, Morocco, and Tunisia. The composition of the LLs gave space to all participants to feel comfortable to express their ideas, concerns, suggestions, and solutions. Most of the stakeholders shared common challenges and worries that was identified as a factor that enabled smooth discussions without conflicts. However, sometimes the living lab involves a heterogeneous group of stakeholders and their awareness of the interdependencies among apparent independent activities and processes is weak. Further, they can have different representation of the ecosystem which increase the intensity of the conflicts in this area. Some difficulties appeared in involving women, especially for LLs of the southern shore of the Mediterranean. For them to overcome this obstacle, specific strategies have been suggested and will be tested.

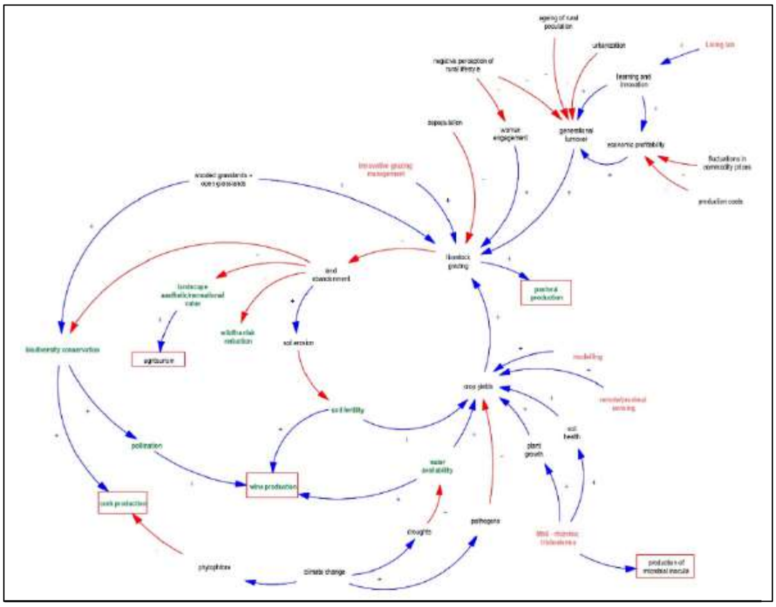


Figure 2. CLD of Italian LL.

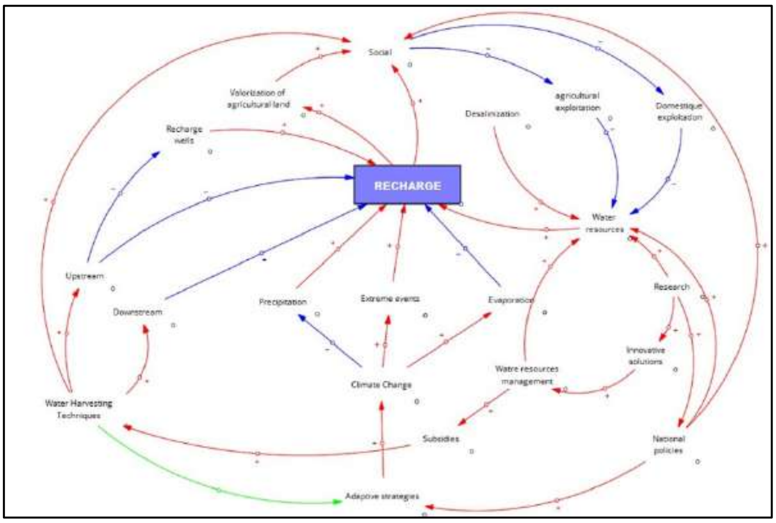


Figure 3. CLD of Tunisian LL.

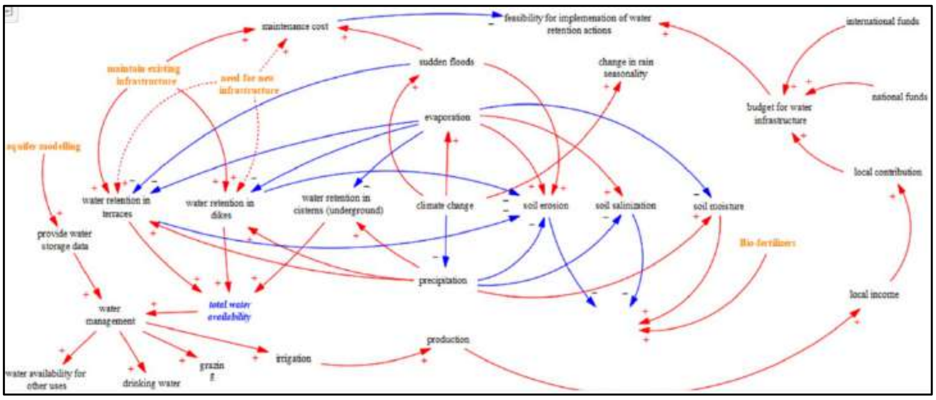


Figure 4. CLD of Egyptian LL.

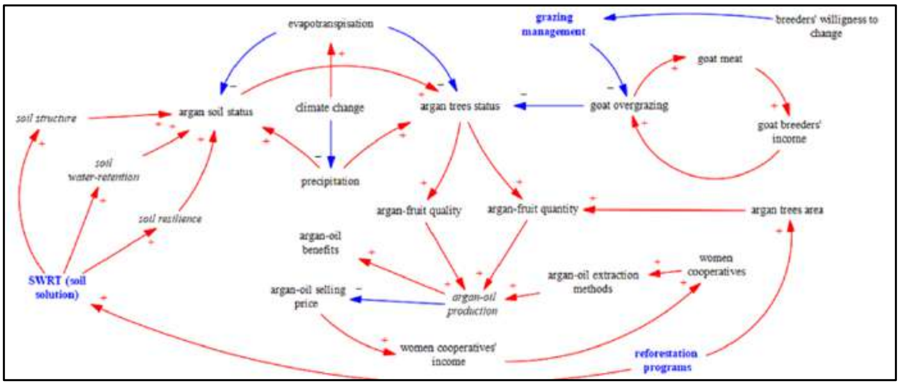


Figure 5. CLD of Moroccan LL.

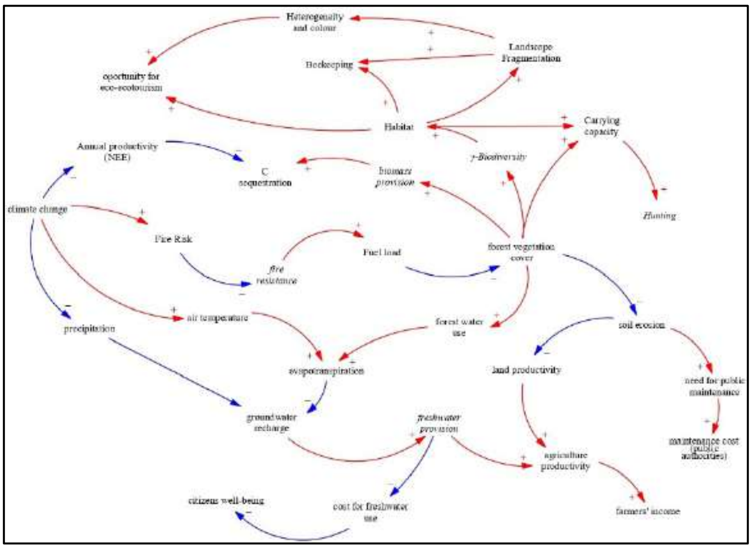


Figure 6. CLD of Spanish LL.

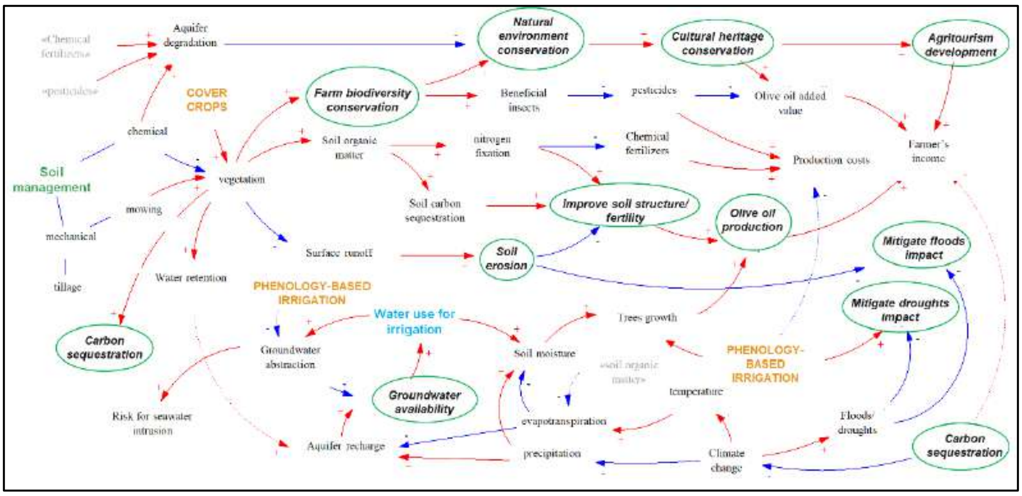


Figure 7. CLD of Greek LL.

The six causal loop diagrams provide an overview of the multiple variables currently connected or potentially related to the problem that the Living Labs aim to solve, as well as to the implemented solution. The CLDs also consider the interactions among these variables, highlighting positive relationships, e.g. the more soil fertility, the better olive oil production; negative relationships, e.g. the less precipitation the less groundwater recharge; negative to positive relations, e.g., the less aquifer degradation, the more environment conservation; positive to negative relations, e.g. the more evapotranspiration, the less groundwater recharge.

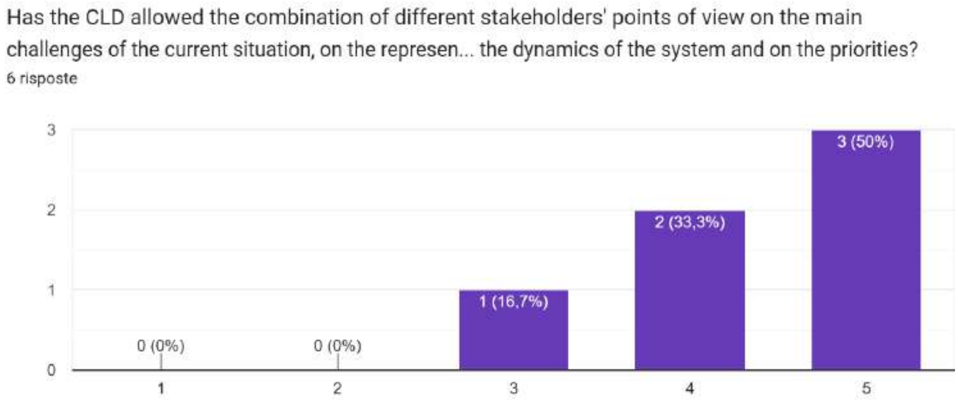
The number of variables differs among the Living Labs, ranging from a minimum of 21 to a maximum of 47. Consequently, the number of positive and negative relationships also varies, with a minimum of 24 and a maximum of 41 positive relationships, and a minimum of 7 and a maximum of 18 negative relationships.

The nature of the variables is also different as it can be distinguished between "determinant variables", "affected variables", "impacts" also defined in terms of ecosystem services and "strategies/actions" which refer to potentially adoptable NBS. It is important to note that, due to differences in reference contexts, not all maps fully include socioeconomic variables. In some cases, it was possible to record them completely, while in others not.

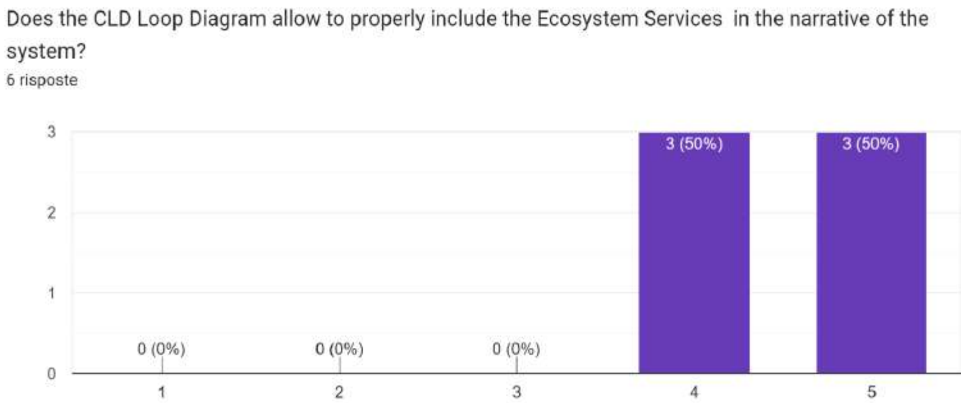
Effectiveness of CLDs

To evaluate the effectiveness of the CLDs as a tool/methodology/approach for co-designing NBSs in rural context that can relate a number of social, economic, and environmental variables, a short interview consisting of three questions was administered to LL managers:

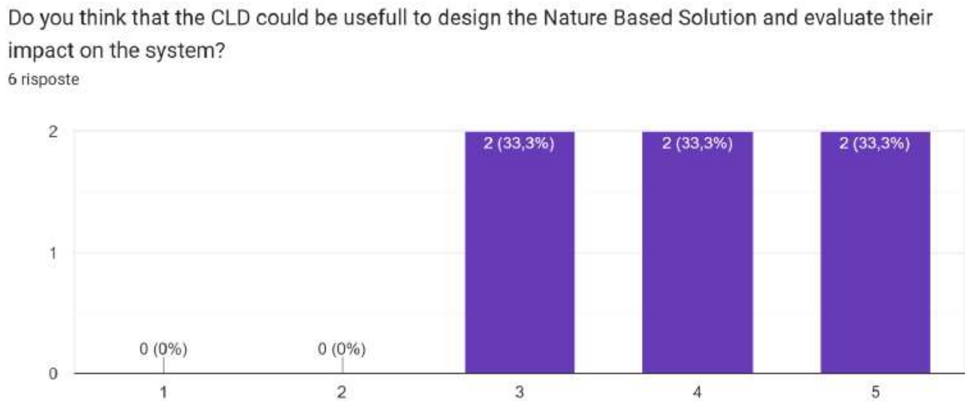
For each question, respondents were given the option to respond by selecting values from one to five, where one stands for “not at all,” and five “very much.”



Graph 1. Answers of Living Labs to the first question.



Graph 2. Answers of Living Labs to the second question.



Graph 3. Answers of Living Labs to the third question.

According to the respondents, the use of CLDs facilitates the representation of the complex interrelationships existing within the ecosystem in all LLs, overcoming the divergences in the stakeholders' perception of the links between economic, resilience and the socio-cultural value of socio-ecological systems.

Being an outcome of iterative interactions both among the members of the SALAM-MED research team and between the research team and the stakeholders of LLs, CLDs allowed the integration of different scientific expertise and stakeholder perspectives, perceptions, and knowledge.

Additionally, the CLD demonstrates how the NBS proposed could contribute to the sustainable management of the natural resources and has a significant impact on all related variables: by using the CLD, is, in fact, possible to visualize the complete impact of any changes made to the system by examining all the variables that it affects.

Evidence indicates the potential of the CLD to promote co-creation in the design of the SALAM-MED practical solutions stand to highlight the multidimensionality of the socioecological systems and the interaction between ecological and socioeconomic dynamics. However, the tool also has some limitations mainly related to its suitability to promote real interaction between all interested parties.

Conclusions

"Systematic methods to identify the relevant stakeholders seem to be crucial to a) enable higher planning efficiency and b) reduce bottlenecks and time needed for planning, deciding, and implementing NBS." (Zingraff-Hamed A. et al 2020). Based on SALAM MED Project we can conclude that for the identification of the stakeholders it is important to keep a balanced selection of representatives including societal organizations, public bodies, private sector, scientific experts etc. to ensure the representativeness of the 4 dimensions of the quadruple helix and to be open-minded and to consider potential stakeholders taking into consideration the innovative nature of NBSs – new markets and technologies, new regulations and legislations can, in fact, appear in the socio-ecological systems.

The participatory approach of CLDs chosen for the design of the solution, while remaining a complicated exercise, produced interesting results in terms of definition of a shared conceptual vision of the system, identification of priority areas of intervention and creation of new social learning spaces. Thanks to increased social capacity and entrepreneurial opportunities, local communities are able to implement effective actions for the restoration of land and water resources or for improving the resilience of the dryland zone ecosystems.

A more comprehensive assessment of the used methodology could be achieved through a deeper analysis of challenges of engaging all stakeholders, and the importance of community ownership over process, while a set of KPIs should offer a more objective analysis of the impacts.

Acknowledgments

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Research-In-Progress Paper

Verifying the Practical Usefulness of a Living Lab Device Taxonomy: Preliminary Results from a Multiple Case Study

Authors

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Abstract

Recently a taxonomy for digital data collection and intervention tools was published in the context of health and wellbeing living labs. However, the taxonomy has not been empirically tested and therefore this multiple case study is proposed to evaluate its practical usefulness. The study sample consists of 9 living labs that were conducting 14 health and wellbeing living lab research projects in the context of rehabilitation, transitional care, and everyday living environments. A total of 47 different devices were identified, including cheap consumer products and more expensive devices targeted at professional users. Devices in 'activity and behavioural monitoring and tracking,' 'cognitive ability and mental processes' 'body size and composition' and 'vital signs' were the most commonly used. Factor analysis loaded the research project into five main factors and revealed that certain devices were utilized in a joint manner. Future research viewpoints regarding taxonomy are discussed.

Key words

living lab, taxonomy, data and devices, data collection tools, intervention, monitoring

Introduction

There are many benefits to using digital technologies and tools in research data collection. Among these are e.g. improved data accuracy and quality, enhanced efficiency, timesaving, better accessibility and management, scalability, cost-effectiveness, and data security (Bart, 2003, Will et al. 2015, Archibald et al. 2019). Therefore, to improve research quality, it is suggested that living labs should start using more and more digital devices for their data collection. However, there is only limited information about what kind of devices living labs are using for their data collection. Therefore, a recent study by Petsani et al. (2024) proposed a taxonomy for the digital data collection and intervention tools in the context of Health and Wellbeing Living Labs. To our knowledge, this is the only publication systematically evaluating living labs data collection device usage. In general, living lab studies are blamed for inadequately reporting their research designs (Paskaleva and Cooper, 2021) and providing empirical evidence on performance (Schuurman et al. 2015).

However, Petsani et al. (2024) did not empirically test their taxonomy to evaluate living lab studies device usage. Therefore, this multiple case study is proposed to practically test how the taxonomy can be used to evaluate and compare different types of research project data collection device usage.

Study design

The proposed taxonomy (Petsani et al. 2024) includes 52 subitems, which are divided into three levels. The first level consists of 'devices for data monitoring and collection' and 'technologies for intervention.' At the second level, the 'data monitoring and collection' category is further divided into 'environmental' and 'human' monitoring. Environmental monitoring characterizes and monitors the environment and establishes environmental parameters and conditions either indoors or outdoors. Human monitoring includes the following subcategories: 'biometrics,' 'activity and behavioural monitoring,' 'cognitive ability and mental processes,' 'electrical biosignals and physiological monitoring measures,' '(primary) vital signs,' and 'body size and composition.' The other second level category 'technologies for intervention' consists of 'assistive technology,' 'extended reality – XR (VR & AR),' and 'serious games' categories.

The study sample consisted of 9 living labs that were conducting 14 health and wellbeing living lab research projects in the context of rehabilitation, transitional care, and everyday living environments. After finishing their research project, living labs were asked to name the utilized devices according to the proposed taxonomy in an Excel sheet. During the data cleaning process, the variations in the name duplicates were simplified to identify device manufacturers and device types. For example, Fitbit Charge 5 and Fitbit Charge 4 became Fitbit in the dataset. However, original names were saved to enable device version-level analysis to reveal how new the devices were.

A binary matrix having 14 research projects as columns and device taxonomy categories as rows were constructed based on the clean data. For each research project, the utilized taxonomy categories were identified to compare the different research project between each other. Also, the total number of utilized devices per research project was calculated. To gain overall understanding on the utilized taxonomy categories, for each category total number utilized devices were calculated.

Preliminary results

The preliminary results reveal that 47 different devices were utilized by the living labs. Among these were for example relatively cheap consumer products like activity trackers, smart watches, action cameras, thermometers, scales, VR headsets, EEG headbands and game manufacturers' motion-sensing input devices. There were also devices targeted to professional usage such as body composition analysers, eye trackers, motion capturing, simulation recorders, vital sign monitoring, and multisensory devices for physical activity and energy expenditure measurement. Classifying devices according to taxonomy revealed clear differences in their popularity as presented in Figure 1.

Audio-visual devices were used once for environment monitoring. None of the studies measured concentration levels, technical alerts, environmental temperature, or luminosity. Also, both biometrics categories face and voice recognition were not used. The utilized electrical biosignals and physiological monitoring measures included EEG, ECG, EMG, Blood oxygen and GSR. Vo2 and blood sugar level remained unutilized.

All the vital signs categories were covered including diastolic blood pressure, systolic blood pressure, heart rate, body temperature, respiratory rate, and oxygen saturation. Respectively all body size and composition items were utilized including body weight, body measures, circumference measures, and Body Mass Index (BMI). Likewise cognitive ability and mental processes categories were also all covered consisting memory, processing speed, attention, and cognitive tasks & paradigms.

The largest category – activity and behavioural monitoring and tracking – was also popular among the living labs. All but fall detection and human body location (indoors or outdoors) were measured. The utilized categories included walking speed, orientation, movement monitoring, human balance, physical activity level, physical performance, sleep, steps, stress level, physical performance, technology usage habits & patterns and gesture recognition & detection.

In the assistive technology category reminders & alert, coaching, training, and support activities of daily living (ADLs) devices were used while walk assistance and natural language understanding devices were not. Both extended reality categories – virtual reality and augmented reality were utilized. Finally, all serious game variation were used including cognitive gaming, physical gaming & exergames and educational games.

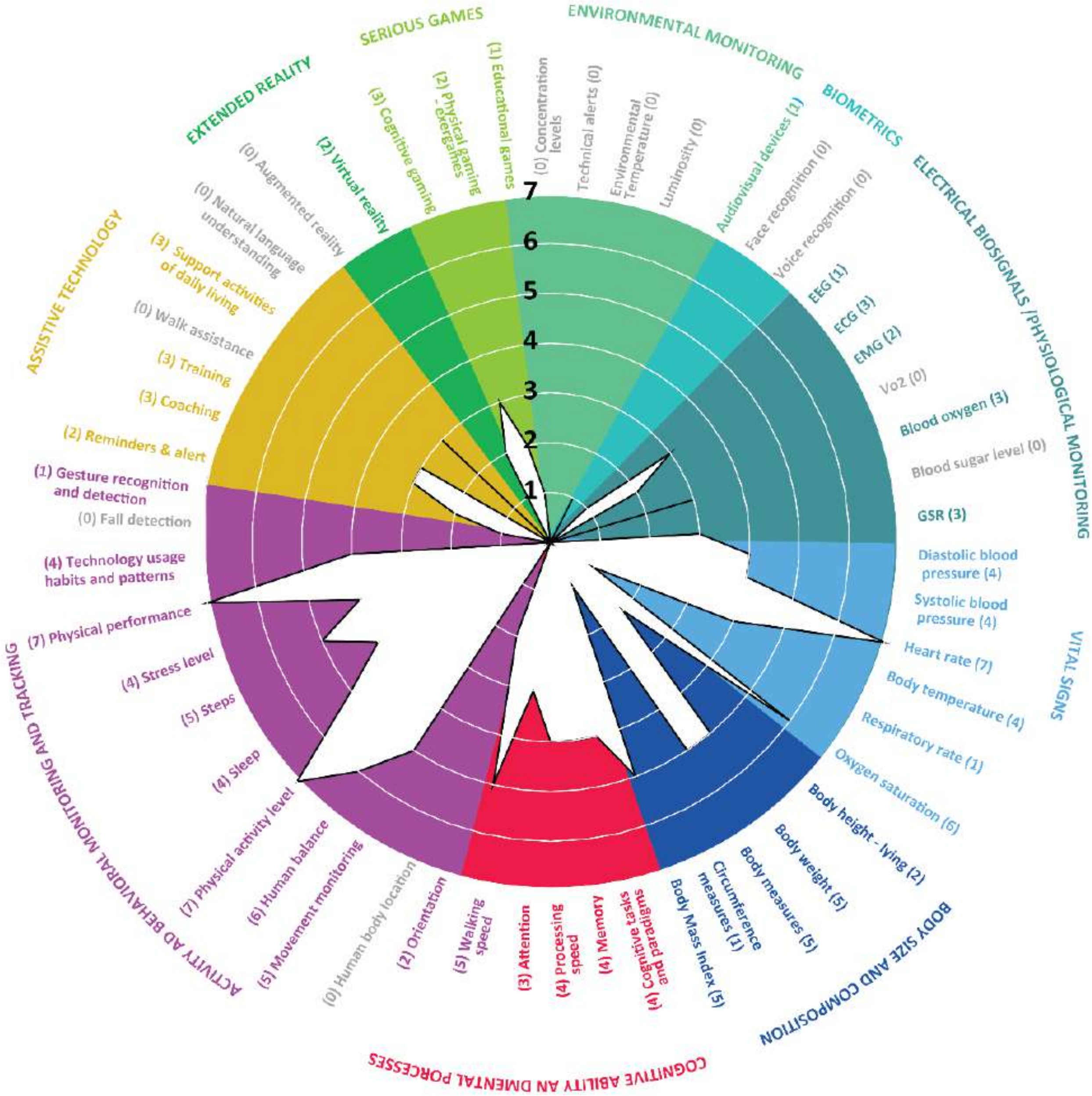

Figure 1. Case studies (N=14) device classification according to taxonomy

When comparing the number of device categories between the research projects, the variation was substantial. The minimum number of utilized taxonomy categories was one and the maximum was twenty. On average 11.3 device categories were utilized in a single study.

Factor analysis revealed the following five factors. The first factor included five studies which were focusing on collecting data on activity and behavioural monitoring and tracking. Most of them also collected body size and composition and vital signs data. Some of these studies added also electrical biosignals and physiological monitoring measures to their data. On average these studies utilized 14 device categories.

The second factor covering two studies consisted of assistive technology devices and included activity and behavioural monitoring and tracking category technology usage habits and patterns. The study tested the same mobile application in two different countries. Their device approach was much more modest since only four device categories were used.

The third factor having three studies was using serious game and extended reality to measure cognitive ability and mental processes. Additional data included some of the items from activity and behavioural monitoring and tracking category. Also, these studies followed extensive usage of devices and on average 14 categories were used.

The fourth factor consisting of two studies collected vital signs and electrical biosignals and physiological monitoring measures. However, studies on this factor had few clear differences since one was doing environmental monitoring and was using only 6 device categories. The other one used 19 devices and was focusing on cognitive ability and mental processes and activity and behavioural monitoring and tracking data collection.

The final fifth factor was the simplest and used only virtual reality devices.

Conclusions and future research avenues

This study empirically tested the usefulness of living lab device taxonomy by evaluating 14 health and well-being living lab research projects' device usage. Preliminary results were reported, and 47 different devices were identified including devices targeted to consumer and professional markets. The first preliminary analysis also revealed that projects can be classified based on their device usage, thus indicating that some of the devices may be more often utilized in a combined manner. In the follow-up analysis attention will be also paid to evaluating the existence of single vs. multipurpose devices. A single-purpose device is defined as a device collecting data only in a single taxonomy category while a multipurpose device can collect data in multiple taxonomy device categories at the same time. Device taxonomy will also help living labs report their research designs more systematic manner, thus address the critic relating inadequately research design reporting (Paskaleva and Cooper, 2021). Furthermore, short desk research was also conducted to evaluate devices' retail prices to gain a better understanding on living labs' cost infrastructure costs.

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Living Labs for Policies, Governance, Collaboration, and Innovation Ecosystems

Thursday, 26th September 2024

The "Living Labs for Policies, Governance, Collaboration, and Innovation Ecosystems" session focused on the pivotal role that Living Labs play in shaping effective policies and governance structures. This session explored how Living Labs serve as collaborative platforms that facilitate dialogue among stakeholders, including government entities, researchers, and community members, to co-create innovative solutions for pressing societal challenges.

Participants engaged with methodologies that emphasise participatory governance, enabling them to understand how Living Labs can influence policy-making processes and enhance collaborative ecosystems. The session showcased successful case studies that illustrated the impact of Living Labs on local governance and community resilience, emphasising the importance of stakeholder engagement in fostering sustainable innovation.

By highlighting various collaborative frameworks and tools, this session aimed to inspire participants to leverage living labs as dynamic environments for experimentation and learning, ultimately contributing to more inclusive and responsive governance models.

Full Research Paper

Living Labs Engagement Framework:
Enhancing Stakeholder Engagement in Collaborative Innovation

Authors

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Abstract

The Living Labs Engagement Framework (LLEF) aims to enhance stakeholder engagement in Living Labs, fostering collaborative innovation. This study, focused on European Living Labs, introduces a structured engagement model categorizing participants into three levels: highly engaged, moderately engaged, and low engagement. By mapping motivations and barriers across these levels, the LLEF provides insights into enhancing participant involvement. The framework's development involved co-design sessions with experts and validation through digital surveys. Key findings highlight the importance of addressing both qualitative and quantitative aspects of engagement, emphasizing continuous feedback and adaptation. The study underscores the LLEF's practical application for Living Lab managers, researchers, and participants, offering a comprehensive tool for planning, monitoring, and evaluating engagement strategies. Despite limitations such as geographic focus and survey-based data collection, the LLEF represents a significant advancement in understanding and optimizing stakeholder participation in innovation ecosystems. Future research should expand the framework's applicability globally and incorporate diverse qualitative methods for deeper insights.

Key words

Living Labs, stakeholder engagement, collaborative innovation, co-creation

Introduction

Living Labs, both as infrastructure and methodology, have emerged as vibrant, innovative platforms where the intersection of research and real-world application is explored and expanded (Malakhatka, 2021). These environments are distinct for their ability to foster collaborative development, bringing together key stakeholders from academia, industry, government, and civil society to co-create, test, and implement solutions tailored to address complex societal challenges (Hossain et al., 2019). The essence of Living Labs lies in their focus on user engagement and open innovation, a paradigm where stakeholders are not just passive recipients but are active participants in the innovation process (Schuurman et al., 2015). This model has proven particularly effective because it ensures that the outcomes are not only technologically sound but also socially acceptable and responsive to user needs, thereby enhancing the sustainability and user-centeredness of solutions.

However, the effectiveness of Living Labs critically depends on the depth and quality of stakeholder engagement. Recognizing this, the current paper focuses on examining and refining the engagement model for Living Labs through the introduction of the Living Labs Engagement Framework (LLEF). The study delves into the various degrees of participant involvement, categorizing them from highly engaged to non-engaged members. By mapping out the motivations and barriers that influence participant engagement across these levels, the paper aims to equip Living Labs with a more structured approach to enhance stakeholder involvement, thereby maximizing the potential for collaborative innovation. The methodology and results of the LLEF validation process are discussed, utilizing a structured digital survey involving participants from various European Living Labs.

Background

The concept of Living Labs as platforms for innovation through user engagement and co-creation has gained substantial attention in academia and industry. A core aspect of Living Labs is the engagement model, which defines how participants interact within the ecosystem. Schuurman et al. (2015) discuss different types of engagement models, focusing on the roles of users as co-creators rather than mere test subjects. Their study emphasizes the importance of integrating users throughout the innovation process, from ideation to validation, ensuring that solutions are user-driven and contextually relevant.

Bergvall-Kåreborn and Ståhlbröst (2009) elaborate on mechanisms designed to facilitate stakeholders' engagement, such as workshops, ideation sessions, and digital collaboration platforms. These mechanisms are designed to ensure continuous interaction between users and developers, crucial for the iterative nature of Living Labs. They argue that such mechanisms should be flexible and adaptable to the evolving needs of the participants and the dynamic nature of innovation projects. Frameworks that guide the systematic engagement of participants are another critical area of focus. Leminen et al. (2012) introduce a framework that categorizes Living Labs based on their formality, focus, and the extent of user involvement. This framework helps in understanding different operational approaches and can be used to tailor engagement strategies to specific project needs or stakeholder groups. Almirall and Wareham (2011) explore multi-dimensional engagement approaches that consider not only the extent of user involvement but also the depth of their engagement across various stages of the innovation process. Their research highlights the need for Living Labs to engage users not just quantitatively but also qualitatively, ensuring that their contributions are intellectually and emotionally invested in the outcomes. The literature also points to the importance of trust and transparency in engagement. Niitamo et al. (2006) stress that for Living Labs to function effectively, stakeholders must trust that their contributions are valued, and that the innovation process is transparent. This trust fosters a collaborative environment conducive to sharing ideas and criticisms openly, which is essential for co-creation.

These perspectives from the literature illustrate that engagement in Living Labs goes beyond mere participation. It requires a synergistic approach where stakeholders are actively involved in co-creation, trust is cultivated, and engagement is sustained and multi-dimensional. This form of engagement is pivotal for driving innovation that is both relevant and adoptable in real-world scenarios. The literature on Living Labs engagement models provides extensive insights into mechanisms and frameworks designed to foster innovation through active and multi-dimensional participant involvement. However, several gaps still exist within these models, particularly in addressing the nuances of the engagement process. Most studies focus on short-term engagement metrics without considering the long-term sustainability of participant involvement. There is a need for more longitudinal research to understand how engagement evolves over time and the factors that contribute to sustained participation or dropout. This could help Living lab managers design strategies that maintain and even boost engagement over the lifecycle of projects.

While qualitative engagement is widely recognized as crucial, there is a lack of robust quantitative metrics to measure this aspect effectively. Some studies have conceptualized the journey from non-engagement to high engagement, however, there is often a lack of detailed empirical research that tracks this progression over time in diverse

Living Lab settings. Many models are theoretical and do not account for the dynamic interactions between different types of participants and the evolving innovation processes. Current literature often identifies general barriers to engagement, such as lack of motivation, resources, or skills. However, detailed, context-specific analysis of barriers—particularly how they vary across different stages of engagement and among diverse participant groups—is less frequently explored. While some models outline levels of engagement, they often do not provide clear criteria or indicators for transitioning from one level to another. This can make it difficult for Living Lab managers and participants to assess progress and determine what specific actions are needed to enhance engagement.

Methodology

The methodology employed in the development and validation of the Living Lab Engagement Framework (LLEF) is participative, integrating academic research with practical insights. The overall methodology of this study is represented in Figure 1. It begins with a literature review, drawing on existing scholarly work to identify gaps and set a foundation for the new model. The focus is to pinpoint areas that are under-researched or lacking effective solutions within the Living Labs context, which are primarily based in Europe.

The co-design process for the Living Lab Engagement Framework involved seven experts from Sweden, the Netherlands, Germany, and the UK, who participated in four digital co-creation sessions amid Covid-19 restrictions. The process began with preparatory work to establish a shared understanding and objectives, followed by a series of sessions that focused on initial brainstorming, detailed drafting, and iterative refinement of the framework. Key activities included defining engagement levels, identifying barriers, and creating a survey for external validation. This survey was then deployed during the AMS Living Lab Summit 2022 to gather broader community feedback, which was crucial for further refining the framework.

The use of digital surveys in the third step allows for rapid collection of extensive feedback from the Living Labs community, further refining the framework. The aim was to implement a digital survey to gather community feedback on the initial version of LLEF, thereby testing its initial assumptions and collecting insights needed to refine the engagement model. This approach allows for efficient and widespread data collection, making it particularly suitable for capturing a wide array of responses quickly.

Finally, the results from all stages are synthesized to ensure the engagement model is both theoretically robust and practically applicable across various settings. This methodical consolidation of findings occurs across different geographies in Europe, aiming to develop actionable and comprehensive implementation strategies for the LLEF across various Living Labs.

Despite the chosen methodology's strength in fostering broad collaboration and enabling swift data collection, there are some limitations in this study. First, a focus on Europe may not fully represent global Living Labs environments. Second, a small number of participants may not capture all perspectives. Third, digital surveys are efficient for broad data collection, they might not capture the depth of insights that more in-depth qualitative methods, such as interviews or focus groups, could provide. This might result in a less nuanced understanding of certain complex issues. Expanding the geographical scope, increasing participant diversity, and incorporating multiple case studies could enhance the framework's robustness and applicability.

	STEP 1	STEP 2	STEP 3	STEP 4
Steps:	Literature scanning	LLEF Co-design	LLEF Survey	Implementation Strategies
Methods:	*Literature review*	*Co-design & Ideation sessions*	*Digital Survey*	*Results synthesis*
Participants:	*Main authors*	*Living Lab experts (7 people)*	*Living Labs community (16 people)*	*Main authors*
Outcomes:	*Research gaps, and questions within existing Living Lab research*	*Development of an initial version of the LLEF*	*Feedback from a broader Living Lab community on LLEF*	*Synthesis of results from previous steps into actionable strategies*
Geography:	*Europe*	*Sweden+Netherlands*	*Sweden+Netherlands*	*Europe*

Figure 1. Overall methodology of the study

Co-development of LLEF

The LLEF is grounded in a blend of theoretical underpinnings and practical considerations that make it particularly suitable for fostering engagement in innovation ecosystems. Theoretically, the framework is anchored in engagement theory, which suggests that deeper involvement within a community or project enhances productivity, innovation, and satisfaction (Fredricks et al., 2004). It also incorporates barrier analysis by identifying and categorizing obstacles that participants face as they progress to higher engagement levels, aligning with literature that emphasizes the need to overcome such barriers to improve outcomes (Lawson et al., 2013). Additionally, the pathway depicted in the framework mirrors theories of behavioural change and adaptation, portraying engagement as a dynamic and evolving process (Bandura, 1999).

From a practical standpoint, the framework is designed with scalability and adaptability in mind, making it applicable across various Living Labs regardless of their size or complexity, a consideration that is critical for operational deployment in diverse settings (Schuurman et al., 2015). Its user-centric approach, focusing on the participant's journey and the barriers they encounter, emphasizes the importance of user experience in the design and implementation of engagement strategies, reflecting trends in user-centred design in innovation (Von Hippel, 2005). Furthermore, the model's straightforward layout facilitates its operational implementation by managers and coordinators of Living Labs, who can use it to plan, monitor, and evaluate engagement strategies efficiently. Lastly, the framework accommodates continuous feedback, essential for the iterative processes that characterize Living Labs, allowing for ongoing refinement and adaptation of strategies based on real-world feedback and outcomes (Bergvall-Kåreborn and Ståhlbröst, 2009).

The development of the Living Labs Engagement Framework (LLEF) was a structured process involving a series of co-creation sessions with a diverse group of seven experts from Sweden, the Netherlands, Germany, and the UK. These sessions were designed to ensure that the framework was both theoretically robust and practically applicable across various Living Lab contexts. The co-creation process was guided by the principles of collaborative innovation, where the involvement of multiple stakeholders is critical for creating a comprehensive and adaptable framework (Schuurman et al., 2015).

Preparatory Phase

The co-creation process began with a thorough preparatory phase, which was essential for establishing a common understanding among the participants and setting clear objectives for the sessions. This phase included an extensive literature review, drawing on existing scholarly work on Living Labs and engagement frameworks to identify gaps and opportunities for innovation (Bergvall-Kåreborn & Ståhlbröst, 2009). The review provided the necessary background for the experts, ensuring they were aligned in their understanding of the key issues to be addressed. Additionally, specific objectives were set for the co-creation sessions, focusing on developing a framework that could be universally applied across diverse Living Lab environments (Leminen et al., 2012).

The selection of experts was a critical step in this phase, with individuals chosen based on their expertise in areas such as stakeholder engagement, Living Labs, and innovation ecosystems. The diverse backgrounds of the experts—spanning academia, industry, and practical engagement—ensured that the framework would benefit from a wide range of perspectives, increasing its applicability and relevance (Carayannis & Campbell, 2009).

Session 1: Initial Brainstorming and Conceptualization

The first co-creation session was dedicated to brainstorming and the initial conceptualization of the LLEF. During this session, the experts engaged in open-ended discussions to generate a wide range of ideas and perspectives on engagement within Living Labs. The goal was to identify the core elements that should be included in the framework, drawing on both theoretical insights and practical experiences (Almirall & Wareham, 2011). The outcomes of this session included the initial outline of the engagement levels—categorized as highly engaged, moderately engaged, and low engagement—and preliminary thoughts on the barriers that participants might face at each level. This session laid the groundwork for the subsequent, more detailed development of the framework.

Session 2: Detailed Framework Drafting

In the second session, the focus shifted to drafting the detailed components of the LLEF. Building on the insights from the initial brainstorming, the experts worked collaboratively to define specific criteria for each engagement level and to identify the barriers and motivators associated with these levels (Fredricks et al., 2004). This session was crucial for translating the conceptual ideas from the first session into a structured and actionable framework. The result was a preliminary version of the LLEF, with clearly defined engagement levels and a list of barriers tailored to each level. This draft also began to outline strategies for overcoming these barriers, ensuring that the framework would be practical and applicable in diverse Living Lab settings.

Session 3: Iterative Refinement and Validation Planning

The third session was dedicated to refining the framework through an iterative process. The experts critically analysed the initial draft, identifying areas for improvement and addressing potential gaps in the framework. This session emphasized the importance of iterative development in creating a robust and adaptable framework (Bandura, 1999). In addition to refining the framework, this session focused on planning the validation phase. The experts collaborated to design a digital survey that would gather feedback from a broader community, ensuring that the framework was tested and validated in real-world conditions. This planning was essential for ensuring that the framework could be empirically validated and adjusted based on the feedback received (Schuurman et al., 2015).

Session 4: Finalization and Survey Design

The final co-creation session was focused on finalizing the LLEF and designing the survey for validation. The experts conducted a comprehensive review of the entire framework to ensure coherence and practicality. They also worked together to develop survey questions that would effectively capture feedback on the framework's validity (Cummings & Kiesler, 2005). The outcomes of this session included a finalized version of the LLEF and a well-designed survey, ready for deployment at the AMS Living Lab Summit 2022. The survey design was particularly important, as it would provide the data needed to validate and refine the framework, ensuring its effectiveness across different Living Lab contexts (Pallot et al., 2010).

Throughout the co-creation process, each expert played a specific role that was critical to the development of the LLEF:

- **Academic Experts:** Provided the theoretical foundation for the framework, ensuring it was grounded in established research on engagement and innovation (Hossain et al., 2019).
- **Industry Professionals:** Contributed practical insights on the applicability of the framework in real-world Living Labs, focusing on its scalability and adaptability (Niitamo et al., 2006).
- **Engagement Specialists:** Led the definition of engagement levels and the identification of barriers, drawing on their expertise in stakeholder interaction (Von Hippel, 2005).
- **Methodology Experts:** Directed the design of the survey and the overall validation process, ensuring the framework could be rigorously tested and refined based on empirical data (Leminen et al., 2012).

The Figure 2 shows a conceptual representation of LLEF for understanding and improving engagement in a Living Lab setting. It categorizes participation into three levels: 1st degree with high engagement, 2nd degree with moderate engagement, and 3rd degree with low engagement. The LLEF illustrates the engagement pathway from not engaged to highly engaged. This systematic mapping is beneficial for analysing the engagement process over time. By categorizing engagement into distinct degrees, the framework provides a structured method to observe and measure the transitions and dynamics of engagement. Such clarity can aid in longitudinal studies that seek to understand the impact of various interventions on maintaining or increasing engagement levels within Living Labs. The proposed framework structured approach to defining and categorizing engagement can also assist in operationalizing these concepts within a real-world Living Lab setting. For example, the framework can guide the development of engagement-enhancing tools and activities tailored to the needs of participants at different engagement levels. It also offers a basis for continuous monitoring and evaluation, which is essential for adapting strategies in response to changing dynamics within the Lab.

A critical aspect of the LLEF is its identification of barriers at different stages of engagement. Each degree of engagement is associated with specific barriers (high, medium, low), allowing Living Lab practitioners to tailor interventions directly aimed at these obstacles. This focused approach to barrier identification and management helps in developing specific strategies that can be implemented to mitigate these barriers, thereby enhancing the overall effectiveness of engagement.

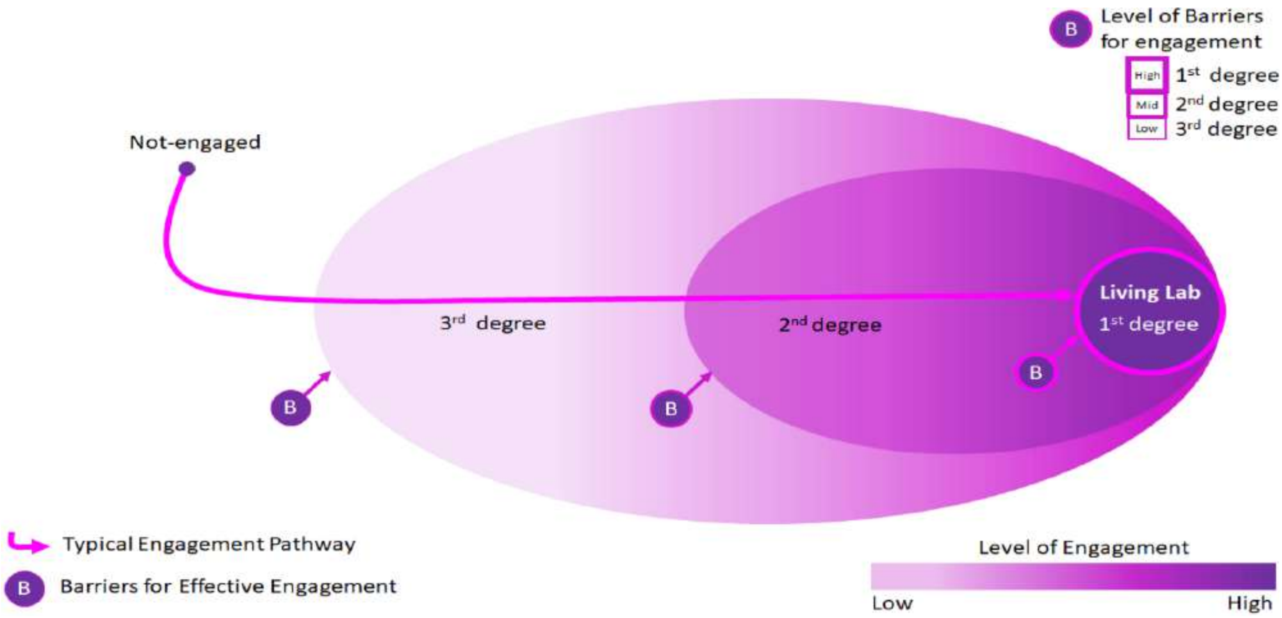

Figure 2. Living Labs Engagement Framework (LLEF) conceptual representation

The Table 1 presents criteria for assessing engagement in Living Labs across four levels of participation. In the 1st Degree, participants are highly active, often taking on leadership roles and making contributions that significantly advance the objectives of the Living Lab. They are consistently involved over multiple years, lead projects aimed at societal benefits, and are meticulous in tracking and reporting their activities, using this data to further enhance their contributions. In contrast, 2nd Degree participants, while still active, may not assume leadership roles, and their contributions, though useful, are less central to the core objectives. They are involved intermittently over time, participate in societal innovation projects less frequently, and maintain some, but less detailed, records of their activities. 3rd Degree participants show only sporadic activity and minimal involvement, making limited contributions and rarely participating in projects aimed at societal innovation, with little to no tracking of their engagements. Lastly, those Not Engaged do not participate in Living Lab activities or projects, make no contributions, and there is no data on their involvement due to their lack of participation. This table provides a structured framework for evaluating the engagement and impact of individuals in Living Labs, highlighting differences in participation depth and effectiveness across the spectrum of involvement.

To ensure clarity and consistency in the assessment of engagement levels described in Table 1, it is important to define the qualitative terms used to describe the frequency of participation. For instance, "Regularly active" is defined as participating in Living Lab activities on a weekly or bi-weekly basis, while "Participates actively but may not take on leadership roles" indicates engagement at least once a month. The term "Participates, but less frequently" should be understood as engaging in activities on a quarterly basis or less often, and "Sporadically active" should refer to participation occurring less than four times per year. This approach will enhance the precision of the engagement framework, making it more actionable and reliable in different contexts.

The framework also addresses the need for graduated levels of engagement, as shown in the provided table. By defining what constitutes 1st, 2nd, and 3rd degrees of engagement across various parameters the LLEF allows for a possible understanding and measurement of engagement. This differentiation helps in recognizing and fostering progression from one level to another, providing clear benchmarks for transition, which can be crucial for both participants and managers in understanding their current position and what is needed to advance.

Table 1. Living Labs Engagement criteria

Criteria	1st Degree	2nd Degree	3rd Degree	Not Engaged
Active Member of at Least One LL	Regularly active, takes on leadership roles	Participates actively but may not take on leadership roles	Sporadically active, seldom participates	Does not participate
Contribution Quality and Impact	High impact, significantly advances objectives	Useful contributions, less central	Minimal contributions, limited impact	No contributions
Longevity and Retention	Consistently involved for multiple years	Moderately involved on and off over time	Short-term or occasional involvement	No sustained engagement
Participation in Societal Innovation	Leads projects aimed at societal benefit	Participates actively but may not take on leadership roles	Rarely participates, minimal involvement	Does not participate
Keep Metrics and Follow-Up of Engagement	Meticulous tracking and reporting, uses data for improvement	Keeps some records, less detailed	Little to no tracking or reporting	No data due to lack of involvement

When considering the criteria for assessing engagement in Living Labs, it is important to ensure that these criteria are not only relevant and aligned with the strategic goals of the lab but also comprehensive enough to capture a broad spectrum of participant activities and contributions, including both quantitative and qualitative aspects. The balance between objective measures, such as the number of projects participated in, and subjective assessments, like the quality of contributions and effectiveness of leadership, is crucial to obtain a holistic view of an individual's engagement and impact (Cummings & Kiesler, 2005). Furthermore, criteria must be flexible to adapt to the dynamic nature of Living Labs, which often see shifts in project scopes, participant roles, and goals. It is also essential to incorporate inclusivity and diversity in the criteria, recognizing various forms of engagement and contributions that reflect the diverse participant base (Hossain et al., 2019; Malakhatka, 2022).

Validation of LLEF

The validation of the Living Labs Engagement Framework (LLEF) was conducted through a structured digital survey designed to gather feedback from the Living Labs community, primarily involving 16 participants from Sweden and the Netherlands. The survey consisted of five distinct modules, each tailored to capture a specific dimension of engagement. Module 1 collected demographic information about participants, providing insights into their roles and backgrounds. Module 2 assessed participants' knowledge and understanding of Living Labs, evaluating their literacy in Living Lab concept and methodologies. Module 3 aimed to identify the participant's organizational or individual proximity to the Living Lab, classifying their engagement level as 1st, 2nd, 3rd, or non-engaged. Module 4 explored participants' willingness and motivation to engage more deeply in Living Lab activities, while Module 5 focused on identifying barriers that inhibit deeper engagement and recommendations on how to hinder the barriers (optional question). In Module 6 we have asked general feedback on the proposed LLEF. The survey structure enabled the collection of both quantitative and qualitative data, necessary for testing the LLEF and ensuring its effectiveness and applicability in enhancing engagement across Living Labs.

The survey participant structure designed to validate LLEF includes from not engaged to highly engaged participants. Such a diversified participant structure ensures that the survey captures a comprehensive range of perspectives, crucial for assessing the effectiveness of current engagement strategies and identifying specific needs and barriers at each engagement level. By incorporating feedback from across this spectrum, the Living Lab can pinpoint both common challenges and unique issues faced by different groups, facilitating the development of targeted strategies to enhance participation and optimize the engagement framework to be inclusive and effective for all potential and current members.

The first-degree engagement includes academia, such as senior researchers and university administrators, along with industry executives from major companies, all of whom are highly involved in strategic decision-making and project oversight. Second-degree engagement consists of the tenants, who are living in Living Lab, architecture company, which representatives are interested in wide spectrum of R&D projects and small and medium enterprise (SME) leaders who engage through specific projects. Third-degree engagement includes students who contribute occasionally through specific research initiatives, municipality representative who ensure alignment with social goals, energy system company and neighbours of Living Lab, which is attending Living Lab events occasionally. The not-engaged group include various low-interest, but curious about Living Lab actors, such as course responsible, IT and energy utility company. This diverse participant structure, is well aligned with the Quadruple Helix model, ensures a multidimensional approach to innovation. By involving representatives from Academia, Industry, Government and Civil Society, Living Labs can leverage comprehensive perspectives and resources, addressing complex challenges effectively and fostering sustainable, community-aligned innovations (Carayannis & Campbell, 2009). This approach not only enriches the innovation process but also enhances the practical and societal relevance of the outcomes.

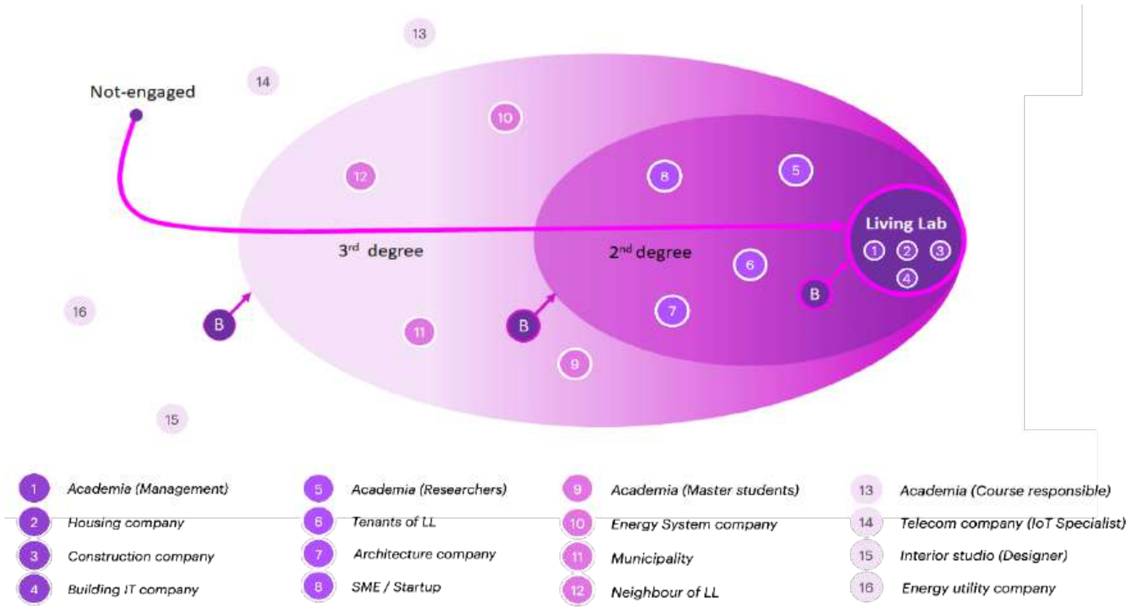

Figure 3. Living Labs Engagement Framework (LLEF) validation survey participants

The survey participants are motivated to be engaged into Living Lab activities by different factors according to their degree of engagement. First Degree participants are deeply involved in strategic decision-making and innovation, motivated by the direct impact and outcomes that influence their fields. Second Degree participants, such as researchers, tenants, architects, SMEs, and master students, are driven by the practical application of theoretical knowledge, professional development, and networking opportunities within the Living Lab. Third Degree participants motivated by specific interests or the potential impact on their operations or local community. Those not engaged are not currently see direct relevance to their roles but could be encouraged to participate if the benefits. Tailoring engagement strategies to these varied motivations can enhance participation across all levels, enriching the Living Lab's ecosystem with broader insights and expertise.

In a Living Lab context, each engagement group faces unique barriers that can impede their participation. First Degree engagement participants in Living Labs, already deeply involved, may face several barriers that hinder their ability to engage even more deeply. These include resource constraints such as limited funding, personnel, or technology, which restrict their capacity to initiate or expand projects. Time management is another significant challenge, as balancing high-level responsibilities within the Living Lab with other professional obligations can be demanding. Lack of organizational support, in terms of alignment with their primary roles and insufficient recognition of their efforts, can also diminish their motivation to engage further. Additionally, innovation saturation might lead to burnout if participants are continuously pushed for new solutions without adequate breaks or support. Moreover, concerns about the scalability of projects and their real-world impact might cause participants to question the value of deeper engagement. To overcome these barriers, Living Labs need to implement strategies that ensure adequate resource allocation, foster diverse and meaningful collaborations, and provide continuous organizational support and recognition to sustain and enhance the engagement of these critical contributors.

Second Degree engagement participants in Living Labs, who regularly engage but lack deep integration in core activities, face several barriers that may hinder their further involvement. Some of them feel that their contributions do not significantly influence Living Lab long term strategy, leading to a perceived lack of impact and reduced motivation. Access to critical information and necessary resources sometimes is restricted, which can prevent them from fully participating in or initiating new projects. Organizational and structural barriers, such as rigid hierarchies and lack of interdisciplinary collaboration, limit their ability to contribute beyond predefined roles. Additionally, if their efforts are not adequately recognized or rewarded, there is little incentive to invest more time and effort. To address these issues, Living Labs need to ensure that contributions are recognized and rewarded, thereby fostering a more inclusive and motivating environment for second-degree participants.

Third Degree engagement participants in Living Labs encounter barriers that may prevent them from deepening their involvement. These include a lack of awareness about the full range of activities and strategic goals of the Living Lab, leading to a limited understanding of how they can contribute meaningfully. Infrequent or ineffective communication can further alienate them, making it hard to stay connected and informed. Limited access to necessary resources and professional networks within the Living Lab also poses a significant challenge, as does the feeling of being an outsider, which can discourage them from participating more actively. Bureaucratic and administrative hurdles complicate engagement processes, deterring regular participation, while the absence of a structured onboarding process can leave new participants unsure about how to get involved effectively. To encourage greater involvement from third-degree participants, Living Labs need to enhance communication, clarify the relevance and benefits of increased participation, ensure easy access to resources, appreciate, and value all contributions and offer structured onboarding experiences.

Non-engaged participants in Living Labs may face several barriers that deter them from becoming interested and involved, including a lack of awareness about the lab's existence, objectives, and the opportunities it offers. Simplifying complex entry processes and providing clear guidance can encourage initial participation, while personal outreach and invitations can significantly impact someone's decision to engage. Addressing misconceptions about the commitment required and clarifying the flexible levels of involvement available are essential. Additionally, highlighting immediate benefits or incentives can spark interest and draw non-engaged individuals into the Living Lab community, enriching it with diverse perspectives and new ideas, enhancing the lab's effectiveness and reach.

Discussion

The LLEF provides a nuanced understanding of participant involvement across various degrees of engagement, from highly engaged to non-engaged members. The framework effectively maps out the motivations and barriers that participants at different engagement levels encounter, which enriches our understanding of how Living Labs can foster deeper and more meaningful participation. Compared to existing models, the LLEF uniquely addresses both the barriers and motivations across different participant groups, integrating these insights into a comprehensive engagement model. This approach is in line with foundational theories such as the Quadruple Helix model, which emphasizes collaboration across academia, industry, government, and civil society. Previous studies like those by Schuurman et al. (2015) and Almirall and Wareham (2011) have highlighted the importance of flexible and inclusive engagement mechanisms, yet often did not provide a clear methodology for integrating feedback from a broad spectrum of stakeholders as the LLEF does.

Practically, the LLEF is a strategic framework designed for optimizing participant involvement in Living Lab environments, particularly useful for administrators, program designers, researchers, policy makers, and participants themselves. Program designers and administrators can employ this model to craft and refine engagement strategies that are inclusive and effective, tailoring activities and support mechanisms to facilitate transitions across different levels of engagement, while simultaneously monitoring and evaluating the impact of these strategies to ensure continuous improvement (Schuurman et al., 2015). The model also aids in the development of communication and support strategies by identifying specific barriers at each engagement level. For researchers and academics, the model provides an analytical framework to study engagement dynamics within collaborative innovation environments, potentially leading to new theoretical developments or improvements in engagement practices. Participants, too, can benefit from understanding this model as it enables them to navigate their own paths within the Living Lab more effectively, identifying critical points where they might need support or can help others, thus maximizing both personal and collective outcomes (Pallot, 2009). The LLEF is also a tool to not only understand engagement levels but can be used to define engagement goals. Each project within a Living Lab infrastructure is unique and requires different actors at different levels of engagement. This tool can support the understanding of what is needed and be used iteratively throughout the innovation process to benchmark engagement and assess and adjust engagement levels throughout. In a proactive approach, Living Lab leaders could also use the LLEF to pre-identify potential engagement barriers that could hinder participation of its members and develop preventive measures to minimize them and increase participation. Potential Engagement Barriers could be pre-identified based on the teams' own experiences, as well as from a consulting process within its members on which time constrains, resources, technology and other socio-economical aspects could be considered. It opens the possibility for further research on developing a suitable tool to assess engagement barriers.

The framework addresses several research gaps identified in the literature, such as the need to understand how engagement evolves over time and integration of diverse participant perspectives. The diversity of organisational structure, business models, and innovation ecosystems of Living Lab infrastructures plays an important role in creating the barriers and motivations for engagement and this needs to be studied and understood to overcome barriers. By providing a clear categorization of engagement levels and associated barriers and motivations, the LLEF allows for more targeted and effective strategies to sustain participant involvement and adapt to evolving project needs and external conditions over time.

Despite its strengths, the study faces limitations, including its primary focus on European Living Labs, which may not fully capture the global diversity of Living Lab environments. Additionally, the reliance on digital surveys for feedback collection, while efficient, might miss deeper insights that could be obtained through more qualitative, in-depth methods such as interviews or focus groups.

To enhance the understanding of the Living Labs Engagement Framework (LLEF) we propose that a detailed step-by-step guide for the operational implementation of the framework be developed as part of future studies. This guide could outline specific actions for managers and coordinators, such as conducting initial assessments of participant engagement, identifying barriers, developing targeted strategies, and establishing continuous monitoring processes. In addition, future research should consider expanding the geographical scope of the study to include Living Labs from different regions worldwide, thereby enhancing the framework's applicability and robustness. Increasing the diversity of participants and incorporating more qualitative research methods could provide a richer, more nuanced understanding of the engagement dynamics in various contexts.

To contribute more comprehensively to research knowledge, future work should include a deeper exploration of relevant theories such as participation and actor-network theory. These theoretical perspectives could provide additional layers of understanding regarding the dynamics of engagement in Living Labs. Furthermore, expanding the research on barriers to engagement is essential, as this study only begins to uncover the complex factors that can hinder participation. By delving further into these areas, future studies can enhance the framework's theoretical foundation and practical applicability, offering a more complete tool for fostering engagement across diverse innovation ecosystems.

Conclusion

The LLEF presented in this study provides a comprehensive approach to understanding and enhancing stakeholder engagement in Living Labs. By categorizing participant involvement into four levels—highly engaged, moderately engaged, low engagement and non-engaged—the framework offers a structured method to observe and improve the dynamics of engagement. This approach allows Living Lab managers to identify specific motivations and barriers at each engagement level, facilitating the creation of targeted interventions to enhance participation and collaboration. The LLEF is grounded in both theoretical and practical insights, making it adaptable and scalable across various Living Lab settings. It emphasizes the importance of continuous feedback and the iterative nature of engagement processes, ensuring that strategies remain responsive to the evolving needs of participants. This model not only aids in the practical management of Living Labs but also contributes to the theoretical understanding of engagement dynamics in collaborative innovation environments. In conclusion, the LLEF advances the field by providing a nuanced understanding of stakeholder engagement in Living Labs. This framework represents a step towards optimizing the collaborative potential of Living Labs, driving more effective and inclusive innovation processes.

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Research-In-Progress Paper

How can living labs contribute to policymaking?

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Abstract

For many years now, various knowledge evidence has indicated that the Dutch land and water systems are reaching their limits. Thus, instead of manipulating the water and subsurface to achieve the desired functions, functions need to follow what the land and water system can offer. Consequently, in 2022, the Dutch Ministry of Infrastructure and Water forwarded an innovative and transitional approach of letting water and soil guide the policymaking, namely 'water and soil guiding'. In this light, this research on progress paper aims to understand the cumulative role that living labs and similar projects existing before the policy guide had in the institutionalization of this policy guide. Further, 'water and soil guiding' is just at an initiation stage. This paper further tries to understand in what capacity can living labs support the operationalization, execution, and monitoring of this policy guide. In our preliminary finding, a direct link between the establishment of policy guide and the living labs existing before this establishment has not been formulated yet. However, indirect links such as delivering hard knowledge evidence, and formation and expansion of networks with relevant stakeholders has been recognized as indirect links.

Key words

Water and soil system, policy cycle, stakeholder network, impacts

Introduction

With water and land systems undergoing continuous changes due to natural and human factors, managing local and regional water and landscape has become a complex societal issue requiring long-term strategic visions for a resilient future (Bhatta et al., 2023; Haddeland et al., 2014). Land and water systems worldwide are characterized by a long history of human-landscape interaction. Especially in the case of the Netherlands, these systems were continuously manipulated to desired human needs for many centuries (Pronk et al., 2021). Meandering rivers were strengthened, polders were drained, and land was reclaimed by digging canals to drain out water and enhance agricultural productivity (Niesten & Frambach, 2023; Stouthamer et al., 2020). As a result, elaborate technical and organizational water-management systems have been designed to preserve the balance between agricultural activities and water safety (Van Lanen & Kosian, 2020). These systems have been used so intensively that they are increasingly running against their limits. For example, there is increasingly severe land subsidence and pressure on quality and quantity of water affecting shipping, agriculture, industry, and nature (Stouthamer et al., 2020). The system is no longer resilient or flexible enough to respond to the shock events such as floods and droughts because of changing climate, which further heightened the tension and uncertainty (Buitenhuis et al., 2020; Deltares et al., Jul, 2021). Therefore, a resilient and sustainable system is required for the changing environment (Niesten & Frambach, 2023).

The water and soil experts in the Netherlands have been pursuing these issues through diverse programs, citizen-science projects, living labs, and other similar approaches for a long time. Many knowledge institutions, along with government bodies, industrial partners, and local communities, have researched over time, proving the imminent need for integrated approaches to these systems by taking extremes into account. For example, '*Op Waterbasis,'* i.e., '*Based on water'* produced through knowledge collaboration among three institutes, highlights the limits to the feasibility of Dutch water and soil systems and the need for a paradigm shift (Deltares et al., Jul, 2021). Similarly, '*Water verbindt,' i.e.*, '*water connects,'* produced by the Union of water authorities and Association of water companies in the Netherlands, argues the need for a national water transition for a climate-robust water system (*Water Verbindt*, Feb 2021). Alongside such reports, many local and regional collaborative projects, Community of Practice (COP), and living labs for sandy soil and coastal areas have been working on the fields with locals, knowledge partners, and local government to understand and derive plausible solutions that lead to sustainable and climate-resilient land and waterscapes.

In response to the challenge of changing climate and intensive use of land and water, as evidenced by widespread reports and research, the Dutch cabinet decided that water and soil should lead the decision-making in country's spatial planning. Thus, endorsed by the Ministry of Infrastructure and Water, water and soil will become the guiding elements in policymaking in the Netherlands known as '*Water-en-bodem sturend'* i.e., '*Water and soil guiding'* ("Water-Bodem-Sturend," Nov 2022). The *'Water and soil guiding'* aims to restore natural water and soil systems, emphasizing the need to enhance resilience and robustness. By designing land use functions to promote cohesion and sustainability, this approach is critical in shaping the country's resilience to climate change and biodiversity preservation (de Rooij et al., 2023). This is an important transition step requiring an area-oriented approach and cooperation between different levels of government and stakeholders which is just in its initiation phase. As such, the living lab approach can be strategically employed to engage all relevant stakeholders in the co-creative approaches to further operationalize, implement, and monitor the policy guide.

Initially adopted in the private firms and industrial context, the living labs concept has emerged as a significant stream in innovation research and is extensively applied to involve citizens and end-user communities in business-citizens-government-academia partnership (Bergvall-Kareborn & Stahlbrost, 2009; Dutilleul et al., 2010; Ståhlbröst, 2012). Living labs have, in recent days, evolved into a policy tool utilized to improve innovation within the public sector (Nesti, 2017). Living labs can be positioned as a policy tool in different ways, one of them being supporting support policymaking with real-world evidence. They facilitate the development of innovative solutions and generate public value in tackling complex societal issues by co-creating innovations among quadruple helix stakeholders (Hansen & Fuglsang, 2020). Moreover, innovative policies and transition plan can often become politically sensitive issue (de Rooij et al., 2023). Thus, policymakers increasingly seek refuge in experimentation and innovation through living labs and other co-creative approaches for complex societal issues (Dekker et al., 2021).

Over the years, numerous living labs and co-creative projects have focused on climate-resilient land and water systems in the Netherlands, highlighting the importance of viewing water and soil management holistically rather than separately, leading to the introduction of *'Water and soil guiding'* for policymaking. Thus, in this paper, we aim to study in what ways did the existing living labs in the period before the policy formulation facilitated the establishment of the 'water and soil guiding.' Next, the paper seeks to understand how the real-world collaboration and innovation in living labs can further support in preparing, operationalizing, implementing, and monitoring such policies.

Case Study

To understand the roles that living labs can play in policy formation, implementation, and monitoring, we take two case studies, namely, Lumbricus and KLIMAP living labs (*KLIMAP*, 2022; Lumbricus, 2017-2020). The selected cases adopt real-world co-creative approaches to generate knowledge on climate-resilient land and water adaptation in the Dutch sandy soil region. Further, after the end of the Lumbricus program, KLIMAP carried its knowledge forward. Thus, these cases are apt to understand the ripple effect of one project leading to next to ultimately influencing policy making.

Both KLIMAP and Lumbricus investigated measures to retain and store water to combat extreme precipitation and prolonged periods of drought, especially in the higher sandy soil region. In this regard, the permeable nature of sandy soil poses a particular challenge, making it more susceptible to climate extremes (Ladányi et al., 2021). While both Lumbricus and KLIMAP worked with different water authorities, knowledge institutes, and local farmers to create healthy soil for agriculture and nature and optimize local and regional water systems, the stakeholder group, and scale of operation in KLIMAP was much more extensive. KLIMAP had a consortium of 24 stakeholders and experimentation was conducted at different levels. The living lab within KLIMAP experimented with potential innovations related to diverse crop types, improving water retention and soil structure in over 25 pilot areas via technical and nature-based solutions. The results of these experiments, along with the ones from Lumbricus, were put together in a catalogue mentioning which measures are applicable under what conditions. These measures were applied in designing the flexible, less-regret climate adaptive pathways at the regional level with the stakeholders.

Method

The research employs a qualitative analysis approach using multiple methods. First, desk research was conducted to understand the activities of KLIMAP and Lumbricus. Then, various documents on the ‘Water and soil guiding’ were analysed. Next, semi-structured interviews were conducted with the coordinators, project leaders, and experts (N=6) involved in KLIMAP, Lumbricus, and other relevant knowledge organizations. All interviewees were active in the field of water and soil (land) management and were related to the ‘water and soil guiding’ policy in different capacities. The questions were self-reflective regarding the role of living labs, their outcomes, impacts, and lessons learned. The study followed the snowball sampling procedure by Goodman (1961) to attain the interviews. The study started with a small pool of known informants and asked them to recommend potential interviewees. However, to get a comprehensive understanding of the role of living labs in policymaking, other living labs and policy officers working with similar goals need to be interviewed. The insights gained so far were applied to position living labs as a ‘knowledge and innovation’ tool providing evidence for policymaking.

Preliminary Findings

The following preliminary findings were observed to link the output from KLIMAP and Lumbricus to the new policy guide.

1. Hard evidence: Deltafacts are short and factual summaries of practical knowledge in the field of water management, mostly consulted by policy officers, managers, and experts. Both these projects have made numerous contributions to Deltafacts, putting their knowledge output in an accessible platform for policymakers (*KLIMAP*, 2022; Lumbricus, 2017-2020).

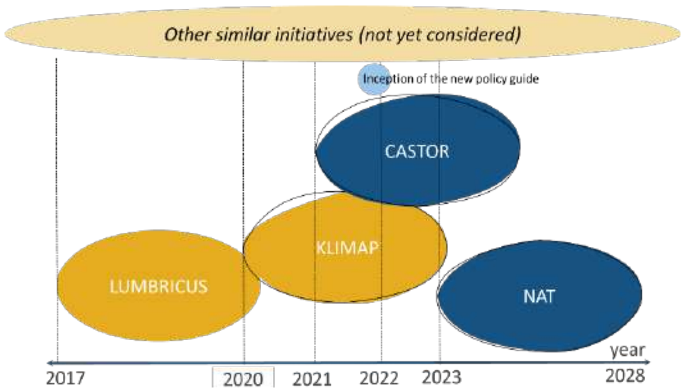

Figure 1. Projectscapes with living labs working on designing climate-resilient land and water systems

2. Network formation: Some of the experiments in KLIMAP were continued from Lumbricus. Thus, the project could strengthen the existing relationship with policy officers and locals while saving the resources required when starting from scratch. Further, relevant organizations such as different government organizations were involved in both projects, thus influencing the process in both directions. In addition, this network has resulted in newer projects such as CASTOR and NAT (***Errore. L'origine riferimento non è stata trovata.*** *1*) that aim to research the significance of living labs in policy landscape and employ them to design nature-based climate-robust approaches (*NAT*, 2023).

When the new policy guide was forwarded, Lumbricus had already ended for three years, and KLIMAP was running in its third year. However, the inception of this guide has its roots much earlier than these projects, to the 1990s in projects such as ‘Room for Rivers’ (Niesten & Frambach, 2023). The cumulative, reliable, replicable, relevant, and practical evidence from multiple projects with similar goals for decades that led to this new agenda-setting. However, policies are influenced by factors other than evidence, such as the urgency of the issue, personal expertise, judgment, and values, and so on (Sutcliffe, 2005).

Living labs can play an informing or influencing role in different steps of the policy cycle, as shown in Figure 2.

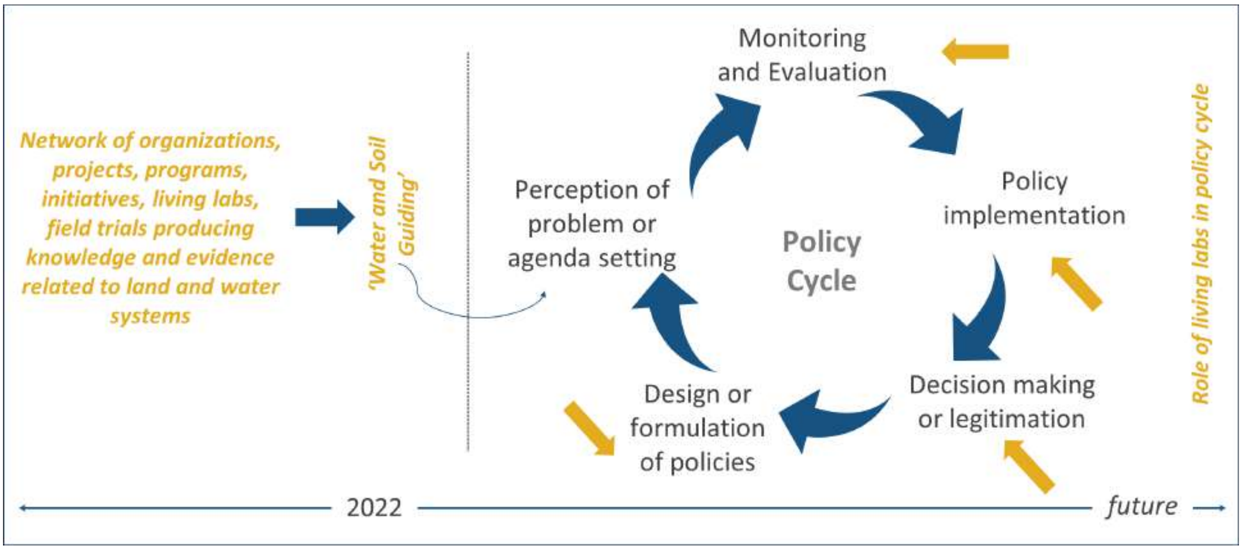

Figure 2. The left section shows past initiatives resulting in a new policy agenda in 2022; the right section shows a standard policy cycle with yellow arrows indicating the opportunities for living labs to influence and support different stages of policy cycle

Conclusion

Many living labs and similar approaches do not usually employ monitoring and evaluation approaches to identify their outcome and impact. This missing information on outcome and impact makes the task of identifying clear links between these approaches and policymaking daunting and often dubious. However, some hard evidence such as research output, and network formation can be indirectly but clearly linked to influencing the inception of the policy guide. The research, when completed, aims to collect all relevant connecting points. Further, this study only highlights potential opportunities for living labs to influence and support different stages of policy cycle. Upon completion, we aim to operationalize comprehensively in which role and under what capacities can living labs influence various stages of policymaking.

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Research-In-Progress Paper

Building Climate Resilience: The Role of Living Labs in Supporting Vulnerable Communities

Authors

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Abstract

Climate change poses significant challenges to vulnerable communities worldwide, exacerbating existing socio-economic disparities and creating new risks that amplify their vulnerability. Vulnerable populations such as homeless individuals, elderly populations, and low-income families face disproportionate risks from climate-related hazards, including heat waves. This abstract explores the role of Living Labs at the intersection of climate change and vulnerable communities, highlighting the impacts of extreme weather events and environmental degradation on those already marginalized. Through initiatives like the CARMINE project, Living Labs are used to identify specific vulnerabilities and adaptation needs, inform targeted interventions to mitigate the impacts of climate change, and foster collaborative innovation. Nonetheless, the focus remains on understanding and addressing the unique vulnerabilities of communities most affected by climate change. By prioritizing inclusivity, innovation, and community engagement, efforts to address climate change can be more effective in building resilience and fostering sustainable development for all.

Key words

Living Labs, Climate Resilience, Vulnerable Communities, Nature-Based Solutions, Climate Hazards, European cities

Introduction

Climate change is one of the most pressing challenges of our time, profoundly impacting societies, ecosystems, and economies globally. As temperatures rise, sea levels fluctuate, and extreme weather events become more frequent and severe, vulnerable communities face disproportionate risks and challenges exacerbated by socio-economic disparities and limited adaptive capacities (Birkmann *et al.*, 2022). These communities include low-income households, indigenous groups, elderly populations, and other marginalized individuals who often reside in high-risk areas such as floodplains or urban heat islands.

The intersection of climate change and vulnerability necessitates a nuanced understanding of how socio-economic, environmental, and governance factors intersect to shape resilience and adaptation strategies. Vulnerability to climate impacts is not solely determined by physical exposure but is also influenced by socio-economic conditions, access to resources, and social networks that facilitate or hinder adaptation efforts (Benevolenza & DeRigne, 2019). Addressing these complex dynamics requires inclusive and participatory approaches that empower communities to co-create and implement solutions tailored to their specific contexts.

This paper explores the pivotal role of Living Labs in enhancing climate resilience among vulnerable communities, within the CARMINE project which looks at different metropolitan areas, as case studies. Living Labs represent collaborative platforms where stakeholders from diverse sectors (i.e., community members, researchers, private and public representatives) come together to innovate and implement solutions tailored to local contexts. By prioritizing inclusivity, innovation, and community engagement, Living Labs aim to address the specific vulnerabilities, and adaptation needs of marginalized populations in the face of climate change.

Climate Change & Vulnerable Communities

Climate change presents unprecedented challenges for metropolitan regions across Europe, threatening the health, well-being, and prosperity of urban communities. More specifically, it poses significant challenges to vulnerable communities, exacerbating existing socio-economic disparities and creating new risks for those already marginalized. Vulnerable communities are groups of people who are disproportionately affected by climate change due to various factors such as socio-economic status, geographic location, age, gender, ethnicity, disability, or pre-existing health conditions. These communities often lack the resources, infrastructure, and social support networks needed to cope with and adapt to climate-related hazards effectively.

One of the defining characteristics of vulnerable communities is their heightened exposure to climate impacts. For example, low-income neighbourhoods in urban areas are often situated in flood-prone or polluted areas, increasing residents' vulnerability to extreme weather events and environmental degradation. Vulnerable communities include people who are susceptible to severe weather conditions, such as those with limited resources, older adults or people with disabilities, young children, individuals in correctional institutions, and those struggling with substance abuse, have faced increased mental, emotional, and physical strain as a result of being exposed to natural disasters (Benevolenza & DeRigne, 2019).

Furthermore, vulnerable communities often face additional challenges in accessing essential services and resources during climate-related disasters. For instance, homeless individuals lack permanent shelter and may struggle to find safe refuge during heat waves, storms, or wildfires. Elderly people, especially those living alone or with limited mobility, may face difficulties evacuating during emergencies or accessing medical care.

Climate change also exacerbates pre-existing social inequalities and health disparities within vulnerable communities. For example, marginalized groups such as ethnic minorities, indigenous peoples, and migrant populations may face discrimination and exclusion, limiting their access to healthcare, education, and employment opportunities.

The impacts of climate change on vulnerable communities extend beyond immediate physical risks to encompass broader social, economic, and environmental dimensions. For instance, displacement due to sea-level rise, land degradation, or extreme weather events can lead to loss of livelihoods, social dislocation, and heightened vulnerability to exploitation and violence. Moreover, climate-related disasters can strain already limited resources and overwhelm local infrastructure, exacerbating poverty and inequality.

Addressing the needs of vulnerable communities in the context of climate change requires a comprehensive and inclusive approach that recognizes the interconnectedness of social, economic, and environmental factors. This includes implementing targeted adaptation and mitigation measures that recognise the specific vulnerabilities and capacities of diverse groups. For example, investing in resilient infrastructure, early warning systems, and disaster preparedness programs can help reduce the risks faced by vulnerable communities and enhance their adaptive capacity.

Furthermore, empowering vulnerable communities to participate in decision-making processes and access resources is essential for building resilience and fostering sustainable development. This involves promoting inclusive governance structures, fostering community-led initiatives, and strengthening social networks and solidarity among community members. Moreover, addressing underlying drivers of vulnerability such as poverty, inequality, and social injustice is crucial for building long-term resilience and ensuring equitable outcomes for all. By adopting a holistic and inclusive approach that prioritizes the voices and experiences of those most affected, we can work towards a more just, equitable, and sustainable future for all.

Methodology

The research methodology employs a qualitative and participatory approach to investigate vulnerabilities and adaptation strategies within the context of the CARMINE project and other Sustainability Living Labs. Qualitative methods are selected for their ability to delve deeply into the perspectives and experiences of participants, essential for understanding complex social phenomena (Smith, 2024). Building on similar studies (Schuurman *et al.*, 2015; Ballon & Schuurman, 2015), this research adopts a participatory approach to actively engage stakeholders in the co-creation of solutions tailored to local needs. The use of participatory methods ensures that the voices of vulnerable communities are central to the research process, aligning with principles of inclusive governance and community empowerment (Jackson *et al.*, 2019).

The study involves a series of participatory workshops, and community consultations, engaging stakeholders representing various sectors and perspectives. These activities are designed to elicit insights into community priorities, perceptions of climate risks, and aspirations for resilience building. Data collection methods include semi-structured interviews, surveys, and participatory workshops conducted with local residents, policy makers, business representatives, associations and NGOs, and academic experts. The qualitative data gathered will support the co-design of climate change adaptation and mitigation pathways. Living Labs are being implemented in 8 cities (Athens, Brasov, Bologna, Prague, Barcelona, Odense, Birmingham, and Leipzig) which serve as distinct units of analysis to examine the effectiveness of Living Labs in addressing vulnerable community risks to climate change and enhancing cities' resilience. This participatory approach ensures that adaptation strategies are grounded in local knowledge and responsive to community needs and preferences. Additionally, by adopting a multi-case approach, this research aims to generalize findings across diverse urban settings, contributing to a broader understanding of the applicability and impact of Living Labs in mitigating climate risks for vulnerable populations. The methodology also emphasizes the integration of traditional knowledge and indigenous practices, recognizing their valuable contributions to sustainable land management and adaptation strategies. By leveraging diverse perspectives and expertise, the research aims to co-create innovative solutions that enhance climate resilience while promoting social equity and environmental sustainability. A comprehensive set of tools and activities (systemic mental mapping of climate change challenges, risks, and drivers and interdependencies; envisioning; co-design of pathways) will be deployed throughout a series of Living Labs workshops. This approach is anticipated to foster a deeper understanding of the interconnected nature of climate-related issues.

The co-design process is structured to remain adaptable, ensuring the effective involvement of vulnerable groups. In instances where vulnerable groups are represented by formalized organizations, they will be actively engaged in the Living Lab's workshop. Where such organizations are absent, individual interviews will be conducted to ensure that the perspectives of these groups are adequately represented in the process.

Discussion

The expected outcomes from the CARMINE project underscore the critical role of Living Labs in promoting inclusive and community-centered approaches to climate resilience. In all cities metropolitan areas), vulnerable communities face multiple challenges exacerbated by climate change, including among others increased frequency and intensity of heat waves, urban heat island effects, flooding, heavy rainfalls, droughts, and socio-economic inequalities. Through participatory processes, stakeholders will identify adaptation and mitigation measures for enhancing resilience and fostering sustainable urban development, leaving no one behind.

Living Labs under the CARMINE umbrella aim at facilitating dialogue and collaboration among diverse stakeholders, enabling the co-creation of contextually relevant strategies that address the interconnected challenges of climate change. By integrating local knowledge and innovative solutions, these collaborative platforms empower communities to become active agents of change, fostering resilience from the grassroots level upwards.

The participatory methodologies employed in the CARMINE project are expected to enhance community engagement and ownership of adaptation and mitigation strategies, ensuring that interventions are culturally appropriate and responsive to local contexts. By bridging the gap between research, policy, and practice, taking into consideration vulnerable communities, Living Labs facilitate the implementation of evidence-based solutions that benefit vulnerable populations and promote inclusive governance.

Furthermore, the different case areas highlight the potential for Living Labs to serve as catalysts for transformative change in urban resilience planning. By fostering partnerships across sectors and empowering marginalized groups, these platforms contribute to more equitable and sustainable development pathways. Moving forward, scaling up successful models of Living Labs and replicating them across diverse urban contexts can enhance the resilience of vulnerable communities worldwide.

Conclusions

CARMINE Living Labs represent a promising approach to addressing the multifaceted challenges posed by climate change within vulnerable communities. The CARMINE project exemplifies how collaborative platforms can integrate local knowledge, foster innovation, and promote inclusive governance to build climate resilience. By engaging diverse stakeholders—including community members, policymakers, researchers, and industry representatives—Living Labs facilitate the co-creation of adaptive strategies that respond to the specific needs and priorities of marginalized populations.

By empowering communities to actively participate in decision-making and solution-building, Living Labs promote social equity and environmental sustainability. The integration of traditional knowledge and indigenous practices is expected to further enrich resilience strategies, ensuring that interventions are culturally sensitive and contextually relevant.

In conclusion, the CARMINE approach to Living Labs is expected to play a pivotal role in addressing the vulnerabilities of local communities to climate change, as well as identify and implement different adaptation and mitigation measures. By employing a comprehensive, flexible, and participatory methodology, the approach ensures that the specific challenges, risks, and drivers associated with climate change are thoroughly mapped and understood within each Case Study Area. The participatory tools and activities to be used will facilitate robust collaboration among stakeholders, enabling the identification of key interdependencies and synergies among various climate-related risks, and tailor-made solutions.

The adaptability of the co-design process ensures that the voices of vulnerable groups are effectively incorporated, whether through the engagement of relevant organizations within the Living Lab's participatory workshops or through individual interviews where such organizations are not present. Ultimately, the CARMINE approach to Living Labs is designed and anticipated to foster a deeper understanding of the interconnected nature of climate risks, thereby empowering local communities to develop and implement effective adaptation and mitigation measures tailored to their unique contexts.

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Research-In-Progress Paper

A Knowledge Exchange Platform (KEP) as a Collaborative Mechanism to Economic and Financial Well-being in South Africa: Who should be involved?

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Abstract

This paper positions a Knowledge Exchange Platform (KEP) as a representation of the South African financial education innovation ecosystem aimed at enhancing Economic- and Financial Well-being (EFWB) as a response to a grand challenge. Efforts to enhance EFWB in SA are limited due to a lack of coordination and collaboration amongst the various stakeholders. This paper, therefore, aims to surface the collaborative stakeholder pathfinding that codesigns the KEP through an experimental yet frugal Living Lab approach. The project is still in the Problem Space per the Living Lab Integrative Process. As such, it is critical to identify the collective action required of stakeholders across the ecosystem platform who pursue the shared goal of enhancing EFWB in SA and, as such, contribute to reducing SA's triple (and grand) challenges.

Key words

Knowledge exchange platform ecosystem, financial well-being, financial education, experimental living lab, grand challenges, South Africa (SA)

Introduction

The World Economic Forum (2023) [1] theorised the cost-of-living crisis and household finances as the number one short-term risk of 2023. These issues have multiple antecedents, namely the 2007 – 2008 Global Economic Crisis, the ongoing geopolitics between the Western and Eastern great powers (USA, Russia, and China), as well as the multiple socio-economic shocks of the Covid-19 pandemic. Policymakers, regulators and intellectual leaders predicated these international events as grand challenges (Seelos, Mair & Traeger, 2023)[2], with role players seeking how best to address the underlying systemic issues yet also the generative outcomes for society at large (Ritala, 2024[3]), especially from a well-being perspective (OECD, 2020a[4]; OECD, 2020b[5]; OECD, 2020c[6]). These attributes of grand challenges, theoretically and practically, also hold for South Africa given that food security, health, and financial interventions, as examples, were implemented to assist the most vulnerable, given that 2.2 million people lost their jobs in the first months of hard lockdown. The pandemic compounded the country's struggling GDP to a record five-year low (Centre of Excellence in Financial Services, 2023) [7]. The pandemic placed tremendous pressure on the country already grappling with the big three societal challenges of poverty, high unemployment, and extremely high levels of inequality (NPC, 2023[8]). These realities also deterred the country's progress towards reaching the Sustainable Development Goals (SDGs) (UN, 2015) [9] – especially goals 1 (no poverty), 4 (quality education) and 10 (reduced inequality). Compounding these global events, local events such as political uncertainty and widespread, high-level service-delivery and corruption failures translated into South Africa (SA) struggling to recover from the impact of globalised and localised grand challenges.

In what could be theoretically framed as a foresight/futures exercise (Könnölä, Scapolo, Desruelle & Mu, 2011[10]), the SA government established the National Consumer Financial Education Committee (NCFEC) in 2012. As a multi-stakeholder committee, NCFEC was established to secure various stakeholders' active involvement, collaboration, and coordination in consumer financial education. The National Treasury chairs the Committee, which is comprised of representatives from the financial sector industry, government departments, regulators, academia, and other civil society organisations. The committee's mandate, amongst others, is to work systemically to develop and update the national consumer financial education strategy, oversee its implementation, and provide proactive leadership and guidance in the planning, coordination, implementation, monitoring, and evaluation of consumer financial education programmes. Könnölä et al. (2011[10]) reinforce the impact of such mechanisms, above, in relation to responsive strategies for grand challenges. In this vein, since the establishment of NCFEC, the first National Consumer Financial Education Strategy (NT, 2013[11]) was developed. This was followed by the publishing of a Financial Competency Framework in 2014 (FSB, 2104[12]. In addition to these two policy documents, the committee has hosted several national financial awareness campaigns under the collective banner of Money Smart Week South Africa (MSWSA). As Könnölä, et al, (2011[10]) argue, complex foresight work does include sustainability challenges. Since its inception, NCFEC has struggled to gain traction for several reasons, ranging from collaboration challenges, lack of funding, and a high level of regulatory reform, especially in the financial sector. For example, SA introduced a new Twin Peaks financial regulation and oversight model in 2011 (NT, 2011) [13] and has been working on implementing this new regime. The new regime required a host of new legislation, the establishment of new market conduct and prudential regulators and a new financial sector ombud system (NT, 2024) [14], as well as the publication of a new Financial Inclusion Policy Statement (NT, 2023) [15]. Given the new regime and the new financial challenges to be addressed for South African households in their resilience journey to economic and financial well-being, the National Treasury is poised to publish the Financial Education Policy Statement with the Financial Sector Conduct Authority about to finalise Market Conduct Standards for Financial Standards. There are thus many interventions within this environment. Still, the remaining challenge for NCFEC is the lack of coordination and collaboration amongst all stakeholders involved in the financial education ecosystem of SA. Ritala (2024[3]) argues that principles of co-ordination, collective multivocality and generative knowledge exchange are critical for complex policy and appear to be highly effective when there is a principle-led transformative ecosystem platform that addresses complex grand challenges: a response which is theorised at the core of this paper.

Conceptual framework

Following Ritala (2024: 170-171[3]), who strongly argues for platform-driven ecosystems, the development of a Knowledge Exchange Platform (KEP) is gaining ground as a “co-ordinating, collective” and “scalable” solution to SA’s grand challenge of economic and financial well-being. Ritala’s framework includes several vital principles which are part of the bigger project, in which this paper is situated, aimed at developing pathfinding innovation (Horsman, 2018[16]) within an Experimental Living Lab for the KEP (Rehm, McLoughlin & Maccini, 2021[17]). Furthering the platform ecosystem concept, Vargo & Lusch (2016[18]) suggest that service ecosystems (e.g. financial education service ecosystem) create value within multi-actor exchange systems in which shared and enduring institutional arrangements could guide resource integration and service exchange. Given the collaboration struggles and duplication of efforts, the envisaged platform will allow for resource integration by the many actors in the system. The current conceptual thinking of the KEP is illustrated in Figure 1.

It is clear from Figure 1 that addressing the economic and financial well-being challenge will require an ecosystems platform (Ritala, 2024[3]) involving a myriad of stakeholders across several pathways to inform the generative development and implementation of the KEP (Könnölä, et al, 2011[10]; Ritala, 2024[3]). Stakeholders across the Quintile Helix of Innovation Model (QHIM) (Barcellos-Paula, De La Vega, & Gil-Lafuente (2021[19]) drawing from frameworks inclusive of those cited in this paper or others will co-evolve the KEP along the principles of frugal, pathfinding innovation (Albert, 2014[20]) to achieve coherence and sustainably over the longer term.

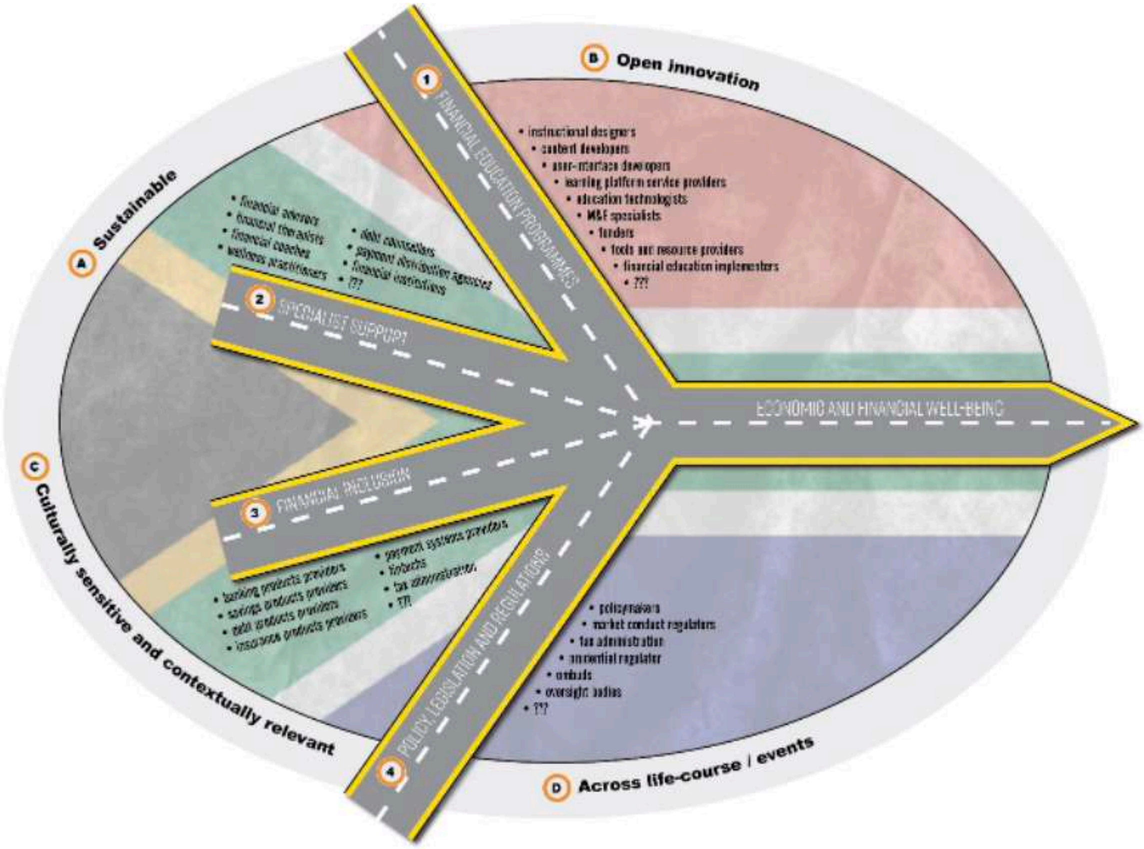

Figure 1: KEP Conceptual framework
Source: Author's own

As indicated in Figure 1, the underlying principles proposed for the framework talk to (A) sustainability, underpinned by (B) open, yet frugal, innovation, which are (C) culturally sensitive and contextually relevant to the SA context and applicable across the (D) life course of SA consumers and their financial decision-making processes. Following Horsman (2018[16]) and Midgley (2024[21]), for the KEP, various pathways to better economic- and financial well-being will be explored, for example:

1. The design, development, and implementation of adequate and appropriate financial education initiatives, informed by an updated competency framework for financial literacy, is an evolving novelty in SA. This will require collaboration from

programme and content developers, implementors, funders, and M&E specialists, to name but a few.

2. Utilising specialist support as and when required but underpinned by sound consumer protection regulations. These specialists could include financial advisors, financial therapists, financial coaches, debt councillors and others.
3. Through the development of appropriate and novel financial products that will contribute to financial inclusion and inclusive innovation. All financial service providers and fintech institutions could collaborate through their customer journey events to ensure consumers are well educated during the product acquisition process.
4. Furthermore, consistency and alignment between the spectrum of applicable regulations and policies should be ensured through the participation of policymakers, regulators, ombuds and other oversight bodies.

Given the scarcity of funds and other resources required to address the grand challenges SA is facing, integrating resources through service-dominant logic will provide a better understanding of creating value through collaboration. This process could also contribute to the transformative impact of the financial education platform ecosystem to benefit all stakeholders across the QHIM. These principles benchmark well with the cited literature's frameworks, specifically that of Seelos, et al (2023[2]) systematic review of architecture for addressing grand challenges and Ritala (2024[3]) ecosystemic platform responsiveness. Intrinsic also to the pathway development of the KEP, it functions as a digital data hub and repository for the quintile collective stakeholders, furthering the principle of "generativity" (Ritala, 2024: 177[3]). The principles describe how digital interfaces enable collective, perpetuating, and insightful knowledge bases that may be sustained for replication or extension by other researchers. The populating of the digital data hub will be achieved through artefacts and evidence from the activities of the various stakeholders to inform the questions of who is doing what, what works, and, very importantly, why it works. These questions embody the generativity imperative that fosters methodologies for extended research agendas (Ritala, 2024[3]). Such ecosystemic participation responds to big questions with which the financial education community is struggling. Through coordinated collaboration, resources can be frugally redeployed away from re-developing similar, yet existing, content as well as increase novel evidence or take learnings to scale. The platform's evolving design thus scales up to sustainable and more considerable collaborative efforts.

The way forward

As indicated, this paper is part of a bigger project aimed at developing the KEP. The project is currently still in the problem phase (ENoll, 2022), during which the researcher is busy gaining an understanding of the socioeconomic and cultural setting but more relevant to this paper, identifying the potential collective of stakeholders in terms of the QHIM to determine their possible roles, responsibilities and contributions towards the development of the KEP as a platform ecosystem. The next phase of the project will include a generative creative visioning workshop with the current membership of the pivotal NCFEC to determine the purpose and scope and platform identity of the KEP. The workshop will also aim to explore their position in the QHIM and their potential user roles (Leminen, Nyström & Westerlund, 2015[9]). Following the visioning workshop, an implementation plan and governance principles will be developed. During the second phase of the project, potential stakeholders outside the ambit of NCFEC will be approached to determine the breadth of the collaboration that could be achieved as there are potentially many other stakeholders involved in the KEP, such as financial education service providers, financial advisors, not-for-profit organisations, and civil society (FSB, 2014[12]). Using best fit-for-purpose frameworks, this initiative will create pathways for their inclusions and contributions.

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Innovation Presentation Outline

MataCities: When Living Labs Meet Smart Cities

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Abstract

MetaCity is an innovative smart city and urban concept that champions open innovation through digital platforms and social networks. It goes beyond being merely a research idea or a single technical advancement, instead embodying a holistic approach that encompasses innovators, innovations, users, and facilitators within a new narrative of innovation ecosystem. Metacities rooted in the Living Lab principles, i.e., the inclusion of early (and continuous) engagement of all relevant stakeholders, value co-creation for all participants, openness and transparency, an iterative process (inclusive to receive and apply feedback), real-life experimentation, the distribution of decision-making power, and the identification of stakeholders' needs, motivations, and expectations to promote social inclusivity. Accordingly, MetaCities can be defined as the extended version of traditional and technically oriented smart cities by integrating Living Lab principles to foster inclusivity by balancing the social and technical aspects. To achieve the main objective of this initiative, the MetaCities project —Connecting Pockets of MetaCity Excellence around the Baltic Sea Region, funded by the European Commission under grant agreement 101134225. The project aims to accelerate, consolidate, align, and leverage the existing MetaCity and Smart City initiatives of the partner regions. Through these efforts, the project seeks to build the world's leading connected MetaCity Region across the Baltic Sea (BSR).

Keywords

Living Lab, Smart Cities, MetaCities, PentaHelix, Principles

Problem statement

Smart cities are urban environments that strategically utilize technology and data-driven solutions to optimize various aspects of city life, including transportation, energy usage, waste management, public services, and infrastructure (Baraniewicz-Kotasińska, 2022; Echebarria et al., 2021; Osman et al., 2022). This approach aims to enhance efficiency, sustainability, and the overall well-being of residents by leveraging advanced technologies such as the Internet of Things (IoT), sensors, data analytics, and connectivity infrastructure in the cities (Osman et al., 2022). While smart cities aim to strive for a balance between social and technical aspects, most smart city initiatives have focused on the technical aspect of smart city development, and the social aspect of it remained unexplored (Echebarria et al., 2021). This issue calls for further endeavors to integrate more aspects of social science and humanity into traditional smart city initiatives.

Approach

To tackle this, MataCities as a novel concept is introduced, in which more weight is given to the social aspect of smart city development by engaging various actors in the development process of smart cities. In so doing Living Labs are seen as a suitable approach to address this gap. In essence, Living Lab is an approach for managing and conducting open innovation processes by involving quadruple helix innovation actors, i.e., public sectors, private sectors, research institutions, and citizens. Together, they collaborate to co-create innovative solutions in real-life settings (Leminen et al., 2012; Schuurman, 2015). MetaCities therefore strive to use Living Labs as the overall approach to innovation development and consider the whole city as an innovative socio-technical ecosystem. When it comes to MetaCities, it even goes one level higher and recommends the engagement of PentaHelix actors. While the fifth helix has been understood differently in different contexts, e.g., as natural environment in rural Living Labs (Habibipour et al., 2021), Media in tourism innovation ecosystems, etc., MetaCities view it as social entrepreneurs, activists, and so forth.

Outcome

Integrating Living Lab principles into traditional smart cities concept is the main idea behind MetaCities concept. The main principles of living labs include early and continuous engagement of stakeholders and users across the Quadruple Helix (Bergvall-Kåreborn et al., 2009) and ensuring value co-creation for all involved stakeholders (Bagalkot, 2009). Openness, transparency, and an iterative process foster inclusivity by including feedback at every phase (Leminen et al., 2012). Real-life experimentation and evaluation drive practical insights, while decision-making power is distributed among all stakeholders

(Bergvall-Kåreborn et al., 2010). Understanding stakeholders' needs, motivations, and expectations promotes social inclusivity and shared ownership (Habibipour, 2020). Figure 1. shows an overview of MetaCities which is built based on the integration of traditional smart city elements (which is more technically oriented), as well as the main principles of Living Labs. Therefore, the outcome is more sociotechnical driven and suggests the inclusion of all actors in MetaCities as an innovation ecosystem.

When it comes to MetaCities project, the main objective is to speed up, consolidate, align, and leverage the existing MetaCity and Smart City initiatives of the partner regions, and through this, build the world's leading connected MetaCity Region across the Baltic Sea (BSR).

Developing MetaCities in the region presents several challenges: ensuring robust data protection protocols to address privacy concerns; identifying influencers and active peers to effectively reach citizens and increase awareness; defining clear goals, timelines, and adopting a co-creation approach for stakeholder engagement; visualizing the concept and implementing small, quickly realized projects to demonstrate feasibility; communicating the benefits across diverse media channels to overcome regional cultural barriers; and outlining business plans early to secure credibility and attract investment for funding.

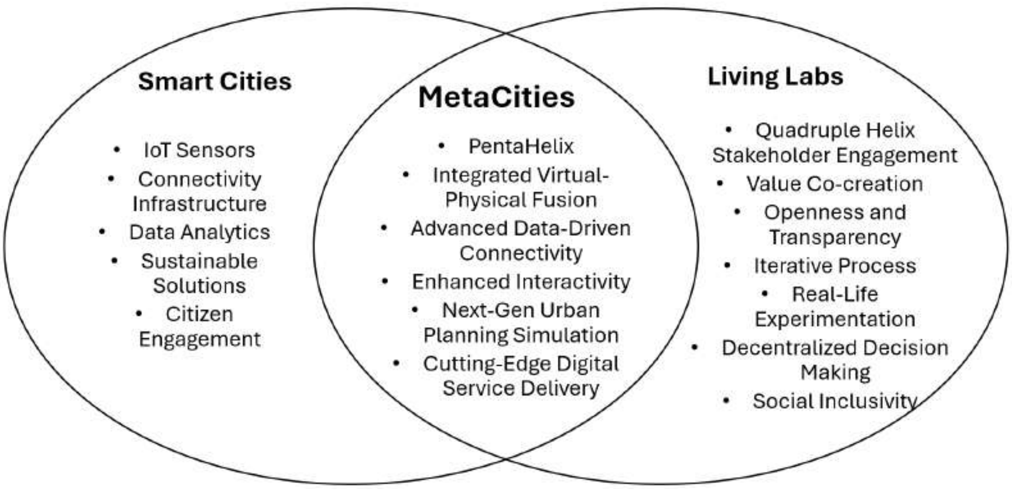

Figure 1. MetaCities, when smart Cities and Living Labs meet

Acknowledgments

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Innovation Presentation Outline

A Holistic, Multi-disciplinary Model for Health & Wellbeing Research & Innovation in Thessaloniki

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Abstract

This paper presents the extension of the Thessaloniki Action for Health & Wellbeing Living Lab (Thess-AHALL), evolving from a focus on Active & Healthy Ageing to a holistic approach to health and wellbeing. Embracing a multidisciplinary model, Thess-AHALL has turned the entire Thessaloniki into a heath & wellbeing living lab. This works discusses Thess-AHALL's innovative model, its impact on research and innovation, and future directions.

Key words

Holistic Health, Multi-disciplinarity, Cross-sectoral Living Lab, Open Innovation, Co-creation, Citizen-led research

Outilne

The Thessaloniki Action for HeAlth & Wellbeing Living Lab (Thess-AHALL), established in 2014 in Thessaloniki, Greece, evolved from the Thessaloniki Active & Healthy Ageing Living Lab. Initially focused on Active & Healthy Ageing (Konstantinidis et al., 2016), it now operates as a unique research and innovation ecosystem, embracing a holistic approach to health and wellbeing and promoting cross-sectoral collaboration. Employing participatory design and city science methodologies, Thess-AHALL develops (non)technological solutions that enhance health, wellbeing, and quality of life (Konstantinidis et al., 2016; Bamidis et al., 2022).

Since 2022, Thess-AHALL has expanded to include oncology research, the agri-food sector, urban resilience, environmental change, and culture. This diverse-sector integration transforms Thessaloniki into a cross-sectoral living lab, addressing health challenges holistically. By integrating health and wellbeing across sectors, Thess-AHALL meets local needs, such as improving nutrition through agri-food partnerships, enhancing mental health with cultural projects, and advancing cancer care through innovative research. Thess-AHALL tackles complex health and societal challenges with a multidisciplinary approach. Its relaunch has fostered a coalition including city authorities, museums, libraries, and university research groups, resulting in initiatives that promote quality of life and empower citizens in health research. Thessaloniki has become an innovation hub, addressing health challenges through collaborative efforts.

The innovative aspect of Thess-AHALL lies in its holistic and multidisciplinary approach, integrating social, environmental, and cultural factors to address health and wellbeing. This model broadens perspectives on health challenges, fostering sustainable solutions. Thess-AHALL's approach ensures diverse expertise and resources are pooled, leading to more effective outcomes. Health challenges are studied beyond clinical settings, encompassing libraries, museums, media labs, and urban areas. This expanded scope enriches research and innovation by aligning solutions with the community’s needs, promoting regional development and enhancing overall health and quality of life. By adopting this holistic approach, Thess-AHALL tailors interventions precisely, leading to more impactful solutions that address specific local health challenges.

To increase its inclusive impact, Thess-AHALL has established the "Collaboration & Research Community for Independent Living," a citizen-led research group. Comprising older adults, patients, caregivers, and healthcare professionals, this panel actively engages in living lab activities, applying scientific research methods, sharing experiences, and co-designing solutions as equal partners with researchers (Konstantinidis et al., 2021;

Mantziari et al., 2022). Recognizing their pivotal role, Thess-AHALL is developing a model to elevate their status from collaborators to co-owners, advancing towards a new patient-led living lab model.

Future work entails Thess-AHALL's model scalability and its influence on local and regional health policies. Additionally, exploring new methods to enhance cross-sectoral synergies and increase community engagement, alongside replicating the patient-led living lab model, is crucial for sustaining open innovation in health and wellbeing.

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IPCC Special Contribution

Wednesday, 25th September 2024

Special reports from the IPCC (the Nobel-prized Inter-governmental Panel on Climate Change) are key drivers for global and local actions. The forthcoming Special report on Cities and Climate Change planned for 2027, can similarly launch unprecedented urban action for sustainability, resilience, and innovation. If Living labs, as concept, governance structures, methods, and experiences, are significantly mentioned in it and begin to be included in the mainstreamed bottom-up and top-down strategies and implementation measures, we can together make the difference.

As background, the IPCC itself is the unusual connection between a large (and structured) scientific community with national governments and local authorities exploring how to cope with climate change, in the logics of deep decarbonisation. Each page of its reports receives hundreds of comments and is approved by both scientists and politician, representing the global consensus.

Research-In-Progress Paper

Towards accelerating restorative transitions in urban, peri-urban, and urban-rural environments - everybody onboard through the new generation of living labs

Maximising synergies and managing trade-offs depend on specific practices, scale of implementation, governance, capacity building, integration with existing land use and the involvement of local communities and Indigenous peoples and through benefit-sharing, supported by frameworks such as Land Degradation Neutrality within the UNCC
(IPCC Intergovernmental Panel on Climate Change, 2022)

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Abstract

This paper explores the concept of transformative governance to foster individual and collective responsibility towards positive climate change. Anchored in the Anthropocene epoch, where human activities have a profound impact on the planet's systems, the study emphasises the dual capacity of humanity to both degrade and regenerate our environment. The framework of the triple transition—social, green and digital—is proposed as a comprehensive multi-faceted approach to navigate the complexity of current and future ecological and societal issues.

Central to this discourse are collaborative methodologies that include multi-actor and multi-level co-creation governance. These methodologies facilitate the creation of the next generation of living labs and ecosystems that drive social, digital and environmental systemic transformation.

The paper underlines the importance of eco-systemic thinking, community-based actions and stakeholder engagement in fostering a people-centred approach to climate governance.

Through in-depth interviews to key stakeholders in regional innovation ecosystems in different world regions, the research deepens on effective strategies for aligned shared visions, decentralised governance and active citizen participation, including actors from the quadruple or n-helix.

The study demonstrates that leveraging the triple transition and collaborative methodologies within the new generation of T-Shaped living labs is essential for achieving sustainable and regenerative impacts in purpose-driven and future-ready resilient urban environments.

Key words

Co-Creation, Transformative governance, Quadruple helix, Systemic change, Common good, Triple transition (social, green and digital), Peri-urban transition

Introduction: Understanding the shared responsibility for an accelerated positive climate change in urban and peri-urban settlements

Climate transition should be a concern for everyone, regardless of the size or wealth of their city or community, i.e. large, influential cities, as well as smaller towns, villages, municipalities, peri-urban settlements, or communities. Humanity is in a state of transition, reflecting the broader shifts occurring on our planet in the Anthropocene era. This epoch is characterised by significant human impact on the Earth's geology and ecosystems, driven by anthropogenic changes. As illustrated in figure 1, 'we are all in the same boat', immersed in an environmental emergency and must work together to ensure our collective effort to prevent further damage on the planet.

Figure 1. 'We are all in the same boat,' Source: Eoh-for-Good©

We are continuously faced with transformations at various levels, from personal to global, despite an inherent resistance to change, evidenced by our tendency to react only when crises are imminent. Recent events such as the COVID-19 pandemic, severe droughts, drastic floods, wildfires, and social inequities exemplify the "heavy storms" that disrupt our socio-economic, political, and environmental status quo. Among the most pressing of these global challenges are the need to mitigate and adapt to climate change (Smith et al., 2020).

These disruptions highlight the need for a courageous acknowledgment of our role as predators or exploiters without measure or control, or as positive agents of change with the Anthropocene epoch presenting unique governance challenges and opportunities. Humanity has arrived now by prioritising individual interests, with only a few taking responsibility for the common good. We must promote shared visions and nurture new generations of change agents committed to collaborative and transformative governance by embracing this shared responsibility.

We urgently need a global and personal wake up to generate real transformations of our societies, our artificial systems, and our natural ecosystems for which we are responsible. We need to have "the courage to recognise that we, humans, are the agents of such changes, for bad or for good. Our choice is for good, for a new common good. We need shared visions about this goal; we need new generations of social, digital, and environmental innovators and entrepreneurs, committed to boost collaborations; we need to create new transformative governance, based on new methodologies, tools and services to respond to these changes" (Caro-Gonzalez, 2023).

This paper examines how new forms of collaborative transformative governance can promote individual and collective responsibility for positive climate action. We can address the unsustainable situation and strive for a fairer, inclusive and sustainable future for humanity to achieve meaningful societal, systemic and ecological transformations for the common good through the exploration and development of new methodologies, dynamics, tools and profiles that reflect on the past, analyse the present and anticipate the future (Jain, 2024; Caro-Gonzalez et al., 2023; El-Sherbini et al., 2024). The work deepens on the need to accelerate the social transition, integrating it with the green and digital transitions, the so-called triple transition (social, green, and digital). Innovation, industry-led efforts, digital leadership, individual and social conduct towards climate neutrality and regeneration must be rooted in responsible environmental engagement in urban and peri-urban settlements. The EU's Roadmap acknowledges the need for changes in social habits and active participation in governance (European Union, 2022), with the 2022 IPCC report already highlighting multi-level governance as crucial for climate transition (Lwasa et al., 2022). However, the novelty of this study lies in placing individual and shared responsibility at the core of multi-level initiatives, making it the driving force behind sustainable change or transition. In other words, making responsibility a conscious effort is what can lead humanity to the success of these transitions.

Theoretical framework - Systemic approaches for fast-tracked positive environmental shifts in urban and peri-urban communities: triple transition, multi-level, and transformative governance

Urban areas play a critical role in mitigating climate change due to their significant greenhouse gas (GHG) emissions, growing urban populations, expanding urban land and infrastructure and the long lifespans of buildings and transport systems (Seto et al., 2021). Efforts are already underway at the highest levels, as seen in climate summits and the 2030 Agenda, among other initiatives (European Commission, 2024; United Nations, 2024).

Systemic approaches to governance are crucial for a) promoting and accelerating regenerative climate change in urban, peri-urban, and urban-rural settlements; b) ensuring long-term stability; and c) supporting transformative actions that drive rapid positive environmental changes in these communities.

The **Triple Transition framework** (Caro-Gonzalez *et al.*, 2023) embodies a forward-looking vision that propels an encompassing complex transition: social, green, and digital, under the motto: "One for All, All for One" triple transition. The Triple Transition advocates for intertwined transitions that are just and human-centred and environmentally friendly, guided by the Sustainable Development Goals and context-driven agendas that defend the resolution of challenges identified by different communities (e.g. indigenous, minorities, etc.). It addresses the urgent need to transition from destructive patterns, such as warfare, environmental degradation, and social alienation, to regenerative practices (e.g. circular economy and sustainable and equitable growth, Eoh-lution podcast #17) to be translated into actionable policies and offer:

a) a strong approach to achieving transformative governance by addressing these dimensions simultaneously;
b) the promotion of a global dynamic reconfiguration by promoting multi-agent engagement to define new purposes and visions aligned with the SDGs and the global agenda, specifically climate change targets.
c) a systemic approach centred on societal development vital for balancing economy and society in a sustainable way through the interaction of digital, energy and environmental concerns.
d) a co-evolutionary process that embodies the "one for all, all for one" principle, directing humanity towards a life-sustaining purpose.

Cities and peri-urban areas are envisioned as vast "co-laboratories" (new generation of living labs and ecosystems) with capacity to drive radical changes through experimentation, learning and multi-actor engagement, promoting systemic innovation and collaboration across various dimensions (Scholl et al., 2022; Bhatta et al., 2023; Serra, Caro-Gonzalez and Colobrans, 2024). This ambitious vision aligns with European values and aims to achieve the targets of the United Nations 2030 Global Agenda.

To effectively address climate change in urban and peri-urban areas, it is essential to involve **multiple levels of governance**, including government and non-state entities and secure substantial funding beyond sector-specific strategies (Costero Bolaños, 2024; Melnykovych et al., 2024; Cheshmehzangi, 2019). Multi-level governance coordinates policies across local, regional, national, and international levels, ensuring coherent and aligned efforts to respond comprehensively to complex challenges.

Authors like Kern wrote about the EU multilevel climate governance based on the dynamics between leaders, followers, and laggards. She stated that "upscaling of local experiments is not limited to horizontal upscaling between leading cities because the role of cities in EU climate governance has changed. Authority and competencies shifted not only upwards to the EU, but also downwards to subnational authorities." She explained that "local climate action has become an important feature of European climate governance, and a considerable percentage of Europeans now live in cities with relatively ambitious reduction goals. Although big, wealthy, and powerful cities, led by charismatic leaders, have become important players in climate governance, local climate action is not a panacea" (Kern, 2019).

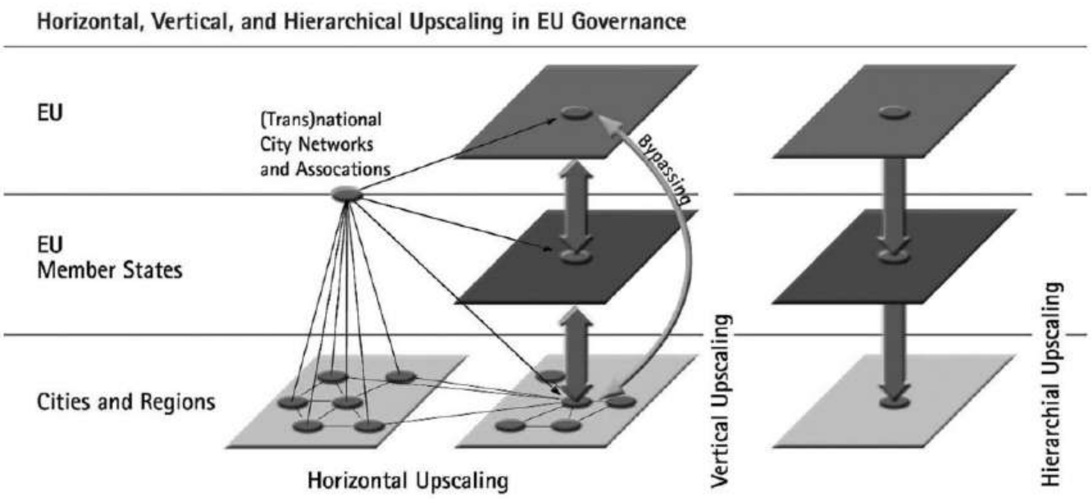

Figure 2. Horizontal, vertical, and hierarchical upscaling in EU governance. Source: Kern, 2019.

Fuhr discussed the benefits of "bottom-up" approaches to climate change, stressing urban climate experimentation and its alignment with polycentric climate governance (Fuhr et al., 2018). Fuhr introduced "embedded upscaling," a governance mode that combines horizontal, vertical, and hierarchical arrangements and a model that considers the dynamics between leaders, followers, and laggards to create an integrated governance setting (Fuhr et al., 2018).

Transformative governance refers to the process of how societies are managed to achieve sustainable and equitable outcomes. It involves moving beyond traditional governance models to embrace more holistic, inclusive, and adaptive approaches for the common good. Key elements of transformative governance include:

a) **Eco-systemic thinking** to understand and manage urban contexts in an integrated, holistic and planet friendly manner;

b) **Community-based and citizen engagement** to actively involve local communities and individuals in decision-making processes '*we are all in the same boat*' (figure 1) and have the responsibility to 'add our drop in the ocean';
c) **Multi-actor engagement** to ensure that diverse perspectives and interests are represented and considered; and
d) **Systems transformation** to promote comprehensive changes across social, economic, and environmental systems with a long-term common good vision.

Through the principles of transformative governance, it is possible to navigate the complexities of profound transitions and shape a more just, sustainable, and inclusive world for future generations. The critical challenge lies not in the availability of information, data, or knowledge—we possess abundant scientific and practical evidence of the detrimental impact we are having on the planet. Instead, **the focus must be on how to effectively implement this knowledge and regenerative oriented policies and practices**. For responding to this 'how': The role of social innovators is crucial in designing new frameworks that include not only political and religious leaders and entrepreneurs but also members of organised communities united by a common purpose. These social infrastructures not only implement but also sustain, refine, and redefine the process, ensuring its continuous development and success. This study explores how experts have designed specific strategies to make urban and peri-urban settlements consciously sustainable, drawing on the illustrative experiences and concrete cases discussed in the interviews.

Research methodology

This research adopts a rigorous qualitative methodology to investigate the opportunities and challenges associated with accelerating positive climate change in urban, peri-urban, and urban/rural settlements worldwide. The study examines initiatives of varying maturity across multiple regions, levels of actor engagement and thematic areas.

This study aims to capture rich narratives and gain in-depth insights into the dynamics and processes essential for transformative governance in urban environments conducive to positive climate change. Qualitative methods are well-suited for exploring complex social phenomena, as they provide rigorous scientific methods to delve into nuanced perspectives and the contextual factors shaping these multifaceted systems.

The study's sample design prioritises representativeness and diversity to encompass a wide array of perspectives and experiences from various initiatives across global regional ecosystems, including Europe, America, and Asia (and examples from Africa through the established cooperation of some experts). Purposeful and snowball sampling methods were employed to select participants and cases that align closely with the research objectives. This approach ensures comprehensive insights into Innovation in governance through multi-level and multi-helix approaches, societal actor co-responsibility and the spaces and dynamics necessary for innovation to propel climate-positive transitions within the framework of a systemic triple transition.

The participant pool includes a diverse range of individuals, from young and experienced committed activists and professionals, providing a thorough view of the field. Purposeful and snowball sampling techniques facilitated the identification of relevant participants across different geographical locations, thematic focuses, stakeholder groups and levels of initiative maturity. This strategy ensures the sample reflects the heterogeneity of urban, peri-urban, and urban/rural settlements and mitigates biases.

The study conducted 17 semi-structured in-depth interviews with key stakeholders engaged in innovative collaborative initiatives, recognised as experienced or emerging leaders in transformative governance across urban, peri-urban, and rural-urban contexts. Selection criteria included geographical and diverse representativeness (including gender balance[4] with 55,6% male and 44,4% female), initiative maturity, actor diversity and thematic breadth. This rigorous selection process ensures an in-depth understanding of the varied contexts and sectors involved. The table below summarises the sample, detailing the countries and areas of expertise, such as health, cultural and creative industries (CCIs), education, public policy and social movements advocating for the rights of women, youth, minorities, and disabled individuals. This overview underscores the diverse expressions of innovative transformative governance, co-responsibility and co-creation across different contexts and sectors, with a focus on identifying examples of positive or regenerative climate change practice.

The research also integrates findings from desk research to establish the state of the art and provide a foundation for discussion and analysis. This is further complemented by advanced keyword coding using Atlas.ti for detailed analysis. This methodological approach enables a detailed understanding of the current landscape and facilitates the identification of key themes and patterns relevant to positive climate change initiatives.

[4] Note: This study acknowledges a non-binary perspective on gender. However, the sample does not include any LGBTQIA+ representatives among the interviewees.

Table 1. List of semi-structured in-depth interviews conducted with key stakeholders (arranged alphabetically by country of initiative location)

Location (country/region)	Code	Scope	Gender	Fields	Target Groups
Belgium (Europe)	I4-BE	International	F	Education, inclusion, integrity, common language, social movements	Youth, academia
Chile (Latin America)	I2-CL	National	M	Technology Education, Social Sustainability	Society, academia, public policy makers
Denmark (Europe)	I11-DK	National	M	Techno-antropology, Fire and security technologies, Information and Communication Technologies (ICT), Policy development	Society, public adminitration
Estonia (Europe)	I3-EE	National	F	Cultural and Creative Industries (CCIs) Museums, Development, Intergenerational use of media, Digitalisation	Society, public administration and local culture preservation
Hamburg, GER (Europe)	I6-GER	Regional European	M	Economy, innovation, startups, advanced technology, health, civic engagement	Public administration, ministry, civil society
Japan (Asia)	I17 - JPN	National	F	Econonmy cooperation, Public administration	Public administration, OECD, academia,
Mexico (America)	I5-MX	National	M	Digitalisation, AI, technology, culture, language inclusion, innovation and indigenous practices	Indigenous communities, civil society
the Netherlands (Europe)	I10-NL	International	M	Ecosystem redesign, Blockchain technology	Business, academia, technology
Norway (Europe)	I9-NO	International	F	Sustainable innovation, Engineering, Education, Tech transfer, Gender, Health technology	Academia, women, society
Peru (Latin America)	I1-PE	National	F	Gender Intersectional approach, Entrustment of women	Women, Society
Poland (Europe)	I7-PL	European	M	Territorial development-rural/urban, civic participation and participatory practices, CCIs	Culture institution, civil society
Philipines (Asia)	I16- PHL	National	F	Education, youth engagement, and volunteer work: Society Helix	Non profit organizations, education
Spain, Catalonia (Europe)	I8-ES	Regional International	M	Helix participation, innovation universal systems, research and innovators, governance.	Innovation ecosystems, connection and collaboration helixes
Spain (Europe)	I12-ES	Regional	F	Integration, Diversity, Education	Civil society, territory balance, public administration
Spain (Europe)	I13-ES	National	M	Politics, re-urbanization of rural areas, Territorial and social innovation	Civil society, Public sector, government, Policy makers
Spain (Europe)	I15 - ES	International	M	Youth, civic, and non-political organizations dedicated to improving society: society helix.	Young activists and civic organizations
Switzerland (Europe)	I14-CH	International	M	Sustainable energy, electrification of transport, energy policy, urban regeneration, knowledge & technology transfer.	Researchers, policymakers, energy sector, sustainable technology experts.

This study is part of a broader ongoing research project. The sample comprises representatives from Europe, Latin America, Asia, and Africa with the aim to examine context-driven urban and peri-urban climate change initiatives (e.g. community led, public policies, private-public collaborations) that seek for positive impact.

The sample for this study includes initiatives from 14 countries across Europe, Latin America, and Asia. These initiatives vary in scope, encompassing:

- **Living labs on circular economy** (e.g. Tokoro Lab, Japan)
- **Long-term institutional transformative plans** (e.g. Danish Institute for Fire and Security Technologies; Estonian National Museum; i2Cat Foundation; Norwegian University of Science and Technology);
- **Community-based projects** (Equipo Europa; Global Shapers to promote the engagement of young people),
- **European education, research, and innovation projects** (FORTH in Philippines; INTEGER in three European regions)
- **Social movements** (e.g. Xquenda_Lab in México for Zapoteca indigenous people; Mujeres Conectadas in Perú to enhance women participation in Trujillo region),
- **Local, regional, or national development strategies** (e.g. Commonwealth of Municipalities Alto Tajo, Spain; Catalonian regional strategy; Chilean national strategy for Social Sustainability),
- **European networks and Associations** (e.g. European Network of Living Labs - Working Group Energy & Environment; European Network of Cultural Centres; Education for and Interdependent World).

Most of the experts consulted possess extensive intercultural and international experience, with many having lived in multiple countries or settings. This diverse background allows them to offer a broad range of perspectives and insights.

The table provided details the country where each primary initiative is based. However, it is important to note that the interviews also cover other initiatives, whether past or ongoing, in separate locations.

Analysing the role of transformative governance in building resilient and regenerative urban and peri-urban settlements for accelerated climate transition

The urgent need of co-responsibility for accelerating regenerative urban and peri-urban settlements

This section addresses the complexity of urban systems and the need for a systemic approach that underscores holistic planning and systems thinking, especially in the context of the Anthropocene. It explores the balance between universal and singular, contextualised innovations, highlighting the role of multi-level governance in managing these dynamics. It also focuses on the enhancement of both individual and collective responsibility, highlighting the importance of co-creation as a key driver of innovation and sustainability. Furthermore, it underscores the critical role of active participation by diverse actors in the design, implementation, and evaluation of initiatives.

The complexity of urban systems requires a systemic approach, where **holistic planning and system thinking are crucial.** This approach adheres to the principle of 'all for one, one for all,' triple transition: social, green, and digital. This stresses that addressing climate change is not just an environmental issue but also an encompassing social and technological challenge.

Understanding multi-level governance which entails local/global, urban/rural, inter-regional within or across countries collaboration. This involves recognising a verticality and horizontality of actors, ranging from the most local to a broader scope, with each playing different roles in the process, tailored to institutional, regional, national, or international structures, dynamics, and purposes.

Concurrently, various authors (Di Gregorio et al., 2019; Gonzales-Iwanciw et al., 2020; Fuhr et al., 2018) have already discussed **multi-level governance**, as climate change governance has evolved into a complex polycentric structure spanning global, national, and sub-national levels, relying on both formal and informal networks and policy channels. This intricate governance framework involves state and non-state actors at various levels in formulating and implementing climate policies, reflecting the 'glocal' nature of climate change—where its impacts are locally distinct, yet solutions require multi-level governance. The global nature of climate change mitigation and the local nature of its impacts and adaptation pose specific multi-level governance challenges for policy integration. However, the cross-level interactions between mitigation and adaptation efforts remain underexplored; and social learning, defined as a convergent change in stakeholders' perspectives and understanding, is crucial in this context, as it fosters integrated solutions through collective support and concerted actions by multiple stakeholders. Studies highlight that effective climate change adaptation requires not only active participation from diverse stakeholders but also governance structures that facilitate learning and transformation. Social learning links to the resilience of socio-ecological systems, enabling stakeholders to foresee and adapt to changes, thus enhancing system resilience; while policy learning, another critical concept, involves states learning from experiences and modifying actions based on evaluations of previous policies. This process can lead to innovative policies or continuous refinements of existing ones.

As Heinen et al. (2022) affirm, polycentric climate governance and multi-level governance operate across five dimensions: governance issues, decision-makers, interactions, rules-in-use, and dependency degrees. Polycentric governance emphasises local self-regulation, while multi-level governance focuses on formally interdependent actors collaborating across government levels.

For example, in transnational municipal networks, cities operate under different rules based on national legal frameworks. Some cities engage in self-regulated climate actions, while others integrate efforts across government levels with substantial funding.

These differences lead researchers to varying conclusions on factors like leadership, trust, and self-regulation. Regarding cities, although cities like Copenhagen and Sydney take effective climate actions, many small to medium-sized ones lack appropriate strategies, highlighting the urgent need for proactive sub-national policies to limit global temperature rise to 1.5°C.

Agenda 2030 highlights the importance of multi-level adaptation governance, including non-state actors from civil society and the private sector. This implies the need for wider arenas of engagement for diverse actors to collectively solve problems and to unlock the synergies between adaptation and mitigation and sustainable development IPCC, 2022:111). (Pörtner *et al.*, 2022)

Most mitigation practices can be implemented without competing for land and can offer multiple co-benefits. Additionally, some practices can reduce the need for land conversion, increasing the effectiveness of other measures in addressing climate change mitigation and adaptation, combating land degradation and desertification, and improving food security. Many of these practices also support sustainable development and other societal goals (Smith et al., 2020). To minimise maladaptation, multi-sectoral, multi-actor and inclusive planning with flexible pathways promotes lowregret, timely actions. These actions keep options open, provide benefits across multiple sectors and systems and help define the available solution space for long-term climate change adaptation (IPCC, 2022).

Several experts, in line with the ideas of the Anthropocene, suggest that innovation processes have the potential to transform individuals and societies. One expert highlight that through these processes, individuals can undergo significant transformation.

'Subjects in one form can transform, or we can transform ourselves through these innovation processes. [Translated from Spanish] (I8-ES, 2024; 00:08:48).

Another *(I8-ES, 2024; 00:26:11)* stresses the concept of cultural innovation as a human-driven phenomenon, asserting that we are actively creating the world we inhabit. However, there is a need for a theory of cultural innovation that holds us accountable for the changes we instigate and those occurring in nature. This theory should reflect on our actions within both the human and artificial realms, recognising our responsibility as creators of the artefacts we produce. The expert notes a surprising lack of awareness among people regarding their role in this creative process and the impact it has on natural evolution. This is specially what the multi-level, multi-i model manages to solve.

Figure 3 '*multi-level, multi-vertical and horizontal interconnected perspectives*' presents a holistic approach where bottom-up, top-down and middle-ground perspectives converge, with the figure of a tornado pushing centripetal forces absorbing the innovation from the edges (Caro-Gonzalez, 2023). Busquets proposed the concept of Orchestrating Smart Business Networks (SBN) (Busquets, 2010), which complements the idea of the tornado. He analysed the network's centripetal and centrifugal forces to test the managerial functions to shape the structural dynamics of innovation. This managerial approach can create an efficient path toward innovation by managing the structural dynamics of the SBN, its network boundaries and digital platforms.

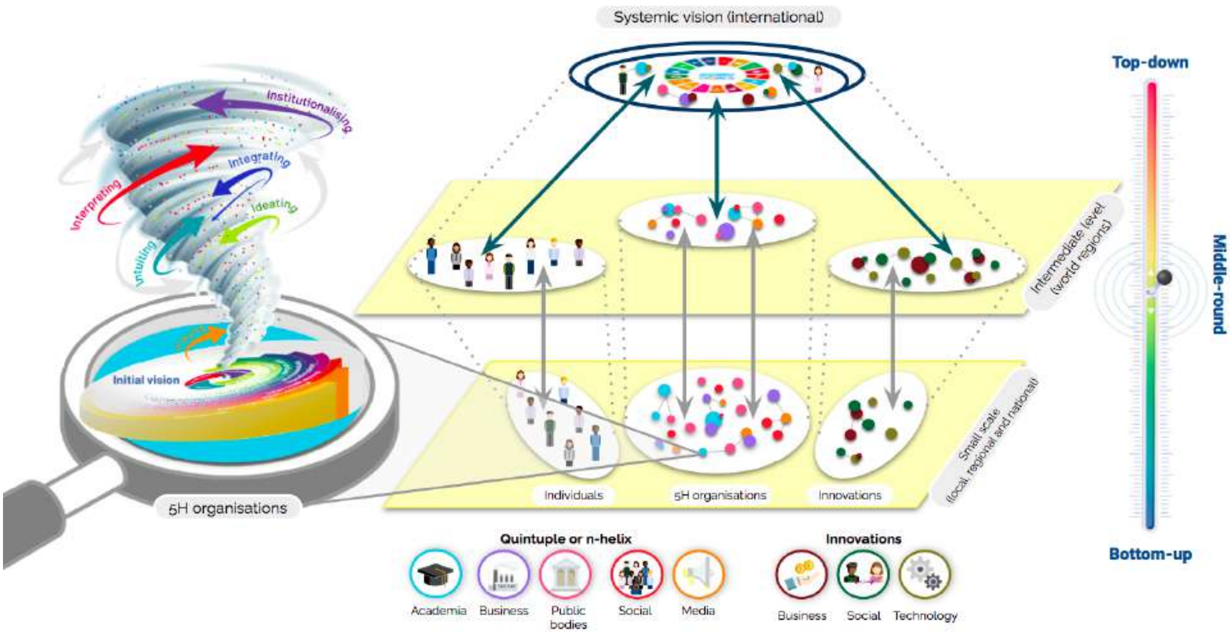

Figure 3. Multi-level vertical and horizontal interconnected perspectives (Source: Eoh-for-Good)

The lower level consists of individuals and disconnected helices and organisations. Currently, many living labs function as isolated nodes, linking people for activities such as innovation in fab labs with 3D printers and city labs, but they lack integration. Local and sub-local innovations and collaborations also tend to be isolated. However, there is a growing push at the EU level to enhance living labs from the policy level, recognising them as spaces capable of boosting bottom-level collaboration connecting people, innovations, and helices. Incorporating initiatives like European projects or networks can further advance transformative governance.

The top-down level includes policies and strategies that enable the implementation of plans, programs, and instruments at all levels, connecting them vertically. As stated in the 2022 IPCC report: integrated, multi-sectoral, inclusive, and systems-oriented solutions, along with supportive public policies, strengthen long-term resilience (high confidence) (IPCC, 2022:90).

By bringing together diverse actors and stakeholders, co-creative multi-i tornado (as portrayed in the left-hand side of figure X) become hubs of innovation, generating transformative solutions to complex problems faced by entrepreneurs, teams, organisations, and ecosystems (Caro-González, 2023:73). The base of the vortex rotates under optimal conditions provided by the inception of ideas, intra- and entrepreneurial activities, stakeholder engagement and continuous learning and adaptation. These conditions foster knowledge exchange, experimentation, and the collective development of innovative solutions, positioning these spaces as the rotating bezel accelerating the needed process of change. This rotation ensures alignment, collaboration, shared ownership, continuous improvement, and resilience amidst change. The funnel expands rapidly by drawing in innovation from its edges, including interdisciplinary collaborations, local or international intersectoral projects and community-based urban and peri-urban environmentally friendly initiatives.

Innovative spaces, tools, and dynamics for purpose-driven and future-ready resilient and regenerative urban and peri-urban settlements

'In connecting the dots, it is crucial to understand what works but more important it is what did not work across different contexts' (I9-NO, 2024; 0:07:24).

The acceleration required for climate change mitigation and adaptation in cities demands a significant increase in their capacity to rapidly transform key sectors. Focus areas for targeted efforts include rooftop photovoltaic systems, electric supply, urban forestry and improving the quality of mobility.

This section explores the importance of identifying and employing both existing and new collaborative spaces and dynamics in innovative ways. Experts interviewed highlighted this as a crucial factor in accelerating regenerative climate change. We reviewed trends with experts in formal and informal place-making for climate transition in urban, peri-urban, and rural-urban areas. These initiatives represent socially driven approaches to climate transition, underlying shared responsibility for the regions where they are implemented, as discussed in the previous section.

One of today's major environmental challenges is the use of space (land, buildings, oceans, etc.) for the deployment of renewable energies (Delgado-Jiménez, 2024). However, this issue is often only dealt with on a large scale and quantitatively and not qualitatively and poorly grounded in the urban and territorial reality. Energy policies do not always consider places and their creation, where society is at the centre.

The informal construction of places, based on bottom-up actions from communities, has a key role to play to make this transition in a fair and environmentally responsible way.

To enable individuals to work together effectively, it is essential to implement spaces, mechanisms, and dynamics that both accelerate innovation and promote collaboration. This requires diverse types of living labs, community participation platforms and collaborative initiatives aimed at exchanging knowledge, ideas, practices, lessons learned, raising awareness, or influencing public policies. These mechanisms can speed up processes by involving key agents who form a coalition of the willing (I17- PHL, 2024)—people who share the same enthusiasm or identify with a purpose and are driven by a specific theme or problem.

The last decades have witnessed the proliferation of living labs: living labs, fab labs, collaboratories, superlabs, policy labs and other "labs" are trying to change the innovation ecosystems as an important part of our social fabric. "The Lab" could be a term that symbolises all these dispersed and unconnected pieces of a new social structure, which can be classified by:

a) **focus area** with living labs addressing a wide range of issues, from urban mobility and sustainable urban development in Urban Living Labs, to agricultural innovation and rural development in Rural Living Labs. Health and Wellbeing Living Labs focus on digital health and elderly care, while Environmental Living Labs tackle climate change mitigation and water management. Energy Living Labs concentrate on renewable energy and energy efficiency and ICT and Digital Innovation Living Labs advance technologies like the Internet of Things (IoT) and cybersecurity. Social Innovation Living Labs promote social inclusion and community development, whereas Cultural and Creative Living Labs support the digital culture and creative industries. Educational Living Labs foster EdTech, and lifelong learning, Transport and Logistics Living Labs innovate smart transportation and Manufacturing Living Labs advance Industry 4.0. Food and Agriculture Living Labs ensure food security and sustainable farming.
b) **geographic scope** referring to the geographic reach of living labs. Local Living Labs focus on city or community levels, while Regional Living Labs cover multiple localities. National Living Labs engage actors at the country level and International Living Labs operate across borders, involving multiple nations.
c) **operational models** which vary from university-based living labs, corporate Living Labs, government-led living labs, community living labs, to public-private partnerships.

In addition to the ones explained by Kern (2019), several other types of instruments and dynamics facilitate collaborations in the context of polycentric and multi-level climate governance. One example are the urban living labs, designed to promote collaboration among diverse actors and, through their experimental sites, are recognised for their contribution to long-term sustainability transitions. They play a crucial role in the co-creation process, involving multiple stakeholders in developing and testing new strategies, agendas and actions aimed at creating sustainable cities. Test beds and living labs also represent an experimental, co-creative approach to innovation policy that aims to test, demonstrate and advance new sociotechnical arrangements and associated modes of governance in a model environment under real-world conditions (Puerari et al., 2018; Engels et al., 2019). Moreover, authors like Prats (2019) highlight the role of public-private partnerships, "as instruments to enhance the scope and efficiency of public investment by integrating the design, financing, construction, operation and maintenance phases of an infrastructure project". There are also other climate action and multi-stakeholder platforms and networks, aiming at connecting agents to facilitate dialogue and implement joint climate initiatives (Betsill & Bulkeley, 2021).

These dimensions and models illustrate the diverse origins supporting these bottom-up initiatives that link innovators across various contexts (communities, cities, regions, territories). They respond to diverse needs and align processes, interests, and rhythms around shared or negotiated purposes, such as energy sustainability interventions within urban buildings (e.g. Sunthalpy efficiency solutions).

The multi-helix model (e.g., quadruple or n-helix) expands collaborative spaces and initiatives by including multiple sectors (government, industry, academia, and civil society) in the governance process. This promotes innovation and systemic transformation by leveraging the unique strengths and contributions of each type of actor. Living labs, which operate on the quadruple, quintuple, or n-helix models, provide scenarios for rapid co-design, co-creation, experiment, learn and upscaling urban and peri-urban positive environmental solutions in real-time.

In most interviews, the lack of proper spaces for collaboration is frequently mentioned as a key factor for identifying problems, sharing the responsibility, and enhancing an orchestrated approach for finding solutions *(I9-NO, 2024), (I6-GER, 2024), (I7-PL,2024) & (I8-ES, 2024)*. As one interviewee pointed out:

'In the realm of environmental sustainability, it is evident that many initiatives struggle to engage the right audience because the necessary platforms or venues for effective outreach are lacking. The issue is not that the message does not reach anyone, but rather that it fails to reach the specific audience that needs to make impactful decisions' [Translated in Spanish] (I2-CL, 2024; 00:05:16).

Various organisations, such as museums, transnational networks and living labs, serve as essential mediating spaces for multi-level and multi-helix collaboration. These entities play a pivotal role in facilitating knowledge exchange and fostering partnerships among diverse stakeholders. By enabling innovative solutions and promoting shared responsibility across sectors and governance levels, they significantly contribute to the acceleration of positive climate change.

Museums, for example, are particularly effective in connecting with the public and helping other sectors understand community needs and behaviours. Their role as mediators extends beyond their immediate function, influencing broader societal engagement and the mediation must be professional and neutral:

'If I think on museums, then the strong point that I find is that they are close to people in my point of view. So this is the perspective but we are able to help the other helices, understand how to work with people, what their needs are, how they use some things so I can see that our museum is quite a lot like this ***mediator*** *in this sense for other areas' (I3-EE, 2024; 1:10:44).*

Transnational networks and alliances are also crucial for the success of climate initiatives, offering opportunities for international cooperation and open, disruptive, or user-driven innovation.

'So, this vision of forming transnational alliances and networks is crucial for the success of these kinds of initiatives. We hope that we can effectively manage these opportunities in a positive way [Translated from Spanish] (I5-MX, 2024; 0:16:34)

'Let's say to innovate as a society by creating spaces that democratise innovation and creativity, allowing everyone to redesign their own lives and their cities' [Translated from Spanish] (I5-MX, 2024; 00:08:36)

Similarly, living labs provide multi-sectoral, multipurpose platforms that underline altruism and the common good, building value for cities, the environment, and the achievement of Sustainable Development Goals (SDGs).

'Multi sectoral, multipurpose tools like the living labs allow to select people doing the right things and be a crucial aspect for the common good not immediate being a stakeholder with stake specifically for their own existence and self-interest. Is the altruistic aspect of living labs that need to be emphasised. To build value for the city, environment, and SDGs' (I14-CH, 2024; 1,16'06'').

These collaborative spaces often involve multiple stakeholders boosting dynamics of working together (e.g. vocational educational training, social services, small businesses, public sport centres, etc.) to define the issues at hand and then jointly develop strategies to address them. This is well portrayed in one of the cases analysed which aligns the vocational training of individuals with intellectual disabilities with their empowerment as individuals, their integration into the workforce, more sustainable urban mobility, healthy lifestyles, and urban environmental care. This is achieved through the development of holistic solutions that address interconnected needs as explained in the novel initiative that many municipalities have overlooked.

A good example is the concept of inclusive bicycles for children and young people with special needs:

"Something that no one had thought of was making inclusive bicycles for kids who can't get on regular bikes due to special needs; they need more stability and hence a tricycle. While municipalities have implemented electric bicycles to decongest traffic and promote healthy transportation, they have not considered those who cannot use them" (I7-ES, 2024, 1:06:34).

By engaging diverse perspectives, participants can pool their expertise, leading to a more comprehensive understanding of the challenges and a greater commitment to implementing effective solutions. This approach not only enhances the quality of the outcomes but also fosters a sense of collective ownership and accountability among those involved.

These innovative spaces also provide opportunities to address ecological disasters and promote social innovation through private initiatives, as pointed out by one interviewee:

Specifically, here, for example, near Riverside, there are cases of terrible ecological disasters that have affected many indigenous populations, so we need to decide who to work with and why, and how, without participating in any form of greenwashing. However, there are many companies, like Microsoft, that are trying to generate programs promoting social innovation within their companies, enabling ecosystems for business. Microsoft, for instance, is enabling its labs and courses like TEALS or TechSpark and a variety of programmes that facilitate access to technologies' [Translated from Spanish] (I12-MX, 2024, 00:00:00).

These initiatives highlight the importance of the private sector involvement in driving regenerative climate change and the potential for businesses to act as catalysts for social and environmental innovation.

The transboundary nature of many climate change risks and species responses will require transboundary solutions through multi-national or regional governance processes on land (IPCC, 2022:111).

This is the reason to apply the multi-i model. Why is it called multi-i?

Because it unfolds combinations of collaborative dynamics with several dimensions *that start with 'i': interpersonal, intersectional, interdisciplinary, interhelix, intersectoral, intergenerational, intercultural, inter-institutional, inter-regional and international (Caro-Gonzalez, 2023: 59-73). These interactions foster innovative co-creation and collaboration processes within and across institutions, sectors, and contexts. These approaches ensure that solutions are context-specific, socially inclusive and can become more broadly supported.*

The multi-i transformative governance for innovation, involves active engagement and alignment of relevant parties, including internal and external partners, ensuring collaboration and shared ownership of the change process. Eoh-Labs and capacity-building initiatives operate alongside our interdisciplinary action-research collaborative methodology, which is rooted in a human-centred approach (Vrontis et al., 2020; Iandolo et al., 2024) and prioritises experimentation over mechanistic processes.

Transnational organisations, networks, living labs and other initiatives act as intermediary points to establish connections across different spaces and levels as will be explored further in the following section. Interdisciplinary and intersectoral collaboration is essential in this context. By integrating knowledge from various fields and involving citizens in decision-making, governance can become more responsive and effective in addressing the complex challenges of climate change (Degroot et al., 2021). As highlighted by the expert operating in Denmark:

'And when do we understand? What is the knot for? Well, suddenly, the one who has more experience in a subject can contribute and we all come to that agreement, and we build in an interdisciplinary way [...] when we talk about transdisciplinary it is no longer the discipline. For example, it is one thing to have engineers and sociologists and another thing to have a discussion with a citizen as the citizen will bring a completely different approach.' [Translated from Spanish] (I11-DK, 2024, 00:07:35).

New disciplines like techno-anthropology or techno-sociology are trying to blend social sciences and design (Børsen, Botin, 2013; Matus et al., 2018) to include diverse perspectives and expertise, going beyond traditional disciplinary boundaries and to create inclusive and comprehensive solutions. Having change agents trained in this hybrid subdiscipline of engineering and social sciences facilitates processes by providing a mediator who does not belong to a single discipline but can cross their boundaries. This allows them to seek agreements and new interpretations that can be accepted by all stakeholders. It also stresses the importance of understanding how climate change has shaped human history and the uncertainties in measuring its impact across different spatial and temporal scales.

Environmental changes in cities and peri-urban settlements are moving typically slowly. One of the urgent needs is to accelerate regenerative urban and peri-urban climate action to enhance both individual and collective responsibility. As stated by one of the experts:

'The type of acceleration that climate change mitigation and adaptation will require from cities require as a jump in the capacity of cities of moving fast and transform around few sectoral issues like rooftops pb, electric mobility and urban forest the quality of mobility' I14-CH 1,16'06''

For this, different experts and practitioners are advocating and implementing novel flexible, adaptable, collaborative and co-creative methodologies with capacity to promote resilient and regenerative urban environments (e.g. Use blockchain for transformative change, with the aim to create inclusive ecosystems; I10-NL 2024), (e.g. development of artificial intelligence tool capable of recognising patterns of Zapotec culture, fostering the democratisation of innovation of the indigenous culture; I5-MX 2024) and (e.g. the Eoh-Methodology multi-i transformative governance©, Caro-Gonzalez, 2023).

Employing co-creation is crucial for fostering innovation and sustainability, as it facilitates discussions and decision-making processes and broadens collaboration, engagement, and entrustment1 of society. This approach helps in reaching strategic goals and making citizen engagement a goal. The critical point here, which makes companies like Eoh-for-Good and professionals such as techno-anthropologists and well-trained change agents imperative, is that poorly guided co-creation does not work, is not sustainable or leads to short-lived agreements.

Moreover, the flexible, formal, and informal setups of co-creation within urban (or peri-urban or urban-rural settled) living labs ensure diverse participation, creating dynamic environments where long-term and short-term goals can be pursued simultaneously, promoting an inclusive and innovative urban development culture (Puerari et al., 2018). The interlinked purpose of co-creation strengthens the development of solutions and shared resources by increasing participants' sense of ownership and commitment, enhancing the likelihood of successful and sustainable outcomes. To tackle climate change in urban and peri-urban areas, we must unite all levels of governance and secure broad funding to ensure efforts are aligned and effective. As one of the experts interviewed stated, we can recognise the importance of the interrelatedness between urban, peri-urban, and rural settlements and contexts:

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[1] We use the term 'entrustment' instead of 'empowerment' because the latter implies that empowering one group of the population means 'disempowering' another.

'Here, you have an ally in anyone who wishes to contribute to the common good, particularly in the context of the numerous rural communities across Spain. These villages are the foundation upon which our cities have been built, reflecting the hard work and dedication of previous generations—our grandparents and great-grandparents. Just as these rural areas once served as vital engines of development, they now have the potential to benefit us all. The key takeaway is that by focusing on and supporting rural areas, we can address many of the pressing issues currently faced by urban centres, such as housing affordability, transportation challenges and pollution.' I13-ES (43').

Many problems are intrinsically linked and therefore, addressing rural depopulation is crucial for managing urban overpopulation.

Collaborative methodologies and co-creation involve the co-responsibility and active participation of diverse actors in the design, implementation, and evaluation of initiatives, allowing motivated individuals or 'early adopters' to become agents of change, who must have a sparring partner and proper capacity programmes. This approach aligns the needs, interests and innovations of both individuals and institutions into co-creative governance networks. It employs a novel socio-digital innovation design which transforms challenges into solutions through collaborative efforts of multiple actors.

A two-way interaction and feedback mechanism is essential for social-digital-technology-driven innovators. They need to collaborate in new spaces to find effective solutions. This approach ensures that all participants can become integrated into the entire ecosystem:

"the next step is how can you, when you are a community, working together, collective action, you create value for somebody and it is offered to the whole community" (I10-NL, 2024, 0:27:00) and "everybody who is participating, whether as a developer, or as a user, or as a founder… they can all become part of the whole ecosystem" (I10-NL, 2024; 0:16:50).

Such inclusivity ensures that solutions are not only technologically sound but also socially acceptable and widely adopted. The focus should be on creating value for the community through collective action, as noted:

"The next step is how can you, when you are a community working together with collective action, you create value for somebody and this is offered to the whole community" (I10-NL, 2024; 00:16:27).

This community-centric approach fosters resilience and adaptability, essential for addressing the dynamic challenges of climate change. Despite the need for structure and specific requirements, templates should also offer enough flexibility to encourage people to explore new research ideas and innovative solutions, allowing for creative freedom. Explore how this balance can encourage people to submit diverse and potentially pioneering proposals aligned with the triple transition's innovative goals (Rodriguez Müller et al., 2024):

'It is, in some way, excluding people who have not been privileged within this system due to social structures that have been imposed for centuries' [translated from Spanish] (I5-MX 00:08:40)

This principle is connected to the principle of "no one left behind" and is particularly important for women, indigenous people, and minorities. Integrated, multi-sectoral solutions that address social inequities, tailor responses to climate risks and working across systems can enhance the feasibility and effectiveness of adaptation in various sectors. (IPCC, 2022:21).

Conclusions and policy recommendations: advancing multi-Actor, multi-Level, and multi-helix collaborative governance through next-generation T-Shaped living labs

Addressing environmental challenges in urban, peri-urban, and rural settlements often progresses slowly, necessitating coordinated and aligned action across multiple factors and initiatives. Without such synchronisation, efforts to resolve environmental problems may lack the necessary pace, impact, and efficiency. This study highlights the potential of the T-Shaped concept (Shabnam et al., 2016) as a framework for enhancing multi-level transformative governance. The T-Shaped model, characterised by deep expertise in specific areas (the vertical bar of the "T") and the ability to collaborate across disciplines (the horizontal bar), is particularly effective in accelerating positive climate transitions. By integrating specialised knowledge with cross-sectoral collaboration, this model fosters comprehensive and coordinated efforts essential for addressing complex climate challenges.

To enhance responsiveness, accountability and adaptability in climate governance, this study proposes the development of a new generation of T-Shaped living labs, encompassing quadruple, quintuple, or n-helix models. These labs serve as neutral and inclusive environments for co-creation and experimentation, supporting the development of innovative solutions and policy strategies to address complex societal challenges. T-shaped living labs are collaborative spaces designed to integrate deep expertise in specific areas (the vertical axis) with broad, interdisciplinary collaboration (the horizontal axis). These labs foster innovation by bringing together diverse stakeholders to co-create solutions for complex challenges, such as climate change, through a balanced approach that combines specialised knowledge with cross-sectoral engagement.

T-Shaped living labs ensure that solutions are contextually relevant and meet real-world needs by promoting collaboration, learning and the integration of multiple actors in the innovation process. Moreover, they offer mechanisms for evaluating the impacts of policies and initiatives, ensuring that governance structures remain adaptable and impactful. These labs, as cooperative instruments, underscores a peer-to-peer approach between business, social and technology-driven innovations (Caro-Gonzalez, 2023).

The systemic perspective represented by the horizontal line of the T is crucial for analysing and understanding contextual factors within these settings through a holistic approach. This approach considers long-term visions, identified needs, immediate responses and shared or negotiated agendas, leading to inclusive, win-win collaborative dynamics that yield mutually beneficial outcomes.

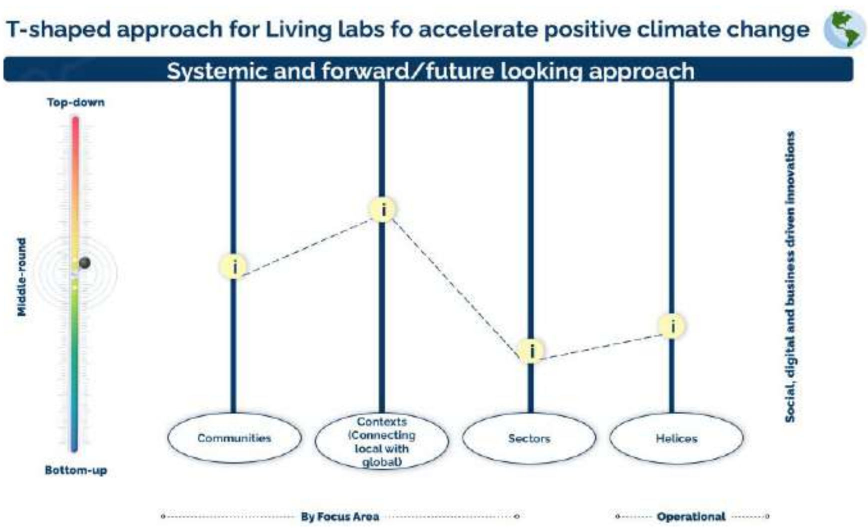

Figure 4. New generation of T-Shaped living labs (Eoh-for-Good©)

Analysis of existing initiatives suggests that T-Shaped living labs should be founded on several underlying principles, including "leave no one behind," "inclusion and diversity," "from ego-centric to eco-centric approaches," and the "no harm principle" (Caro-Gonzalez, 2024:36-40). Additionally, the T-Model deepens vertically along several lines, such as:

1. Communities engaging diverse individuals and organisations.
2. Context-driven connecting local and global agendas in a hyper-globalised world.
3. Fields or related sectors addressing the acceleration of climate transition.
4. Helices integrating multiple stakeholders in the innovation process.

The diverse and representative sample in this study ensures a comprehensive perspective on the varied strategies and practices employed in different urban and rural contexts. By capturing detailed narratives and in-depth insights, this research contributes valuable knowledge to the field of climate change governance and innovation, laying the groundwork for more effective and inclusive approaches to fostering positive environmental outcomes on a global scale.

The emergence of T-Shaped living labs represents a new generation of decentralised governance models that could serve as critical bridging spaces for co-creating negotiated solutions. These models enhance multi-level and multi-actor engagement by integrating multi-helix dynamics to promote initiatives for the common good. Such spaces are particularly relevant for accelerating the climate transition, shifting from destructive patterns towards regenerative ones.

There is also a pressing need for more coordinated co-creation efforts and the international exchange of examples of radical action. Developing new policies and measures that achieve broader political acceptance should be underlined. Active engagement of citizens and diverse actors is crucial for the success of transformative governance. Policymakers should prioritise mechanisms that facilitate inclusive participation, such as public consultations, participatory budgeting, and collaborative platforms. These approaches help foster a sense of ownership and co-responsibility, driving sustained and collective action toward accelerating positive climate change.

Addressing climate change in cities and peri-urban and rural areas requires a comprehensive analysis that acknowledges the interconnectedness of these issues with others.

For example, tackling urban overpopulation should involve efforts to reverse rural depopulation, addressing two critical issues simultaneously for more effective solutions. Urban and rural environments are interdependent, with cities relying on rural areas for raw materials and rural regions depending on urban centers for services and products.

Another critical consideration is the unique conditions of each city or location where an initiative is to be implemented. While this may seem obvious, it is essential to recognize that every cities or peri-urban settlement's circumstances, context and challenges are distinct, with local culture and character playing significant roles. Decision-making processes must be tailored to the specific needs of each location, as strategies that succeed in one city may not necessarily be effective elsewhere. Involving all relevant stakeholders in the decision-making process is crucial to ensuring co-responsibility and practical, beneficial outcomes. This approach aligns with the quintuple helix model, which engages a broad range of actors—from citizens to businesses—in the planning and implementation of solutions.

In conclusion, addressing and accelerating regenerative climate change in urban, peri-urban, and rural areas necessitates a multifaceted strategy that integrates innovative transformative governance, individual and collective responsibility among societal actors and the design and implementation of new frameworks for innovation, such as T-Shaped living labs.

This study underscores the importance of incorporating expert perspectives, which confirm the advantages of this new generation of living labs. These labs must clearly promote principles of interdisciplinarity and rigour to specialise knowledge and develop effective, inclusive, and sustainable solutions. We can create impactful strategies to mitigate the anthropogenic effects of climate change and drive positive environmental outcomes by fostering well-trained agents of change, interdisciplinary collaboration, engaging all stakeholders and leveraging these advanced living labs.

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ENoLL is an international non-profit association based in Brussels (Belgium), which aims to promote and enhance user-driven innovation ecosystems, more precisely the Living Lab concept, globally, ENoLL focuses on facilitating knowledge exchange, joint actions, and project partnerships among its historically labelled +480 members, influencing EU policies, promoting the Living Labs and enabling their implementation worldwide.

The ENoLL network aims at creating pan-European experiments and prototypes for new markets, based on the Digital Single Market. It is an open engagement platform where new business models can be co-designed, experimented with, and developed, all based on a quadruple helix approach, creating safety nets for experiments and prototypes with new roles of the public sector as enabler and catalyser. ENoLL combines European vertical specialisation domains (health & wellbeing, agriculture and agrifood, social impact of AI, energy & environment, culture & creativity, social innovation, mobility, etc.) with horizontal and territorial specialisation.

The ENoLL members (host organisations of the Living Labs or ecosystems) are mainly research institutions, public local and regional authorities and agencies, public-private innovation actors, or private companies. They all represent a community of change makers that have contributed over the years to generate business and societal positive impact through open and user driven innovation. ENoLL is active in 19 of the 28 EU member states, and in 4 of the candidate states. It is present in all the continents with around 20% of members based out of the European Union. The whole list of ENoLL members can be found at https://enoll.org/our-members/.

As a legal entity, ENoLL international association focuses on facilitating knowledge exchange, joint actions, and project partnerships among the members, promoting Living Labs and enabling their implementation worldwide, thus influencing public policies.

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