Building a Living Lab Learning Framework
Understanding the types processes, levels and outcomes of learning in living labs

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"Living Labs for an Era of Transitions"

How human-centric innovation is changing our lives

European Network of Living Labs

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"Living Labs for an Era of Transitions. How human-centric innovation is changing our lives"

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

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Top Contribution Research Session

Thursday, 21st September 2023

11:00 – 12.30 CEST

Sur 3-4

Research-In-Progress Paper

Reframing Transition Pathways and Values Through System Innovation Across 9 European Regions.

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Abstract

This is an account of an ongoing participatory research involving 9 European regions at the forefront of climate change. Within the framework of ARSINOE, a Horizon 2020 project developing regional adaptation pathways and strategies across 15 countries, we implement the System Innovation Approach, a practice-based framework for innovation based on Living Labs where diverse pools of stakeholders self-assess the state of their system and co-design adaptation pathways. Living Labs are developed through a series of three workshops, each with a particular focus.

Preliminary results show that the specifics of each territory act as triggers of situated strategies and actions that respond to challenges in novel ways. Beyond local problem-solving, the process reveals that 1) reframing problems from a holistic perspective is essential to unveil major blockers and opportunities currently overshadowed by partial viewpoints; 2) community well-being and care are perceived by Living Lab participants as core drivers for collective action; 3) finding new ways to address long-term social trends and transforming existing legal and financial frameworks are crucial to leveraging positive transitions; 4) the main types of innovations required are socio-technical, rather than technological, in nature.

Key words

Resilience, innovation, climate change, participatory research.

Introduction to ARSINOE

ARSINOE – Climate-resilient Regions Through Systemic Solutions and Innovations – is a Horizon 2020 project that aims to build an ecosystem for innovative climate change adaptation across Europe. Coordinated by the University of Thessaly (Greece), it brings together 41 partners from 15 countries gathered in 9 case studies to co-design innovative pathways for resilience with local stakeholders through a participatory process.

Case studies are designed to address specific climate-related challenges, such as urban heatwaves, flooding, water management, heritage preservation, and biodiversity loss. The selected regions are the Athens metropolitan area (case study 1), Mediterranean ports (case study 2), the Main river region in Germany (case study 3), the transboundary Ohrid and Prespa lakes region (case study 4), the Canary Islands (case study 5), the transboundary Black Sea region (case study 6), Southern Denmark (case study 7), the Torbay & Devon County in the United Kingdom (case study 8) and the island of Sardinia (case study 9).

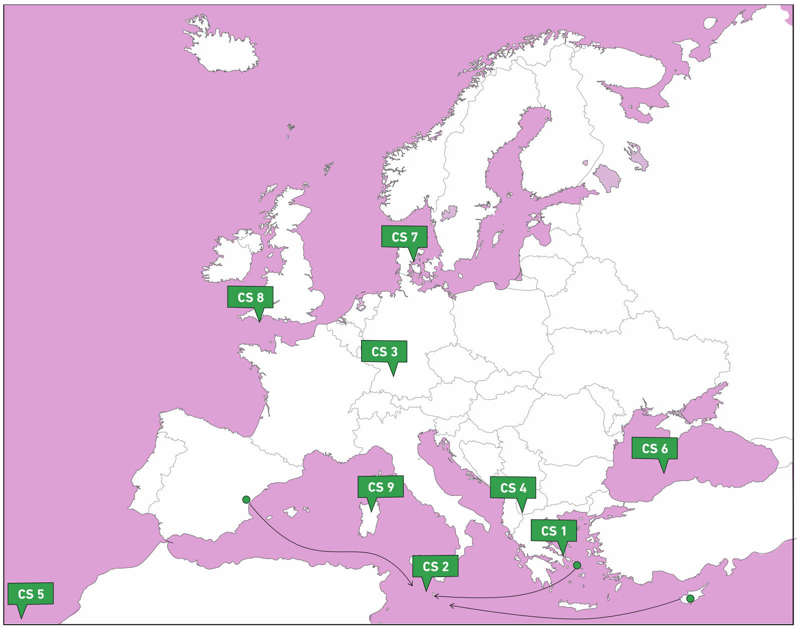

Figure 1. The nine ARSINOE Case Studies

System Innovation Approach and the Living Labs

Complexity results from the interconnectedness of interactions between different subsystems and their environment [1]. Because climate-related problems are open, complex, dynamic, and networked, they cannot be split up into smaller parts that could be dealt with more easily (as in conventional problem-solving), without risking severing key relations, that will need to be re-established later in the problem-solving process, “when they will present themselves as flaws in the solution or, indeed, as fresh problems” [2:10]. Moreover, while problems are often framed from technical perspectives alone, yet excessive focus on technical aspects may prove harmful in the longer run: “When new technologies are used to eliminate well-understood system failures or to gain high precision performance, they often introduce new pathways to large scale, catastrophic failures. […] these new, rare catastrophes have an even greater impact than those eliminated by the new technology” [2]. Therefore, even though our goal is to find solutions, it is questions, not answers, that we need to look for, because once problems are correctly framed, solutions immediately exist. All that is needed is to *dis-cover* them, as Bergson famously argued. Hence, the main innovation in our project lies not at the level of solutions, but at that of problem framing, which, in return, produces innovative outcomes at various levels.

Because human practitioners are the adaptable element in such systems [2], it is crucial that challenges are framed through a dynamic, multi-stakeholder perspective.

Within ARSINOE, we implement the System Innovation Approach (SIA), a methodological framework based on Living Labs, where a diverse pool of stakeholders self-assesses the state of their system, work together toward transformative visions, and co-design adaptation pathways for their region. SIA relies on systems thinking, design methods, and situated knowledge to address complex challenges, by examining the underlying structure of a system, seeing relationships, patterns, and cycles [3]. Local Living Labs produce visions of the future that describe the values, functions, order, and means shared among stakeholders, aligning interests and framing problems as the process unfolds. Then, trajectories to face climate challenges are co-created, enabling experts, decision-makers, and citizens to move beyond the current state and envision future scenarios that deviate from the expected curse of actions through transformative actions at multiple levels.

Through SIA, we assess interconnectedness among system components (decisions, decision-makers, stakeholders, resources, organizational setups, emergent behaviors, and cultural identity), within a specific time frame. This broad view can help identify the structural causes of issues and know just where to work to address them.

ARSINOE’s Living Labs take the form of three workshops. Convened every 6 months, each one addresses a specific goal and produces a pre-defined set of outputs. The first workshop’s main goal is *mapping*. Participants draw a mental map of the system's current state, including stakeholders, processes, issues, and challenges, and formulate a problem statement. This material serves as the basis for *envisioning*, –the second workshop's main activity–, with the goal of producing a future vision for the region and defining a timeframe for transformation. Finally, during the *backcasting* exercise carried out in the third workshop, participants co-design pathways for resilience, adaptation, and sustainability, working backward from the future vision produced in workshop 2.

So far, we have implemented the first two rounds of workshops across the nine case studies and are about to begin the third. Convening the first workshops was often challenging: sometimes, stakeholders envisioned Living Labs as ways to validate pre-existing strategies, policies, and plans; in other cases, research teams saw workshops more as spaces for data collection than as opportunities for problem refinement. An important shift in perspectives took place during the process, as participants began to take ownership and carry the workshop's concerns beyond their initial circle.

The following section provides an overview of the general trends observed during the first round and discusses the significance of the proposed exercises.

Reframing transition pathways

All first Living Lab workshops began with a presentation of local challenges, followed by a collective mind-mapping exercise where keywords trigger thematic exploration to produce a new frame. Case study teams pre-selected between 4 and 6 major drivers, such as "water", "biodiversity" or "heatwaves". Participants were asked to suggest new topics from the original ones, and to draw connections between topics, discussing and explaining reasons behind choices. The outcomes were an entwined, messy diagram representing a snapshot of the current state of the system from the participant's perspectives, and a draft problem statement based on the mapping activity.

Between workshops one and two, research teams worked on refined versions of maps and problem statements, validated by participants at the beginning of the second workshop. Maps and statements consistently showed that the core issues identified by participants did not fully match the researcher's initial hypothesis, revealing hidden blockers and blind spots underneath well-known issues. This result not only confirms the added value of the SIA for transition-framing processes, but also reveals how this type of action research positively impacts other methods and tasks carried out at the project's level.

A good illustration can be found in Case study 8's experience. Torbay&Devon County (UK), where this case study is located, is a coastal area highly vulnerable to flood. The ARSINOE research team studies the effects of flooding on the water supply network, the local environment, infrastructure and healthon Beyond the workshop's core exercise, team members involved in modeling activities wanted to take the opportunity to gather feedback on the model's design.

Figure 2. Workshop facilitator with participants.

Core ideas pre-selected by the local research team placed particular emphasis on flooding interactions, with "water", "environment", "health", and "infrastructure" as the key drivers. During the exercise, however, the topic of "community" emerged as a central component of regional resilience, shifting the approach to modelling. Not only is "community" a new parameter to be incorporated in the models, but also, importantly, the very fact that an unforeseen driver may emerge triggers an evolution in the model's structure to include new parameters on the fly over the curse of the project.

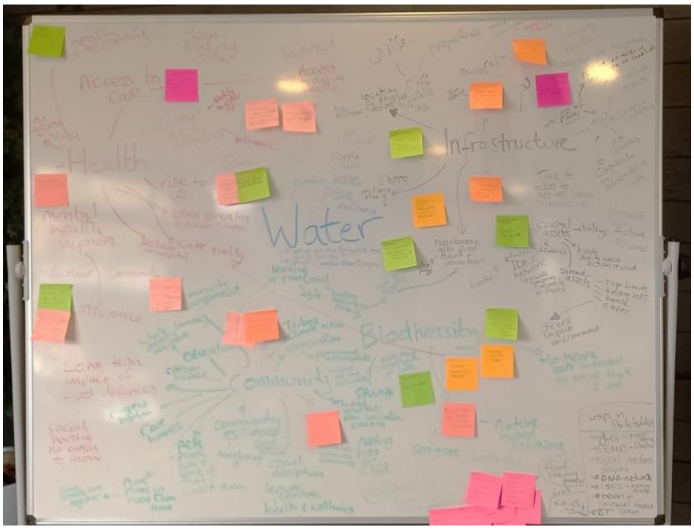

Figure 3. Map of the system produced during the first Case Study 8 workshop.

Another interesting example was provided by Case Study 9 (Sardinia). This group works on the Water-Food-Energy nexus, with a specific focus on durum wheat production chain transformation to ensure optimization of water and land management, sustainability and production stability. The initial framing, "Food security in climate change conditions" focused on well-defined questions with known answers: Increasing yield, improving sustainable food production, adapting to climate change, enhancing short chains, raising awareness in consumers, and improving information on food safety. During the workshop, however, the group's discussion shifted towards the need to grant good quality food access for everyone, a more complex socio-technical challenge that cannot be addressed through concrete, actions alone, but instead, requires a shift in the values underpinning food production and social relations in the region. Triggering a shift in stakeholders' priorities, from initial concerns to more community-oriented values in which ensuring the right to food for everyone seems more important than economic growth alone.

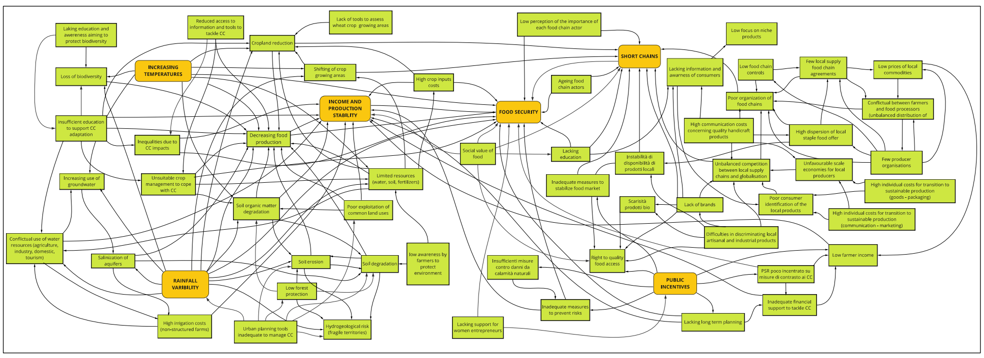

Figure 4. Refined system map for CS9 elaborated from initial workshop inputs

Preliminary conclusions and next steps

Designing efficient transition pathways demands new forms of problem-framing that take full account of the complex reality of contemporary societies and environments. The System Innovation Approach provides a general framework to implement participatory research involving diverse stakeholders and perspectives. To achieve its full potential and trigger transformative actions, the methodology relies on local geographies, situated knowledges, and social dynamics.

Beyond local problem-solving, the implementation of the first round of SIA workshops in ARSINOE reveals that 1) reframing problems from a holistic perspective is essential to unveil major blockers and opportunities currently overshadowed by partial viewpoints; 2) community well-being and care are perceived as core drivers for collective action 3) finding new ways to tackle long-term social trends and transforming existing legal and financial frameworks, are crucial to leveraging positive transitions; 4) therefore, the main types of innovations required to achieve resilience and successfully implement transition pathways are socio-technical, rather than technological, in nature.

The next steps involve shaping desirable future visions based on problems framed in the first workshop and co-designing the path from that vision to the present day, identifying milestones and innovation gaps. Outcomes from this process will help shape other ARSINOE tasks, such as modeling, governance analysis, innovation pathways, financial tools, and calls for innovations, all of which will have a direct impact on stakeholders and communities and may become examples of best practices for other regions, in Europe and beyond. In this sense, we expect to maximize the impact of this project, facilitate inclusive transitions, and produce better research.

Acknowledgments

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Research-In-Progress Paper

Blue Transitions in the Black Sea: Living Labs as a tool to support the transition to a sustainable blue economy in the Black Sea

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Abstract

This paper captures an ongoing joint initiative which spans three EU-funded projects active within the Black Sea region, each utilising living labs to support the overall development of the Blue Economy in a sustainable manner. The Black Sea is a complex resource-rich socio-ecological ecosystem nestled within a dynamic geo-political space, thus providing both fundamental challenges and great opportunities within the Blue Economy sectors. Each of the projects adopts diverse yet complimentary focii in terms of stakeholder groups, geographic location, thematic focus and level of governance. The paper outlines the overarching methodology of Systems Innovation for Blue Transition implemented by the initiative, before presenting each project and the activities undertaken therein. The paper concludes on the potential implications held by emerging findings, both methodological and thematic, on the sustainable development of the Blue Economy and related policy in the region.

Key words

Living Labs, Co-creation, Blue Economy, Black Sea, Systems Approaches

Introduction

The Blue Economy represents the overall contribution of seas, oceans and other marine or aquatic ecosystems to a nation or a region's wealth. The EU's Blue Economy is recognized as a major driver for development within Europe, and is clearly identified as a priority area for growth [1]. At the same time, European seas are overexploited, being placed under multiple pressures from human activities [2], this has led the European Commission to acknowledge the need to transition toward a sustainable Blue Economy [3]. This can only be achieved through the preservation of marine ecosystem services and their resilience towards the multiple anthropogenic stressors.

Figure 1. Map of the Black Sea

Located in south-eastern Europe, on the outer limits of the EU, the region is regarded as a 'strategic bridge', an economic, geopolitical and trade corridor of strategic importance, connecting to the Mediterranean Sea, and Europe with Asia and the Middle East. It is a dynamic, heterogeneous region characterized by the countries' great economic potential, diverging interests [4] but also an open conflict. That said, the Blue Economy within the region is still largely under-developed [4], with vast reserves of untapped potential for economic development. Its significance for the development of the region was formally recognized by the key regional actors in the Burgas Vision paper [5] and the Common Maritime Agenda [6]. The Black Sea itself, despite being resource-rich, also exemplifies the current poor environmental status of European Seas, and is widely regarded as one of the most polluted seas on the globe. The poor water quality has had a significant impact on fish populations, and the diversity of species is gravely threatened. The negative environmental effects of the poor ecological status inevitably harbour socio-economic consequences on employment, food security, tourism and health; thereby calling for an urgent transition towards a more sustainable development trajectory within the Blue Economy.

Through 3 different EU Horizon funded projects, Living Labs (LLs) are being implemented to support this transition, bringing stakeholders at the core of the strategy. This current research-in-progress paper seeks to share with the Living Lab community insights from the current experiments on 1) how LLs are used in the context of the "blue transition" 2) how a system innovation approach has been implemented to trigger transformative processes, 3) how collaboration across EU projects strengthen stakeholder engagement impacts.

Methodology

A System Innovation Approach for Blue transition

The System Innovation Approach (SIA) is a methodological framework which enables systemic change based on an interconnected set of innovations, where each influences the other; with innovation both in the parts of the system and in the ways in which they interconnect. SIA is rooted in system thinking [7], and its implementation within the context of the research draws on transition management [8;9] in order to deal with persistent problems and facilitate sustainability. It is based on a highly participatory methodology where stakeholders are actively engaged in LLs, resulting in the co-identification of an interconnected set of innovations to drive the desired transition. In this context, LLs act as open innovation spaces which foster co-creation with users, the end result is expected to better solve stakeholder needs. Stakeholders are engaged, from many different domains and scale-levels, in solving problems oriented activities, co-production of knowledge and co-design of solutions in an iterative process [10;11]. They are actively involved in co-identifying main challenges and needs related to the Blue Economy in the Black Sea, co-defining common goals in a form of a desirable future vision. Envisioning desirable futures is a critical step toward creating a sustainable future [12]; it gives a sense of direction to enable positive transformation [13;14]; finally, pathways can be co-developed to drive the region towards a sustainable state.

Towards a complementary stakeholder strategy across EU projects Black Sea stakeholders from the quadruple helix are currently engaged through 3 different projects which allow the involvement of multi-level stakeholder (local, national and regional) while covering different facet of the problem (figure 2).

The BRIDGE-BS project objective is to advance the Black Sea's marine research and innovation to co-develop Blue Economy pathways under multi-stressors for the sustainable utilization of the ecosystem services. Five LLs covering the Romanian, Bulgarian and Georgian Black Sea coastline and marine space as well as two Turkish regions (Istanbul/Bosporus and Sinup) are being implemented. In the BRIDGE_BS context, LLs represent an instrument to empower local communities in the future sustainable management of the Black Sea, breaking sectoral silos and ensuring a systemic approach. They create a new local participative dynamic to explore alternative forms of governance while being a focal point for greater interconnection between physical and socio-economic sciences. Various participative tools exploit and enhance the inter-actor exchanges, to create a learning loop, raise awareness on ecosystem services and their multi-stressors, current and future, stimulate a thinking "out of the box", develop trust and collaborations, to foster the adoption and implementation of innovative eco-solutions. The main outputs will be transformative pathways for a sustainable Blue Economy for each country.

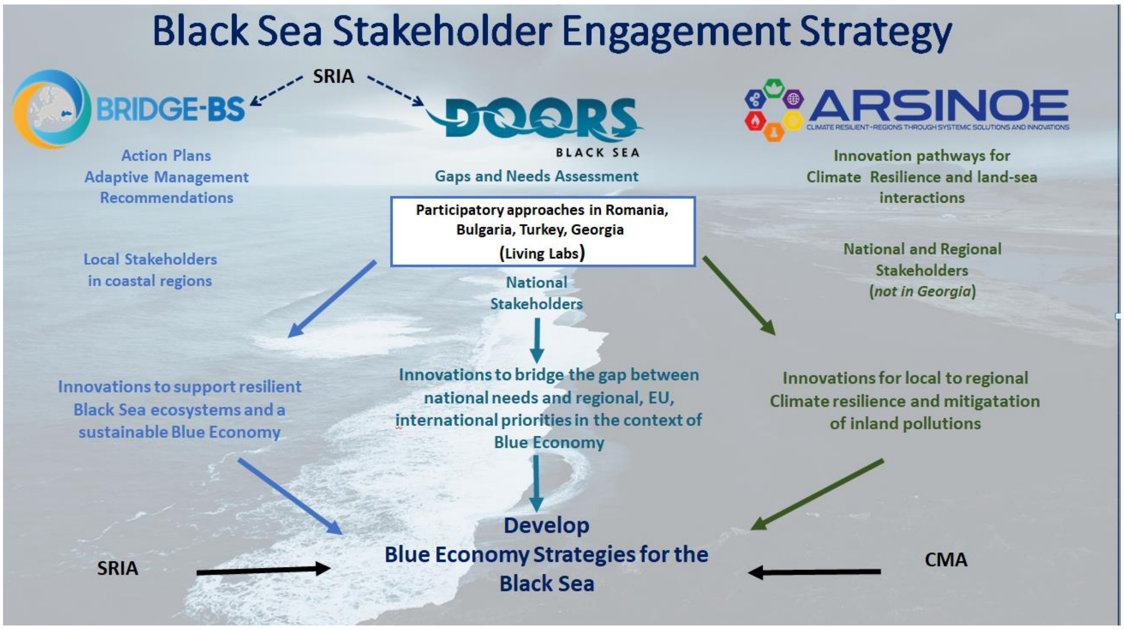

Figure 2. The overarching framework for the interactions between the three projects

The BRIDGE-BS sister project, DOORS will link citizens, science, and industry for the vital regeneration of the Black Sea, stimulating a new wave of 'Blue Economy' opportunities through the development of a System of System to address the human and climate change impacts on the marine ecosystem. Stakeholder engagement determines DOORS' success, value, and impacts. They drive science and technology breakthroughs with researchers, making the project work more meaningful on the ground. Here Multi-Actor Forums (MAFs) are implemented, as a different form of stakeholder engagement structure, which bring together national stakeholders in the same countries as the BRIDGE-BS LLs, from all backgrounds, to help scientists prioritizing Black Sea issues with a focus on Blue Economy policies and the use of innovations to fill identified gaps.

Finally, the ARSINOE project aims at building an ecosystem for climate change adaptation solutions, it does not focus on the Black Sea specifically but has a dedicated Black Sea case study covering the Danube Delta in Romania, the Ropotami river in Bulgaria and the Bosporus region in Turkey, looking at land-sea interactions from source-to-sea in the context of climate change. Stakeholders from each region are engaged in what is called national working groups (WG) which are then feeding the discussion occurring in an international LLs where representatives from regional institutions and national WG are brought together to tackle the identified problems and envisage solutions in a regional perspective.

Spaces for Change: Engaging Stakeholders via a coordinated set of Living Labs

The first round of local BRIDGE-BS LLs has involved more than 120 stakeholders in 8 workshops representing all Blue Economy sectors. The workshops were divided into four active participatory activities in order to identify 1) key Black Sea ecosystem services from the perception of local stakeholders 2) pressures and risks related to ecosystem services, 3) local challenges and needs for the sustainable development of the region, and finally 4) Blue Economy opportunities. The results allowed drawing a comprehensive understanding of the system, key drivers and issues to tackles to transition towards a sustainable Economy in the region. Findings from the different local LLs turned out to be very similar across countries calling for a coordinated Blue Economy strategy across the region. Within a second round of workshops, local stakeholders in each LL co-developed a common vision for their region while the third workshop will dive into transformative processes to support the transition toward sustainability.

In parallel, at national level, four MAF workshops were conducted where academic, industrial, regional government delegates shared their perspectives on Black Sea socioeconomic and policy needs for the emergence of a sustainable Blue Economy. An online survey was also launched to determine the Blue Economy obstacles and potential in the region, inquiring about the development of Blue Economy sectors and entrepreneurial support, obstacles, and priorities. This first phase of stakeholders' interactions prioritized the Blue Economy sectors based on the national context, to then map national needs and opportunities. The resulted analysis will highlight policy gaps between national Black Sea Blue Economy needs, and EU strategic and policy priorities, and potential discrepancies with local realities (BRIDGE-BS LL outputs).

Two online international workshops took also place so far. Following a mapping of key land-sea interactions, integrating the outputs of national workshops in Romania, Bulgaria and Turkey, data collection and monitoring were identified as key priority issues across the region when it comes to fresh and marine water management and climate change which became the focus of this international LL.

Conclusions and next steps

The development of the Blue Economy within the Black Sea is at a crucial juncture, where strong foundations must be laid to ensure the that burgeoning Blue Economy in the region evolves and transitions in a direction that is in harmony with sustainability and resilience. Different type of LLs have been implemented across the region to support the transition towards sustainability; local, national, and regional stakeholder representatives are being engaged in solving problems oriented activities, co-production of knowledge and co-design of solutions. The use of a system innovation approach combining system thinking and transition management methodology allowed so far to a better understanding of complex Black Sea systems from science-society perspectives in an iterative, interactive and reflexive ways, and setting up priority issues. It will enable the co-development of complementary pathways based on the co-identification of a portfolio of innovations and actions to support the necessary blue transition.

A comparative analysis of the initial outputs of the BRIDGE-BS local LLs and DOORS national MAFs will allow to assess whether local and national needs and priorities aligned and flag out to national policy makers' potential miss-matched. The national innovation pathways to be developed by the DOORS MAFs in order to fill existing regional blue policy gaps will serve as a basis for the co-development of the BRIDGE-BS transformative pathways which aim at providing a roadmap for change in order to reach the sustainable future co-designed by local stakeholders in each country. The ARSINOE international LL provide the fora for sharing experience and knowledge across countries.

Moreover, the framing of a joint stakeholder engagement strategy across multiple European projects is facilitating collaboration and sharing of experiences of running LLs across research teams, contributing to the development of a strong interdisciplinary cross-country marine research community in the Black Sea. It also provides a better visibility to local practitioners on the overall purpose and progresses of the Living Labs initiatives as well as their specific contributions.

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Full Research Paper

Festivals as Living Labs for System Innovation: Experiences from the interdisciplinary innovation programme DORP

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Abstract

The use of Living Labs is a promising approach to develop and test sustainable system innovations. A Living Lab approach that is yet to be discussed in literature, is that of a *Festival Living Lab* (FLL). Festivals can be considered as temporary mini societies with systemic sustainability challenges regarding water, energy, housing, logistics, waste management, food and behaviour. Since a festival is built up from scratch every time the event is hosted, adjustments can be made to its overarching system, and mutual interrelations between different aspects of the system can be experimented with. To evaluate the potential of FLLs as effective real-life experimentation settings for sustainable system innovation we present the *Living Lab Activity Framework* (LLAF), distinguishing various innovation stages and system levels. We deploy the LLAF to evaluate a selection of innovation projects within the DORP Festival Living Lab at the Welcome to The Village festival in The Netherlands, demonstrating that festivals can host various stages of the innovation process on different system levels.

Key words

festival living lab, real-life experimentation, evaluative framework, sustainable system innovation

Introduction

Transition, System Innovation & Living Labs

Transitioning from a linear to a circular economy requires system innovations in order to achieve the large-scale transformations in the way societal functions such as transportation, communication, housing, feeding, are fulfilled (Elzen, Geels, & Green, 2004). Although many enthusiastic entrepreneurs, policy makers and students come up with new innovative products, services and systems to realise a circular economy, only few of these are actually realised, implemented and/or scaled up (Kirchherr et al., 2018). Within the theory of strategic niche management (SNM) Schot and Geels (2008) argue that:

> *[…] for many innovations, especially with sustainability promise, market niches and user demand are not readily available because the innovations are not minor variations from the prevailing set of technologies but differ radically from them.* (p. 539)

To achieve transition, innovation needs to take place on multiple system levels (Schot and Geels, 2008). It is the process of co-evolution and mutual adaptation between these system levels that leads to change (Walker & Shove, 2007). A promising approach for experimenting with the interrelated and mutual adaptation of system levels in real-life settings, are living labs. Leminen, Westerlund and Nyström (2012) define Living labs as:

> […] physical regions or virtual realities, or interaction spaces, in which stakeholders form public-private-people partnerships (4Ps) of companies, public agencies, universities, users, and other stakeholders, all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts. (p. 7)

From this perspective, a living lab for sustainable transition is well equipped to facilitate real-life experimentation as it may provide a conducive environment in which system transformation may take place.

Within the field of living labs, several sub-categories of living labs can be defined. Commonly used categories are Sustainable Living Labs, Product Living Labs and Urban Living Labs (Bulkeley et al., 2016; Schliwa, 2013; Steen & van Bueren, 2017). A novel category of living labs are *Festival Living Labs* (FLLs). This paper focuses on the potential of FLLs to facilitate sustainable system innovation.

Festival Living Labs

The potential for innovation at festivals is already being explored through various innovation initiatives. Several festivals in Europe provide access to their sites to conduct scientific research and test new innovations (de Ruiter, 2012; Open-House, 2019; Stichting Innofest, 2019). In addition, several regional and European funded initiatives explore the concept of festivals as test beds for innovation (Stichting Innofest, 2019; Inno-Quarter, 2019). According to these initiatives, festivals pose interesting settings for experimentation because of multiple defining characteristics. These are described extensively in the *Festival Experimentation Guide* (Dijkstra & Boonstra, 2021).

Festivals are celebratory or thematic events that come in many forms. For the purpose of this article, festivals may be defined as *celebratory events that build one or more temporary, independent logistical infrastructures, such as an energy grid, a camp site and/or water supply for the purpose of facilitating the gathering of people.* Combining the definition of a festival with the definition of a living lab, a Festival Living Lab (FLL) may be defined as a *celebratory event that facilitates the gathering of people and that offers (interdisciplinary collaborations between) companies, public agencies, universities, users, and other stakeholders access to one or more of their temporary, independent logistical infrastructures to create, prototype, validate and test new technologies, services, products and systems'*.

With many temporary inhabitants moving, eating, sleeping and generating waste, festival sites are compared to small cities and temporary settlements (e.g. refugee and humanitarian aid camps). They are considered temporary 'mini-societies' with similar sustainability challenges regarding water, energy, housing, logistics, waste management, food and behaviour. For example, the three-day festival LowLands, which uses 300.000 kWh of electricity generated with 120.000 litres of Diesel each edition (LowLands, 2019). This is similar to the amount of electricity needed by 85 Dutch households in one year.

The interesting aspect of festival sites in comparison to cities, however, is their temporary and flexible nature. Because a festival is built up from scratch every time the event is hosted, adjustments and interventions to experiment with their different systems can be made relatively easy. The clearly defined borders of the festival site, together with its clear demarcation thereby adds to the level of control when conducting experiments, making it relatively easy to monitor and quantify in- and outgoing flows (e.g. material or energy flows) (Dijkstra & Boonstra, 2021). Also, the affordability of experimentation on festivals is mentioned by e.g. humanitarian research projects: 'While large aid agencies can often afford to role-play disaster responses, the festival scene offers an alternative for small, impact-oriented companies without such deep pockets' (Elks, 2019).

Within the transition to a circular economy an important challenge is behavioural change and acceptance of the new. Besides technical and economic aspects, also social aspects can be experimented with at festivals. Festivals are posed as interesting places for introducing novelties, as argued by Potts (2011) and Schulte-Römer (2013), precisely because of the festival framework which is expected to conduce a positive mind-set among the audience towards trying out new things. From a living lab point of view, festivals attract a large amount of people, or 'guinea pigs', that can be engaged as end-users in open innovation processes and experiments.

Another interesting opportunity that is mentioned by the programmes is that with over 1000 festivals in The Netherlands annually, the opportunity for a consecutive chain of FLLs facilitating multiple iterative experiments in a short amount of time and within (slightly) different settings can arise.

Evaluating System Innovation at Festival Living Labs

Based on the festival characteristics described above, it is posed that festivals are promising settings for experimentation and can contribute to sustainability transitions. Since multiple Festival Living Labs (FLL) are already running and to further explore the value of arts and culture festivals within sustainable transitions, it is relevant to examine the effectiveness and impact of FLLs on sustainable system innovation more closely. This results in the following research question for this paper:

> *Research question: Are Festivals Living Labs effective real-life experimentation settings for sustainable system innovation?*

But how to evaluate this? Multiple scholars address the need for standard methods to evaluate the effectiveness, impacts, and performance of living labs (Beaudoin et al., 2022, Bronson et al., 2021). Based on a scoping review, however, Bronson et al concluded that there is no generalizable approach or framework for evaluating the impact of living labs up to date and that 'the dominant method for evaluation used in the literature is comparative qualitative case studies' (Bronson et al., 2021, p.8). Also, it was found that the purpose of most available evaluation tools is aimed at evaluating the functioning of the overall living lab, or whether it has reached its specific goals (Bronson et al., 2021). In this paper we are interested in evaluating the impact of the FLL on the experiments hosted in the FLL, rather than evaluating the wider impact of the FLL itself and so none of the existing frameworks were fitting to answer our research question.

We therefore introduce the *Living Lab Activity Framework* (LLAF) (section 3) which we use to evaluate the *DORP FLL* (section 4). We answer our research question by discussing the results and conclude the paper by providing recommendations for future research (section 5).

Method

To explore the potential of FLLs for sustainable system innovation we took the following steps:

- **Step 1) Develop Evaluative Framework**: Based on a literature review of existing evaluative approaches and frameworks for living labs, we developed the *Living Lab Activity Framework* (LLAF) to evaluate the movement of innovation projects participating in a FLL across innovation stages and system levels.
- **Step 2) Case selection**: We selected the DORP FLL as a project case to plot on the developed LLAF. We selected this case as all authors have been closely involved in this FLL providing access to relevant documentation. We used existing project documentation to inform the case description of the DORP FLL in paragraph 4.1.
- **Step 3) Project selection**: Over the years, many projects participated in the DORP FLL. To select projects for plotting on the framework, a full inventory of projects that took place within the DORP FLL from 2015-2018 was made. The inventory was put together with the help of project lists provided by the programme leaders of the DORP FLL. Then a selection of projects for the plotting on the LLAF was made based on the criteria below.

This resulted in the selection of 31 out of 70 projects from the project inventory:

- **Criteria a**: Only projects that took place between 2016 – 2018 were selected (3 DORP editions) as projects from the first pilot year of the DORP Summer School deemed not representative as the DORP program was still developing itself as a FLL.
- **Criteria b**: Student projects were excluded from the selection because the research institutions posing these challenges usually had no or little interest in developing these projects into larger initiatives, start-ups or organisations after DORP. They were mostly seen as an educational experience for students. Therefore, many student projects had little to no follow up by default.
- **Criteria c**: Projects with insufficient or incomplete data were excluded from the selection.

- **Step 4) Plotting and analysis of projects**: The selected projects were plotted on the LLAF by identifying their innovation stage and system level before and after their participation in the DORP FLL. The categorization of the projects in the different innovation stages and system levels was derived through an iterative process between the researchers. The categorization is based on the presence of the researchers during the programs, seeing the projects in the field and using the criteria described in table 3 and 4. The resulted plotting is shown in figure 1. The 'activity' of the projects within the DORP FLL was then evaluated through a discussion amongst the authors interpreting whether and how the projects moved between innovation stages and system levels.

Living Lab Activity Framework

As described in the introduction, it is argued that transition is achieved by the mutual adaptation of system levels in niches, as this is where radical (opposed to incremental) innovation that is needed for transition can occur (Sengers et al., 2019). As living labs are posed as an approach to experiment with these mutual adaptations, this suggests that projects within living labs should focus on (I) projects in a stage of experimentation and on (II) projects exploring interdependencies in or between system levels. To explore the potential of festivals as real-life experimentation settings for sustainable system innovation, we therefore identified two sub-questions that should be considered in our evaluative framework:

Sub-question I: On what phase of the innovation process do the projects within the

Festival Living Lab focus?

Sub-question II: On what system level do the projects within the Festival Living Lab focus?

It is commonly agreed that no design or innovation process is a linear process and that within an innovation process many iterations are made. Similar to the fact that innovation processes are not linear, there is no hierarchical sequence for when to address a specific system level of an innovation either. Although the hierarchical approach of system levels somewhat resembles the means-end chain that is often used by designers (Joore & Brezet, 2015) and system levels do influence each other as described in the MLP model of Geels (2008), design and innovation processes are based on the interrelated development of different aspects simultaneously (e.g. technology, legislation, user markets). These aspects influence each other during the design process as demands or barriers from e.g. legislation will change e.g. the product or service. This holistic approach is shown, for example, in the Design-Driven Innovation Process model of Acklin (2010) and in the model of the TU/e Innovation Lab (Den Ouden et al., 2016). By testing innovations in real-life settings, these interdependencies might surface. This means that a project within a living lab can start with a challenge on a certain aspect or on a certain system level but might then find out that adjustments are needed on other system levels or aspects. This 'iterative learning means that experiments are conducted, monitored and conducted again with improvement from the previous round, in order to generate useful knowledge in a real-life setting' (Schliwa, 2013, p.15). It is the possibility for iteration between the innovation stages and system levels that adds value to the design process in living labs.

To illustrate this iterative character between innovation stages and system levels, we plotted both sub-questions in a matrix resulting in the *Living Lab Activity Framework* (LLAF) as shown in figure 1. Herein both sub-questions relate to the two axes of the framework: the system levels (sub-question I) are set out along the y-axis and the project's innovation stages (sub-question II) are set out along the x-axis. To identify the distribution of both axis we conducted a literature review (see table 1 and 2) resulting in five innovation stages on the x-axis (1. Exploration, 2. Development, 3. Experimentation, 4. Implementation and 5. Commercialisation) and four system levels on the y-axis (A. Product-Technology System, B. Product-Service System, C. Socio-Technical System and D. Societal System).

The LLAF is deployed by plotting a project's innovation phase and system level on the framework before and after its participation in the FLL using the criteria described in table 3 and 4. This provides a visual representation of a project's learning activity in the FLL.

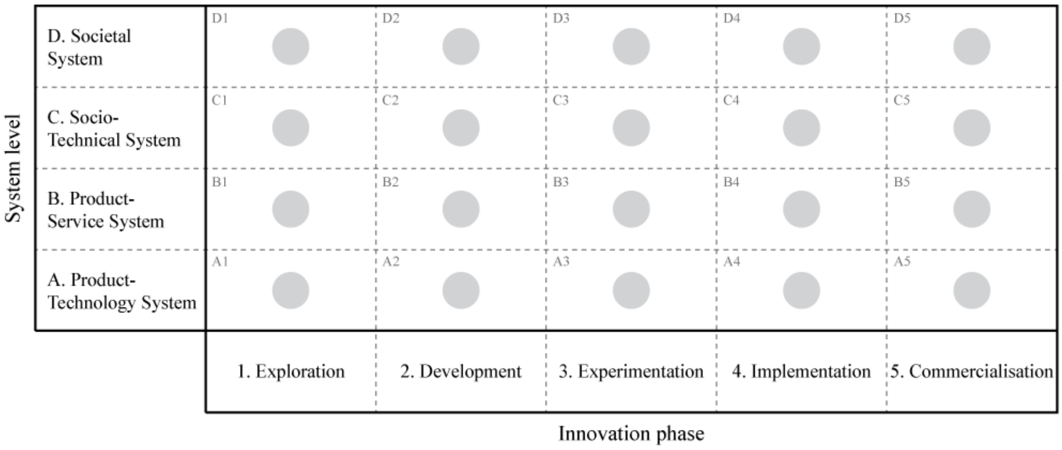

Figure 1. Living Lab Activity Framework (LLAF) for evaluating Festival Living Labs projects

Table 1. Comparison of innovation stages in academic literature (x-axis)

Living Lab Activity Framework	TRL's (Mankins, 1995)	Stage-gate model (Cooper, Edgett & Kleinschmidt, 2002)	The Fugle Model's Innovation Funnel (Du Preez & Louw, 2008)	TUe Innovation lab (den Ouden, 2016)	ULL Way of Working (Steen & van Bueren, 2017)
1. Exploration	TRL0 - Not officially defined by NASA.	1. Preliminary assessment	A. Idea Generation/Identification	Exploration	Research
	TRL 1 - Basic Research	2. Definition	B. Concept Definition		
2. Development	TRL2 - Proof of Principle	3. Development	C. Concept Feasibility & Refinement	Concept Development	Development
	TRL3 - Early lab scale demonstration		D. Portfolio		
3. Experimentation	TRL4 - Lab scale demonstration		E. Deployment	Evaluation and Validation	Testing
	TRL5 - Validation	4. Validation			
4. Implementation	TRL6 - Early prototype		F. Refinement & Formalisation		Implementation
	TRL7 - Late prototype			Market Introduction	
5. Commercialisation	TRL8 - Early stage commercial environment application				Commercialisation
	TRL9 - Market ready application full commercial application	5. Commercialisation	G. Exploitation Stage		

Table 2. Comparison of system levels in academic literature (y-axis)

Living Lab Activity Framework	Innovation levels (Ceschin & Gaziulusoy, 2016)	MDM Model (Joore, 2015)	Transition Management (Geels, 2005)	Intelligent products (Andrews, 2003)	Design for Sustainability (Brezet et al., 2001)	Systems Engineering (Haugan, 2001)	Means-end-chain (Roozenburg and Eekels, 1998)
D. Societal System	Spatio-Social innovation level	S: Societal System	Transitions (landscape)	Rethinking Values	System Innovation	System	Values
C. Socio-Technical System	Socio-Technical System innovation level	R: Socio-Technical System	System innovations (social-technical regime)	Systemic Context	Function Innovation	Subsystem	Needs
B. Product-Service System	Product-Service System innovation level	Q: Product-Service System	Process innovation (niche)	Ecological Context	Function Redesign	Element	Functions characteristics
A. Product-Technology System	Product Innovation level	P: Product-Technology System	Product-innovations (niche)	Immediate Context	Product Improvement	Component	Form

Table 3. LLAF Innovation Stages (x-axis):

Dimension	Description	Criteria
1. Exploration	The process of making new discoveries about a problem or solution and coming up with an innovative concept.	The project is based on an idea or problem but has no evidence to base its assumptions on. It is an unproven concept and no validation has been done yet.
2. Development	The process of advancing basic ideas and concepts into more concrete and holistic requirements of the innovation.	The project is based on a clear concept but needs further development and/or validation of its underlying assumptions.
3. Experimentation	The process of testing and validating assumptions about the innovation.	The project has a prototype that needs to be tested. This can be a physical prototype but also e.g. a service or societal concept.
4. Implementation	The process of applying or integrating the innovation in its designated real-life setting.	The project has a product, service or approach that is tested in relation to its context while being integrated in the larger system.
5. Commercialisation	The process of making the innovation available on the market.	The project has a product, service or approach that is implemented and commercially operates in its (simulated) context testing mutual dependencies between all system aspects (technical, economic and social).

Table 4. LLAF System levels (y-axis):

Dimension	Description	Festival Context	Criteria
A. Product-Technology System	The Product-Technology System level is made up of tangible products that one can touch.	Within the context of a festival the product level refers to the 'hardware' the festival is built up from (its tents, cabins, sound systems, generators, etc).	The project focuses on tangible products.
B. Product-Service System	The Product-Service System level is made out of the combination of physical and organizational components that together fulfil a specific function.	Within the festival the service level refers to the services provided for by the festival; the total of products and services providing e.g. the economic infrastructure (often coins) people can buy food or drinks with, the campsite people can safely sleep but also the provision of drinking water and the service of waste removal.	The project focuses on new types of services (e.g. Product-as-a-Service models, cryptocurrency systems) and/or is exploring their product's market fit.
C. Socio-Technical System	At the Socio-Technical System level 'a large number of components are combined that are not formally related to each other' (Joore & Brezet, 2015). The socio-technical system can be defined as 'a cluster of aligned elements, including artefacts, technology, knowledge, user practices and markets, regulation, cultural meaning, infrastructure, maintenance networks and supply networks, that together fulfil a specific societal function' (Geels, 2005).	Within the context of a festival, this level refers to the coherence of the festival's technical and economic infrastructure together with its entertainment programme, its safety protocols, its organisation, suppliers and stakeholders, and its audience.	The project focuses on the integration of new products or services in (a part of) the full festival system. An important difference within this criterion as opposed to experimentation on other system levels, is that something in the wider system of the festival is depending on the project innovation's functioning.
D. Societal System	The Societal System level relates to the intangible believes, traditions, norms and values of a community of people in a specific place.	Within the festival context the Societal System level is made up of the festival audience that behaves according to their communal believes.	The project focuses on behavioural change or the acceptance of the new.

Although living labs 'are composed of heterogeneous actors, resources, and activities that enable and support innovation at all phases of the lifecycle' (Leminen et al., 2012, p.7), living labs can only challenge projects to make a few iterations within their programmes and settings. Since we wanted to identify the projects' activity while participating in a FLL, the framework only shows the progress of the research, development and/or experimentation process made by the projects within (one edition of) the FLL. The framework does not say anything about the impact of the FLL on a project's overall innovation progress. Also, since not all programmes in our case study focus on the same types of challenges (e.g. one focusses on realising a technical prototype, another creating a business model, and another on researching user behaviour), the phase a project starts or ends in, does not say anything about the quality of the iteration made by the projects. The iterations made by the projects are therefore not qualitatively comparable.

Results

Case description of the DORP Festival Living Lab

Welcome to The Village (WTTV) is a three-day music festival hosted in the recreation area of the 'Groene Ster' in Leeuwarden, the Netherlands. The festival hosts around 9000 visitors enjoying music from three semi-large stages, together with a side programme including theatre performances, visual arts and a substantive social, sustainability and innovation programme. Between 2014 and 2018 over 70 innovation projects from students, start-ups and companies developed and tested new sustainable concepts, prototypes, business- and service models at the festival via different innovation programmes and initiatives. We refer to the collection of all these sub-programmes as the *DORP FLL*.

Test & Implementation projects

Through the DORP FLL and with the help of Innofest, entrepreneurs can use the festival's technical- or economic infrastructure or its audience to get (user) feedback on their innovation. **Greener**, for example, tested their off-grid battery providing festivals with sustainable energy as an alternative to diesel generators. A project that tested in the economic infrastructure of the festival was **Loyal Garden,** who developed a blockchain system making it possible to reward volunteers of the festival in a specific crypto currency. A prototype version of the system was implemented during the DORP Summer School leading up to the festival. During the festival, the system was tested with volunteers in the backstage area of the festival.

As a festival organisation, WTTV can also act as a launching customer for new sustainable and circular innovations, generally festival related. An example of a multi-year collaboration is **LILY**. LILY is a light installation that initially was developed to illuminate the dark pathway from the festival to its campsite and now illuminates a forest in the Dutch province of Drenthe. Over the years, the LILYs were extensively tested at the WTTV festival and further developed into a floating art installation inspired by the complex patterns that exist in nature, such as schools of fish or flocks of birds. Illustrations of these cases can be seen in the images in figure 2.

Figure 2. Illustrational images of Test & Implementation projects at WTTV: Greener (Picture © Greener), Loyal Garden (Picture © Innofest), and LILY (Picture © WERC).

Innovation projects

A sub-programme of the DORP FLL that uses the festival as place for co-creation is the DORP Summer School (DORP meaning VILLAGE in Dutch). The DORP Summer School was initiated to offer entrepreneurs and organisations the opportunity to further develop their innovative ideas and concepts with the help of an interdisciplinary team of students from different disciplines, faculties and universities before testing them at the festival. The DORP Summer School is set up in a hackathon format and is based on the design thinking approach. For 7-10 days and under guidance of experts, the interdisciplinary teams help the entrepreneurs or organisations to develop their concepts or prototypes and directly validate it during the festival, resulting in a very quick feedback loop in comparison to other hackathon programmes that generally focus on either the ideation or development phase. From a university perspective, the Summer School is designed as an interdisciplinary course to teach students to work together in interdisciplinary teams.

Challenges brought in to the DORP Summer School could be about different aspects and could be in different innovation stages. For example, there could be a need for scientific research to develop innovative concepts, for example the project **Offgrid Basecamps** brought in by construction company Van Wijnen. Within the challenge, the team worked on developing a solution for construction site managers to select the best renewable energy solution for setting up their construction sites. On the other hand, entrepreneurs could also already have a technical prototype that needed to be developed and tested. For example, **Saru Soda**, who needed help with ‘hacking’ a post-mix lemonade machine so it could also dispense the biological lemonades they make. Or **Comp-A-Tent**, who’s challenge it was to develop an attractive and functional festival tent from their newly patented compostable material. Illustrations of these cases can be seen in the images in figure 3.

Figure 3. Illustrational images of Innovation projects at WTTV: Saru Soda (Picture © Nena Bode), Comp-A-Tent (Picture © DORP Summer School), and Offgrid Basecamps (Picture © DORP Summer).

Experience projects

WTTV has a designated area for innovation where festival visitors are introduced to innovative products, business models and services in a fun and interactive way. It the place at the WTTV festival where visitors can, either consciously or unconsciously, be part of scientific research, provide feedback on new products or services from entrepreneurs or participate in experiments as 'guinea pigs'. This helps raise awareness and support for sustainable transitions. An example of such a project is the **Hair-Washing District** developed by the Japanese artist Sachi Miyachi. Together with students from the DORP Summer School, she developed an elevated and self-sustaining construction to wash hair from festival visitors to make them appreciate the little things in life. Another example is the **Snackathon** that WTTV introduced in 2018. Within the Snackathon food entrepreneurs were challenged to develop healthy and sustainable snacks for the 'Cafetaria of the Future' during the DORP Summer School to then test these directly by selling them to the festival audience during the festival. This resulted in a.o. 'Cricket fries', fries made from cricket flour by **&Cricket** and the **Vegandel**, a typical Dutch snack but then made vegan by using seitan. Illustrations of these cases can be seen in the images in figure 4.

Figure 4. Illustrational images of Experience projects at WTTV: Hair-Washer District (Picture © Nena Bode), Vegandel (Picture © DORP Summer School), &Cricket (Picture © DORP Summer School)

Resulting plotting of DORP projects

Plotting the selected DORP projects on the *Living Lab Activity Framework* (LLAF) resulted in figure 5. As can be seen in figure 5, many projects make a forward iteration in their innovation process as they managed to test, implement or even commercialise a product, service or concept at the festival (16/31 projects). For example, **Saru Soda** who went from Product-Technology Development (A2) to Product-Technology Implementation (A4).

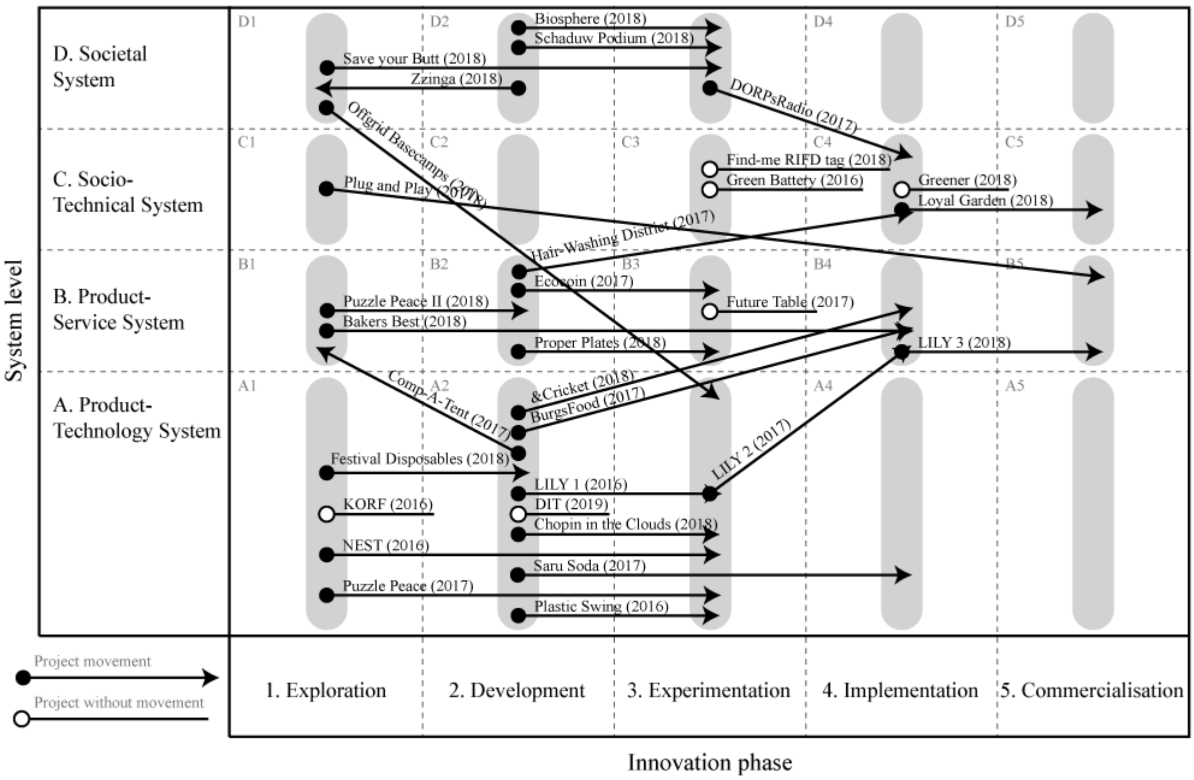

Figure 5. Selected projects participating in the DORP Festival Living Lab from 2016-2018 plotted on the Living Lab Activity Framework (LLAF).

The framework also shows that some projects iterate between system levels (7/31 projects). On the one hand, forward iterations are made. For example, **Offgrid Basecamps**, that researched a solution for construction site managers to select the best renewable energy solution for setting up their construction sites which first resulted in a concept for a decision-based algorithm, and which was then developed (D1) into a protype of a serious game which was tested at the festival amongst its audience (A3). Another project that makes a large iteration is **Plug & Play** that moves from the Exploration phase on the Socio-

Technical level (C1) to the Commercialisation phase on the Product-Service level (B5). Plug and Play was posed by the WTTV organisation as a challenge to explore how the batteries of electric cars of visitors could power their music stages in the future. At the festival, the students who worked on this challenge and managed to 'hack' an electric car, organised a fully operational car-powered silent disco during the festival. Projects that also made quite large iterations are **BurgsFood** and **&Cricket**. These two projects were part of the **Snackathon** and developed, tested and eventually sold sustainable snacks at the festival (see description in case study). As they were challenged to sell their snacks according to the official festival rules (so they would not be unfair competition to other food stalls) these projects were really forced to make a leap from Development on a Product-Technology level (A2) to Implementation on the Product-Service level (B4).

On the other hand, there are also projects that iterate backwards in the framework (2/31 projects) namely **Zzinga** and **Comp-A-Tent**. A backward movement does not mean that no valuable insights were found but that the participant encountered a challenge during their participation in the program that meant that the project had to reiterate the viability of (an element of) their idea in its current form. This was also one of the aims of the DORP Summer School: to identify early in the design process whether an innovative concept is viable before investing a lot of time and funds into its development. For example, Comp-A-Tent joined the DORP Summer School with the aim to design and test a new biodegradable tent for festival visitors based on their newly patented material. During the design process however, they found out that their intended user (the festival visitor) was not their customer. This was actually the festival organisation itself which not only changed the programme of requirements for the tent, but also their entire business case. For Comp-A-Tent the fact that the DORP FLL facilitated all system levels, meant that they could still have learnings about their innovation, just on a different system level than initially intended.

Not directly visible but also notable is that projects that participated in the DORP FLL for multiple years on a row, focus on challenges within different system levels each year. This is greatly illustrated with the **LILY** project from WERC that was present at the WTTV festival every year and developed from a single LILY prototype in 2016 to a fully implemented sustainable art installation in 2018. Also, **Puzzle Peace** illustrates this. First, they joint the DORP FLL in 2017 with a challenge to develop multifunctional furniture which resulted in a successful prototype and which the festival organisation bought as a launching customer after the festival. The year after they returned to the DORP Summer School to develop their business case which they then tested amongst the festival audience.

Discussion & Findings

The aim of this paper is to understand whether FLLs may function as effective real-life experimentation settings for sustainable system innovation. Our research resulted in three key findings:

Festival Living Labs may function as a relevant real-life experimentation setting for sustainable innovation.

The proposed *Living Lab Activity Framework* (LLAF) enables the visualization of 'activity' of innovation projects in terms of movements between various innovation stages and system levels. The plotting of 31 DORP projects showed 'horizontal' movement, suggesting that a FLL is able to facilitate innovation projects to learn across various innovation phases. The plotting also showed 'vertical' movement of the projects, suggesting that a FLL is able to move between various system levels.

This is important because the radical change needed for sustainable transition requires a systemic perspective and mutual adaptation between these system levels (Walker & Shove, 2007) (Schot and Geels, 2008).

The DORP FLL is a unique initiative closely connected to the identity of the WTTV festival. For an increased understanding of how and if all festivals may be a suitable context to support sustainable system innovation, more research on e.g. characteristics and prerequisites of both FLLs and other categories of living labs is needed.

System innovation can happen in FLLs but this is not yet proven sufficiently.

The temporary and flexible nature of festivals pose that they are great places to experiment with its technical, economic and social systems (Dijkstra & Boonstra, 2021). Within the LLAF, projects focusing on experimenting with these systems would entail projects that interact with sections C3 and C4 of the LLAF. In the DORP FLL there is only a small number of projects positioned in this part of the framework. The derived plotting reveals that most of the development in the DORP FLL is concentrated on the product-technology systems (level A of the LLAF) and product-service systems (level B of the LLAF). This is not necessarily uncommon, e.g. Steen & van Bueren (2017) found that the majority of Urban Living Labs in their study lacked some of the key characteristics that would be required to develop ground-breaking innovations. The LLAF also showed some development and experimentation with regards to the Societal System (level D), suggesting that festivals are indeed interesting places to experiment with novelties as described by Potts (2011) and Schulte-Römer (2013).

The focus of the plotting on the lower left corner of the LLAF could be interpreted as FLLs not being effective real-life experimentation settings for sustainable *system* innovation. However, the limited number of projects in this area might also be impacted by the limitations of our research. Namely: the fact that (i) we were not able to plot all projects on the LLAF due to the absence of data, (ii) the fact that the plotting of the projects was not done by the project owners themselves who might have different perspectives on the iterations they went through, or that (iii) the programmes of the DORP FLL focus on accelerating (sustainable) innovation in general and did not specifically focus on Socio-Technical System innovation. This means that although our research suggests that FLLs can certainly be effective settings for the development of sustainable innovation projects in general, the results of this study are not necessarily representative to conclude that festivals are especially effective settings for sustainable *system* innovation.

To further explore and develop the effectiveness of a FLL for sustainable system innovation, case studies specifically focussed on innovation on the Socio-Technical System level would be required, investigating how movements on the LLAF towards and from the Socio-Technical system level may be enabled.

The LLAF may contribute to analysing the effectiveness of living labs by providing a framework to evaluate and compare the impact of living labs over time.

There is an increasing need for approaches and frameworks to evaluate the impact and effectiveness of living labs (Beaudoin et al., 2022, Bronson et al., 2021). Visualising the development of living lab projects with the help of the LLAF enables more insight into the results of a living lab and could help to improve its focus or design to improve innovation outcomes. Herein it should be noted that the LLAF only captures the iteration of projects made within one or several editions of a FLL. It does not provide any insight into whether a project's participation in the FLL impacted the project's long term innovation process outside of the FLL. Evaluating the impact of the FLL, beyond the actual FLL event, is outside the scope of this paper.

To confirm the effectiveness and workability of the LLAF, further research focusing on applying the framework at other FLLs, or other living labs in different contexts (for instance at various Urban Living Labs) would be needed. Additionally, it would be valuable to investigate how and if results and insights of FLL experiments are scaled beyond the FLL.

Conclusion

We have tracked the development or 'activity' of 31 innovation projects at a recurring Festival Living Lab (FLL) over a five year period (2014 till 2018). By visualising the activity of these innovation projects with the *Living Lab Activity Framework* (LLAF), we have determined that FFLs can indeed serve as effective experimentation settings for various types of innovation, including sustainable system innovation. As our results are only based on the tracking of projects at one specific FLL - the DORP Festival Living Lab at the Welcome to The Village festival in The Netherlands - further research would be needed to evaluate the potential impact of FLLs in a more general sense. We suggest that applying the LLAF may provide an effective approach to support the evaluation of FLLs, by effectively visualising the various types and levels of innovations that take place. With an increasing need for generalizable approaches and frameworks to evaluate the impact of living labs, we also suggest that the LLAF may support the evaluation of other types of living labs, for instance Urban Living Labs or Sustainable Living Labs, as a unified way of measuring the effective development of various innovation projects that take place within the context of these living labs.

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Research-In-Progress Paper

Me or the machine, who decides? Acceptance spillover of digital automation for a sustainable transition

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Abstract

To meet net zero targets and achieve a sustainable transition, the electricity network needs to become more integrated, decentralised, and flexible. Digitalisation – specifically provided through algorithms and automation – of daily life activities has huge potential to enable such a network. Many daily life activities have already become automated and/or are controlled through algorithms, e.g., paying our monthly bills, searching for information online and streaming entertainment recommended to us. However, activities with greater impact on the energy system, such as home energy management, struggle with issues of trust and acceptance from end-users. Research is lacking on the concept of acceptance spillover, the acceptance and use of automation in one activity or domain of daily life and the impact it has on acceptance and use in another.

As part of a living lab of UK households with wide ranging characteristics (household composition, socio-economic, digital engagement, home type and ownership, rural/urban location), this research will conduct two distinct trials which automate daily life activities. We will use a mixed methods approach of interviews, surveys and activity-specific behavioural and energy monitoring data to: 1) detect feedback mechanisms of automation experience and potential acceptance spillover across activity domains that have varying levels of impact for a sustainable transition; 2) identify generalisable insights on factors influencing acceptance of automation across different activities of daily life; and 3) contribute to the literature on time-use, energy and resource impacts of specific automation technologies.

Key words

Daily life, energy use, IoT, automate activities, technology acceptance model

Introduction

Digitalisation is a transformative force rapidly shaping how we socialise, travel, shop, work, relax and manage our homes. Despite digitalisation's potential to reduce energy and resource use to help tackle climate change - for example, through substituting physical movement, accessing services rather than owning physical goods and helping manage energy use – current uptake of innovations providing such potential are far from reaching the mass market (Wilson, Kerr, Sprei, Vrain, & Wilson, 2020).

One aspect for achieving a sustainable energy transition requires not only end-user demand reduction but also increased flexibility in energy consumption as a response to the more volatile production patterns of renewable resources such as wind and solar. Automated demand-side management solutions support flexibility but struggle with trust and acceptance issues from end-users. We investigate whether positive experiences of automation in one activity or domain of daily life results in greater acceptance and uptake of automation in another, especially for contexts which help the energy transition.

Daily life automation

Technical developments enabling automation – the machine execution of a function or operation previously performed by a human – have dramatically evolved in the past decade and have entered many aspects of our daily life. From information acquisition online to smart devices in the home and transport route optimisation. Different levels of automation (LoA) exist, with the literature developing a wide range of taxonomies adapted to specific contexts (Vagia, Transeth, & Fjerdingen, 2016). Diamond, Mirnig, & Fröhlich (2023)'s study on trust in demand-side energy management in the home builds of Vagia et al.'s work and categorised automation into six levels. Examples of their LoAs include manual programming of devices by the user, consensual automation with the user actively being contacted to agree, and full automation whereby the user has no possibility to interrupt or control. As our research looks across contexts (different activities and domains) we draw upon Vagia et al. (2016)'s literature review and use a LoA taxonomy widely applicable to activities across daily life (Table 1).

Table 1. Levels of automation taxonomy adapted from Vagia et al. (2016)

Level of automation	Description	Explanation
Level 1	Manual control	Computer offers no assistance
Level 2	Decision proposal	Computer offers decision. User is responsible to decide and execute
Level 3	Execute with approval	Computer decides and executes with user approval
Level 4	Autonomous control	Computer decides and executes without user notification

Digitalised daily life activities have varying impacts on energy and carbon resources, and some activity domains are more saliently digital to end-users. Table 2 summarises the scientific interest of the different activity domains of daily life and provides examples of possible automation for each. Our research aims to improve understanding of the factors which influence people's acceptance of different LoAs in their daily lives, whilst also contributing to the literature on the impacts of automation on energy and carbon.

We first present literature informing the theoretical framing for our research design to investigate automation acceptance. We then describe our living lab and provide an outline of: the mixed methods data collection being conducted during 2023; our progress to date; and expected contributions towards a green digital transition.

Theoretical framing

Drawing upon insights from Information System and Cognitive Engineering research, Ghazizadeh, Lee, & Boyle (2012) developed an extension of the well-established Technology Acceptance Model (TAM) to provide a comprehensive perspective of automation and evaluate user acceptance - aptly named the Automation Acceptance Model (AAM) shown in Fig.1. TAM theorises that perceived usefulness and ease of use are key determinants of attitude towards a technology, which in turn, predict behavioural intention to use and accept (Davis, 1989). Ghazizadeh et al. (2012) extended this model and posit that compatibility of the technology for the task at hand impacts upon other constructs and ultimately acceptance. In addition to compatibility, trust in the predictability and performance of the automated activity is deemed a key component in AAM.

Diffusion of innovations theory (DOI) states that users' trust and relationship with a technology often progresses through various phases of adoption as they adapt to a new system, from initial discovery of its existence to deciding to adopt and continue usage

(Rogers, 2003).

Table 2. Scientific interest and estimated energy/carbon impacts of domain categories of daily life activities and examples of automation

Scientific interest		Activity domain	Automated activity example
Low	*Most salient digital daily life activities*	*Communication, socialising*	Receiving, sorting and replying to emails
		Information search, provision	Creating online content (e.g., for a webpage) Information searching Information providing e.g., weather, news
		Entertainment, media	Choosing a movie/episode to watch
	Possible spillovers via thematic similarities	*Health, fitness*	Arranging medical treatment Fitness tracking, Developing an exercise plan
		Education, study, learning	Progress tracking
	Possible spillovers via thematic similarities	*Work (paid)*	Scheduling meetings Coding
Energy/carbon impacts		*Managing home - non-energy intensive (e.g., hygiene, childcare, finances)*	Paying household bills
		Retail - other	Buying new clothes
		Retail - food & drink	Doing grocery shopping Creating a menu/diet plan
	Uncertain direct carbon impacts	*Managing home - energy-intensive (1) lighting, devices, appliances (exc. food-related)*	Turning home lighting on/off Turning washing machine on Hoovering
		Managing home - energy-intensive (2) cooking, dishwashing, other food-related	Preparing a cup of tea/coffee Preparing a meal Washing the dishes
		Managing home - energy-intensive (3) heating, cooling, hot water, + own energy (e.g., PV, storage)	Turning home heating on/off
High		*Travel*	Booking travel tickets Optimising journey route Driving to visit friends/ family Refuelling/charging private transport mode

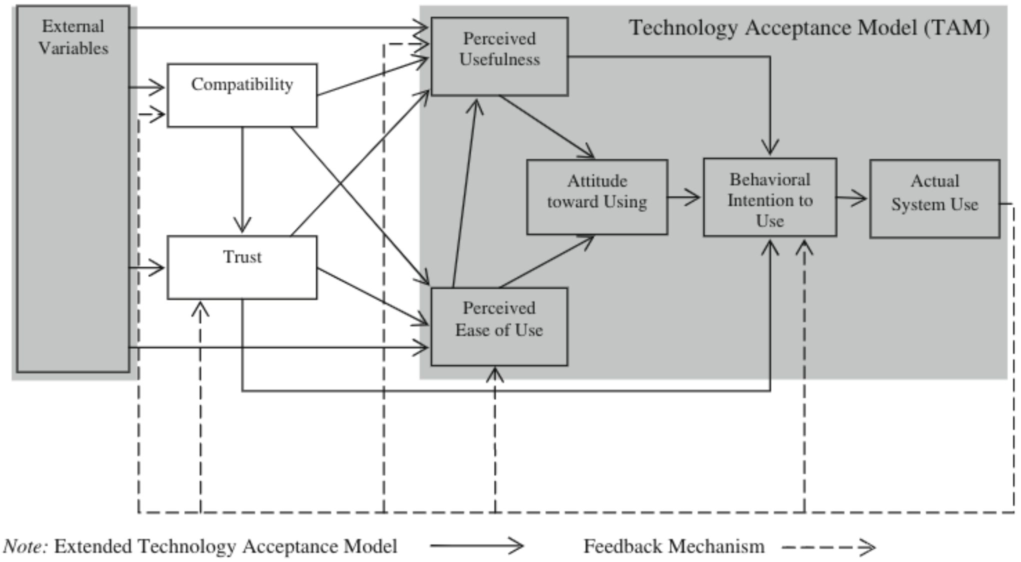

Figure 1. The Automation Acceptance Model (AAM). Source: Ghazizadeh et al. (2012)

Such changes over time and the impact on acceptance and use are captured by AAM through feedback mechanisms (Ghazizadeh et al., 2012).

Our research uses AAM as a theoretical framework to empirically investigate the range of constructs and feedback mechanisms hypothesised in the model to impact acceptance and investigate whether spillover of acceptance occurs.

Research methodology

Living lab

Our living lab infrastructure was developed as part of a European Research Council project and focuses on digital daily life and its impact on climate change. The living lab consists of households in and around Oxford, UK who provide insights into real-world conditions in their own homes and are committed to trial, learn, interact, and share data with the research team on digitalised daily life. A current sample of 47 households have been recruited with wide ranging characteristics (composition, socio-economic, digital engagement, home type and ownership, location - rural/urban). Strong relationships between researchers and all members of the households were established during the recruitment process in autumn 2022 and enthusiastic engagement is maintained through offering short, gamified activities referred to as ‘mini missions’. Data collected from all individuals within the households thus far include: 1) qualitative insights from home visits on their daily routines (across work, leisure, travel, food/grocery habits and home management), social dynamics and decision making processes for managing and co-ordinating daily life, use of digital devices and online services; and 2) quantitative insights through an online survey into their digital skills, technophilia, innovativeness, values, data privacy concerns and attitudes towards internet usage. Our proposed research in this paper builds on this data and explores the theme of automation.

Automation trial study design

For households to participate in smart energy networks the automation characteristic required involves the automation of when energy is used/an activity occurs (scheduling and execution). Two distinct sub-samples of 10 households will each trial an innovation for one month which automates such aspects for one of their daily life activities. Our sub samples will consist of households along a spectrum of prior automation experience, categorising them by the number of different domain activities and frequency of automation they use. Fig. 2 summarises the study's protocol highlighting the data collection process, timings and data used to investigate specific research questions. The two different trials proposed are: 1) automation of the scheduling and execution of meal planning and grocery shopping provided through a subscription to a meal kit delivery service, and 2) automation of the scheduling and execution of floor cleaning through the use of a smart hoover/mop.

Following Ghazizadeh et al. (2012)'s suggestion, we aim to validate the feedback mechanisms of AAM using a multi-wave experiment capturing changes in behaviour and perceptions at several points in time, e.g., pre introduction of activity automation, after one month of usage, and after 6 months (of usage or discontinuance). Baseline data on activity-specific time and energy use will be collected for one month prior to the trial. Then, during the pre-trial interviews, we will conduct an interactive mapping exercise to collect data on the different ways they currently automate their daily life (the level of automation - Table1 and across activity domains – Table 2).

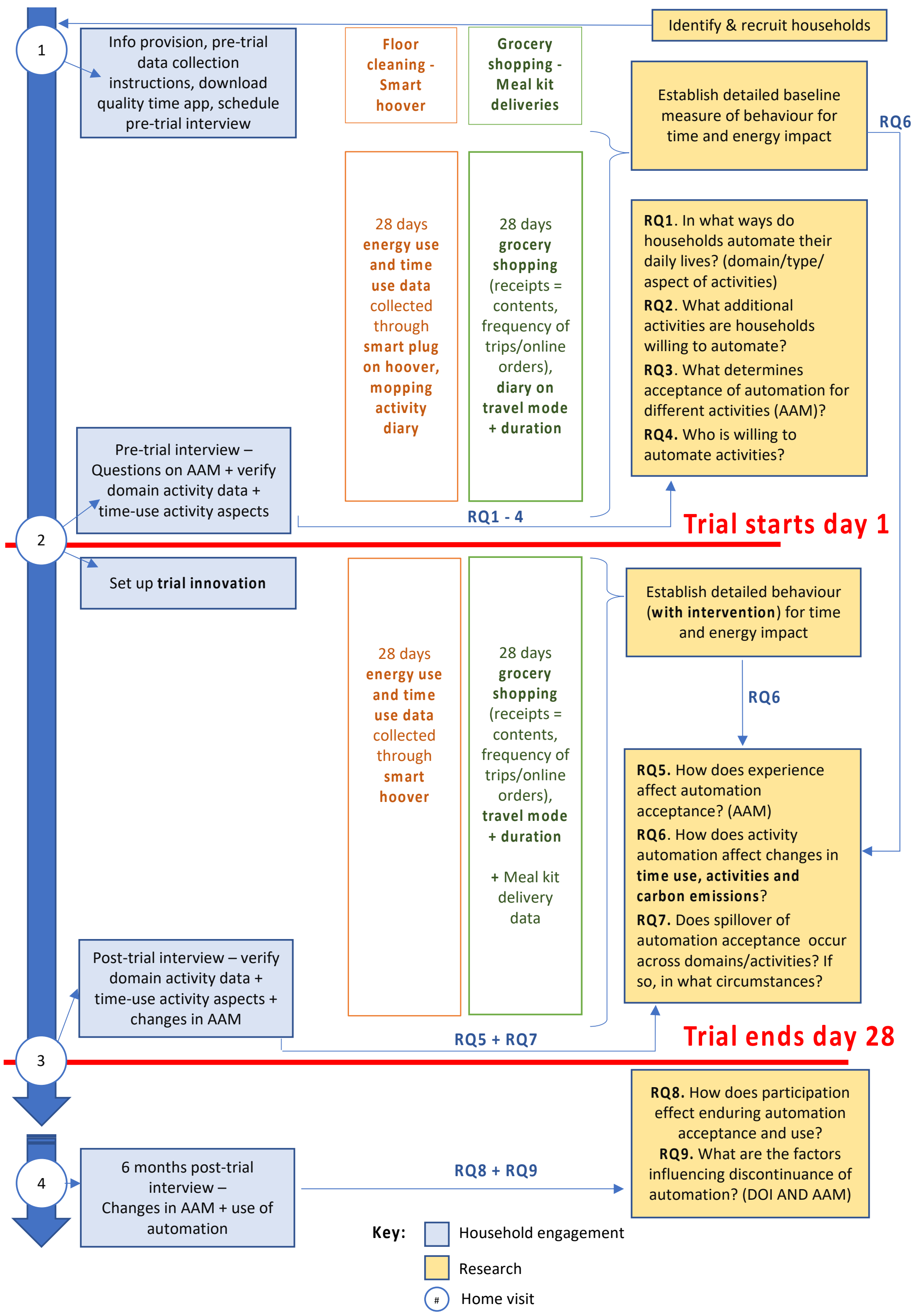

Figure 2. Summary of the living lab trial protocol

We will also ask what additional activities they are willing to automate and then explore AAM constructs to determine what influences acceptance of automation for different activities. After the one-month trial we will return and repeat the interview activity on

AAM constructs to detect changes in acceptance and the impact of feedback mechanisms through automation experience.

To analyse the impact of the trials on time and energy use, we will compare the activity-specific monitoring data collected pre and during the trials. We will also use a conceptual framework developed by Bieser & Hilty (2020), who categorise ICT impacts on time and energy as distinctly different phases and aspects of an activity: Phase 1 – activity planning (consisting of activity selection, scheduling, planning horizon, duration and frequency) and Phase 2 – activity execution (consisting of activity manner, duration and fragmentation). Bieser & Hilty (2020) qualitatively describe their framework and apply it to the example of telecommuting. They encourage researchers to apply their framework to other activities and to use more empirical evidence. We propose to use this framework as one of our analytical dimensions to investigate whether acceptance spillover is likely to occur for certain aspects of an activity e.g., scheduling, but not for all.

Conclusions

Utilising a living lab of diverse households in the city of Oxford, UK, this research investigates the factors influencing acceptance of automation across different activities of daily life and the possible feedback mechanisms and acceptance spillover to activities impacting the sustainable transition. As a research resource, our project's living lab provides an invaluable opportunity for gathering in-depth, multi-wave insights at the individual and household level on automation acceptance and adoption which supports a sustainable digital transition. By September 2023, the grocery shopping trial will have been conducted and smart hoover trial underway. Preliminary results will be available to present. Results from a potential further trial on EV charging automation, as well as a longitudinal study measuring enduring automation acceptance/use and discontinuance are expected to be available in 2024.

The unique contribution of our study is threefold. First, we comparatively assess a range of automated daily life activities using a standardised methodology and data. Second, we focus on feedback mechanisms of automation experience and potential spillover of acceptance across activity domains and aspects that have varying levels of impact for a sustainable transition. Third, our results will identify generalisable insights on drivers of automation acceptance that hold across daily life activities and contexts to inform macro-level understanding, policies and intervention strategies for harnessing digitalisation and support less energy-intensive forms of consumer behaviour.

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Research-In-Progress Papers

Integrated Impact Assessment of Living Labs

Conceptual Framework, Approach and Methods applied in the LANTERN project

Authors

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Abstract

Switzerland aims for net-zero greenhouse gas emissions by 2050. Against this background, the LANTERN project uses urban Living Labs to co-design, test, validate, and scale up a portfolio of interventions that can contribute to a more user-empowered, decarbonized, resource efficient and sufficient energy consumption in Switzerland. An important component of this project is the development, test, and application of an integrated impact assessment.

However, an important limitation of the Living Labs approach that has been identified in the literature is that it has failed so far to convincingly demonstrate its impact.

To contribute to the discussion about how to overcome this gap, we are currently developing a conceptual framework with support of our project's different work packages and Living Labs using a co-design approach.

This Research-In-Progress paper will present the current state of the ongoing work related to the integrated impact assessment in the LANTERN project, thus providing the opportunity to receive feedback on our work in progress and to discuss our experience on the topic of impact evaluation of Living Labs with the other conference participants.

Key words

Living Labs, Energy, Integrated impact assessment, Conceptual framework, Methods, Socio-technical systems

Introduction

In Switzerland, the Federal Council decided in 2019 to aim for net-zero greenhouse gas emissions by 2050 (Federal Council, 2019). To achieve this goal, technical and regulatory solutions but also the behaviour, social norms, acceptance and changing values of the various actors play a key role.

The LANTERN project uses Urban Living Labs to co-design, test, validate, and scale-up a portfolio of interventions that can contribute to a more user-empowered, decarbonized, resource efficient and sufficient energy consumption in Switzerland. It conducts research and development at the interface between markets, technology, policies, and society and assesses the relevance of socio-technical aspects towards sustainable ways of living and working whilst improving the quality of life. The 8-year project has an overall budget of CHF 33m and consists of a broad consortium including at its initial stage five Urban Living Labs, five cities and other public sector institutions, seven public research institutions, forty-one companies and cooperation partners, and four associations. It reflects the diversity of the Swiss ecosystem and covers three linguistic regions with several of the country's main urban areas represented.

LANTERN and its Living Labs allow us to co-design, test and validate corresponding new services, programs and policies at different scales (e.g., in homes, institutions, districts, or city level) and therefore to develop and test pathways to achieve the objectives of national energy strategy and the climate plans. The country-wide potential will be established through the development of a strategy for scale-up. Furthermore, an explicitly designed evaluation framework aims at supporting the working plan of the Living Labs (van Geenhuizen, 2018).

Hence, an important component of the project is the development, test, and application of an integrated impact assessment. The assessment focuses on the impacts of the created service, programs and policies on different dimensions such as technology, economy, and society, and integrates these dimensions them while considering interactions and dynamics between the three dimensions.

Research gaps and objective

Research has shown that the impact assessment of Living Labs is challenging and needs to be further improved. First, there is not yet an evaluation method or framework that is generally accepted and used (Bouwma et al., 2022) and it is unclear how Living Labs can be operationalised and how their outcomes can be measured (Mbatha & Musango, 2022; Paskaleva & Cooper, 2021). Second, limited attention has been paid on how evaluation methods can contribute to future Living Lab performance (Vervoort et al., 2022) and how interventions through Living Labs contribute to sustainability transitions (von Wirth, Fuenfschilling, Frantzeskaki, & Coenen, 2019). Third, the assessment of Living Labs has mostly been done using qualitative and descriptive case studies. Quantitative methods and comparative studies are often missing (Schuurman, De Marez, & Ballon, 2015). And last, transitions inherently affect multiple domains but developing tools and methods that capture change across different domains is difficult both conceptually and practically (Williams & Robinson, 2020).

To address these gaps, we are currently developing a conceptual framework using a co-design approach involving our project's different work packages, its researchers from different disciplines, and Living Labs with its practitioners. We develop and discuss specific "Theories of Change" (ToC) of the projects different work packages and Living Labs. This allows us to consider the different contexts, objectives, approaches and needs and hence, to design a conceptual framework that allows integrating all key aspects in a holistic and specific way at the same time. Hereby, the assessment approach will consider the level of participant involvement and empowerment, time-series analysis, and long-term viability of the Living Labs (Bronson, Devkota, & Nguyen, 2021).

Method and Results

This Research-In-Progress paper will present the current state of the ongoing work related to the integrated impact assessment in the LANTERN project. First, we will outline the planned activities and expected impacts of the project. Second, we will present the challenges and opportunities for an integrated impact assessment, which we have identified based on a literature review and the ongoing project experience. Third, we will present the conceptual framework of the integrated impact assessment, which focuses on various dimensions such as technology, economy, and society, and integrates them by considering interactions and dynamics between them. Fourth, we demonstrate the operationalization of the conceptual framework and its applicability by using a set of selected indicators. Lastly, we present the planned data collection procedure.

The originality of the approach lies in a cascading approach by which the Living Labs (as permanent entities, including some certified by ENoLL, Vervoort et al. 2022) are considered at a project level and at the interventions in real life settings. Instead of having one goal and with all pillars of activities being directed to it, we assume that the activities of the interventions will be connected in a way to be discovered through the co-design and to several outcomes, some of which some will be expected, and some others will be unexpected.

Based on the information presented in our Research-In-Progress paper, we would like to use the opportunity to receive feedback on our work in progress and to discuss our experience on the topic of impact evaluation of Living Labs with the other conference participants.

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Full Research Paper

Towards living lab value proposition: Living lab experts' perceptions on living lab value

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Abstract

Prior studies have argued that the value what living labs are providing is blurry. Grounded on the Living Lab experts' opinions, the study aims to identify the key value proposition elements for Living Labs. An online workshop was arranged in which 22 experts provided a total of 209 value proposition suggestions. Participants were asked to generate value propositions for the following Living Lab customer groups and for different innovation process phases: researchers, policy makers and public authorities, and SMEs/companies. The suggestions were strongly relying on the activities that living labs are doing and resulted in an initial categorization of Living Lab values. In the follow-up process, expert arguments were used as a guidance for literature search, in which the following quantifiable value proposition elements were defined: 1) Economic benefits, 2) Improved innovation, 3) Better validity and reliability, 4) Benefits for the users and society, 5) Enhanced collaboration and networking possibilities, 6) Safe environment for RDI and 7) Increased skills and capabilities.

Key words

Value proposition, Expert opinion, Living lab benefits, Living lab value

Introduction

Living labs (LLs) are collaborative and user-centered environments that enable the co-creation and testing of new technologies, services, and systems in real-life contexts. According to the literature, a key-characteristic of Living Labs is that they promote and facilitate research and innovation through the collaboration and interaction between various stakeholders, such as universities and researchers, businesses, policy makers and citizens/users, by using a participatory approach (Leminen, Westerlund and Nyström, 2012; Schuurman, De Marez and Ballon, 2015; Sangiorgi, D., & Prendiville, 2018) .

Customer value proposition (CVP) defines how an organization aims to provide value to customers (Payne, Frow and Eggert, 2017). From a customer-enterprise perspective, "value proposition" is a dynamic statement that explains and summarizes the benefits that a service, product or solution offers to its customers or users and why this product or service should be chosen over other similar, competitive options (Johnson, Christensen and Kagermann, 2008; Osterwalder and Pigneur, 2010). In the context of Living Labs, although the value proposition is not yet clearly defined, in this study it refers to the unique value or benefits that the Living Lab approach offers to its stakeholders. Living Lab stakeholders are either the Living Lab customers (a person or organization who purchases or uses living lab research infrastructure services to conduct a specific contract-based research) or end-users that are study participants who voluntarily participate in research after giving informed consent to be the subject of the research.

The aim of the present study is to identify the key elements of Living Lab value propositions from Living lab expert's point of view, having as a starting point the Living Labs in the Health & Wellbeing domain.

What value living labs can provide for their customers

Who is a living lab customer?

Multi-stakeholder participation is one of the key elements of Living Labs, which are engaging all the actors of the Quadruple Helix innovation framework in their studies (Carayannis and Campbell, 2009). Grounded on Business Model Canvas (Osterwalder and Pigneur, 2010), a study by (Santonen et al., 2020) identified key customer segments of the quadruple helix for health and wellbeing Living Labs. Companies were represented by device manufacturers, digital service providers and preventive health/wellbeing service providers. Academia group included educational and research organisations. Public sector organisations covered municipalities and cities, state level organisations, regional public authorities as well as primary, secondary, and tertiary care health organisation which depending on the country can also be private organisation. For civic society non-governmental organisation were referred. Networks and clusters were also mentioned, which can belong to multiple quadruple helix groups depending on their mission.

The aforementioned customer segments can be considered as Business-to-Business Customer (B2B) who purchase or use living lab research infrastructure services to conduct a specific contract based research and/or development activity. To clarify, in this study we are mainly interested to define value propositions for Living lab research infrastructure end users, not the study participants who are representing final end-users.

What value Living Labs provide

Existing literature and references discuss a plethora of benefits of the Living Lab approach, including increased user involvement and collaboration between multiple stakeholders and, consequently, better alignment with user needs and preferences (Følstad, A., & Kvale, 2018), more effective innovation processes and outcomes (Dell'Era and Landoni, 2014; Schuurman, De Marez and Ballon, 2015), faster time-to-market (European Commission, 2016), as well as improved product and service quality along with reduced risk of failure (Leminen, Westerlund and Nyström, 2012; Dell'Era and Landoni, 2014; Schuurman, De Marez and Ballon, 2015). Living Labs as open innovation ecosystems are noted for their ability to bridge the gap between research and development (Følstad, A., & Kvale, 2018) and, also, stimulate economic growth by providing a safe space for collaboration and experimentation (European Commission., 2016; Følstad, A., & Kvale, 2018). A study by (Santonen and Julin, 2019) evaluated what kind of needs and expectations SMEs have for using transnational living lab services. The main findings include 1) testing, 2) marketing/sales support, 2) R&D for new ideas, 3) networking and collaboration, 4) access to end-users, 5) market knowledge, 6) support for innovation management, localization/landing, and funding.

These benefits claims are not without critic. After extensive literature review (Paskaleva and

Cooper, 2021) concluded that the actual Living Lab performance and benefits remains blurry. Authors also argue that the published evidence so far leans on inadequate research design and circular reasoning derived from the Living Lab definition is often utilized to arguing the benefits. As the value proposition of Living Labs is a crucial element that inspires stakeholders to collaborate with the Living Labs and commit their time, resources, and knowledge, it is of utmost significance to explore this issue in more depth.

In order to robustly correspond to (Paskaleva and Cooper, 2021) claims regarding living lab performance and benefits, we must first understand what living lab experts themselves think about the value they can provide for their customers. Once the key elements of the value have been identified, then a robust empirical evaluation framework can be defined to validate these value arguments in further studies.

Methodology

Expert opinion evaluation and brainstorming as a research method

This study can be considered as an expert opinion evaluation, as the main target was to define the Living Lab value proposition from Living lab expert's point of view. The utilization of expert knowledge is grounded on an assumption that using experts will lead to better results than using from non-'experts' (Goodman, 1987). However, prior studies have challenged this assumption, but the research approach is commonly used in scientific studies and therefore suitable for our research purposes (Sackman, 1975; Baker, Lovell and Harris, 2006). Open-ended questions were used for collecting value proposition suggestions. The advantage of open-ended questions is that they encourage respondents to expand on their thoughts, providing more intricate and nuanced responses, stimulate creativity and innovation, leading to new insights and ideas and facilitating the generation of new hypotheses for further investigation (Kvale, 1996; Rubin and Rubin, 2011).

Formation of an expert panel

Horizon 2020 funded Virtual health and wellbeing Living Lab Infrastructure (VITALISE) project's Harmonization Body members were representing Living Lab experts. VITALISE project aims to open up Living Lab research infrastructures as a means to facilitate and promote research activities in the Health and Wellbeing domain in Europe and beyond, as well as harmonise processes and common tools commonly utilized by living labs. The VITALISE Harmonization Body consists of VITALISE partner representatives, people that are currently working in Living Labs of the ENoLL network as well as professionals with expertise in Health and Wellbeing and ICT domain.

Data collection process description and response

The data collection took place during the VITALISE Harmonization Body meeting was held virtually, on the 17th of January 2023. The participants were asked to report through the mentimeter platform their opinions regarding the value they consider that the Living Labs can actually offer. In particular, 22 participants joined the Harmonization Body meeting and provide anonymously their suggestions about the value that Living Labs provide to each of the following customer groups 1) researchers, 2) policy makers and public authorities, and 3) SMEs/companies. They were also asked to define the Living Lab value proposition for different Technology Readiness Level phases (TRL 1-9). The Technology Readiness Level (TRL) scales are commonly used and widely accepted framework for assessing the maturity of technologies and describing the current innovation process stage (Héder, 2017). The TRL value proposition was grouped in three levels, as the researchers have identified that there no major changes among these levels that can be clearly depicted in the value proposition (TRL 1-3, TRL 4-6, TRL 7-9).

On average the available time for them to answer was ca. five minutes for each question. After each question, the results were shown to respondents and they had a possibility to comment on the outcomes. Everyone was able to submit multiple answers for each question. In total, 57 answers were collected regarding the value propositions for the researchers, 32 for the policy makers and public authorities and 46 for the SMEs/companies. Regarding value proposition related to TRLs, 26 answers were collected for TRL 1-3, 27 answers for TRL 4-6 and 21 answers for TRL7-9. In all 209 value proposition suggestions were provided.

Data analysis process

All the 209 answers were analysed as a combined dataset in order to define the Living Lab value proposition. The differentiation in customer groups and TRL level was not taken into account in the analysis and the initial use of different questions was aiming at stimulating the participants new ideas generation. The data analysis was performed in three steps: 1) initial coding and categorization by 2 independent researchers, 2) consensus workshop among an experienced researchers' group, 3) formulation of the value proposition definitions by the research team.

The coding process proposed by (Saldaña, 2021) was applied from 2 independent researchers using a combination of deductive codes drawn from the prior research (Santonen and Julin, 2019; Santonen et al., 2020) and inductive codes generated by the Living Labs expert's arguments. After the initial coding, a categorization and grouping of answers was performed based on the assigned codes.

After the initial categorization, a consensus workshop took place among the core research group in order to align the results, identify similarities and differences and result to a common categorization strategy. The final step, included a deeper analysis of the resulted categories, including the definition of each category and the correlation of the results with elements coming from scientific literature regarding the value of Living Labs. The literature search was used to complement the results rather that compare and make changes.

Results

The analysis identified seven categories, and a mapping to existing literature was performed for each category. Table 1 presents the mapping, along with living lab expert arguments based on the final classification results, and the corresponding benefits derived from scientific literature covering various collaborative innovation terms (Santonen, 2021). In the discussion section, each value category is discussed in-depth, and corresponding scientific literature is referenced. The value proposition elements were classified into the following seven main categories based on the coding process: 1) economic benefits, 2) improved innovation, 3) better validity, 4) benefits for users and society, 5) enhanced collaboration, 6) safe development environment, and 7) capacity building.

Table 1. Living lab expert value argument mapping and generalised benefits from existing literature

Living lab expert arguments	Benefits derived from literature relating arguments
Economic benefits	
1. Living lab can provide funding (e.g., via open calls)	1. Cost savings, 2. Reduced development costs,

2. Support to gain investments 3. Faster development time 4. Fail fast 5. Risk reduction	3. Increased Efficiency, 4. Shorter time-to-market, 5. Funding
Improved innovation	
1. Better solutions 2. Prioritization 3. State of the art / current status 4. Local and Internationalization market knowledge / marketing 5. Marketing support	1. Better product design, 2. Improved quality, 3. Better problem solving, 4. Better decision making, 5. Competitive advantage, 6. Increased creativity and innovation, 7. Access to new markets
Validity and reliability	
1. Living labs have extensive methodological expertise 2. Real-life 3. Test, Validation / impact analysis (Iterative validation 4. Proof of concept 5. Risk reduction	1. Enhanced ecological validity, 2. Improved external validity, 3. Better generalizability, 4. Increased validity, 5. Richer data, 6. Complementary insights
Benefits for the users and society	
1. Verified user acceptance 2. Needs and wants 3. Identification and definition of relevant target groups for your study purposes 4. Needs and requirements	1. Enhanced User Experience 2. Improved User / customer Satisfaction 3. Enhanced Social and Environmental Impact
Enhanced collaboration and networking possibilities	
1. Providing access to user and engaging them across different innovation process phases 2. Networking and collaboration opportunities 3. Multi/Interdisciplinary 4. Innovation network orchestration 5. Panel management 6. Co-creation 7. Engagement / Involvement / feedback 8. Publications	1. Increased Opportunities for Collaboration 2. Improved Communication and Collaboration: 3. Enhanced Collaboration 4. Strengthened Partnerships and Networks 5. Increased Stakeholder Engagement and Ownership 6. Greater Access to Participants 7. Increased Efficiency 8. Improved Resource Allocation
Safe environment for RDI	
Ethics Risk reduction	Protecting Human Participants Upholding Public Trust Ensuring Fairness Promoting Integrity Preventing Research Misconduct Meeting Legal Requirements Regulatory Compliance

Increased skills and capabilities	
Capacity building 1. Skills to do user centric innovations 2. Understanding agile/iterative/ innovation process	

Discussion

The resulting categories and sub-elements for each category have also been identified in the literature to some extent. An attempt was made to provide a more in-depth explanation and presentation of the categories, taking into account the existing findings on the value that Living Labs offer.

Economic benefits refer to gains that can be expressed in financial terms resulting from the Living Lab innovation process or the improvement of the developed solution (modified from Oxford Reference, 2023). A common approach in European Commission funded projects is competitive open call funding. Many project examples, such as the Health Innovation Center of Southern Denmark (2017), show that Living Labs offer money to companies and researchers to conduct Living Lab research. Additionally, startup companies often struggle to find their first customers, which are needed to convince investors. Therefore, a Living Lab study verifying customer acceptance and other solution benefits can help assure investors.

Fail fast refers to an iterative innovation process that involves quick testing to identify and address potential problems as early as possible (Müller and Thoring, 2012) and is a common approach used in design thinking and lean startup methodologies. Additionally, the risk of solution failure is greatly reduced since many problems can be detected at the beginning of the development process, where making changes is cheaper (von Hippel, 1993). Early problem detection can also reduce time to market, enabling faster revenues.

Improved innovation refers to all the different aspects in which the developed solution, whether it be a product, service, process, decision, policy, etc., could be better than competing solutions. The key idea of the Living Lab process is to improve the design and user experience quality of the developed solution (De Moor et al., 2010). Better user experience typically includes factors such as usability, accessibility, functionality, desirability, credibility, and efficiency (Hassenzahl and Tractinsky, 2006; Sauer et al., 2020; Barnum and Palmer, 2010). Living Lab studies have referred to better design in terms of functionality, usability, sustainability, and cost-effectiveness (Brankaert and Den Ouden, 2017; Liedtke et al., 2012; Fleet, 2020). Living Labs are also argued to widen the scope of innovation, stimulate creativity, and facilitate better decision-making and policymaking, especially when dealing with complex societal challenges and problems (Barata et al., 2017; Sörvik et al., 2015; Liedtke et al., 2012; Gatta et al., 2017). As a result, improved innovation should eventually lead to a competitive advantage if proper competitor analysis and high user acceptance have been achieved during the Living Lab process.

Validity and reliability are also factors of Living Lab value proposition, with reliability referring to the stability of findings and validity to the truthfulness of findings (Altheide & Johnson, 1994). Living Lab research, driven by design thinking, combines laboratory-based and field-based approaches to ensure better validity and reliability. The use of real-life settings with real users in Living Lab studies results in high ecological validity, meaning that findings can be generalized or applied to real-world situations (Cronbach, 1957). The combination of laboratory- and field-based approaches also increases validity, as they complement each other's strengths and weaknesses. Living Lab research designs follow a multistakeholder approach, leading to larger and more diverse sample populations covering all quadruple helix actors, resulting in more grounded study results. The multimethod requirement derived from the Living Lab definition strengthens external validity, extending research findings beyond the sample population and research context.

Benefits for users and society refers to the impact of Living Lab studies in these groups. User-centricity is at the heart of the Living Lab approach, where research and innovation activities prioritize the needs, behaviors, and preferences of users (Eriksson et al. 2005). By involving users as active participants in the Living Lab process, the developed solutions are more likely to meet their needs, leading to higher user adoption and retention rates. In addition, the Public-Private-People Partnership (4P) approach of Living Labs provides a way to legitimize the results across society, ensuring that the solutions developed are not only effective but also socially acceptable and sustainable (Molinari, 2011).

Enhanced collaboration and networking possibilities is another value that Living Labs offer. Collaboration lies at the core of participatory design and co-creation. Living Labs offer a wide range of tools and methodologies to enhance collaboration among the quadruple helix stakeholders (Kalinauskaite et al. 2021). These tools mainly focus on communication among the stakeholders, increasing transparency and trust, which is essential for successful collaboration. Effective communication strategies used by Living Labs increase stakeholder engagement, facilitating the creation and management of a long-term panel of engaged stakeholders. This expands the value that Living Labs can offer as they have access to a greater number of potential participants. Another advantage of Living Labs is that they enable more diverse and multidisciplinary collaborations, bringing together stakeholders from different industries and fields (Hakkarainen and Hyysalo, 2013). This fosters cross-sectoral and interdisciplinary collaboration, opening up new and sometimes unexplored opportunities for cooperation.

Safe environment for RDI refers to the provision of the mechanisms for ensuring regulatory and legal compliance. Living Labs provide mechanisms to ensure stakeholders' rights are protected and ethical considerations are integrated into technological research (Callari et al. 2020). However, this adoption of an ethical approach is not just a one-off consideration for specific projects, but rather fostered over the long-term with stakeholders, building trust and establishing environments for democratic and fair dialogues. These real-life environments are considered safe for experimentation due to the trust of ecosystem actors and systematic approaches of Living Labs that pay special attention to how to experiment in real-life settings. In today's context, with the emergence and application of regulations such as GDPR, most Living Labs have ethics experts who are involved in the protocol design of the experiment. Additionally, there is a trend towards equally acknowledging the stakeholders involved in scientific publications and setting their own participation rules for Living Lab experiments.

Increased skills and capabilities. The term 'capacity building' can have various interpretations (Simmons et al., 2011). For the purpose of this study, capacity building is defined as a process that enhances the knowledge, skills, and abilities of individuals, organizations, or communities to understand the key principles of the Living Lab approach. By acquiring new knowledge and skills, these actors can initiate or undertake their own Living Lab projects or become proficient end-users of Living Lab research infrastructure. Living Labs can transfer the knowledge and experience that they have acquired in a comprehensive and effective way.

Conclusions

Living labs have been criticized for the lack of clarity around the value they provide. To address this, we conducted a study to identify the key elements of the Living Lab value proposition, drawing on the perspectives of Living Lab experts. During an online workshop, experts express their opinions on the value Living Labs are offering for the research and development community and the importance of Living Lab activities. These arguments were used as a guide for a literature search, which led us to identify seven benefits of Living Labs: economic benefits, improved innovation, better validity and reliability, benefits for users and society, enhanced collaboration and networking possibilities, a safe environment for RDI, and increased skills and capabilities.

While our study was based on expert perceptions and scientific literature, future studies should aim to define quantifiable measures for evaluating the suggested value propositions. This study can also contribute to the work that is being performed by Koen et. al (2022) that aims to define the evaluation framework of Living Labs. Our results can serve as a roadmap and checklist for Living Labs as they consider the value they can provide to their customers. Further research to produce quantifiable results on each of these domains should be also done in order to strengthen the Living Lab position in the research and innovation ecosystem.

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Thematic Research Session

Thursday and Friday, 21st - 22nd September 2023

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Sur 3-4

City blocks as living labs for sharing economy

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Abstract

While circular and sharing economy services are widely available at national and city levels, only a few apply directly to the city block level. In this presentation we explain how the circular and sharing economy has been promoted at the city block level by implementing co-creation activities and facilitating agile pilots in four pilot locations in the Helsinki region. The presentation provides insights from the living lab activities and how the learnings could be scaled-up.

Keywords

circular economy, sharing economy, sustainable urban living, action research, agile piloting, co-creation

Introduction

The current lifestyle and covid-19 pandemic have increased time spent at home. Simultaneously, the triple crisis calls for a rapid change in lifestyle and consumer habits (UNFCCC, 2022). As our daily environments, city blocks are essential for meeting CO2 objectives.

While circular and sharing economy services are widely available at national and city levels, only a few apply directly to the city block level. New business opportunities arise, but seizing them requires a better understanding of the target audience and diversity of block contexts—namely, a dialogue between companies and service users. The Circular Green Blocks project (Circular Green Blocks, 2023) raises awareness and coaches block level operators, such as housing associations, to implement circular and sharing economy solutions in their property and neighbourhoods. It also supports companies in developing their services to answer block-level needs.

Methods

The project utilises an action research approach and seeks a transformation through the simultaneous process of doing research, implementing co-creation activities, and facilitating pilots. Four pilot blocks including both rental and privately-owned premises in the Helsinki region (Finland) provide a living lab for the co-creation activities and pilots. Altogether the pilots affect forty residential buildings with nearly 500 apartments.

The project team facilitates co-creation and sharing economy pilots with residents and service providers, utilising the double diamond model of service design (Design Council, 2019; Pyykkö, Suoheimo, & Walter, 2021) and agile piloting program (Rinne & Spilling, 2020). The first phase focused on creating an in-depth understanding of each block: their context, development needs and challenges. These insights fed into launching two open calls for pilots of innovative sharing economy services from companies.

The second phase focused on piloting the selected solutions within the blocks. Five companies representing the sectors of the sharing economy, smart mobility and urban farming were chosen for the pilots. During a six-month period, the residents and housing associations tested shared electric bicycles, borrowing and sharing of goods, as well as communal urban gardening.

Throughout, the project team collected and analysed experiences to develop the services.

Results and take-aways

The needs identified during the first phase were overall similar in all pilot blocks with block-specific nuances that were specified further to 3-4 development tasks reflecting the context of each block. The pilots provided key learnings on sharing in city blocks and enabled the development of the solutions. The companies gained experience from a new customer segment and received first-hand feedback from their services.

A short piloting period allows companies a low threshold to test solutions with a new target group. Residents' outreach and communication about pilots were found challenging, which may have affected negatively on the utilisation rate during the piloting. However, the adoption of a new service takes time and a full picture of demand and residents' needs and desires may not become visible in a short time.

In our presentation we will provide the public with learnings from the living lab activities run in the city blocks as well as insights from the sharing economy pilots and how the learnings could be scaled-up. We also aim to gain new insights on the applicability of the project's methods and results on the international contexts, and learn how the block level circular and sharing economy has been addressed in other cities and neighbourhoods.

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Research-In-Progress Paper

LIFE-BECKON proposal for Transition Living Labs

Authors

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Abstract

This paper discusses the importance of energy communities in the transition to renewable energy and how the LIFE-BECKON project is supporting their development through a comprehensive support mechanism, including a Technical Assistance Cookbook, Capacity Building program, and One-Stop-Shop platform. The role of Transition Living Labs in facilitating the development and scaling up of Energy Communities is also explored, with a focus on the Transition Living Lab created by LIFE-BECKON to validate its support mechanisms.

Key words

Energy Communities, One-Stop-Shop, Technical Assistance, Transition Living

Introduction

Energy communities are an innovative and increasingly popular approach to promote the energy transition. They represent a paradigm shift from the traditional centralized energy system towards a more decentralized, democratic, and community-driven one. Energy communities enable citizens to take an active role in shaping their energy future, by promoting local ownership, collective decision-making, and mutual benefit. By involving citizens in the planning, development, and management of renewable energy projects, energy communities can enhance public acceptance, generate social and economic benefits, and contribute to the achievement of national and international climate goals.

The LIFE-BECKON project aims to boost the deployment of Energy Communities across Europe by developing and delivering comprehensive support mechanisms for public authorities, promoters, and local action groups. The project is focused on the Green Transition, which emphasizes the transition towards a more sustainable and environmentally friendly society.

The project's comprehensive support mechanism includes a Technical Assistance Cookbook to enable the creation of Technical Assistance Offices, a Capacity Building program via Train the Trainer approach to increase stakeholder knowledge, and integrated services via a One-Stop-Shop platform to facilitate access to information, tools, and guides as well as matchmaking among actors along the value chain.

The LIFE-BECKON project is well-aligned with the Living Labs approach focused on creating sustainable impact through iterative feedback processes and co-creation among stakeholders. The services via One-Stop-Shop platform operate as intermediaries among citizens, research organizations, companies, and government agencies, and provide comprehensive support mechanisms to facilitate the creation of Energy Communities.

Importance of Energy Communities

Most efforts to promote renewable energy have traditionally come from a top-down approach, where governments commit to certain goals by specific deadlines without considering the necessary value chains. While setting national goals and passing legislation are essential to incite climate action, a bottom-up approach can also be effective (Prina, Matteo Giacomo, et al., 2020). In areas where government accountability is lacking, citizens can demand national action and embrace the energy transition independently of the national agenda.

Currently, there are over 9,000 energy community initiatives across Europe. Renewable energy communities have been shown to significantly influence public opinion in favor of renewable energy projects. For example, a case study in Germany revealed that the presence of energy communities reduced the percentage of negative opinions towards renewable energy from 60% to just 12% (Musall & Kuik, 2011). This remarkable shift can be attributed to the local ownership aspect of energy communities, which enhances public acceptance of renewables by reversing the "not in my backyard" mentality (Commission Staff Working Document Impact Assessment, 2016).

By using a simultaneous top-down and bottom-up approach, we can help reach net-zero goals while improving public opinion (Koopmans & Velde, 2001). Governments can set national goals and create the legal framework necessary to support renewable energy initiatives, while citizens can take an active role in promoting energy communities and demanding change. Together, this collaborative approach can foster a more sustainable energy system, empower communities, and transform our world (Dai, *et. al.*, 2015).

Role of Transition Living Labs in Energy Communities

In the context of Energy Communities, Transition Living Labs can facilitate the development and testing of new energy technologies, business models, and governance structures. They can provide a platform for collaboration among stakeholders and help to build trust and social capital, which is essential for the success of Energy Communities. Transition Living Labs can also help to identify and address potential barriers to the development of Energy Communities, such as regulatory and policy constraints, technical challenges, and market barriers.

Moreover, Transition Living Labs can play a key role in the scaling up of Energy Communities. By providing a platform for testing and validation of Energy Community solutions, Transition Living Labs can help to build evidence and momentum for wider adoption of these solutions. They can also facilitate the dissemination and replication of successful Energy Community models across different geographical areas and market contexts.

LIFE-BECKON's Transition Living Lab

The Transition Living Lab is focused on validating the comprehensive support mechanisms developed by LIFE-BECKON (LIFE21-CET-ENERCOM-LIFE-BECKON, 2023) to promote the creation of Energy Communities. This validation will be made with pilot's Technical Assistance Offices, citizens open places with tailored training material on how to develop an EC and how to use the One-Stop-Shop (OSS) with more in-depth tools and resources. Embodying a Living Lab approach, the content will address the specific needs of these pilot offices that are currently unfulfilled by existing tools. Surveys and interviews are being conducted in these pilot areas to hear exactly from the future users what needs are left unmet.

These mechanisms include a Technical Assistance cookbook, Capacity Building program, and One-Stop-Shop platform. The Technical Assistance cookbook enables the creation of Technical Assistance Offices, while the Capacity Building program uses a Train the Trainer approach to increase stakeholder knowledge. The One-Stop-Shop platform facilitates access to information, tools, and guides, as well as matchmaking among actors along the value chain.

Technical Assistance Cookbook

The purpose of the Cookbook is to outline the technical steps and the administrative steps (financial, legal, participatory, etc.) with corresponding tools to simplify the process for project promoters. Both categories of steps (technical and administrative) are divided into four distinct phases: initiation, design, implementation, and operation. This is to ensure the user is working on both types of tasks in parallel. The Cookbook is set up as a roadmap that starts with an initial placement quiz to determine the stage of the project to filter out the already accomplished steps. It is designed so that someone with little technical expertise can navigate the Cookbook, understand each of the steps, and make use of the tools. At this point, the steps of the Cookbook have been defined, and a gap analysis is underway to identify which existing tools to leverage and which must be developed or modified. This Cookbook will be available on the OSS.

Capacity Building Program

This capacity building program will equip project promoters (public authorities, energy agencies, local action groups, energy companies) with the knowledge they need to confidently lead an energy community initiative. A "train the trainers" approach will be implemented at the three pilot sites to create a ripple effect. The goal is to heighten community energy awareness amongst local stakeholders, thereby encouraging them to spread the enthusiasm across their region. This approach follows a Living Labs methodology; with the citizens involved at all stages, and the program is constantly evolving to meet their needs. As of now, hundreds of actors across the three different pilot sites have been surveyed or interviewed to perform a needs analysis and learn how best to tailor the various resources. Preliminary results have shown that all pilot sites need support regarding financial management at a project level and individual level.

Additionally, the capacity building program will include a series of interactive training. These will include videos to complement the Cookbook, physical workshops to facilitate relationships across the value chain in each region, and webinars to support EC deployment. The recorded resources will be made available on the Training Hub of the OSS.

Integrated Services via One-Stop-Shop Platform

The OSS will be composed of a Knowledge Hub, a Training Hub, and an Opportunities Hub. The Knowledge Hub will host the Cookbook and a bibliography with useful resources. These resources will include those referenced by the Cookbook and other tools that could be useful for audiences other than EC promoters. For example, there are tools to help citizens independently improve energy efficiency in their home or install solar panels on their roof (without being a part of an EC). The Training Hub will include the educational materials produced in the Capacity Building effort, described below. The Opportunity Hub acts as a matchmaking platform and will directly interface with the Cookbook in the Knowledge Hub. Specific technical and financial experts in each location are recommended at certain steps of the roadmap if extra support is deemed necessary. The Opportunity Hub also includes a forum where ECs can publish their project with the intention of finding investors, technical experts for specific problems, or starting a discussion.

Validation in demo areas

The support mechanisms will be validated in three supramunicipal areas in Avila-ES, Sofia-BG, and Copenhagen-DK, covering a wide range of conditions, cultural aspects, and market maturities. This diversity is necessary to ensure the robustness of the tools to maintain its applicability throughout the EU. The technical assistance offices or Transition Living Lab will educate actors local to the three pilot areas.

In general, the TAO pilots will interact with the existing local energy office to launch a call for projects. The target is to assist between a minimum of ten to a goal of twenty-five initiatives in each area. This assistance includes a Cookbook introduction session, a capacity building program throughout the area, and OSS engagement initiatives. The capacity building aims to reach 150 - 200 stakeholders in each pilot area, effectively training the trainers and filling knowledge gaps.

After the launch of the pilot TAOs, the effectiveness and quality of the support mechanisms will be evaluated for certain indicators such as ease of use, robustness of features, and areas of improvement. The validation of the tools' efficacy is the most crucial step to guarantee the lasting impact of the implemented activities. The Living Labs evaluation and feedback of the tools will incite corrective actions to strengthen the Cookbook, Capacity Building program, and/or the One-Stop-Shop. These improvements will be implemented prior to the replication and dissemination activities to capitalise on the lessons learned from the pilot sites.

Conclusion

Energy Communities are gaining traction as an innovative approach to promote the energy transition, allowing citizens to take an active role in shaping their energy future by promoting local ownership, collective decision-making, and mutual benefit. The LIFE-BECKON project aims to boost the deployment of Energy Communities across Europe by developing and delivering comprehensive support mechanisms for public authorities, promoters, and local action groups. The project's comprehensive support mechanism includes a Technical Assistance Cookbook, Capacity Building program, and One-Stop-Shop platform.

The Transition Living Lab as Technical Assistance Offices developed in several municipalities across Europe are focused on validating the comprehensive support mechanisms developed by LIFE-BECKON to guarantee the quality before dissemination and replication. In the context of Energy Communities, this Transition Living Labs can facilitate the development and testing of new energy technologies, business models, and governance structures, and play a key role in the scaling up of Energy Communities.

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Innovation Presentation Outline

Cluster Program as a tool for promoting circular economy in construction

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Abstract

Collaborating between public departments and units, research institutes, universities and companies is necessary for implementing circular solutions in the construction sector. As a part of its ambitious environmental sustainability goals, the City of Helsinki founded the Circular Economy Cluster Program in 2021. To support the great demand for new information about circular economy in the construction sector, the Circular Economy Cluster Program serves as a development platform for testing and developing solutions that enable taking the circular leap.

The Cluster brings together actors from within the city and the construction industry, co-develops circular solutions and processes, carries out real-life experiments and studies, and offers an informal space for knowledge exchange. Experiments and pilots are conducted on both city-owned development platforms, e.g., demolition sites and public spaces, and on privately owned premises.

Key words

Circular economy, public-private partnership, innovation, experimentation

Introduction

The City of Helsinki aims to be one of the European forerunners in climate change mitigation and reach carbon neutrality by 2030 (City of Helsinki, 2021). Construction is identified as one of the key areas to help reach these goals in Helsinki's Roadmap for Circular and Sharing Economy (City of Helsinki, 2020). As the capital of Finland, Helsinki has, in fact, great potential for supply and demand to meet as it operates in the local construction ecosystem as a client, developer, and a constructor.

On the contrary to the linear economic model, circular economy aims to keep products and materials in use at their highest value (Ellen MacArthur Foundation, 2017). Yet, more practical experiences and know-how are still needed to achieve circular economy in the construction sector. The City of Helsinki Circular Economy Cluster Program (CE Cluster) was initiated in 2021 to help accelerate the transition.

The three-year-program is funded by the city with three million euros and brings together professionals to create innovative solutions, tools, processes, and business opportunities. With the city taking an active role as a facilitator, the CE Cluster serves as a tool for testing and developing solutions that enable taking the circular leap.

Focus on collaboration between the public and private sector

Situated in the Economic Development Department of Helsinki, the CE Cluster works closely with different departments within the city as well as with private organisations. The Cluster is joined by more than 100 members from the industry, i.e., construction and real estate stakeholders, material providers, architects, construction and infrastructure consultancies, recycling operators, digital solution providers, universities, and research institutes.

The diversity of the participants throughout the value chain enables creating an ecosystem required for solving bottlenecks and advancing circular economy in the local construction sector. Participation in the CE Cluster is flexible and based on the needs of its members and the city.

All activities are conducted in collaboration with various partners on a case-by-case basis: the CE Cluster finds synergies between actors and financially supports projects that boost circularity and the experimentation of new materials or processes. It also promotes peer learning by organising innovation challenges, events, and trainings (Figure 1).

Figure 1. The CE Cluster challenged concrete companies to innovate new uses for mineral wool waste. One of the winning products, Cubeco, is piloted in Helsinki during summer 2023. Each module uses 300 litres of mineral wool that would otherwise end up in the landfill.

Finding solutions through concrete actions

While the objective is a systemic change on a larger scale, the CE Cluster seeks concrete, replicable solutions with agile experiments that contribute to the circular transition. One of the main goals is to help real estate owners and developers better identify materials and products that could retain or even increase their value when extending their lifecycle.

Activities facilitated by the CE Cluster include e.g., mapping out resources with pre-demolition audits, developing a data platform for reused materials, testing methods for extracting buildings parts, developing new products of reused materials, and updating circular procurement criteria. To benefit the whole industry, results are shared openly with the ecosystem and brought back into the city's own development (Figure 2).

Figure 2. Aalto University's students designed warehouses of reused materials for Helsinki's outdoor sports facilities in the CE Cluster's Closing Loops architecture competition. The concept "Lippa" is further developed as a pilot project.

There are still many questions to be solved about the process, regulation and cost structure for reusing construction materials and components – and three years is probably not enough to ensure the uptake of circularity in construction. The CE Cluster, however, has already initiated the change by influencing the city's own circular processes while also supporting the business of private actors.

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Learning Spaces as Living Labs in Dutch River Management: Joint effort to improve river management through innovation

Authors

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Abstract

To facilitate innovation in Dutch river management, the river authority has launched the concept of ‘Learning Spaces’. These learning spaces function as living labs in bringing different stakeholders from the quadruple helix together. The team collects and tests innovative ideas and prepares them both technically and socially for implementation. Tools to monitor the progress are Stakeholder Readiness Levels and Portfolio Management. During the first learning space period 8 innovations have been tested, some have moved towards implementation, and some to a next research phase. However, the innovation with most impact is possibly the learning space itself. It is included in any performance contracts of the river authority, and as such has become a standardized form of cooperation.

Keywords

Innovation Team, Rhine, Operational Management, Quadruple Helix

Problem statement

Rijkwaterstaat initiated in 2014 so-called Learning Spaces in the Dutch branches of the River Rhine (1,2). Learning Spaces are innovative forms of Living Labs as they are part of multi-year maintenance contracts between Rijkswaterstaat and a contractor, and in which knowledge institutes are invited to participate. Furthermore, the connection to the maintenance contract gives the living lab direct access to real-life challenges to be addressed and an experimental space. The aim of the living lab is to develop innovations improving efficiency and sustainability of river management (Figure 1).

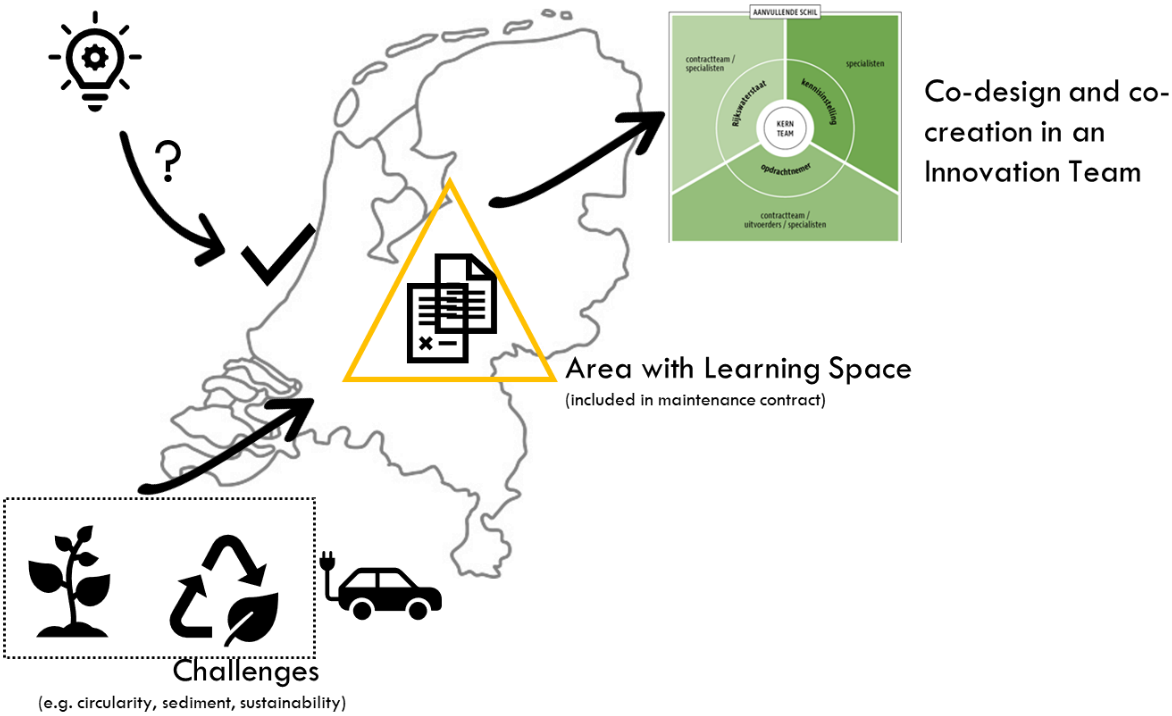

Figure 1. The focus and design of a Learning Space (source: Rijkswaterstaat)

Since 2020, Learning Spaces are a contractually approved instrument, and included in any new river maintenance contract. In this paper we aim to analyse how the Learning Spaces contribute to innovation and knowledge development. In particular we are interested in supporting the partners in this new way of working as well as improving the knowledge development and learning process.

Methods used

This paper is the result of action research. Two of the authors participate in a Learning Space, both in the operational teams (the 'Innovation Teams') and as coordinators. For this paper, we draw on our experiences in or with the Learning Spaces and on documents developed by the Innovation Teams, complemented with interviews with other participants. Innovations are collected and their progressed tracked with Technological Readiness Level assessments, Stakeholder Readiness Level assessments (3), and portfolio management.

Results/outcomes

The study shows that Learning Spaces provide a new, both promising and challenging way of working. In the first Learning Space, up to 8 innovations have been tested or supported in multiple ways, leaving space for initiatives from different partners. The Learning Spaces have increased both the technological and stakeholder readiness levels, but the extent to which differs per innovation. Furthermore, the most successful innovation is maybe the instrument itself: Learning Spaces are now an approved and established instrument in Rijkswaterstaat. At this point in time at least 8 new Learning Spaces have been launched and more will follow when new maintenance contracts start, both in river and road management.

Interest to the audience

This paper discusses an innovative form of Living Labs and it demonstrates how a Living Lab could be institutionalized. Furthermore, instruments like Stakeholder Readiness levels and Portfolio Management may interest the audience.

What we would like to get out of the presentation

The learning spaces have become the new standard in Dutch river management. We would like to substantiate the way we work. Which theories are useful to further analyse the living labs, how could we improve the quality of the living labs and improve learning within the involved organisations?

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Full Research Paper

The Role of Policy in City-Region Food System Transformation: Evidence from Living Labs across the EU

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Abstract

The rising need for system wide food system transformation is recognised across the nexus of environmental sustainability, human health, social justice, and economics. As scholars and practitioners focus their efforts on the complexity and pressures of food systems, Living Labs are conceptualised as experimentation grounds for city region food system (CRFS) transformation, engaging with the urban-rural continuum of food. Yet, the role that local policy can play in the transformation process is unknown. This paper presents an assessment of CRFS labs across the EU, focusing on food stakeholders and policy actor perspectives to provide insight into policy initiatives, policy instruments and the factors influencing food transformation policies at city-region level. In-depth semi-structured interviews with CRFS lab coordinators from thirteen EU city-regions capture the variation in characteristics of CRFS. Lessons are drawn on policy efforts and experimentation, which portrays the diversity of approaches and the power dynamics, local capacities, mandates, and priorities in urban (food) agendas. Mapping out responses to CRFS challenges demonstrates a transition from top-down to citizen-driven collaborative models where citizens, local governments and organisations play an increasing role in the development and implementation of transformative activities and policies. Findings also stress currents gaps in cross-scale governance collaboration and highlight the need for adopting system thinking principles in the urban food governance discourse, moving away from monomeric responses to the calls for sustainability in CRFS.

Key words

Living Lab, Policy Lab, Food Governance, Food System Transformation, City Region Food System (CRFS), Sustainability

Introduction

The need for food system transformation to increase environmental sustainability and human health is increasingly recognised and permeates governance and policy strategies at the international, European, and national levels. Despite the recognition that these issues negatively impact society, food systems governance has been limited. The current tools and strategies used to steer food systems towards sustainability have been criticised due to their fragmentation and oversimplification (Ballamingie et al., 2020; Blay-Palmer et al., 2015; Moragues-Faus & Sonnino, 2019; Sibbing et al., 2021; Sonnino et al., 2019). Particularly the lack of systems thinking in EU's food governance has led to a fragmented and disconnected approach and a concentration of power in the hands of market actors (SAPEA, 2020).

City regions are emerging as a new nexus for urban transformations surrounding policy, research, and food innovation. The City Region Food System (CRFS) approach is based on the concentration of flows of resources and impacts within the high demand city region food systems, and therefore focuses on the city region as an appropriate and effective locus of policy and transformation activities (Blay-Palmer et al., 2018). The momentum in city-regions is demonstrated by the uptake of food into strategies and development plans that policymakers undertake (Dubbeling et al., 2015; Jennings, 2015), as well as participation in city networks, bottom-up urban initiatives, and local governments' declarations (e.g., the MUFPP (Milan Urban Food Policy Pact)) towards establishing more sustainable, fair, and resilient urban processes that frame urban agendas accordingly.

However, city-regions remain challenged by the growing pool and variation of food actors and the collective interest involved with food system transformation. Living Labs have sprung up in multiple development areas, including the agri-food economy, and grassroots innovation in the wider food system (Wolfert et al., 2010; Campbell Angus Donald, 2017). The Living Labs approach plays a vital role in transformational processes as its core concepts evolves around open innovation, based upon the processes of prototyping, validation, and continuous development of solutions in dynamic and complex solutions. This facilitates policy experimentation, co-creation, and citizen involvement within the evolving real life policy contexts in which city-region food system transformation takes place.

Embedded in this emerging stream of interdisciplinary practice, there is an on-going academic debate on the role of cities in sustainable food transitions. Scholars from many disciplines have widely discussed the need for a system thinking approach to food, and the role of policymaking and urban experimentation in addressing complex sustainability issues in urban territories (Blay-Palmer et al., 2018; Moragues-Faus et al., 2017; Sonnino et al., 2019). But as many have argued, there is still a need for more empirical and place-specific research that focuses on practical elements (Candel, 2014; Sonnino, 2023; Wolfram et al., 2016), such as local government decision making (Candel, 2020), the role of system thinking in local governance (Sonnino et al., 2019), and the role that Living Labs play in the overall sustainable transition of food systems. At the same time, to date, according to (Frantzeskaki, 2019), ''the majority of the cases are analysed and documented in time-distance to contemporary urban agendas and policy issues''. This research replies to these gaps and calls and assesses the application of the City Region Food System approach to develop viable and sustainable city-region policies and governance that entails the diversity and uniqueness of city-region food systems (Eakin et al., 2017). The focus of this paper is on the food system transformation efforts of city regions across the EU, joining the discourse on policy and governance to reach food system sustainability. Consequently, we question the types of policies and strategies that city-regions in the EU follow. How does the concept of Living Lab help them to experiment and co-design such policies in a bottom-up manner together with citizens? Ultimately, what's their relationship with different levels and scales of food governance?

Urban food policy transformation: from theory to practice

Understanding the theoretical concepts of urban food system transformation is required to successfully coordinate transformation efforts and deal with socio-environmental challenges linked to food system sustainability. Complex problems with multi-causality and diverse interlinked interactions must be addressed if sustainable transformation in production, processing, transportation, consumption, and food waste is to be reached on a territorial scale (Ericksen, 2008). Multiple systemic concepts apply to this context. Academic discourse of the food system contains definitions and conceptualisations of the term sustainability. This research adopts the food system sustainability definition of the FAO (2018): "*a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition* *for future generations are not compromised"*. This definition stresses the flexible and adaptive alignment of human and ecological needs across diverse scales (Eakin et al., 2017) to generate positive value cross the economic, social, and environmental aspects simultaneously.

Region-specific approach to food systems: the territorial dimension of food system transformation

Until recently, cities were seen as sole drivers of socio-environmental problems, operating under fragmented governance structures and limited agency. However, city planners, urban practitioners and policymakers have started to perceive cities as agents of action that can drive change, and as terrains of policy experimentation (Hebinck & Page, 2017; Wolfram et al., 2016). Even though urban transformations discourse has focused primarily on mega-cities (Hölscher et al., 2021), medium-sized and middle-income cities are increasingly acknowledged as leaders of sustainable transformation (Vojnovic, 2014), and are a good middle-ground for food policy experimentation (Ballamingie et al., 2020). Given the territorial proximity of food processes and actors, these cities and city-regions can opt for more integrated and sustainable food system processes that enable shorter food supply chains and connect farmers and consumers more directly, transforming the food system.

City-regions can enhance food security and urban resilience by adopting the City Region Food System (CRFS) approach. A CRFS is defined as *"the complex network of actors, processes and relationships to do with food production, processing, marketing, and consumption that exist in a given geographical region"* (Jennings, 2015, p.29). The city-region consists of several overlapping and interacting systems that have varying boundaries, with the territories of some systems spilling across city borders or across wider networks. The recognition of a lack of food system governance has led to a shift in focus towards city-regions as the nexus of food system transformation. The approach is characterised by diversity and involvement of institutional and societal partners in food governance. CRFS particularly focuses on the elements of (1) food access, (2) stimulating jobs and income, (3) resilience of the region and the food system, (4) improving the urban-rural linkage, (5) ecosystem and resource management and (6) participatory governance (Blay-Palmer et al., 2015, 2018). The region-specific concept of CRFS can stimulate sustainable operations by enabling democratic and bottom-up governance approaches in the local level and helps building more inclusive political narratives (Dubbeling et al., 2015; Moragues-Faus & Morgan, 2015). CRFS are considered a hub for innovation and new food governance that foster the creation of new relations between the state, the market and civil society (Wiskerke, 2009), functioning as a potential nexus to fill the vacuum left by the lack of integrated and coherent food policies (Rocha, 2009; Sonnino, 2016; Moragues-Faus et al., 2017).

Typologies of food policy initiatives

The role of policy should be explored in food system transformation under the domain of city-region governance. Policymaking is a process of steering and orchestrating activities towards certain outcomes and is an essential part of governance. New configurations of food policies and different policy types form part of governance-beyond-the-state processes that allow policy experimentation over different scales of governance (Moragues-Faus & Morgan, 2015). The concept of *new food governance* is introduced by Renting & Wiskerke (2010) and describes a governance mode that goes beyond states' traditional roles, and entails the co-existence of civil society, the state, and the market. This governance thinking brings power and agency to non-traditional urban actors such as citizens and grassroots organisations and democratises urban processes and policymaking.

Policy typologies are helpful in assessing policy instruments and approaches. One such approach is the distinction between soft and hard policy instruments, given the level of coerciveness. A commonly used policy typology is introduced by Vedung (1998) who makes the distinction between regulative, economic, and informative instruments. These typologies are utilised to place CRFS lab activities on axes that expresses the degree of coerciveness, ranging from voluntary and market-based policy responses to regulative non-voluntary one (Fattibene et al., 2020; Galli et al., 2018; Gelius et al., 2022; Krigsholm et al., 2022; Vedung, 1998). Table 1 presents the typology of policy instruments and interventions in place towards steering the CRFS: regulatory policy instruments, urban planning instruments, economic and market-based instruments, and informational and educational instruments.

Table 1. Policy toolbox for CRFS policies

Instrument category	Examples of policy instruments		Degree of Coerciveness
Regulatory policy instruments	Regulations, standards, rule and requirements, reforms, food safety standards, public procurement principles and criteria, advertisement restrictions		High ('hard instruments' and non-voluntary)
Urban planning	Public land acquisition policies, public land allocations, zoning and spatial plans, measures for access to agricultural or vacant lands		
Economic and market-based instruments	Fiscal incentives, tax reductions, financial support, subsidies, nudging tools and brokering		
Informational and educational instruments and programmes	Campaigns and events, raising awareness activities, educational activities, recommendations and food strategies, partnerships and cooperation, advice, and guidelines		Low ('soft instruments' and voluntary)

At the moment of authoring this paper, much is unknown about local policy makers' decision-making processes in food governance (Candel, 2020). Developing CRFS strategies poses choices to local policymakers for tacking multiple food system challenges. Although urban food policies usually emerge from local governments and municipalities, civil society and other urban actors can play a role in the design and introduction of such policies at the city-region level (IPES-Food, 2017). Softer instruments are applied by municipalities as they can be adapted to local contexts, lack implementation costs, and can function as a leverage point for local strategies development, but there might be insufficient when not coupled to hard policy instruments (Kasa et al., 2018). Consequently, a policy mix with various policy interventions can be an effective way forward for city-regions.

Food policy experimentation in CRFS labs

A growing number of city-regions are experimenting with Living Labs, or CRFS labs, as food systems serve multiple functions that are essential to societal welfare, including public health, individual nutrition, and environmental objectives. CRFS labs aim to activate stakeholders through local experimentation, social innovation, and public involvement, by bringing diverse food actors and stakeholders together to contribute to the transition toward CRFS sustainability. Bulkeley et al. (2016) describe these experimental spaces as *safe zones* that go beyond innovation and extend into urban governance, as they explore methods for setting up urban networks and assess CRFS actors' vision. Policy innovation efforts enable knowledge sharing, empirical testing, and reflection on regulatory reforms. In addition, they may add to the democratisation of CRFS decision making and have an integrative potential in policy formulation in city-region level (Willems et al., 2022).

The CRFS lab approach is inclusive and directly involves stakeholders and urban-rural actors in a collaborative policymaking arena. CRFS labs function within new urban governance forms that fall under the quadruple helix, a framework commonly utilised to examine the development of CRFS labs (Nguyen & Marques, 2022). The model brings science, policy, business, and civil society together, and is widely used to foster innovation and help knowledge and resource-sharing among these parties (Hakeem et al., 2023). This type of approach can reinforce what Giambartolomei et al. (2021) call *policy entrepreneurship*, a collective place-specific leadership of learning-by-doing, and what Moragues-Faus & Morgan (2015) refer to as *food entrepreneurship* and *food champions*. It can also support the development of social innovation, considering citizens as urban stakeholders equal to industrial, market, state, and academic actors.

The Living Lab approach is utilised in various transition studies and debates due to its ability to conceptualise practices; particularly the inclusion of citizens' initiatives into local public policy (Aalbers & Sehested, 2018). Given the challenges in bringing CRFS actors together due to either organisational isolation or competition, Living Labs provide added value because power dynamics between policy actors are known to impact the outcome of policy creation processes (Gamache et al., 2020). Consequently, the Living Lab remains an attractive option for local food system transformation as it may enable integration of the currently fragmented food arena governance and may support more inclusive policy creation processes.

Methodology

This research aims to understand the practical and place-specific dimension of food system thinking and the role of policy experimentation in city-regions. This comparative multiple case study examines EU city-regions that are part of a research consortium into food system transformation at the city-level; the Cities2030 European Horizon project. Such research method is common in 'territorial' and 'transformation studies' as it allows for acquiring in-depth, context-specific knowledge, which is crucial for understanding policy processes in a territorial context (Yin, 1994). The research also builds upon the paradigm of reflexive interpretivism as epistemology, focusing on how the groups of actors themselves construct the answers and perceive their own realities. Accordingly, policy experimentation and the CRFS context will be described as perceived by the Labs coordinators themselves.

Data is collected through in-depth semi-structured online interviews with representatives from CRFS labs. The city-regions initiated CRFS labs that focused on innovation and policy elements. The CRFS labs formulate local food agendas and policy action plans including experiments to test interventions on how to transform their CRFS. No selection procedure was used, as all labs were approached for interviews. Prior to the interview, interviewees were requested to sign consent forms to comply with the ethical standards of the researcher institute and the project data collection requirements. The interviews contain three main sections. The first section was dedicated to their perception of sustainability in food systems and city-regions' approach towards sustainability. The second section addressed the CRFS policy landscape, and examined the various levels of governance levels, ranging from the European to the national, regional, and municipal levels. This entailed the mapping of various power dynamics and relationships among distinct levels of governance and their engagement with local realities. In the third section, insights focused on CRFS labs' policy efforts and methods of addressing and interpreting CRFS elements. Areas of analysis were adopted from the Cities2030 key thematic areas: production, processing, distribution, markets, consumption, food waste, food security, ecosystem services, livelihoods, and inclusion. These categories are compatible with the MUFPP and Food2030 areas of action (Carey & Cook, 2021) and respond to scholar calls for embedding different dimensions of sustainability of food systems into food governance research (Sonnino et al., 2019).

Lab coordinators were also asked to place their activities and policy efforts onto a *policy matrix*. This matrix consists of a vertical and horizontal axis, with each axis reflecting a policy distinction. The horizontal axis shows the policy instruments ('Policy Type'), while the vertical axis reflects the governance approach ('Governance Mode') indicated by the top-down and bottom-up approaches at its extremes. This distinction is often referred to as the 'vertical interplay' in governance (Nilsson et al., 2012). The Matrix allows CRFS labs to pilot solutions that populate a two-dimensional area and offers a comprehensive visual tool to grasp Labs' approaches and efforts to CRFS policy experimentation.

Results

Sixteen CRFS labs that were part of the Cities2030 consortium were approached for an interview, which led to thirteen interviews that were held online in October 2022. The labs demonstrate adequate variation in geographical spread (Figure 1) and in organisation types associated with their coordination (Table 2). Interviews were between one and two hours in duration and were each dedicated to one CRFS lab.

Table 2. The city-region food system labs

	City-region	Country	Type of interviewed organisation(s)
1	Murska Sobota	Slovenia	Municipality and NGO
2	Vidzeme	Latvia	Regional public authority and NGO
3	Iasi	Romania	Municipality and university
4	Marseille	France	NGO
5	Veijle	Denmark	Municipality-led organisation
6	Velika Gorica	Croatia	Municipality and SME
7	Quart de Poblet	Spain	Municipality
8	Bremerhaven	Germany	Municipality
9	Bruges	Belgium	University, municipality, and independent external research institute
10	Troodos	Cyprus	University
11	Haarlem	The Netherlands	Municipality
12	Seinäjoki	Finland	Local development company and NGO
13	Vicenza	Italy	Municipality

Figure 5. Location of the CRFS labs included in the study

The interviews provided information on the CRFS characteristics and allowed identification of the policy instruments employed in CRFS. Most labs employ a mix of policy instruments, including non-voluntary and voluntary responses. The instruments that were used most by the CRFS labs consist of informational and educational instruments (e.g., information campaigns, and events), and market-based instruments (e.g., local taxes and economic benefits). All CRFS labs have introduced informational activities to raise awareness about various food system components and territorial challenges. Awareness raising takes place through the policy instruments education, training, information programmes and skills-sharing workshops. Citizens' participation and engagement is a key priority for such activities. These programmes target various citizen audiences and stimulate conversations that go beyond the established roles of city and citizens and enhance new roles to citizens as co-creators. Sharing responsibilities over urban governance facilitates citizens and stakeholders to contribute not only to the identification of territorial challenges but also to viable solutions and design of food planning.

The tendency of CRFS to move from a top-down to a more bottom-up governance approach is evident in Figure 2. Most policy efforts are concentrated at the bottom-right of the policy matrix, which signifies a tendency towards bottom-up voluntary policy instruments. This is driven by lab coordinators' attempts to introduce democratic processes in the development of new food projects or strategies and experimenting. A CRFS lab coordinator describes it: *"We wanted to avoid coming up with a food policy which is only the result of an internal debate. For us, the policy lab is not a starting point, but the result of a set of dialogues, activities, knowledge exchange with citizens and experiments".* Stakeholder engagement and co-creation are the main characteristics of a CRFS approach, and this is reflected in the engagement of most CRFS labs partner with local organisations and grassroots organisation to co-design and coordinate CRFS-specific food activities. These stakeholders consist of citizens or community initiatives, NGOs, municipalities from the region and knowledge institutions that share a common vision for transforming their CRFS.

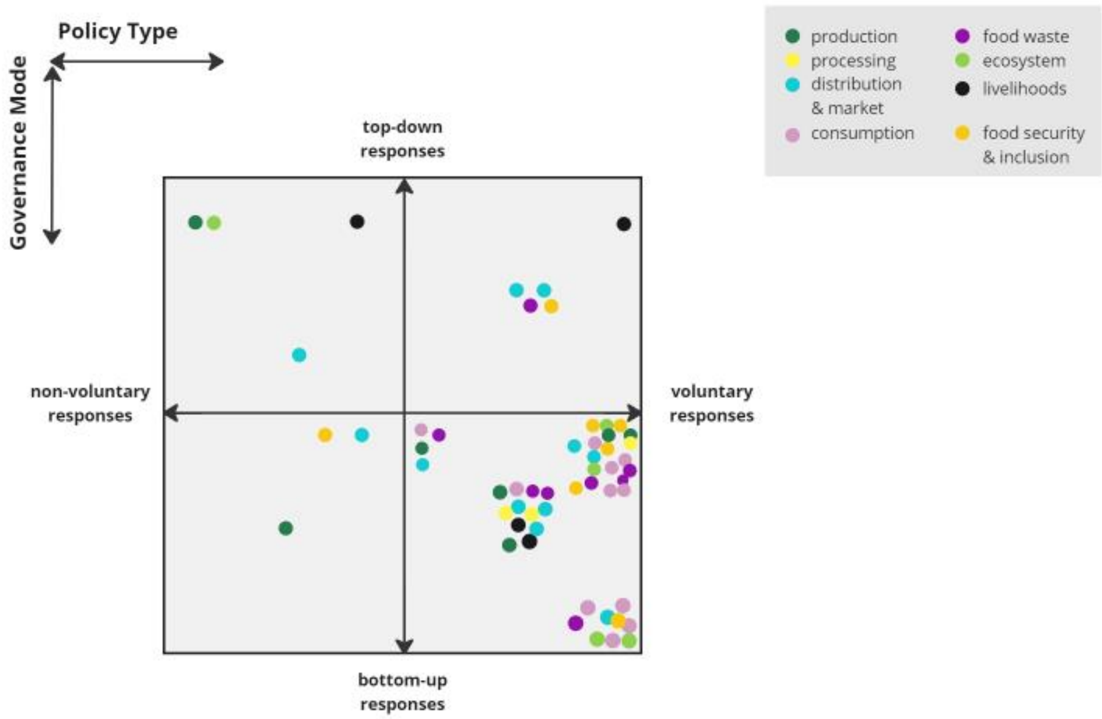

Figure 6. Policy Matrix. Graph is based on lab responses in the current study. Each dot represents a single policy response per Lab, as indicated by the Lab coordinators during the interviews, after receiving a standardised explanation of each axis and their meaning. Responses are also categorised per CRFS thematic area (colours typology). 'Governance Mode' on the Y-axis and the 'Policy Type' on the X-axis.

Figures two and three present the CRFS focus areas, as indicated by CRFS Lab coordinators. Labs' interventions commonly address consumption and food waste. Health and sustainable consumption are a widely actionable goal across CRFS labs. Efforts towards a healthy food environment and stimulating the consumption of healthy food and nutrition were addressed concretely by nine labs, while three other labs willing to prioritise it in future interventions. Lab activities include the development of regional plans and the design of educational programs in collaboration with primary schools, while special consideration is given to stimulating sustainable diets for children through the educational sector in six regions. *"We had this whole action week on the topic of nutrition, with external partners, teachers and NGOs and our motto was 'eat differently' presenting good examples of fair and regional community day-care and school catering"'* mentions a lab coordinator. Secondly, food waste management is another prominent theme across eight labs, primarily driven by national or regional plans or strategies. CRFS Lab activities address food waste reduction through informative campaigns and workshops aiming at public awareness-building. CRFS labs are often secondary in affecting food waste management yet indicate that food circularity and food waste are becoming a priority area for CRFS actors. Examples of such interventions range from experimental activities such as inviting citizens to daily weight food waste and receiving creative food waste tips, to building restaurant networks to communally tackle food waste.

CRFS elements related to the social dimension of food are poorly addressed by nine labs. As a lab coordinator argues, *"we weren't used to seeing food as a social matter; we used to tackle its environmental side, but we need to focus more on food security and inclusion in our region".* Examples of supporting social innovation are present to some city-regions, through citizen-led and grassroots initiatives such as social kitchens and community gardens. Three labs also link food with local culture and heritage.

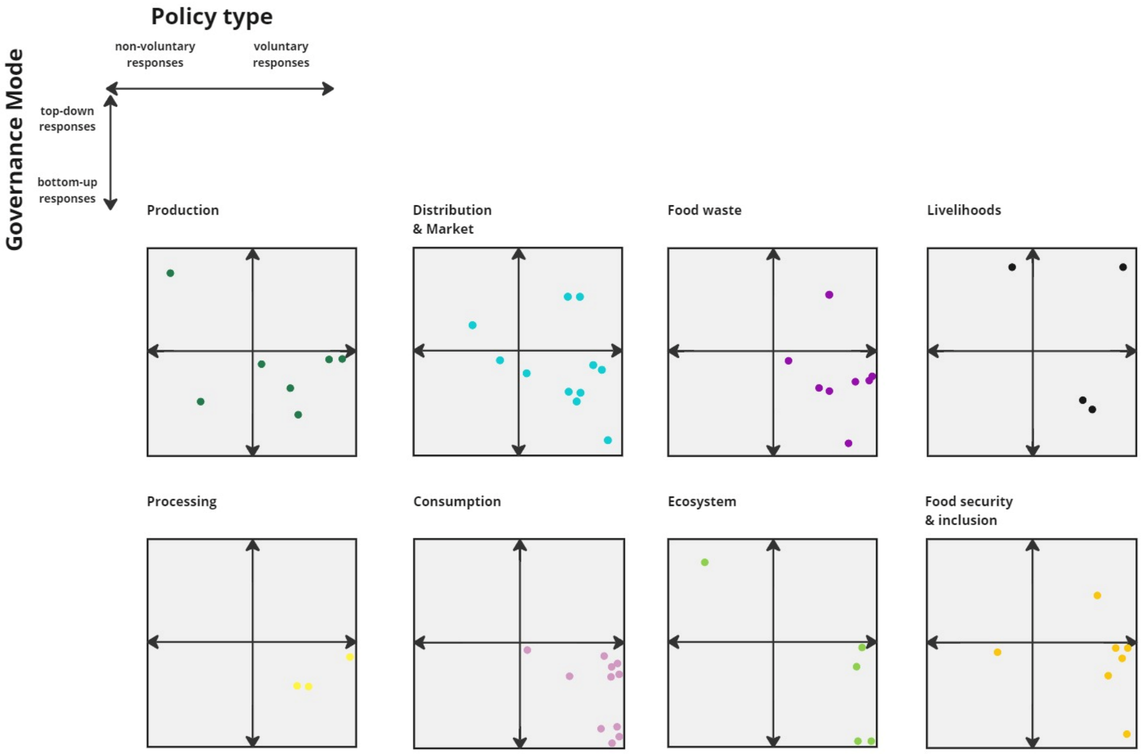

Figure 7. Policy Matrices showing policy interventions per thematic area. Graph is based on lab responses in the current study. Each dot represents a single policy response per Lab, as indicated by the Lab coordinators during the interviews, after receiving a standardised explanation of each axis and their meaning. 'Governance Mode' on the Y-axis and the 'Policy Type' on the X-axis.

Labs' food policy initiatives appear segmented across areas of interest and do not exhibit strong cross-sectoral strategies, which is also evident in Figure 3. Regulative policy instruments have been introduced only in certain CRFS elements (production, distribution and market, livelihoods, and ecosystem services). On the contrary, sustainable consumption is the most targeted element by soft policies, such as events and educational activities. City-regions struggle to introduce concrete food strategies and policies that address their entire CRFS, leading to fragmented interventions of specific food system elements.

The analysis also reveals certain recurring themes across the different governance levels. A theme repeatedly indicated by the CRFS labs is the need to mobilise food system actors at the national level into applying a systemic approach to food system transformation. City-region actors indicate to be isolated in their efforts to introduce a more sustainable urban food agenda, with five lab coordinators sharing experiences of lock-ins or inertia at the national level that constrain activities at the CRFS level. Consequently, CRFS actors skip directives or strategies from the national level and initiate their local policy experimentations. A lab coordinator mentions they skip the national level, because *"Brussels is perceived to be closer than the national government".* Simultaneously, city-regions and municipalities at the regional governance level gain new roles, shifting from service providers to agents of change. *"We're seeing a new role for local government, initiating new projects, and connecting with groups and parties. We are true partners right now and not just the government, you know, signing laws and directives,"* observes a municipality-led lab coordinator.

A recurring theme across multiple interviews and themes is the mandate that CRFS actors have to initiate, alter or implement policies. Five lab coordinators expressed the concern that they have neither mandate, nor power to introduce urban food policies. *"We can influence the CRFS but there is no mandate on doing so",* states a lab coordinator. Another coordinator explains that [they] "*…don't have a central responsibility, there's no department in the administration which is responsible for the CRFS system".* In contrast to the perceived lack of power and influence of local actors and CRFS labs, national governments are perceived as an essential governance level to deal with CRFS policy elements. Mandate is indicated to be especially relevant to certain CRFS elements such as food waste management.

Finally, CRFS lab interviewees expressed difficulties in achieving cross-scale governance and policy integration. One lab coordinator shares *"…we have achieved this level of knowledge that includes the EU contribution, the national level, and the regional level. What is missing is the capacity to transfer knowledge to local authorities. We still have to work on integrating the three different levels in our work."* CRFS labs overcome such barriers created by disconnected governance processes by joining city networks and peer groups. CRFS networks serve as enablers for city-to-city exchange of experiential knowledge, awareness, and lobbying. To illustrate, three labs are part of association of regional or provincial municipalities, one lab is member of a national coalition among municipalities with a particular focus on food system sustainability, and one lab is member a global network. Six labs also underline the importance of the MUFPP network. Two labs simultaneously stimulate cross-sector collaboration and integrated governance by establishing food policy networks such as Food Councils. One interviewee shares that [they] *"… work on a higher goal of coordination for our CRFS via a Food Board, bringing together public servants, policymakers, stakeholders, and regional state actors*".

Discussion

This paper aims to provide insight into the application of Living Labs to sustainably transform urban food systems across city-regions, and to assess the role of policy in this process. Special attention has been devoted to what the literature considers as the most urgent objectives of food system transformation: the achievement of a balance between the social, economic, and environmental dimensions of sustainability, following the FAO definition on food system sustainability (FAO, 2018). City-regions traditionally perceived food to be a domain outside of their policy radar, which has led to a focus on isolated food elements. The adoption of a systems thinking approach stimulates a better understanding of food system complexities, linkages, and feedbacks along components and thereby also support the integration of policy instruments designed to steer the food system towards a social optimum (Ericksen, 2008; Level Panel of Experts on Food Security, 2017). The innovativeness of the CRFS approach is both a lens and tool to re-connect the urban with the rural. Building upon the literature on CRFS and the need for more integrated policies, and due to the delineated territories of city-regions, the CRFS approach can provide systemic solutions oriented to sustainability in food systems and assist in dealing with fragmented knowledge (Blay-Palmer et al., 2018). In practice, Labs try to engage with a broad range of stakeholders including farmers and producers, and actors beyond the physical territorial urban boundaries.

CRFS pilots have developed a wide range of policy initiatives. The majority of policy initiatives are classified as bottom-up and voluntary instruments, yet this typology varies across thematic areas. Voluntary policy types are easier to introduce by pilots compared to the regulatory and urban planning responses. However, CRFS labs also indicated a lack of mandate, which could stimulate the selection of bottom up and mandatory instruments as they fall within the scope of influence of the pilot actors. Such concentration of bottom-up instruments indicates a potential shift from state dominated policies and market-driven forces towards citizen-driven collaborative models where local governments and organisations increasingly claim a role in the development and implementation of new food policies. The role of local governments and cities is evolving from service providers to actors that bring concrete change to local realities, a tendency by cities to connect food with other policy priorities (Sonnino et al., 2019). Resources scarcity and shifting priorities has given space to non-state stakeholders to take responsibility in realising sustainability objectives in the city-region level. Candel's research (2020) also shows that local urban governments act as facilitators for interventions initiated by citizens or local NGOs. As demonstrated in this research, there are possibilities of institutional entrepreneurship, facilitation and policy experimentation that hold a transformational potential in the urban context (Wolfram et al., 2016).

Living labs are lauded as tools to provide region-specific insights and sites for policy experimentation and urban-rural interventions and CRFS pilots across the EU support this positive sentiment. Place-specific pilots provide new forms of governance where ingrained institutional structures are temporarily lifted, potentially fostering innovative multi-actor collaborations and participating in a shifting governance landscape that shapes urban sustainability transitions (Bulkeley et al., 2016; Willems et al., 2022). Living Labs stimulate participatory and multi-stakeholder governance and have the potential to increase sustainable and just food strategies and safeguard affordable and healthy food for all residents of the CRFS. The engagement of citizens and stakeholders is crucial (Giambartolomei et al., 2021) and local and translocal networks have contributed to the emerging governance models that CRFS labs provide (Moragues-Faus & Sonnino, 2019).

Conclusion

Existing literature on urban food systems and city-region food systems has recognised the role of cities and urban policies as catalysts to face the multiple threats of existing globalised food systems. This multiple case study-research demonstrates that Living Labs can indeed stimulate CRFS transformation through supporting cross-scale governance and policy interventions that address multiple elements of the CRFS. Living Labs achieve this by initiating new forms of collaboration and assigning new roles to traditional food actors. They are proven to be fertile ground to experiment with food system alterations and food policy integration within the region, while adopting a system thinking approach, in a manner that is most fitting to the CRFS characteristics and policy context.

Living Labs demonstrate to be an effective tool in CRFS transformation to be more sustainable and equitable, leading to an increase in social welfare of city-regions. Scholars and urban practitioners use multiple levels of citizen participation to enable citizens' and stakeholders' active involvement; consisting of informative, consultive, participative or involving, collaborative and empowering (Foroughi et al., 2023). This multi-level approach provides city-regions and local governments with opportunities to move towards more inclusive and collaborative governance models while enabling cross-scale governance. The way forward to reach more sustainable and just food systems has been identified as actively questioning the status-quo of top-down food system governance (Moragues-Faus & Sonnino, 2019) and Living Labs across Europe are working towards finding solutions tailored to their specific CRFS through collective and participatory governance.

This research is highly exploratory due to its experimental nature and the early phase of lab development, yet it reveals the need for a comprehensive analysis of potential outcomes and the role of CRFS in delivering well-round sustainable policies. The diversity of CRFS and the resulting variation across the Living Labs assessed in this study would make the generalisation of study conclusions across CRFS speculative. However, this study uncovered characteristics of and barriers to CRFS transformation that are common across the city-regions included in the sample. These themes require additional research given the urgency and growing interest in urban food governance by scholars, urban-rural practitioners, and policymakers. Future research should aim to provide evidence of the outcomes of CRFS labs' activity after the labs have been fully developed and ex-ante assessment can take place. Interest goes out to providing an understanding of the circumstances under which Living Labs can have long-term impact and efficiently dismantle governance silos to reach societal benefits. The identification of best practices and facilitating an understanding of the role of cities in urban-rural linkages will support the development of efficient policy interventions under the CRFS approach.

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Full Research Papers

Infrastructuring social labs: Establishing a sustainable research, development, and innovation platform driven by citizen collaboration

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Abstract

In this study, we propose the concept of 'social lab' as a sustainable research, development, and innovation (R&D&I) platform. A social lab is a derivative of Living Labs (LLs) that emphasises R&D&I in collaboration with citizens. This paper especially describes our case study aims at 'infrastructuring' (i.e., establishing and sustaining) a social lab in an actual city setting. By analysing the case study process and results, we identified three key implications for effectively infrastructuring social labs: supporting the process of core member formation, leveraging existing urban resources, and establishing a coevolutionary loop between infrastructural resource development and R&D&I practices. We also revealed the challenges in infrastructuring social labs, such as human resource issues, low visibility of outcomes, and a lack of service design methods and tools.

Key words

social lab; infrastructuring; R&D&I; citizen involvement; case study

Introduction

Digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and big data processing have become essential components of our lives, and the digitisation of society is rapidly progressing. Additionally, 'smart city' initiatives that use and integrate various digital (smart) technologies in city settings are being actively promoted. While digital technologies have a strong potential to create a better future society, there is growing concern about their negative impacts on society, such as the loss of human autonomy and breaches of privacy [1]. In addition, some researchers and journalists have strongly criticised technology-driven approaches to smart city initiatives and argued for the importance of human-centric smart cities [2]. Against this backdrop, emphasis has recently been placed on the inclusion of social and ethical considerations in technical research and development (R&D) process [3].

To use digital technologies to positively affect society and realise human-centric innovation, we should focus not only on developing the technology itself but also on designing a 'service system [4]' that includes technologies as its components to create social value [5]. In other words, we should go beyond R&D for core technology development; rather, we should focus on the integration of R&D and subsequent Innovation processes (hereafter, R&D&I), where innovation activities can be regarded as a process of designing service systems [6]. Considering the potential negative impacts of digital technologies, the involvement of 'citizens' directly affected by technologies in the R&D&I process is important. Furthermore, to generate continuous and varied innovations, we should establish a sustainable platform for co-creation that supports various R&D&I projects.

Living Lab (LL), an innovation approach driven by co-creation with citizens and other stakeholders (e.g. [7]), is expected to be an effective means of realising the R&D&I platform [6]. Recently, many LL projects have focused on innovation based on co-creation with users (citizens), and often include research and innovation processes [8]. However, few studies have discussed how to establish an LL from a viewpoint of an R&D&I platform for human-centric innovation.

In this study, we first propose the concept of 'social lab' as a sustainable R&D&I platform in a city. We then describe our case study, which was promoted for several years, to investigate the establishment of a social lab in an actual city setting. Finally, through an in-depth analysis of the case, we discuss our findings on the key activities and challenges for effectively establishing and sustaining social labs.

Background

Designing service systems in R&D&I context

In the context of human-centric innovation, the focus should be on ‘services’ that include technology as its component, rather than on technology itself. In service research, the concept of a service system is defined as ‘a configuration of people, technology, and other resources that interact via value propositions to create mutual value [4].’ As this definition indicates, technology should be developed and integrated to enhance value creation in service systems. Designing service systems is therefore a particularly important approach for R&D&I, especially for the ‘I (innovation)’ context.

In academia, the approach to designing service systems has been discussed in the field of service design (SD) studies (e.g. [9]). In SD, various methods and tools have been developed to support the service system design, including user behaviour analysis, value analysis, business model design, and service process design.

LLs for human-centric innovation

According to ENoLL (European Networks of Living Labs), the world’s largest community on LLs, LLs are defined as ‘user-centred, open innovation ecosystems based on a systematic user co-creation approach, integrating research and innovation processes in real-life communities and settings [10].’ LL aims for human-centric innovation and often involves research activities. Furthermore, LL is positioned as an open innovation approach based on the Quadruple Helix Model (QHM), in which four types of stakeholders—citizens, industries, government, and academia—collaboratively work for social innovation [11]. These stakeholders in QHM play important roles in R&D&I; academia conducts R&D activities, industry and government act for innovation, and the citizen community strongly infuses a human-centric perspective into all the contexts of R, D, and I. This indicates that LL is an effective approach for R&D&I.

Issues on project-based nature of LLs

Continuity is one of the challenges faced by LLs when viewed as R&D&I platforms. As Hossain [8] pointed out, many LLs are promoted as project-based activities, which means that the end of project funding is the end of LL activities. Also, in the HCI (Human-Computer Interaction) field, scholars have denoted considering 'after-the project' is essential in field-based research aiming to social use of technologies [12]. To extend the LL concept as an R&D&I platform, where various R&D&I projects are actively implemented, the co-creation scheme should be sustainable (i.e. not limited to the project duration) and embedded as an urban resource in a city.

Furthermore, the continuity issue is also inherent in citizen participation. Previous studies have pointed out the issue of the heavy burden on citizens in the LL process [13]. Scholars have also illustrated the difficulties in preventing users from dropping out of LL projects and explored ways to maintain their motivation in the long-term participation process. These issues essentially stem from the researcher-citizen relationship. A collaboration scheme based on an asymmetrical beneficial relationship in which researchers 'use' citizens for their projects, has limitations in its sustainability as an innovation ecosystem.

Social Lab as a sustainable R&D&I platform

Concept of social lab

In this study, we propose the concept of the 'social lab' as a sustainable R&D&I platform in a city. Hassan [14] first used the term social lab as a platform aimed at tackling complex social problems with multiple actors. The authors also define the social lab from the R&D&I context as 'an R&D&I scheme to foster a socially acceptable implementation of digital technologies in the service form through cooperation with citizens [6].' This social lab concept can be regarded as a derivative of LLs, which emphasise the context of R&D&I in collaboration with citizens.

This study extends the existing concept of social labs by highlighting the perspective of sustainable R&D&I platform. Figure 1 presents a conceptual sketch of the social lab proposed in this study. This concept has four key facets: the first three are based on our previous social lab concept [6] and the fourth is newly added in this study.

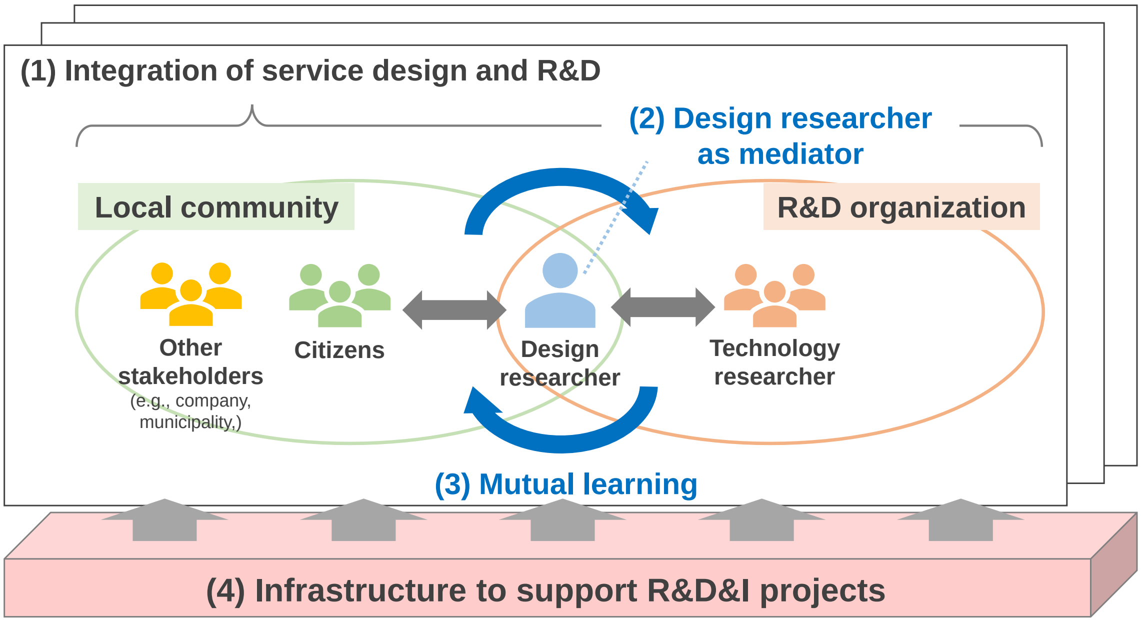

Figure 1. Social lab as sustainable R&D&I platform (illustrated based on [6])

(1) Integration of SD and R&D

As discussed, the integration of SD and R&D is essential for developing digital technologies that create value for stakeholders and society. The insights obtained from the SD activities will support to clarify the direction of R&D. Integrating appropriate digital technologies into a service system will contribute to higher value creation and differentiation from competitors.

(2) Design researchers as key mediator

In this model, an R&D organisation (e.g. a university or research institute) includes two types of researchers: technology and design researchers. The design researcher acts as a mediator between the city (i.e. local organisation and community) and the R&D. They mainly promote SD activities to explore the values to be provided and design service systems with citizens and other stakeholders (e.g. companies and municipalities). Simultaneously, design researchers communicate with technology researchers to share their findings or ideas about the service systems to be realised. This mediation by design researchers will allow for successful harmonisation of technologies and service systems.

(3) Mutual learning between citizens and researchers

Citizen involvement in technology and service development is important for human-centric innovation [15]. Scholars argue that mutual learning between citizens and researchers is the core of effective co-creation [16]. Researchers, including both design and technology researchers, should learn about the context, values, and issues of local communities. Citizens must also understand digital technologies and their positive and negative impacts. The mutual learning process contributes to creating a flat and close citizen-researcher relationship and empowering the citizens.

(4) Infrastructure to support practices in R&D&I projects

This study aims to establish a social lab as a sustainable R&D&I platform. A sustainable platform indicates a long-lasting scaffolding 'infrastructure' to support various R&D&I projects in a city. Therefore, we conceptualise a social lab as an urban infrastructure for supporting R&D&I activities rather than as a scheme for one-time R&D&I projects with a limited duration. This is challenging in LL studies because many LL projects are project-based and discontinuous in the long term [8].

The term 'infrastructure' in this study is based on the concept proposed by Star and Ruhdler [17]. Infrastructure is a bundle of tangible (e.g. physical products, buildings, tools) and intangible resources (e.g. rules, knowledge, know-how, customs) that supports people's practices [18]. Thus, establishing a social lab as an R&D&I platform requires the development of tangible and intangible infrastructural resources that effectively support various R&D&I practices. Based on Karasti's work [19], we use the term 'infrastructuring' to refer to the activities of developing and embedding infrastructural resources in a city.

Infrastructural resources

Next, we discuss the infrastructural resources that should be developed in infrastructuring social labs. Previous studies reported resources that had fostered or foregrounded through infrastructuring work, such as actor network and trust [20, 21], knowledge and skills [22], and common spaces for collaboration [23]. Interpreting these resources in the context of the social lab concept proposed in this study, we identify key resources to be focused on.

Actor network and trust

A social lab as an R&D&I platform requires a continuous citizen-researcher relationship rather than short-term collaboration for a limited time. Therefore, in terms of actor network and trust, more emphasis should be placed on the '*solid and long-term* *partnerships with citizens*' for sustaining a social lab. Such close partnerships are also practically helpful in recruiting appropriate participants and ensuring their continuous and proactive participation in R&D&I projects.

Besides citizens, as argued in previous studies, R&D&I projects in a social lab must also collaborate with practitioners and experts who are active in a city on the social issue or industry focused on the project. For example, a project related to the healthcare of the elderly should involve collaboration with local daycare centres and hospitals. To collaborate with the appropriate actors in each R&D&I project, a '*local actor network*' is essential as a resource for supporting a social lab.

Knowledge and skills

To achieve active and long-term citizen participation in R&D&I projects, we should focus on the development of appropriate attitudes (or mindset) in addition to knowledge and skills, as Kirkpatrick's KSAs (Knowledge, Skills, and Attitudes) model [24] argued.

Namely, the actors involved in the social lab (citizens, industry, government, and researchers) preferably have KSAs that positively affect R&D&I projects (hereafter, '*KSAs for R&D&I*'). For example, in terms of knowledge, it is important for citizens to have the right knowledge (i.e. literacy) of digital technologies; for researchers, knowing about the local community is important. In terms of skills, creative thinking skills are required to tackle complex social issues and collaboration with others are required [25]. Attitudes include, for example, an interest in local issues and the design attitude [26] for actively exploring solutions to local issues. These KSAs are intangible resources which are difficult to measure, but are important for making collaborative R&D&I projects more effective.

Furthermore, in terms of knowledge and skills of design researchers, '*methods and tools*' for SD in the R&D&I context are important to be developed. In the R&D&I context, design researchers should consider not only value creation for citizens and society but also technological R&D and the use of technologies. This design problem is more complex than a general SD problem, which focuses primarily on the value aspect. Therefore, methods and tools to support this complex design task should be developed and provided as infrastructural resources to enhance the KSAs for SD activities in social labs.

Common spaces for collaboration

From the viewpoint of spaces, R&D&I projects in social labs use various locations in a city. For example, in the initial phase of R&D&I, collaborative discussions on future vision and conceptual design are often held in workshop spaces. R&D&I projects also require physical locations to promote experiments on the technologies or services developed in the project. These '*spaces for design and experiment*' should be provided to actors as highly accessible resources that can be used immediately when they want to use.

In summary, we identify five key resources to be developed in infrastructuring social lab: (1) solid and long-term partnerships with citizens, (2) local actor network, (3) KSAs for R&D&I, (4) methods and tools, and (5) spaces for design and experiments.

Infrastructuring a social lab

Case study

To deeply investigate how to establish a social lab, this study adopted the design case study approach demonstrated by Dalsgaard and Eriksson [27]. We played the roles of design practitioners and researchers. On the one hand, we actively promoted various activities to establish a social lab as a practitioner; on the other hand, we analysed our own processes as researchers to clarify the key activities and challenges for effectively infrastructuring social labs. In general, this type of single case study is effective for deeply investigating a particular topic in a unique context [28]. We therefore did not aim to present a universal conclusion that can be applied to all cases or contexts. Instead, we aim to provide findings that are practically helpful to other practitioners and researchers working in areas related to this study.

The case we focused on was the project where the authors have been working to establish a social lab since 2019. We played the role of 'design researcher' in Figure 1. The research institutes to which some authors belong are engaged in R&D activities on digital technologies such as robotics, motion analysis, healthcare, and sensing. We attempted to establish a social lab in a city where our research institute is located to realise the social use of such advanced technologies and subsequent human-centric innovation.

The city where the case study was conducted is Kashiwa-no-ha, a suburban area of Tokyo. It is one of the most famous smart cities in Japan, where leading universities, research institutes, and various companies are located. The area near the station is mainly populated by relatively young residents (in their 30s-40s) and their families; older residents live in residential areas a short distance from the station.

Infrastructuring activities

This section describes the details of our infrastructuring process in a social lab corresponding to the five key resources identified in Section 3.2.

The infrastructuring process described below was analysed to investigate how to effectively promote the infrastructuring work of a social lab. To this end, we used multiple data sources such as public reports, materials used in the planning phase, and field notes. The analysis results, namely our findings related to key activities and challenges in infrastructural social labs, are described in Section 5.

(1) Solid and long-term partnership with citizens

To create a solid citizen-researcher partnership, we started a 'citizen advisor' program in November 2019 [6]. This program is unique as it aims to organize a more general citizen community of those interested in advanced technologies and social lab activities, rather than a group of citizen participants for a specific project. After the community started, COVID-19 spread across Japan and the world. We therefore held the regular virtual café talk meetings once or twice a month in 2020 for maintaining the relationship with citizens. This continuous communication between citizens and researchers helped to build trust and closer relationships.

(2) Local actor network

To build the local actor network necessary for the social lab, we tried to build relationships with various local actors in addition to citizens. At that time, we realised that an invisible local actor network had already been established in the city and it would be better to be incorporated as a member of the existing network than to build a new one. We thus first tried to build a relationship with an area management organisation, which is a key actor in the local actor network. The organisation has played a central role in the area management of the smart city for many years; therefore, it has a wide and strong network with various local actors. By leveraging the organisation's existing network, we could access and communicate with a wide range of local actors (e.g. shopping centres, bus companies, and public park management organisations) in several R&D&I projects described in Section 4.3. This process was really effective to become a part of local actor network and build relationships with specific actors in the network when needed.

(3) Knowledge, skill, and attitude

To foster KSAs for R&D&I as infrastructural resources, we started to provide the 'mini-school program' for citizens in 2021. The mini-school programs had two categories: technology and design. Technology mini-schools (Tech-MS) aimed to provide an opportunity for citizens to learn about advanced digital technologies. We organised Tech-MS three times in 2021; in each program, researchers first demonstrated a digital technology; subsequently, citizens and researchers collaboratively discussed the potential benefits and threats of the technology. Meanwhile, the design mini-schools (Des-MS) provided a training program to teach creative mindsets and co-creation skills. The Des-MS was also provided three times in 2021. In fact, skills for creativity and collaboration cannot be fully acquired through this kind of short-term training sessions; however, they are valuable for citizen participants as they allowed them to experience new mindsets and ways of thinking.

(4) Methods and tools

To develop an infrastructural resource for supporting SD activities in a social lab, we developed several SD methods and tools. For example, we proposed a method to support the conceptual design of service systems that can holistically consider three domains: social (e.g. strategies and citizen values), digital (e.g. digital technologies and data), and physical (e.g. physical products and urban resources) systems [29]. Other, we developed the 'participation blueprint' method to systematically design the long-term citizen participation process [30]. These methods were exploratory developed to overcome difficulties encountered in R&D&I activities in the social lab.

(5) Spaces for design and experiments

In terms of the physical spaces needed for the social lab, we explored the opportunity to use the existing spaces to organise design workshops and social experiments. Fortunately, because the field was a smart city, the culture and facilities encouraging new initiatives such as workshops and experiments were available. This strategy also helped to avoid the large costs to develop and set up new physical spaces.

For the design workshop, we primarily used digital spaces (i.e. web conference services) during the COVID-19 pandemic. After the pandemic began to subside, we could use physical workshop spaces owned by the area management organisation, based on the collaborative relationship constructed in advance. Regarding the space for experiments, we could conduct experiments in the real field of the city (e.g. existing facilities and public spaces) based on the collaboration with local actors. For example, in the R&D&I project related to local transportation systems, a digital signage system was experimentally installed in a large shopping centre and hotel to verify its functionality. Within the same project, automated delivery robots were also tested on public sidewalks.

Domain-specific R&D&I projects

In addition to infrastructuring activities, we promoted two R&D&I projects that dealt with specific domains. The first is an R&D&I project to develop digital technologies that support the well-being of seniors. In this project, which lasted for over four months, we visualised future visions from citizens' viewpoints and extracted key insights into R&D&I in health and welfare technology. The second project was an R&D&I project aimed at developing local transportation services using advanced mobility technologies. Through the collaborative and exploratory process in this project, we obtained some important insights for enhancing local transportation. Based on the insights, we developed and tested some prototypes of service systems such as a digital signage system to encourage local mobility and automated delivery robots as means of efficient goods transportation.

Findings

This section presents the findings regarding key activities and challenges for effectively infrastructuring social labs, which were identified from our case study experiences.

Key activities for infrastructuring social labs

The first key activity we found relates to the citizen-researcher relationship. In this case study, we aim to build closer relationships through mutual learning processes. As a result, some citizens became so-called 'core members', which refers to citizens actively participating in most events and workshops held in the social lab. These highly engaged citizen partners provided valuable opinions and comments on operating a social lab.

Furthermore, some of them widely disseminated and shared their experiences in the project through personal social media accounts. These phenomena clearly indicate the importance of supporting the formation of core members to realise a sustainable social lab.

Second, we identified the importance of utilising urban resources that already exist in the city when developing infrastructural resources for social labs. In the case study, we connected our social lab activities with existing tangible and intangible resources, such as workshop spaces and actor networks. In infrastructuring studies, resources already exist in the field is referred to as 'installed base' [31] and using the installed base has been seen as important for penetrating our social lab activities into the city, as it meant making connections to social inertia and powers that already existed there [19]. Hence, exploring urban resources that can be leveraged to operate social labs is important in establishing social labs.

Third, we found the co-evolutionary loop between infrastructural resource development and R&D&I practices (Figure 2) contributes to building a more solid infrastructure for sustainable social labs. Prior to the case study, we assumed that infrastructural resources had a positive impact on R&D&I projects. However, through a case study, we realised the importance of influence in the opposite direction; the R&D&I project has also reinforced infrastructure resources. For example, some citizens who participated in a workshop held in an R&D&I project were subsequently registered as members of the citizen advisor program. This type of co-evolutionary loop between infrastructural resource development and R&D&I practices contributes to building a solid infrastructure and sustaining the social lab.

Challenges for infrastructuring social labs

First, we found the challenge relates to human resources in developing long-term relationships with citizens. In the case study, many human resources were needed to organise collaborative activities with citizens and other actors. This indicates stable human and financial support are required in social labs.

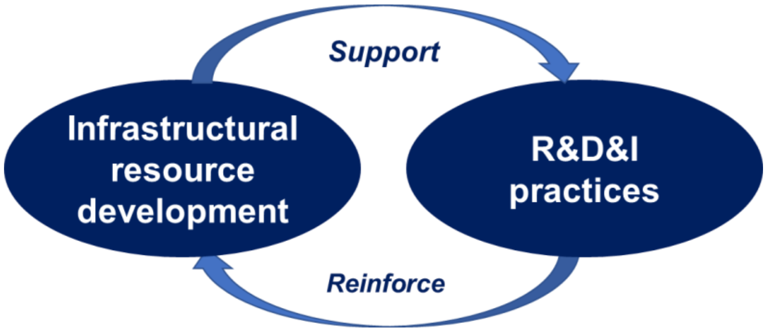

Figure 2. Co-evolutionary loop between infrastructuring work and R&D&I projects

Second, infrastructure is a behind-the-scenes activity to develop resources to support future R&D&I projects, which is not easily visible. Unlike specific R&D&I projects, in which digital technologies and services are developed as an outcome, the results of infrastructuring activities tend not to be highlighted [20]. This issue should be overcome as it relates to maintaining the motivation of social lab operators.

Third, methods and tools to support SD in the social lab context have not yet been comprehensively prepared, although we have developed some original methods (see Section 4.2). Therefore, in future work, we will investigate and collect relevant existing methods and develop original methods, if required. Through such continuous SD research activities, we will develop an SD toolbox appropriate for the social lab context.

Discussion and conclusion

In this study, we proposed the concept of social lab as a sustainable R&D&I platform and described the details of our activities for infrastructuring a social lab in a city. By analysing the case study process and results, we clarified three key implications for effectively infrastructuring social labs: supporting the process of core member formation, leveraging existing urban resources (i.e. the installed bases), and establishing a coevolutionary loop between infrastructural resource development and R&D&I practices. We also revealed the challenges of infrastructuring social labs, such as human resource issues, low visibility of outcomes, and a lack of SD methods and tools.

The contributions of this study to the LL studies are summarised as follows. The first is the conceptualisation of the social lab as a sustainable R&D&I platform. The proposed social lab concept suggests a concrete relationships between four actors in LLs as QHM and indicates a new potential for expanding the LL methodology, focusing on the R&D&I perspective. Second, we present the implications for infrastructuring social labs based on our findings from a several-year case study in an actual city setting. We believe that the findings will be of practical use to future practitioners and researchers involved in social labs and projects related to this study (e.g. citizen-driven R&D&I and sustainability of LLs).

Star et al., in their research of infrastructure, emphasised the continuous process of building infrastructure; they placed more focus on the process aspect of infrastructure, namely 'how to build infrastructure' [17, 18]. This idea inspired further discussions on infrastructuring among various scholars, mainly in the field of participatory design (e.g. [19-24]). The three implications identified in this study are exactly what present concrete and practical suggestions on the process aspect of infrastructure, which focus on how to infrastructure social labs. Hence, we believe the findings of this study are not only practical but also contribute to the development of existing discussions on citizen involvement in the design of socio-technical systems.

Our in-depth analysis of the case enabled us to obtain new findings that would be difficult to identify using a more objective approach such as questionnaire-based investigations. However, the findings were derived from a single case; thus, the exhaustiveness and generality of our findings are limited. For example, Kashiwanoha Smart City, where we conducted the case study, contained urban resources for utilizing new technologies (e.g., workshop spaces and actor networks) as an installed base, whereas other cities may have few such resources. In future work, we will conduct further activities on infrastructuring the social lab and integrate other case study approaches, where we will investigate and compare a wide range of cases.

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Research-In-Progress Paper

Co-creating a Citizen Science Toolkit for Climate Assemblies in Living Labs

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Abstract

Citizen science, living labs and climate assemblies are spaces that open participation to the public. This manuscript describes a novel methodological approach which involves building scientific knowledge through citizen science projects, developing innovative tools in living labs, and generating recommendations for policymakers raised in climate assemblies. In this case, the Ebre Bioterritori Living Lab serves as the hub for co-creating a citizen science toolkit for climate assemblies. Citizen science projects are carefully selected from diverse databases and platforms and are relevant to climate change action. Furthermore, the citizen science toolkit is co-created in the living lab, with activities designed around each citizen science project. The toolkit is tested by a group of people in the living lab before being deployed in climate assemblies for different stakeholders, including policymakers, facilitators, technicians, and citizens. The primary goal of the toolkit is to enable participants to acquire knowledge from citizen science projects and to ensure the inclusivity and accessibility of the participatory process to all living labs and climate assemblies. In summary, this research aims to create an inclusive, accessible, and effective citizen science toolkit that ultimately empowers citizens to take collective action on climate adaptation through participatory processes.

Keywords

citizen science, climate assemblies, deliberative democracy, climate adaptation, climate policymaking, bottom-up governance

Introduction

Citizen climate assemblies bring together randomly selected citizens to learn, deliberate and make recommendations on collective issues of the climate crisis, following a participatory action research mechanism (KNOCA, n.d.). In recent years multiple citizen climate assemblies have taken place at local, regional, and national levels around the world. Given their participatory nature and evidence-based approach, climate assemblies can be a perfect place for introducing citizen science practices, which can contribute to bottom-up policymaking, embracing multiple perspectives (Schade et al., 2021).

Citizen science projects have contributed to the research in multiple domains: social sciences (Bonhoure et al., 2023), environmental advocacy (Johnson et al., 2014) and public understanding of science (Bonney et al., 2016). Citizen science is not only a powerful set of methodologies but also a way to understand and practice research allowing citizens and researchers to collaborate in scientific research. In recent years, citizen science projects have undergone a significant evolution to become more genuinely participatory (English et al., 2018). These projects invite citizens to collaborate more closely with researchers and involve them in most parts of the scientific research process. Citizen science toolkits have been implemented successfully in contexts such as education (Bonney et al., 2009) or libraries (Perelló et al., 2019) with a powerful community of citizens engaged to participate in activities for generating new knowledge. This collaborative approach allows citizens not just to collect evidence but also to co-create scientific knowledge and, eventually, generate policy recommendations based on the outcomes obtained and, subsequently, force changes in policies.

One area where citizen science has the potential to make a significant impact is living labs (Veeckman & Temmerman, 2021). Living labs are perfect spaces where multiple stakeholders collaborate to co-designing projects for sustainable impact (ENOLL, n.d.). Thus, living labs can become an ideal interphase to introduce citizen science projects on developing sustainable solutions to complex social and environmental challenges. Living labs thus allow designing, re-designing, adapting, testing, and eventually deploying technologies and services that better meet the needs of users, engaging citizens to effectively tackle socio-ecological challenges. Therefore, they may lead to the creation of more innovative, effective, and sustainable citizen science projects that benefit the community and the territories.

In this paper, we present work-in-progress research that combines citizen science, living labs and climate assemblies. Overall, we introduce how citizen science projects can be included in citizen climate assemblies and how living labs serve as a space for co-designing, testing the toolkit and eventually deploying citizen science projects in the local context of the living labs.

The CLIMAS project for creating a toolbox for climate assemblies

CLIMAS is a comprehensive project that seeks to create a toolkit for climate assemblies, which is co-designed, tested, and deployed in living labs. The project works with three climate assemblies and four living labs. In the context of the project, we will work with three climate assemblies (i.e., Catalunya, Edermünde, Riga) and four living labs (i.e., Chios Living Lab, Vilnius Living Lab, JRC Living Lab and Ebre Bioterritori Living Lab). Here we present the co-creation of a citizen science toolkit for climate assemblies built in the Ebre Bioterritori Living Lab.

Our proposal is to bring citizen science into climate assemblies and use living labs as a space for co-designing, testing and deploying tools within the community. Putting together a whole participatory approach lifecycle which includes: building scientific knowledge by means of citizen science projects, developing innovative tools in living labs and generating recommendations for policy-makers in climate assemblies. This process helps us to create evidence-based tools with and for society, considering the interests of different stakeholders and ensuring that the horizontal participatory process is inclusive and accessible for all the living lab community and subsequently by the citizens in climate assemblies.

Selection of relevant citizen science projects

As a starting point, we look for citizen science projects that research topics related to climate change action. We select projects from citizen science platforms and databases (e.g., EU Citizen Science (EU-Citizen.Science, n.d.), SciStarter (SciStarter, n.d.), Zooniverse (Zooniverse, n.d.)) with active projects relevant for understanding climate change impacts and, therefore, providing valuable knowledge to citizens, facilitators, and government body of climate assemblies. The idea is to compile a collection of projects that represent the diversity of topics and geographies to ensure those projects are relevant for living labs and consequently for climate assemblies. Beyond scrutinising European-wise infinitives, we collect requirements from all the living labs to understand the currently active projects that they are working on in the local context. Additionally, we will open a call for citizen science projects that could be interested in being included in the toolkit for climate assemblies.

Co-creating a citizen science toolkit in the living lab

The citizen science toolkit is co-created in the Ebre Bioterritori Living Lab where, firstly, we define the plan for implementing the participatory activities. It requires the following aspects:

- Identify stakeholders and plan their engagement towards the development of the citizen science toolkit.
- Deployment of participatory toolkits and ITC infrastructure for facilitating participation in the living lab (e.g. Decidim (Decidim, n.d.)). ENOLL toolkits will be at the core of tools to develop the citizen science toolkit for climate assemblies.
- Deliver two informative hybrid sessions to foster a deep understanding of the project as well as the results from the process. The first session will be aimed at explaining the features of the CLIMAS project, as well as the planning and engaging stakeholders. The final session will focus on the main results and the outputs obtained through the participatory process as well as the next steps.
- Deliver a series of 4 on-site workshops using living lab methodologies. It implies: i) testing and validating existing citizen science projects for climate assemblies and evaluating the user's perception, ii) discovering and identifying user needs, goals, and values, iii) ideating innovative insights and proposing solutions for the citizen science toolkit. Finally, based on the feedback, iv) test and validate the developed citizen science toolkit.

We plan to carry out different activities in the Ebre Bioterritori Living Lab:

Co-design the toolkit. Create guidelines for the introduction of citizen science projects in climate assemblies.

- Define the attributes that make citizen science projects suitable for a climate assembly and select the most relevant projects based on the criteria. Projects may be relevant for a variety of reasons that should be assessed, including the topic's relevance, the significance of research findings, the project's leadership team accessibility, the opportunity to actively participate in the project, the alignment with community concerns, and so on.
- Design activities around each citizen science project that can be beneficial for acquiring knowledge for the members of climate assemblies. These activities could range from actively participating in the citizen science project to inviting the experts involved in the citizen science research to participate as speakers in the assembly. Some projects have been previously adapted to another context (e.g., schools, libraries, hospitals, etc.). During the sessions, the participants propose activities in the context of climate assemblies.
- Redesign active citizen science projects or reactive non-active citizen science projects to tackle community concerns of the living lab and the climate assemblies. The community around living labs has the mission to redesign or reactive citizen science projects if these projects can be beneficial for the community.
- Potentially, create guidelines for generating a new citizen science project if a community concern is not being addressed by existing citizen science projects. In this case, we will create a viability plan that includes a set of needs for building a new project, ranging from funds to domain expertise.

Testing the toolkit. Once the toolkit has been designed, a group of people will test it in the living lab and/or climate assemblies. In this phase, we test the guidelines for the groups that are part of the climate assembly and the phases of the participatory process in which the activities fit better.

Deploying the toolkit. The toolkit is conceived to be used in climate assemblies, however potentially the living lab community can adopt some of the projects for being deployed and integrated into the regular activities of the living lab without further modifications.

Citizen science toolkit in climate assemblies

Finally, and once the Toolkit has been tested and validated in living labs and/or climate assemblies will ready to be deployed in climate assemblies. Climate assemblies have a very particular structure with different phases (e.g., learning, consultation, deliberation, decision-making, etc.) and bodies (e.g., governance body, group of experts, citizens, etc.). Citizen science relies on the basis that citizens can contribute to research as experts and acquire knowledge through this process. Some of the citizen science toolkit goals are to allow citizens to participate as experts in climate assemblies, to provide evidence to the governance body for designing the framing or choosing the topic discussed during the climate assembly; or to provide evidence to policymakers. Overall, we aim to deploy the citizen science toolkit in different phases of climate assemblies and for different bodies.

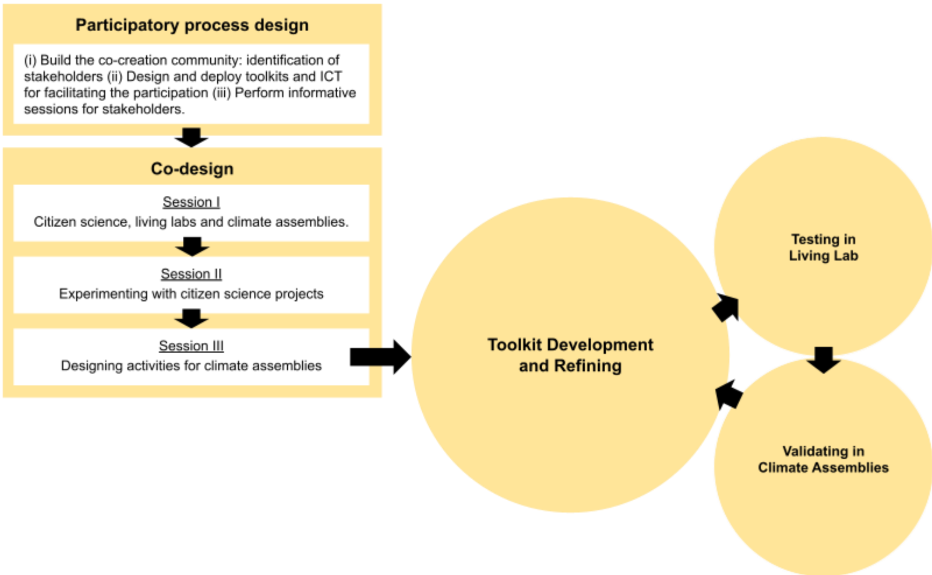

Figure 1. Road plan for co-creating, testing and validating the citizen science toolkit for climate assemblies.

Conclusions

Citizen science has emerged as a powerful tool for engaging communities in various research domains, including climate action. Through citizen science, communities are more deeply involved in tackling societal concerns, leading to a greater sense of ownership and investment in the process. By leveraging the knowledge produced by citizens, citizen science can enhance the effectiveness of climate assemblies, making them more inclusive and accessible.

We are currently conducting ongoing research to co-create a citizen science toolkit specifically designed for climate assemblies. This toolkit is being co-developed and tested in living labs, where different participatory approaches are being used to democratize science, produce innovative tools and generate policy recommendations. Through this toolkit, we aim to raise awareness about the environmental and social issues that arise from climate change, ultimately facilitating social change.

Living labs are a critical component of this effort, as they provide a platform for experimentation and innovation. By bringing together stakeholders from diverse backgrounds, living labs enable us to develop and test solutions that are both technically and socially feasible. This collaborative approach is essential for achieving our goal of democratizing science and creating effective tools for addressing the challenges of climate change.

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Research-In-Progress Paper

Living Lab in making: Exploring the emergent phase of University Living Lab development

Authors

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Abstract

The aim of this study is to explore the emergent phase of a university living lab to identify and explain the contingencies that surface from the process of developing and implementing an idea of a living lab in an already complicated institutional environment. The empirical research followed a single case study design. The analysis of the data gathered from multiple primary and secondary sources was guided by the qualitative content analysis approach. The study provides insights into behavioural, social, and cultural factors that underlie the emergence of a university living lab. It contributes to theory and practice by explaining the pre-lab dynamics and its context.

Key words

Living lab, university living lab, pre-lab, emergent phase

Objectives

Two decades of scholarly studies into living labs (Følstad, 2008; Ballon & Schuurman, 2015; Leminen & Westerlund, 2019) produced a wealth of knowledge and insights into how living labs can be utilized as a means of fostering innovation, engaging stakeholders, and promoting sustainable development (Hossain, Leminen & Westerlund, 2019). The research has identified various design principles, as well as different approaches to their governance and management (Leminen & Westerlund, 2019). While a systematically growing number of studies have enriched the understanding of components and processes that constitute living labs, there is a lack of works providing insights into the pre-lab dynamics to shed light on how a living lab becomes established. Acknowledging that living labs are generally understood as open innovation ecosystems (https://enoll.org/about-us/), their very logic builds on interdependence and coordination that leads to new value creation, and inherent variability in the configuration of internal attributes of ecosystems (Spigel, 2017) emphasizes the fact that there are multiple ways living labs can develop. Hence, as an ecosystem, a living lab does not necessarily emerge as a fully designed institutional project from the outset. The formal institutional framework can be developed in a non-linear fashion through complex interactions and experimentation with new ideas and approaches (Singh & Gurumurthy, 2013; Gancarczyk et al., 2023). Moreover, the practices used by actors to implement ideas may involuntarily change their meaning while institutionalizing them (McCarthy, 2009). Therefore, it is necessary to untangle the behavioural, social, and cultural factors that underlie the emergence of living labs.

The aim of this study is to explore the emergence phase of a university living lab to identify and explain the contingencies that surface from the process of developing and implementing an idea of living lab in an already complicated institutional environment. The theoretical foundations of our study focused on the processes of ongoing evolution within a system are the multi-actor network perspective of the ecosystem concept (Tsujimoto et al., 2018), the institutional view (Green et al., 2009) and evolutionary perspective (Martin, 2010). Thus, our study makes a contribution to the body of knowledge on living labs by focusing on the largely overlooked emergence stage of their development, and by shifting the discussion beyond the mere description of successful, role model case studies toward the exploration of ways to foster development and improvement of homegrown ecosystem solutions based on the realities of own circumstances.

Approach

The empirical research followed a single case study design. The selected case was the Campus Living Lab (CaliLab) established at Jagiellonian University (Poland). In order to restore the behavioral, social, and cultural underpinnings of CaliLab emergence, the study design included an expanded set of research methods:

- First, we focused on analyzing the existing official documents of two initiatives: Kampus+ and "Research for practice. The use of master's implementation theses based on action research for the development of organizations" project. These initiatives were among the first steps towards the creation of the university's collaborative model with the environment. Our analysis included internal project documentation, as well as the official website and social media channels of the Kampus+ initiative.
- In the next stage we conducted in-depth interviews with people involved in the Kampus+ and "Research for practice" project to understand how the idea developed over time.
- Then we analyzed official documents developed in the process of design and formalization of CaliLab initiative, incl. project proposals, official correspondence with university officials.
- Finally, we applied the method of auto-ethnography to investigate the design process of CaliLab.

Given the focus of the study, the retrieved data referred to behavioural, social, and cultural factors that influence the development of the innovation ecosystem, which subsequently evolves into a living lab. The analysis of the gathered data was guided by the qualitative content analysis approach. The iterative process involved meaning-making, synthesizing, theorizing, and re-contextualizing. At present, the analysis is not yet concluded, and the work is still in progress.

Findings

The research is currently underway; hence the final results are not available at the moment. However, at this stage we already track the key interaction patterns. The activities that led to the launch of the Campus Living Lab were multifaceted. At the same time, several initiatives and projects have been implemented over the last few years. Importantly, most of these activities were bottom-up and initiated by employees. One example was the project 'Research for practise. The use of master's implementation theses based on action research for the development of organizations', implemented between 2017 and 2019 by students and employees of the Faculty of Management and Social Communication of the Jagiellonian University in cooperation with public and nongovernmental organizations.

The project were (1) to implement practical MA theses, based on the Action Research approach to the practice of the Faculty and (2) to test the university's collaborative model with the environment. In Poland there is a lack of commitment and cultural orientation towards cooperation with business and other organizations (Bogacz-Wojtanowska, Jedynak, Wrona and Pluszyńska, 2019). Polish university managers and academics generally assess themselves and their environment as one of the least orientated to cooperate with business, public, and non-governmental organizations in Europe (Davey et al. 2013). For us, it was an important step toward the implementation of scientific activities in greater participation with the environment and getting closer to the quadruple helix model.

In other departments of the University at the same time, other activities aimed at change were launched. One of these initiatives was Kampus+, a grassroots movement established by students, PhD candidates, and academics at Jagiellonian University in the first half of 2017. Its goal was to spark a conversation on the quality and sustainability of public spaces on the university campus (Działek et al. 2021). The initiative sought to share knowledge on current trends and best practices for designing and managing these spaces, particularly with respect to the concept of a learning landscape. This concept reflects recent shifts in research and education, emphasizing collaborative efforts, informal knowledge exchange, and co-creation using both digital and physical resources (Backman et al. 2019; Cox et al. 2022).

Kampus+ engaged in scientific activities such as campus space studies, educational activities like lectures and workshops, and outreach activities such as seminars, study visits, and cooperative endeavours such as planting actions. As a result of coalition-building efforts, the initiative began collaborating with partners from within and outside the university, leading to small-scale test projects like outdoor seating areas and green spaces that linked social activities with biodiversity preservation. One of its most recent outcomes was a strategic plan for the public spaces of the campus, which proposed using living labs as a tool for their development, among other proposals.

Kampus+ successfully ignited the conversation on the previously overlooked aspects of campus life. However, as a bottom-up enterprise, it was unable to take action on a larger scale. Thus, there was a need to integrate it into the wider inter-faculty and interdisciplinary structures of a living lab.

When the possibility of internal funding of projects appeared in the university, the willingness to undertake joint action arose among the implementers of the above-mentioned projects. The concept of a joint initiative, Campus Living Lab, was built on the basis of the experience gained from two different projects implemented at different faculties.

Value and implications

Our study contributes to the body of knowledge on generation of living lab projects (Evans et al., 2015). Focusing on the pre-lab stage fills the gap as most of the research on living labs concentrates on the full-scale phase. The study provides insights into complex interactions involving re-tooling the campus from a passive to an active environment for teaching and learning. It helps to understand how dispersed initiatives across university units can become integrated into a legitimized and institutionalized ecosystem of a living lab.

The experience of Jagiellonian University in the implementation of CaliLab can be valuable for universities struggling with providing institutional anchoring for cross-disciplinary, multi-level, and multi-stakeholder projects. It can also inform other organizations implementing projects aimed at boosting innovation processes that require the involvement and activation of many diverse stakeholders, as well as inspire further work on universities and their ways to foster the development and improvement of homegrown ecosystem solutions based on the realities of own circumstances.

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Research-In-Progress Paper

AI to Fight Disinformation: a Living Lab Approach

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Abstract

Disinformation is a main problem in today's digital society, as it affects public opinion and causes public harm. This paper introduces research carried out within the Horizon Europe project *anonymised*, where an AI-based engine will be developed to counter disinformation by encouraging citizens' critical thinking processes. The overall implementation methodology of this project consists of a Living Lab approach in three phases. With this, the realization of a socially accepted and trustworthy citizen-centered AI-system will be ensured. This paper will present the findings and results of the first phase within the co-creation process and will cover the expected outcomes of the other two phases.

Key words

Disinformation - Trustworthy AI - Citizen Engagement - User Involvement - Living Labs

Introduction

Today's digital society is characterized by a continuous information flow and can be appointed as the information society (Kobelieva & Nikolaienko, 2021). News and information consumption therefore plays a significant role in citizens' daily practices. Due to this digital transformation, new actors came into play regarding the production, dissemination, and consumption of news. Users took on an active role within those processes and contributed by producing user-generated content (Paulussen et al., 2007). As content production and dissemination was simplified and made accessible to the broad public, the problem of disinformation arose (Rubin, 2019). Disinformation is false information that was spread to intentionally mislead its reader and can harm involved people and institutions (Hernon, 1995).

The aim of this paper is to present the research conducted within the Horizon Europe project *anonymised*. The objective of this project is to develop an AI-based engine that will encourage citizens' critical thinking processes and therefore will aid in fighting disinformation. AI offers opportunities to benefit the social good but equally entails ethical dangers (Hermann, 2021). In addition, using an AI-based system creates its own set of obstacles to overcome in terms of trustworthiness and transparency (Thiebes et al., 2021), these are only amplified by putting it to use in addressing something as controversial in itself as disinformation (Kertysova, 2018).

The application of a citizen-centric approach is required to counter these ethical implications and to ensure the social acceptance and trustworthiness of the AI-based system. The system will therefore be co-created through a process carried out in 3 phases. With this paper we will focus on the question how the application of a Living Lab approach can aid the co-creation of a complex AI-based system. In addition, we will argue how our methodological approach will support both the fighting of disinformation with AI and the assurance of a citizen-centered ecosystem.

Disinformation and the importance of critical thinking

Since the rise of the Internet, numerous ways of disseminating, producing and consuming information arose, resulting in an increasing amount of available online information. Along with this increased availability of information, the necessity to be able to navigate this substantial quantity grew (Hernon, 1995). As the different manners in which one can disseminate and produce information were simplified, the amount of misleading and false information that was spread increased equally (Fallis, 2015). Besides the simplification of the aforementioned processes, algorithms play a significant role in the creation and spread of disinformation (Kertysova, 2018). One could on the on hand share false information to intentionally mislead and deceive its reader and on the other hand spread misleading information unintentionally, as a genuine mistake. Respectively appointed as *disinformation* and *misinformation* (Hernon, 1995). The disinformation concept will be the focal point within this paper and the project.

The disinformation phenomenon is accompanied by a threat to the values of democratic societies, as it impacts the credibility of institutions, undermines trust, is intended to harm citizens, institutions, or governments (Sadiku et al., 2018) and supports the inception of false beliefs (Fallis, 2015). Critical thinking and the critical assessment of content is crucial to navigate the quantity of online information and limit the consumption of disinformation (Kertysova, 2018). Factors such as relevancy, accessibility, quality (Hernon, 1995), effectiveness, credibility, completeness, depth, authority, belief, and clarity (Rubin, 2019) came into play while critically assessing online information.

The disinformation problem needs to be tackled in order to safeguard the societal values crucial to democracy. The past years, a significant rise in fact-checking tools could be noticed (Akhtar et al., 2022). However, the biggest part of those were dependent on human intervention through the manual screening of online content and tracking down disinformation. Since AI technologies, algorithms, play a part in the production and dissemination of information, the technology gained interest to counter the problem and serve as a solution to disinformation (Kertysova, 2018) through automation (Rubin, 2019).

AI as a solution?

AI technology offers innovative ways to reform, earlier human steered, daily practices and interactions (Hermann, 2021). Since Kaplan and Haenlein (2019) describe AI "*as a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation*" (p. 17), it can be applied in a variety of sectors (Akhtar et al., 2022). The technology presents us with different ways to benefit society (Hermann, 2021), and for instance counter disinformation (Akhtar et al., 2022), but equally entails legal and ethical challenges and questions (Kertysova, 2018). With this, the concept of *trustworthy AI* is introduced:

> To maximize the benefits of AI while at the same time mitigating or even preventing its risks and dangers, the concept of trustworthy AI (TAI) promotes the idea that individuals, organizations, and societies will only ever be able to achieve the full potential of AI if trust can be established in its development, deployment, and use. (Thiebes et al., 2021, p. 447)

The concept of trust and *trustworthy AI* is crucial within our project's approach. As the aim is to develop an AI-based system to fight disinformation, social acceptance and trustworthiness are required in order to reach the tools full potential and encourage citizens' critical thinking processes.

Methodology

The project's overall implementation methodology is characterized by a citizen-centric co-creation approach to ensure the end product's trustworthiness, transparency, and acceptance, to increase awareness among the general public (Pierson & Lievens, 2005) and to limit the ethical challenges that are often involved with the application of AI technology (Hermann, 2021). The system will therefore be co-created through a three phase Living Lab process, which will shape its fundamental design principles. The applied methodology offers a new, interesting approach for future Living Labs as the implementation was carried out in different European countries and the different phases lasted, and will last in the future, an entire day. Figure 1 presents an overview of the different phases, its aims and where we currently are in the three phase implementation methodology.

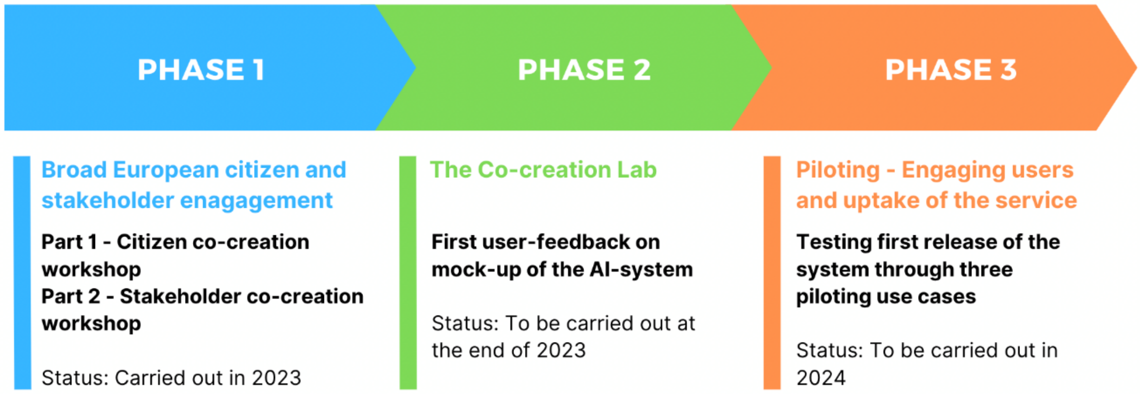

Figure 1. Overview three phase implementation methodology

Phase 1 - Broad European citizen and stakeholder engagement

In the first phase, the emphasis lies on engaging citizens as well as stakeholders to promote trust and acceptance as an integrated feature of the system. By conducting a five-hour co-creation citizen workshop with 30 citizens in 8 European countries, insights were generated on two aspects, namely disinformation and trustworthy AI. The workshops' framework consisted of four sessions. In the first session, the participants were asked to draw a timeline that demonstrated their daily news consumption and equally made them aware of their own habits. During the second session participants had to evaluate ten news articles at first sight, they got 30 seconds to consider each article, and decide whether they were disinformation or true news. This session was able to give an insight into certain triggers that influence the news' credibility evaluation. By touching upon values, habits, and concerns regarding the disinformation problem, these two sessions gave insight into the first aspect.

In the third session participants were offered possible design options during a scenario game, this provided us with the citizens' preferred functionalities and design choices. Features of the system that caused concerns and could result in pitfalls were discussed in the last session through a brainstorm. These last two session gave us an understanding of the second aspect: requirements for the successful implementation of a trustworthy AI tool. To further qualify the outcomes and deepen the understanding of the concerns discussed during the citizen workshop, three stakeholder workshops are being conducted.

Phase 2 – The co-creation Lab

In the second co-creation phase, four Living Labs will be conducted across different European countries. These will valorise our research further by implementing an open innovation approach in an early stage of the project. In addition, the Living Labs will provide us with user-feedback on a mock-up of the system (Schuurman et al., 2016). 72 selected citizens will test the AI tool during a five-hour co-creation lab in a real-world setting. The outcomes of this phase will structure a first version of the system.

Phase 3 – Engaging users and uptake of the service - Piloting

In the last phase, both citizens and stakeholders will evaluate and test the first release of the AI-system through three piloting use cases. Each use case will represent a societal challenge and will engage diverse citizen groups. The first use case will target higher education institutions to ensure a 'fact-checking state of mind' among students. The second use case will focus on the involvement of NGOs and provide them with a system to counter disinformation and help them fight against malpractices. The last use case will target citizenship at large and focus on false information regarding migrants and refugees to counter a general negative perception. The pilot results will support the iterative development of the system and will equally show the usage and implementation of the tool into users' reality. It will demonstrate its performance in a socio-cultural context.

Results phase 1: co-creation citizen workshop

We are currently concluding phase 1 of the research. Subsequently, we are able to report the first findings of the co-creation citizen workshop, carried out as a first part of phase 1. At the OLLD, we will equally be able to present the results of the co-creation stakeholder workshop, to be carried out as a second part of phase 1. There will be no results yet for the later stages of the Living Lab process, phase 2 and 3, as these will be carried out respectively in the end of 2023 and 2024.

The co-creation citizen workshop took place in eight European countries, namely Belgium, Bulgaria, Denmark, Ireland, Italy, Lithuania, Slovakia, and Spain. The average participation rate was 27, which made a total of 215 participants who were all purposefully sampled to ensure diversity, as demonstrated in Figure 2. There was however an imbalance in gender, as 61% of the participants were female, 38% was male and 1% indicated *other* as their gender. 27% was between 18 and 29 years old, 21% was 30-39 years old, 18% 40-49 years old, 11% 50-59 years old, 12% 60-69 years old and finally, 11% was above 70 years old.

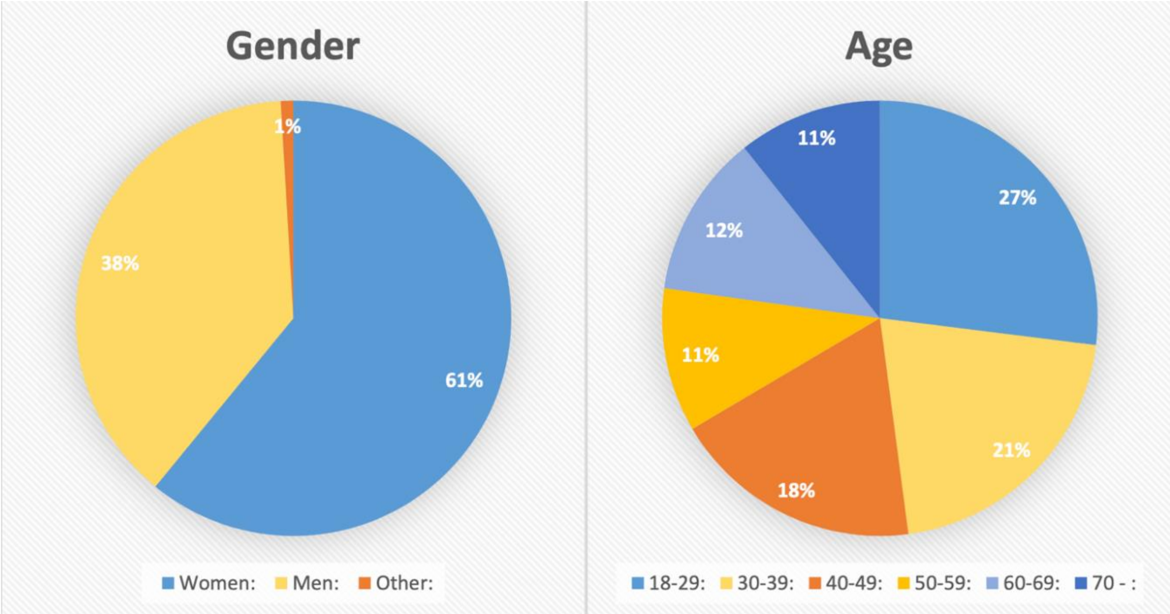

Figure 2. Gender and age of participants

We can conclude that the critical assessment of online news and information is strongly dependent on the participants' personal knowledge, earlier experiences, and biases. In addition, the provision of personal data appeared to be a threshold for citizens to use the system. As the aim of the system was to offer each user with personalized functionalities to consider individual preferences and needs, this concern complicates the intended personalized design principles.

All concerns mentioned by the participants must be considered and can be divided in four main categories. Firstly, the system must be transparent about the use and storage of personal data. Secondly, the system needs to be adaptable to individual users' needs and requirements. Thirdly, the systems' coaching tool has to be user-friendly and transparent in its functionality. Lastly, to gain trust from citizens, the reasoning and design behind the tool needs to be communicated clearly. These results will be further discussed in detail during the OLLD23 presentation, but the format of this paper did not allow us to give an in-depth explanation here.

Conclusion

The digital society we live in is confronted with the problem of disinformation. Intentionally sharing false information can harm people, public opinion and can cause false beliefs. This forms a threat to democracy and needs to be countered. AI technology offers the opportunity to aid in this fight against disinformation but equally raises ethical, social, and legal challenges. The goal of the Horizon Europe project *anonymised* is to develop an AI-based system that will encourage citizens' critical thinking and will accordingly contribute to fighting disinformation.

To limit the challenges that AI entails and ensure the development of a socially accepted and trustworthy AI-system, implementing a citizen-centered approach is necessary. The first results of our 3 phase Living Lab approach already demonstrated the complexity of the process. Individual preferences and needs, transparency and trust seem to be crucial elements that will shape the system's fundamental design principles. By continuing this process and iteratively testing and developing the tool with all involved stakeholders from the early stages of the design process, we hope to be able to develop a system that will be used and trusted by citizens in their struggle with the omni-present disinformation problem.

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Research-In-Progress Paper

Living Lab and International Cooperation in Tertiary Education

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Abstract

Living labs are a series of problem-solving and innovation activities carried out by citizens, scientists, specialists, governments, and firms. If used in college education, living labs become a typical example of a community-based problem-solving learning method. In this study, a project on international educational cooperation based on living lab activities will be introduced. Three universities from three different countries have been invited by our host university, and these four universities are implementing living lab projects simultaneously. The results will be shared once the project is completed, and the similarities and differences in the project outcomes will be analysed. To date, two cooperative models have been identified. First, students in different countries can focus on similar problems but come up with different solutions based on their political, economic, social, and cultural conditions. Second, students in different countries can focus on different problems but can cooperate to address the problem more effectively.

Keywords

living lab, problem-solving, tertiary education, international educational cooperation

Introduction

Living labs are a series of activities, such as generating ideas, designing, and implementing experiments, and developing innovative technologies, carried out by citizens in cooperation with researchers, government officials, firms, and other specialists to address local problems in their communities. If used in college education, living labs become a typical example of a community-based problem-solving learning method. Students are organised as groups, attempting to find problems in the college town (or on campus), design and implement experiments, produce a prototype, and apply it to designated problems. Professors can use living labs as a learning tool in college education, with the expectation that living lab activities can promote students' creativity and empower their problem-solving skills and abilities.[1]

We major in social science disciplines such as political science, international relations, public policy, and education. We taught several undergraduate classes in which students experienced parts of a living lab project, such as International Development Cooperation and Global Environmental Politics. In these classes, students identify local problems, come up with ideas for solutions, and design living lab experiments based on their solutions. After the semester, if students want to conduct the experiment they have designed, they apply for government-organised living lab contests. If accepted, a budget and other support are provided to carry out the experiment. They produce prototypes, apply them to local problems, and in some cases, they invent business models based on the results.

Based on these experiences of living lab-based educational innovation, we recently launched a new research project titled 'Living Lab and International Cooperation in Tertiary Education'. The basic idea is that multiple universities in diverse countries simultaneously organise and implement living lab activities in their undergraduate classes, and participating students and professors share their processes and results. The

[1] Ann-Louise Davidson, Ariel Harlap and Nadia Bhuiyan, "A Living Lab Approach to Prepare Students to Be Confident Innovators," *Revue Interventions Economiques*, 68(2022); See following articles on PBL in general. Jonathan Williamson & Alison S. Gregory, "Problem-Based Learning in Introductory American Politics Classes," *Journal of Political Science Education*, 6:3(July 2010); Heidi M. Berggren, "Problem-Based Learning and Improved Learning Outcomes in "The Politics of Welfare Reform"," *Journal of Political Science Education*, 7:4(October 2011).

goals of these cooperative projects are (1) to help students understand the 'glocal' way of problem-solving (how global problems are defined and addressed differently in different local areas); (2) to guide students in finding possible political, economic, social, and cultural conditions that might generate different processes and outcomes of the living lab class activities across the countries; and (3) to help students thrive as global citizens and cultivate the sense of global responsibility. In addition, as researchers, we will explore how these activities impact students' academic competence, creativity, and problem-solving abilities and how and why this impact varies across countries and/or regions.

This project is unique in terms that it focuses on multiple cases in different countries while existing living lab projects deal with one problem in a certain place. Comparing and contrasting each case in diverse countries would lead to a new way of problem solving. We expect that the project would extend the boundaries of living lab and can be a new model for international cooperation at the university level.[2]

In this paper, we first introduce the project outline and its background motivations. We then present what we have done to date and what we expect from it. Finally, we discuss two important findings that have been reported to date.

Project Outline

The project was initiated in September 2022 when our research institute received a government research fund designed for international educational cooperation. The estimated duration of the project is six years. Our research institute is an institute stipulated in the international development cooperation. It organises and implements official developmental assistance (ODA). The original plan for this research project was to cooperate with local universities located at ODA project sites. This would not only save time and energy in finding partner universities, but we could also expect some synergistic effect on existing ODA partnerships between the two sides. However, we identified other general partners and extended our partnership to other universities.

The 6-year period is divided into two parts. **Part I** is divided into three stages. In **the first stage**, participating universities implement living lab classes separately with baseline

[2] Katharina Greve, Riccardo De Vita, Seppo Leminen and Mika Westerlund, "Living Labs: From Niche to Mainstream Innovation Management," *Sustainibility*, 13:2(January 2021).

(minimum) coordination (such as schedules and forms of activities). In **the second stage**, we designate similar courses in the same academic disciplines and implement living lab activities. For example, the participating universities are all political science majors, and they open courses on environmental politics. The living lab activities are implemented in the same context as the course objectives. In **the third stage**, a common course titled 'Living Lab and Social Innovation' is available to all participating universities with the same course outline and syllabus. The course objectives, student responsibilities, curriculum, living lab activities, and evaluations are all fully coordinated. In **Part II**, while maintaining the basic framework for cooperation, we include more participants from various academic disciplines beyond the social sciences. We also extend our cooperative project to graduate-level seminars. Additionally, we may be able to develop a new model for educational ODA projects based on these living lab activities. In the future, we shall implement our educational ODA model at partner universities.

Progress to date

We first developed a manual and teaching portfolio for living lab class cooperation. In the manual, we introduced specific directions and stages of living lab activities. The teaching portfolio included a syllabus, handouts, examples of previous presentations, and other teaching materials. We distributed these to our partner universities and held a series of online and offline workshops to share opinions and decide on a cooperative framework for the first year.

The framework has been planned and implemented as a five-step process:

<u>Step 1.</u> At the beginning of the semester, the instructor introduces the entire project to students, especially focusing on the meaning of the project in the context of the course.

<u>Step 2.</u> The instructor explains the meaning of a living lab and its importance to the context of the course and gives examples of living lab projects for students. In some cases, we provide special lectures to partner university students to introduce a living lab.

<u>Step 3.</u> Students are grouped, and their living lab activities are initiated. They are supposed to identify problems, gather (or create) data, determine their cause(s), and develop solutions. All groups present their projects in their classrooms (Table 1).

Step 4. Students upload a short video clip explaining the group project outline to the YouTube channel. In this way, students in different universities share projects. They write a short response memo for their partner university's projects and send them to partner universities. Once they have received a memo, they read it and discuss it themselves.

Step 5. All the participating professors meet at a conference in late August in the host country to share their projects and discuss possible research cooperation for publication. In addition, they discuss the future directions for further cooperation in the next semester.

Table 1. Examples of Presentations

Problems	Causes	Solutions
Lack of educational opportunities for female students	Early marriage traditions in the ethnic minorities	Education to increase awareness
Blind people cannot recognise the colour of apparel and shoes when they shop for them or keep them at home.	Visual handicap, but at the same time, social exclusion of disabled people	Make rubber tags indicating the colour in Braille and attach them to the clothes and shoes Suggest apparel companies include this tag in their product as a campaign
Slow business of local shop owners	COVID-19, but also shop owners are older individuals not familiar with e-commerce	Students cooperate with shop owners to develop applications for online shopping
Patients visiting hospitals have a hard time with taking their medical procedures.	Hospitals have congested facilities and complicated system process.	Make a wearable hospital device to let patients know complicated medical procedures.

For research purposes, we conducted a pre-project survey of students in five classes. After completing the project, we will conduct a post-project survey with the same students. A questionnaire was designed to examine the possible effects of the living lab project on students' problem-solving abilities and creativity. We also plan to conduct semi-structured interviews with students during and after the project. Eventually, we will write papers titled, 'The impact of living lab classes on students' problem-solving ability and creativity', 'Local-to-local educational cooperation and its implications on existing international development cooperation', 'Socioeconomic conditions affecting the differences in the process and outcomes of living lab class activities in different countries'.

Findings

There are at least two findings to share at this moment.

First, we identify at least two patterns that could potentially become models of cooperation. First, students at different universities (in different countries) encounter similar problems, but the solutions are different. We found that one group in Vietnam and another in Indonesia designated early marriage as the same problem. However, they focused on different aspects of the problem, and their solutions were different. Therefore, we can compare and contrast them and analyse possible factors contributing to these differences. Second, students in different universities (in different countries) face different problems, but there is the possibility of generating cooperative solutions. For example, students in Indonesia and the host country could cooperate to establish an online marketing mechanism that targets the Korean market. This will help boost the local economy on the Indonesian side but simultaneously help the host country's students overcome their limited job opportunities.

Second, we have been concerned about the limited opportunities for the actual implementation of living lab activities when the semester is over in partner universities. In the case of the host country, there are a number of opportunities to apply for the actual implementation of the experiment. As mentioned previously, there are many government-driven laboratory tests in Korea. Our concern is that partner universities may have some problems finding additional funding sources for actual experiments. However, this was not a factor that delayed cooperation. Since professors at partner universities have realised the importance of living lab projects, they have become enthusiastic about finding funding sources for their students. In addition, we will attempt to find ways to conduct cooperative experiments between the host and partner universities. We hope that this project will create new possibilities for international cooperation of the living lab in the future. In addition, in terms of education, we hope to find new implications (both theoretical and policy) in our project and research and contribute to existing discussions on the effectiveness of various teaching and learning methods.[3]

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[3] Carina Veeckman, Dimitra Schuurman, Seppo Leminen and Mika Westerlund, "Linking Living Lab Characteristics and Their Outcomes: Towards a Conceptual Framework," *Technology Innovation Management Review*, 3:12(December 2013).

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Full Research Paper

Inclusive primary healthcare in the community: stakeholder consultation to guide service implementation

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Abstract

Societal changes in terms of healthcare needs and availability of healthcare professionals call for adaptations in the organisation of primary healthcare. Citizens can help to design integrated health, care, and community services, hereby aligning policies and services to communities' needs. However, stakeholder consultation is often limited and does not sufficiently take health literacy into account. By joining forces between local communities and living labs, several methodologies can be set up to gain insight into the healthcare needs and expectations of citizens and care professionals to guide future-oriented and innovative public care. The current paper describes a study that took place in the municipality of Vorselaar in Belgium. In the first phase, a survey study included a sample of 1078 participants from the local community to provide insight into user needs for primary healthcare practice and preventive initiatives as well as the health literacy of the population. Recruitment activities focused on engaging a sample that reflected the local diversity and, therefore, also actively lowered participation thresholds by e.g., sending personal invitations and providing support in completing the online or pen-and-paper survey. In a second phase, co-creation sessions with citizens, (care) professionals, and more vulnerable residents were initiated to get more in-depth information about primary healthcare needs. Results indicated the need for interdisciplinary care centres with GPs, dentists, nurses, psychologists, dieticians, and social workers, and showed that citizens believe that the local government has a role to play in health promotion related

to e.g., healthy food, exercising, and mental health. Health literacy in this local community was varied, covering the full range of the spectrum, and proved to be associated with age, education, general and mental health, and loneliness. The co-creation activities led to concrete ideas for regional strategic actions to promote high-quality primary care. The current study showed that targeted recruitment for a comprehensive survey and co-creation sessions allowed for the inclusion of a large and rich sample to inform on local healthcare needs and define priorities for the local government. Residents and care professionals can be motivated and interesting partners in designing futureproof and inclusive primary healthcare.

Key words

Living Lab, co-creation, health literacy, primary healthcare, health prevention, citizen participation

Introduction

Societal changes in terms of healthcare needs and availability of healthcare professionals (e.g., in rural areas) call for adaptations in the organisation of public healthcare. Instead of being passive recipients, citizens can help to design integrated health, care and community services, hereby improving municipalities' accountability and aligning policies and services to communities' needs (Conklin et al., 2015; De Weger et al., 2022). However, while the 'stronger and more active citizens' are regularly involved in participation, more vulnerable residents are overlooked (Glimmerveen et al., 2019). Also relevant in this respect is that these more vulnerable individuals are more likely to have lower health literacy (Sørensen et al., 2015). To ensure the provision of high-quality healthcare, it is important to tailor communication and service provision to the health literacy of the entire target population. Health literacy is defined as "people's knowledge, motivation and competencies to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course" (Sørensen et al., 2012). Lower health literacy has been associated with poorer health conditions, unhealthy behaviours, and less use of preventive services (Berkman et al., 2011; Fernandez et al., 2016; Jayasinghe et al., 2016; Sørensen et al., 2015; Von Wagner et al., 2007). Promoting health literacy is, therefore, important. Studies indicate that promoting health literacy not only reduces healthcare costs (McCray, 2005), but also has important health benefits, both on an individual level as well as on a societal level (Nutbeam, 2000). In addition, health literacy has been recognised as a key factor for reducing health inequality (Sørensen et al., 2013).

Local governments often do not have the necessary expertise to perform the required inclusive and large-scale stakeholder consultation for healthcare reorganisation. However, they could get support from local living labs. Living labs are open innovation ecosystems with expertise in the inclusion of end-user populations and the execution of such large-scale data collection in the context of exploration and co-creation of innovations (De Witte et al., 2021). Additionally, living labs focus on the testing and upscaling of innovative solutions, granting value to the involved stakeholders. The current study concerns a collaboration between a municipality and a living lab with the goal of shaping future primary healthcare. The study has two main aims: (1) gaining insight into the local user needs for an interdisciplinary primary healthcare practice and preventive initiatives as well as the health literacy in a representative sample of the population, and (2) obtaining more in-depth qualitative data from three distinct stakeholder groups, i.e., citizens, care professionals and more vulnerable residents (e.g., citizens with lower socio-economic status), to formulate concrete and tangible goals for the organisation of healthcare and prevention.

The study took place in the municipality of Vorselaar in Belgium where healthcare provision was under severe pressure due to a retirement wave in healthcare professionals, more specifically GPs and dentists. Residents were forced to look for alternatives in the wider region or postpone essential care. Therefore, the municipality wanted to create an open interdisciplinary healthcare network, putting the focus on prevention and close cooperation between different actors in the health and care sector, and established a primary healthcare practice. The study took place in two phases, namely a large survey-based citizen consultation and a qualitative small-scale co-creation phase for further reflection and enrichment of the data.

Phase 1: The Health Survey

Method

Recruitment

All residents of Vorselaar aged 18 and above were invited to participate in the study through a personal invitation in their letterbox, signed by the mayor. To lower participation thresholds, a paper version of the survey was enclosed. However, citizens were encouraged to complete the survey online, using a QR code or website link. Reminders to fill in the survey were provided on paper through the local newspaper, online on the website and social media profiles of the municipality, and in person through flyers distributed at the annual fair. Special attention was given to the inclusion of more vulnerable residents by e.g., sending personal invitations to every adult inhabitant and providing support in completing the online or pen-and-paper survey on different locations (such as the town hall, local service centre or even at home). Recruitment and data collection took place during 2 months in the summer of 2022. The Study was approved by the Social and Societal Ethics Committee SMEC of KU Leuven (G-2022 06

2111) and all participants provided informed consent.

Health survey

The survey consisted of three themes in addition to the demographical information (age, gender, education, and income): health and well-being (including general health, mental health, and loneliness), health literacy, and needs and preferences related to health prevention and a local primary healthcare practice. The survey included both existing (previously validated) scales and novel survey items, when no suitable existing instruments could be identified. The 6-item De Jong Gierveld loneliness scale calculates a score between 0 and 6 with higher scores representing more loneliness (De Jong Gierveld & van Tilburg, 2008). The scale has good internal consistency in the current sample, α = .84. The Dutch translation of the short version of the European Health Literacy Questionnaire allows to calculate a total score ranging from 12 to 48, with higher values representing better health literacy (HLS-Q12; Finbråten et al., 2018). This 12-item questionnaire has good reliability (α = .89) and is conceptually conceived as a matrix of four cognitive domains (access, understand, appraise, and apply health information) and three health domains (health care, disease prevention, and health promotion). Five-point Likert scales were used to assess (mental) health. The level of education was measured with 6 categories from no degree to university degree. Income was defined on a 5-point Likert reflecting the extent to which household income could cover all expenses, ranging from very easy to very difficult.

Data Analysis

Data were analysed using SPSS 28.0 (IBM SPSS Statistics). Associations between different variables were calculated using Kendall tau (τ) correlations. Hierarchical regression analyses were used to assess to which extent demographic and health variables predicted health literacy. In advance, categorical variables were dichotomised and differences in health literacy across demographic or health factors were examined using independent t-tests. All variables showing significant t-tests were entered in the hierarchical regression analyses. Ranking questions were analysed using Friedman ANOVA. Open-ended questions were analysed through thematic analyses. Sample sizes can differ between analyses due to missing values.

Results

A total of 1078 inhabitants of the municipality completed the survey, of which 728 did so online. This corresponds to a response rate of 16.5%. When comparing the sample to data from the Belgian bureau of statistics, we achieved in covering the diversity within the community. Sample characteristics showed a good distribution in age (from 18 up to 80+), professional situation, and income. Nevertheless, the sample included slightly more women (60.6%), and showed fairly high education levels.

Health and well-being

On average, respondents reported satisfactory general and mental health (see Figure 1). A minority stated to be in (very) poor general (n = 58/1064) or mental health (n = 62/1049). Feelings of loneliness were present to some extent in 50% of the respondents (n = 544/1023), with about 7% attaining the maximum score (n = 72/1023). Table 1 shows that lower general and mental health were related to lower income, lower levels of education and more loneliness. General health also correlated with age, with increasing age being associated with a decrease in self-reported health. Mental health nor loneliness were related to inhabitants' age (τ = -.00, p = .89 and τ = .04, p = .12, respectively).

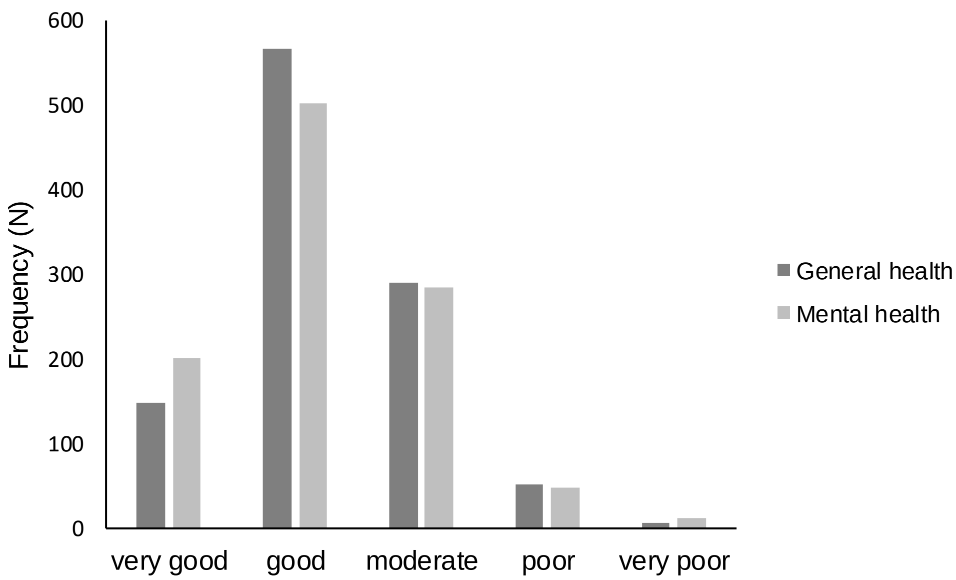

Figure 1. General and mental health

Table 1. Correlations (Kendall τ) between demographical and health variables.

		1	2	3	4	5	6
1.Loneliness		1					
	N	995					
2.Age		.04	1				
N		956	993				
3.Education		-.13*	-.33*	1			
	N	995	993	1036			
4.Income		.26*	.09*	-.29*	1		
	N	984	977	1019	1019		
5.General health		.24*	.13*	-.13*	.24*	1	
	N	992	988	1030	1016	1030	
6.Mental health		.38*	-.00	-.10*	.25*	.49*	1
	N	994	976	1018	1004	1014	1018
7.Health literacy		-.26*	-.16*	.19*	-.19*	-.21*	-.22*
N		910	893	923	916	920	919

Note. * $p < .001$.

Health literacy

The sample obtained a mean health literacy score of 34.04 ($SD = 5.13$, range 12-48, Figure 2). Health literacy showed a positive correlation with education and correlated negatively with loneliness, age, income, general health, and mental health (Table 1).

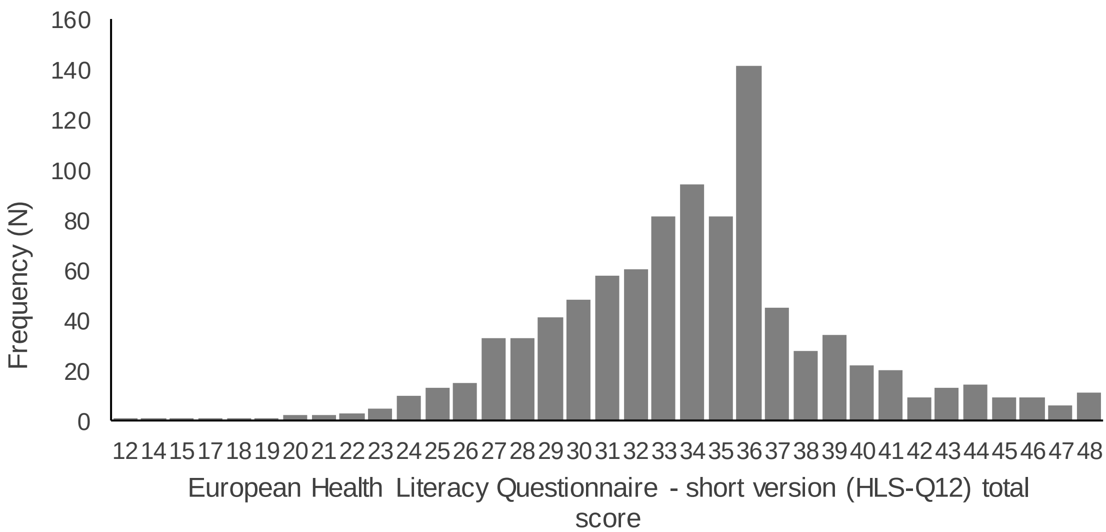

Figure 2. Health literacy scores (N = 945)

Independent variables were included in the hierarchical regression in 5 steps (Table 2). Assumptions of multicollinearity, normality of residuals, and homoscedasticity were not violated. Model 4 provides the best fit, explaining 16.3% of the total variance in health literacy. Age, education, general and mental health, and loneliness are unique predictors for health literacy, whereas no additional contribution was found for gender or income. The direction of effects showed that health literacy was lower in individuals with higher age, lower education, lower general and mental health, and higher scores for loneliness.

Table 2. Hierarchical regression analysis for the dependent variable health literacy.

	R^2	$R^2_{adjusted}$	ΔR^2	Standardised β-coefficient
Model 1	**0.07**	**0.07**	**0.07****	
Age				-0.16**
Gender				-0.04
Education				0.18**
Model 2	**0.10**	**0.10**	**0.03****	
Age				-0.14**
Gender				-0.04
Education				0.17**
General health				0.17**
Model 3	**0.14**	**0.13**	**0.03****	
Age				-0.15**
Gender				-0.05
Education				0.16**
General health				0.08*
Mental health				0.20**
Model 4	**0.16**	**0.16**	**0.03****	
Age				-0.15**
Gender				-0.05
Education				0.15**
General health				0.07*
Mental health				0.15**
Loneliness				-0.17**
Model 5	**0.17**	**0.16**	**0.003**	
Age				-0.15**
Gender				-0.05
Education				0.14**
General health				0.06
Mental health				0.14**
Loneliness				-0.16**
Income				0.06

Note. R^2 is the proportion of variance explained by the model. $R^2_{adjusted}$ is an estimation of the variance explained on population level. ΔR^2 verifies whether a model is a significant better fit compared to the previous model. Standardised β shows the unique contribution of each variable. **p* < .05; ** *p* < .001.

Needs and preferences regarding health prevention and a local primary healthcare practice

Participants ranked several lifestyle factors according to the influence they can have on health outcomes (Table 3). Healthy food was perceived as the most important factor regarding health prevention, followed by exercise, mental health, and sleep. There were only minor differences in ranking across age groups. People over 80 attributed a bit more influence on sleep compared to mental health and individuals under 60 ranked smoking before alcohol consumption.

Table 3. Participants' ranking of the extent to which lifestyle factors influence health.

Health factors	Mean rank
Healthy food	2.05
Exercise	2.62
Mental health	3.43
Sleep	3.55
Alcohol consumption	4.71
Smoking	4.87

Note. Lower mean rank represents higher perceived influence on health.

Most residents believed that the local government has a role to play in health prevention. This was reflected in a score of 7.10 (SD = 2.36, N = 1018) on an 11-point rating scale (0 = *not at all*; 10 = *definitely*). An open question regarding this topic revealed that motivating, stimulating, and activating residents is the most important task, followed by informing people on prevention through thematic sessions, providing health articles in the local newspaper, etc. In third place, they mentioned the need to involve a sufficient number of affordable general practitioners, dentists and paramedics in the primary healthcare practice in order to make health (promotion) accessible to all inhabitants.

The majority of the respondents (96.81%) has a 'family doctor' or a regular general practitioner (GP) to visit when needed. However, this is GP is situated outside of the municipality for two-thirds of inhabitants. Factors that play a role in GP selection are (ranked from most to least important): (1) being able to access GP quickly, (2) physical distance, (3) recommendations from friends or family, (4) GP as part of a group practice, (5) other. Common self-reported other factors consist of having a relationship of trust with the GP (N = 137), competency (N = 81) and empathy (N = 45) of the GP, communicative skills (N = 29), and providing sufficient time for patients (N = 26).

Participants selected their top 5 of preferred disciplines for an interdisciplinary primary healthcare practice out of a list of 13 care professions (Table 4). For the five most listed professions their mean rank was taken into account to determine an overall top 5. Adding a dentist to the primary practice was considered most essential, followed by a nurse, psychologist, dietician, and a social worker. Results were similar across age groups.

Table 4. Preferred health professions for the primary healthcare practice in addition to the general practitioner.

Care profession	N	Mean rank
Dentist	869	1.31
Nurse	392	2.29
Psychologist	532	2.52
Dietician	263	3.17
Social worker	275	3.29
Burn-out coach	191	3.45
Medical secretary	184	2.64
Occupational therapist	182	3.38
Speech therapist	170	3.50
Move-by-referral coach	85	3.25
Midwife	82	3.33
Sexologist	37	3.81
Smoking cessation counsellor	19	3.32

Note. N is the number of times a particular profession is mentioned in the top 5. Lower mean rank indicates a higher need to include the profession in the healthcare practice. Physiotherapists were not included in the list because this group is already well represented in the municipality.

Phase 2: Co-creation sessions with different stakeholders

Method

Recruitment

Recruitment aimed to include citizens, care professionals, and more vulnerable residents of whom we expect lower health literacy (e.g., citizens with lower socio-economic status). We aimed to include about eight to ten individuals per group, with a minimum of four individuals for the harder to reach samples (in line with Carlsen & Glenton, 2011). Citizens were recruited through targeted emails to the group of respondents of the survey that had indicated to be willing to participate in follow-up research. Batches of approximately 10 emails were sent every two days until we reached a satisfactory number of participants for this session. We aimed to include a balanced ratio of males/females and participants of different age groups. All care professionals active in the municipality were invited for participation by the local government through email. Finally, more vulnerable residents with assumably limited health literacy were recruited with the help of a local organisation that focusses on inclusion of vulnerable people in society (e.g., older adults, citizens with lower socio-economic status). The study was approved by the Social and Societal Ethics Committee SMEC of KU Leuven (G-2022 06 2111) and all participants provided informed consent.

Co-creation

The goal of the co-creation sessions was to enrich the findings of the health survey and to generate ideas for the future local health strategy. For this purpose, the GPS brainstorm kit (Flanders DC, Figure 3) for idea generation was used in all three sessions. This is a structured brainstorming method based on presenting five relevant subthemes related to the vision and strategy of the upcoming interdisciplinary healthcare practice, represented by the overarching statement 'The healthcare practice is an open, inviting environment for anyone with questions about health, care and well-being'. Additionally, a sixth residual subtheme or free field, in our sessions called 'the sky is the limit', encouraged participants to think out-of-the box and to come up with innovative ideas without restrictions in time and money. The generated ideas were prioritised. For citizens and more vulnerable individuals with assumably limited health literacy the following five themes were used: preventive health, inform and learn, open for everyone, inviting meeting place, and new building 2024. For the care professionals the focus was a little different and included the themes preventive health, primary healthcare, enhancing health literacy, interdisciplinary, and partner network.

Procedure

All sessions took place in October or November of 2022. Every co-creation session started with an ice-breaker game. This animation technique made participants more conducive to creativity and sharing, and aims to relax the atmosphere. Then both the primary healthcare practice and the living lab were introduced. Next, the GPS brainstorm was applied. Participants successively discussed the six subthemes regarding the upcoming primary healthcare practice in small groups. Every idea was written on a separate post-it. Afterwards, ideas were prioritised with all participants. In case there was still time left in the 2-hour session, the prioritised ideas were substantively elaborated.

Data analysis

All ideas (post-its) were prioritised by the participants. The moderators of the sessions combined the insights of all three sessions into practice-oriented advices.

Results

Citizens

Ten citizens were included. Participants indicated that the local government should target health promotion to inhabitants of all life stages, starting at a school context. The primary healthcare practice should be easily accessible and affordable for all citizens. Different online and offline contact options should be available flexibly (daytime, evening, weekend). The healthcare practice is recommended to not only accommodate doctors and paramedics but to be a multifunctional room where also workshops or thematic sessions regarding health-related topics can be hosted. Examples consist of yoga or work-out sessions, workshops to enhance individuals' computer/digital skills, social media training, and first aid trainings. Participants also had several suggestions concerning the design of the new building. Citizens recommended to include plenty of natural light, art of local artists, a children's corner, a stable internet connection, a large parking lot nearby, and some benches for informal talks.

Figure 3. Using the GPS brainstorm kit in co-creation with citizens

Care professionals

Fifteen local care professionals from nine different disciplines agreed to participate (out of 51 municipality care professionals; response rate 29%). They acknowledged that cooperation across disciplines was limited at the time. Online information on local care professionals was often outdated and they, therefore, felt the need to get acquainted with each other and each other's expertise. Better interrelations would also facilitate referral between the disciplines. One suggestion was to build an online platform with updated information of all care professionals of the municipality. Care professionals wanted to prioritise inclusion of vulnerable individuals but found it a challenging subject to tackle on their own. Therefore, they suggested to get together quarterly to exchange ideas on different health themes, including how to strengthen residents' health literacy. However, one concern that emerged was the funding of health promotion activities. Dissemination of events or thematic sessions could use the proposed platform or website of the primary healthcare practice. Participants also stressed the importance of attracting enough dentists for the primary care practice, as the municipality had lacked a dentist for several years already. Finally, targeting schools for health prevention was considered an important step to start early with the introduction of healthy life habits. This entails the additional advantage that school children can act as a gateway for providing information to parents who might be more difficult to reach, such as parents with a migration background or lower socio-economic status.

Vulnerable residents

Five vulnerable residents could be recruited. One of the inclusion coordinators of the inclusion organisation also participated in the session. Participants indicated that the best way to improve accessibility for vulnerable participants is through personal contact. However, these people often tend to live in isolation. Since doctors are not allowed to advertise their services (in line with the Belgian law), the participants suggested that volunteers affiliated with the primary care practice could go door-to-door to inform about the services of the healthcare practice. These volunteers could work with informal district leaders who are aware of specific difficulties in the neighbourhood. In terms of the design of materials, leaflets for health prevention activities should be playful rather than pedantic, with concrete tips and tricks. Preventive initiatives could be conceptualised as group challenges that are rewarded. Furthermore, participants also indicated that the primary health practice should be easily accessible, e.g., for wheelchairs or rollators, and touch screens at the entrance should preferably be avoided as they are a burden to the visually impaired. The practice should have extensive opening hours but additionally, offer GP home visits since they are essential for those who are less mobile. One should be able to make an appointment online or by phone. A warm welcome was deemed important as they indicated that the primary healthcare practice should have a cosy reception with friendly staff that help without prejudice. The idea of a coffee corner as a meeting place was also suggested. Finally, the participants would like the primary healthcare practice and the local government to organise workshops for citizens to improve both digital and health literacy skills.

Discussion

Citizens can facilitate change in a range of health, care, and community services (Conklin et al., 2015). In line with Milewa et al. (2002), who indicate increased awareness of strategic public and patient involvement in primary healthcare planning and organisation, the present study was designed to co-create a futureproof primary healthcare strategy with an open interdisciplinary healthcare network, putting the focus on prevention and close cooperation between different actors in the health and care sector. The current work describes a partnership between a living lab and a local government to organise an inclusive and large-scale stakeholder consultation for healthcare reorganisation.

Findings indicated that citizens of Vorselaar were generally in reasonably good health. Lower general and mental health were related to lower income, lower levels of education and more loneliness, which is consistent with previous research (Klein et al., 2021; Quadt et al., 2020; Veenstra & Vanzella-Yang, 2020). The sample showed varying levels of health literacy and analyses revealed that lower health literacy was associated with higher age, lower education, lower general and mental health, and more loneliness, in line with previous work (Musich et al., 2015; Paasche-Orlow et al., 2005; Van Der Heide et al., 2013). Results also supported a need for accessible interdisciplinary care practices with GPs, dentists, nurses, psychologists, dieticians, and social workers. Co-creation sessions with different types of stakeholders revealed that both citizens and care professionals were willing to invest in the municipality's health landscape and led to suggestions for concrete actions concerning launching the primary care practice as well as preventive activities organised by the local government. Additionally, citizens believed the local government has a role to play in health promotion related to e.g., healthy food, exercise, and mental health.

This study reached a large sample of inhabitants of a local municipality. A comparison with governmental statistics showed that the sample was a good cross section of inhabitants of the municipality, including elderly and more vulnerable individuals. This suggests that findings are representative for the population of interest. The study also succeeded in including almost one third of local care professionals in co-creation. By combining multiple perspectives and research activities (survey and co-creation sessions) the current study was able to gain rich insights allowing for the design of better primary healthcare in the community. While findings regarding health literacy, (mental) health and related characteristics are in line with existing evidence, other findings and preferences will likely be driven by the local context and cannot directly be generalized beyond this municipality. Another limitation concerns the cross-sectional nature of the study, which makes establishing causal directionality difficult.

The pressing shortage of care professionals in the rather small municipality provided a suitable context to design innovative local healthcare services from scratch. The current study will shape the healthcare organisation in this municipality. A detailed report of the co-creation activities was shared with the local government for the implementation and further development of ideas regarding the primary healthcare practice or preventive health initiatives in the municipality. At present, the local government has set up a prevention working group that aims to implement the suggested preventive initiatives in a sustainable way. Furthermore, the health promotion strategy is planned to be embedded in a new methodology concerning caring neighbourhoods that is being deployed in different Belgian municipalities. The current study has also led to additional collaborations between the municipality and the living lab, the latter of which is organising trainings for the municipality health professionals concerning oral and written communication in health practice (using the Memori toolkit). During these sessions, caregivers will learn how to recognize and handle health illiteracy, which is considered an important predictor for health inequity (Nutbeam & Lloyd, 2020). Trainings are followed by a network event to strengthen links between different care professionals of the municipality. In addition, the use of a digital platform for individualised health prevention is explored. In such a platform citizens could complete a set of health-related questions to obtain an overview of relevant health promotion activities organised nearby and optionally share the results directly with their GP.

Conclusion

Over the past years, an increase in research on the development of a health ecosystem approach for regional (mental) healthcare can be observed (e.g., Rosen et al., 2020). Such an approach will lead to better care and benefit both citizens and health professionals. However, an important challenge for health promotion and healthcare proves to be health literacy, which is lower in vulnerable individuals, e.g., elderly or lonely individuals and patients with (mental) health problems. This should be taken into account by policy makers and health and care professionals when designing high-quality primary care in the community. The current study also shows that a living lab approach including a large stakeholder consultation and co-creation delivers relevant insights that facilitate the redesign of healthcare services in the community and guide implementation efforts. Interesting avenues for future research are situated in conducting localised implementation research into health promotion interventions, with special attention to the inclusion of vulnerable citizens. As a next step, such successful health promotion interventions may be deployed in larger health networks or even at a national level. Taken together, the current study shows that partnerships between living labs and local governments are promising in assessing municipality needs in terms of reorganisation of primary healthcare and implementing local preventive initiatives supported by society.

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Research-In-Progress Paper

Bologna Living Lab. Pilot project for implementation of serious game in citizen science initiatives

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Abstract

Nowadays, climate change shows irreversible consequences for the well-being of humanity, territories, and resources. The city of Bologna (Italy) is facing environmental, societal, and digital challenges that are currently featured in urban spaces worldwide: air pollution and intense urban mobility, due to anthropic activities and ever-increasing urbanization. A just socio-ecological transition towards sustainable urban spaces relies on the collaboration among all actors involved in the Quintuple Helix of Innovation (Carayannis et al, 2012). In an attempt to address these challenges, researchers from the University of Bologna established the Bologna Living Lab, actively engaging a comprehensive network of stakeholders including policy and decision-makers, academic and research institutions, civil society, and industry aiming to democratize knowledge and research in the environmental field. The H2020 I-CHANGE project "Individual Change of HAbits Needed for Green European transition" intends to demonstrate how collective behavioral change is possible through the involvement of civil society in citizen science initiatives (Goudeseune et al, 2020; Vohland, 2021). The research approach is structured around Living Labs (LLs) to raise awareness about climate change impacts in urban space and to promote behavioral changes toward more socially and environmentally sustainable lifestyles.

Key words

Citizen science, urban mobility, air pollution, serious game, just transition, behavioral change, STS, co-creation

Raising climate awareness and promoting more sustainable lifestyle in urban space

Introduction

The city of Bologna (Italy) is facing environmental, societal, and digital challenges that are currently featured in urban spaces worldwide: air pollution and intense urban mobility, due to anthropic activities and ever-increasing urbanization. In an attempt to address these challenges, researchers from the University of Bologna established the Bologna Living Lab, a democratic science space where researchers and members of civil society collaborate in the definition of environmental protection and climate actions to undermine inequality in the eco-social just transition framework.

Bologna Living Lab is implemented within the H2020 I-CHANGE project "Individual Change of HAbits Needed for Green European transition". It intends to demonstrate how collective behavioral change is possible through the involvement of civil society in citizen science initiatives (Goudeseune et al, 2020; Vohland, 2021) in the setting of Living Labs. The project has built a wide network of Living Labs, operating at a local level and cooperating at an international scale, since they set up in six cities in Europe (Amsterdam, Barcelona, Bologna, Dublin, Genoa, Hasselt), two in extra-European countries, one in West Asia (Jerusalem) and one in West Africa (Ouagadougou). The project started in November 2021, and it will end in April 2025.

Methodology

In Bologna, the Living Lab is actively engaging a comprehensive network of stakeholders including policy and decision-makers, academic and research institutions, civil society, and industry. Bologna Living Lab stakeholders have been mapped thoroughly in the framework of the Quintuple Helix (Carayannis et al, 2012) with a Multilevel perspective (Geels, 2011). To identify the needs and the specific role of each stakeholder, the research team delivered a survey to classify and assign the proper role in the project according to their relevance level (De Vincente Lopez & Matti, 2016, p. 46-53). Four main roles have been identified in the project for stakeholders: enabler, user, provider, and consumer (Leminen et al, 2014). Each role requires a different level of engagement and different activities to be involved in. For example, students involved will represent providers for data collection via maps and surveys; social scientists and atmospheric physicists will enable the data elaboration. The results produced will intertwine with the activities of the Municipality of Bologna (provider of information and data) and with initiatives of local Associations, users of the innovative results developed by the Living Lab.

According to one of I-CHANGE's purposes, the social scientist operating in Bologna Living Lab developed a social and economic tool for the analysis and evaluation of behavioral changes. The main activities implemented in the Bologna LL were carried out in two macro directions: on the one hand, the dissemination of a survey to understand the level of climate awareness and the factors capable of directing a change in behavior, and on the other hand, the experience of a serious game on urban mobility practices. These activities are to be considered interrelated, as useful steps to analyze and understand the areas of possible intervention, identifying guidelines and recommendations to be shared with local institutions dealing with urban policies.

As a first step, a semi-structured survey grid has been created and addressed to target groups (students, citizens, consumers) selected with a snowball sampling methodology (Parker et al, 2019). Data collection and analysis has been guided by COM-B model (*Fig.1*), a theoretical framework based on Theory of Change (Mayne, 2015; Stein & Valters, 2015) to set goals and outcome for understanding and supporting a concrete and effective behavior change (Keyworth et al, 2020; Michie et al, 2013). The grid is designed to investigate 6 dimensions that could drive behavioral decisions, namely physical capability, psychological capability, physical opportunity (afforded by the environment, including time and resources), social opportunity (afforded by interpersonal influences, social cues), reflective motivation and automatic motivation. The evaluation tools consider not only behavioral changes that have occurred, *process indicators,* but also their socio-economic durability and sustainability over time, *impact indicators* (Gertler, 2011; Hàk et al, 2012).

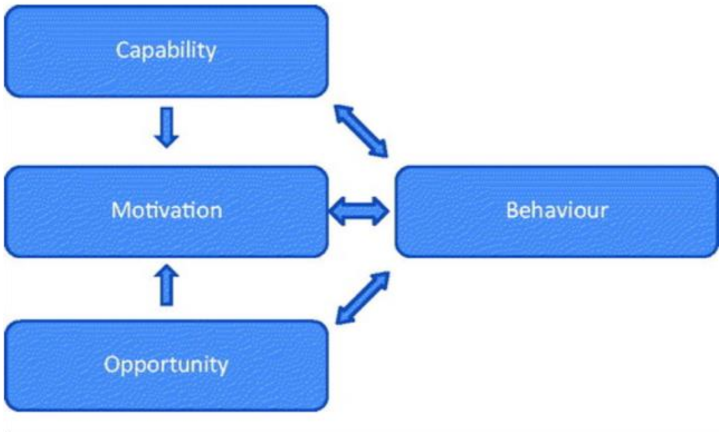

Figure 1. COM-B Model (Michie et al. 2011)

The three dimensions of COM-B were retraced to structure the areas to investigate to identify, according to the respondents, what are the factors most likely to impact a behavioral change. In our case, it was not necessary to delve into what the concrete interventions to be implemented might be. Indeed, we used the COM-B model to explore some aspects and/or characteristics to take into consideration when assessing and evaluating outcomes and impacts of citizen science activities.

Based on the collective answer, the survey helped identify what individual, collective, or structural clinchers can contribute to supporting concrete and effective change toward more sustainable lifestyles. We specified how there were no right or wrong answers, and participants were invited to respond according to their own views on the topic.

The survey is structured into four main sections:

a. *climate change awareness*, to assess the level of understanding of the issue;
b. section identifying factors influencing behavior change in actions areas related to urban mobility and air pollution (*Tab.1*). Questions are related to *capabilities* and *opportunities* that can foster or hinder behavior change (Tamlin et al, 2020);
c. section on *motivation (Tab.2)*, to explore the extent to which certain factors may promote or limit participation in a project on climate change and environmental issues and their impacts. Questions were built on the outcomes of the literature review (Abernathy et al, 2022)
d. *socio-demographic section*

Table 1. Capabilities and Opportunities Indicators of behavioral change. Left column, researchers' agreed vocabulary; right column, extended sentences on the survey. XXX has been replaced with the Action Area in each survey. (I-CHANGE D1.4, 2022)

Capabilities	
Knowledge and skills	
Knowledge	To what extent would more information about XXX influence a person's decision to use them?
Beliefs	How much would the environmental impact of a type of XXX affect a decision to adopt it?
Skills	How much would the expertise on XXX affect a decision to adopt it?
Education	How much would the education you receive (school, peers, family) about XXX affect your decision to put in place actions to mitigate their impacts?
Experience and habits	
Experience	Does previous experience of XXX increase the willingness to use it?
Cultural norms	Does the general behavior and habits of someone's cultural context support a sustainable XXX choice?
Social Status	How much does someone's social status (e.g., social or/and economic position in society) affect the choice of XXX?
Gender	How much does someone's gender affect their choice of using XXX?
Biology and health	
Type and degree of existing health	How much would health condition impact the choice of XXX?
Cognitive, mental, or physical disability	How much would a cognitive, mental or physical disability impact the choice to put in place actions to mitigate XXX?
Chronic illness	How much would chronic illness impact the choice to put in place actions to mitigate XXX?
Opportunities	
Support and services	
Availability and continuity of social support and ties	How much does family/social network support influence someone's decision to XXX?
Availability of appropriate services	Would a good sustainable transport infrastructure increase the use of XXX?
Availability of appropriate resources	Do you think that more resources (economic, access to knowledge to individual impacts on air pollution) affect the choice to put in place actions to mitigate XXX?
Access, barriers, and opportunities	
Physical access	How much does physical accessibility affect the use of XXX?

Communication	How much does comprehensible communication affect the choice to put in place actions to mitigate XXX?
Discrimination	How much does age, race, gender, sex, ability discrimination affect the choice to put in place actions to mitigate XXX?
Consequences of efforts	
Social approval or disapproval	How much does social, cultural, and common approval on tools and infrastructure to mitigate impacts of XXX affect its use?
Incentives and disincentives	How much do incentives on tools and infrastructure to mitigate impacts of XXX affect your everyday life to prevent it?
Time costs	How much does travel time affect the use of XXX?
Policies and living conditions	
Policies	How much do government policies on XXX affect its adoption?
Financial barriers	How much does the ticket price affect the use of XXX / How much does the cost of tools and infrastructure to mitigate impacts of XXX affect their adoption?
Exposure to hazards	How much does personal safety impact someone's decision to use XXX?
Living conditions	How much does lifestyle (job, children, need of multiple rides during the day etc.) influence someone's decision to use XXX?

Table 2. Motivation Indicators to join a project related to climate change. Left column, researchers' agreed vocabulary; right column, extended sentences on the survey. (I-CHANGE D1.4, 2022)

MOTIVATION	
Appreciation	Possible feeling of being appreciated
Accomplishment	Possible feeling of being accomplished
Acknowledgment	Knowing that I could be acknowledged of my commitment
Clear Goals	Clear project goals
Clear Timeline	Clear guidelines and timeline
Collective aim	The aims of the project at individual and collective level
Communication	Accessible and clear communication
Group	Possibility to join a group
Impact	Knowing that the project would have concrete impacts
Open Data	Knowing that data produced will be accessible and open
Role	Having a specific role in the project

In the first batch of the selected sample between June and July 2022, a selective mechanism in the Climate Change awareness evaluation allows a distinction between people who think their behavior has a low impact on climate change issues and the ones who believe they can have an impact. The first type of people skipped the whole topic insight section and jumped directly to the motivation to join a project on climate change. This differentiation allowed the researchers to pin a focus point not only on how to change the behavior of citizens but also on the importance of raising awareness before any citizen science activity.

A second questionnaire's structure has been piloted in April 2023 with a selective question on participation in citizen science projects. The goal is to be able to administer the survey to a selected group of citizens who attend Living Lab activities to investigate in depth how much involvement in citizen science activities leads a person to change his or her habits toward more conscious and sustainable choices or if it does not result in any significant effect. The survey's results will be compared to a sample of citizens who were instead sure not to have participated in any activities.

The second research activity aimed to investigate how the adoption of sustainable mobility practices is closely linked to the different lifestyles of Bologna citizens, a Serious Game was tested with students of the Environmental Sociology course at the University of Bologna in April 2023. The students, divided into groups, were given fictitious characters (personas) with targeted socio-demographic characteristics gathered from what the literature and the first survey identified as barriers for sustainable behavioral choices: gender, age, health status, family composition, work position, economic situation. Each personas features a mobility daily schedule (*Fig.1*) and quests to complete using the three main modes of urban transports, if applicable (private car, bicycle/foot, public transport) and different policy scenarios (30 areas, low emission areas), already or in progress to be implemented in the city of Bologna. Students then had to develop different mobility solutions on a paper map (*Fig.2*), also acquiring information from the tools provided by the Municipality of Bologna (PUMS, PGTU, maps) and the Emilia-Romagna Region. The results, still processing, aim to identify good practices or areas for improvement in the urban mobility system. The cartographic research work is enriched by quali-quantitative research (questionnaires and semi-structured interviews) and the elaboration of statistical models on urban traffic in collaboration with the Physics Department of the University of Bologna, to help students to describe as accurately as possible the complexity of the mobility system involving social, economic, and technological variables.

Gabriela - collaboratrice domestica				
Persona	35 - 45 anni Collaboratrice domestica in diverse case del Centro Città Due figli (6 e 10 anni). Orari: scuola 8.30 - 16.30			
Mobilità	Non ha la patente né della macchina né del motorino e di conseguenza non li possiede. In famiglia possiedono delle biciclette ma non è solita usarle. Ha l'abbonamento dell'autobus.			
Luoghi	Casa	Via Fornasini		
	Scuola dei figli	Primaria "Casaralta"		
	Lavoro A	Via Farini		
	Lavoro B	Via Manin		
	Spesa	ALDI, via della Liberazione		
Agenda	**Mobility Agenda**			
	Orario	**Spostamenti**	**Mezzo**	**Appunti**
	< 7	Partenza da casa		
	7 - 8	Arrivo nel luogo di lavoro A		
	8 - 12			
	12 - 13	Spostamento nel luogo di lavoro B		
	13 - 14			
	14 - 16			
	16 - 17	Uscita dal lavoro, ritiro dei bambini da scuola		
	17 - 18	Spesa		
	18 - 19	Ritorno a casa		
	19 - 21 <			

Figure 2. Example of Personas' mobility schedule (italian language)

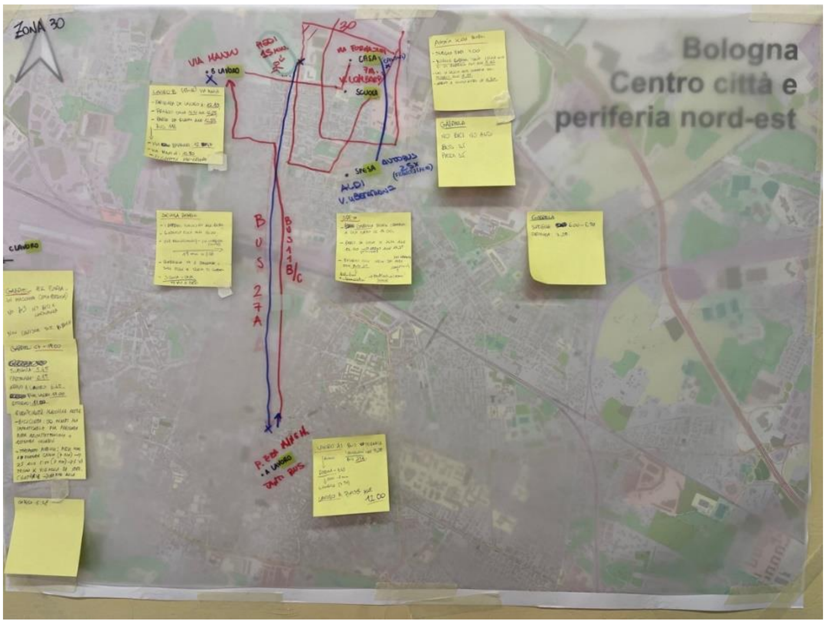

Figure 3. Example of map elaboration from the student activity held in April 2023

In the coming months (summer and fall), after careful evaluation of the results of the pilot activity with students, the serious game will also be submitted to selected groups of stakeholders interested in sustainable mobility and air quality. Involving more stakeholders in the serious game and in filling out the questionnaire to expand the critical mass of data is intended to achieve two goals: on the one hand, deliver suggestions to municipalities and decision-makers based on solid science, and on the other hand, to contribute to social research on how to stimulate a change of life for a more sustainable future.

Conclusions

The goal of the research is to create a tool that enables the assessment of citizens' behavioral change before and after participating in citizen science activities in the Living Lab. To achieve this goal, the main tool used is the qualitative-quantitative questionnaire, assisted by focus groups, administered before and after the proposed activities to living lab participants. At present, the data processed is that of the first 200 questionnaires describing the current state of the population of Bologna, to which should be added those collected during the second phase of research that will end in May 2023, achieving the critical number of at least 500 surveys.

Initial results show that the average awareness of the impact on climate change in cities is low compared to the level of education of all respondents, contrary to the literature. In fact, out of the 79% of respondents with a higher education degree, only the 47% think that they could have a moderate or major impact on climate change.

Out of 11 “Motivation on joining a climate project”, 10 dimensions of data identified are consistent with the literature review carried on by Abertnathy et al (2022). On the other hand, “Group” dimension has been indicated as the least important motivation in clear contrast with literature, where the feeling to belong to a group is identified as a relevant driver for participation in environmental-related projects. Thirdly, gender appears to be the least important indicator for all respondents no matter their gender, age, or education level. This data is at odds with literature related to the eco-gender gap (Normandin, 2020). It could mean that among respondents the perception of the gender perspective is less relevant or underestimated than what is reported in the relevant literature. Gender is, in fact, a determinant variable with respect to both awareness about climate change and the possibility of adopting more sustainable and eco-friendly behaviors (Simićević et al, 2016; Swim et al. 2018, 2020; Normandin, 2020). This opens a new field of research to investigate.

In May, the researchers will conclude the activity with students and administer the survey for the second time to find out if any differences appear after participating in a citizen science activity. In June and September 2023, the same Serious Game will be offered to key stakeholders of Bologna Living Lab relevant also at the policy and decision-making level. The expectation is to provide not only an evaluation tool for Living Labs to assess the effectiveness of involving citizens towards a sustainable lifestyle, but also to carry out consistent data useful for evidence-based decision making for local ecosystem where the Living Lab operates, becoming itself a key actor in climate action.

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Urban Living Labs for the development of hybrid research methods in contextualized societal challenges; the example of Cultural Probes in poverty research in the Netherlands.

Abstract

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Abstract

Poverty is a persistent and insufficiently understood societal challenge that requires the inclusion of lived experiences of poverty (Hagenaars, 1986; Reeves et al., 2020). Traditional approaches to poverty are dominated by the non-poor's understanding of poverty, which hinders effective policy and intervention strategies. To address this gap, we demonstrate that Urban Living Labs (ULLs) provide the potential for the development of hybrid research methods, i.e., the Cultural Probe methodology. We argue that this method is able to explore the lived experiences of poverty, and shed light on how people perceive poverty, themselves and others in their local context. We apply the method via the social-cultural perspective, going beyond the traditional economic perspective on poverty (Lok-Dessallien, 1999). We aim to explore the usefulness and feasibility of the methodology in local context, particularly in terms of participants' ability and willingness to share their poverty experiences and complete the probe booklet.

Key words

Urban Living Labs, Cultural Probe, Poverty, Hybrid Research Methods, Societal Challenges.

Methods and Approach used

Cultural probes are a - research through design - participatory research method to gather information about people's habits, routines and values. It allows researchers to understand the lived experiences of people in more depth via research in which participants themselves have control over the data delivery.

We have been developing the Cultural Probe method since September 2022 in collaboration with the ELSA Lab for Poverty and Debts in the Netherlands as well as experts working in the field of poverty and cross-cultural communication. In practice, the Cultural Probe is a booklet assignment that is integrated in the Dutch language classes of participants, i.e., cross-border migrants, of the language café to explore poverty via the social-cultural lens. The language cafés are free classes hosted by the library and volunteers. The Cultural Probe booklet is given to participants to complete individually over a period of 2-3 weeks, after which they will come together with the researchers and training lead to discuss their experiences and perspectives on poverty.

The research focus is on cross-border migrant groups who are in the process of social integration programs in South-Limburg region since this groups has a rich cultural diversity that will give better insights towards the experience of poverty. We need to make nuances here, because there is an ambivalent assumption that this target group is part of poverty clusters in the region according to formal registers of the language café. We aim to investigate if this assumption is true and how people position themselves within this assumption via their own personal experiences.

Results and Outcomes

Upon conducting the study, the language levels of the participants differed greatly from our expectations. Because of this, it has been decided to change the set-up of the two sessions: during the first session, all fourteen participants are split into three groups, depending on their level of language. Together with two researchers and three language teachers, the participants were helped in filling out the Cultural Probes.

Upon the second visit, two weeks later, participants were asked follow-up questions to common themes that arose in the findings. It must be noted here that the group composition is slightly different from the first session.

A total of fourteen participants have filled out the Cultural Probes. These findings have been thematically analyzed. From the filled out forms, nine aspects have been identified. Important to note is that a majority of the participants are currently living in Dutch asylum centers. This means they do not have housing, nor do they pay for housing or electricity. They receive 65 EUR per week per person for food and clothing. Children receive about half of this amount and this money is given to the caretakers. Some participants have only been living in the Netherlands for one month, whereas others live here for multiple years already.

In the thematic clustering, the areas of focus are the experiences of their day to day lives, their social circle and integration, and their association with aspects such as money, friendship, and the municipality.

Day to day Life experiences

Participants were asked to draw a cartoon of yesterday and explain what activities they did. Most of the activities that they undertook were 'for free', such as walking, reading, or watching television. One participant explained that he often walked to the city center. He was not able to purchase items, but he liked being among the fellow Dutch. He was eager to learn the Dutch language, but the asylum center prohibited him as he was always in a bubble of cross-border migrants unable to speak Dutch yet on a daily basis.

Some participants claimed doing more expensive activities, such as going to an indoor ski hall or to the swimming classes for their children. However, it is questioned whether these participants had been honest, or gave wished-for answers. To illustrate our doubt here, it was asked in the Cultural Probe to point out on a city map where they undertook their activities. The participant from the indoor ski hall (in the region there is only one known option) did point towards something else on the map. So, our checks and balances in the Cultural Probe did not always congruent.

Social Circle and Integration

The social circle of the participants is highly linked to their country of origin. This is to no surprise as the participants have only lived in the Netherlands for a limited amount of time. It is noted that all participants have the most contact with their parents, partner, or children rather than their friends. Many participants have had a long journey before coming to the Netherlands, which is also showcased in the geographical dispersion of the people they are in touch with. One participant's son lives in Sweden, his wife in Syria, and he lives in the Netherlands. Talking about this topic was also emotional to the participants. Furthermore, similarities in their journey have brought people together. People who have made friends in the Netherlands, tended to make friends with other refugees who they could share their experiences with.

Association with certain terms

One assignment in the Cultural Probe revolved around association techniques on various topics, such as friendship, the municipality, or money. One interesting similarity is found between the topic of friendship and family. To many participants this seemed interchangeable. Furthermore, on the topic of health both mental and physical health is adressed. Health is also considered a more important factor in their life than money, even though money is scarce to the participants at the time of the study. Despite thinking about money often, health is associated with freedom.

Presentation interest

ULLs are able to learn collectively about cities (Blezer and Abujidi, 2021; Puerari et al., 2018), yet it remains unclear how they can facilitate sustainability challenges on local level (Marvin et al., 2018), such as poverty. Recently, the role of ULLs is recognized to prepare students, researchers, and stakeholders to tackle local societal challenges transdisciplinary, co-creatively and in line with the SDGs in context (Verhoef et al., 2019; Van den Heuvel, 2021; Blezer, Abujidi and Sap, 2022).

The Cultural Probe is a hybrid research method in that it is able to bridge communication and understanding between 'types of stakeholders' in ULLs, in this case poor and non-poor people. Consequently, it 1) enhances understanding of a local societal challenge in context from those experiencing it, 2) criticizes traditional research methods in that they remain limited by being designed through thinking from one stakeholder needs, and also 3) facilitates the co-creation and social learning process in ULLs for students, researchers, citizens and practitioners to acquire skills needed to overcome sustainability transitions on local scale (see e.g. Stern, 2014).

We believe the Cultural Probe methodology can also redefine prejudices and assumptions that define poverty in formal institutions, municipalities, and social integration organisations. Consequently, enhance effective policy and intervention strategies by drawing upon the exploration of lived experiences of poverty, and shed light on how people perceive poverty, themselves, and others in their local context.

Discussion and dissemination

We aim to spark interest in our methodology and start dialogue with the public about the importance of ULLs for two points:

1. To what extent ULLs can improve traditional research methods to enhance research effectiveness for informing policies and programs to tackle societal challenges. Particularly, by incorporating the perspectives of those who experience that societal challenge, i.e., poverty in this innovation presentation.
2. The role of ULLs in examining 'individualized yet collective societal challenges', like poverty. By the use of ULLs, we can develop more comprehensive solutions to address institutional causes of societal challenges (see e.g., Bluemink et al., 2023 for poverty) next to existing solutions merely focusing on individual behavior.

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Research-In-Progress Paper

Towards defining "Responsible Living Labs" in the era of digital transformation and AI

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Abstract

This research-in-progress article explores how living labs (LLs) as a facilitator of digital transformation (DT) activities should be in line with responsible research and innovation (RRI) principles. This alignment gains special prominence when DT processes leverage AI-driven innovations and have a young citizen demographic as the focus. In so doing, we propose the new concept called "Responsible Living Labs" (RLL) as an overarching framework for LL researchers and practitioners to ensure transparency, stakeholder engagement, ethical considerations, and sustainability in all stages of LL activities and actions. The research methodology involves conducting a systematic literature review and organizing a workshop at Open Living Lab Days 2023 conference within the context of Interreg Baltic Sea Region project UrbanTestbeds.JR (#S004). This will be done to explore the potential of AI in fostering RRI in LL activities, as well as ethical challenges and other RRI related concerns that LLs are facing when young citizen are engaged. The study will contribute to the body of knowledge by bridging the gap in research on how LL activities can be more responsible and ethical while benefiting from advanced technologies such as AI.

Key words

Living Lab, Responsible Research and Innovation, Young citizen engagement, Artificial Intelligence, Digital Transformation, Ethics

Introduction

Currently, digital transformation (DT) is changing the dynamics of society and shaping how we live and work (Agarwal, 2020). DT can be understood as the "changes that digital technology causes or influences in all aspects of human life" (Stolterman & Fors, 2004, p. 689). DT greatly relies on the use of advanced digital technologies, in which many of them are driven by artificial intelligence (AI) (Holmström, 2022). AI is a particularly powerful enabler of DT since it has the ability to learn from data, identify patterns, and make predictions, all without human intervention (Verhoef et al., 2021). As AI becomes more intertwined into our daily lives, it's vital to ensure that its development and use is in line with ethical principles and societal values, the so-called Responsible Research and Innovation (RRI) (Owen et al., 2012). RRI is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society) (Bajmócy & Pataki, 2019).

There are various approaches that researchers and practitioners use to ensure that DT activities are in line with RRI principles, such as open science, citizen science, Living Lab (LL), and so forth. This research is focused on DT activities and actions which are supported and facilitated by a living lab as the overall approach (Bagalkot, 2009; Schaffers et al., 2009; Schuurman, 2015), with a particular emphasis on young citizen engagement. LLs have been introduced and proposed as an inclusive and sustainable approach involving various stakeholders, focusing on individuals in their role as citizens, inhabitants, end-users etc., are engaged throughout the DT process in their real-life setting (Bergvall-Kåreborn et al., 2009; Ståhlbröst, 2008). Accordingly, LLs can be seen as an approach for innovation development processes, as they allow one to simultaneously focus on individuals, technologies, tasks and structures, and the interactions between different stakeholders (Schaffers et al., 2009).

Despite this, the implementation of DT in LL activities also poses significant ethical and social challenges (Habibipour et al., 2018), particularly when it comes to AI driven innovations with and for young citizens, and there is a dearth of research on how LL activities should be more responsible and ethical, while benefiting from advanced technologies such as AI throughout DT processes (Ruffolo, 2022; Saurabh et al., 2021).

Accordingly, this research-in-progress aims at exploring how our LL activities and actions should be in line with RRI, when it comes to AI driven DT processes with a particular emphasis on young citizen engagement. To achieve the aim of this study, we will introduce the term "Responsible Living Lab" (RLL) as an overarching framework for LL researchers and practitioners. The proposed framework emphasizes the need for transparency, stakeholder engagement, ethical considerations, and sustainability in all stages of LL activities and actions and identifies key principles and best practices for implementing RLLs.

Research Methodology

To address the aim of this research-in-progress, we have started conducting a systematic literature review, which will be complemented by the results of a workshop on the AI's role in enabling RRL, opportunities for co-creation, innovation, and address challenges and consequences of DT for human and society as a whole. The workshop will be done in the context of Interreg Baltic Sea Region project UrbanTestbeds.JR (#S004) and is planned to be held at the Open Living Lab Days 2023 conference. The workshop follows a reverse brainstorming approach that enables participants to discuss both problems and solutions.

UrbanTestbeds.JR aims to foster resilient communities through co-designed urban testbeds, emphasizing tangible sustainability experiences for young citizens. The project focuses on enhancing participatory capacity and inclusivity in addressing climate and sustainability challenges, incorporating AI-driven climate plan analysis and urban data storytelling.

When it comes to the systematic literature review, we started by following a concept-centric approach as outlined by Webster and Watson (2002). This approach contrasts with the author's centric approach in which the readers are usually familiar with the main topic and there are already available studies that discussed the main topic in detail. We chose the concept-centric method as it allows us to systematically synthesize the literature and enables us to create a preliminary classification on the food analytics literature.

The process of conducting a literature review on LL research began by determining the primary journals and conferences in the field, namely, Technology Innovation Management Review, Sustainability, Frontier, and the Open Living Lab Days conference. These sources are considered to be the main generators of LL research within the community. We started going through the table of contents of each of these core journals and conferences and manually search for the relevant articles by reviewing the title, abstract, and keywords of the articles. In addition to the core journals, we will expand our search for the articles in online databases (namely, Scopus, Web of Science, EBSCO, PubMed, MDPI, and Taylor & Francis), using the search terms for literature search. The keywords that are used for this systematic literature review are: Living Lab (LL), Responsible Research and Innovation (RRI), Artificial Intelligence (AI), Citizen engagement and Digital transformation (DT). Any meaningful combinations of these keywords are included as a search term.

Finally, to identify further relevant studies, backward and forward citation analysis based on Webster and Watson's (2002) recommendation will be conducted. We employ this approach because the number of relevant findings in the preliminary step was too few to obtain reliable results. In this article, due to the emerging nature of RRL, we will also include the secondary resources (i.e., sources that analyze, interpret, or summarize primary literature), such as industrial and consultancy reports, project deliverables, press, and so on. However, only publications in English language will be considered in this review and no time limitation was set.

When it comes to the workshop, participants will be engaged in collaborative discussions and brainstorming activity to co-create the definition of RLL. Through co-creation activities and group discussions, LL researchers and practitioners will gain insights into the potential of AI in fostering responsible research and innovation (RRI) in LL activities, including young citizen engagement, co-creation, and innovation development in real-life settings. They will also discover the ethical considerations and challenges associated with AI in LL activities for and with young citizens, such as dehumanization of actions, responsibility, transparency, as well as imbalance in power distribution, and the digital divide. Our workshop aims to provide a milieu for contributors to share their knowledge, experiences, and perspectives, and collectively develop a deeper understanding of RLL with a particular focus on DT and AI.

Preliminary results

The increasing use of AI in DT in various domains raises ethical and social considerations, such as bias, accountability, transparency, dehumanization of actions, digital divide, and privacy issues (Kim et al., 2021; Nadoleanu et al., 2022; Saurabh et al., 2021). These challenges are particularly pertinent in the context of LL actions (Harbers & Overdiek, 2022), which are real-world settings for research and innovation that involve stakeholders in co-creation, experimentation, and evaluation processes. The unique features of LLs, such as the involvement of end-users and other stakeholders in the innovation process, create both opportunities and challenges for the implementation of AI powered DT in all individual, organizational and the societal level (Frey et al., 2022; Harbers & Overdiek, 2022).

One example of an ethical challenge in LL activities is ensuring that the data to be used to train AI models is representative of the population (Ruffolo, 2022). For example, in a co-creation activity involving the development of a health app, if the data used to train the AI models is biased towards a certain population group, the resulting app may not be effective or safe for other population groups. Additionally, if the AI system used to make decisions in the app perpetuates societal biases, it may lead to unequal treatment or discrimination against certain groups (Nebeker et al., 2019).

Another example of an ethical challenge is ensuring that AI systems used in LL activities are transparent and accountable (Hasenauer et al., 2022). If the data driven decisions which are made using AI tools are not transparent enough, it might be challenging for stakeholders to assess whether the decisions are fair and unbiased. Moreover, it may be difficult to ensure that the decisions are in line with ethical and social considerations (Lepri et al., 2017).

While there are challenges associated with the use of AI DT process that follow LL approach, there are also significant opportunities to employ AI driven tools to foster DT in LLs. One way which AI can support RRLs is by enabling more inclusive and participatory decision-making processes (Lepri et al., 2017). By including large amounts of data (the so-called big data) from various stakeholders and individual users, AI can provide insights into the needs and preferences of different LL actors, which enhances the inclusion of various parties in the decisions (Bibri, 2019). For example, in a co-creation activity of developing a smart city solution, AI can be used as an enabler to analyze data on traffic patterns, energy consumption, public transport use, and help the city planners to better identify the needs and preferences of all stakeholders, including public and private sectors and citizens (Bibri, 2019).

Overall, these opportunities highlight the potential for AI to support RRI in LLs by enabling more inclusive, transparent, and efficient decision-making processes, and accelerating innovation cycles. However, it is important to ensure that these opportunities are realized in a responsible and ethical manner, taking into account the challenges and risks associated with the use of AI in LL activities.

Discussions and future steps

The next step in this research-in-progress will be to complete the literature review and synthesize the results with the workshop on defining a framework for RRL. In so doing, we will identify the key principles and best practices for defining and further implementing RLLs for young citizens. The proposed framework for RRL will emphasizes transparency, stakeholder engagement, ethical considerations, and sustainability in all stages of LL activities and actions. Additionally, the researchers can also explore how this framework can be implemented in real-world LL activities and actions, particularly those that involve AI-driven solutions for DT processes.

One of the key benefits of using a Responsible Living Lab (RLL) approach is to ensure LL researchers and practitioner that their research is conducted in a way that is more aligned with RRI principles, which are becoming increasingly important in the development and use of advanced technologies such as AI (Frey et al., 2022; Nebeker et al., 2019). Another key benefit of using an RLL approach is that it can help LL practitioners to create more inclusive and sustainable innovation processes. RLLs prioritize early stakeholder engagement and inclusion (Habibipour et al., 2021), which means that they involve individuals in their role as citizens, inhabitants, end-users, etc., throughout the DT process in their real-life setting. This can help to ensure that the innovation process is more aligned with the needs and values of the stakeholders who will ultimately use the digital solutions (Habibipour et al., 2021). RLLs also focus on the interactions between different stakeholders, which can help to foster collaboration and co-creation. Finally, RLLs emphasize the need for sustainability in all stages of their activities and actions, which can help to ensure that the innovation process is more environmentally and socially responsible (Bajmócy & Pataki, 2019; Harbers & Overdiek, 2022).

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The transformative agency of university researchers involved in of a living lab on digital inequalities in education

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Abstract

The LaVIE project aims to reduce social and digital inequalities in education through a living lab initiative. In the living lab, the participation of research team members was closely monitored through co-creation meetings and barometer questionnaires. Their participation was analysed using the concept of transformative agency. The team's active involvement in the living lab beyond observation or intervention demonstrates their multi-faceted role as participants and leaders. The analysis was carried out from the perspective of manifestations of transformative agency. Our results demonstrate manifestations of shared transformative agency.

Key words

Living lab, research, academia, transformative agency, participation

Context

A team of university researchers from UQAR University is conducting an action research project in collaboration with the *Centre de transfert technologique* (LLio). The objective of the *La VIE* project is to support the creation of desirable, feasible, and viable solutions to promote the adaptation of educational and pedagogical practices to reduce social and digital inequalities [1].

Living labs usually welcome members of academia for their expertise [2, 3] and some even take place in universities [4]. Our initiative has the particularity of giving a significant place to researchers since the research team leads the project subsidised by the Quebec Ministry of Education.

The project has, but not only, research purposes. The researchers contribute to the project through their expertise: they are experts in the subject matter of the laboratory and familiar with action research. In order to analyse the participation of research team members in the living lab, the concept of agency is used [5].

Methods used

Every step of our joint venture was closely monitored. Artefacts of participation are left on virtual walls shared during co-creation meetings, to which research members contribute. Some participate in the discussions; others opt to observe. In addition, each researcher is asked to answer a barometer questionnaire and research meetings were held [6]. These artefacts were used to analyse the agency of the university research team involved in a co-creation group of a living laboratory on digital inequalities in education. The analysis was carried out from the perspective of manifestations of transformative agency: resisting, criticising, explaining, envisioning, engaging in actions and undertaking actions [7, 8].

Results

In transformative agency, we paid particular attention to the posture of the research team as they questioned and critiqued, then explicated and envisioned new modes of activity, and engaged in actions and took steps to improve a situation.

Our results demonstrate manifestations of shared transformative agency, as well as proxy agency, notably through the involvement of several stakeholders in the project. While facilitating elements were noted, notably the team's adherence to the action research in which a living lab is embedded, it was sometimes more difficult to reconcile the scientific rigour desired by the research team with the needs of the group's participants. There was little resistance, while members of the research team were very involved in the action. Whereas in a more traditional living lab approach, researchers are usually content specialists (which was also the case), in LaVIE they were the people documenting the content: managing the dual posture, between intervention and observation, tinged certain manifestations of agency.

The reflection on the critical posture of researchers, approached here according to transformative agency, would benefit from being discussed with the community interested in living labs, notably because the latter welcomes academia in its activities.

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Research-In-Progress Paper

Towards a methodology for monitoring and evaluating living labs: Insights from the early stages within the SCORE Project

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Abstract

Monitoring and evaluation is a recognized method to achieve the intended results and examine the outcomes and impacts of a given intervention. In this study, we propose and apply a framework of key themes, indicators, and corresponding data collection methods for monitoring and evaluating living labs. The framework is applied in ten "Coastal City Living Labs" which are part of the Smart Control of the Climate Resilience in European Coastal Cities (SCORE) project. Ultimately, the comparison of applying the framework across ten different cases is assessed with the aim of generating a universally applicable framework for M&E of LLs.

Key words

Living labs, monitoring, evaluation, methodology, impact, sustainability

Introduction

Monitoring and evaluation (M&E) is a recognized method to achieve the intended results and examine the outcomes and impacts of a given intervention (Myrick, 2013). More specifically, M&E assesses (1) whether the intended results are being delivered to the stakeholders; (2) how these results are being achieved over time; and (3) the actual outcomes and impacts of the intervention. When implemented consistently, M&E allows for learning and change over time (Masuku et al., 2015). The participatory aspect in the M&E is especially relevant for Urban Living Labs (ULLs) where co- creation among a variety of stakeholders is used to address complex (urban) challenges (Menny, 2018). Chronéer et al. (2019, p. 60) define ULL as a "a local place for innovative solutions that aims to solve urban challenges and contribute to long-term sustainability by actively and openly co-constructing solutions with citizens and other stakeholders".

Although M&E is a core element of ULLs, few frameworks have been developed or applied. There is a need for a universally agreed upon strategy on how to measure and evaluate the performance of a given process within the LL, especially concerning its wider impacts (Bronson et al., 2021; Ballon et al., 2018). In this context, Ståhlbröst, et al. (2012) suggest five elements to assess impact. However, Ståhlbröst, et al. (2012) 's framework represents an evaluation of the LL after activities have started or even finished. M&E is beneficial for a ULL from an early stage on. A pre-evaluation of the setup phase provides a baseline for the assessment of the ULL overall performance over time (Ravetz, et al., 2018). M&E is also relevant for assessing the LLs in the interim for reflection, learning, and continuous improvement. In this way, necessary interventions can be introduced during the process.

Furthermore, in Ståhlbröst, et al. (2012)'s framework, insights on how the indicators should be operationalised or assessed have not been provided. In that regard, Mastelic, et al. (2019) propose a set of key performance indicators (KPIs) for the assessment of LLs which consider funding structures, target audiences, and revenue streams among other important factors that need to be assessed continuously over time by different stakeholders. Such academic contributions show the scientific relevance for further developing these frameworks for LLs and synthesizing previous findings into an easily applicable methodology for practitioners. On the other hand, there is practical relevance for these frameworks, considering the proliferation of LLs across varying geographical locations and thematic sectors.

From a societal perspective, the European Union (EU) puts a strong focus on citizen participation in the design and implementation process of innovation projects from different research areas to boost democracy and legitimacy of interventions. Horizon 2020 is an example of such as programme, where the use of LLs is specifically promoted (European Commission, 2013), for example, in the field of adaptation to climate change. To better assess the overall impact of the LL concept across different projects and disciplines, a uniform framework would be highly beneficial.

By applying the same framework in each LL from each project within the Horizon 2020 programme, cross-project comparisons would be more viable, which could enable an overall assessment of the contextual scope in which LLs are most effective and impactful. Moreover, as participants often have limited experience with the LL concept and methodology, a baseline and interim assessment could provide guidance in the setup of the LL. Outside of EU funded projects, such a framework could also enable a broader adoption of ULLs as a support tool for a more structured implementation of LLs. However, there is no uniform framework for a baseline and interim assessment of ULLs in scientific literature and an overall lack of strategies and contributions in that context.

In this study, we outline a framework of key themes, indicators, and corresponding data collection methods for M&E of ULLs. For this purpose, we rely on existing M&E frameworks and methods for LLs as well as general principles of M&E. The framework is applied in ten (10) "Coastal City Living Labs" (CCLLs) which are part of the SCORE: Smart Control of the Climate Resilience in European Coastal Cities project. Ultimately, the comparison of applying the framework across ten different CCLLs - and its assessment – can support the development of a universally applicable framework for M&E of LLS.

Methodology

The methodological approach consists of four steps. First, a literature review was conducted to identify criteria clusters and key indicators for the M&E of the CCLLs. Second, these were reviewed and validated by different groups, which resulted in deriving ten (10) criteria clusters for the M&E of ULLs. Third, data were collected through survey questionnaires, complemented by online meetings with all 10 CCLLs.

These 10 CCLLs are as follows: Sligo and Dublin in Ireland; Oeiras, Portugal; Gdansk, Poland; Piran, Slovenia; Samsun, Turkey; Massa, Italy; and Benidorm, Oarsoaldea, Basque Country; and Vilanova I la Geltru / Barcelona Province in Spain. Fourth, a qualitative analysis that compared the outcomes of applying the framework across all 10 CCLLs have been conducted.

Literature review

The literature review yielded 14 different frameworks for LLs (See Table 1 in Annex). The indicator clusters included themes such as results, tools, solutions, resources, participants, intellectual property rights, operations, activities, communication, organisation, processes, and knowledge sharing/learning. These clusters included a total of 80 indicators which track the progress of the CCLLs. The indicators were divided into baseline assessment, interim assessment, and impact assessment.

Validation

Once the list of criteria clusters and respective key indicators was finished, we validated the strategy internally, externally and with the CCLLs. Firstly, an internal review of the strategy was performed by 14 members of the SCORE project. Secondly, an external review via a public webinar was performed. Thirdly, validation of the LL M&E strategy happened through the online meetings with the CCLLs.

Resulting from the literature review and the three-step validation process, an overview of the major themes, including the corresponding key indicators, for the baseline and interim assessment of CCLLs has been prepared. See Tables 2 and 3 in Annex for the overview of the major themes and key indicators for baseline and interim assessment.

By interim assessment, we refer to the phases of the living lab integrative process adopted for SCORE: Phase 1: Empathise and define; Phase 2: Ideate and co-design; Phase 3: Prototype and pilot; and Phase 4: Test and evaluate. In this document, we first focus on Phase 1: Empathise and define. As for the impact assessment, the main themes and key indicators will still be finalized with the CCLLs.

Data Collection

Data was collected through survey questionnaires, complemented by online meetings with CCLLs. These questionnaires were answered by team members from each CCLL for the baseline assessment in the following periods: January 2021 and April - May 2022. For the interim assessment, CCLL team members and stakeholders provided their responses via questionnaires in April – May 2022 and December 2022 for Phase 1: Empathise and define.

See Tables 4 and 5 in Annex for the survey questionnaires.

Data Analysis

A comparative analysis is suitable for small to intermediate numbers of cases, aiming at a systemic cross case comparison while maintaining case sensitivity. The cases were selected through literal replication, meaning that the selection processes focused on a similarity of the setting in each case. Although the ten CCLLs vary in their geographic, economic, and demographic features, they are all coastal cities, part of the SCORE project, and in the process of implementing a CCLL. A qualitative analysis comparing the outcomes of applying the framework is in progress.

Preliminary Results and Conclusions

Few frameworks have been developed or applied for monitoring and evaluating LLs. There is then a need for a universally agreed upon strategy on how to measure and evaluate the performance of a given process within LLs, especially concerning its wider impacts (Bronson et al., 2021; Ballon et al., 2018). Further, M&E is beneficial for LLs from an early stage on, starting with a pre-evaluation of the setup phase as a baseline for the assessment of the overall performance (Ravetz et al., 2018). In this study, we propose and apply a framework of key themes, indicators, and corresponding data collection methods for M&E.

For this purpose, we relied on existing M&E frameworks for LLs as well as general principles of M&E and from the review and feedback from multiple groups which resulted in 10 criteria clusters. The M&E framework is applied in ten CCLLs which are part of the SCORE project. Preliminary data were collected through survey questionnaires, complemented by online meetings with the 10 CCLLs. A qualitative analysis comparing the outcomes of applying the framework is in progress. Ultimately, the comparison of applying the framework across ten different cases is assessed with the aim of generating a universally applicable framework for M&E of LLs. This addresses the need for frameworks and methods for M&E and for LLs to monitor their progress and performance over time.

Acknowledgements

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Annexes

Table 1. Frameworks related to M&E of LLs

	Authors	Name of frameworks
1	Maculiene Skarzauskeine	Digital Co-creation Index framework for Evaluation in EU
2	Ondiek and Moturi	The four-capital method of sustainable development evaluation
3	Dell'era and Landoni	Conceptual framework mixing user centered strategy and participatory strategy
4	Ballon, et al.	Logical effect model living labs
5	Osorio, et al.	Maturity grid-based assessment tool
6	Kovacs	Harmonisation cube
7	Mastelic, et al.	Business model canvas
8	Veeckman et al., 2013	Living lab triangle conceptual framework
9	Guzman et al., 2015	Process reference model (PRM)
10	Stahlborst et al.,2012	Key principles to guide evaluation processes in LL
11	Chen & Chou 2010	Living lab analysis model
12	Vontas & Protogeros 2009	Evaluation toolkit
13	Parkinson & Ramiraz 2007	The sustainable livelihood model
14	Geenhuizen, 2018	Living labs as boundary spanners

Table 2. List of major themes for the baseline assessment

	Theme	Key indicators
1	Objectives	Definition of objectives and vision for the CCLL Definition of the scope of the CCLL (subject matter and physical context)
2	Resources	Availability of financial, human, time & material resources
3	Organisation	Definition of roles and responsibilities in the management of the CCLL Identification of relevant stakeholders for the CCLL
4	Process	Level of knowledge and experience of Living Lab concept and methodology

5	Activities	Existence of (previous) collaboration and innovationactivities in the city / CCLL
6	Participants	Level of stakeholder and user involvement in the CCLL
7	Solutions	Existence of (previous) solutions that are relevant for the CCLL Identification of problems to be addressed by the CCLL Identification of potential barriers for the success of theCCLL
8	Tools	Knowledge and experience of participatory tools relevant to the different steps of the LL integrative process
9	Communication	Frequency of internal and external communication Definition of a communication strategy for the CCLL
10	Knowledge sharing /learning	Availability of relevant knowledge for the CCLL Existence of partnerships and networks where knowledgeis shared

Table 3. List of major themes for the interim assessment (Phase 1: Empathise and define)

	Theme	Key indicators
1	Organization	Clarity of vision and plan of the core team Stakeholders involved in the CCLL
2	Process	Over-all satisfaction Level of satisfaction with content Level of satisfaction with results Quality of over-all engagement process
3	Tools	Usefulness of different tools (e.g., SWOT analysis, Fishbone analysis, Force Field analysis, Stakeholder Mapping; Canvas; Stakeholder List) Usefulness of the pilot operational plan

Table 4. List of survey questionnaire statements for each main indicator theme for the baseline assessment

	Theme	Number of questions and the questions/statements

1	Objectives	*2 questions / statements:* The objectives and vision of the CCLL are identified. The scope of the CCLL (subject matter and physical context) isidentified.
2	Resources	*8 questions / statements:* The financial resources were sufficient to achieve the goals of yearone. There are/will be sufficient financial resources to achieve the goals ofyear two. There were enough people working on the CCLL to achieve the goalsof year one. There are/will be enough people working on the CCLL to achievethe goals of year two. The time the core team spent on SCORE/the CCLL was sufficient to achieve the goals of year one. The core team has sufficient time to spend on SCORE/the CCLL to achieve the goals of year two. The material resources were sufficient to achieve the goals of yearone. There are sufficient material resources to achieve the goals of yeartwo.
3	Organisation	*2 questions/ statements:* The roles and responsibilities of the CCLL core team are defined. The stakeholders to be involved in the CCLL are identified.
4	Process	*12 questions / statements:* What is the level of knowledge of the Living Lab concept and methodology? What is the level of experience in the Living Lab concept and methodology? What is the level of knowledge of co-design? What is the level of experience in co-design?

		What is the level of knowledge of testing and prototyping? What is the level of experience in testing and prototyping? What is the level of knowledge of evaluation? What is the level of experience in evaluation? What is the level of knowledge of implementation? What is the level of experience in implementation? What is the level of knowledge of replication and scaling up? What is the level of experience in replication and scaling up?
5	Activities	*2 questions / statements:* There were/are already collaboration and innovation activities taking place in you city/CCLL related to coastal resilience. Collaboration or innovation activities for year two of SCORE are already defined and planned.
6	Participants	*4 questions / statements:* Stakeholders were already involved or engaged during year one of SCORE. Users/citizens were already involved or engaged during year one of SCORE. There is a plan on how to involve stakeholders in year two of SCORE. There is a plan on how to involve users in year two of SCORE.
7	Solutions	*3 questions / statements:* Technical solutions to address coastal resilience were implementedin the past in your city. The main problems to be addressed by the CCLL are identified.

		Potential barriers that could hamper the success of the CCLL are identified.
8	Tools	*3 questions / statements:* Level of knowledge of participatory tools relevant to thedifferent steps of the Living Lab integrative process Level of experience in using participatory tools relevantto the different steps of the Living Lab integrative process The CCLL team feels like they have the necessary tools to startactivities in the CCLL.
9	Communication	*4 questions / statements:* There was a frequent communication among the CCLL core team during year one of SCORE. There was a frequent communication with stakeholders during year one There is a plan on how to communicate internally (within the CCLLcore team) for year two of SCORE. There is a plan on how to communicate externally (to stakeholdersand citizens) for year two of SCORE.
10	Knowledge sharing/ learning	*2 questions / statements:* The CCLL team feels like they have the necessary knowledge to begin developing the CCLL. The CCLL team is part of network(s) where knowledge is shared on EBAs, Living Labs, and/or climate change adaptation.

Table 5. List of survey questionnaire statement for the CCLL team in the interim assessment (Phase 1: Empathise and define)

	Theme	Number of questions and the questions/statements
1	Organization: CCLL Core Team	*8 questions / statements:* Our CCLL core team has a clear vision for our CCLL. Our CCLL core team feels more confident to run our CCLL following the workshop.

		Our CCLL core team has the adequate skillsets to run our CCLL. Our CCLL core team feels ownership over our CCLL and its future. Our CCLL core team understands what a CCLL is. Our CCLL core team can confidently explain the CCLL concept to non-experts. Our CCLL core team has a clear plan for our next steps in the 6-12 months. Our role(s) as a frontrunner and/or follower are clear.
	Organization: Stakeholders	*2 questions / statements:* The stakeholders at the workshop were able to provide relevant inputs for the CCLL's development. There were essential stakeholder groups missing from the workshop.
2	Process	*3 questions / statements:* Rate the over-all level of satisfaction with Phase 1: Empathise and define. Rate the level of satisfaction with the content of the CCLL workshop under Phase 1: Empathise and define. Rate the level of satisfaction with the results of the CCLL workshop under Phase 1: Empathise and define.
3	Tools	*2 questions / statements:* Usefulness of the tools used (SWOT Analysis Tool, Fishbone Analysis tool, Force Field Analysis tool, Stakeholder Mapping tool, Canvas tool, Stakeholder List) The needs of our specific CCLL have been well articulated in our Pilot Operational Plan.

Table 6. List of survey questionnaire statements for the CCLL stakeholders in the interim assessment (Phase 1: Empathise and define)

	Theme	Number of questions and the questions/statements
1	Organization	*4 questions / statements:* Rate the over-all level of satisfaction with the CCLL workshop. Rate the level of satisfaction with the content of the CCLL workshop. Rate the level of satisfaction with the results of the CCLL workshop. Please rate the quality of your overall engagement process with your CCLL.

Research-In-Progress Paper

Building a living lab learning framework: Understanding the types, processes, levels and outcomes of learning in living labs

Authors

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Abstract

Learning is an integral part of living lab activities and outcomes. This research in progress paper aims to understand the learning aspects in the collaborative activities and innovative outputs of living labs by developing an analytical learning framework for living labs and applying it to the case study of KLIMAP living labs in the Netherlands. The research adopts a mix of approaches, including qualitative document analysis, interviews and participation in brainstorming and knowledge sessions. The study develops a working analytical living labs learning framework. The preliminary findings of the framework in the KLIMAP living lab show different types of knowledge on content, capacity and network are intentionally or incidentally produced at different levels (individual, team, community) of a living lab.

Key words

Co-creation, innovation, learning, knowledge types, knowledge-levels

Introduction

A living lab is an organized, real-life and user-centered approach to innovation (Schuurman et al., 2013). Each living lab is designed differently based on its context, prerequisite and resources. Therefore, the motive and aims of living labs, their positions, participating stakeholders, their disciplinary backgrounds, available resources such as people, money, medium and time, and the employed methodologies vary for different living labs. The idea that the successful innovation derives its understanding from existing and emerging user needs prompted the integration of a higher degree of user-centeredness in the living lab approach, thus introducing the dimension of co-creation to the concept (Eriksson et al., 2005). Consequently, many present-day living labs have evolved to implement co-creative processes in their design and activities. In living Labs, collaborations between multiple stakeholders from multiple disciplines accelerate the innovation process (Leminen et al., 2016; Nyström et al., 2014) as they contribute heterogeneous resources and knowledge resulting in innovations (Edwards-Schachter et al., 2012; Leminen & Westerlund, 2012). shows the major components of living lab design and its effects.

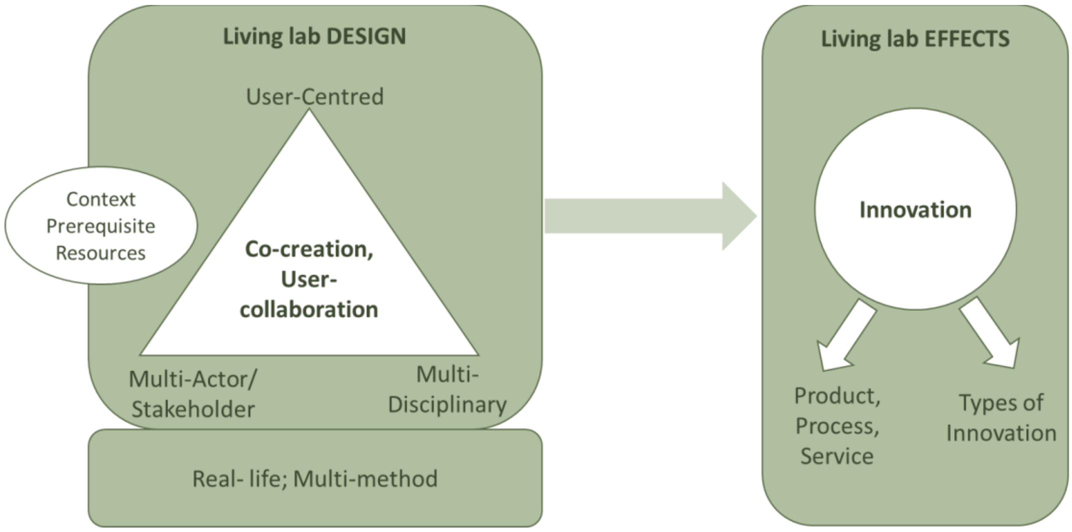

Figure 1. Major components of living lab design and effects

For successful innovation, a combination of different types of knowledge, capabilities, skills and resources is required (Fagerberg, 2004). Hence, in most contexts, innovation comprises a social component, such as learning (Kohlgrüber et al., 2021). However, for many years, living labs remained focused on innovation in the technological context, with only recent living labs integrating learning aspects (Schuurman et al., 2013). By opening the innovation process to all relevant stakeholders through co-creation and collaboration, living labs incorporate learning and knowledge development as an integral part of their design, activities and outcomes, as shown in ***Errore. L'origine riferimento non è stata trovata.***. However, most works on living labs do not highlight their learning mechanisms. Therefore, this paper aims to understand the learning components of living labs and thereby incorporate a learning framework to living lab framework in the light of the KLIMAP living lab located in the Netherlands.

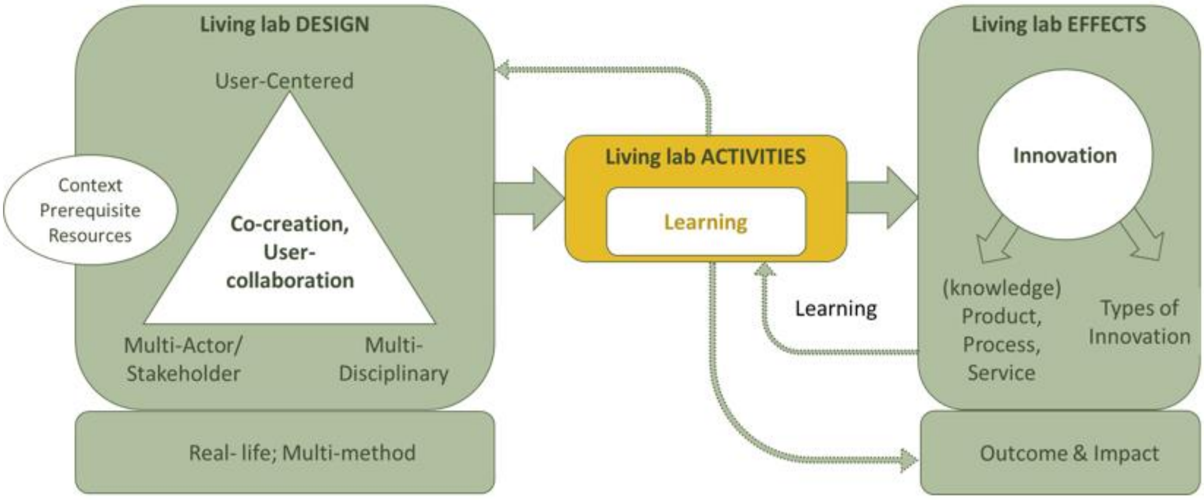

Figure 2. Major components of living lab design, effects and role of learning

Co-creation, innovation and learning

Co-creation is a fusion between collaboration (co) and creation, where collaboration indicates 'with' different cross-sectoral stakeholders, and creation signifies a productive way of thinking, seeing, and doing arising from relational knowledge practice (Franklin, 2022). Thus, co-creation facilitates a much-needed cross-sectoral and socially inclusive understanding to address relevant problems (Payne et al., 2008). As a result, co-creators bring massive social and organizational learning that triggers transformation. Successful co-creation depends on core competencies such as knowledge and on interactive environment that leads to better learning, sharing and understanding of actors' needs, thus increasing the trust and quality of shared knowledge (Payne et al., 2008). When the actors collectively learn about and from each other by surpassing individual barriers, they co-create. Hence, co-creation is highly linked to the learning process in the given network. Likewise, innovation implies adopting a new idea or behavior (Jiménez-Jiménez & Sanz-Valle, 2011). Innovation can be conceptualized as knowledge creation, and at the same time, the knowledge creation process is also a driver of innovation (O Riordan, 2013). The development and dissemination of innovations increasingly focus on exchanging knowledge, learning, and cooperation between actors and organizations. Accordingly, living labs foster collaborative actions and learning between stakeholders to support integrated and appropriate technological and social innovations in local practice and governance processes (Edwards-Schachter et al., 2012), as shown in Figure 3.

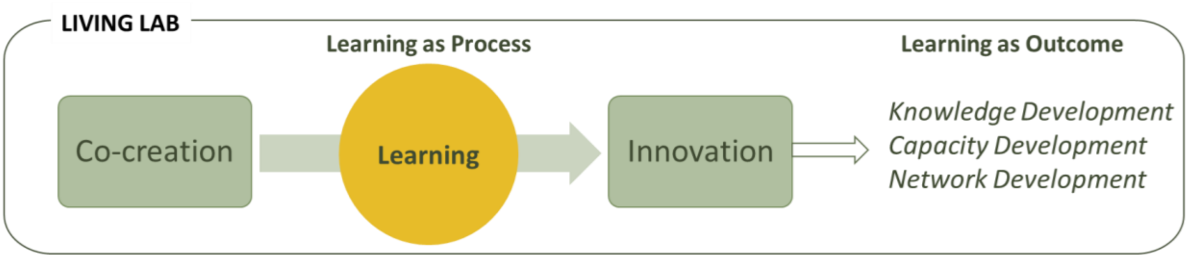

Figure 3. Co-creation- innovation-learning model for living labs

KLIMAP

KLIMAP (KLIMaatAdaptaie in de Praktijk) aims to design innovative climate-adaptive pathways for sustainable land and water management transition. With a consortium of 24 parties consisting of regional authorities, private companies, and research institutes, KLIMAP focuses on agriculture and nature area in the Dutch sandy soil region (KLIMAP, 2022). Sandy soil poses a particular challenge due to its permeable nature, making it vulnerable to the effects of climate change, such as extreme drought (Ladányi et al., 2021). In the living lab work package of KLIMAP, potential innovations related to diverse crop types, improving water retention and soil structure are explored and tested in over 25 pilot areas via technical and nature-based solutions, shown in Figure 4. The major output of KLIMAP is insights into possible climate adaptation measures and ways to implement them in these areas. The resulting outcome would be a change in traditional land and water management methods to adapt to the changing climate, thus initiating social transformation and influencing policies.

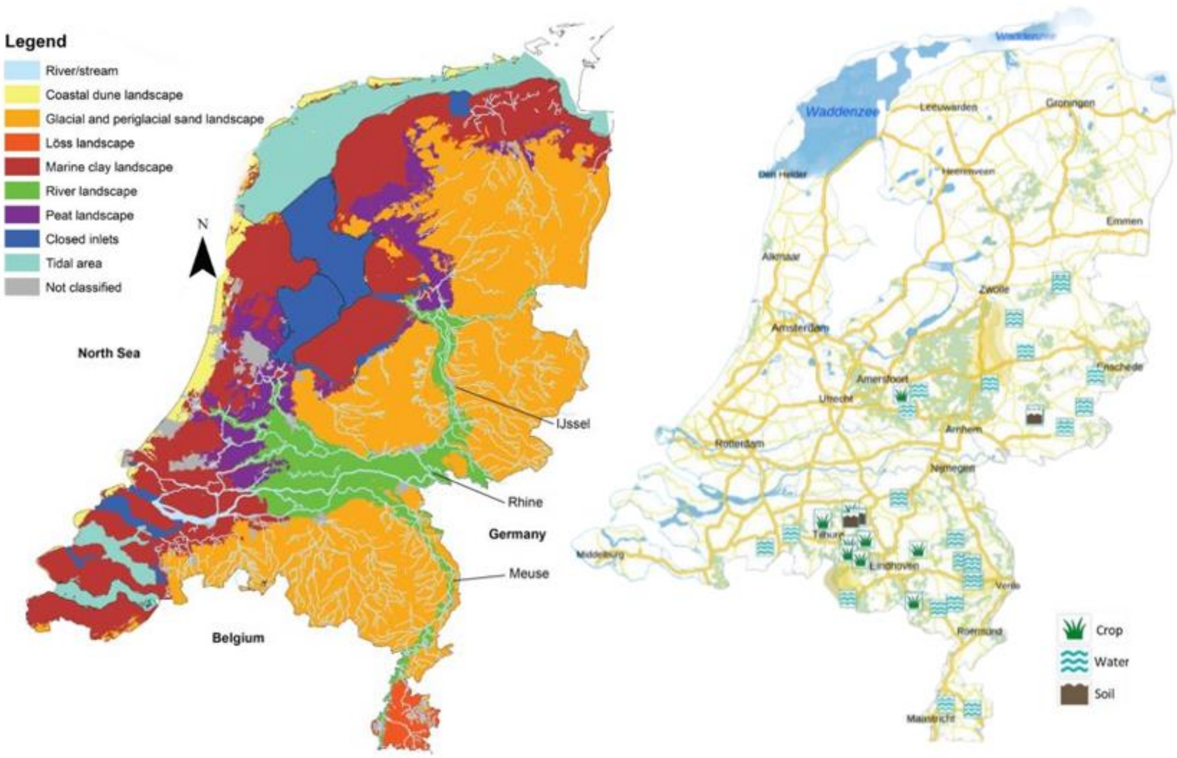

Figure 4. Dutch landscape (left), KLIMAP experimentation areas (right)

Methodology

The research follows a qualitative analysis approach using multiple methods. First, desk research was conducted to understand levels, processes and types of learning and transfer these understandings into the living lab learning framework. Next, the case study was researched via document analysis, participation in brainstorming and knowledge sessions, and interviews with KLIMAP stakeholders. Qualitative document analysis was conducted to capture the timeline of KLIMAP activities and their learning aspects. The analyzed document comprised the minutes of living lab meetings and knowledge sessions from the last two years. However, more living lab meetings, workshops and knowledge sessions are planned in future, the analysis of which will be adapted to the main analysis—similarly, brainstorming and knowledge sessions allowed for data triangulation.

Further, semi-structured interviews were conducted with the coordinators, project leaders, field-experiment experts, knowledge session facilitators and people in similar positions actively involved in KLIMAP. The study follows a wide-adopted method in qualitative research, i.e., the snowball sampling procedure (Goodman, 1961). The study started with a small pool of known informants and asked them to recommend potential interviewees. Questions were divided per themes such as design, process and outcome-related queries and questions on knowledge development, capacity building and networks. So far, only 20% of the planned interview have been conducted.

Analytical framework

A working analytical living lab learning framework is drawn to highlight different learning types, levels, processes, and outcomes through the lens of social learning (informal incidental learning) and organizational learning (intentional transdisciplinary learning), as shown in Figure 6.

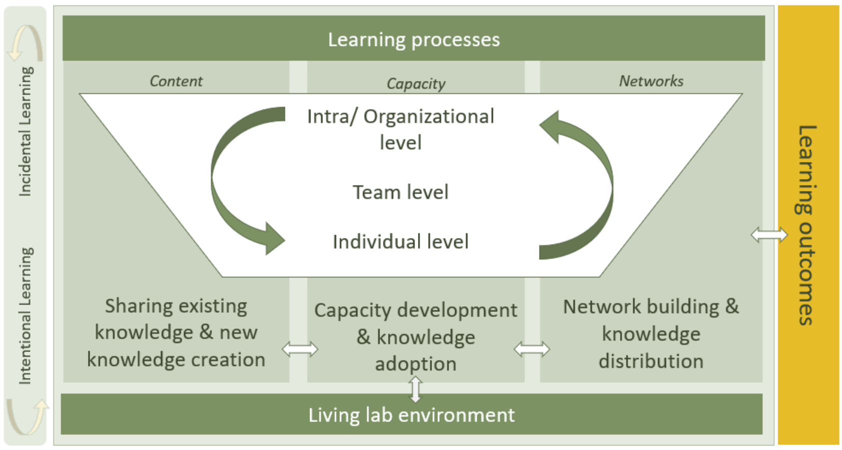

Figure 5. Working analytical learning framework with living lab as enabling environment, based on Bhatt (2000) and Cooke and Gorman (2009).

expands the central part of the learning framework. As research progresses, it will incorporate different learning processes and outcomes from the analytical learning framework.

Living lab as enabling environment for engagement and learning

Level of Learning / Type of Learning	Individual/ member level	Group/ Team level	Organizational/ Community level
Knowledge sharing & creation on content	• Developing comprehensive understanding and sharing existing factual knowledge, conceptual knowledge, procedural knowledge, as well as metacognitive knowledge regarding the content of the living lab (Anderson and Krathwohl 2001) • Peer-review to critique, revise and refine ideas (Bhatt 2000) • Generating a *new knowledge*		
Capacity Development & Knowledge adoption	• Capable to adopt, apply and transfer available and new-produced knowledge and skills • Create tools, skills, process and structures that allow for desired change at personal level, as a group, and at organization level (Potter and Brough 2004) • Peer-review to critique, revise and refine skills (Bhatt 2000) • *New actions*		
Network Building & knowledge distribution	• Partnerships to further deepen or broaden the knowledge (living lab experimentation) • *New coalition* in the network of similar kinds • Knowledge reusability and replicability in another field (Bhatt 2000) • applicable knowledge directly available to users • Knowledge network		

Figure 6. Expansion of the central part of the living lab learning framework, based on Anderson and Krathwohl (2001), Potter and Brough (2004)

Preliminary Findings

From the data collected from KLIMAP, the following preliminary findings were observed.

1. Knowledge creation & sharing on content:
   a. The individual stakeholders in the KLIMAP living labs learn through learning community and observational learning. The stakeholders organize learning sessions, field-experiments and participate in online or offline group discussions in the learning community. Similarly, observational learning in the stakeholders occurs from observing presentations from other stakeholders with diverse knowledge backgrounds, listening to the group discussions, observing how to use certain tools, etc. With these kinds of shared knowledge, all individuals create their mind-maps and understanding of the subject.
   b. KLIMAP has designed sub-groups to have frequent communication and share their insights. Cross-experimental learning is crucial in large projects such as KLIMAP with diverse field-experiments. Hence, establishing sub-groups allows learning from each other experiences.
   c. Failures are a great way to learn. Some failures are bound to occur during experimentation and innovation. Thus, judgement-free space for making mistakes and learning from them is available for individuals, teams, or organizations.
2. Capacity development & knowledge adoption:

    a. With all the field-experiments and research on upscaling, KLIMAP aims to create a list of possible adaptation measures and ways to implement them in the study location. This tool can significantly benefit individuals or organizations (users) who will apply it in practice.

3. Network building & knowledge distribution:
    a. KLIMAP supports open communication and collaboration among its stakeholders and similar external projects. As a result, various new coalition was formed during the living lab experimentation, e.g., new combination of knowledge on hydrology and agronomics in the study area.

Conclusion

The research, when completed, aims to highlight the importance of learning in the living lab, both as a process and product. It intends to develop a comprehensive learning framework to evaluate different types, levels, and processes of learning in living labs. Then, the outcome derived from such learning will be explored to capture the significance of learning in living labs. The result will offer valuable insights to researchers and practitioners in understanding the significance of living labs beyond their immediate results.

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Research-In-Progress Paper

How to build consensus between multidisciplinary teams on methods and tools for co-designing interventions in the energy transition through Living Labs

A review of the Living Lab Integrative Process methodology using a Delphi method based approach.

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Abstract

Using appropriate methods and tools throughout the innovation process is essential to maximise resources and ensure success towards a sustainable energy transition. In the Lantern Project, interventions in the energy field will be developed through applying the Living Lab Integrative Process (LLIP) (Mastelic, 2019) using a range of participative, analytical, open innovation methods and tools. A review of these methods and tools using an adapted version of the Delphi method, to obtain consensus, will be undertaken. Insights from transitions labs, *Reallabore* and Living labs outside Lantern will be sought to build consensus on the methods and tools proposed. The research is expected to help identify differences in methodological approaches between researchers and practitioners, gain consensus on, and identify tensions as well as new approaches, methods and tools in the Swiss and EU research and practice communities.

Key words

Living Lab Integrative Process (LLIP), Multidisciplinary, Delphi method, Consensus, Energy Transition

Introduction

Living Labs have a significant potential to impact sustainability transitions through co-created quasi-experiments (Puerari et al., 2018) potentially leading to systemic change, particularly in urban environments (von Wirth et al, 2019; Fuenfschilling et al. 2019). Starting from highly contextualized, often spatially limited niche experiments trialing alternative socio-technical configurations and use practices (van Waes et al., 2021), change momentum can be built up towards transitioning incumbent socio-technical systems such as the energy, mobility or building systems (Geels, 2004). In order to achieve a sustainable, long-lasting effect on social practices, norms, and technical artefacts, as well as increased legitimacy and user acceptance, Mastelic (2019) proposes using participatory processes of co-design (Puerari et al., 2018), the quadruple helix (Carayannis and Rakhmatullin, 2014) and Open Innovation (Chesbrough, 2003). This is translated into the methodological framework known as the Living Lab Integrative Process (LLIP) (Mastelic, 2019), illustrated below, on which the Lantern consortium is based.

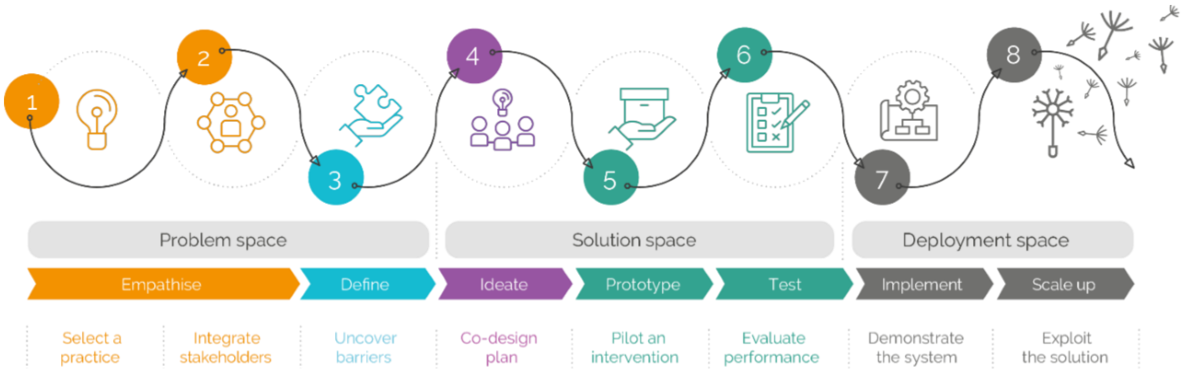

Figure 1. The Living Lab Integrative Process (LLIP) adapted from Mastelic 2019

The LLIP process is not linear and will evolve iteratively during the 8-year program as a meta-process nourished by learning feedback loops from experiments, methods, and tools developed in six different, topical and research-focused Work packages, five Urban Living Labs and one Pre-Living Lab. Urban Living Labs (ULL) are considered spaces to facilitate experimentation about sustainability solutions (von Wirth et al.,2019), and are located in a built-up and well-connected urban or suburban area. In Switzerland, urban and suburban are defined by the Federal Statistical Office (the first three categories (Agglomerationskerngemeinden / communes-centre d'agglomération). A Pre-Living Lab is defined as a testbed, a platform for experimentation of large development projects.

Testbeds allow for rigorous, transparent and replicable testing of scientific theories, computational tools and new technologies (Mastelic, 2019). For the purposes of this research, it is defined as a controlled environment (not real-life), with users often represented by researchers mainly (a specific category of users, not the same level of energy literacy). Testbeds are seen as pre-Living Lab setting, with a smaller scale and level of analysis for example one building). Multidisciplinary teams from engineering, science, social science, humanities, and business will work together with public and private cooperation partners and citizens through the Living labs to develop and trial solution approaches for societal problems associated with the energy transition.

The research presented in this paper forms part of the Living Lab Interfaces for the Energy Transition (Lantern) project which aims to co-design, test, validate, and scale up a portfolio of novel, socio-technical interventions, for a user-empowered, low- carbon, resource-efficient and -sufficient Switzerland. The 8-year project (2022-2030), partially funded by the Swiss Federal Office of Energy (SFOE) and sixteen research partners, will be executed in form of applied research and development at the interface between markets, technology, policies, and society and provides an excellent opportunity for long term research into transdisciplinary change management using a Living Lab approach.

Within the project, four Living Labs and one Pre-Living lab in Switzerland will provide the setting and context for multi-stakeholder experimentation across six thematic areas including *Smart Energy Users*, *Energy at Work*, *Sustainable Mobility*, *Energy Communities and Cooperatives at District Level*, *Affordable & energy-efficient housing and retrofitting* and *Low Carbon Recreational Cities*. The labs are conceptualized and operationalized using a three-level perspective for Urban Living Labs (Schuurman, 2017):

- Macro level: governance of the ULL, focusing on organizational and stakeholder management challenges,
- Meso level: projects in ULLs,
- Micro level: methods and tools for interventions in ULL

The three-level perspective is also used for targeted support for Living Lab practitioners and managers, and researchers active in Living Labs, in the form of capacity building activities related to governance, stakeholder management, project implementation, methodological consideration and use of specific tools, implemented through an online platform and a series of workshops.

The methodological approach presented in the remainder of this work is mainly concerned with the meso and micro levels, empirically focusing on Lantern work packages, potential spinoffs and continuation activities, and individual methods and tools implemented as part of the work package tasks and interventions. The main research objectives are as follows:

- To provide a comprehensive review of the proposed methods and tools by the Lantern Researchers at each step of the LLIP
- To obtain feedback from expert practitioners in Living Labs, transition and Reallabore on the methods and tools proposed
- To build consensus on the methods and tools using a Delphi method approach
- To identify new research methods and tools throughout the innovation lifecycle, to drive collaborative, user centered, open innovation and design thinking as well as scale-up methodologies and measures.

Methodology

A systematic literature review (Tranfield et al., 2003) to study the conceptual genealogy of the theoretical frameworks preceding and contributing to Living Lab methodologies (i.e., *Reallabore, Sozialabore,* participative methodology, social marketing, sustainable transitions research, systems theory and particularly innovation systems, institutional theory…) with reference to energy transitions is currently being carried out. The keywords used in the searches included quantitative, experimentation, co-creation, Living Labs AND Transitions, institutional logics, practitioners, Co-creation methods, Design thinking Process, Co-Design methods, Living Lab methods, transdisciplinary, energy transition and consensus.

The strongly trans- and cross-disciplinary nature of the Lantern consortium with more than 60 researchers and 10 Living Lab Practitioners, as well as the heterogeneous backgrounds and research aims of the consortium's members, led to a broad range of opinions and preferences on the tools to be used within the consortium work packages and in individual interventions. Initially, a review of methods and tools proposed at each step of the LLIP was undertaken and a matrix of tools was co-created.

The Delphi method was defined as an approach of choice for reviewing the Living Lab methods and tools in the Lantern proposal based on its flexibility of implementation together with a focus on consensus-gathering among expert practitioners. The method is based on the principle that forecasts (or decisions) from a structured group of individuals are more accurate than those from unstructured groups (Linstone and Turroff 1975; Okoli and Pawlowski, 2004). A high-quality delphi method identifies the most important issues of interest by engaging qualified experts. Our approach adds to the single-panel sample approach, often taken as standard in qualitative research (Okoli and Pawlowski, 2004), by engaging two expert panels representing distinctive and partially separate groups of knowledge: one panel consisting of research professionals engaged in the Lantern consortium as WP leaders and/or task leaders (12 members in total), and a second panel consisting of practitioners in Living Lab, Transition Lab and Reallabor settings (28 members in total). Selection criteria for the first panel were solely role-based, i.e. the individuals assigned the relevant role within the consortium were invited to join the panel, while the selection approach for the second panel used a combination of snowballing and self-assessment based on i) current engagement in a lab/experiment setting, ii) utilisation of participatory and design thinking methods and tools, iii) co-design and experimentation with (innovative) solutions and iv) experience, in a partner role, in at least one energy-related project. While overall the methodological approach is qualitative-dominant, the first panel (Researchers) is approached using predominantly qualitative methods in the form of semi-structured respectively structured interviews while the second panel (Practitioners) is approached using a mix of quantitative (preference scoring-based survey) and qualitative (focus group discussion also including members of the first panel) methods. The moment of analysis across the methodology is nethier ex-ante nor ex-post.

In terms of sequencing, the approach consists of a series of distinctive steps, with the research team collecting, analysing and synthesising data in between each step and using them to inform the tools applied in the subsequent one. In this way, a quasi-dialogue is established between the two groups, followed by an on-site exchange in the final step. The following is an overview of the approach sequence:

- Preparatory Round (Round 0), April-May 2023: semi-structured interviews with members of the first panel (Researchers – Lantern WP leaders and task leaders)

- Delphi Round 1 – May 2023 – Quantitative questionnaire sent out to the second panel (Lantern Living Lab managers & External EU Practitioners (20))
- Delphi Round 2 – August 2023 – Structured interviews with members of the first panel (Researchers), based on questionnaire results
- Delphi Round 3 – September 2023 – On-site focus group discussion combining members of the first panel (Researchers) and selected members of the second panel (Lantern Living Lab managers & Practitioners)

In line with the Delphi method logic (Linstone and Turroff, 1975), a consensus position on the utilization of Living Lab methods along the Living Lab Integrative Process is sought following each step, with the core dialogue taking place between the two panels. The final round of the approach will lead to an inter-group consensus, representing the shared positions of both panels.

Following the delphi method a cascade approach will be applied to deep dive into the results and to explore further the competing institutional logics, and methods on barrier definition using semi-structured interviews with Practitioners outside Lantern project. This will form part of a separate research paper.

Conclusion

Other than the direct benefits for the Lantern project in undertaking this comprehensive review of methods and tools and the application of the Delphi method in building consensus, the research has relevance for the wider Living Lab Community by bringing the energy and environmental practitioners together with scholars working in these areas. By identifying common grounds as well as potential conflict areas, further collaboration as well as methodological co-creation will be enhanced.

There are several European projects currently working in the energy sector (oPEN Lab, SCORE, DomOS, 2ISECAP) where the LLIP is now being used to solve the wicked problems associated with the energy transition. Comparisons of methods and tools by Practitioners applied in the projects as well as their impacts will help to determine the effectiveness of the application of the LLIP methodology, as well as for scale up of social and technological innovations.

Given the urgency and importance of the energy and climate crises, many Living Labs across Europe are diversifying to solve these problems and will greatly benefit from this research because it provides a practical demonstration of what methods and tools are applicable at what stage of the innovation process and in an energy context and how to use the delphi method to build consensus amongst a variety of actors with dynamic capabilities and competencies. Indeed, the approach is expected to reveal tensions when opening up the research proposals for feedback while also contributing to better participation in the long term, and sharing of new tools and approaches between the Living Lab, Transdisciplinary and Reallabore Communities. The methodological approach will later be expanded out to review methods and tools through the lens of learning theories and knowledge frameworks.

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Research-In-Progress Paper

Harmonizing the Living Lab Language: Towards a Living Lab Lexicon (LLL)

Authors

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Abstract

With Living Lab (LL) research and infrastructures supported by LLs increasing exponentially over the past two decades, there is a need for clear and fluid language, understanding and communication among the LL communities and all those who come into contact with LLs. We present a 'Research in progress paper' detailing the steps (term identification, definition(s) selection and validation through internal and external consensus) in the creation of an open access dynamic Living Lab Lexicon.

Key words

Living Lab, Lexicon, Terminology, Communication, Harmonization

Introduction

The first descriptions/definitions of Living Labs (LL), as environments for designing, developing, testing and evaluating communication technologies and services in early stages of the innovation or as a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real-life contexts, appear in 2005 (Pierson & Lievens 2005; Eriksson et al., 2005). Since then, a number of definitions have surfaced, providing variations on main themes describing Living Labs, such as: user-centric environments for open innovation (Schaffers et al, 2007), collaborations of public-private-civic partnerships (Feurstein et al., 2008), platforms with shared resources (Leminen et al., 2017), to name a few. The European Network of Living Labs (ENoLL), describes LLs as open innovation ecosystems in real-life environments based on a systematic user co-creation approach that integrates research and innovation activities in communities, placing citizens at the center of innovation." LLs focus on co-creation, rapid prototyping & testing and scaling up innovations & businesses, providing (different types of) joint-value to the involved stakeholders.

In 2020, the Horizon Virtual Health and Wellbeing Living Lab Infrastructure (VITALISE) project brought a new era to LL Research, Development and Innovation (RDI) services by introducing the LLs as Research Infrastructures (RIs). VITALISE aims to strengthen the LLs position in the worldwide RIs roadmap by assembling and harmonizing processes, procedures and tools across the European Living Labs including some Canadian Living Labs. This collectively espoused endeavour is ultimately leading to effective and fluid access for researchers, as well as knowledge transfer and exchange among LLs centered on the health and well-being domain.

As European LLs gathered around the main theme of harmonization, it became clear that one of the first activities that would help ensure fluid and transparent communication would be the establishment of a 'common language and terminology'. Indeed, even though the VITALISE consortium members all have extensive experience in LL methodology and research, the 'language' and terms used did not always refer to the same concepts, even if the core meaning was often similar. As one can imagine, this sometimes led to confusion and misunderstandings that became even more apparent when talking to different 'players' within the LL communities that are not part of VITALISE. This became even more pronounced when interacting with individuals who are novices or those completely outside the LL community. With the overall vision to facilitate and increase understanding and communication between the different 'players' within the LL communities and all those who come in contact with LLs, we decided to create a VITALISE Living Lab Lexicon (LLL) where LL key terms are identified, defined, and shared with the LL community and beyond. During this process we also remain mindful that certain terms have variations in meaning depending on the context in which they are used.

The Current Project

To respond to this challenge, we assembled a team of VITALISE researchers from European and Canadian LLs. The team was supported by external experts in the fields of linguistics and psycholinguistics, as well as by a medical librarian.

Objectives

The following five (5) objectives were pursued:

1. Determine and select which LL terms to define.
2. Identify already existing definitions.
3. Consider who the target audience(s) is (are). What are their potential backgrounds? Consider having a primary definition for each term and potentially a secondary or tertiary definition based on context and the user.
4. Establish a process that will result in the definitions that we propose for the selected terms.
5. Propose definitions for the terms selected within a framework representing the LL process and reality.

Methods and Preliminary Findings

In addressing the first objective, we began with a small number of terms which were nevertheless representative of the most frequently used terms in Living Lab research. To avoid selection bias, we opted for a systematic search through the literature to create a corpus of articles containing relevant terms. A health sciences librarian conducted a multi-file search of MEDLINE, EMBASE, and PsycInfo on the Ovid platform using the syntax (Living adj1 lab*).mp. on August 12, 2022. The search found 854 citations across the three databases; duplicates were removed using the Ovid platform, leaving 567 unique citations. These were imported into Rayyan, a screening platform often used in Scoping or Systematic Reviews (Ouzzani et al., 2016). At this point, for articles to be considered for inclusion in the corpus, they had to have been published in 2008 or later and to have utilized a Living Lab methodology or to have included key words such as "living labs, co-creation, real life settings, user centered, interactive exchange, interdisciplinary and transdisciplinary research, innovation, users as partners, controlled environment, participatory design" in the abstract or the keywords provided in the article. Furthermore, articles had to have at least an abstract in English or French. Following a similar selection process to the one used in scoping reviews, two reviewers judged the eligibility of each citation. The Rayyan platform also allows one to vote on eligibility of an article to either: 1) Include (if relevant), 2) Maybe Include, or 3) Exclude if not relevant. The majority of citations also provided a full pdf of the article. Of the 567 articles initially entered, 173 were initially included, 340 were excluded, and 54 were in the 'Maybe' category. For those articles assigned to the 'Maybe' category, a third reviewer resolved conflicts.

In addition to the articles identified by the search above, we also added the papers included in the proceedings of the ENoLL Open Living Lab Days (2013-2022). Articles selected from the two sources, the literature and the ENoLL proceedings were treated as two separate corpora and the ensuing analysis was also conducted separately in order to avoid bias.

At a second step we compiled the list of articles and ENoLL papers and downloaded all the pdfs into Word Stat, a word mining software (Provalis Research). Using WordStat, we calculated frequency of occurrence and percent of occurrence for single word terms (e.g. user), for two-word terms (e.g. real life) and for three-word terms (e.g. technology innovation management). These counts were calculated separately for the articles identified from the literature and for those obtained from the ENoLL proceedings. When we compared the two sets of data, we observed that there were minor differences and thus proceeded to consider them as one set. Table 1 presents the top ten (10) terms identified from the articles and ENoLL papers combined.

Table 1. Top 1-word, 2-word, and 3-word terms

	FREQUENCY	NO. CASES	% CASES	LENGTH	TF • IDF
LIVING	14389	341	98%	1	127,0
INNOVATION	8625	314	90%	1	385,1
LAB	8366	332	95%	1	171,0
RESEARCH	8078	334	96%	1	144,1
LABS	6389	297	85%	1	439,7
DESIGN	4814	310	89%	1	241,7
USER	4420	292	84%	1	336,8
SOCIAL	4292	317	91%	1	173,9
PROJECT	4201	311	89%	1	205,1
USERS	3960	285	82%	1	343,5

	FREQUENCY	NO. CASES	% CASES	LENGTH	TF • IDF
LIVING LAB	7223	326	94%	2	204,9
LIVING LABS	5678	293	84%	2	424,2
OPEN INNOVATION	1184	182	52%	2	333,3
OLDER ADULTS	964	70	20%	2	671,4
REAL LIFE	739	196	56%	2	184,2
CASE STUDY	645	169	49%	2	202,3
END USERS	635	146	42%	2	239,5
LONG TERM	584	156	45%	2	203,5
HEALTH CARE	562	98	28%	2	309,3
INNOVATION MANAGEMENT	559	146	42%	2	210,9

	FREQUENCY	NO. CASES	% CASES	LENGTH	TF • IDF
URBAN LIVING LABS	377	72	21%	3	258
TECHNOLOGY INNOVATION MANAGEMENT	317	115	33%	3	152,4
URBAN LIVING LAB	142	49	14%	3	120,9
OPEN INNOVATION NETWORKS	124	45	13%	3	110,2
BUSINESS MODEL CANVAS	104	15	4%	3	142
USER CENTRED DESIGN	91	55	16%	3	72,9
LIVING LAB SERVICES	73	9	3%	3	115,9
PUBLIC SECTOR INNOVATION	65	8	2%	3	106,5
LIVING LAB NETWORKS	64	32	9%	3	66,3
SUSTAINABLE DEVELOPMENT GOALS	57	25	7%	3	65,2

At a third step, and following a consensus process, we selected the top 50 terms with regard to frequency of occurrence and % of occurrence across the different corpora. These would be the first terms that would be defined. We then proceeded to search for existing definitions in the literature. In parallel, a concept map was created, and a subset of the selected terms was mapped onto the concept map, as seen below (Figure 1).

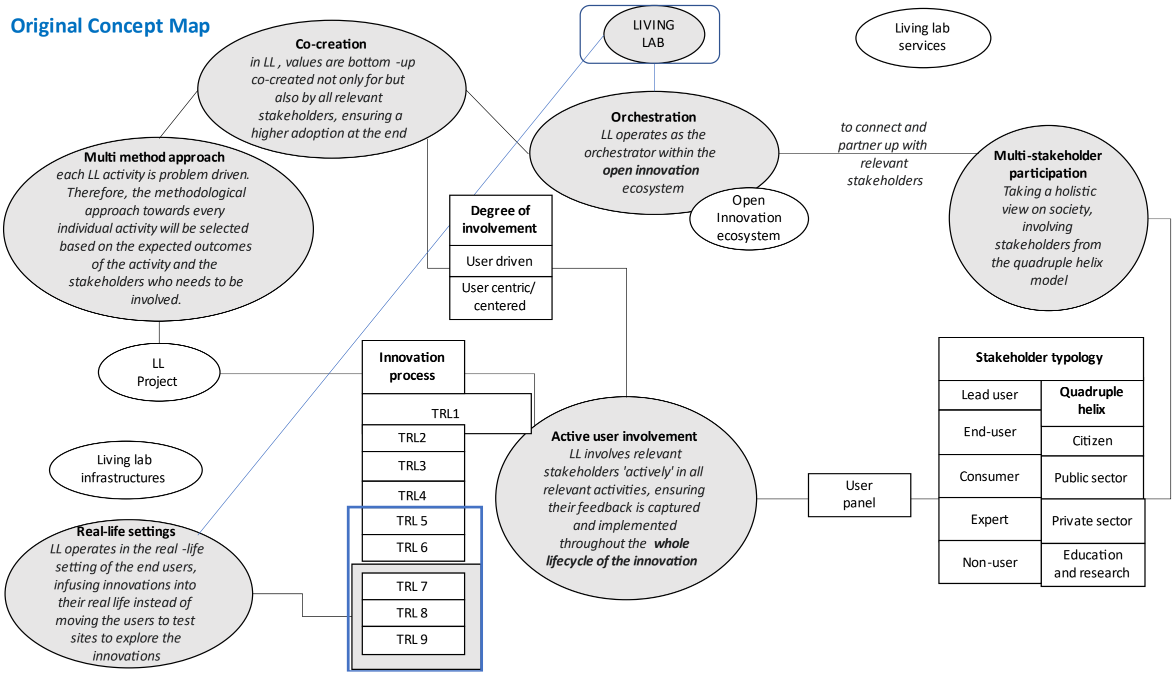

Figure 1. First draft of the Living Lab concept map with terms

Working within the principles of the LL methodology, we used an iterative approach of consultation in small group and then in a larger working group attended by VITALISE LL researchers during a working session where the goal was to examine/debate existing definitions for suitability and appropriateness, identify new concepts linked to the chosen terms, discuss them and arrive at a consensus that resulted in maintaining some of the original definitions and altering others. For example, for the term 'Co-creation' the original definition that appears on the graph was changed to: Creating new value for and with the relevant stakeholders in a collaborative process. We also added the most recent revision of the definition of 'living lab' from ENoLL.

We then proceeded to work on the Stakeholder typology. Following discussion and consensus the following changes were made as shown below in bold: Stakeholder typology was replaced by Stakeholder involvement and two new categories were added.

- Lead user
- End-user
- **Consumer became Customer**
- Expert
- Non user
- **Target user**

- **Early adopter**

During the same working session a new concept map was created, comprising the changes proposed by the group (Figure 2).

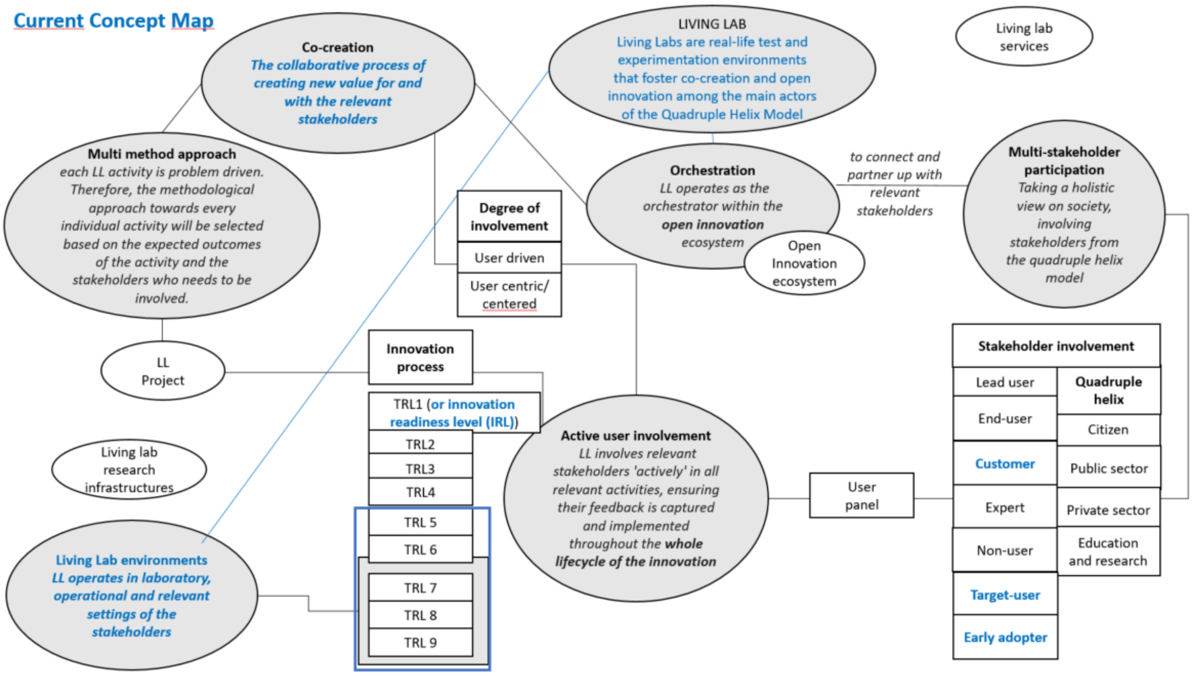

Figure 2. Most recent Living Lab Concept map with terms

Conclusion and Next Steps

While several LL terms have already been defined and validated there are several other terms pertaining to living labs and to the living lab methodology for which definitions need to be identified and validated. These include terms already identified and presented in the VITALISE deliverable D4.5 Living Lab Guidelines (first version). Furthermore, the variety of concepts associated with LLs operating in diverse environments will be explored. As a further step we will seek to obtain feedback on all of these terms and definitions from a larger pool of 'LLabers' outside the VITALISE consortium, as well as from novices in the LL experience. This will allow us to obtain external validity on the set of definitions. In parallel we will also seek feedback from other groups of potential users (Academia, Industry, Government, Citizens), to ensure that the definitions included in the Living Lab Lexicon will reflect the diversity of context and use. In the end, all feedback and information will be compiled and imported in what will become an Open

Access Dynamic Living Lab Lexicon.

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Innovation Presentation Outline

A low-code crowdsourcing platform to support innovation and increase efficiency

Authors

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Abstract

In their attempt to innovate, companies need to develop custom software products that in most cases need to be co-created with end-users. The use of a low-code platform can facilitate this process by allowing requirements gathering based on real interactive mockups designed by non-tech users through the use of a low-code tool. Through this co-creation phase, end-users can navigate on the real mockups and provide valuable feedback. After this co-creation/crowdsourcing phase with stakeholders, the owners of the platform (non-tech users) can easily transform the mockups to software code ready to be deployed. Living labs can consider the use of low-code tools to enhance their portfolio of services.

Key words

#low-code, #mockups, #MVP, #livinglabservices, #innovation, #requirements

Problem statement

In their attempt to innovate, companies need to develop custom software products that in most cases need to be co-created with end-users. However, developing software products is costly and time consuming mainly due to the very limited software engineering resources available worldwide (500K developers are missing from the job market in Europe). At the same time, gathering appropriate requirements is not an easy task and sometimes the methodologies used are not sufficient.

Methods/approach used

We propose the use of WABLI (https://wabli.eu), a low-code (and no-code) platform that facilitates rapid prototyping for bootstrapping the design process and generating ready-to-deploy innovative web applications. In WABLI, the approach that is being used is the following:

1. SMEs can easily design the pages of their innovative products. In accordance with best practices in UI prototyping solutions, WABLI allows non-tech users to define the application layout (both web and mobile) in the form of interactive mockups.
2. Stakeholders (citizens, end-users) can now be involved (early in the design process) and can navigate through the real interactive mockups. Stakeholders can provide structured feedback (crowdsourcing) on every single page of the application. They are provided with a clear view of the end product, and they are given the ability to modify and comment all entities in a consistent manner.
3. After the mockups have been refined and approved by the end-users, the owner of the application (non-tech) can easily create the data model of the application. The requirements are automatically being extracted and the application is ready to be deployed.
4. Through WABLI's automatic code generator, back-end (node.js, mongoose, MongoDB) and front-end (HTML, CSS, Javascript) code is automatically being generated. Users can download the source code of their application and deploy it either automatically on WABLI servers or at their premises.

Results/outcomes

Using WABLI, or a similar low-code platform, startups and SMEs can co-create innovative products in a cost-efficient and time-effective manner. End-user involvement is the key in the development of useful, usable and innovative products and has positive effects on the success of product and user satisfaction. Living Labs can provide to their customers low-code solutions to allow them easily co-create their MVPs.

Why WABLI?

The increasing need of innovation and digitalization is expected to enhance the use of low-code development platforms. The time for low-code is now. WABLI provides the place where startups and SMEs can co-create fully functional data driven web applications on without the support of software developers. WABLI turns non-tech SME employees into software builders. WABLI has been used successfully by startups to create their prototypes. It is important for the public and also for the Living Labs to be aware that such tools exist and can speed up the development of MVPs involving end-users in the design of their products.

It would be interesting to examine whether Living Labs could be interested in such a tool. WABLI could be provided for free at least for one year to all ENoLL members. Living Labs can use WABLI as a service to their customers to allow them co-create their innovative web applications with their end users.

Poster Session

Thursday, 21st September 2023

17:30 – 18:30 CEST

Sur 3-4

Innovation Presentation Outline

Circular Economy Solutions Transforming Innovation Processes in Manufacturing Industry Ecosystems

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Abstract

Circular economy (CE) solutions represent one key element in achieving the ambitious goals of Twin transition and the Sustainable Development Goals in Europe and beyond [1,2]. Especially when intertwined with the objectives of Green Deal and the related other ambitious European and national policies, these solutions may be perceived as barriers or even inhibitors, as they often challenge the existing technological prospects and business models. This is often the case especially in heavy industrial sectors such as manufacturing industry requiring expensive, long-term and large-scale investments in process or production equipment and facilities.

Additionally, turning the mindset and processes to be in favour of circular economy may also bring disruptive new business possibilities. Furthermore, integrating circular economy solutions into innovation processes requires new, upgraded or updated competences and skills in order to be effectively and efficiently benefitted. Approaches and tools such as Living Labs are the key in designing and implementing CE solutions holistically on production and business levels.

In our approach aiming at supporting integration of circular economy into manufacturing innovation ecosystem we study 3D printing possibilities as part of disruptive solution for wider CE adoption. 3D printing as a feasible and agile production method offers a fruitful playground to innovate and test e.g., bio-based materials and sustainable production. The approach focuses on creating an innovation process with commercial users and research organisations of advanced research and innovation infrastructures and their related service models.

The Living Labs approach emphasizes the engagement of all relevant stakeholders of the

value chain, applying open innovation procedures to all activities, and demonstrators in real-life environments, not just university labs. Specific focus is on SMEs, boosting their competitiveness in the ecosystem. TAMK Knowledge Transfer Charter (KTC) is essential part of the innovation process when enhancing adoption of CE solutions within manufacturing companies [3,4]. Physical platforms for these testbeds are offered via SIXLabs Initiative in Tampere Region. Additionally, the facilities and factories of our industrial partners serve as real-life environments for co-creation.

In this outline we present a case focusing on 3D printing combined with circular economy solutions in manufacturing industry innovation ecosystem. The innovation process builds on learning environment formed by open innovation testbed for hands-on trials and knowledge transfer for ecosystem network. The case investigates and pilots the utilisation of bio-based materials, bridging the gap between new technology early adapters and mainstream manufacturers. Improvement of an integrated knowledge valorisation process is especially essential for SMEs, as they often form the cornerstone as innovators and early adaptors of new technologies. In the meantime, they are still also often struggling with scarcity of resources and agile ways to innovate. The effective inclusion of all the value chain stakeholders in both CE and manufacturing ecosystems enables the effective transformation towards more sustainable and green manufacturing.

Interest group within the Living Labs community are members with high passion towards integration of circular economy solutions into innovation ecosystems of various sectors. More specifically, there is a need for deploying innovation process actions in companies, midcaps and SMEs in traditional industrial sectors where the introduction of CE is utmost demanding but also might have the greatest effects on the Green Transition in the long run.

By presenting and sharing our case we hope to get feedback from the Living Labs community to improve our approach, tools and cases. We look forward to gaining new partners for future collaboration and elaboration of the process jointly with our networks of companies and SMEs in international project contexts.

Keywords

Innovation ecosystem, Innovation process, Living Labs, Manufacturing, SMEs, Circular economy

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Innovation Presentation Outline

Reflexive Monitoring for Living Labs

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Abstract

Living labs have become vital settings for catalyzing transformative learning, responding to the pressing need for substantial societal change. The demand for such change arises from the recognition that addressing modern challenges requires profound transitions. However, questions linger regarding the efficacy of learning within these dynamic environments.

Our exploration therefore investigates the potential of reflexive monitoring as a catalyst for transformative learning within living labs. Reflexive monitoring, a continuous process closely aligned with the goals of living labs, facilitates the conscious and action-oriented monitoring of projects and programs. It encourages the critical examination of assumptions and promotes radical changes through various methods such as learning-history workshops and dynamic learning agendas.

This research identifies three transformative learning opportunities within living labs through reflexive monitoring: collective reflection and shared learning when addressing systemic challenges, monitoring systemic impact to unveil enduring changes, and linking experimental insights with established practices for widespread replication.

Key words

Learning-by-doing, Reflexive monitoring, Learning history workshop, Systemic bullet journaling

Outline

Living labs, the ideal places for transformative learning.

Today, both citizens and governments demand transformative changes. This demand appears to stem from a growing understanding of the type of change required to address present-day challenges: transitions (Geels et al., 2011).

In contrast to traditional science, living labs offer the potential to initiate such transformative learning. They encompass changes in technologies, organizational structures, and social norms that shape society (Schuurman et al., 2015).

But do we 'learn' effectively?

Living labs are frequently proposed as capacity-building initiatives, e.g., in sustainable agriculture. In this domain researchers have explored the operationalization of the living lab approach through systems thinking and reflexive monitoring (Potters et al., 2018). They noted that the analysis, monitoring, and evaluation of living labs, as well as their effectiveness, are however limited (Potters et al., 2022). Yet, the specifics of how social learning is encouraged in living lab settings and how to foster that environment remain vague.

Likewise, through observation, interviews, and active participation in three completed and three ongoing living lab initiatives, we found that conscious methods for learning are rarely present. Instead of a genuine desire to learn, the focus is often driven by time and output pressures, as well as the established practice of continuous reporting. While partners and participants may not express a strong urgency to learn better or more effectively, they do display enthusiasm for being informed about and introducing more structure into their learning processes.

So, how can we learn in a transformative way?

One option is through reflexive monitoring. Reflexive monitoring and living labs are well-aligned due to their shared ambitions of initiating and accelerating systemic change, as well as their engagement of stakeholders (Van Mierlo et al., 2010).

Reflexive monitoring is a continuous process that enables effective steering of sustainability projects and programs. It allows to track experiences and insights while encouraging the questioning of assumptions and fostering radical innovation. Various formats can be employed, including learning-history workshops, systemic bullet journaling, and dynamic learning agendas.

By introducing 'reflexive monitoring' in living lab settings, we have identified three opportunities for transformative learning.

First, when different experiments within a living lab setting address the same systemic hurdles - which requires a thorough system analysis - there is an opportunity for collective reflection, shared learnings, and mutual inspiration.

Second, if the challenges being tackled are genuine transition challenges, it becomes possible to monitor and scrutinize the level of systemic impact and dive beneath the surface (Davelaar, 2021), uncovering enduring changes.

Third, if it is feasible to connect the experimental space of living labs with conventional practices, it becomes possible to monitor how the acquired insights can be replicated to policies, companies, and individuals (Gorissen et al., 2018).

And, what can you do?

In conclusion, we propose reflexive monitoring as an opportunity for living labs to question, envision, and initiate systemic change in what we do, how we organize ourselves, and what we value the most. Visit **https://nexuslearn.vito.be**, empower your living lab and unlock the change.

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Innovation Presentation Outline

Societal engagement in tech innovation

Authors

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Abstract

The SocKETs project have used social living labs as a methodology for engaging tech representatives, citizens and other stakeholders into co-creation, experimental and participatory process around three KETs-based innovation ecosystems (circular economy, eHealth and industrial automation). The outcomes of the SocKETs Labs have been used to create an online guide on engaging citizens and societal actors in tech development and an online exhibition that explores the intricated relation between society and technology.

Key words

Social engagement, Co-creation, living labs, KETs, societal challenges

The main problem statement(s)

Societal challenges demand a more responsible relationship between technology and society. Disruptive technologies such as artificial intelligence (AI) or Internet of Things (IoT) have a significant potential to provoke societal transformations such as in the case of Key Enabling Technologies (KETs). Technological innovation needs to become more responsive to societal challenges and concerns, to stay in line with the increasing demand for accountability within tech development through new laws, policies and quality standards. The SocKETs projects has examined how technology actors can engage with citizens and societal actors to make the development of novel technology and technological products more sustainable and responsible.

Methods/approach used

In the SocKETs project we have combined the Living Labs approach with the social lab method (Hassan, 2014) to promote societal engagement into tech communities focused on KETs. This has been done through six **SocKETs** Labs across Europe with the aim of establishing the right conditions, resources, and tools to facilitate Societal Engagement activities using co-creation tools. The labs have been focusing on three innovation ecosystems: eHealth, artificial intelligence in industrial automation systems and circular economy. All SocKETs Labs followed a similar structure based on three predefined momentums that comprised three different workshops: Design workshop, Maturation workshop and Celebration workshop (Mendibil et al., 2021). However, each Lab dealt with different socio-technical and socio-ethical challenges and engaged different type of stakeholders and citizens. The six labs were able to gather researchers, industry representatives and citizens to develop and co-create solutions, prototypes and alternatives that can be responsive towards societal needs and challenges.

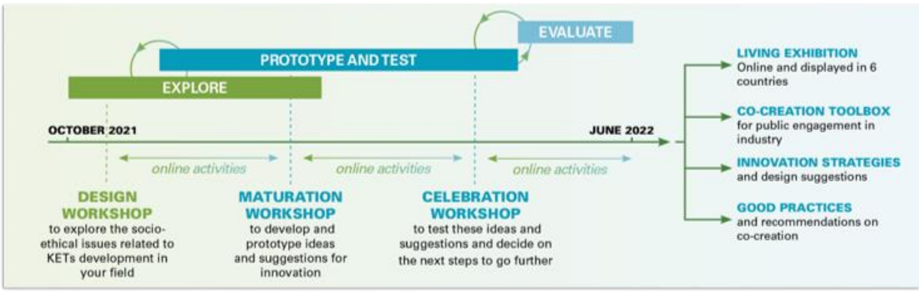

Figure 1. Stages of societal engagement process in SocKETs Labs

Results/outcomes

Findings from the experimentation enabled by the six SocKETs labs have been employed in different ways. Some of these learnings (Jiménez Iturriza et al., 2022) have been used to develop the online guide 'The Guide Towards Responsible Tech Innovation using Societal Engagement' (home - The Tech Industry's Guide (sockets-cocreation.eu)) which aims at helping tech industry actors in navigating how to engage citizens when developing new technologies and products. Other conclusions extracted from the SocKETs Labs have contributed to set up a physical and online exhibition that displays the relation between society and tech innovation (SOCKETS – OnlineExhibition (sockets-cocreation.eu)).

Why is this presentation of interest for the public?

Outcomes of the SocKETs project can be interesting for the audience of OLL event as this initiative has provided interesting insights about how to promote societal engagement around KETs through co-creation and participatory processes. Furthermore, a dedicated guide provides a modular approach to help other similar endeavors in in the tech industry.

What do you want to get out of the presentation?

We want to be present at OLL for sharing our findings, raising awareness of social engagement and inspiring others. Last, we want to promote debate and discussion around the role of co-creation in industry through similar guides to the one that has been produced in our project.

Acknowledgements

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Research-In-Progress Paper

Motivations and Incentives for Stakeholder Participation in Citizen-Driven Living Labs

Authors

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Abstract

Living Labs (LLs) provide a framework for convergent co-creation among companies, research institutions, and government agencies led by citizens. However, citizen-led LLs are rare, and there have been few studies on citizen-driven LL management. In Japan, many LLs have been established by local governments or universities, focusing on service development. However, achieving the proactive participation of diverse residents is challenging due to the structural contradiction of LLs, which, despite being citizen-driven in the ideological form, require institutional and policy involvement of governments and businesses. Practical research on the sustainable management of citizen-driven LLs is required to overcome this contradiction. To sustainably operate a small-scale, bottom-up LL, it is necessary to clarify how citizen-driven LLs can benefit businesses, research institutions, and governments.

Oyamachi Living Lab is a citizen-driven LL launched in 2022, a co-creation of residents of Oyamadai area and Tokyo City University, based on the community of the Oyamachi Project, in which residents and various stakeholders, such as schools, shops, and universities, participate and act informally.

We analysed the motivations and incentives of each of the four sectors participating in 10 diverse projects at Oyamachi Living Lab, conducted in 2022. We found that Oyamachi Living Lab provides exploratory and cross-border opportunities for each actor to step outside their expertise and explore a different approach to the current way of conducting business, with new partners and ways of working together, building more flexible relationships. For each sector, the strength of citizen-driven LLs is that they support exploratory and cross-border efforts.

Key words

Citizen-driven Living Labs, Quadruple Helix Model, Motivation, Incentives, Operational sustainability

Introduction

Living Lab (LL) is a framework for convergent co-creation among companies, research institutions, and government agencies led by citizens. It is based on the Open Innovation 2.0 framework and the Quadruple Helix Model (QHM) in which governments are prioritizing greater public involvement in innovation processes (Hossain et al., 2019).

However, citizen-led LLs are rare (Steen & van Bueren, 2017), and there have been few studies on citizen participation, motivation, and community-based LL management. In Japan, many LLs have been established by local governments or universities with a focus on service development, but the proactive participation of diverse residents is challenging (Akasaka & Nakatani, 2021). This is due to the structural contradiction of LLs, which, despite being citizen-driven in the ideological form, requires institutional and policy involvement of governments and businesses. Practical research on the sustainable management of citizen-driven LLs is required to overcome this contradiction.

Previous research suggests issues with developing incentive schemes for each stakeholder. LLs focusing on a particular service or product technology system are more likely to attract stakeholders because each stakeholder has direct incentives. However, in LLs that are more interested in social systems, the incentives are collective and benefit individuals less directly. Moreover, the core members who gather with intrinsic motivation to participate and those who participate peripherally differ (Puerari et al., 2018).

To sustainably operate a small-scale, bottom-up LL approach, it is necessary to clarify how citizen-driven LLs can benefit businesses, research institutions, and governments. In this study, we analysed the motivations and incentives of each of the four sectors participating in the Oyamachi Living Lab which was established in Oyamadai, Setagaya-ku, Tokyo, in 2022, to determine management methods for creating a sustainable innovation ecosystem through the interaction of diverse participation centred on citizen-driven LL.

Practices of Oyamachi Living Lab

The Oyamachi Living Lab originated from the Oyamachi Project, an activity in which residents of the Oyamadai area, elementary and junior high schools, stores, universities, and various other groups participate informally. The Oyamachi Project was established in 2017, with "learning" and "connection" as keywords. The project has hosted workshops at elementary schools and exchange events in the shopping district, creating social capital and

Figure 1. Oyamachi Living Lab

spontaneous activities that had not existed previously in the area (Sakakura, 2021a). Driven

Table 1. List of projects conducted in 2022

	Projects	Main Theme	Project Outline	Stakeholders	Image
1	Oyamachi Living Infirmary	Community Welfare, Local Medical service	An infirmary that creates opportunities for consultation on small life problems that do not require hospital visits. It is supported by a local home-visit treatment clinic.	· Tatata House · 5 citizens' groups · Fukuro Clinic Todoroki · Panasonic Corporation · Tokyo City University	
2	Oyamachi Curry Diner	Solitary Eating, Child Care Support	Oyamachi Curry Diner is a communal dining room that meets once a month on Sunday at noon. Local housewives and students cook the vegetables provided by local farmers.	· Citizen's group · Setagaya Child Food Pantry · Setagaya Council of Social Welfare · Neighborhood farmers	
3	Community Building Project between cooperative houses and local residents	Housing Supply and Community Building	A community design project that will enable residents of 18 households who will move into a cooperative house in Oyamadai in June 2023 to gain social capital in the community.	· COPLUS CO.,LTD. · Resident Union · Tokyo City University	
4	Super Happy Birthday : Wellbeing Literacy Card Game	Education, Children's Wellbeing, Active Moral Learning	Development of the card game, "Super Happy Birthday" to enhance children's wellbeing, advance their literacy and moral education in junior high schools.	· Nissay Foundation · Oyamadai Junior High School · NTT · Tokyo City University	
5	Wellbeing business games for workers	Organizational Development, Worker's Wellbeing	Development of an experiential training program to learn how to work well-being through games.	· PERSOL RESEARCH AND CONSULTING CO., LTD. · PERSOL HOLDINGS CO., LTD. · Tokyo City University	
6	Research on human resource requirements for community managers	Human Resource, Community Manager	A research project to identify through interviews the expertise of community managers as a profession that creates value from human connections.	· Fireplace Inc. · Tokyo City University	
7	Tamagawa Nogemachi Park Lab	Participatry Design, Park Management	A project to design the landscape and facilities for a park scheduled to open in 2025, with local residents working on site.	· Setagaya City Office · Tamagawa Nogemachi Partners · Nogemachi Park Lab (citizens' group) · Tokyo City University	
8	Mizube Fun Base: Riverside Work Place Project	Work Place Design, Utilization of Riverside	Research project to evaluate the effectiveness of an outdoor office with a campfire in order to utilise the riverbed space effectively.	· Futakotamagawa Area Managements (Tamagawa Neighborhood Assoc., Tokyu Co., etc.) · Setagaya City Office · Tokyo City University	
9	JST/Moonshot9 "Child Care Commons" Research Project	Child Care Support, Information Technology	The project envisions a system of society in which others can be involved in child care using ICT such as blockchain and NFT.	· Tokyo City University, Tohoku University, Sophia University · NTT Institute · Local Residents	
10	Wellbeing Shopping Street Project	Local Commerce, Civic Involvement	Activities to create a "shopping street as a place" where many residents can participate to make Happy Road Oyamadai shopping street more pleasant.	· Oyamadai Shoeikai "Happy Road" Shopping Street · Tokyo Met. Small&Medium Enterprise Support Center · Local Residents · Tokyo City University	

by the Oyamachi Project, the Oyamachi Living Lab opened in April 2022 in a renovated two-story wooden store building facing a shopping street with a community space on the first floor. The Oyamachi Living Lab is a community-based LL co-created with residents in collaboration with the Wellbeing Living Lab Research Unit, a research project of the Tokyo City University which is also located in Oyamadai (Figure 2). The Advanced Research Laboratories of Tokyo City University funded the research for the start-up; however, in 2023, only limited budget came from the university's regional cooperation department. The shortfall in operating costs is paid for by government budgets and the corporate research projects.

In FY2022, 10 projects were conducted to enhance community well-being with collaboration among diverse actors ranging from citizen groups and individual participants to governments, medical institutions, private companies, and national research institutes (Table 1). The projects are diverse and include the following themes: medical welfare, childcare support, housing complexes, well-being education, organisational development, park designs, utilisation of riverfront spaces and shopping street revitalisation.

Analysis of stakeholder participation and motivating and incentive factors

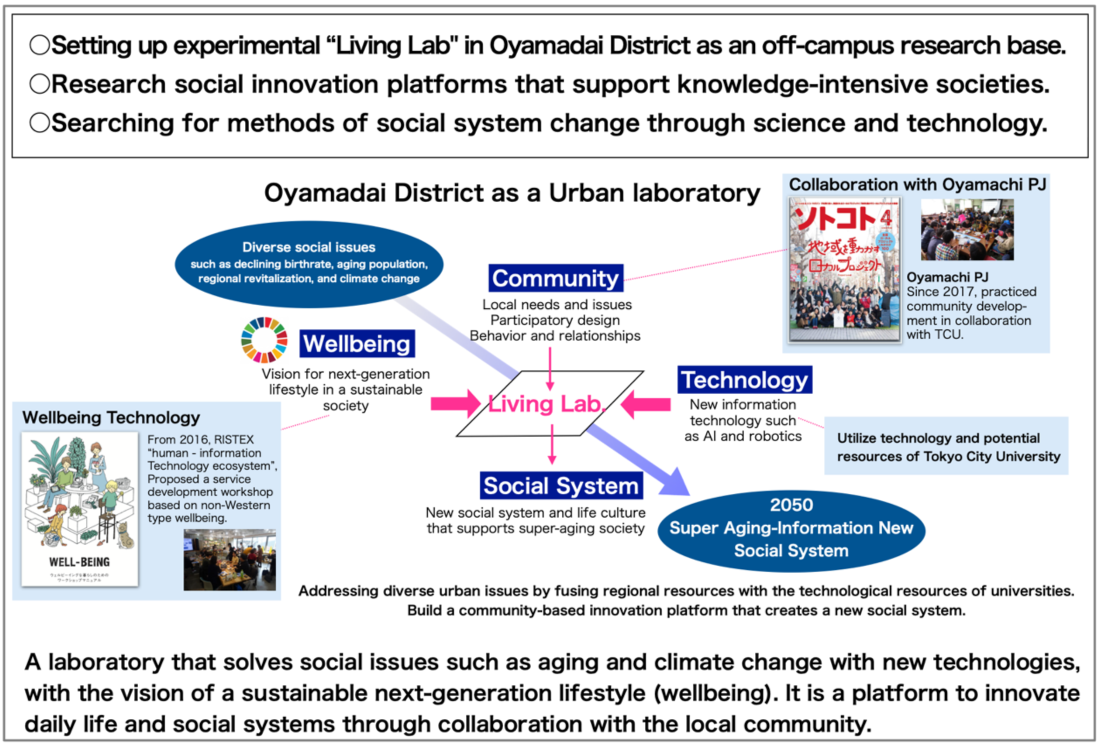

Figure 2. Concept of the Wellbeing Living Lab Research Unit

Table 2 shows the type of projects, participating sectors, and main objectives. There are three types of projects: community activities aimed at the wellbeing of residents, design projects to solve issues by prototyping products and services with diverse participants, and academic research to foster exploratory knowledge and conduct empirical community-based experiments. All projects are multi-sector collaborations.

How can such cross-sectoral collaboration bring value to each participating organisation?

First, we extracted 12 representative stakeholders of different types from 4 sectors.

Next, we conducted one-on-one interviews with each participant or key decision-making

Table 2. Collaborative status of the four sectors in 10 projects

	Projects	Type	Community	Government	Company	University	Main Objectives
1	Oyamachi Living Infirmary	Community Activities	●	○	○		Provide daily health care services for seniors, households raising children and family caregiver
2	Oyamachi Curry Diner	Community Activities	●	○			Providing a co-eating dining that solves the problem of solitary eating
3	Community Building Project between cooperative houses and local residents	Design Project	○		●	○	Creation of methods for interactions between new residents of the cooperative houses and local residents.
4	Super Happy Birthday : Wellbeing Literacy Card Game	Design Project	○	●	○	●	Development of wellbeing tools for children and utilisation in school education
5	Wellbeing business games for workers	Design Project	○		●	○	Development of games for organizational development for workers
6	Research on human resource requirements for community managers	Academic Research			●	○	Research and publish the new profession of community manager
7	Tamagawa Nogemachi Park Lab	Design Project	○	●		○	Park design and creation of a management organization with the participation of residents
8	Mizube Fun Base: Riverside Work Place Project	Academic Research	○	●	●	○	Evaluation of riverside workplaces with campfires
9	JST/Moonshot9 "Child Care Commons" Research Project	Academic Research	○		○	●	Building a childcare support system using blockchain with the participation of residents
10	Wellbeing Shopping Street Project	Community Activities	●	○		○	Formation of a vision for a new shopping district, creation of activities, and promotion of involvement

● : establisher ○ : participant

member of the participating organisation to find out what motivated each participant and participating organisation to join the Oyamachi Living Lab (needs and wants) and incentives. Incentives are external factors that encourage participation and can be described as expectations from the characteristics and features of the Oyamachi Living Lab itself such as the opportunity for collaboration rather than independent implementation. Each interview lasted about 30 minutes and was conducted face-to-face or online. Then we generated transcripts, extracted the element, and sorted out motivations and incentives for participating in LL co-creation opportunities (Table 3). Incentives are current at time of research as ongoing projects are included.

The motivation for participation by stakeholders is largely based on internal motivations and not on social contributions or because they were asked to co-operate. Incentives include a place for collaboration across sectors, which is difficult to secure in normal transactions. Flat relationships are expected between organisations and individuals. Equal relationships based on the community allow companies and governments, in particular, to grasp users' deep needs and diverse opinions. Through co-creation experiences, they become aware of different ways of conducting business from existing approaches. In the community sector, participation is based on individual internal motivations, along with the desire to expand

Table 3. Analysis of Motivations and Incentives

Sector	Stakeholder	Motivations	Incentives
Community	Citizen groups	· Have a place for exploratory activities	· Contact with diverse neighborhood residents · Gentle support for experimental activities
	Citizens who have daily contact with LL	· Daily contact with neighbors · Interest in activities introduced by acquaintances	· Collaboration with people of various attributes · Cozy like a friend's house
	Cooperative house residents	· Acquire city information and new relationships	· Relationships with like-minded community acquaintances · Connection with the LL, which is a point of contact for various activities and interesting project
	Child-rearing parents	· Interest in participating in research	· Co-creation experience with people with different attributes with whom they do not usually have contact
	Board members of a shopping street	· Creation of a new vision and action plan for the shopping street in collaboration with diverse people in the community	· Gain expert and resident insight, new ideas, and connections with residents
Government	Setagaya City Office	· Opportunity for informal and free discussion to encourage the independence of resident groups	· Collaborative relationships between government, residents and designers are smoothed by the university's professional support · Laboratory space suitable for thinking about co-creative themes
	Medical institution	· Creating opportunities to go out to prevent frailty among the elderly · Understanding potential needs of elderly families and providing preventive medical services to local communities	· Practicing a living infirmary not only for the elderly but also for people of various generations · Informal access to healthy residents who do not come to the hospital · Connections with various experts and organizations such as medical welfare, child care, nursing care, etc.
	Junior high school	· Development of well-being education program as career education	· Exploratory process of developing educational programs through dialogue with universities and communities · Laboratory space where various things can combine and interact suitable for the theme of connecting learning in school with society
Company	Residential developer	· Exploring new community formation methods for residents	· Publication of academic qualitative evaluations · Building relationships between residents
	Facility management consulting firm	· Objective assessment of company value through academic research	· High-quality analysis and dissemination capabilities through collaboration with research institutions. · A sense of fulfillment due to the fair and open atmosphere of the laboratory and matching research themes
	Human resources company	· Develop new and effective training programs for workers via an exploratory method in collaboration with well-being experts.	· New ideas and designs through a co-creation process with experts and universities · Experience of being creative outside the logic of a private company
University	Collaborative research universities	· Acquisition of research support and external funding · Student educational environment · Contribution to the local community	· Relationships with co-researchers on diverse research themes, formation of a community that cooperates in research, and advanced research results · Legitimate peripheral participation in practical research and close relationships with local residents · Resolving specific regional issues and acquiring opportunities to improve well-being

activities, and to enjoy opportunities for social co-creation with universities and companies that are not generally possible.

Conclusion

This study presents an analysis of the motivations and incentives of the stakeholders in the 10 projects conducted at the Oyamachi Living Lab in FY2022. Citizen-driven LLs provide an opportunity for each actor to step outside their own field and explore a different approach to their existing way of conducting business, with new partners and new ways of working together. While in a top-down living lab, the relationships among stakeholders tend to be formal, at the Oyamachi Living Lab project that is exploratory and cross-border, the stakeholder relationships are more flexible. It offers a "third space" that is neither for its own benefit, nor for the service that it provides to its clients. Rather, citizens can participate in this space based on their own intrinsic motivations and have the opportunity of co-creation with companies and universities. Governments and companies can also collaborate with citizens to create better relationships with them, which is a key strength of citizen-driven LLs.

Generally, in many LLs, the issue lies with the creation of sustainable, proactive communities of participants. Our findings suggest that in a citizen-driven LL, a project formation process that connects the intrinsic motivations of citizens to corporate and government issues can be effective. What the citizen-driven LL can offer is not just user testing, but rather a process that engages citizens interested in the issues of companies and governments to explore them together. If these opportunities could be provided on an ongoing basis, companies and governments would have an incentive to participate that other research organisations and LLs cannot provide. To this end, it is necessary to form a community that will serve as a database of motivation of diverse individuals and civic organisations in the local community.

However, our research and practice are still ongoing. We have gained a general idea of the motivations and incentives of each sector, but we have not yet known in detail how they change over time or how they differ by type of project (community activities, design projects, or academic research). Once we clarify each actor's level of satisfaction with the project outcomes and the systematic project promotion method from research/design to social implementation, we will be able to accumulate more general management knowledge, such as effective ways of recruiting stakeholders and fundraising for citizen-driven LLs. Going forward, we shall further obtain additional data from our operations of the LL and report on our findings.

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Strategic Plan for the Food Transition of the City of Taranto

Authors

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Abstract

The text discusses the challenges faced by the City of Taranto because of industrialization and the negative consequences it has had on the population's quality of life. The adoption of a Food Policy is proposed as a solution that can improve the environment, create local jobs, and provide access to healthy food for all citizens, ultimately reducing social inequalities and improving health and well-being. The article details the co-design process conducted by CIHEAM Bari and the local administration to develop a strategic plan for the transition of the food system of the City of Taranto. The participatory process involved actors from the quadruple helix, and was divided into three phases, resulting in the identification of strategic orientations and priority actions for the city's food transition. The process highlighted the need for local actors to engage and commit to a sustainable transformation involving the food system. Each city/territory have social resources that the Living Lab approach can integrate in a systemic way to foster the development of solutions aimed at meeting the territory’s specific needs.

Key words

Food Policy, food system transition, Taranto, Living Lab approach, sustainability, health.

Taranto is currently the symbol of a city that has been heavily transformed by industrial policy, unconsciously accepting the negative consequences in exchange for jobs and a growth model that is no longer sustainable as well as monofunctional. The Taranto area today experiences socio-economic and environmental emergencies that affect the population's quality of life. In response to these issues, the adoption of a Food Policy understood as a cross-cutting policy can improve environmental sustainability, local job creation and access to healthy, quality food for all citizens, thus reducing social inequalities and improving the health and well-being of the population.

To start this process, CIHEAM Bari and the Taranto administration divided the co-design activity of the strategic plan for the transition of the food system of the city of Taranto into three phases, involving the actors of the quadruple helix. To this end, relevant stakeholders were firstly mapped, then directly engaged. The connection between local administration and University helped the process.

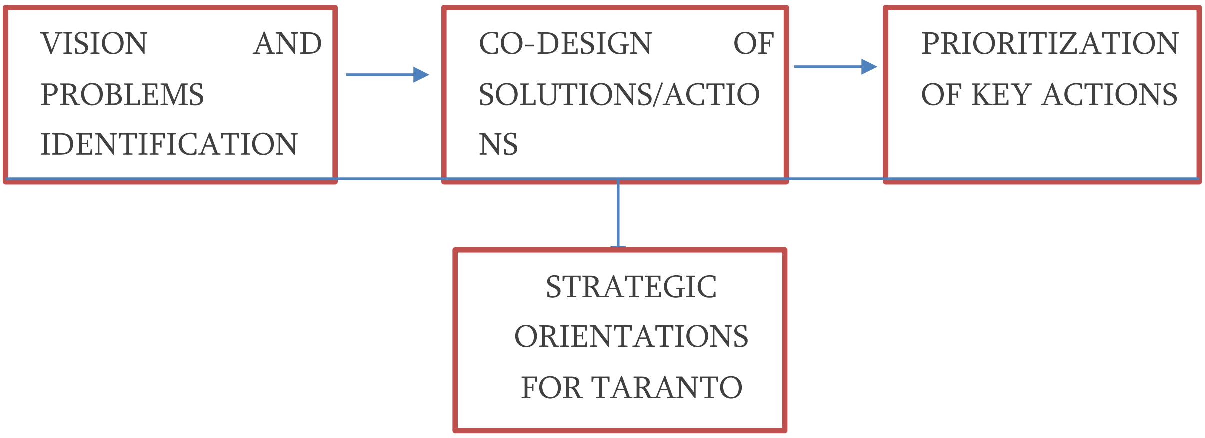


Figure 1. co-design process of the strategic plan for the transition of the food system of the city of Taranto

The first phase engaged participants in a brainstorming activity aimed at:

- Identification of the desired vision.
- Identification of problems that prevent the achievement of the desired vision.
- Existing projects and activities contributing to problem mitigation.
- Missing actors to be involved.

Figure 2. brainstorming – vision and problems

Figure 3. brainstorming results

After collecting and clustering the input received, the brainwriting tool was used during the second phase, with the goal of co-designing solutions that would respond to the problems identified in the previous phase. The participants, after being divided into three groups, developed an idea for each of the problems identified in each vision.

Figure 4. brainwriting – group 1 and 2

Figure 5. brainwriting – group 3

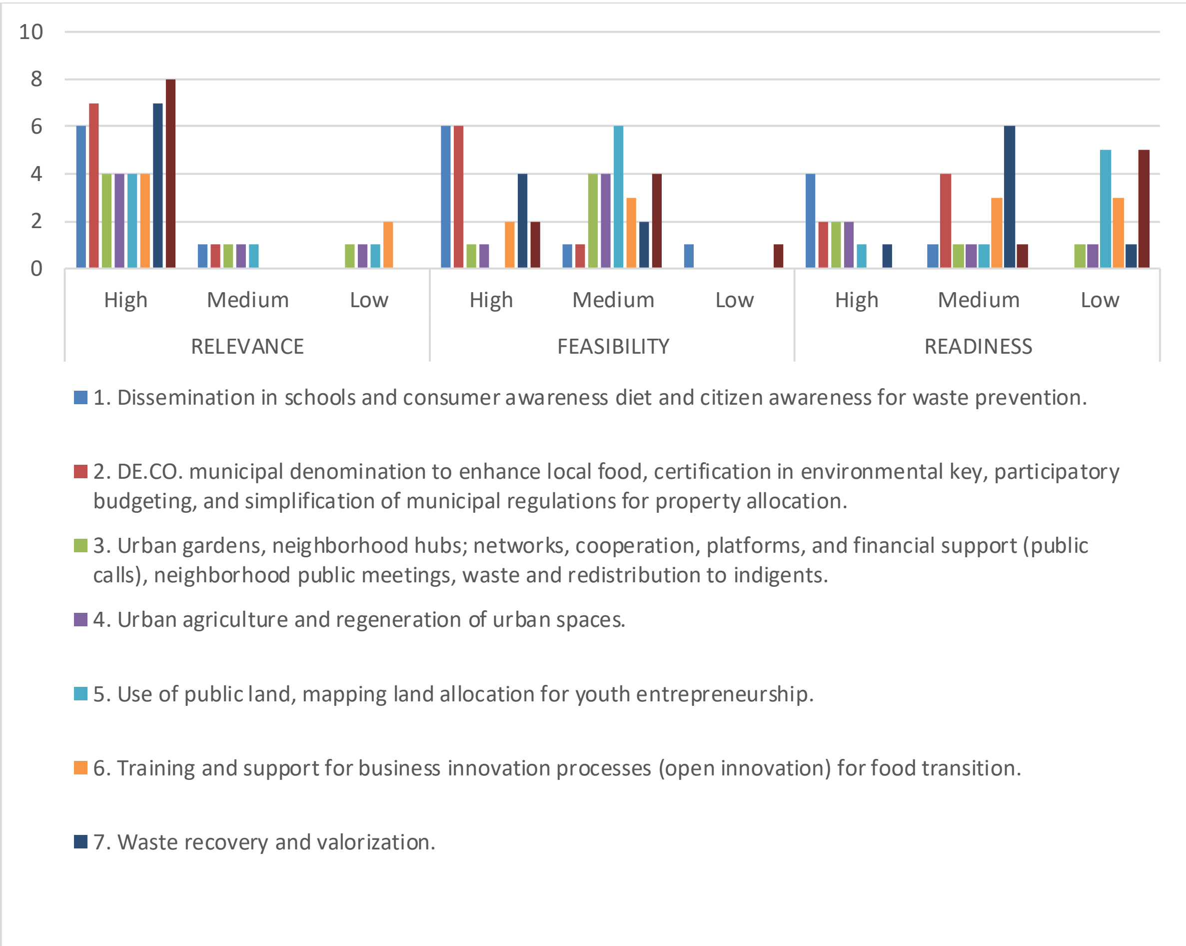
The CIHEAM Bari team, after analysing the results of the previous meetings, existing best practices in food policies, and the guidelines of the Milan Urban Food Policy Pact (MUFPP), presented 8 key actions that could be included in the food policy of the city of Taranto. These actions, during the third and final phase, were prioritized by the participants: they were asked to indicate, for each of the "recommended" actions, the relevance, i.e., how important its implementation was; feasibility, i.e., how feasible it was in terms of administrative, authorization and regulatory tools; and readiness, i.e., the time needed for its implementation.

Figure 6. prioritization

Figure 7. validation of prioritization

The chart below shows the results.

Table 1. prioritization results



The participatory process allowed identification of strategic orientations and priority actions underlying the food transition of the city of Taranto, i.e., those actions that can represent a first element of sharing with Taranto's policy makers as well as a political commitment, with due insights, for the elaboration of the food policy of Taranto.

A fundamental element that emerges from the participatory co-design process is the need required by local actors, in their breadth and diversity of membership, to engage and commit the city of Taranto in a process of sustainable transformation involving the food system.

Thus, this paper aims to foster the application of the approach used in other territories as well, since they have social resources that the Living Lab approach can integrate systematically to foster the development of solutions aimed at meeting the specific needs of the territory.

Acknowledgements

This paper is a summary of the strategic document that CIHEAM Bari has prepared for the City of Taranto. The strategic document will be approved by the city council and subsequently published on the institutional channels of the City of Taranto.

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Research-In-Progress Paper

Co-design in Social Robotics to support Independent Living: Creating empathy and understanding the needs of older people with cognitive impairment

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Abstract

Participatory action research involving older adults with cognitive impairment has largely been considered a challenge, but promoting meaningful and accessible collaborations have been found key for implementing true partnerships in value-driven innovation. In this article, we present the first step on a co-creation process, focused on an initial needs analysis that also looks to the initial perception and response to SARs (social assistive robots) and the understanding on types of support older adults that would be interesting or potentially accepted.
Different sessions were held on the pace of the participants, for which a code of support and facilitation was adopted, thus ensuring a meaningful participation and allowing all participants to express themselves in a respectful, joyful and collaborative environment.
Results reinforce, overall, a positive understanding on the SARs potential, highlighting aspects that affect the acceptance, such as ethical concerns and trustworthiness, opinion divided regarding greater potential for social connection and on key activities to which SARs can be programmed for, being generally accepted as a potentially helpful tool when it is used for support.

Key words

Social robots, co-creation, independent living, older people, cognitive impairment.

Introduction

Life expectancy has increased worldwide. According to the Alzheimer Europe Yearbook 2019, around 9.8 million people are living with dementia in Europe, and it is expected to double by 2050 ("Dementia in Europe Yearbook ", 2019). Providing the necessary care to the elderly has become a challenge. Social robots are considered an ideal alternative for social and health care of older adults. The positive impact of social robotics on older people is supported by scientific results, suggesting that social robots can improve quality of life by reducing loneliness, stress and anxiety (Pu, Moyle, Jones, & Todorovic, 2019).

Despite these benefits, the implementation of social robots includes limitations for adoption, such as the lack of input from older adults in the design and development of these solutions (Pino, Boulay, Jouen, & Rigaud, 2015). Different models have emerged to achieve this goal, such as participatory and user-centred design. These models are primarily based on end users actively involvement into technology development, leading to solutions that are easily acceptable, beneficial and empowering to end users. Taking into account their needs is especially relevant when designing social robots, since their effectiveness and impact depend on their acceptance. Co-design studies with people with dementia have a positive impact for stakeholders as well (Wang, Marradi, Albayrak, & van der Cammen, 2019).

The EIAROB project[1] aims to develop a social robot that will be able to move autonomously in the house, to supervise the well-being of the person (diet, hygiene, medication intake or detection of risky situations), and even to suggest games, exercises, reminders and stimulate physical or cognitive activity, thus offering support to people who live alone and promoting communication with professionals, family or friends. Focusing on the preliminary results could help to empathize and define the end-user needs.

The objective of this study was to capture preliminary priority areas for social robots from the perspective of stakeholders through co-creation processes.

Scoping study about the use of social robots by older people with MCI

[1] The EIAROB project is financed by the Family and Social Services Management of the regional government of Castilla y León (Junta de Castilla y León) through the EU Next Generation funds.

or dementia

A scoping review was made by the research team in order to screen the available studies related to the use of social robots by older people with mild cognitive impairment (MCI) or dementia. This research was made prior to the co-creation process according to the PRISMA (Preferred Reporting Items For Systematic Reviews and Meta-Analyses) criteria (Figure 1). Studies from 01/01/2015 until 17/03/2023 were considered.

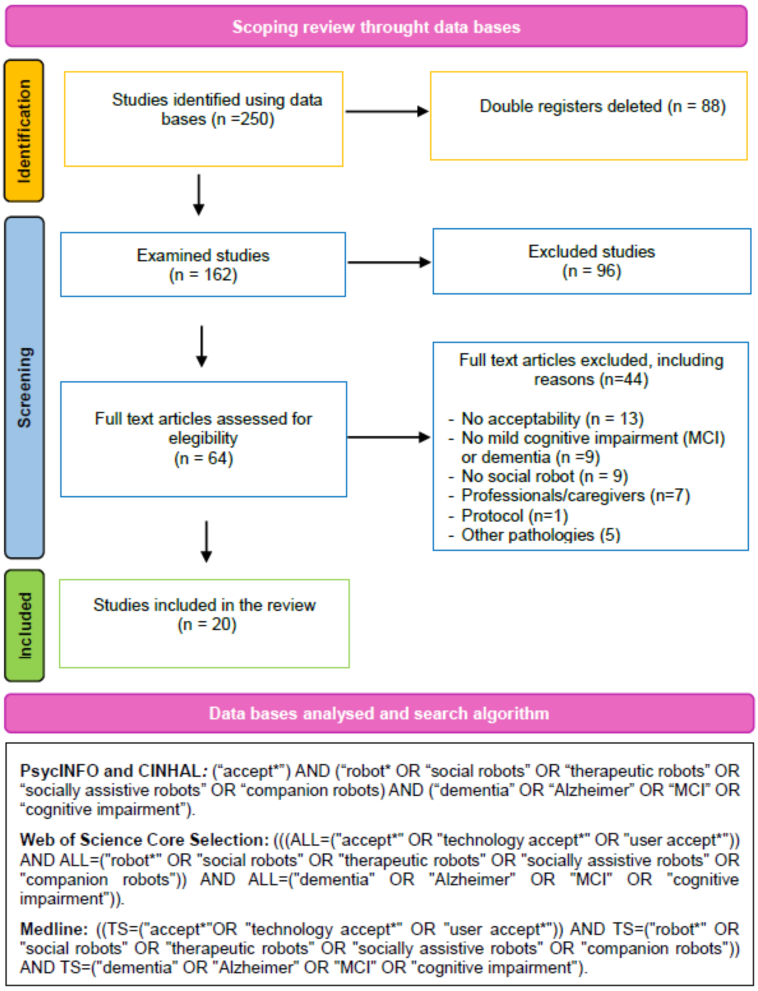

Figure 1. Scoping review about the use of social robots by older people with MCI or dementia: Full process.

The studies analysed show that social robots impact in the wellbeing of the older people with MCI or dementia, being able to relieve depression and isolation, increase social connections and resilience, thus improving their quality of life.

They show a positive attitude towards its use as long as the robot satisfy their needs and requirements. User experience, perceived usefulness, social acceptance and influence and perceived ease of use are key for the social robot acceptability. Personalisation and adaptation of the robot play also a major role in order to be accepted by the target group.

Method

A participatory methodology based on co-creation processes is used, which allows for the involvement of, not only the actors who normally have an active role in this type of design (clinical professionals and engineers), but also the groups usually playing a more passive role (older adults and caregivers). What is pursued in this methodology is to encourage the participation of the end users, recognizing the importance of experiential knowledge and the value of their contributions.

The design process encompasses three consecutive phases: Needs analysis (empathize/define), co-design, co-development (ideate/prototype) and evaluation (test) (see table 1). For this paper, we will focus on phase 1: Needs analysis.

Table 1. Research plan

CO-CREATION			
Phase 1	Phase 2	Phase 3	
NEED ANALYSIS	CO-DESIGN	CO-DEVELOPMENT	ASSESSMENT
Identification of stakeholder needs and implementation factors	Design and development of social robotic solutions in collaboration with end users, formal and informal caregivers, clinicians and engineers		Evaluation of user experience, usability, usefulness, etc.

Co-creation sessions

The proposed methodology is based on an iterative co-creation approach. The co-creation sessions took place at INTRAS Foundation in Valladolid on March 2023. Two 60 minutes co-creation sessions were held. Each of these sessions involved 8 participants (4 older people with cognitive impairment, 1 caregiver, 1 clinical professional, 1 engineer). A total of 14 people participated in the sessions: 8 were men (57.1%) and 6 women (42.9%). The mean age of the participants was 61.4 years with a standard deviation of 18.86.

Each of the sessions was audio and video recorded, and photographs were taken. All the participants were asked to sign an informed consent form agreeing to participate in the study and to use the recorded materials for analysis and dissemination purposes. All the data collected during the co-creation sessions will be analysed both qualitatively and quantitatively.

The methodology proposed in this first phase of needs analysis, is based on a study by Robillard and Kacacińska (2020).

In the co-creation sessions, the following issues were discussed:

1. To identify images that correspond to robots.
2. Social consequences of the use of robots.
3. Ethical aspects.
4. To identify those daily life activities in which robots could help.

Results

Quantitative analysis

The first question was focused to identify in a series of images, which of them corresponded to robots. Figure 2 shows the percentage of people identifying the robots. As can be seen, most of the participants properly identified it.

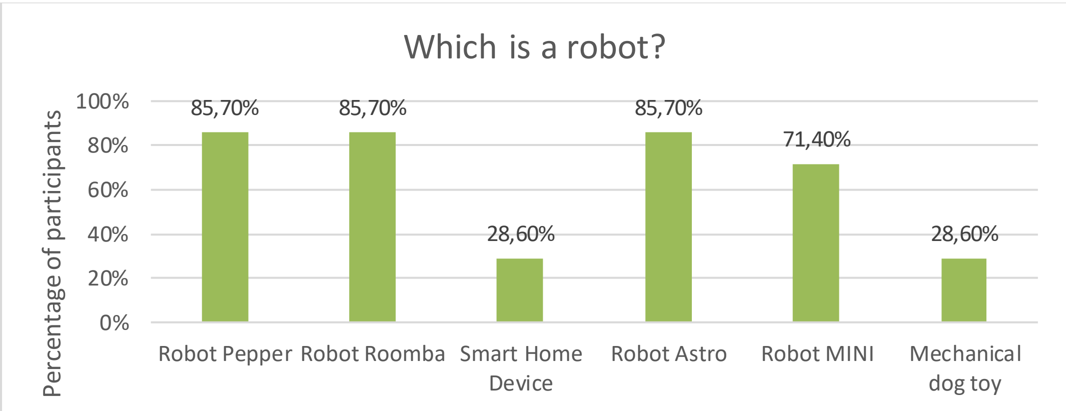

Figure 2. Percentage of participants who properly identified the image as a robot.

The second question revolved around the social consequences of the use of robots and, more specifically, on whether the use of social robots would lead to greater social connection or to more isolation. As can be seen in Table 2, the majority response was greater social connection (42.9%), followed by 35.7% who thought that this would not change the level of social connection. Finally, three people considered that having a robot would bring them greater social isolation.

Table 2. Social consequences of robots.

	Frequency	Percentage
Increased social isolation	3	21.4
Increased social connection	6	42.9
It will not change the level of social connection	5	35.7
Total	**14**	**100.0**

The third question was related to ethical aspects. Participants had to order them from most to least concerned. The results are shown in Table 3. As can be seen, the greatest concerns are focused on the use of the information collected by third parties (2.36), the lack of control over personal data (2.86) and the lack of clarity about liabilities (who is responsible if something goes wrong) (2.93). On the other hand, it is worth highlighting aspects such as attachment to robots and the stigma associated with their use, which has not been considered a priority by the participants.

Table 3. Ethical concerns ordered from most to least concern.

Order	ETHICAL CONCERNS	Mean
1	Use of information by third parties	2.36
2	Lack of control about who sees the data collected by the bot	2.86
3	Lack of clarity on who should be held responsible in case something goes wrong	2.93
4	Personal Information Privacy	3.14
5	Feeling too close to robots	4.43
6	Stigma associated with the use of the robot	5.29

The fourth question was aimed at identifying those daily life activities in which robots could help. Table 4 shows the different activities suggested, considering positively those that obtain a support of 50% or higher. Among all of them, activities such as cleaning the house (92.9%), reminders (92.9%), emergency calls (85.7%), physical exercise coaching (78.6%) and training activities stand out. Other functionalities such as communication, fall detection, home security and environment monitoring, were considered important as well (71.4%). On the other hand, those activities related to hygiene and personal care such as dressing and grooming, going to the bathroom, bathing (7.1%), were not considered helpful.

Table 4. Daily life activities in which robots could help.

	Frequency	Percentage
House cleaning	13	92.9
Reminders (appointments, medication, meal times, etc.	13	92.9
Emergency calls	12	85.7
Fitness trainer	11	78.6
Home security (locking doors, detecting leaks, etc.)	11	71.4
Environment monitoring (temperature, humidity, etc.)	10	71.4
Detect Falls	10	71.4
Communication	10	71.4
Routine monitoring	9	64.3
Food (healthy diet advice, control food and liquids ingested)	9	64.3
Games	9	64.3
Medication	8	57.1
Medical control (blood pressure, heart rate, etc.)	7	50.0
Conversation	7	50.0
Accompany on walks	7	50.0
Find lost items	7	50.0
Open boats, containers, etc.	6	42.9
Assessments (health status)	6	42.9
Brush the hair	5	35.7
Push wheelchair/scooter	4	28.6
Emotional Support	4	28.6
Walking the dog	4	28.6
Shopping and meal preparation	4	28.6
Transport	4	28.6
Manage finances	4	28.6
Bathrooms	2	14.3
Go to the bathroom	1	7.1
Dress and groom	1	7.1

Qualitative analysis

All data collected during the co-creation session was transcribed verbatim and anonymously. Data analysis was carried out with the Nvivo program version 1.7.1 (QRS International), which facilitates the coding and management of nodes. A content analysis and data coding was performed. Previously, relevant topics for the study were identified and new ones were generated. The final themes were (figure 3):

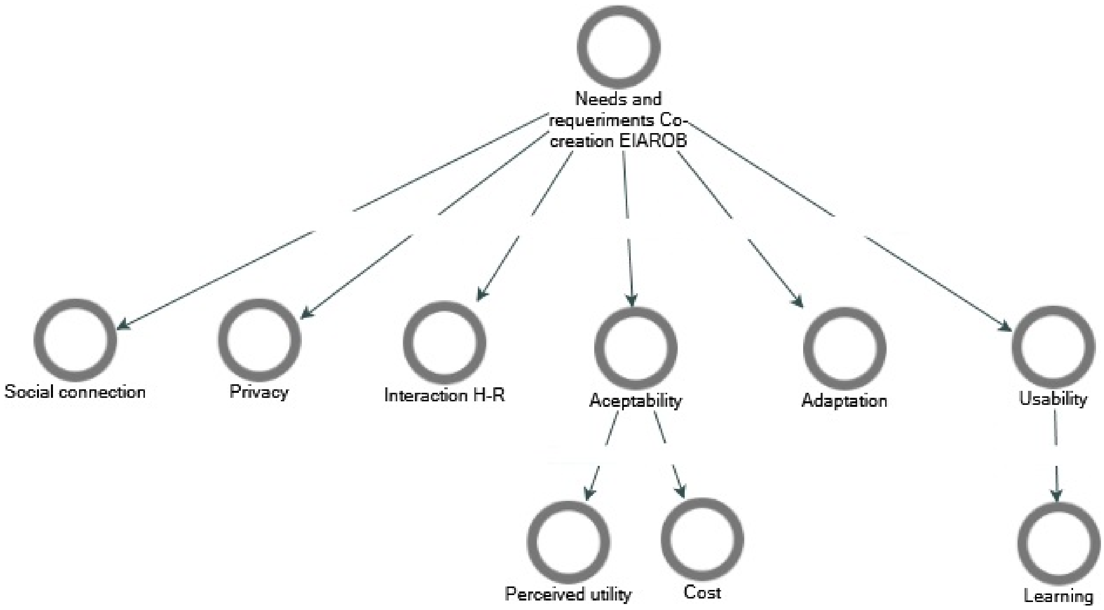

Figure 3. Study topics (node map).

Table 5. Summary of some of the ideas expressed by the study participants about the different topics.

Acceptability (perceived utility, cost)	On the one hand, there are patients who would like to have it at home.	P4G1: *"Yes, I would like to have the robot at home".*
	And even those who immediately perceived its usefulness.	P5G2: *"The robot can be interesting to remember things, to warn you of things".*
	Others, despite being people with cognitive impairment, do not think they need it.	P5G1: *"I don't need the robot nowadays."*
	The cost of the robot was also mentioned.	P4G1: *"Yes, I would like to have the robot at home, but if the robot costs more than an assistant, then maybe I would not like to have one."*
Privacy	Few comments related to privacy came up; these were focused on concerns about the data that the robot could gather.	P4G1: *"Of course we are concerned"* P5G1: *"Yes, it is a concern", although not everyone* P3G1: *"I'm not concerned".*
Human-Robot Interaction	With regards to human-robot interaction, the issue of the robot's response to different situations arose.	P4G1: *"...it depends on what conversations it has recorded, it will give you an answer, but other replies are impossible".*
	It was especially relevant the aspect of the emotional support.	Prof1G2: *"He will only give you emotional support based on what has been programmed".*
	Therefore, it can give adjusted and personalized answers to help the person.	P1G2: *"I do see it as a good thing, ...because it can avoid emotional problems..., a series of responses can be programmed to the robot and it can help you to overcome a certain moment... I think that it can clearly help you".*
Social Connection	Positive comments arose related to the possibility of being able to communicate with your contacts.	P4G2: *"I think so..., it's good to be able to communicate".* Cuid1G2: *"It's good that you can communicate with your contacts".* Prof1G2: *"If you manage to contact yes, yes...".*
Adaptation	Another aspect that was commented was the one related to the ability of the robot to move within the house.	P4G1: *"You have to prepare the house to be able to have the robot, since there should be no obstacles that prevent its movement.* In this sense, Prof1G1 commented: *The issue of opening and closing doors is important... the robot can be locked".* Ing1G1: *"You can go through the frame of a 60 cm door... and I can't open a closed door."*
Usability (learning)	The participants considered that they could handle a robot with the presented characteristics without major problems.	4G1: *"If the robot is similar to the one in the video, yes, I could handle it well"*; P5G1: *"Today, yes, it is similar to a mobile, you give it some orders"*; Cuid1G1: *"It would be to put myself with it..."*
	Caregivers and clinical professionals see that there could be some problems to handle the touch screen	Cuid1G2: *"A touch screen is not so easy for people who aren't used to using screens, sometimes you press and go twice and you've gone too far... a bit of simplicity is missing.* Prof1G2: *"A touch screen for the elderly, there are many people who develop tremors and that is a problem".*

Conclusions

Preliminary quantitative results, indicate that most of the participants correctly identified the images of the robots, which shows that, despite the different forms of robots, they are somewhat familiar with how this technology looks like.

Regarding the social consequences of using robots, the predominant consideration in the co-design group was that using a robot would produce a greater social connection, and this is an important factor for the acceptability of the technology. A minority did not think that this technology can influence the level of social connection. This could be related to the expectations of the users about the possibility of having a robot replacing human interaction.

With regards to the ethical concerns of the participants, the focus was on the use of the information that the robot collects. It is evident for them that having a robot at home involves that personal and private information of the end-user is gathered and processed as sensitive information. Assuring control over that information related to the end-user is of outmost importance, being crucial for the older adult security when interacting with a robot.

In relation with daily life activities in which robots could help, those related to housekeeping, food, medication, reminders, communication and leisure aspects stand out significantly. Home security aspects (alarms, fall detection, etc.) and environment monitoring are considered very relevant.

The results of the qualitative analysis have yielded results in aspects of acceptability, privacy, human-robot interaction, social connection, adaptation and usability. The robot must be designed taking these aspects into account, since whether the robot is not perceived as useful, this will affect its acceptability. Therefore, the robot must be easy and intuitive to use, perform tasks that are essential for the person and implement these tasks in a reliable way.

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Innovation Presentation Outline

Mobile Hybrid Energy System as Open Innovation Ecosystem

Authors

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Abstract

Continuous power balance is the key property in electric energy systems. In other words, the produced electric power needs to match the consumed power all the time. In case of imbalance the quality of electric energy declines. The frequency of electric energy serves as the primary indicator of quality: if the nominal power of consumption exceeds the production, frequency will decrease, and vice versa. The sensitivity of frequency on power imbalance depends on inertia, which is significantly reduced due to ongoing smart energy transition [1]. Inertia arises from power production with massive synchronous generators, which are used in traditional energy production by means of fossil-based power production, and also in hydro and nuclear power plants. In smart energy transition, fossil-based power production is run down, which results in significant reduction of inertia in the power grid. And as the fossil production is mainly replaced with weather-dependent wind and solar power, they provide hardly any increase of inertia, since they are connected to the grid via power converters. As a consequence, smart energy transition causes significant reduction of inertia, which results in increased sensitivity of frequency in power imbalance situations. This is to say, new technical solutions and more accurate power control is required to ensure high quality of electric energy in modern and sustainable power grids. [2]

One example of a new technical solution to ensure high quality of electric energy is the combination of energy storage and smart control. At Tampere University of Applied Sciences we have built a technically versatile mobile hybrid energy system (Figure 1), which enables the demonstrations of smart energy transition related modern electric drives as living lab examples. The mobile hybrid energy system has served as open innovation ecosystem that provides real-life examples of modern electric drives, in which weather-

dependent renewable production, energy storage and smart power control play key roles. Several companies and public stakeholders have also been involved, which significantly increases the sustainable impact. [3]

Figure 1. Mobile hybrid energy system built in two trailers. The left trailer includes energy storage system, and the right one encloses power electronics system and high power charging station for electric vehicles. Technically versatile system offers excellent open innovation ecosystem for modern electric drives of smart energy transition. [3]

In order to serve as open innovation ecosystem for modern electric drives of smart energy transition, the mobile hybrid energy system needs to be technically versatile and flexible. The word hybrid refers to multiple choices for sources and loads of electric energy. For example, photovoltaic system, energy storages (battery or ultracapacitor), power grid or some reserve power station may simultaneously serve as energy sources. In order to enable simultaneous utilization of electrically different sources, sophisticated power electronics is required for matching. Then, electric energy from multiple sources can be supplied to different loads and drives, to power grid or to energy storages. In the design and construction of the system, investment was all the time in the diversity of modern electric drives of smart energy transition. In this way the possibility to serve as open innovation ecosystem was enabled. Modern electric drives, such as peak shaving [4], supporting the grid, providing green reserve power, enabling isolated grid for off-grid situations, offering mobile charging of electric vehicles, etc., can be implemented.

In general, numerous hybrid energy systems have been built for different targets of use. Many investigations of hybrid energy systems have been targeted for electric vehicles [5, 6], and mobile charging solutions [7-11]. Other typical uses for hybrid energy systems are in smart grid solutions [12] and in supporting renewables [13, 14]. The mobile hybrid energy system presented in this paper is not tailored for any specific use, but instead, we wanted to build as technically versatile system as possible to act as open innovation ecosystem for the demonstration of different modern electric drives.

Key words

smart energy transition, energy storage, renewables, smart power control, open innovation ecosystem

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Research-In-Progress Paper

Initiating a regional innovation ecosystem: engagement tools supported by a Living Lab approach

The case of plastic waste bioprocessing

Authors

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Abstract

The regional management of plastic waste generated by economic activities poses many challenges. Recent work by a biotechnology research group has enabled the characterisation of a local bacterium capable of degrading certain plastics, a new and promising solution for the implementation of a regional innovation ecosystem. Few works document the tools that promote the initiation of ecosystems, and our research project, using social innovation design, aims to test and prototype mediation tools and methods that will enable the commitment of actors to a future ecosystem. The contribution of this project is therefore part of the framework of an intermediary organisation with a Living Lab in the making approach.

Key words

regional innovation ecosystem; bioprocessing; plastics; plausible promises; social innovation design; living lab

Overview

In a region of Quebec, economic activity generates a large plastic waste management problem. Bioprocessing of this waste (Tournier et al., 2020) is one way to reduce the scale of the problem and stimulate innovation. This research programme on biotransformation and open innovation focuses on optimising the biodegradation process of plastic waste on one hand, and on the other hand, on the role of human actors in solving the problem of plastic waste management through an open innovation approach. In this context, this project aims to study, through the use of collaborative tools within a platform of exchanges and concerted actions, how to encourage the commitment of actors to the implementation of the solution in a regional ecosystem of plastic waste management.

By definition, an ecosystem is "a multilateral structure of organisations that materialises a joint value proposition (...) Ecosystems have two distinctive characteristics (...) : complementarities and interdependencies are present at the same time, and the system is not fully hierarchically controlled (...)" (Cobben et al., 2022). A regional innovation ecosystem (RIE) is also defined geographically and allows innovation to be stimulated by the proximity of actors in its territory (Doloreux & Bitard, 2005). This proximity favours the circulation of information through meetings and opportunities for co-creation and collaboration, which are conducive to innovation (Torre, 2018). In order to be effective, the RIE must meet several criteria: creativity fostered by the confrontation and intersection of diverse knowledge and practices, and coordination of the diversity of actors and functions. The Living Lab (LL), by definition, encompasses these functions, in particular by orchestrating the participation of actors in the RIE (Guimont & Lapointe, 2016; Schuurman et al., 2019). Moreover, the proper functioning of an ecosystem is supported by two essential components: the presence of an orchestrating body and that of a platform for exchange between the different actors in the ecosystem (Cobben et al., 2022), which is envisaged here according to an LL approach (Malmberg et al., 2017).

The aim of this research is to evaluate different forms of tools and activities to be carried out within the exchange platform that brings together the actors of the existing network, namely those of the plastics recycling sector. In fact, in the region concerned, several plastic recycling actors (researchers, companies, non-profit organisations, municipalities, etc.) work together due to their geographical proximity, but they do not form an ecosystem due to the lack of a common value proposition. While many articles focus on the analysis of established innovation ecosystems and the search for evaluation criteria for these ecosystems, too few document the initiation phase of this governance model. However, the existing literature shows that in the context of ecosystem initiation, the attitude of the leader is a key element (Dedehayir et al., 2018). Indeed, his or her role is to facilitate governance, forge partnerships, and lead the management of the platform and its value creation (Dedehayir et al., 2018). In the context of entrepreneurial ecosystems, this ecosystem initiation phase itself can be divided into five phases: Initiate, Design, Review, Activate, Sustain (Nthubu, 2021). The first two phases aim to ensure the networking of the ecosystem through network mapping tools and co-design of the future ecosystem (Nthubu, 2021). We would like to apply this division into phases to the context of the region hosting a future ecosystem. To do this, we propose to include in a first iteration of the exchange platform needed to initiate an ecosystem, a set of tools to support engagement and co-design of the ecosystem within the existing network, using the concept and methodology of plausible promises. Plausible promises are defined as "the discourse formulated by an initiating actor, faced with a given situation, with the aim of mobilising a set of target actors in a collective response to this situation"(Bijon, 2022). This methodology is enriched by the systemic design methodology (La Roque et al., 2021) and the JIGSAW model (Nthubu, 2021). Our project is therefore based on the capacity of design to generate controversy and mediation at the intersection of several knowledge production levers (Renon, 2020) and proposes to adopt a social innovation design approach based on resilience-driven activities for sustainable future systems (Tromp & Vial, 2023), a stance that is in line with the principles of LL.

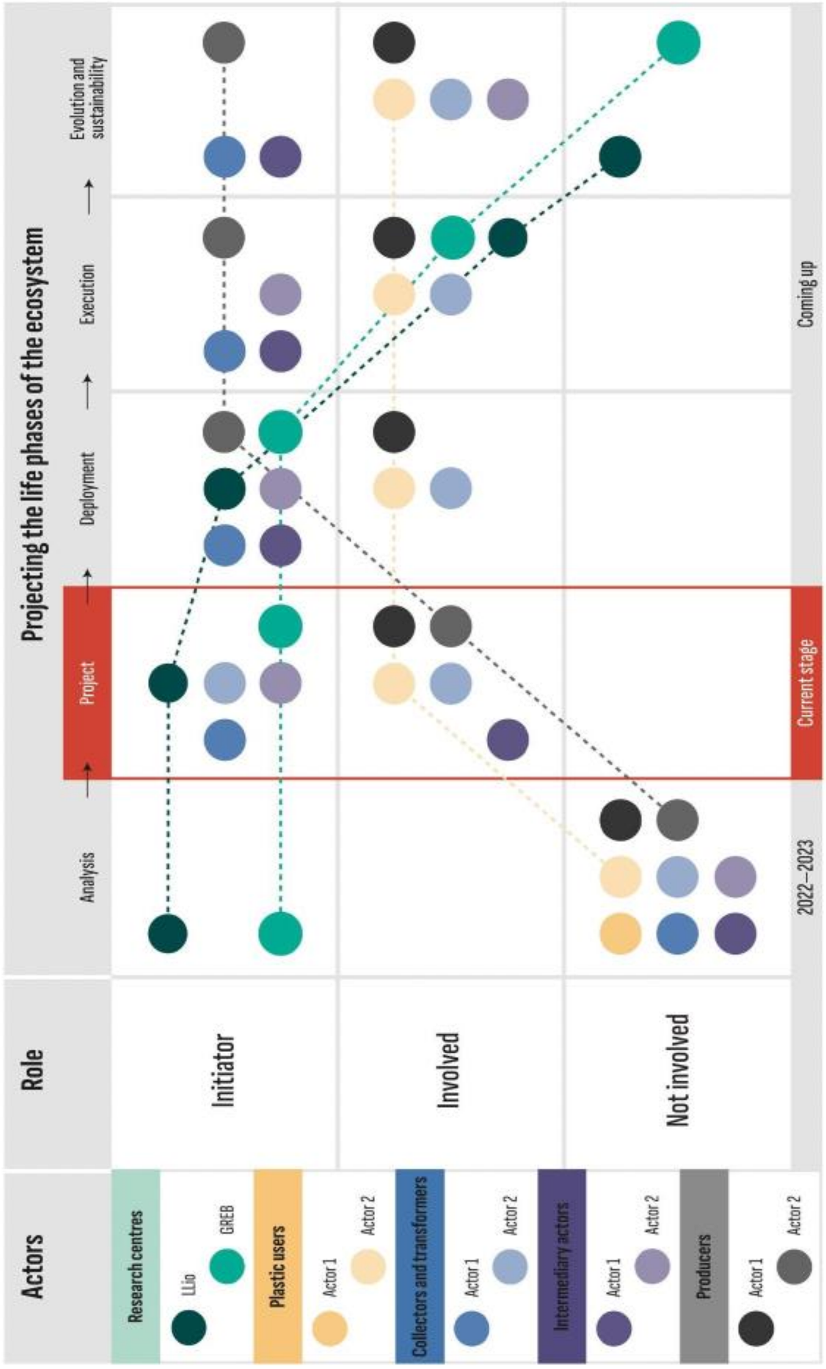

Figure 1. The role of stakeholders in the life of an ecosystem

Methodology

There are two steps to our methodology. The first step consists of a comprehensive analysis of the socio-technical network of plastics recycling through the reading of existing public documents and recorded interviews with the actors involved in the network (intermediaries, users, collectors and processors) and the researchers who initiated the bioprocessing solution. The number of informants is therefore not known a priori, but will respect a ratio representative of the number and diversity of actors involved in the socio-technical network. The aim of this stage is to ensure that the network is framed, to define its boundaries and to identify the existing links. To this end, an interview guide provides a precise grid for analysing the issues in the field, and the use of physical and graphic tools enriches the exchanges by highlighting the network in which the actors are involved and the role they play in it. The collection of photographic and physical (materials) data provides additional understanding. The analysis of the information collected during the first step of the project will make it possible to initiate the activities of the platform through various tools and to formulate plausible promises, i.e., imaginary scenarios for the implementation of the bio-processing solution.

The second step consists of a model for a physical platform for exchange and concerted action. In order to introduce plausible promises, the actors recruited for the activity will be made aware of the whole network and the key elements identified in the analysis phase (step 1). Several stations will be designed to transmit information from the socio-technical network, and the use of different communication media (audio, visual and material) will make it possible to understand the most relevant ways of communicating information, i.e., those that generate the most interest and feedback from the actors. Secondly, the exchange space will host a moment to present plausible promises. These will be discussed by the participants in order to identify possible evolutions in the way the innovation will be developed and deployed.

Several data collection tools will be used to analyse stakeholder engagement, to refine the proposed solution and to prepare future platforms for further stakeholder engagement. Video recording tools will be used to record the interactions of the participants at the different stations of the socio-technical network representation and during the presentation of the plausible promises (time spent at the different stations, number of artefacts used). A questionnaire will be used to collect the level of potential commitment to the proposed solution. Finally, the comments generated to evaluate the information available at the different stations will be analysed.

These tools are based on an interpretation of the different VARK learning models (Othman & Amiruddin, 2010) and an adaptation of the MASCO method of controversy mapping (Desfriches Doria, 2022). These tools are built on the belief in the importance of 'raw empirical experience' as a first step in objective reasoning (Renon, 2020).

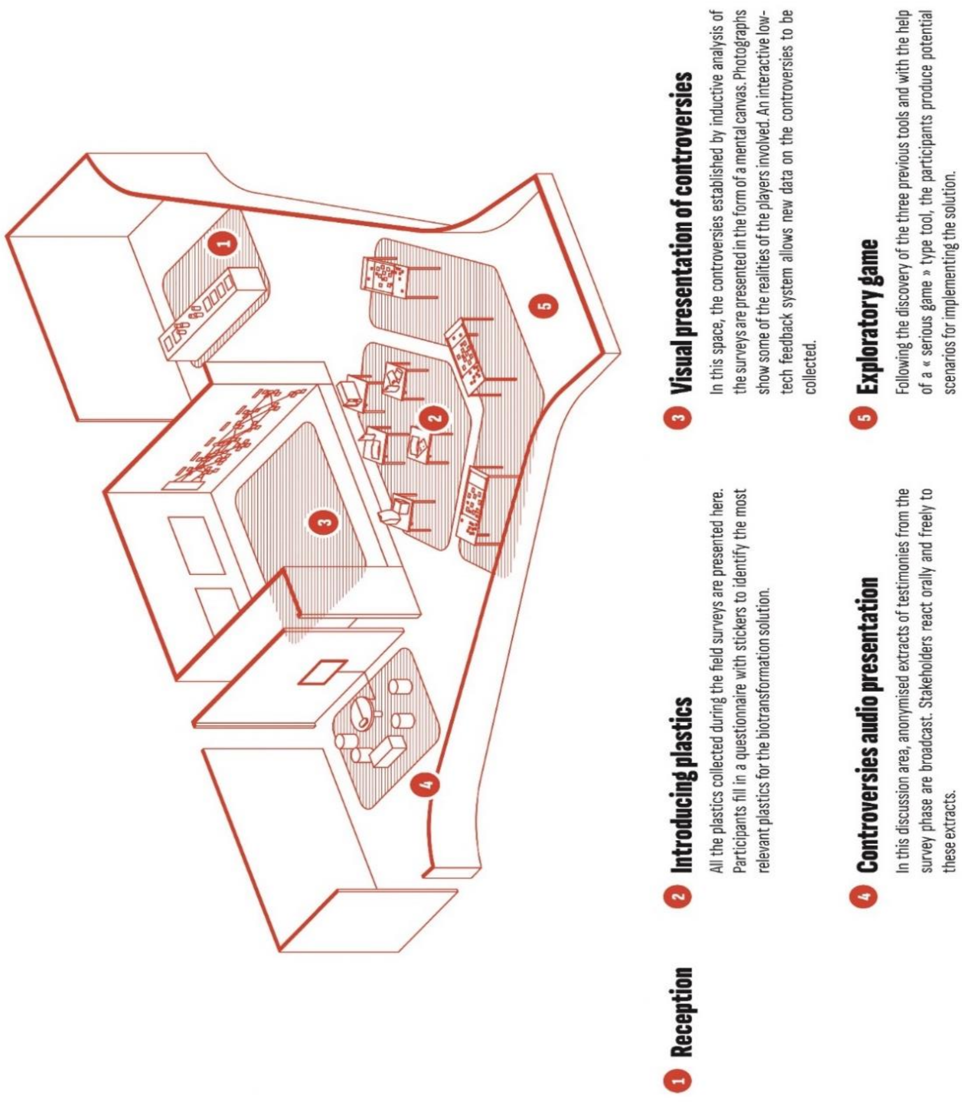

Figure 2. Overview of the platform tools

Conclusion

This project focuses on the evaluation of stakeholder involvement in an applied research programme to promote the integration of a solution in an RIE for plastic waste management through an LL mode approach. Based on the existing literature, we propose to organise a platform for exchange and concerted action. We materialise the current state of the socio-technical network of plastic waste management through different tools and formulate fictitious scenarios of implementation (plausible promises) of the innovation.

The analysis of these tools will shed light on the hypotheses formulated in the framework of this research, namely that the contribution of design methodologies and tools could help foster commitment and stimulate the imagination of network actors. The main hypothesis is that the form of the platform will make it possible to create or intensify links between these actors. The work of mediation through design could foster a better understanding of the environment and the network in which the innovation is implemented by its current and future actors. Finally, the development of a debate could be stimulated and accompanied by the organisation of this platform and the tools presented.

Subsequent platforms could be adapted according to the actors' reaction to the proposal made, thus completing the knowledge of a LL's action possibilities in initiating a regional innovation ecosystem.

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Innovation Presentation Outline

Lessons learned in the establishment of 10 Coastal City Living Labs within a H2020 framework

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Abstract

The SCORE project is creating Coastal City Living Labs (CCLLs) across six countries to tackle climate-related hazards using ecosystem-based approaches and smart technologies. Establishing these labs presents challenges due to the heterogeneous nature of each community and the complexity of SCORE's technical activities. To ensure future success, a lessons-learned methodology was established, involving mixed-methods data collection from the CCLL teams. The lessons learned from this multisite research project can be divided into internal and external factors, including challenges related to diverse team composition and stakeholder engagement. This reflection on SCORE provides insight into the challenges of interdisciplinary and large-scale research involving living labs and offers possible solutions for the future.

Key words

Living labs, methodology, impact, knowledge transfer, implementation

Problem Statement

SCORE (H2020 project) is developing a network of Coastal City Living Labs (CCLLs) to address climate-related hazards and enhance climate resiliency through ecosystem-based approaches and smart technologies. Establishing ten CCLLs across six countries is challenging due to the CCLLs' diversity and SCORE's technical complexity. Reflecting on "lessons learned" is crucial for the development of current and future CCLLs.

Methods

The CCLLs have been established using the Living Lab Integrative Process (LLIP). To reflect on the CCLLs implementation, a lessons-learned methodology was established, which involves a mixed-methods collection procedure, including recurrent interviews, surveys, and other group discussion methodologies (i.e., World Café) with the CCLL teams.

Results

The lessons learned across the CCLLs are largely homogenous despite the disparate nature of the CCLLs. They have been organised based on internal and external challenges.

SCORE is a complex project with 28 partners with variable expertise who all contribute to the advancement of the CCLLs. Within each CCLL, the core-team's also have varying composition and expertise, posing internal challenges, particularly during the early stages of the LLIP. The partners and CCLL core-teams were not consistently using mutually understood terminology, further, CCLL core-teams are often composed of multiple organisations with differing Living Labs (LLs) experiences, and conflicting schedules. This ultimately caused delays in the progress of certain CCLL activities and a sense of uncertainty within the CCLL core-teams during the Problem Phase. A key lesson learnt from this is the importance of training all partners to a common level on the LL methodology and SCORE's technical processes. When reflecting on the challenges faced, we understand now that a uniform SCORE terminology guide and practical LL examples would have facilitated the empowerment and understanding within SCORE early on.

As SCORE moves into the "solution space" of the LLIP, the lessons learned are increasingly developed based on external challenges and are predominantly linked to stakeholder engagement, including knowing when and how to engage which stakeholders and managing their priorities. Lessons learned include developing tailored communication and engagement strategies, and maximising alignment between the stakeholder's priorities and SCORE's expected outcomes.

The benefit of multisite research is that the CCLLs are not isolated in their challenges and successes. The network developed within SCORE means the CCLLs have easy access to each other and benefit from knowledge sharing, which is formally facilitated within the SCORE framework. So while the challenges of establishing such a complex network are extensive, particularly during project initiation, the opportunities for knowledge sharing and collaboration amongst the CCLLs are proving to be exceedingly valuable.

Disclaimer

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The European Network of Living Labs (ENoLL) is the international association of benchmarked Living Labs in Europe and worldwide.

Founded in November 2006 under the auspices of the Finnish European Presidency, the network has grown in 'waves' up to this day.

ENoLL counts today over 150 active Living Lab members worldwide. Directly, as well as through its active members, ENoLL provides co-creation, user engagement, testing and experimentation facilities, targeting innovation in many different domains such as IoT& AI, media, energy, mobility, agriculture & agri-food, social innovation, smart cities & regions, culture & creativity, health & well-being, environment, etc.

Via our Action Oriented Task Forces and Working groups, ENoLL empowers knowledge sharing and cooperation in- and outside our network.

The Capacity Building Program of ENoLL creates strong connections in-between the experts of the network and all organizations wanting to learn the principles of setting up & running a living lab.

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