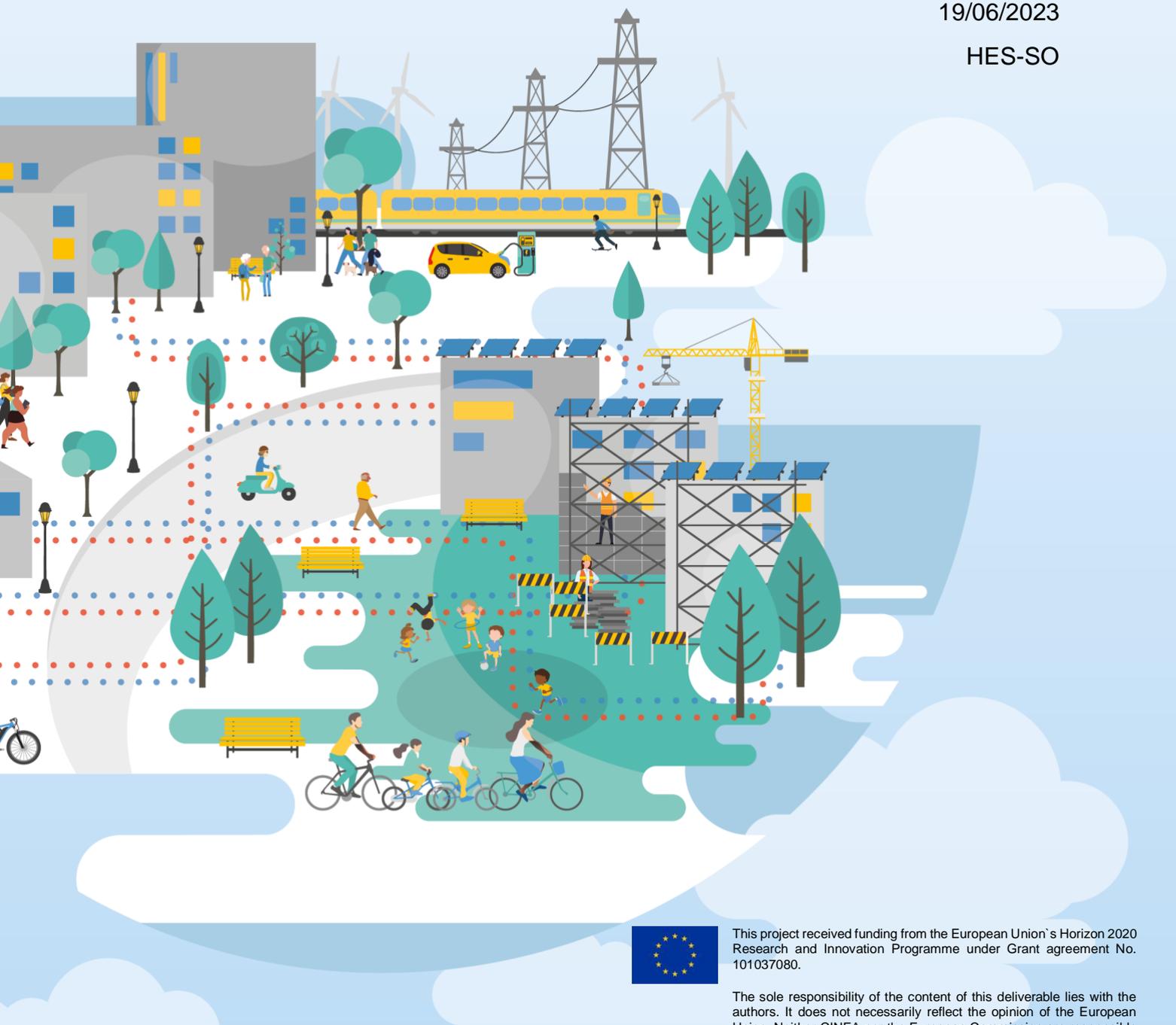


Capacity building handbook and mentoring report

For the set up and implementation of Positive Energy Neighbourhoods through a Living Lab Approach.

19/06/2023

HES-SO



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- [Coventry City Lab](#), UK
- [LiCaLab](#), Belgium
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Abbreviations and Acronyms

Acronym	Description
AOTF	Action-oriented Task Forces
BAPV / BIPV	Building Applied Photovoltaics / Building Integrated Photovoltaics
BIM	Building Information Modelling
BM	Business Model
CBP	Capacity Building Programme
CVC	Computer Vision Center
DC	Direct current (about power supply)
EbAs	Ecosystem-based Approach solutions
EC	Energy Community
EIB	European Investment Bank
ELLA	Energy Living Lab Association
ENoLL	European Network of Living Labs
GHG	Greenhouse Gas
GM	Governance Model
HES-SO	University of Applied Sciences Western Switzerland
IMP	Innovation Management Plan
IPR	Intellectual Property Right
IT	Information Technologies
KWMC	Knowledge West Media Centre
LEC	Local Energy Community
LL	Living Lab
LLIP	Living Lab Integrative Process
MCA	Multi-Criteria Analysis
MIT	Massachusetts Institute of Technology
MOU	Memorandum of Understanding
PEN	Positive Energy Neighbourhood
PPPP	Public-Private-People Partnership
PV	Photovoltaics
SME	Small and Middle Enterprises
SRL	Societal Readiness Level
SWEET	SWiss Energy research for the Energy Transition



SWOT	Strengths and Weaknesses, Opportunities and Threats
TRL	Technology Readiness Level
UAB	University of Barcelona
WG	Working group

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0. Executive Summary

This Capacity Building Handbook and Mentoring Report is a guide to support the set up and implementation of Positive Energy Neighbourhoods (PENs) using a Living Lab approach. As important drivers of transformational change for the successful decarbonisation of the European building stock, PENs seek an integrated, participatory and neighbourhood-based approach to maximise the benefits of innovative energy systems. Living Labs facilitate this change by co-designing solutions with citizens through open and user innovation. Society's level of readiness for technological and social innovations is tested and implemented in the PENs.

Through the oPEN Lab project, three Living Labs at Genk (Belgium), Tartu (Estonia) and Pamplona (Spain) have been working extensively to establish PENs. This handbook summarises the methodology and key outcomes of applying Living Lab concepts, methods, and tools in the three oPEN Labs from September 2021 to March 2023.

This Handbook is produced for:

- The existing oPEN Living Labs as a reference guide to setting up and implementing a Living Lab for PENs and the associated Capacity Building programme. It may also be useful for onboarding new team members in the consortium.
- Other projects working on the development of PENs or energy retrofit projects in general such as ARV, Atelier, Metabuildings Lab, LIFE Beckon, Energiesprong, SWEET Lantern, among others.
- Other organisations interested in setting up a Living Lab or intending to use participative methods and tools to develop PENs. The handbook could be adapted to different fields and used as a practical guide on the Living Lab methodology and use-cases.

The handbook explains what a Living Lab is, how to set up a Living Lab, Co-Creation and Co-design, Stakeholder Ecosystem management, Governance and Business Models of Living Labs. It gives extensive examples from oPEN Lab and Living Labs across Europe, as well as templates for tools and methods used throughout the set-up phase.

The mentoring report highlights the mentoring needs of the oPEN Labs such as how to integrate industrial partners and share data in an open innovation environment.

The oPEN Living Labs face many challenges, risks and barriers along their journey of developing the PENs, however their participatory approach, methods, tools and lessons learned have resulted in a very positive start to the oPEN Lab story. We hope you find this handbook useful and please do not hesitate to give us feedback through the [oPEN Lab Project website](#).

1. Introduction

This handbook presents a summary of theory and practice applied through the capacity building programme of the oPEN Lab project in the set up and implementation phase of three Living Labs at Tartu in Estonia, Genk in Belgium and Pamplona in Spain to develop Positive Energy Neighbourhoods (PEN).

PENs are important drivers of transformational change (oPEN Lab, 2022). Successful decarbonisation of the EU building stock calls for an integrated, participatory, and neighbourhood-based approach (EC, 2020).

The PEN definition determined by oPEN Lab project is:

“Positive Energy Neighbourhoods are energy-efficient and energy-flexible groups of connected buildings or urban areas which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy. PENs seek an integrated, participatory, neighbourhood-based approach to maximise the benefits of innovative energy systems”

The development of the PENs is supported in this project by Living Labs in each city and they can be defined as:

“A Living Lab is an innovation intermediary that orchestrates an ecosystem of actors in a specific region. Its objective is to co-design solutions in an iterative way in a public-private-people partnership (PPPP) and in a real-life environment. To achieve its objectives, the Living Lab mobilises existing innovation tools or develops new ones.” (Mastelic, 2019).

The Handbook aims to be a practical guide which summarises the methodology and key learnings of applying Living Lab concepts, methods, and tools in the three oPEN Labs during the set -up phase. Mentoring recommendations throughout the rest of the oPEN Lab project until March 2026 are provided.

1.1 oPEN Lab Project and Living Labs' Settings

The following information has been adapted from the [oPEN Lab Project Website](#). oPEN Lab is a project funded under the European Union's Horizon 2020 Research and Innovation Programme. Under the coordination of VITO, 32 partners from 7 countries are collaborating to revitalise urban areas across Europe to lead the transition to PENs. Over the duration of 4.5 years, oPEN Lab will focus on identifying and demonstrating replicable, commercially viable solution packages enabling to achieve positive energy buildings and neighbourhoods. Activities will take place in the three oPEN Living Labs whose setting and activities are described here:

1.1.1 oPEN Lab – Tartu

Tartu's Annelinn district is socio-demographically diverse and densely populated. The main characteristics of the district are:

- The area was built during the Soviet period (1970s-1980s) and is characterised by low quality construction, five- and nine-storey apartment buildings with small flats and limited public space around the buildings.
- A multi-lingual community with speakers of Estonian, Russian and third languages
- The most densely populated district in Tartu, with almost a third of the population.
- The exact pilot area includes 22 nine-storey apartment blocks at the end of Annelinn, where nearly 3,500 people live. In this area, three apartment buildings will be renovated, the surrounding area will be cleaned up and residents will be involved in various social initiatives and experiments.



Figure 1: Annelinn Neighbourhood,

Credits Siilak

The activities planned in the Tartu Annelinn pilot area are:

- Full renovation of three apartment buildings, including the installation of solar panels and a solar energy storage station, and the introduction of home automation.
- The creation of original works of art on the walls or around the renovated houses.
- Improving public spaces, including new cycle parking, improving accessibility of services, etc.
- Studies on behavioural change, including changes in mobility and acceptance of technology.
- Social innovation experiments, including experiments with play elements.

The current key challenges for oPEN Living Lab Tartu are:

- Market and financial situation with high interest rates and costs of retrofit for residents
- Establishing a path forward for the Living Lab by exploring alternative financing and buildings options for retrofitting.

1.1.2 oPEN Lab – Pamplona

oPEN Living Lab Pamplona will deploy one of the first PENs in Spain, demonstrating an advanced, scalable and replicable urban energy model; they will also develop and validate innovative solution packages for the renovation of buildings and energy services, in response to the challenges of the Renovation Wave, that contribute significantly to the decarbonization of the urban environment.

The project's actions will focus on the Rochapea district, a working-class neighbourhood, whose origins date back to the 1940s with the establishment of industry north of the old town, which, despite decades of economic difficulties, maintains an industrial legacy in its architecture.

The Pamplona Living Lab will carry out the profound energy renovation of the old and emblematic industrial complex of IWER, as well as two housing blocks of the San Pedro group, and then carry out the energy linkage, thus sowing the seed of the positive energy neighbourhood of Rochapea.

The driving idea of the Living Lab in Pamplona comprises the determined investment in integrated and superimposed photovoltaics (BIPV and BAPV), reaching a critical mass of urban energy generation, as well as the demonstration of innovative industrialized renovation solutions, advanced energy management systems and process improvements, taking advantage of digitalization, to cover the entire life cycle of the buildings and the infrastructure of the neighbourhood.



Figure 2: The Rochapea Neighbourhood

Credits: Google Maps



Figure 3: The IWER Buildings

In Pamplona the following activities will be carried out to develop a PEN:

- Implement the concepts of Open Innovation and Living Lab to maximize end-user participation in the development of solution packages, as well as in the validation of new products and services.
- Drive economic transformation, generating new business and employment opportunities related to deep energy renovation and renewable energy generation for existing buildings and their articulation in a PEN.

- Integrate life cycle thinking from the earliest stages of design to ensure that embedded energy is reduced by 50%, as well as a 75% reduction in Greenhouse Gas (GHG) emissions by the end of the project, and towards zero by 2030.
- Implement seamless and innovative digital workflows for design, advanced industrial manufacturing, construction or renovation that contribute to reducing time and costs by 40%.
- Undertake a determined investment in integrated photovoltaics to reach the critical mass of local generation for self-sustaining scalability of the PEN concept.
- Develop digital twins for multi-vector energy optimization, determining operational strategies for efficient facility management of buildings and neighbourhood energy assets.

The current key challenges for oPEN Lab, Pamplona are:

- The complexity and cost of multiple control systems in the buildings.
- How to have citizens actively involved and valued positively?
- How to continue to convince citizens of the value of participation?
- How to engage the private sector?
- Rochapea energy community's decision on the legal entity to adopt and draft community statutes.
- Policy and legal barriers and challenges for Energy Communities.

1.1.3 oPEN Lab – Genk

The Living Lab in Genk is located in the residential suburb called "Waterschei". The district consists of two different areas: a former mining district built in the 1920s and a more recent social housing district called "New Texas", built in the 1990s. Along with the local context, the high degree of social housing (85%) in the New Texas neighbourhood and its proximity to the former mine site presents a unique opportunity for large-scale, real-life demonstrations of promising technology, and social innovation in creating a PEN.

The design of the PEN is realized through highly energy-efficient building renovation combined with optimal control of innovative building technologies at the individual and collective level. These concepts are brought together in a collective renovation concept, applicable for both rental and private housing.



Figure 4: Waterschei Neighbourhood

Credits: Stad Genk



Figure 5: Nieuw Dak

In Genk, the following activities are foreseen for the development of the PEN:

- Demonstration of a PEN in an existing neighbourhood.
- Transformation of 33 houses into energy-positive buildings through a collective renovation concept, applicable for both rental and private houses.
- Creation of an "Open Living Lab" – testing infrastructure for future novel technologies.
- Testing, monitoring, and comparing different (combinations of) renovation measures, energy techniques and systems.
- Development of general guidelines for scalable design of PEN based on actual demonstration, focused on achieving a balance between collective and individual measures.

The overall objective of the oPEN Lab project is to provide viable business models and use cases to help support the replication of PEN solutions across Europe. These solutions are services and products related to the integration of renovation and Renewable Energy Services (RES) production and flexibility.

The replication of Living Labs is not an objective of the oPEN Lab project, however the participative methods and tools applied through the Living Lab approach have been essential in the success of the oPEN Lab project to-date. The interface between the PEN solutions and the Living Labs is illustrated and shows the importance of the Living Lab capacity building, organisation, and operational management in the business models of the PED.

The key current challenges in oPEN Living Lab Genk are:

- Digital Twin for Positive Energy Neighbourhoods.
- Business models & local energy community.
- Governance: contracts & agreements between Living Lab partners.
- Design challenges associated with accessibility, flexibility and changes.
- Legal constraints associated with mixed ownership, connection to electricity grid, and new business models.
- Community engagement & communication: keeping the contact warm, interest high.
- Monitoring setup: bringing all data & control signals together in one platform.
- Availability of technologies such as DC heat pumps.

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1.2 What is a Living Lab?

This chapter introduces general information about the Living Lab, presenting its definition, predecessors, key elements, main principles, characteristics, benefits and challenges, as well as illustrating key methods to consider while launching and running a Living Lab. The importance of open innovation and its context for the oPEN Lab project as well as the approach to innovation management are explained.

1.2.1 Definition

“A Living Lab is an innovation intermediary that orchestrates an ecosystem of actors in a specific region. Its objective is to co-design solutions in an iterative way in a public-private-people partnership (PPPP) and in a real-life environment. To achieve its objectives, the Living Lab mobilises existing innovation tools or develops new ones.”

(Mastelic, 2019)

1.2.2 Predecessors

The current Living Lab concept came into use towards the end of the 1990s and spread worldwide. **Four predecessors** influenced the concept of the Living Lab can be discerned:

- Cooperative design movement in Scandinavia.
- European "social experiments" with IT.
- Development of "Digital City" initiatives.
- Creation of "Home-Lab" by MIT.

The Living Labs accumulated elements from their predecessors, as illustrated in Figure 6.

	<u>Cooperative Design</u> 1970'	<u>Social experiments</u> 1980'	<u>Digital cities</u> 1990'	<u>Home labs</u> 2000'
Active user <u>involvement</u>	+	+/-	-	-
Real-life setting	+	+	+/-	+/-
Multi-stakeholder	+/-	+	+	-
Multi- <u>method approach</u>	+/-	+	-	+/-
Co- <u>creation</u>	+	+/-	-	-

Figure 6: Characteristics of Living Labs, from their predecessors

(Adapted from Ballon & Schuurman, 2015)

A Living Lab is an organisation acting in a real-life setting. This is not a controlled environment such as a Test Bed. To give an example, the MIT project *PlaceLab* was a simulation of a regular home. Users were observed, logged, and tracked with multiple sensors, allowing to record their habits and activities. Strong importance was placed on the technical infrastructure for gathering data. *Place Lab* does not correspond to the characteristic of a real-life environment but to a **Pre-Living Lab setting**: before testing in real-life, these pre-Living Lab settings allow to diminish the risk for the companies developing new technologies. The

users are also different as in the Pre-Living Lab setting, these are often researchers with different socio-demographic characteristics and energy literacy than the final user of the product or service (see Example 1: NEST Pre- Living Lab).

As an organisation, a Living Lab aims to be sustainable over the time, with a portfolio of projects, rather than a single project. A project, by definition, has a beginning and an end. An organisation such as a Living Lab is institutionalised over time and aims at continuing its activity with a long-term perspective. The governance and business model are an important step towards institutionalisation.

A Living Lab organises participatory workshops and uses co-design tools, but it goes beyond a participatory approach. A Living Lab is not just a scope of participatory tools and methods, it uses transdisciplinary approaches to combine tools from multiple fields according to the needs of actors.

A Living Lab orchestrates an ecosystem of actors composed of the quadruple helix. As an organisation, the host can be one of the four helixes: a public authority such as a city, a company, an association representing the civil society, or an academic partner such as a research institute. The host often owns the infrastructure, hires the employees of the Living Lab, coordinates the strategy and the emergence of the portfolio of projects.

1.2.3 Key elements

Here are the key elements of a Living Lab:

- **active user involvement** (i.e., empowering end users to thoroughly impact the innovation process).
- **real-life setting** (i.e., testing and experimenting with new artefacts "in the wild").
- **multi-stakeholder participation** (i.e., the involvement of technology providers, service providers, relevant institutional actors, professional or residential end users).
- **multi-method approach** (i.e., the combination of methods and tools originating from i.e., ethnography, psychology, sociology, strategic management, service design, engineering...).
- **co-design** (i.e., iterations of design cycles with different sets of stakeholders).
- **co-creation of value** (i.e., social value as an outcome of the process).
- **orchestration & collaboration** with key actors.

Adapted from: Ballon & Schuurman, 2015

1.2.4 Main principles

The key principles of the Living Lab are illustrated in Figure 7.

Value	Influence	Sustainability	Openness	Realism
Public Authorities & Stakeholders in terms of meeting their planning, project or business value. People in terms of improvement of life quality.	Launching of the decision-making process beyond Stakeholders participation, involvement and engagement.	Meeting the needs, with regards to LL processes goes beyond environment and resources and builds on creating relationships for the present and the future.	Collaboration between people of different backgrounds, perspectives, knowledge and experience that secure faster and feasible integrated sustainable energy planning.	Generations of solutions and results that are valid for a particular context and an integrated sustainable energy planning.

Figure 7: Main principles of the Living Labs
(Adapted from Habibipour, 2018)

1.2.5 Characteristics of the Living Labs

A Living Lab operates as the orchestrator within the ecosystem to connect and partner up with relevant stakeholders.

A Living Lab actively involves stakeholders in each phase and in relevant activities, ensuring their insight is captured and implemented throughout the whole lifecycle of the innovation.

In a Living Lab, **values are co-defined** in a **bottom-up process**, not only for but also **by all relevant stakeholders**, ensuring a higher adoption at the end.

A Living Lab **operates in open innovation ecosystems in the real-life setting** of the final users, infusing innovations into their real-life instead of moving the user to test sites to explore the innovations.

Each Living Lab activity is problem driven. Therefore, the methodological approach towards every individual activity is selected based on the expected outcomes of the activity and the **stakeholders who needs to be involved**.

A Living Lab **uses tools from different disciplines and creates new ones.**



Figure 8: Characteristics of the Living Labs
(Adapted from Schuurman, 2015)

1.2.6 Benefits & Challenges

Living Lab approaches generate multiple benefits:

- Identifying key stakeholders' values.
- Providing methods and tools to guide stakeholders.
- Co-designing new solutions with users.
- Mastering the value chain of a given project.

In the context of Energy Living Labs and PENs, multiple benefits could be for instance: improved health and wellbeing as a result of a retrofit, improved energy security and peace of mind, improved community engagement and social inclusion through the process.

However, Living Labs could face **challenges** such as (Habibipour, 2018):

- Theoretical & methodological challenges
 - Lack of comparative/cross-cultural studies.
 - Lack of quantitative studies.
 - New data collection & analysis methods in real-life setting.
 - Integrating social and technical aspects of Living Labs.
 - Lack of pre-determined objectives in Living Lab research.
 - Development of a standardized Living Lab model.
 - Scalability of the results.
- Governance & process-related challenges
 - Multi-business collaboration and openness.
 - Visibility and dissemination of the Living Lab activities.
 - Flexibility and fast changing requirements.
 - Collaboration & communication with stakeholders.
 - Financial issues.
 - Technical and infrastructural challenges.
 - Balance between research and development activities.
- Actors' motivations, needs and expectations.
 - Users' recruitment challenges.
 - Building commitment with stakeholders.
 - Identifying relevant parties and contacts.
 - Cultural factors on users' motivation and engagement.
 - Motivation of all stakeholders, not only users.
 - Motivating factors in online groups.
 - Ensuring continuous and active participation.
- Ethical challenges
 - Informed consent.
 - Unwitting participation.
 - Voluntariness on participatory research.
 - Privacy and use of participants' data.
 - Overlooking users' interest in Living Lab activities.
 - IPR in Living Lab activities.
 - Levels of Openness.

1.2.7 Three-layer Model

One of the key Living Lab concepts is the *Three-layer Model* proposed by Schuurmann (2013). Living Labs act at different levels: MACRO, MESO and MICRO as illustrated in Figure 9:

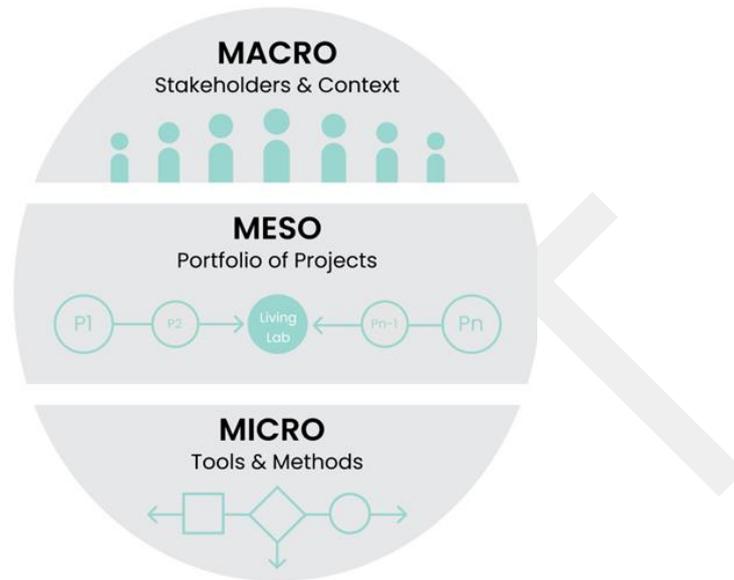


Figure 9: Three-layer model
(Adapted from Schuurmann, 2013)

- **MACRO** (organisational or system level) consisting of actors (PPPP) and infrastructure using Open Innovation.
- **MESO** (project level) innovative projects using open and user Innovation. The Living Lab Integrative Process, described below, shows the innovation process across the project level.
- **MICRO** (tools and activities) methods and tools focused on user innovation.

The MACRO level represents the context and the governance of the stakeholders. The MESO level comprises the portfolio of projects managed by the Living Lab. The MICRO level refers to the specific methods and tools mobilised. There is no hierarchy between these three layers, each level supports and reinforces the other. When creating a Living Lab, organisations often begin with what they know already: project management. They often enter the Living Lab world by a single project such as oPEN Lab (MESO), discover and test different methods and tools during the project life cycle (MICRO). Once the project is finished, organisations have the strategic choice whether to continue using participative methods and tools but without a dedicated structure or to develop a specific structure for this type of activity (MACRO). This becomes an example of **institutionalisation of the Living Lab, which is the more advanced phase when mastering the Living Lab concept and to ensure longevity**. The first steps to institutionalisation are establishing a governance and business model.

In the oPEN Lab project, the capacity building programme has been developed extensively at the MACRO level for the set up and implementation of the three Living Labs. The stakeholders' ecosystem, governance model and business model of the oPEN Living Labs have been developed and are described in the following sections. The oPEN Lab project aims at developing PENs and is considered as a project at the MESO level. The Living Labs that have

been set up through the oPEN Lab project may go on to develop other additional projects and potentially other PENS. Already many innovative projects are being developed through the PENS in the neighbourhoods and beyond. Examples of these are provided in this Handbook.

For more information on ‘What is a Living Lab?’ see: E-learning video 1: [What is a Living Lab?](#)

1.2.8 Open Innovation

Open Innovation is a term coined by William Chesbrough in 2003 and refers to the common problem of a lack of innovation in companies due to the failure of using internal and external ideas to create value and reach new markets. Open Innovation is therefore defined as *“purposeful inflows and outflows of knowledge to accelerate innovation internally while also expanding the markets for the external use of innovation”* (Chesbrough, 2003).

Living Labs are defined by ENOLL 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”* (ENOLL, 2022)

The Living Lab methodological approach adopted in the oPEN Lab project is focused on enacting open innovation in developing PENS.

The Living Lab methodology promotes open innovation and co-creation of value among different stakeholders, especially users. In energy retrofit projects, such as oPEN Lab project, the users are the inhabitants of the buildings being renovated, therefore involving the users in the co-design of the intervention measures is even more critical to improve the uptake of the energy products and services, as well as for ensuring that the long term technical, social and economic impacts of the renovations are beneficial for the people living in the buildings and neighbourhoods. There is some available research on the application of the open innovation methods in the energy retrofit sector (Mlecnik, 2011) making the oPEN Lab project an important test case for the sector.

The typology of innovation intermediaries described by Lopez-Vega and Vanhaverbeke in 2009, identifies different maturity levels of innovation intermediaries such as Living Labs and how it grows over the time. The goal is to achieve the last level, *innovation mediator*, providing infrastructure and open innovation in a large ecosystem of actors. Ongoing mentoring is required in oPEN Lab to achieve this objective.

For an introduction to ‘Why Open Innovation?’ see E-learning video 2: [Why Open Innovation?](#)

1.2.9 Innovation management

Innovation Management is a key activity of the oPEN Lab project and includes technical, social, economic, and political innovation management. To date, approximately 100 innovations have been identified through oPEN Lab and are being assessed and evaluated for inclusion in the Innovation Management Plan (IMP).

These innovations are tracked using a Technical and Non-Technical Innovation Screening tool which helps to monitor both new and proposed innovations including technologies, business models, tools, and methods. The energy community and cooperation models show particular promise, however a strategic approach to barrier assessment and removal is also needed.

The non-technical innovations are categorised as policy, economic and social innovations. An evaluation process that integrates the Societal Readiness Levels (SRL) and the degree of co-design in the innovation process is being explored.

Societal Readiness Levels (SRL) defined by the Denmark Innovation Fund are a way of assessing the level of societal adaptation of, for instance, a particular social project, a technology, a product, a process, an intervention, or an innovation (whether social or technical) to be integrated into society. The Living Lab “innovation funnel” ranges from very low to very high Technology and Societal Readiness Levels (TRL/SRL), e.g., by integrating users at the problem definition stage (TRL/SRL1-2), or testing in real life through the Living Labs, before market/social adoption (TRL/SR 7-8). If the SRL lags behind the TRL the innovation will not succeed as it will not be accepted neither adopted.

The Innovation Management Plan lays the ground for methodology, process and procedures on managing oPEN Lab innovations, including an approach to intellectual property (IPR) management. This plan will be executed in several iterations along the project and consist of various stages as: (i) identification, (ii) characterization, (iii) evaluation, (iv) steering and (v) dissemination & IPR management.

These five stages are defined as:

1. Identification: this is to identify and report all the innovative ideas and initiatives across all three living labs. These ideas are classified as technical and non-technical initiatives (social, business and policy).
2. Characterization: this is a complementary step to the first step that provides screening of innovations. Characterization here refers to the type of innovation, product, process, business model, and space of which these initiatives have advanced in their life cycle, e.g., preliminary study, detailed study etc. This is step that all the necessary additional information is collected in order to enable the innovation committee member to fairly and thoroughly evaluate these ideas.
3. Evaluation: this step provides a framework to evaluate both technical and non-technical innovations across various factors. These factors are (a) proposal fit, (b) desirability (c) feasibility (d) viability (e) adaptability. A show case example of this evolution is illustrated bellow. This step will firstly help to create a criteria system for all the innovations to be ranked against the base line and each other and secondly provides enough information to help steer these initiatives along their project development and deployment.
4. Steering: will build on results of evaluation framework to further support the innovations with guidelines and directives based on their scores and their progress along their lifecycle.
5. Dissemination & IP management: the last step in the Innovation Management Plan covers the dissemination and IPR management building on the 4 previous stages.

The IMP and the Technical and Non-Technical Innovation Screening tool will form part of the oPEN Lab Toolbox later in 2023.

1.3 Objectives of the Handbook

The objectives of the current document are:

- To demonstrate the practical application of the Living Lab approach through use-cases of setting up and implementing Living Labs in the 3 oPEN Labs (described in D1.2).
- To provide methods and tools for co-creation and co-design to the oPEN Labs and other interested in developing PENs using the Living Lab methodology.
- To document the process and facilitate replicability in other contexts of use, whether PENs or Living Labs working on the energy transition.
- To present the main recommendations to train and mentor the oPEN Living Labs for the duration of the project.

The document is divided into 5 main parts:

- How to set up a Living Lab?
- Co-creation and co-design.
- Stakeholder ecosystem management.
- Governance models.
- Business models.

Each part is detailed in sub-sections:

- **Theory and practice** presenting key theoretical elements adapted specifically for the oPEN Lab project and giving examples of how they were applied in the 3 oPEN Labs.
- **Methods and tools** for Living Labs working on PENs, with examples of how they were used in the oPEN Lab project, as well as in other Living Labs in Europe.
- **Main findings to train and mentor** Living Labs with a summary of learnings, mentoring requirements for the remainder of the oPEN Lab project and for future research.

This Handbook guides you through the journey of the Living Lab from the set up to the implementation phases and can be further used for scientific needs (use-case analysis and multiple examples) and practical needs (guidance for the Living Labs).

By the end of this document, you will have an idea of general concepts defining a Living Lab, stakeholder ecosystem management principles, co-creation and co-design methods and tools, as well as governance and business model features and how these have been practically applied in the oPEN Lab project as well as in different existing Living Labs around Europe.

1.4 Examples from other Living Labs

Here you will find examples from other Living Labs researched through the oPEN Lab Project to provide use cases to the oPEN Living Labs.

Example 1: NEST – Pre- Living Lab, Dubendorf, Switzerland

NEST is the **modular research and innovation building** of Empa and Eawag for testing of new technologies, materials, and systems. They are also **researched, further developed and validated under real conditions**. NEST aims to bridge the gap between research laboratories and construction sites.

Close cooperation with partners from research, industry, and the public sector ensures that innovative construction and energy **technologies are put onto the market faster**. NEST contributes to making the use of resources and energy more sustainable and circular.

[Link for more info about NEST](#)

Example 2: Citizen Innovation Lab – Limerick, Ireland

Limerick is to become a climate-neutral city by 2050, that means the city will change through decarbonisation. There will be new technologies, new opportunities and changes in our day-to-day lives. The goal of the Citizen Innovation Lab is **to help empower people in Limerick to take part, to co-create this future together**.

[The Citizen Innovation Lab](#), initiated in 2021 through the [+CityxChange H2020 project](#), operates as a collaboration between Limerick City and County Council and the University of Limerick. The Lab **orchestrates the city's Innovation Playground, and builds on a history of Labs** in Limerick:

- 2012 – Fab Lab Limerick, a digital fabrication laboratory was formed by the School of Architecture at University of Limerick offering cultural, educational and research programmes on digital fabrication to bridge the gap between these technologies and creatives from all disciplines.
- 2017 – The Adaptive Governance Lab, Limerick's first Living Lab was registered with ENoLL, working collaboratively with local government and community groups on action research projects, co-designing solutions to improve liveability in their areas.

[Link for more info about Citizen Innovation Lab](#)

Example 3: Green Energy Lab – Vienna, Austria

[The Green Energy Lab](#) is a research initiative for sustainable energy solutions. Green Energy Lab is Austria's largest innovation laboratory for green energy. Its objective is **to develop and test solutions for a sustainable energy future on the market as well as to demonstrate a universal, scalable energy system**.

The Green Energy Lab was **founded by four Energy providers** in eastern Austria: Energie Burgenland, EVN, Energie Steiermark, and Wien Energie. It's a part of the Austrian innovation campaign "Flagship region Energy" of the Climate and Energy Fund. The idea is to bring together the efforts to develop projects in the energy sector.

Working with **more than 200 partners**, the Green Energy Lab wants to allow widespread collaboration **to develop a universal vision and propose solutions for the energy system of the future**.

[Link for more info about Green Energy Lab](#)

Example 4: Başakşehir Living Lab – Istanbul, Turkey

Başakşehir Living Lab is the Turkish first Living Lab aiming at **developing user-centred solutions mainly in the field of ICT technologies**. It is an innovation and technology centre in which products and services in the field of IT and design are co-developed with stakeholders and tested with real users in real-life environments. These environments can be cities, universities, public parks, agricultural lands etc.

The Living Lab acts as a facilitator of innovations between companies and final users. **Co-design is done in the Living Lab by organising hackathons/competitions** (4-6 per year). In the Living Lab facility, there is also a design factory which involves the stakeholders.

[Link to more info about Başakşehir Living Lab](#)

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2 How to set up a Living Lab?

This part is composed of the key elements for the setting up and future implementation of a Living Lab, it presents different important roles to consider within the Living Lab team, as well as actors and types of Living Labs according to the most active stakeholders.

2.1 Theory and Practice

When setting up a Living Lab, it is essential to think about: *who, why, how, and what* of your structure.

- **Who:** consider different roles within the Living Lab internal team. Interdisciplinary collaboration is proven to foster innovations. The Living Lab team could include such roles as a Living Lab Manager, Project Manager, Pilot Manager, Panel Manager, Human Interaction specialist, and Communication Specialist.
- **Why:** create a common vision and mission for your Living Lab, thinking about its values, goals and objectives.
- **How:** covers rules, processes, methods and tools used to develop solutions. Numerous tools have been developed to facilitate the co-design process, many of which are listed in the next chapters.
- **What:** aims to define different fields, projects and activities of the Living Labs. For the oPEN Lab project, the fields could be for example, Building refurbishment, Energy Transition, Sustainable Mobility, Circular economy, etc.

Illustrations for this section are taken and adapted from open-source website undraw.co.

Main elements to consider:

Operations

- Experience.
- Commitment.
- Openness.
- Communication.



Figure 10 : Operations

The operations perspective helps to measure Living Labs maturity and experience level, the way of developing an open-minded vision on stakeholders' ecosystem management including four groups of the quadruple helix. Important aspects in this part are the Living Lab activities, stakeholder engagement, and communication strategy, effective and transparent communication with stakeholders.

Users

- User engagement.
- User-driven.
- Co-created.
- Values.
- Reality.



Figure 11: Users

Such elements as the manner of users' involvement, intellectual property issues, and co-creation process integration, could be considered in users' engagement and management. A structured way and dedicated efforts for active user involvement, the effectiveness of methods and tools for co-design, as well as evidence of co-created values for all types of stakeholders should be considered.

Organisation

- Partnerships.
- Management.
- Governance.
- Infrastructure.

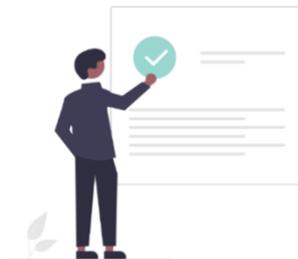


Figure 12: Organisation

A Living Lab's organisational level includes an analysis of its strengths and potential in terms of resources and management. Some essential elements here are the following: infrastructure, equipment, and data, stakeholders' network, as well as a clear governance model with dedicated and sufficiently supported roles and responsibilities.

Business Model

- Innovation ecosystems.
- Life-cycle approach.
- Value-chain coverage.
- Business Model.



Figure 13: Business Model

A viable Business Model can ensure a Living Lab's long-term viability, offering additional value to the different stakeholders involved. To achieve this objective, it is important to consider such elements as a clear value proposition, funding sources, purpose, activities, resources, and key metrics to evaluate impact. In addition, a lifecycle approach could be applied: from ideation to prototyping, experimentation, and validation of results.

(Adapted from the REWAISE Handbook, pp. 26-27. Accessible online: http://rewaise.eu/wp-content/uploads/2022/05/REWAISE-LL-online_handbook.pdf)

Roles within a Living Lab

Setting up of a new Living Lab, and at the organisational / MACRO level, it is important to consider different internal roles within the Living Lab. One of possible roles' distribution is the following:

Living Lab Manager

Responsibilities: Manages everyday activities of the Living Lab, develops projects by ensuring the Living Lab is maintained and used effectively and sustainably by intended users, and creates value for the stakeholders. Is the initiator and the keeper of the Living Lab strategy.

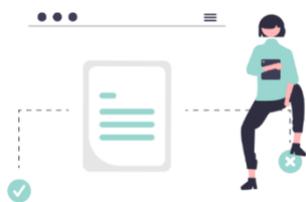


Figure 14: Living Lab Manager

Project Manager

Responsibilities: Responsible for the management of the entire Living Lab. In charge of the planning, procurement and execution of the project, with a defined scope, start and end date. This person is usually employed by the Living Lab and could potentially cover other internal roles.

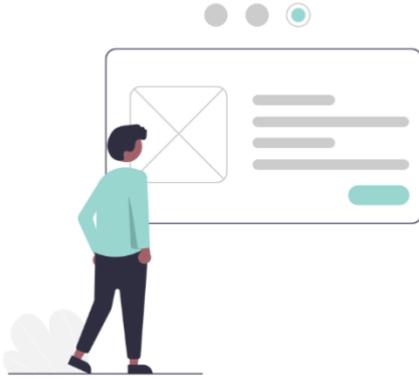


Figure 15: Project Manager

Panel Manager

Responsibilities: Recruits and interacts with a panel of citizens, users and other actors involved in test & evaluation activities. They are responsible for identifying the users to be involved in the process and interacting with them (together with the Human Interaction Specialist). They plan and coordinate interaction with the panel and communication manager between stakeholders and activities in pilots, and is responsible for stakeholder management, citizen engagement/outreach and co-creation.

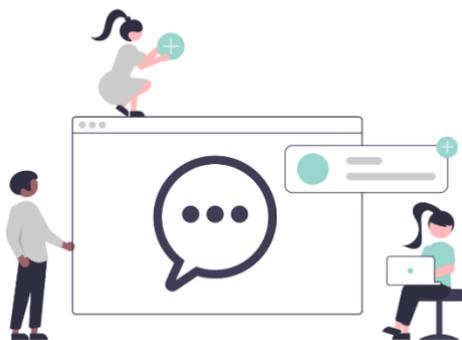


Figure 16: Panel Manager

Pilot Manager

Responsibilities: Facilitates the implementation and test of the innovation being developed in the Living Lab, as well as plans, coordinates, and implements real world experimentations centred on users and coordinates the interaction between other roles (innovators, users, problem owners and project manager). They also coordinate interactions between other external roles (innovators, users, problem owners, etc).



Figure 17: Pilot Manager

Human Interaction Specialist or Researcher

Responsibilities: In charge of analysing results from different user-centred human interaction methods, planning the innovation process, designing concepts and principles, need-finds studies, tests and evaluations, as well as testing the solution in the real-world context prior to the implementation.

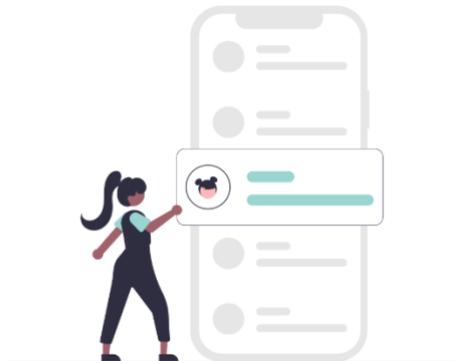


Figure 18: Human Interaction Specialist

The above roles are defined by Ståhlbröst, Bergvall-Kareborn, Eriksson, *Stakeholders in Smart City Living Lab Processes*. Proceedings of the 21st Americas Conference on Information Systems (AMCIS 2015), Puerto Rico. 2015;1–11.

An additional role of Communication Specialist has been added based on recent experience in the oPEN Lab project, through the use case interviews undertaken with Living Labs and projects such as SWEET Lantern.

Communication Specialist

Responsibilities: In charge of communication of Living Lab activities, for example, in social networks or through the Living Lab website. Manage internal and external communication, prepares and executes strategic communication plans. The goal is to provide an effective flow of information between the Living Lab and different stakeholder groups.



Figure 19: Communication Specialist

Actors of the Living Lab

Living Lab orchestrates multiple stakeholders. The table below represents different actors to consider. **Utilizers** are those who will use the Living Lab methods to create innovative solutions. They might hire a Living Lab team to develop a project. **Enablers** are the resources providers, such as cities. **Providers** could be private companies. **Users** are the citizens who will be affected by the project work and lastly, **Researchers** are mostly representatives of the universities who generate and structure knowledge of the Living Lab. Of course, these actors will vary according to each project.

Utilizers	"Customers" of the Living Lab who use it to co-create innovations.
Enablers	Resources (financial) providers or facilitators to sustain the Living Lab activities.
Providers	Infrastructure or service providers to be used in Living Lab projects.
Users	Participants of the Living Lab activities (inhabitants).
Researchers	Knowledge generators of the Living Lab (user & stakeholder co-creation).

Figure 20: Actors of the Living Lab
(adapted from Leminen, Westerlund & Nystrom (2012))

Characteristics of the Living Labs could differ according to the type of actors. While working in a Living Lab, you should think about it according to your specific context, the capacity of your team and most active stakeholders, who could potentially manage Living Lab activities in the future.

Characteristic	Types of Living Labs			
	Utilizer-driven	Enabler-driven	Provider-driven	User-driven
Purpose	Strategic R&D activity with present objectives	Strategy development through actions	Operations development through increased knowledge	Problem solving by collaborative accomplishments
Organisation	Network forms around an utilizer, who organises action for rapid knowledge results	Network forms around a region (regional development) or a funded project (e.g. public funding)	Network forms around a provider organisation(s)	Network initiated by users lacks formal coordination mechanisms
Action	Utilizer guides information collection from the users and promotes knowledge creation that supports the achievement of preset goals	Information is collected and used together and knowledge is co-created in the network	Information is collected for immediate or postponed use; new knowledge is based on the information that providers get from the others	Information is not collected formally and builds upon users' interests; knowledge is utilized in the network to help the user community
Outcomes	New knowledge for project development	Guided strategy change into a preferred direction	New knowledge supporting operations development	Solutions to users' everyday-life problems
Lifespan	Short	Short / medium / long	Short / medium / long	Long

Figure 21: Characteristics and types of Living Labs (adapted from Leminen, Westerlund & Nystrom (2012))

2.2 Methods and Tools

The methods and tools for setting up a Living Lab are mostly applied to develop the MACRO level, developing an understanding of values and value creation, vision, mission, and engaging the ecosystem of actors. Establishing a governance model and business model at an early stage are important, although they will evolve over the time as new projects start.

The methods and tools used at the MESO or project level are mainly associated with the innovation process itself and will vary for each project.

2.3 Examples from oPEN Lab

oPEN Lab 1: Methods and tools used when setting up oPEN Living Labs

The key methods and tools used in the Capacity Building programme (CBP) mainly came from the Virtual Learn Lab of ENoLL. In addition to those presented here, a SWOT (internal factors: Strengths and Weaknesses, and external factors: Opportunities and Threats) analysis and a needs assessment for the CBP were undertaken and were presented in Deliverable 1.2.

oPEN Lab Tool 1: Mapping Canvas

The Living Lab Mapping Canvas is a table presenting different elements of the Living Lab which aims to capture the starting situation with the group and covers all aspects of the Living Lab set up and implementation including: stakeholders, internal and external roles, context, vision and purpose of the Living Lab, needs, challenges, etc.

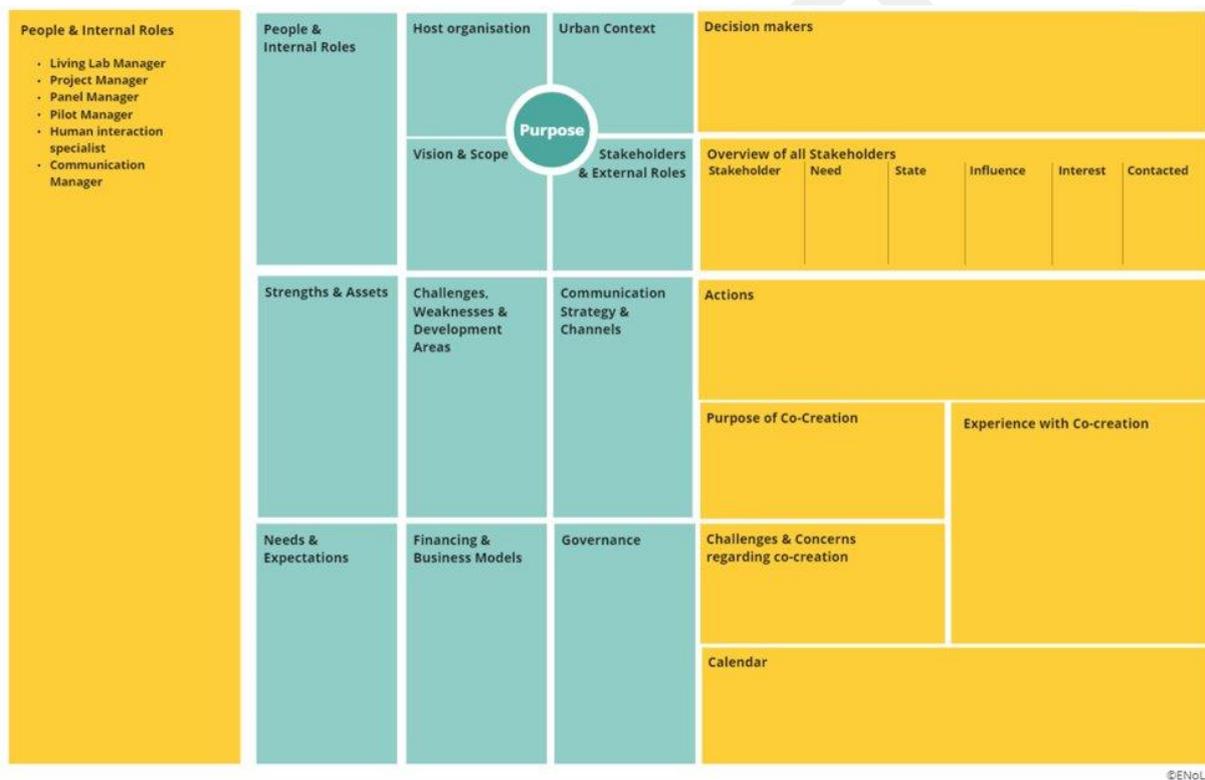


Figure 22: Living Lab Mapping Canvas

oPEN Lab Tool 2: Stakeholder Mapping

The quadruple helix model is used to identify stakeholders from citizens, public, private and research and their relationship to the Living Lab. The Interest Influence Matrix should be completed for each Living Lab as it's a useful tool to identify changes in power and who are the new and potential players.

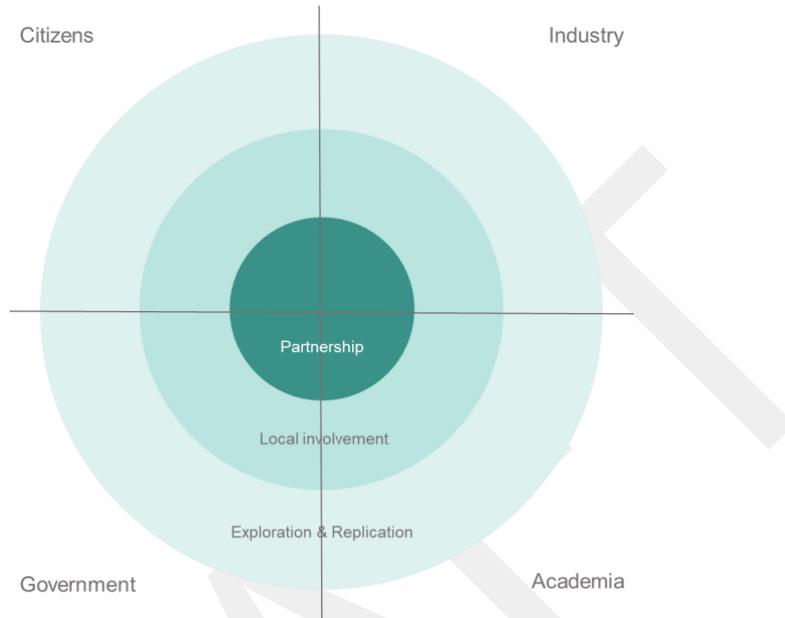


Figure 23: Quadruple Helix Model

oPEN Lab Tool 3: Stakeholder Journey

The key steps from the stakeholders’ perspective are considered and a story is generated. The needs of stakeholder are verbalised. This is undertaken for each representative of the quadruple helix (Public, Private, Citizens and Researchers).

WHO DO WE NEED?

1. Think of your stakeholder journey
2. Identify all stakeholders involved

**STAKEHOLDER GROUP 1:
PRIVATE OWNERS**

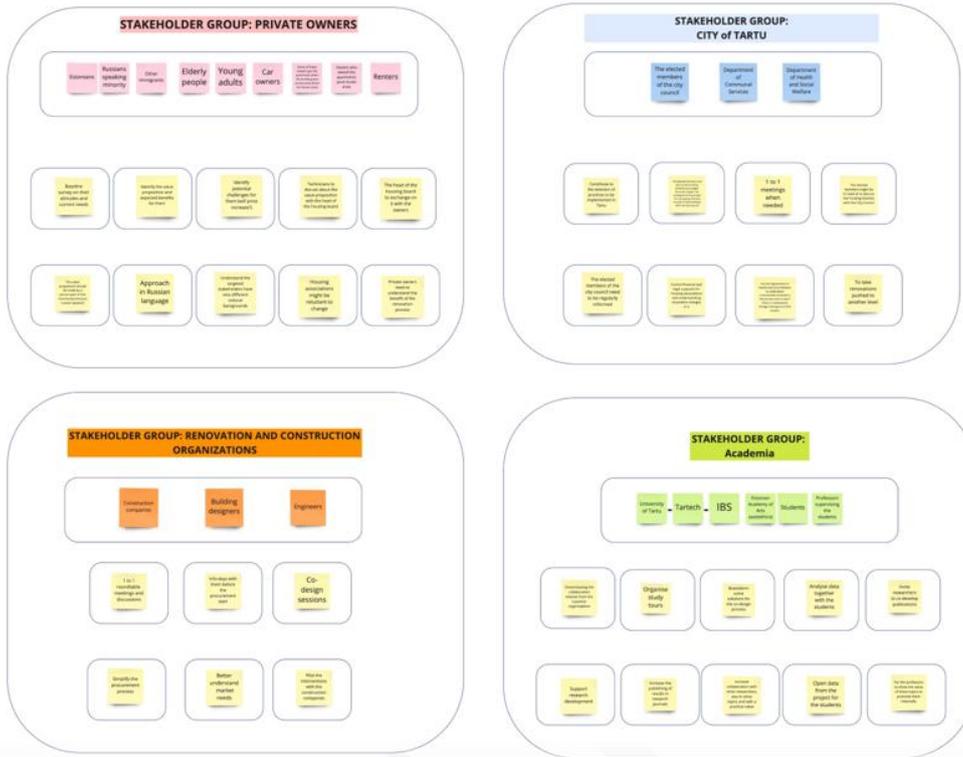
STAKEHOLDERS STORYBOARD

Draw the first steps from the stakeholder’s perspective
Explain the key steps to create a story

NEEDS

At each key step, define the main need of the stakeholder

Figure 24: Stakeholder Journey Board for Private Owners



oPEN Lab 2: Full Stakeholder Storyboard at oPEN Living Lab Tartu

oPEN Lab Tool 4: Governance Model Canvas

The vision and purpose of the Living Lab is confirmed and mapped, together with a review of resources, decision making on a strategic and operational level and the communication of the innovation, internally and externally.

0. SHARED MOTTO				
	INDUSTRY	GOVERNEMENT	CIVIL SOCIETY	ACADEMIA
1. WHO IS IN THE LAB Priorities				
2. WHY WE DO IT Expected results based on needs and opportunities				
3. WHO PAYS OR CONTRIBUTES Types of contribution: • Financial • Personnel • In-kind • Representation				
4. HOW DECISIONS ARE MADE At a strategic level At an operational level	Modus Operandi			
	People			
5. HOW THE INNOVATION IS COMMUNICATED Internally Externally	Modus Operandi			
	People			

Figure 25: Governance Model Canvas

A summary of the Governance model for each of the oPEN Labs is presented in Section 5.

The LIAISON Business model canvas was used to identify the key problem, solution, activities and value proposition, funding and revenue model for the Living Lab.

Problem	Key activities	Value proposition	User segments	Customer segments
Solutions	Key resources		User engagement	Key stakeholders
		Key metrics		
		Impact		
Cost structure		Revenu streams		

Figure 26: LIAISON Business Model Canvas (source Juan A. Bertolin)

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oPEN Lab Tool 5: Implementation Plan/Panel Matrix

The results of the Stakeholder Journey are used to develop the panel matrix, to identify the activities associated with developing the PEN. A linear timeline is used to identify the activities planned across the innovation process. In reality, there are iteration loops, however this tool helps in developing an initial implementation plan.

LL MATRIX OF IMPLEMENTATION ACTIVITIES		Living Lab integrative process - Design Thinking method								
		Empathise		Define		Ideate	Prototype	Test	Implement	Scale up
		Select a practice	Integrate stakeholders	Uncover barriers	Uncover barriers	Co-design	Pilot an intervention	Evaluate performance	Demonstrate the system	Exploit the solution
Activities >>										
Dates >>										
Who should attend										
Internal stakeholder: Living Lab staff	Urban Living Lab Manager									
	Project Manager									
	Pilot Manager									
	Panel Manager									
	Human Interaction Specialist									
	Communication Specialist									
Stakeholder group 1: citizens	Stakeholder Forum									
Stakeholder group 2: public sector										
Stakeholder group 3: private sector	Technical Partners									
Stakeholder group 4: academia / research										

Figure 27: Implementation Plan / Panel Matrix

The oPEN Labs used a simplified version of the panel matrix to feedback on progress on a regular basis.

2.3.1 Other Methods and Tools used in oPEN Lab Project

- Communication and Engagement plans – outlining the co-creation and range of activities used to promote and engage citizens in the project.
- [Co-creation Toolbox](#) – the challenges of oPEN Lab were presented and the range of methods and tools to apply at each step of the innovation process were determined.
- Lessons learned – a review of lessons learned was used throughout the CBP.
- Reflexive Monitoring (oPEN Lab Tool 16) – a methodology introduced by the partner Vito Nexus to enable the Living Labs to review progress and learnings.

2.4 Examples from other Living Labs

Example 5: Library Living Lab – Barcelona, Spain

Based in the Autonomous University of Barcelona (UAB), the Computer Vision Centre Living Lab aims to carry out cutting-edge research in the field of computer vision. It also promotes the transfer of knowledge to industry and society. It strives to prepare and form researchers of the highest level in Europe.

[Link to more info about Library Living Lab](#)

Example 6: Başakşehir Living Lab – Istanbul, Turkey

Roles' distribution within the Basaksehir Living Lab (internal and external actors):

- **Living Lab manager**, to define collaboratively what kind of activities the Living Lab will develop and what type of Living Lab should be set up, as well as how it will evolve.
- **Stakeholder management and engagement manager** is also one of the key functions.
- The Basaksehir Living Lab also has **public relation officer** for promoting the activities of the Living Lab (events, training, etc.).
- **The design manager** is a key person in the Basaksehir Living Lab as it is relevant to develop the innovative products and services.

For the ICT function, Basaksehir Living Lab is **supported either by the start-ups** located in the facilities **or the IT department of the municipality**.

[Link to more info about Başakşehir Living Lab](#)

Example 7: Eindhoven Living Lab – Eindhoven, Netherlands

The Living Lab in Eindhoven is **an approach, a way of thinking and working that emerged in the city of Eindhoven and it is materialized in various places in the city**.

Transformation from central Living Lab to [Stadslab Eindhoven](#) that was created around the focus of how to make the city safer. It was decided to transform the Living Lab into something completely new for Eindhoven with **the idea of making creative spaces with residents about new technologies and innovation in the city**.

In the first place, **the Living Lab was exploited by a private organization** that then left the Living Lab. A new partner was found (creative sector, Stichting Madlab) to join the Living Lab looking for solutions in the creative space. A city lab (Stadslab) was set up that took about a year.

[Link to more info about Eindhoven Living Lab](#)

3 Co-creation and co-design

One of the key objectives of this deliverable is to support Living Labs' development and implementation and to train and mentor on co-creation and co-design methodologies and competencies. The development and implementation of Living Labs is strongly driven by the projects which are carried out on a day-to-day basis. This involves the application of design thinking and the practical use of participative approaches to drive change. The theory will be aligned to the practice in the oPEN Lab project through providing examples of how the methodology was applied and the lessons learned as a result.

3.1 Theory and Practice

This section helps to explain how the theory on co-creation and co-design is applied in practice, the differences between co-creation and co-design and the basics of design thinking. It presents the Living Lab Integrative Process (LLIP) and its relevance and application in the oPEN Lab project.

3.1.1 Differentiating Co-creation and Co-design

The distinction between co-creation as an overall process and co-design as its specific dimension is often confused. The following definitions aim to further avoid this confusion.

Co-creation is a generic term and refers to value creation. Co-creation happens by using participative methods and tools throughout the innovation process.

Co-design is a specific instance of co-creation, which is undertaken in the solution phase during the ideation step. It refers to **the creativity of people not trained in design**, working together with specialists in the innovation process (Mastelic 2019, adapted from Sanders and Stappers, 2008).

3.1.2 Design Thinking

Design Thinking is defined as *“an iterative process in which we seek to **understand the user, challenge assumptions, and redefine problems** in an attempt to identify alternative strategies and solutions that might not be instantly apparent with our initial level of understanding. At the same time, Design Thinking **provides a solution-based approach** to solving problems”* (Dam and Siang, 2021).

Design Thinking can be presented as a triad of the cognitive style (way of thinking), a general theory of design and organizational resource (way of doing) (Kimbell, 2011).

So as Design Thinking, a Living Lab approach involves at the same time a methodological approach and a way of working through a collection of hands-on methods. Design Thinking and Living Lab approach both interested deeply in engaging and understanding actors for whom projects are developed valorising empathy, experimentation, and human-centred design.

It is important to mention and illustrate that the Design Thinking and Living Lab methodologies are iterative and non-linear.

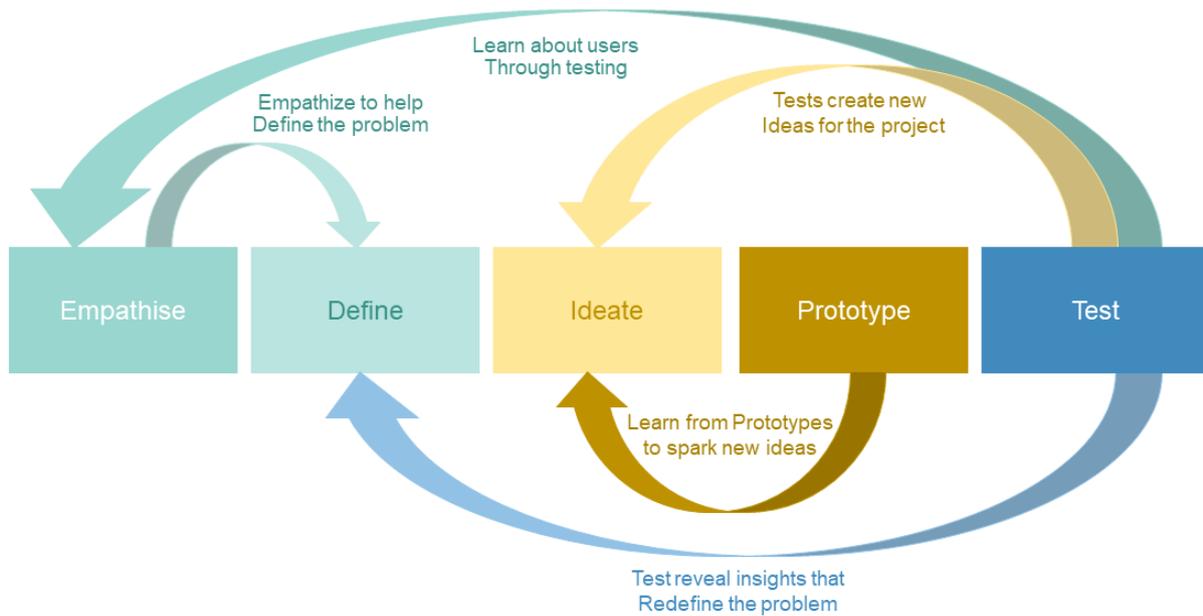


Figure 28: Design Thinking as a non-linear process
 (adapted from Dam and Siang (2021))

The five phases of Design Thinking are the following (Dam and Siang, 2021):

- Empathise – with users.
- Define – users’ needs, problems, and insights.
- Ideate – by challenging assumptions and creating ideas for innovative solutions
- Prototype – to start creating solutions.
- Test – solutions with users.

For more information see this e-learning video used in the Capacity Building programme:

E-learning video 3: [Introduction to Design Thinking](#)

The Living Lab Integrative Process – LLIP (Mastelic, 2019) integrates the steps of Design Thinking with other methodological frameworks such as socio-technical systems and community-based social marketing. As it was presented in the previous chapters, the LLIP (Figure 29) has several steps corresponding to the Design Thinking steps and expanding it into the Deployment space.

3.1.3 Living Lab Integrative Process

The LLIP is a Living Lab methodology used to develop projects in an iterative and participative way at the MESO level (Mastelic, 2019). The LLIP is based on the principles of *Design Thinking* and has 3 main stages or “spaces”: The Problem Space, The Solution Space, the Deployment space. Empathising with users, integrating stakeholders, and defining barriers are part of the problem space. For more information see the e-learning video used in the capacity building programme:

E-learning video 4: [Empathise and Define](#)

Each stage contains action steps, annotated in the Figure 29 below which can be thought of in an iterative manner. The process is not linear and involves ongoing evaluation through lessons learned and the principle of “failing fast”. Moving through the steps, if the solution has been co-designed and tested but is not working, it is important to take a step back and reconsider the problem, by empathising with users, integrating stakeholders, addressing barriers, using appropriate tools and methods (MICRO level).

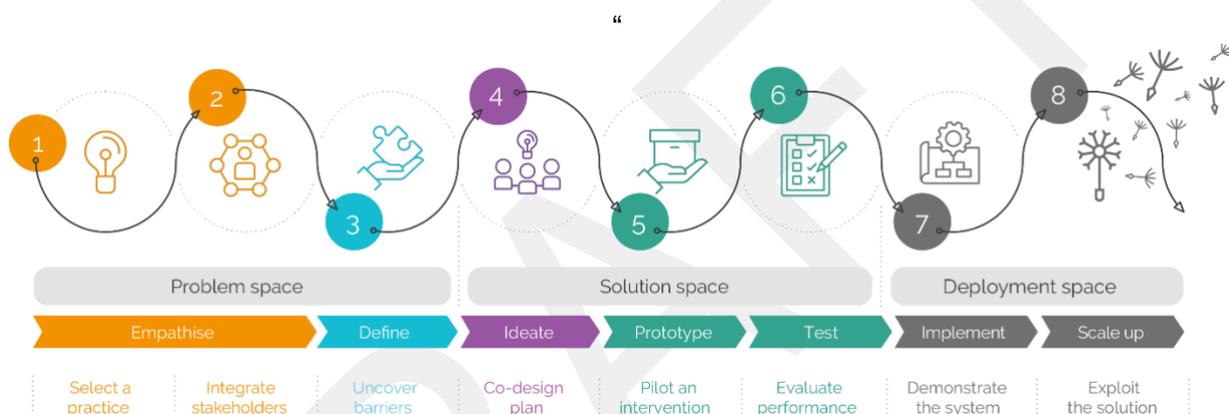


Figure 29: Living Lab Integrative Process, adapted from Mastelic (2019)

The application of the LLIP in the oPEN Lab project was aligned through the implementation plans (D1.2) and the design and procurement process for the PENs.

The selection of the social practices which the oPEN Lab project aimed to change in the neighbourhoods were mainly associated with energy consumption in the home and mobility around the home. Empathising with users was mainly undertaken by dedicated expert partners in the project who are key stakeholders in each Living Lab. Detailed local knowledge and understanding of the needs of the residents was obtained through 1:1 meetings, community events and workshops. A detailed baseline survey was carried out in Tartu to inform the oPEN Lab ([Detailed baseline survey](#)).

In the setup of the oPEN Lab project, emphasis was mostly placed on integrating the stakeholders at the neighbourhood level through extensive co-creation activities in WP2 (Co-creation, community, and value chain engagement for user-centric PENs) and integrating industrial and external partners through open calls.

The level of co-design of the PEN solutions in the oPEN Living Labs was mainly limited to user features in the neighbourhood and homes to improve aesthetics and comfort such as artwork, draught proofing, and noise. Some infrastructure co-design was possible, for example the balconies in Tartu. However, the design of the technology and energy systems proposed in

the PENs had already been proposed as part of the oPEN Lab Project proposal therefore participation from users on decisions associated with these energy aspects was limited. Participation from external partners on innovative solutions was sought through open calls. The theory, practice, methods and tools, and mentoring needs associated with the innovation process that was applied are described further in the next sections.

Experimentation through prototyping and testing is a key aspect of Living Labs. Quasi-experimentation is more common in Living Lab as there is no control group for measuring impacts. Evaluation of results can be qualitative and quantitative. Developing viable business models is a key action to enable the deployment of the PEN solutions.

The deployment of the PEN solutions will continue from 2023 to 2026 with many opportunities for learning from the residents, key stakeholders, industrial and external partners, through reflexive monitoring, iteration, and ongoing improvement of the PEN offering. In this way, the LLIP creates value for key stakeholders involved in the oPEN Lab project.

The overall objective of the oPEN Lab project is to provide use cases to help support the replication of PENs. Although the replication of Living Labs is not an objective of the oPEN Lab project, the application of the LLIP and the participative methods and tools have been essential in the success of the oPEN Labs to date. Whether or not the oPEN Labs develop their organisations into a formal Living Lab, certified by ENoLL, the practical use of the methods and tools can be applied in all innovation projects. The oPEN Lab project has Key Performance Indicators (KPIs) and is monitoring not only technical innovation, but also business, policy and social innovations that are derived using the methods and tools applied at each of the oPEN Labs.

3.2 Methods and Tools

At the MICRO Level – Living Labs use multi-methods at each step of the innovation process. An example of some of the potential tools that can be used at different steps are show in the Matrix of Tools.

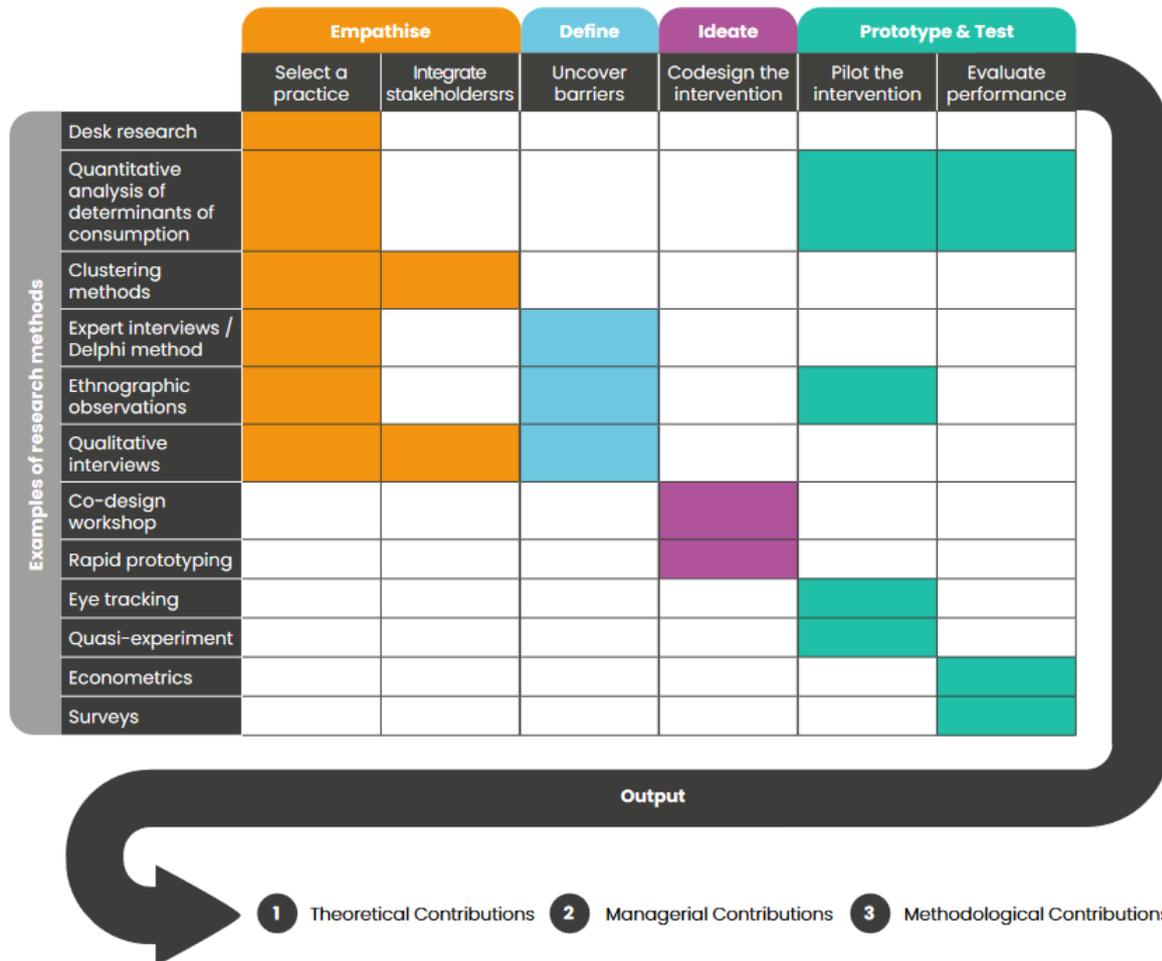


Figure 30: Matrix of Methods and Tools aligned to the LLIP (source SWEET Lantern)

The first step in any Living Lab project is to understand the problem or challenge. This is done through empathising with users, integrating stakeholders and defining barriers. The type of method or tool to use will depend on the challenge.

3.2.1 Problem Tree

Also known as the tree method, problem tree technique, situational analysis or problem analysis, this tool allows to map the problem and to think deeper on its causes (the roots) and potential consequences (branches).

The steps to follow using a Problem Tree are:

- First, it is important to define a problem and put it in the centre of the tree – the trunk represents the main problem.
- Then, add different causes of the chosen problem in the roots' space, thinking of political, social, technical and other possible types of causes.
- In the leaves and branches put the effects or consequences of the problem.
- After the first tree is finished, it is possible to choose one of the lines (cause – problem – consequence) and create smaller trees based on the chosen line.

oPEN Lab Tool 6: Problem Tree

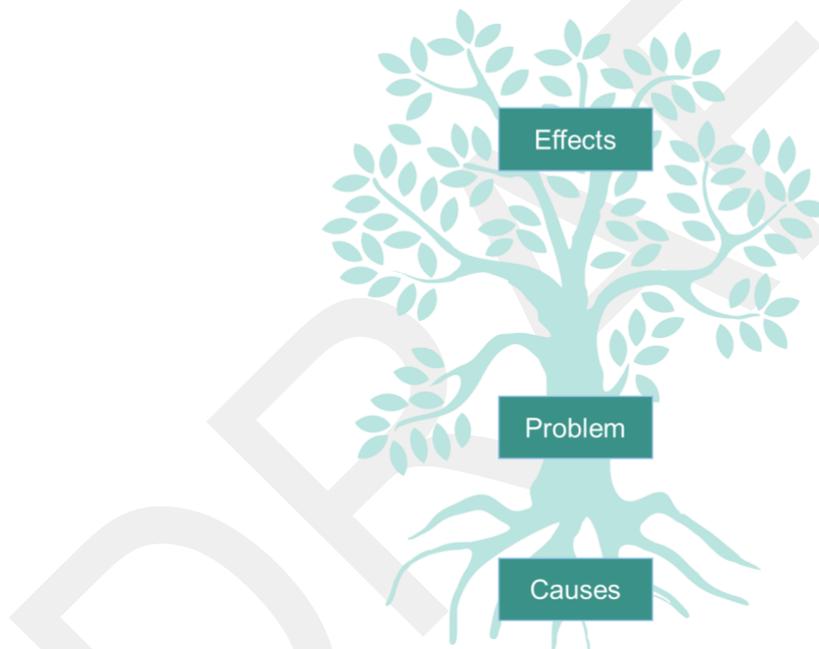


Figure 31: Problem tree

To see how the problem tree tool was used to inform the co-design of the oPEN Lab Capacity Building Programme see:

The oPEN Lab Capacity Building Programme comprised:

- Online group workshops – based on the needs of the oPEN Labs and focussed on specific topics such as Governance Models, Living Lab Business Models.
- Monthly and bimonthly operational meetings to enable exchange of experience between the oPEN Labs.
- In person workshops – associated with the General Assembly and other key meetings, visual, participative and interactive, Q&A sessions, practical examples and use cases

- Ongoing online support as required through direct enquiries.
- E-learning videos on Design thinking, Governance Models and Business Models.
- Use cases testimonials, videos and live presentations, with tips for setting up a Living Lab from experienced practitioners.

The co-design of the initial CBP for the set up and implementation of the Living Labs was important in ensuring the needs of the oPEN Labs were met. Ongoing mentoring and training needs are discussed in Section 7.

3.2.2 Tools for Defining Barriers

Prior to co-design and developing ideas in the ideation phase, it is important to define barriers at the project level and how to overcome them. The legal barriers for energy communities and cooperatives require further focus and are addressed in **WP7 - Exploitation Steering Market Update and PENS Roll Out** of the oPEN Lab project. For example, in oPEN Living Lab Genk, the Business case & permit process for district batteries and the social housing funding mechanisms are not currently very open to innovation.

oPEN Lab Tool 7: Barriers and Drivers Analysis

A basic PESTEL analysis tool can help to identify Political, Economic, Social, Technical, Environmental and Legal barriers at the project level.

Political	Economic	Social
Technological	Ecological	Legal

Figure 32: PESTEL for Barriers

At the community level, the drivers and barriers for participation and action can be better understood using the barriers tool to ideate on how to remove barriers and facilitate positive practices or add barriers to reduce negative practices.

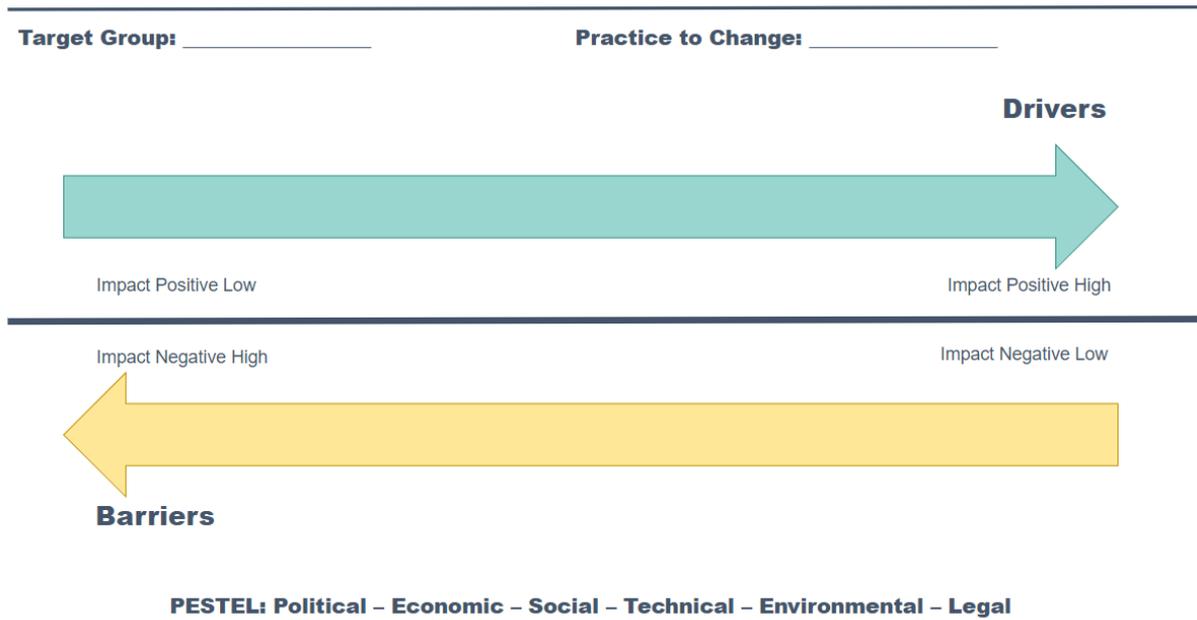


Figure 33: Barriers and Drivers Tool

3.2.3 Community based social marketing

“Social marketing seeks to develop and integrate marketing concepts with other approach to influence behaviours that benefit individual and communities for the greater social good. Social marketing practice is guided by ethical principles. It seeks to integrate research, best practice, theory, audience, and partnership insights to inform the delivery of competition sensitive and segmented social change programmes that are effective equitable and sustainable” (iSMA 2013).

Increasing the technology uptake needs a change management process in which the barriers to adoption are identified, understood and a plan is developed to remove the barriers. In Living Labs, participative methods are used to co-design the plan, to remove the barriers to adoption or add new barriers to limit unsustainable practices. Mc Kenzie-More has proposed the process called community based social marketing (2011). The social marketers try to change behaviours but in the LLIP, the socio-technical system plays an important role, and the social practices are the main target to be changed. The main difference between behaviour changes and social practices change is the role of the context such as the neighbourhood which influence the behaviours. The practices such as heating an apartment is strongly influenced by the technical system and the interaction between the humans and the system. Hence the importance to begin by the social practice to be changed, the analysis of the actors and the barriers to change and the co-design of a plan to be piloted in the neighbourhood to finally measure the impact of the intervention.

3.2.4 Tips for running Co-design sessions

- Before your session, don't forget to check all digital devices especially for hybrid events including sound set up and supporting software such as mentimeter and miro.
- Think of materials for facilitation, prepare a check list and verify if everything is ready.
- Prepare a list of participants, assign key roles in the workshop, inform participants in case they need to prepare anything.
- Prepare an agenda and share it with the participants before the session.

- Ensure diversity in proposed activities and that the quadruple helix is represented.
- Check all supporting materials (post its, pencils, papers, flip charts) before your session.
- Co-designing means creating together > ensure that you have more time for collaborative activities than for a conference type “one-to-many”.
- Plan different types of sessions: one-to-many (e.g. short introduction, explaining the rules, presentation of session results), individually (e.g. brain storm), in small groups (e.g. ideas building and classification, stakeholders mapping).
- Think of ice-breakers to start your session (you can use existing or create for your own relevant for your specific session).

The co-creation toolbox was developed through the oPEN Lab project to help the oPEN Labs determine what methods and tools they could use in their co-design activities throughout the innovation process.

3.2.5 Existing Toolboxes

Living Labs use multiple tools from a large spectrum of fields such as economics, sociology, ethnography, service design, game design or urbanism. To achieve their goals, the Living Labs could apply existing tools or create new ones that better correspond to their co-design activities.

The creation of tools & methods library is a potential solution to share useful information with the Living Labs and a broader public in an interactive and accessible way. Different toolboxes are available online for reading or printing and using during the participatory workshops with multiple examples of tools.

UnaLab Tools for co-creation: <https://unalab.enoll.org/>

The UnaLab toolkit constitutes a compilation of co-creation tools and methods, as collected through the UnaLab project. UnaLab is an EU-funded project that ended in 2022 and successfully contributed to the development of more resilient, more inclusive, increasingly sustainable and smarter cities by implementation nature-based solutions.

The available tools and methods in this toolkit target a broad audience, and cover a wide range of user-friendly formats, including workshops, templates, and games. They are suitable to be used with citizens and all relevant stakeholder groups of a city, for co-designing experimental and innovative solutions in real life settings. UnaLab toolkit includes tools that cover various co-design aims, including need identification, ideation, strategy planning, experimentation, and feedback.

Here are some other examples of toolboxes:

- Coco Toolkit of Laurea: <https://www.laurea.fi/en/cocotoolkit/>
- IMEC’s User Innovation ToolKit: <https://userinnovationtoolkit.ugent.be/#/methods>
- SCORE Co-create your City ToolKit: <https://www.ihs.nl/en/advisory-training-and-research/tools-and-toolkits/co-create-your-city-toolkit>

3.2.6 Participatory Workshops

Organising participatory workshops is one of the important activities of the Living Labs as innovation intermediaries. To mobilise, co-design solutions, engage and empower different actors, Living Labs should have an idea on how to organise and manage a participatory workshop (Chambers, 2002).

A participatory workshop is an event bringing a group of stakeholders together to exchange, co-design, share knowledge, and solve problems in a collaborative and creative environment.

Facilitators of participatory workshops should think of:

- Finding balance between informational and practical parts.
- Helping people feel comfortable, creating a friendly environment.
- Encouraging people to share information, ideas, concerns, knowledge.
- Supporting active learning.
- Helping people to communicate effectively.
- Managing group dynamics.
- Keeping the workshop practical and relevant.
- Inviting participants to take responsibility for the learning and sharing process.

Participatory workshops' facilitators ensure that everyone gets an equal opportunity to participate. Through active listening and good questioning, they should demonstrate that each person's contribution is valuable. Facilitators help participants to develop communication skills by promoting discussions and exchanges.

It's important to think in terms of "before-during-after" when organising a workshop. Questions to ask yourself are the following:

- What is the main goal of the workshop (choose relevant tools)?
- Who will be involved? How many people will participate? What groups of stakeholders need to be engaged?
- Where will the workshop take place?
- How long should it take?
- How many facilitators needed? What are their roles?
- Who else could participate, co-organise, facilitate?
- What methods and tools will be used for participatory activities?
- How much will it cost and how it will be paid?
- What will be the programme? How will it start? How it should be communicated to participants?
- What are the best communication channels according to the public?
- What languages will be used?
- How the logistics will be managed and by whom? Are extra support staff needed?
- What should be sent to participants before the workshop? After the workshop?
- What materials (visual, audio etc) will be needed during the workshop?
- What technical equipment is needed?
- What could be the workshop outputs (written text, posts, audio, video, etc)? Who will be responsible for these outputs, how they will be communicated and with whom?
- What will be a follow-up after the workshop?

3.2.7 Gamified tools for co-design

The use of serious games, gamification, and game design, in general, has proven to have potential as a way of inspiring awareness, acquiring understanding, and obtaining high participation rates in a broad audience who might, otherwise, not be motivated to care about climate change or carbon reduction, energy efficiency, and sustainability (Ouariachi, Elving and Pierie, 2018).

During the oPEN Lab project several gamified tools were tested with teams (*Co-creation tools*, *E4Citizens serious game*) to discover different tools for co-creation, to generate ideas in energy and to launch discussions around energy issues.

DRAFT

3.3 Examples from Open Lab

oPEN Lab Tool 8: Co-creation Toolbox

The [Co-creation toolbox](#) is a set of cards integrated into a participatory workshop that was co-designed and tested during the oPEN Lab project. The tool originated at imec (User Innovation Toolkit of imec: <https://userinnovationtoolkit.ugent.be/#/methods>), was made available through creative commons, and was adapted through the collaboration of ENoLL and the Energy Living Lab at HES-SO by creating a central board following the LLIP. The toolbox can be used to identify the most appropriate methods and tools to use in assessing a specific challenge, as well as discover the Living Lab staff and key stakeholders to involve in solving a specific challenge.



Figure 22: Co-creation toolbox set up

The Co-creation Toolbox is being constantly adapted and completed by new tools according to the feedback of workshops' participants. The toolbox will be further developed to add gamified features as gamification has been used widely to tackle complex challenges and to address strategic questions.

The Co-creation Toolbox was demonstrated at each of the in-person workshops at each of the oPEN Lab as part of the Capacity Building Programme in 2022. oPEN Living Lab Tartu later used this toolbox in their first co-creation workshop with the residents of Annelinn and learned a lot about the barriers to renovation. The importance of the balconies for their health and wellbeing was further revealed and enabled a clear focus on finding solutions through co-designing options in the retrofit.



Figure 34: Workshop using Co-creation methods and tools in Tartu

Follow to obtain a copy of:

- [The Co-creation Toolbox](#)
- [The Co-creation Board](#)

oPEN Lab 3: Research tool to Empathise and Define Barriers – Baseline Study in Tartu

The oPEN Lab in Tartu undertook a comprehensive baseline study of their neighbourhood Annelinn to inform the project planning and development. The survey had 54 questions and took approximately 30 minutes to complete. An incentive prize of a 50 Euro Voucher was offered to encourage participation. See the [Press Release](#) for more info.

The results provided essential information about occupancy, age, language, ownership, income as well as the values, norms, and attitudes in relation to ventilation, energy, and how they use energy in their daily lives. Key health related aspects were also revealed such as:

- Nearly 81% of respondents need to air their rooms several times or once a day
- Nearly 70% want to regulate the temperature in their room, more than half want to regulate the ventilation and nearly 50% want to regulate both

It was determined that in the value proposition, the impact of renovation on improving the indoor climate and on people's health is important.

In general, people were satisfied with their apartments, however they are too hot in summer. Dissatisfaction was highest with the condition of balconies. While the size of electricity bills is not a cause of dissatisfaction for nearly half of the residents, 35% of the respondents are "very or somewhat dissatisfied" with heating bills, and 28% are "very or somewhat dissatisfied".

Overall, the results showed that 60% of the residents wanted a full building renovation, however they differed in their assessment of the cost and affordability of renovation.

The most requested renovations were:

- an upgrade of the ventilation system (70% consider it very or rather important), energy efficient lighting (64%).
- replacement of plumbing and radiators (63%).
- insulation (60%).
- renewal of the house (60%).
- smart meters and control panels (57%).

Opinions were most varied on balconies (built-in or openable windows), and least divided on solar panels (29% don't know, 42% thought it is very or rather important).

Regarding investment decisions:

- the majority of respondents were in favour of using the maximum rate of support from Kredex
- opinions were mixed on whether to renovate in one go, or in batches, or to focus only on essentials – there was also uncertainty
- a quarter of respondents were not prepared to pay monthly for renovation

Neighbourhood satisfaction was also measured relating to services, public transport connections, playgrounds and sports fields, outdoor sports halls and pavements, parking, and community gardens. The majority of respondents like living in Annelinn.

Annelinners seem to have little knowledge of or personal exposure to a number of innovative solutions and services, such as electric car charging, community gardens and cycle parking and sharing.

The survey, together with the meetings with housing associations revealed that local residents may have a number of hesitations and fears about joining the renovation process. These obstacles, together with possible messages to mitigate them were essential for the development of the Renovation As a Service Model (RaaS) and the Local Engagement and Communication Plan for the project. The survey is referred to in every stage of the planning of the project.

See the oPEN Lab Toolbox for an example of the tool.

oPEN Lab Tool 9: [Questionnaire for baseline survey](#)

The problem definition approach of the LLIP was applied to the development of the CBP to ensure activities and media were fit for purpose and met the needs of the oPEN Labs.

oPEN Lab 4: Problem definition for the Capacity Building Programme

To help oPEN Lab teams to set up and manage their Living Labs, a CBP combining online and in situ workshops was proposed. To “walk the talk”, future Living Labs were asked about their needs for the CBP.

PROBLEM

- Too much information is overwhelming. People learn in different ways. The challenge was to know the format of learning materials most suitable for oPEN Lab partners, and to understand their needs in knowledge generation.

METHODS

- Collaborative online workshop using Miro board with predefined layouts.
- Brainstorm on the problems/barriers while learning and preferred methods/formats for learning.
- Problem Tree approach to go deeper into a chosen problem related to learning (*the tool is presented below*).

SOLUTION

- A series of short e-learning modules and presentations shared online with the Living Labs.

SUCCESS FACTORS

- Use more examples illustrating theory application.
- Make the CBP interactive and visual.
- Combine online and offline sessions.
- Integrate Q&A parts.

LESSONS LEARNED

- Practical examples are important to integrate theory and to present concrete cases to stakeholders.
- Importance to integrate experience exchange between the Living Labs.
- Variability of learning materials/formats appreciated a lot.

oPEN Lab 5: Example Learning needs identified for Genk

The learning needs of the oPEN Labs were identified as part of the co-design of the CBP.



Figure 35: Learning needs of Genk oPEN Living Lab

Different co-creation Methods & Tools were shared during the on-site and online workshops in Tartu, Pamplona and Genk in 2022 to help the three oPEN Living Labs to set up and develop their Living Lab, as well as to their co-design sessions with citizens.

oPEN Lab 6: Integrating Stakeholders – Genk Appreciation Enquiry

Genk applied an Appreciation Enquiry methodology which is an example of how co-creation activities can lead to the successful design of solutions for the improved comfort of residents in the proposed Positive Energy Neighbourhood (PEN). oPEN Living Lab Genk developed their co-creation methodology organically through the early stages of the project and is now known as the Genk Timeline. Extensive engagement with the residents of the social housing neighbourhood Nieuw Texas (tenants of social housing company Nieuw Dak) was undertaken to help co-design the solutions for the residents and the PEN:

PROBLEM

- How to involve stakeholders of the quadruple helix in a co-design process?

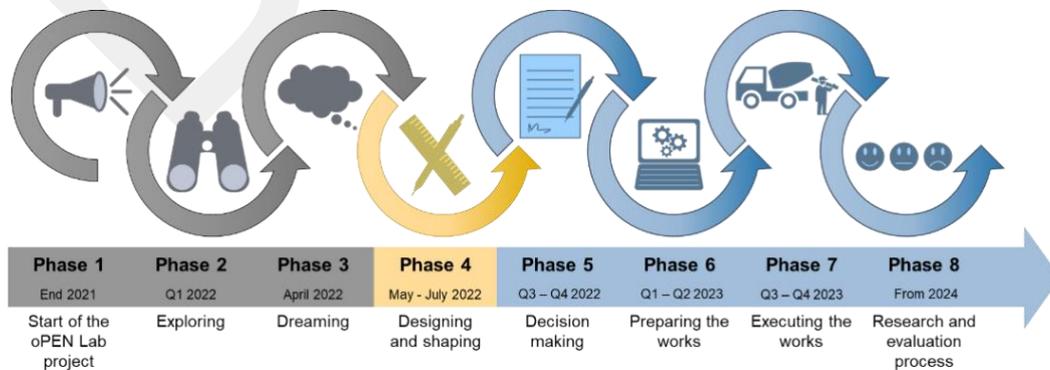


Figure 36: oPEN Living Lab Genk Project Timeline

METHODS

- Community events, 1:1 meetings and Ambassadors (November 2021 – March 2023).
- Three co-creation sessions followed a theme (Discover, Dream and Design).
- Approximately 40 residents attended each event.
- Events followed the design thinking double diamond by exploring extensively the problem phase, empathising and defining needs and barriers with the users for the users.
- Round table discussions using simply post-its and posters, but also crafting materials to stimulate creativity.
- Co-design of features in homes.

SOLUTION

- Voluntary participation led to unexpected empowerment of stakeholders.
- Changes to the design at home level can improve comfort associated with draughts, maintenance, over-heating, heights of doors and ceilings, interior doors, sound barriers between the bedroom and kitchen.
- Pragmatic solutions integrated into the design.
- Methodology led to the acceptance of design solutions.
- Limited changes to design of technology itself, rather a focus on citizen engagement with regard to the user-friendliness of the technologies (use and control).

SUCCESS FACTORS

- Local Communication and Engagement strategy.
- Independent facilitator of events highlighting both the home and neighbourhood
- Internal briefings and recapping with residents.
- Skills and competencies of the Living Lab core team.
- Focus on interaction and gathering input from the stakeholders (rather than a one-way communication).

LESSONS LEARNED

- Many issues were not initially considered: people value other items than expected.
- The level of importance and difference to people's lives was underestimated.
- The approach is time and resource consuming but builds trust and empowers participants.

oPEN Lab 7: Integrating Stakeholders – oPEN Living Lab Tartu

Following the baseline study to identify social practices, norms and preferences, oPEN Living Lab Tartu also initiated a comprehensive engagement and communication programme to integrate stakeholders, comprising several co-creation workshops, one to one meetings and events with stakeholders. The stakeholder mapping tool using the quadruple helix model was applied at a project level and helped to determine the key stakeholders to integrate at an early stage.

The Wishing Lab used a World Café style workshop to bring residents together and work on the features they wanted in their home.



Figure 37: Wishing Lab oPEN Living Lab Tartu

oPEN Living Lab Tartu also intends to initiate an Ambassador Programme, to help influence the residents and Housing Associations.

oPEN Lab Tool 10: Raising awareness through the ambassador programme

Activities also involved the integration of building contractors into the programme, to generate interest in the project through information days, a conference “Knowledge-based construction”. Ongoing meetings with the Estonian Association of Construction Entrepreneurs and the Estonian Association of Civil Engineers was also involved. This focused stakeholder engagement strategy enabled a successful tendering process which is currently underway. However, in oPEN Living Lab Tartu, large companies do not know how to assess risks in the renovation process and this impacts market entry in the prefabrication market. The size of the Annelinn and other potential projects in the portfolio exceed the financial capacity of the companies operating in the renovation market.

The City of Tartu benefits from a number of Living Lab running projects such as [2iSECAP](#), an European Union (EU) projects aiming at co-designing the sustainable energy and climate action plan (SECAP). It helps to develop a culture of participation and a portfolio approach across projects. This approach is also evident in the governance and business models of oPEN

Living Lab Tartu which are focussed on a project level. The success of previous projects, such as the bike sharing scheme, involved the integration of several local stakeholders using a participation mapping tool. Successful integration of stakeholders to date and the plans to continue this, despite the market barriers, will help in the success of the project when the market conditions changes.

oPEN Lab 8: Co-design of the Balconies at Annelinn in oPEN Living Lab Tartu

Through the baseline study and co-creation workshops at oPEN Living Lab Tartu, the problem of how the residents use their balconies was revealed. Although the current balconies are considered small (120cm in depth), their importance for health and well-being was clearly identified, however some antisocial behaviour was also identified with the use of the balconies. The engagement with residents enabled the team to focus on co-designing solutions with residents. The co-design activities involved participative workshops and one to one meetings with residents. Further discussions with project stakeholders (contractors and city department) orchestrated by members of oPEN Lab, enables three options to be offered to residents as follows:

- Close the balcony and replace with an insulated, prefabricated panel.
- Install a new larger balcony, with a panel in the front.
- Insulate manually the inside of the balcony and lose 30cm of size.

These options were then further assessed using the Construction Calculation Tool to help residents make decisions about their renovation what they could afford.

oPEN Lab Tool 11: Construction Calculator tool oPEN Living Lab Tartu

The second co-creation event of oPEN Living Lab Tartu took place in August 2022 and focussed mainly of helping residents of Annelinn to make decisions about preferred features in their home, such as the decoration of hallways and the basement, design of their balconies. And explaining about joint purchasing agreements. A construction pricing calculator tool was developed by Lauri Lihtmaa's, as part of the oPEN Lab Project, to help residents estimate the costs and benefits of the decisions about the features they desired. The Excel based tool takes into account the specifics of each building and considers real energy consumption and the list of priced works. It allows choices to be made between different technical solutions. Financial aspects can be changed such as the interest on the loan payment and the rate of own contribution. It calculates loan payments and home costs per apartment.

The Tartu Energy Agency were able to set up one to one meetings with residents in partnership with the Housing Associations to use the tool. The combination of the co-creation workshop with the one-to-one meetings and the construction pricing calculation tool, enabled residents to consider how the retrofit would look and if they can afford it.

An example of how the tool looks like is shown in the figure 37 below. The tool will be made available through the oPEN Lab toolbox.

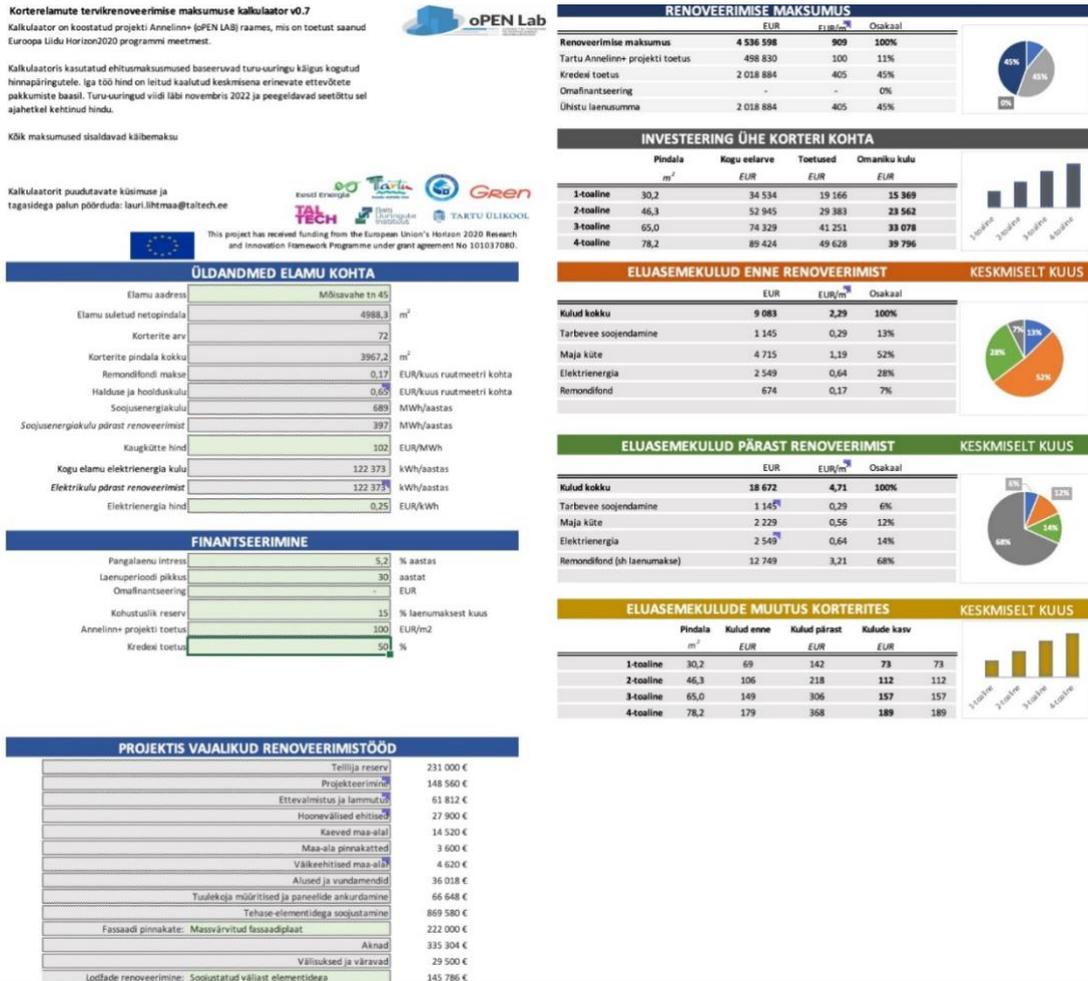


Figure 38: Image of the oPEN Lab pricing calculation tool at oPEN Living Lab Tartu

This tool was focussed mostly on individual assessments. It could potentially be innovated to include multiple benefits of energy retrofit such as health and wellbeing factors and expanded to show the collective benefits for neighbourhoods.

oPEN Lab 9: Prototype Wall, oPEN Living Lab Tartu

The integration of other projects in the oPEN Living Lab Tartu enabled a demo element to be installed in the neighbourhood. A prototype wall was also installed which comprised 23 different sensors, different combinations of layers and integrated Photovoltaics from 2 different manufacturers. The prototype wall is an important element not only to test the building system, but also to improve familiarity amongst residents and enable them to imagine how the new buildings will look more concretely. The residents were not involved with the co-design of the building system, other than their balconies.



Figure 39: Prototype wall, oPEN Living Lab Tartu

oPEN Lab Tool 12: Governance model game, oPEN Living Lab Pamplona

Based on the Governance model canvas (proposed in the Capacity Building Programme), a role-playing Governance Model game was created by oPEN Living Lab Pamplona.

This interactive tool helps to:

- Discuss important questions and define basic rules for a Living Lab governance model in a structured and dynamic way.
- Detach actors from their own objectives and roles, being able to think in terms of the broader picture.
- Assess the responses to each question of the governance model, taking into account different aspects (positive, negative, organisational, economic, etc.).
- All attendees are obliged to participate by responding, commenting, and voting during the game, which ensures a high level of participation and engagement.

The Governance model game is represented by a board, where each box is equivalent to one question from the Governance model canvas. Players choose roles of different entities that should be represented in the Living Lab (using the Persona tool), which helps them to dissociate from personal involvements and points of view and to see from the perspective of others or to think out of the box. To answer questions in each box, there are choice cards that can be used or not. Once the answer is given, it is commented on by 5 of the other players to clarify the answer.

These comments are made by wearing different “glasses” (facts and numbers, creative vision, organisational vision, positive vision, and devil’s advocate) that force participants to react to solutions using a critical approach. As a final step, the responses are evaluated through voting.

Observations based on the workshop experience:

- A lot of time is needed to complete the entire canvas.
- As the questions are randomly arranged on the board, this makes it difficult to give an answer. It is necessary to create a tree system in which, by answering one question, other questions are unlocked.
- Difficulty in assuming the given role and in answering under the gaze of one of the glasses (e.g. the creative one).
- Reduce the number of questions to increase the complexity and collective/consensual dimension of the answers.
- Dynamic and fun, it works very well as a first approach to the governance model.

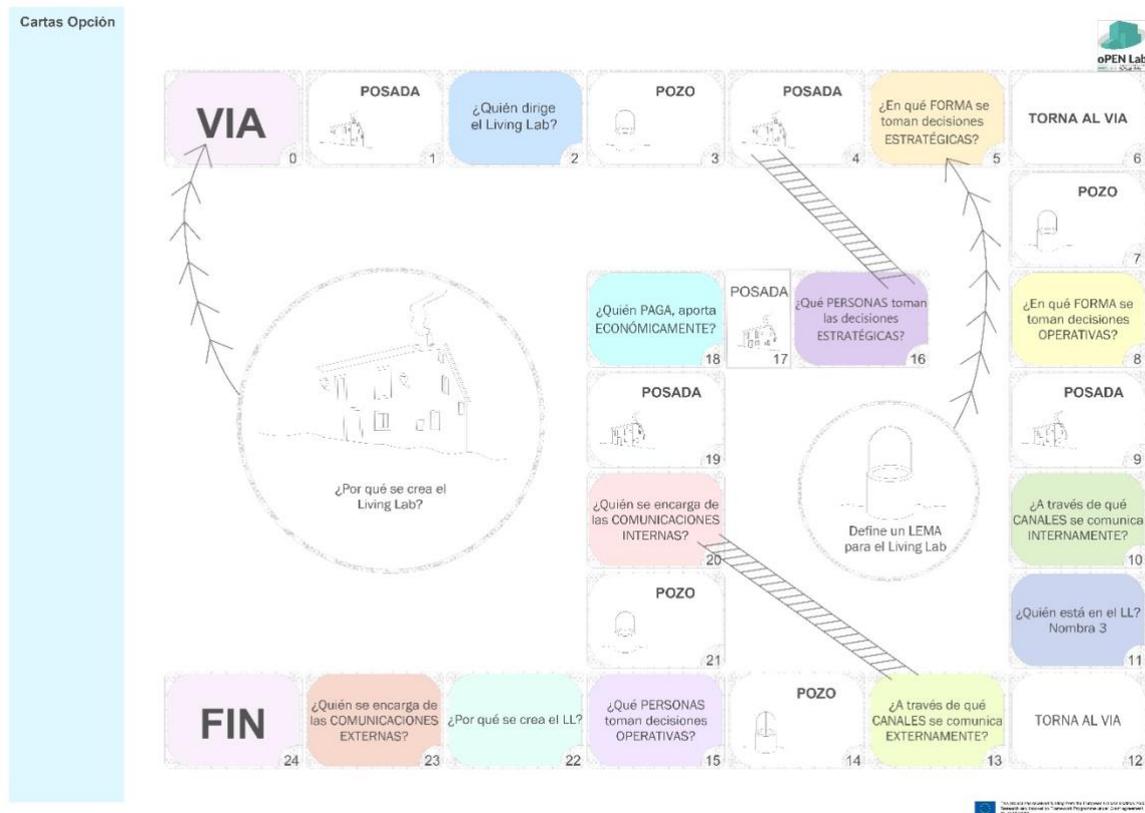


Figure 40: Governance model game, oPEN Living Lab Pamplona

oPEN Lab Tool 13: Virtual Reality with eye-tracking oPEN Living Lab Pamplona

A Virtual Reality (VR) co-creation tool allows to visualise and modify an environment that does not exist, being able to imagine and better understand future scenarios and results. With the help of eye-tracking, it is possible to analyse areas where users' attention (eye position) is staying longer or shorter. It is also possible to receive objective feedback and reactions from users through immersion and tracking.

Virtual Reality with eye-tracking helps to:

- Facilitate understanding of future spatial development and create a feeling of immersion, which helps better understanding.
- Visualise / modify future scenarios in a simple and collaborative way adapting solutions to participants' needs and experiences.
- Enable users' active participation and register participants' direct and indirect feedback
- Obtain subconscious information from the participants.

Before the experience was conducted, the Pamplona team identified different challenges, such as the possibility of inconclusive results due to the limitations of the VR environment in each case; getting not useful feedback in case the environment is not specific enough, or losing the possibility to extrapolate results if the environment is too specific; the necessity to improve the tool through experimentation.

oPEN Lab 10: Iwer Square Participatory workshop, oPEN Living Lab Pamplona

This co-design workshop aimed to propose ideas on how urban furniture (benches, streetlamps, fountains, green areas, trees, paths, and entrances) will be organized in the Iwer Square area. The workshop participants worked in teams, then the results of each team were presented and shared. The participatory activities were realized using Square's printed plans. Participants were invited to think of the future design of the area adding different furniture (represented by simple objects such as coloured pins, paper clips, green cardboard, etc.). Such process of co-design allows to:

- Get closer to the citizens and the actors involved in the neighbourhood, designing urban spaces according to their needs in a simple and flexible way.
- Create interaction between different residents of the neighbourhood, being able to discuss and share their experiences and opinions.
- "Humanise" and scale urban projects bringing them to the level of real users.
- Promote the space's appropriation and build higher project acceptance by citizens.

After the workshop, it was observed that:

- The number of young people was minor, which suggests the importance of broadening the methods of participation and the channels of dissemination.
- There is a need to articulate the process in two working sessions to be able to merge the results of the different working groups in a collaborative way.
- It is necessary to ensure equal participation of all people participating in the workshop.
- It's important to hold a quick analysis and implementation of the results by the competent bodies and deliver results to citizens in a short period of time after the workshop.



Figure 41: Results of the Iwer Square workshop, oPEN Living Lab Pamplona

oPEN Lab 11: Co-creation of Local Energy Communities, oPEN Living Lab Pamplona

As first steps for the co-creation of local energy communities (LEC) in the Rochapea neighbourhood, was a series of four co-creation workshops that were carried out with the Living Lab partners. The aim was to align objectives and points of view in order to define a joint vision on how the creation of the energy communities should be carried out.

The first Energy Community is being created in the IWER building, led by one of the industrial partners. Five partners participating in the renovation of the IWER building have created an energy community as a cooperative. The company has been created and its operating statutes defined. The expansion of the community is expected as the reform of the building progresses, making it possible to incorporate residents and businesses from the neighbourhood.

The Co-creation of the second LEC followed a more participative process, promoted by the city of Pamplona including a presentation session and four (4) training sessions (November 2022-February 2023) with the citizens and the creation of a permanent local core group. The workshop sessions addressed the following aspects:

- Sessions on basic aspects of energy communities.
- Self-consumption and operation.
- Governance and legal form.
- Examples and good practices (3 experiences).
- Energy drift. Walk around the neighbourhood.
- Core group sessions were with the people most involved in the specific topics.

The progress towards the setting up of the LECs is a great example of how participative processes of the Living Lab are essential to the creation of PENS.

DRAFT

3.4 Examples from other Living Labs

Example 5: Energy Living Lab HES-SO – UserGap Project

What is the Influence of users on the performance gap in energy-efficient buildings?

Eikenott is a sustainable neighbourhood in Gland, Switzerland, in which Living Lab methods and tools were applied. The aim was to better understand the components of the performance gap and how to reduce it.

Transdisciplinary research was conducted at the MACRO (neighbourhood), MESO (buildings) and MICRO (households) levels. The action research allowed to co-design an energy performance plan with key stakeholders.

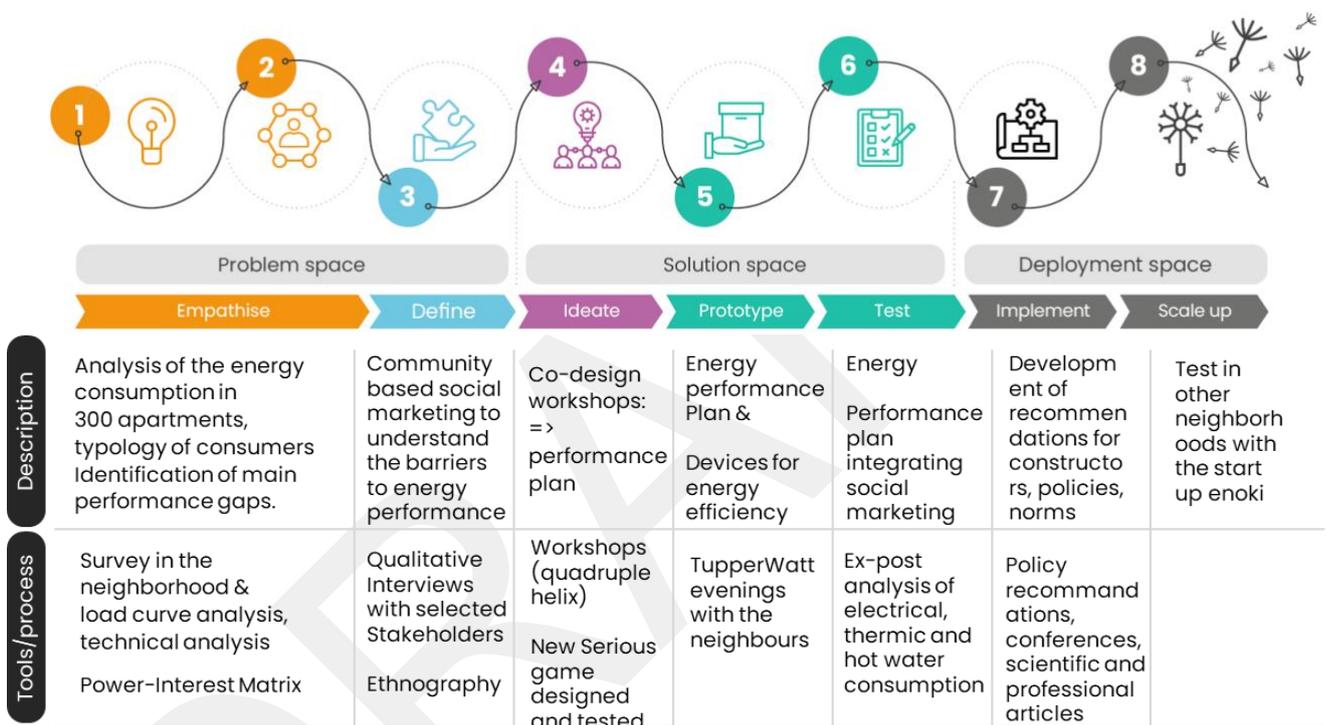


Figure 42: Application of the LLIP in the User Gap project (source HES-SO)

Lessons learned

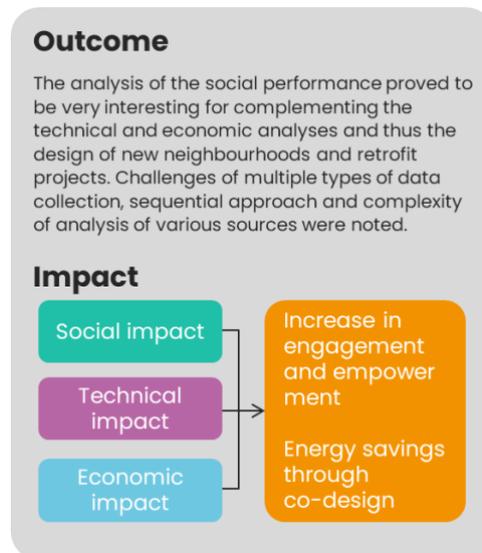


Figure 43: Outcome and Impact of UserGap

- Factors linked to energy and environment are not directly influencing the satisfaction to live in the neighbourhood.
- The “correct” use of blinds has a strong impact on thermic consumption in low consumption buildings.
- Automation could help users with default setting but the regulation and maintenance are often neglected.
- Energy services and maintenance need a leadership with an actor situated in the neighbourhood.
- There is an a “**social performance gap**” measured with the importance/performance matrix applied to energy.

Example 6: E4Citizens serious game – Energy Living Lab @HES-SO– Sion, Switzerland

Co-design is a specific instance of co-creation and is a very important step in the ideation phase of the design thinking process where innovators can be divergent and develop solutions based on real problems. The users can participate in the innovation process through co-design. Co-design of technologies for the PENs has been limited, however co-design of features that lead to comfort and living improvements have been possible. Equally residents can ideate and co-design improvements in their neighbourhoods leading to better quality of life.



Figure 44: E4Citizens game set up

The E4Citizens serious game was tested with the oPEN Living Labs to generate ideas about energy in their particular contexts. This game is made available to the public through the [Energy Living Lab Association](#).



Figure 45: Workshop using E4Citizens game during the OpenLivingLab Days 2022

[Link for more info about Energy Living Lab](#)

Example 7: 20 Tips & Tricks for Building a Sustainable Living Lab – Bristol Living Lab, UK

The Bristol based Living Lab, Knowledge West Media Centre has been co-designing [Tips & Tricks resources](#), a series of thought-provoking recommendations for collaboration, innovation and action since 2014, when they worked with academics and community activists to explore how they could better understand each other's ways of working. When creating the Tips & Tricks for Building a Sustainable Living Lab in the context of iScape project, the discussion-starter cards have been provided in the following four themes to help reflect on the work of the Living Lab and explore new perspectives and possibilities.



Figure 46: Tips & Tricks for Building a Sustainable Living Lab

[Link for more info about Bristol Living Lab](#)

Example 10: Citizen Innovation Lab – Limerick, Ireland

Citizen Innovation Lab in Limerick propose a collaborative platform comprising physical space (Citizens' Observatory, Engagement Hub and Fab Lab) connected to [a digital platform](#) and a programme of engagement that supports citizen innovation towards decarbonization and sustainable digitalisation.

- **CommunityxChange** – Six frameworks enabling top-down and bottom-up engagement including the Bold City Vision, Innovation Playground, Participation Playbook, Learning Framework, Positive Energy Champions Network and Innovation Lab.
 - **Innovation Playground** – a spatially defined area of the city for observation, sense making, co-design and prototyping, orchestrated through the Lab.
 - **Participation Playbook** – a city roadmap for meaningful engagement using four participatory processes; Co-design of Urban Interventions, Collaborative Legislation, Participatory Budgeting, and Citizen Proposals.
 - **Limerick Energy Model** – a 3D Digital Twin and Decision Support Tool for the city to plan and monitor decarbonisation pathways to 2050 by analysing data sets including citizen sourced data.
 - **Community Mapping Tool** – a crowdsourced mapping tool used to gather citizens' knowledge of the city e.g. the extent of a future city bike-share scheme.



Figure 47: Limerick's City Energy Model, a digital twin of the city (source CIB)

[Link for more info about Citizen Innovation Lab \(CIB\)](#)

Example 6: SCORE Project – Multicriteria Analysis

SCORE is a four-year EU-funded project that aims to increase climate resilience in a network of ten Coastal City Living Labs (CCLs). For the socio-economic assessment of climate change adaptation options, particularly ecosystem-based approach solutions (EbAs) within the CCLs, Multi-Criteria Analysis (MCA) was used.

MCA is a useful method and a participatory-based assessment of policies, actions, or measures against a series of pre-defined evaluation criteria (qualitative and/or quantitative), providing a structured framework for decision-making. It allows for comparison among various options, against the pre-defined criteria, resulting to an overall score and ranking and indicating which of the actions is the most suitable or more preferred for the case/context at hand.

Stakeholder engagement is fundamental in MCA, as it allows for both objective and subjective socio-economic assessment, as well as it integrates diverse perspectives, interests, and knowledge inputs. In SCORE, MCA was conducted in interactive workshops, both online and face-to-face, in each of the CCLs. Starting with the frontrunners CCLs, local and regional stakeholders, including public authorities, experts, and citizen groups, worked together on the MCA steps to define the adaptation solutions and evaluate their feasibility for their local context. The feasibility assessment was based on four main criteria (stakeholder feasibility, financial feasibility, technical feasibility, and ease of implementation) and supported with retaining the focus on the more realistic and less (technically) complex options. The same process is intended be followed for the rest of the CCLs (fellows).

For more information see:

[Smart control of the climate resilience in European coastal cities – Score \(score-eu-project.eu\)](https://score-eu-project.eu)

4 Stakeholder ecosystem management

This section invites you to learn how to work with an ecosystem of stakeholders and illustrates different methods and tools of multiple stakeholder coordination by the Living Lab.

4.1 Theory and Practice

4.1.1 Quadruple Helix model

Taking a holistic view on society, Living Labs involve and orchestrate stakeholders from the quadruple helix model comprising government, academia, private sector, and citizens.

- Public sector.
 - Public authorities.
 - Research organisations (Academia).
- Private companies.
- Citizens.

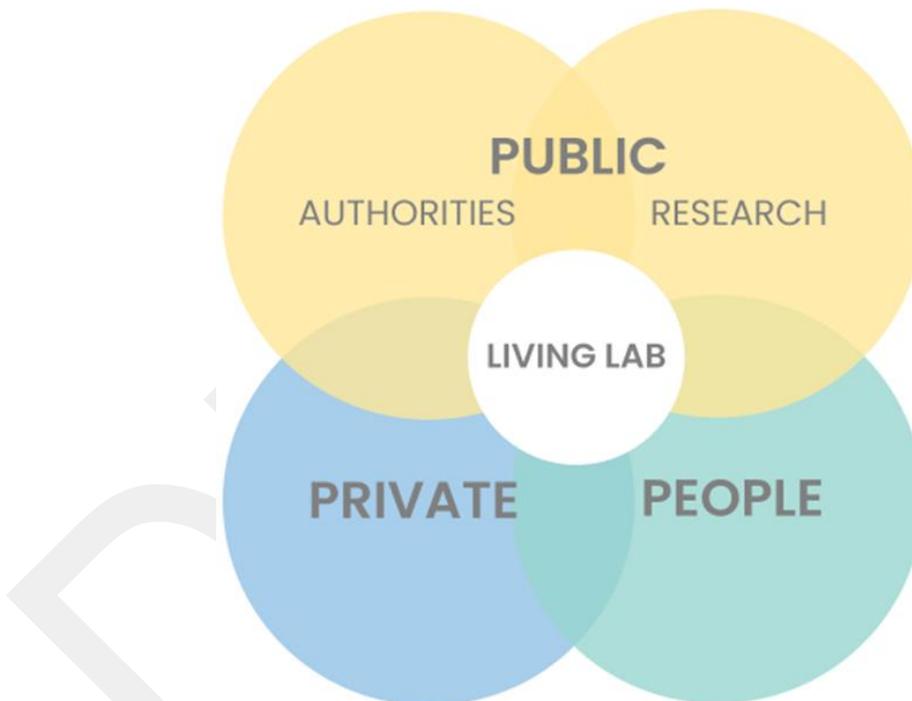


Figure 48: Quadruple helix model, adapted from Carayannis & Campbell (2012)

The practical tool for applying this theory is the stakeholder map and is presented below in Methods and Tools.

4.1.2 Panel management for engaging stakeholders in Living Labs

Panel management is an important activity associated with some Living Labs. Panel based Living Labs are different to traditional Living Labs in that they have a more permanent Living Lab infrastructure or panel of users. The user is at the centre of the innovation process (Schuurman, 2012).

Currently panel management in the oPEN Lab project is limited to the PENs. However, in the business model of oPEN Living Lab Genk, for example, there is the potential to test new innovations using the same residents in the PEN. This could be an important panel for new innovation development.

Further capacity building will be offered on panel management by ENoLL at the OpenLivingLab Days conference 2023, on Day 0, in Barcelona. This may be a future mentoring need for the oPEN Living Labs as described in the Mentoring report in Section 7.

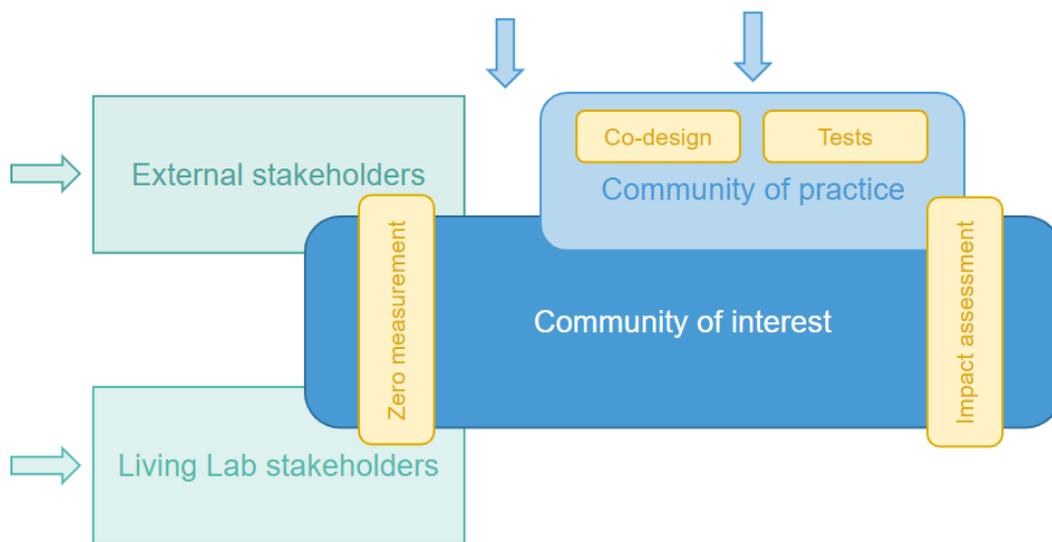


Figure 49: Panel management for stakeholder engagement

4.1.3 Action -orientated Task Forces (AOTFs) of ENoLL

The European Network of Living Labs (ENoLL) is an important partner in the stakeholder ecosystem by supporting capacity building through the **Action-oriented Task Forces (AOTFs) and Working Groups (WGs) Programme**.

ENoLL has built tremendous expertise in the area of co-creation and action-research methods for multi-stakeholder user centric innovation, and thus is placed in an excellent position to explore emerging approaches in Special Interest Groups. The AOTFs and WGs Programme is the main entry point for all the topics the ENoLL community is particularly active and/or holds a leading role within their regional ecosystems or globally. The AOTFs and WGs programme is based upon core topics with evidence of critical mass within the ENoLL community and provides support during a 2 year-term to the interest groups. The core topics that are part of ENoLL's AOTFs and WGs are:

- Social Innovation and Digital Rights.
- Social Impact of Artificial Intelligence (AI).
- Rural Living Labs.
- Health and Wellbeing.
- Energy and Environment.
- Living Labs as Regulatory Learning Tools.
- Agriculture & Agri Food.
- Culture & Creativity.
- Mobility.
- Digital Sustainability (for zero pollution).

The Energy and Environment AOTF (E&E AOTF), which aligns with the objectives of oPEN Lab, aims to contribute on generating a global movement towards a more sustainable society to solve complex challenges related to energy and environment, such as zero emissions and zero pollution. We engage Living labs that have their core in such issues, as well as Living Labs that have (past, current, or envisaged) projects or are simply open to bring, adapt and reconfigure – in their territories of reference – possible solutions, including green digital tools.

4.2 Methods and Tools

There are a variety of methods and tools that can be used to empathise with user and integrate stakeholders such as persona tools, expert interviews, PESTEL analysis, focus groups, empathy mapping and many more as described in the co-creation tool box. However, the quadruple helix visual map and the Interest-Influence matrix are the most important and commonly used in setting up and implementing a Living Lab.

4.2.1 Quadruple-Helix Model Visual Map

Using the Quadruple Helix Model, we can develop a visual map that situates Stakeholders according to their role or level of importance in the project. In this three-circle map, the circles drawn upon the Quadruple Helix Model represent the levels of integration & importance of each stakeholder involved in the process. The core stakeholders or key partners are placed in the central/core area of the circle. Local organisations involved in the project are placed in the second circle and the third will feature future possible collaborations, on a broader scale.

The Quadruple Helix Model helps to visualise different stakeholders and to separate them according to their level of importance in the project.

Three circles represent different levels of integration & importance of Stakeholders.

- 1 – the core stakeholders/key partners.
- 2 – the organisations locally involved.
- 3 – future collaborations.

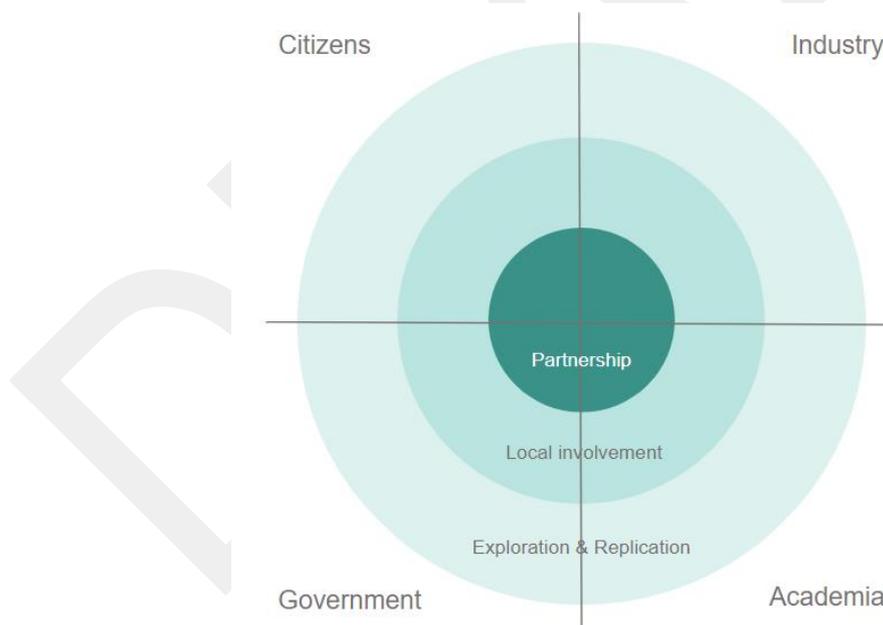


Figure 50: Quadruple helix model for stakeholder ecosystem analysis and mapping

4.2.2 Interest-Influence matrix

Stakeholder Interest-Influence matrix is a method that allows to show the relative position of different Stakeholders according to their interests in a project and the level of influence. The result of this method is a visualised representation of the relative position of different Stakeholders and their power dynamics.

Interest-Influence matrix aims to identify the right people for the right purpose and to recognize and take relevant action so that you have interested & influential actors in place who support your project. By positioning different Stakeholders upon the matrix, according to their decision-making power or “Influence”, and their motivation or “Interest” it’s possible to recognize the strategy to put in place to better engage them.

oPEN Lab Tool 14: Interest Influence Matrix

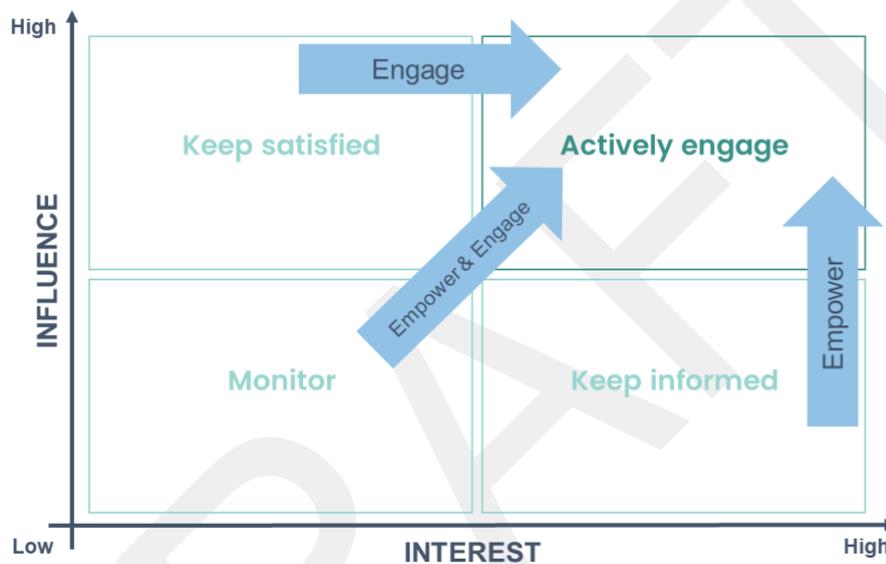


Figure 51: Interest-Influence matrix

(adapted from Eden and Ackermann (1998) in Bryson (2004))

Both the Quadruple Helix model and the Interest Influence matrix should be updated regularly to help identify changes and strategies for Ecosystem Management.

4.3 Examples from oPEN Lab

The Capacity Building Programme focussed mainly on the stakeholder ecosystem management for the set up and implementation of the Living Labs for the PENs. In the oPEN Lab project extensive work was undertaken on co-creation, community and value chain engagement for user-centric PENs. This work initially considered structures for stakeholder engagement by proposing stakeholder forums, and working groups, as well as co-creation activities detailed in the communication and engagement plans of the PENs. The broader stakeholder ecosystem management for the Living Lab outside the oPEN Lab project has been considered in the business model development.

oPEN Lab 12: Stakeholder Assembly, oPEN Living Lab Pamplona

Stakeholder Assemblies are comprised of groups of citizens who take an active part in the project by co-creating with the Living Lab. The stakeholder assembly aims to inform the decision making of the Living Lab and may be part of the governance model. In the case of oPEN Living Lab Pamplona where the Living Lab in Rochapea would like the citizens to become agents of change in the development of the Energy Community and the transformation of their real residential and/or work environment and take a leading role in co-designing solutions.

The first phase was launched in May 2023 and brings together citizens and other stakeholders to provide preliminary using participatory and interactive tools. The Agents Assembly, which will be a space for collective encounter, exchange, reflection, and creation in the Rochapea Living Lab.

oPEN Lab 13: Stakeholders and Heritage Buildings – oPEN Living Lab Genk

PROBLEM

- The neighbourhood of the Waterschei is locally known as the Garden City and is comprised of residential buildings with high heritage value. The oPEN Lab project experienced several barriers in planning, as there are several legal constraints and uncertainties for renovation.

METHODS

- Heritage study commissioned by the city and carried out by University of Hasselt
- Qualitative interviews with residents organised through the oPEN Lab project
- Simple but effective communication using postcards to 'Imagine a Positive Energy Neighbourhood' to promote visits to the local information centre.

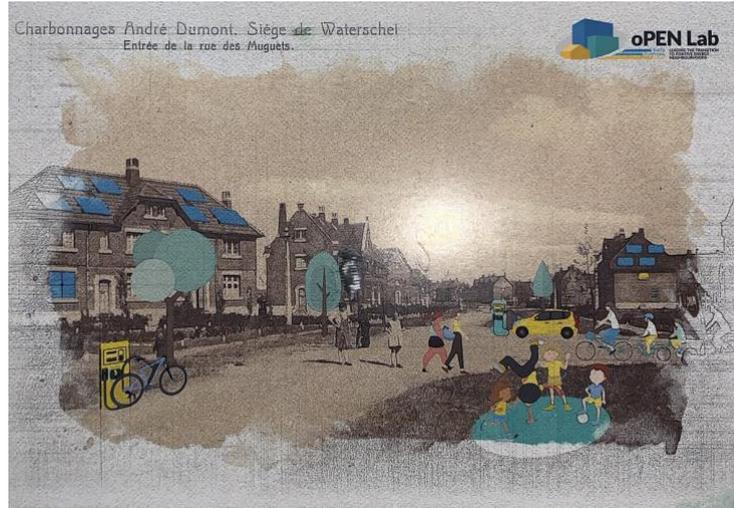


Figure 52: Postcard – Imagine a Positive Energy Neighbourhood (PEN)

SOLUTION

- Several experts, including oPEN Lab partners, gave input to University of Hasselt (U Hasselt) during several workshops and interviews. U Hasselt started their study with a very detailed preliminary investigation, looking into the specifications of a Garden City and how other cities facilitated the energy transition in these districts. They studied the candidate test dwellings in oPEN Lab. U Hasselt conducted in-depth interviews with the residents to assess their perception and relationship with their houses, the neighbourhood and its heritage value. All this will feed into the final output of the study (to be completed by the end of April 2023), which the City of Genk will use as a guidebook to develop new regulations on how to renovate your dwelling and preserve or restore the heritage value.

SUCCESS FACTORS

- Local communication strategy.
- Orchestration of partners by oPEN Lab.
- Strong relationships and trust between the residents and oPEN Lab.

LESSONS LEARNED

- The city greatly benefited from listening to the inhabitants. This was an unforeseen outcome which emerged from the project.
- The postcards also had the role in keeping partners engaged in the project.

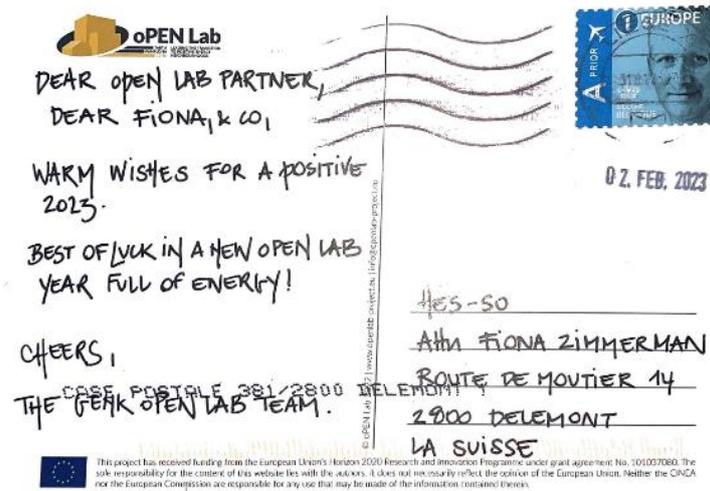


Figure 53: Postcard – Novel communication with partners

oPEN Living Lab Genk is also planning on experimenting with collage as an art-based research method by creating a Monumental Mural with printed Photovoltaic (PV) panels in the neighbourhood in May 2023. Through open participatory visual and graphic workshops with the residents, they aim to create the energy identity of the Neighbourhood. A documentary video will be also created.

oPEN Lab 14: Stakeholders Cooperating to Remove Barriers – oPEN Living Lab Tartu

Following a huge amount of communication and engagement activities undertaken in Annelinn with residents, resident associations, contractors, and project partners, ten buildings joined oPEN Lab by June 2022. The market situation with high inflation and construction prices are a key challenge for the financial model. Ongoing discussions with Swedbank and Kredex as well as the Ministry of the Economy by the City of Tartu for the oPEN Lab project resulted in an increase of the National Financing Scheme from 30% to 50% for prefabricated renovations. Own funding of 45% was still required by residents, however the subsidy increase greatly increased the investment power of the residents. Recent interest rate rise has since increased the cost of borrowing above viable rates and the financial model is still not currently viable. The current market conditions are a key risk for the progress of the project. Alternative sites are being considered as well as a one-stop shop renovation service financed by the European Investment Bank (EIB). Ongoing engagement with new stakeholders driven by the entrepreneurial skills of the Living Lab, continue to reduce barriers to investment in oPEN Lab Tartu.

oPEN Lab Tool 15: Reflexive Monitoring

The Reflexive Monitoring approach in oPEN Lab Project is being led by the partner VITO Nexus. Reflexive Monitoring is a learning by doing approach and is a continuous process of learning and adapting to effectively steer initiatives to a more sustainable future. Two key tools are used including Learning History Workshop and Systematic Bullet Journaling. A Reflexive Monitoring in user guide is also made available. For more information go to [reflexive monitoring in action](#).

A pilot application of Reflexive Monitoring at the Garden City in Genk highlighted for example the relevance of regular encounters for the industrial partners and the importance of human interactions with the residents. The application increased the commitment of the industrial partners as it gave them the personal connection to the project and helped them in improving their satisfaction in participating in the project.

oPEN Lab 15: Integrating new Stakeholders through oPEN calls

Open calls were launched for innovation partners to participate in the oPEN Lab Project. In early 2023, companies, start-ups, and institutions were requested to submit proposals for funding to test innovative energy solutions before bringing them to market.

The practical challenges were demand-driven ventilation management, efficient and secure bicycle storage, tools to support co-creation and management of energy communities, innovative energy solutions for energy generation, regeneration and storage, innovative and cost-effective user interfaces for remote management and maintenance systems for building energy systems, building information modelling (BIM) from scanning to construction, neighbourhood education infrastructure and DC (direct current)-powered heat pumps.

The Open Calls helped to introduce new stakeholders to the project who are considered potential innovators to solve particular issues in PENs. Although the number of applications for the open calls was limited, the process of engaging with Innovators was considered beneficial. A key challenge of the Living Labs is how to integrate industrial partners.



Figure 54: Open calls to Integrate Innovation Partners

4.4 Examples from other Living Labs

Example 12: Energy Living Lab Association – Sion, Switzerland

The Energy Living Lab Association manages the stakeholders' ecosystem of the SWEET Lantern in Switzerland. The Living Lab Interfaces for the Energy Transition (LANTERN) Project 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. This 8-year project (2022-2030) will be achieved through 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. Four Living Labs and two Pre- Living Labs in Switzerland will provide the setting and context for the experimentation, supported by over 70 researchers and Living Labs practitioners. The interventions will be developed through applying the LLIP (Mastelic, 2019) at the project level across six thematic themes 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.

[Link for more info about SWEET Lantern](#)

The energy transition cannot be reduced to an engineering problem, it is a societal problem that concerns everyone, which is why this project is intended to be inclusive and participatory. Energy Living Lab Association (ELLA) uses **the open access Tools Library accessible for all partners and Living Labs (in Miro)** facilitating interactions and providing necessary information in an open way.

[Link for more info about Energy Living Lab Association](#)

Example 8: Eindhoven Living Lab – Eindhoven, Netherlands

For the Living Lab it's essential to have **both types of mindsets on board: thinking out of the box, but also making things real**. Most important is **to identify ways and tools to mobilize the right people for the co-design process**. **The main challenge for us was to get a continuous vibrant energy within the Living Labs**, to bring together all the different creative minds and develop real activities and outcomes.

[Link to more info about Eindhoven Living Lab](#)

Example 9: Bristol Living Lab – Bristol, UK

The Bristol Living Lab **is based within the community of Knowle West**, an area of approximately 5,500 households in the south of Bristol. The Bristol Living Lab **positions as a community-based 'enabler-driven' living lab**: Knowledge West Media Centre (KWMC) acts as a 'broker' between citizens and organisations, ensuring that each participant in a particular project can contribute their knowledge and experience. KWMC **adopts an 'action research' approach**, where continual reflection and evaluation are built into the working process, and this enables KWMC to be flexible and responsive to the changing needs of partners and communities. The Living Lab has a wide range of citywide, regional, and international networks and actively works with and takes a 'Commons' Approach to sharing knowledge and learning. Whilst it works 'hyper locally' within the community and is committed to sharing theoretical and practical knowledge with an invitation to 'adopt and adapt'.

[Link for more info about Bristol Living Lab](#)

5 Governance models

This chapter concerns the notion, types and characteristics of the Living Lab's governance models.

5.1 Theory and Practice

5.1.1 Definition

The governance and management structure reflects the way that a Living Lab is managed and organized at the strategic and operational levels. The governance model describes how governance will be achieved.

A governance model is a structure used to assist the management in fulfilling its governance roles. Such a model is likely to enable the executive leadership to organize the governance structure and the mechanisms by which governance is implemented. Lack of a governance operating model can lead to an incomplete or faulty governance structure, to inconsistencies, overlaps, and gaps between governance mechanisms (Deloitte Development LLC, 2013).

The context of the governance and thus the governance model may evolve over time as different stakeholders have more or less power and influence. For example, some Living Labs start with a Research Host and develop into an Association to enable more industry and citizen partners to participate equally. In any case, it is essential to start with establishing a governance model open to change and evolution.

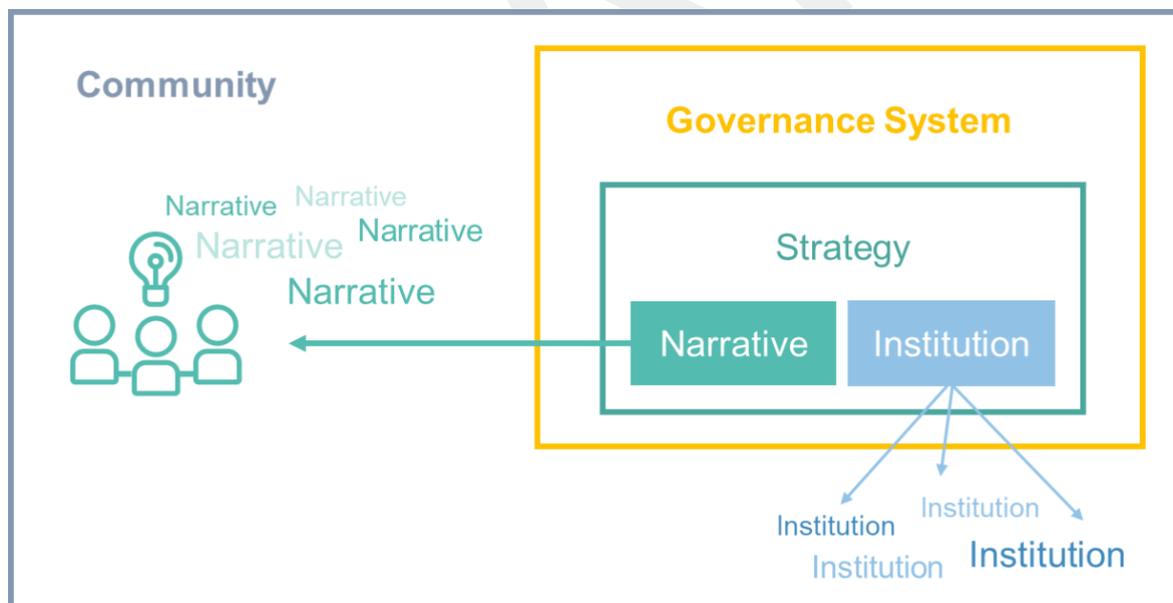


Figure 55: Governance and community engagement
 (updated from Institute of Innovation in Governance (2022))

5.1.2 Importance of Governance Models

A clear Governance Model for the Living Labs will help in supporting the sustainability and viability of the new organization. The Governance Model will allow for more efficient communication internally and externally, and help to avoid failure of the Living Lab, certainly since it is the structure that defines activities and who is responsible for whichever issue. It can also help to gain insights into new ways of handling societal challenges. Establishing a Governance Model will encourage all entities to respect ethics, integrity, and a responsible code of conduct. It will be the foundation for future development strategies.



Figure 56: Why create a Governance model?

Here you will find inspirational videos from other Living Labs on the importance of governance models:

- [Library Lab, Barcelona, Spain](#)
- [UJI>Lab, Castello, Spain](#)
- [Coventry City Lab, UK](#)

5.1.3 Developing a Living Lab Governance Model

To develop a Governance Model, it's important to have a structured approach (Figure 56) presents some steps and elements to consider while developing your Governance model.

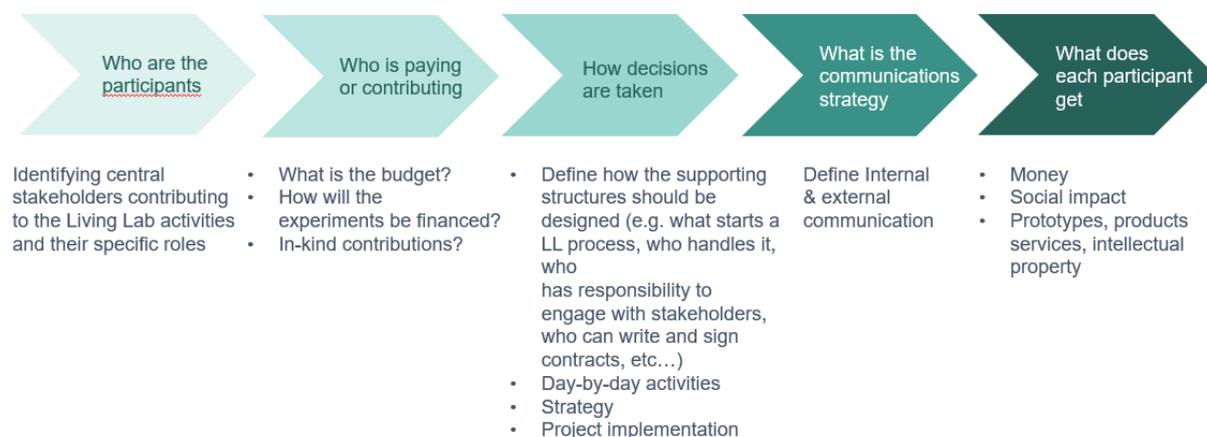


Figure 57: Steps to develop a Living Lab Governance model

5.1.4 Types of the Governance models

Living Labs are different in terms of their goals, activities, and host organisation. As a result, there are a wide variety of different Governance Models derived from the particular situation of each Living Lab. A clear Governance Model, together with the plan and process to achieve it, is an innovative tool in itself and will support the sustainable development of your Living Lab.

Governance Models can be classified according to the host organisation. By "hosting" or "leading" organisation we understand that it is an official entity, to which your Living Lab is answerable. It's a kind of umbrella organisation that provides resources and structure; a framework upon which your Living Lab functions. It is also a structure that is legally responsible for your Living Lab. Living Labs can be hosted by a:

- **Group Around a Public Regional or City Structure.**
- **Department of a Research Centre.**
- **Not for Profit Organisation.**
 - Association.
 - Cooperative.
 - Foundation.
- **Private Company.**
- **Cluster.**

5.1.4.1 Pros & Cons of different Governance models

Each of the types of Living Lab Governance models mentioned above have their advantages and disadvantages.

- **Group around a Public or Regional City structure.**

+	-
Clear strategic directions set for the long term.	Bureaucratic.
High level of collaboration.	Long time to take decisions.
Easy to engage end users and stakeholders.	Need support from private contractors/external consultants.
In-house budget from the city.	High costs in terms of time and budget.
Sponsors.	Yearly procurement processes for external contractors.

- **Department of a research centre.**

+	-
Open Innovation approach.	Bureaucratic.
Knowledge creation driven.	Decisions on innovation strategies & directions are managed top down.
Formal process of value capturing.	Low appetite for risk.
High innovation impact.	Multidisciplinarity can sometimes be limited within departments.
Long-term innovation strategies.	Low collaboration with 4-helix.

- **Not for Profit Organisation.**
 - Association & Foundation.

+	-
Member driven, defined roles & operation in statutes.	Decision cliques.
GA/collaborative decision making integrate citizens, shared value.	Bureaucracy.
Tax exemptions, access to grants, profits re-invested.	Human resource imbalance.
More open innovation.	

Example: [Green Energy Lab, Austria](#)

- Cooperative.

+	-
Multiple members, collaborative, integrate citizens, facilitates scale up, shared value.	Strategic direction can change, less control.
	Collective decision-making process takes longer time.

- **Private Company.**

+	-
Decision/voting linked to shareholding/investment.	Domination of individuals.
Faster decision making.	Can be less collaborative.
Higher appetite for risk.	Value focused on profit.
Open Innovation control.	Less socially innovative.

- **Cluster.**

+	-
Large diverse groups.	Takes time to develop contracts.
Multidisciplinary.	Can be bureaucratic.
Contracts define model.	High coordination costs of boards.
Transparent decision making.	Lower innovation impact.
Access to funding.	
Conflicts dealt with procedurally.	

5.2 Methods and Tools

There are several methods and tools to support the development of a governance model for a Living Lab, including those used to establish a clear vision, mission, values and goals. The golden spiral, values spider web, futures wheel, SWOT and fishbone analysis can be used to align stakeholders and determine a collective view of the strategic direction of the Living Lab. An important tool to support the strategic development of the Living Lab at the macro level is the Governance Model Canvas.

5.2.1 Governance model canvas

The governance model canvas for Living Labs was developed by Library Lab in Barcelona (Fernando Vilnariño) and is divided into the Quadruple Helix Model of Public, Research, Private and Citizens.

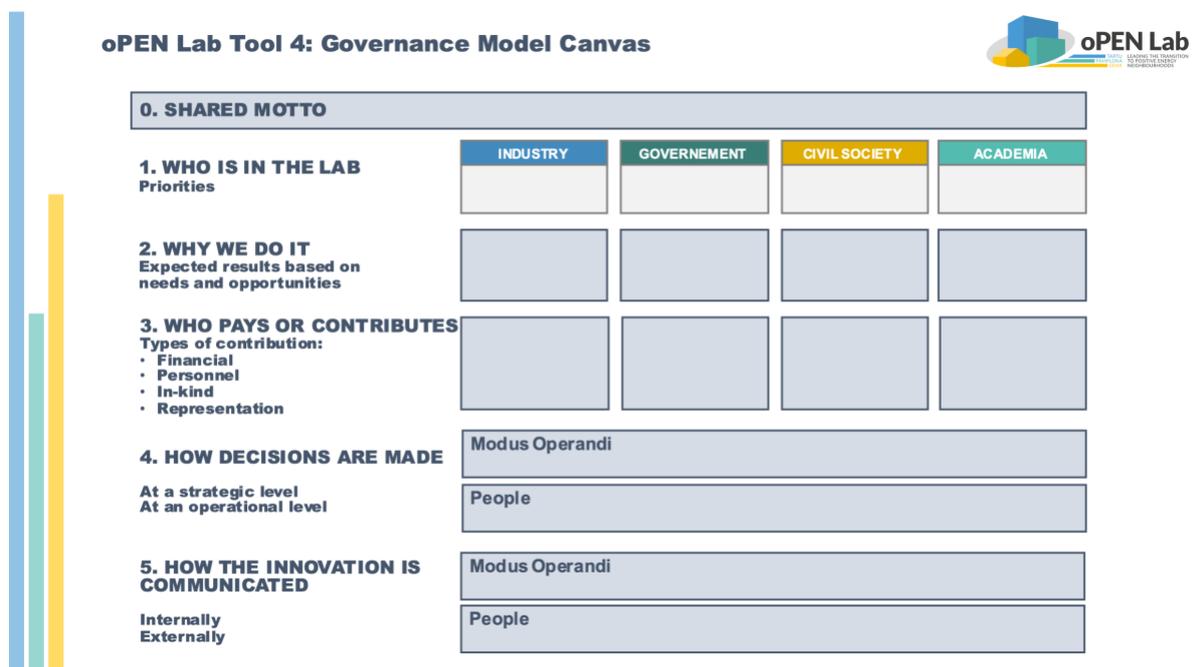


Figure 58: Governance Model Canvas

The canvas can help in getting a signed agreement between the partners, whether it's a Memorandum of Understanding (MOU) or a formal contract. The canvas should be worked on participatively by the key stakeholders. An example of the template can be found in the [oPEN Lab Toolbox](#).

5.3 Examples from oPEN Lab

During the oPEN Lab project and the capacity building process, each of the Living Labs worked on creating its own Governance Model (GM). Here is an example from oPEN Living Lab Genk.

oPEN Lab 16: oPEN Living Lab Genk Governance Model

The oPEN Living Lab Genk is part of the [Open Thor Living Lab](#) currently under development in the surroundings of the Thor business and science park in Genk, Belgium. A governance model is being developed at the level of Open Thor Living Lab – however – the information provided below focuses specifically on the residential area being developed under oPEN Lab.

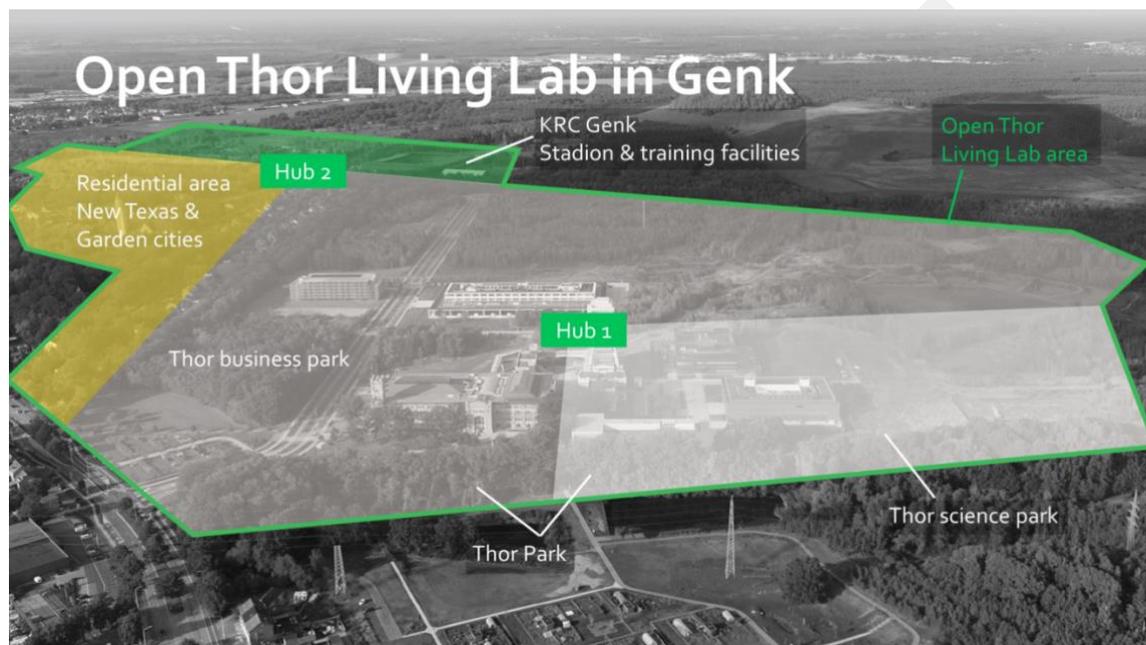


Figure 59: Open Thor Living Lab in Genk

The residential living lab area currently comprises of three sub-areas, each with a similar but separate governance model: the social housing area Nieuw Texas, the private homes in Waterschei and the neighbourhood infrastructure. VITO as a Hosting Organisation manages the residential living lab area and its sub-areas.

SHARED MOTTO

Open Thor Living Lab: a state-of-the-art living lab for the energy transition.

WHY WE DO IT

To develop a top-level European innovation environment that focuses on innovative solutions for the energy transition, including Positive Energy Neighbourhoods.

WHO IS AT THE LAB

INDUSTRY

- Flux50, Cast4All, Futech, DCinergy, LITO, Van Roey, Daikin, Habenu van de Kreeke (Technology Partners within oPEN Lab Project, Not currently part of the GM)
- Innovation Partners from oPEN Calls – (Not currently part of the GM).

GOVERNMENT

- City of Genk (structural partner associated with the Open Thor Living Lab).
- Social Housing Company Nieuw Dak (structural partner associated with the oPEN Lab project).

CIVIL SOCIETY

- Residents Nieuw-Texas (27 homes) of Nieuw Dak (Not currently part of the GM).
- Residents Waterschei (up to 8 homes) (Not currently part of the GM).
- Renovation coaches STEBO (Not currently part of the GM).

ACADEMIA & RESEARCH

- VITO (Hosting Organisation).
- KULeuven (structural partner associated with the Open Thor Living Lab).
- IMEC (structural partner associated with the Open Thor Living Lab).
- UHasselt (structural partner associated with the Open Thor Living Lab).
- EnergyVille (Collaboration between the above research partners, structural partner associated with the Open Thor Living Lab).

WHO PAYS OR CONTRIBUTES?

- VITO: funding for assets (technologies, monitoring & control).
- Nieuw Dak: funding for assets (building renovations).
- EU commission: funding for research and assets through oPEN Lab.

HOW ARE DECISIONS MADE?

VITO will coordinate activities in the different sub-areas of the residential living lab.

- For the Nieuw-Texas area, an agreement for an indefinite period between VITO and Nieuw Dak has been drafted, describing the roles and responsibilities of the two key partners as well as the decision-making bodies.
- For the Waterschei area, an agreement for an indefinite period between VITO and each individual household has been drafted describing the roles and responsibilities of the two key partners. STEBO currently facilitates the discussions but is not expected to pick up a formal role in the governance of the living lab after the oPEN Lab project duration.
- For the neighbourhood infrastructure, the governance model will depend on the scope of the asset design, but will likely involve the city of Genk, and potentially Nieuw Dak.

STRATEGIC

- Nieuw Texas area: Steering Committee comprising VITO and Nieuw Dak.
- Entire Living Lab: Possibly a separate steering Group with Citizens.
- Neighbourhood Infrastructure and Waterschei area will have their own governance model.

OPERATIONAL

- New innovations outside oPEN Lab project are not included in this agreement.
- Garden City is a separate PEN.

HOW THE INNOVATION IS COMMUNICATED

- oPEN Lab Project Communication and Engagement Plan, social media, newsletters, websites, info points, post cards, magazines, videos.

ADVICE FOR NEW/OTHER LIVING LAB

If you want to go fast, go alone. If you want to go far, go together – African proverb

Setting up a Living Lab is a complicated and intense process. To accomplish your ambitions, strong partnerships are essential, but they are built on a common goal. At the same time, any partnership should leave room for partners to pursue their own goals. And finally, goals are dynamic, so any plan should leave room for dynamic processes and detours along the way.

DRAFT

oPEN Lab 17: oPEN Living Lab Pamplona

SHARED MOTTO

There have been different proposals but no consensus on a shared motto has yet been reached. This will be decided in future meetings.

WHY WE DO IT

Main objective: To innovate by orchestrating the participation of all the actors of the quadruple helix in order to co-create products, services and values related to the framework objective of regenerating, under an integral approach, the urban environment focusing on the local reality.

Specific objectives: Positive Energy Neighbourhood

- Energy Communities.
- Reduction of travel needs + e-mobility.
- Energy rehabilitation.
- Reduction of energy poverty.
- Urban regeneration.
- Local economy + employment.
- Create meeting places for local actors.
- Promoting associations related to energy issues.
- Facilitate a fair energy transition.

WHO IS AT THE LAB

Two groups have been defined in the Living Lab: operational group and consulting or support group:

Operational group: the different agents that compose it have a vote and are in charge of:

- Planning.
- Preparation, management and development of activities and projects.
- Evaluation of projects and activities carried out in the Living Lab.
- Integral management of the Living Lab.
- Acceptance of external projects/proposals - project monitoring.

This group is composed by the following entities:

Entities	Aim of involvement	Funding	Role / Skills needed
University	R&D&I	Projects	Project development
SME co-creation (social science)	Work and innovation	Public/Projects	Co-creation processes
SME communication	Work and innovation	Public/Projects	Communication process
Architecture/engineering company	Work and innovation	Public/Projects	Project development
Consultant's office	Consultancy	Living Lab	Legal/technical

The consulting or support group: which has a vote for strategic decisions but not for operational ones. Its work is:

- Give advice.
- Technical and logistical support.
- Knowledge transfer.

- Follow-up and review of the work of the Operational Group.

Entities	Aim of involvement	Funding	Role / Skills needed
Local government	Neighbourhood development	Own	Support and funding
University	Knowledge exchange	Own	Areas of knowledge related to the project
Technical centre	Knowledge exchange	Own/Projects	Technology and innovation
Expert assistance	Advice	Per projects	Financing, legal aspects, administration

WHO PAYS OR CONTRIBUTES?

The Living Lab's activity will be financed through public funds (grants) and self-funding by the agents involved, as indicated in the previous section.

HOW ARE DECISIONS MADE?

STRATEGIC They are defined internally in the stakeholders' committee. That is, between the Consulting Group, the Operational Group and the citizen ambassadors (local agents) with the support of external entities with expertise in Strategic Planning. They are validated and approved by the Stakeholders Assembly.

OPERATIONAL By the operational group through internal working sessions.

HOW THE INNOVATION IS COMMUNICATED

Through stakeholders' assembly and local media: magazine, social media, press releases, messaging app, website, among others.

Also, the innovation will be disseminated through scientific publications and other non-scientific journals.

ADVICE FOR NEW/OTHER LIVING LABS

Due to the complexity of an Living Lab, it may be helpful to make a first exercise of schematization of the governance model in order to understand the workflows, involvement of each agent and systems of relationships between them.

Having an initial project to finance the first steps in defining the Living Lab is very helpful.

Citizens and local actors are key stakeholders. So, if you want them to have an active presence from the beginning, you have to do a lot of work. A first project of their interest that hooks them can be a good way to get them involved. Getting local key actors involved in dissemination is crucial (ambassadors), because it increases citizens' confidence.

5.4 Examples from other Living Labs

Example 10: Association Governance Model – Green Energy Lab – Vienna, Austria

[Green Energy Lab](#) is an association set up by 4 energy providers with the goal to support projects during their whole life cycle and funded as a part of the Energy module region (Austrian programme on Climate and Energy).

The Governance model is formed by a **Steering Group (decisions about the projects)**, an **Executive Board**, and an **Operational Team** with several project managers. **Operational decisions** are taken by a Team internally, **Strategic decisions** are taken by the Executive Board. There's a **clear process of project evaluation and funding** developed by the Green Energy Lab and a **portfolio management** is a highly important aspect for this Living Lab.

[Link for more info about Green Energy Lab](#)

Example 11: Research Governance Model – Citizen Innovation Lab – Limerick, Ireland

The current Governance Model (MACRO) of [Citizen Innovation Lab](#) operates **within the structure of the +CityxChange H2020 project with further collaboration between the founding partners on two follow-on projects**. At a project level (MESO) decisions are made by the project teams under research collaboration agreements.

Discussions about a future Governance Model are ongoing. An option being considered is an **embedded, collaborative governance model with a steering group** who co-create the Lab's programme and orchestrate the Innovation Playground following the CommunityxChange frameworks for DPEB Innovation Labs and Innovation Playgrounds developed in +CityxChange (D3.6 Framework for DPEB Innovation Labs, Fitzgerald, Burón García & Sánchez Mora; D3.3 Framework for Innovation Playgrounds, Mee & Crowe).

A University-City agreement is being explored to extend the Citizen Innovation Lab collaboration between the founding partners, and to align efforts in the city to achieve its 2030 and 2050 decarbonisation goals.

[Link for more info about Citizen Innovation Lab](#)

Example 12: City Governance Model – Başakşehir Living Lab – Istanbul, Turkey

The Başakşehir Living Lab is **fully owned by the (Başakşehir municipality) but operating by a professional third party (external company)**. Every year the Living Lab goes into a tendering process based on the strategy for each year. **One of the main criteria in the tender is to have an experience on managing Living Labs**.

The company operates the activities of the Living Lab which is co-managing the facilities, spaces and activities with a manager (and a team) from the municipality. The municipality organizes weekly meetings with the Living Lab team. Every 2 weeks they have meetings with the vice-mayor to decide the actions for the Living Lab.

[Link to more info about Başakşehir Living Lab](#)

Example 13: Private Company GM – RedLab – Lausanne, Switzerland

The RedLab is a Living Lab hosted by a private company aiming to accelerate energy transition and contribute to smart sustainable cities. Supporting creative ideas, the Red Lab **brings together players in the fields of energy and mobility** to address the challenges of the energy transition **using co-creation approach**.

The Red lab **creates a space for dialogue**, exchanges and practical, collaborative experiments, generating new encounters and projects. The RedLab **builds a community**: start-ups, researchers, private companies, representatives of municipal, cantonal and federal public administrations, work together on the use of data for the energy transition.

[Link for more info about RedLab](#)

Example 18: Torino City Lab Governance Model – Turin, Italy

Torino City Lab (and its spin off Torino House of Emerging Technologies) promotes functional experiments for the ecological and digital transition and confirming itself as an open innovation laboratory for smart life.

Born in 2016 in a single Living Lab in a district of Turin, it was called the Living Lab of Campidoglio. Then it was extended offering the city different assets and creating opportunities for companies and research organisations. **The Living Lab is an intermediary that helps different institutions to co-develop innovative solutions** of the public interest of the City of Torino.

The city manages a Living Lab **creating a network of organisations and partnerships between local stakeholders** (more than 15) and aiming to promote collaboration. The power is in the ecosystem where the city acts as an enabler of innovation, not imposing solutions.

[Use case video](#) on the Governance and Business model of Turin City Lab.

[Link for more info about Turin City Lab](#)

Example 19: Library Living Lab Governance Model – Barcelona, Spain

Initially the Governance of the Library Living Lab was **stated by an agreement between CVC, UAB and the Municipality of Sant Cugat**, as well as another agreement between decision of neighbours and the CVC. Library Living Lab has **three levels of decision-making process: strategic board, technical committee, and day-by-day committee** for operational questions.

The goal of creating a small unit within the public library was **to scale up a model of working to other libraries and institutions**. It was a challenge to create a new mechanism. An important point was to understand **how to work with the actors who could scale up a Library Living Lab model** to help local actors to create local innovations and translate them to a broader network. Nowadays, they are in the 3rd stage of the process – getting the know-how and distributing it within the network.

[Use case video](#) on the importance of a Governance Model in Living Labs.

[Link to more info about Library Living Lab](#)

6 Business models

This chapter explains different building blocks of the Business model for Living Labs as well as gives an example of the Business models developed specifically for the oPEN Lab Living Labs.

6.1 Theory and Practice

6.1.1 Definition

A business model describes the rationale of **how an organization creates, delivers, and captures value** (Österwalder & Pigneur, 2010).

A Business Model is a tool that **helps to define what value a Living Lab proposes to different actors**. The difference is that the Living Labs engage different groups of actors, so they have different users.

Business models are important for both new and established Living Labs to have resources for developing their team, projects, and activities, to attract investment, and to ensure the Living Lab viability. Established Living Lab should **regularly update their Business Model**, or they'll have a risk of not anticipating trends and challenges ahead properly.

A Business Model **could become an innovation itself** providing a new vision of how a Living Lab acts to sustainability and viability in a long-term.

6.1.2 Business Model and Living Lab's sustainability

A Business model **refers to a Living Lab's plan for being sustainable and profitable in a long term**. It identifies the products, services, or activities the Living Lab plans to provide, as well as its users, resources, and expenses.

Creating a viable business model that offers value to all different types of new and/or involved stakeholders is key to the sustainability of a Living Lab. Critical elements to be considered are, for example, **funding sources, value proposition, lean approach, impact, purpose, and key metrics**.

In addition, **all the phases of a lifecycle approach should be considered**: from ideation to design, experimentation, and validation. Important aspects in this part of the evaluation are, among others, proof of integration of the Living Lab operations into innovation ecosystems.

6.1.3 Living Lab Interface with PENs

In the oPEN Lab project, Living Labs, PENs organisational and business models interact to deliver a unique business model for the wider district. Each PEN is a complex urban energy environment where the participative methods of the Living Lab enable the development of solutions that can be implemented and potentially replicated in other PENs.

Interface of business, organisational and capacity building models

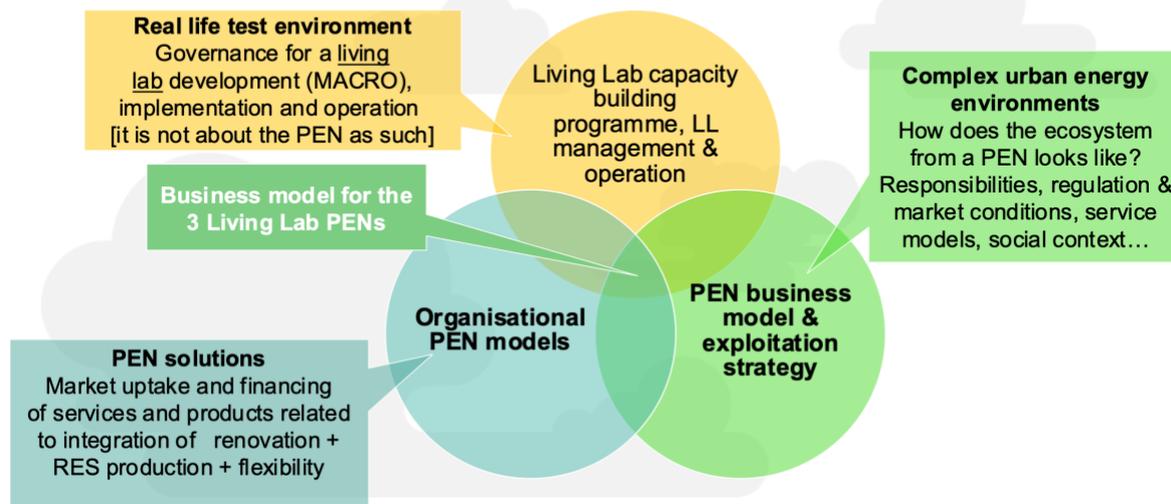


Figure 60: Interface of PEN Solutions and Living Labs in the PEN business model

At the time of publication of this Handbook, the oPEN Living Labs were mainly at the stage of proposal validation or procurement and therefore no major technical interventions had taken place. Many social interventions associated with the co-creation activities of the oPEN Labs were carried out and have been essential for the development of the PEN solutions.

The part of the Capacity Building Programme (CBP) that focussed on business models was aimed at the MACRO level of the Living Labs business model of which the PEN project is a key activity. Living Labs were encouraged to think beyond the oPEN Lab project and consider how PEN solutions, could be innovated further. The oPEN Lab project is tasked with developing and validating the business models for the PENs. Extensive human resources are required in applying a co-creative and participative approach, however it is important that this is continued throughout the oPEN Lab project as new technologies and business models are developed, and not just at the beginning to encourage energy users to join the project. The Living Lab is an important part of the overall PEN Business model.

6.1.4 Important questions to ask to develop a Living Lab Business Model

Business models and revenue sources are important to consider ensuring your Living Lab sustainability and viability in a long term.

- What is the specific value proposition of your Living Lab?
- Who are the key stakeholders involved and what kind of relationships does your Living Lab propose to the users?
- What are the key activities and resources of your Living Lab?
- Will procurement and public tendering for projects be required?
- Through what channels could users get access to your services and activities?
- Who are your key partners?
- What are your main revenue sources? How is your Living Lab financed and by whom?

6.1.5 Types of the Business models

Some of the existing Business models are more oriented toward business development, others on social value creation. For instance, the Social Business model and Sustainable Business model Canvas, represented by the tools such as a Triple layered Business Model canvas (Joyce et Paquin, 2016), were developed to face specific challenges in the fields dealing with issues of social integration and sustainable development. These canvases could bring additional value in comparison to the classical Business Model allowing to consider specific challenges and aspects.

6.2 Method and Tools

Several methods and tools can help prepare to inform the business model, these include for example SWOT-analysis, a value chain analysis throughout the operations of a Living Lab, visioning or a roadmap for the future.

6.2.1 LIAISON Business model canvas

There are many types of Business model canvas that are used as a tool to present and work on the business model. The canvas created specifically for the Living Labs is the LIAISON business model canvas that was developed by Juan Bertolin, director of UJI>.Lab – In this [inspirational video](#), he explains why he developed the LIAISON Business Model Canvas.

6.2.1.1 Living Lab Business models – LIAISON

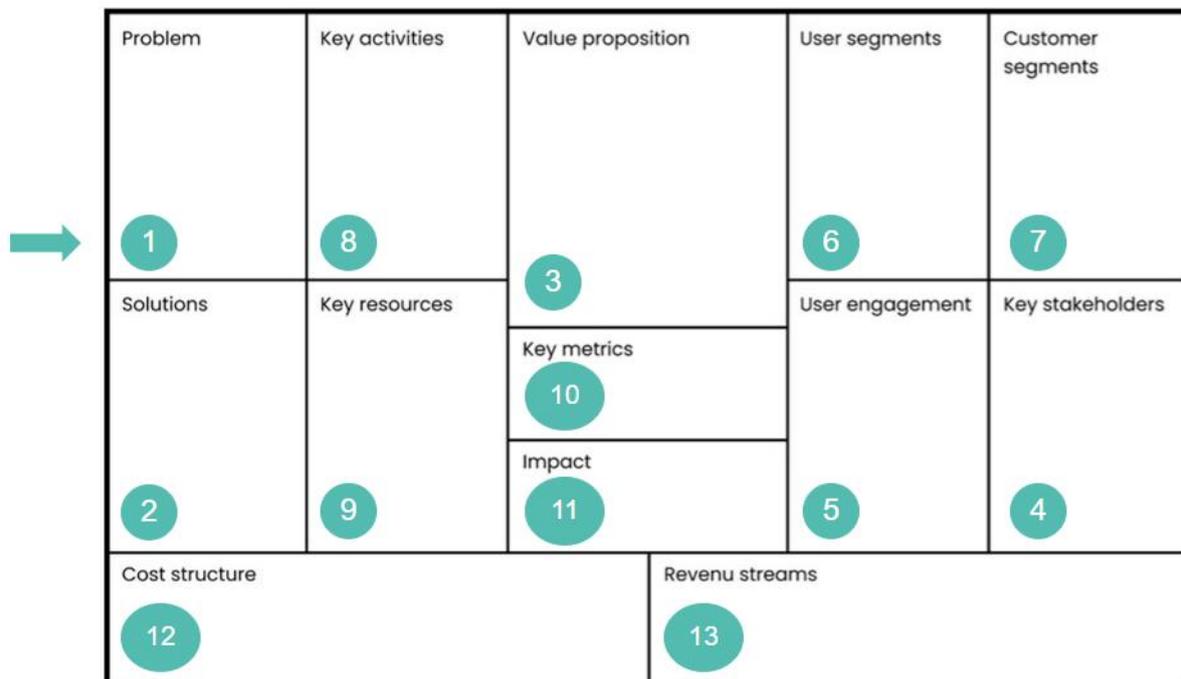


Figure 61: LIAISON Business model Canvas, (source Juan A. Bertolin)

The numbers indicate the order in which the canvas can be completed, starting with the problem and the solution, then moving to the value proposition, the key stakeholders, users engagement etc.

6.3 Examples from oPEN Lab

Here are examples of the LIAISON Business Model canvas from the oPEN Lab Living Labs. Each Living Lab was proposed to fill in key elements of the Business model canvas. As it was already mentioned, a business model is not a fixed image, but an evaluative tool, so the Business models described below represent a vision of the current point of the oPEN Living Labs in Tartu, Genk and Pamplona (April 2023).

Example from oPEN Lab 1: Business Model – oPEN Living Lab Tartu

The business model for oPEN Living Lab Tartu is part of a larger business model for the city, there is no separate formal business model for the Living Lab, nor a separate legal entity proposed. However, there are several innovative services that are part of oPEN Living Lab Tartu which can be grouped together into a business model, including one of the key services Renovation-As-A-Service (RaaS) which helps Building owners undertake renovations.

PROBLEM & SOLUTION

Large scale renovation of apartments such as those in Annelinn is needed to reduce energy consumption and improve quality of life for residents.

More defined roles on national and local level in supporting the developments towards PEN are needed as well as commitment towards climate goals from the private sector and society, where the support structure via oPEN Living Lab Tartu can help.

VALUE PROPOSITION

- For the residents and citizens: support in preparing for large scale renovations; additional financing; support in the implementation phase; bringing the best and innovative technical solutions to the area; engaging the community, increasing their awareness; reshaping the understanding about the neighbourhood (also on practical level via implementation of solutions).
- For the public sector: complying and delivering the strategic climate goals, implementing the mitigation measures; boosting innovation; delivering the best foreign expertise to the area.
- For the private sector: testbed for innovative solutions and services.
- Tartu Open Living Lab helps to create trust between key stakeholders, build collaborations, provide opportunities for testing.

USER & CUSTOMER SEGMENTS

- Residents of Annelinn and surrounding neighbourhoods.
- Public sector – local government, Ministry of Economic Affairs.
- Private sector: industrial partners; start-ups, innovators.

KEY STAKEHOLDERS

- City of Tartu.
- Housing Associations of Annelinn pilot area houses.
- Tartu Regional Energy Agency.
- Tartu University and TalTech University.
- IBS (research and consulting other key stakeholders).
- Construction Companies, construction engineers.

USER ENGAGEMENT

- Through the Housing Associations.
- Direct through Communication and Engagement plan.

KEY ACTIVITIES & RESOURCES

- Building retrofit.
- Financing.
- Renovation as Service (RaaS).
- Public space improvement.
- Research and data monitoring and analysis.

KEY METRICS

- 10 buildings qualified for retrofitting, number of buildings eventually renovated (building renovated m2).
- No of affected citizens, apartment owners, dwellers.

IMPACT

- Improvement of the quality of the housing stock.
- CO2 savings.
- Satisfaction of affected residents.
- Number of enterprises directly benefitting.
- New solutions, services, methods and tools in wider application.

COST STRUCTURE

- Cost of retrofit and implementation of solutions.
- Interest rate.

REVENUE STREAMS

- oPEN Lab project until 2026 (and other connecting projects on a city level).
- New projects applied in the future (connected to the climate plan goals).
- City budget.

The learnings from the oPEN Lab project have helped the Municipality to launch a 'one stop shop' approach and has applied for further funding through a separate European Projects. Other sources of funding are being sought to develop these services beyond oPEN Lab. Future Projects will have more of a focus on climate adaptation to address public spaces, heat islands through renovated neighbourhood-based concepts.

Example from oPEN Lab 2: Business Model – oPEN Living Lab Genk

PROBLEM & SOLUTION

The residential building stock must be renovated to reduce energy consumption, CO₂ and improve comfort and wellbeing for residents. There is a lack of real-life lab environments to test near to market solutions. There is a lack of awareness, trust, and engagement of residents in the benefits of renovation, and financing for energy renovation is challenging.

Collective renovation improves uptake and viability of renovation projects. Testing of innovations in a real-life setting enables anticipation of changes prior to market. Data provides valuable information for co-designing innovations and new business models. PENs enable innovation and reinvestment in society through energy communities.

PROBLEM & SOLUTION

The residential building stock must be renovated to reduce energy consumption, CO₂ and improve comfort and wellbeing for residents. There is a lack of real-life lab environments to test near to market solutions. There is a lack of awareness, trust, and engagement of residents in the benefits of renovation, and financing for energy renovation is challenging.

Collective renovation improves uptake and viability of renovation projects. Industrial partners improve their expertise and product offering for large scale renovations. Testing of innovations in a real-life setting enables anticipation of changes prior to market. Data provides valuable information for co-designing innovations and new business models, that allow for upscaling and rolling out in a larger market context. Positive Energy Neighbourhoods (PENs) enable innovation and reinvestment in society through energy communities.

VALUE PROPOSITION

- Trustworthy, independent party.
- Facilitator of collaboration between stakeholders.
- Test environment for technology, new energy devices and innovations.
- Monitoring of quality and services.
- New innovations close to market.

USER & CUSTOMER SEGMENTS

- Housing Associations – advice on portfolio, methods and feasibility.
- Industrial Partners – combining assets, products and services to improve their own offering.
- Data Users.
 - Industrial partners.
 - Policy makers.
 - Other researchers (lower TRL).
 - Housing Associations.
- Energy Users (tenants and private).

KEY STAKEHOLDERS (UPDATE ORDER)

- Vito.
- Nieuw Dak Housing Association and its residents.
- Private housing residents.
- Stebo – energy house/agency.
- City of Genk.

- Industrial Partners.
- EU/Regional/National Policy makers.

USER ENGAGEMENT

- Business to Living Lab for researchers and industrial partners.
- Face to face and community engagement with;
 - residents via Housing Associations, with support of VITO.
 - private homeowners – directly via Stebo, with support of VITO.

KEY ACTIVITIES & RESOURCES

- Combining Existing infrastructure and new energy devices into solution packages
- Advice and consultancy.
- Research and development (Smart controls, IOT applications, new prototypes, BEMS).
- Product and service testing and monitoring.
- Data analysis and processing.

KEY METRICS

- CO2 savings, reduction of energy use (would put this first).
- Number of industrial companies supported.
- Number of innovators through open calls.
- Number of contracts, patents and their outcome.

IMPACT (ORDER UPDATED)

- New approaches and methods for engagement.
- Measurable CO2 and energy efficiency cost reductions.
- Improvement of social housing stock.
- New innovations, start-ups and patents.
- Energy security improvements for residents and social housing associations.
- Energy poverty reduction through energy sharing.

COST STRUCTURE

- Membership fees.
- Asset acquisition (energy devices).
- Data platform fees.
- Building and lab use fees.
- Consultancy fees.

REVENUE STREAMS

- oPEN Lab project until April 2026.
- Contracts with Industry to test and monitor.
- New local, regional and EU projects.
- Energy Community revenue for reinvestment in neighbourhood/society projects.

6.4 Examples from other Living Labs

Example 14: Energy Living Lab Association (ELLA) – Sion, Switzerland

The goal of the ELLA is to **replicate, disseminate and communicate Living Lab approaches in the energy field** supporting an ecosystem of actors in the use of co-design methods and tools. **Its Business Model is built around the Social Franchising Model of Innovation Intermediaries** through the Innovation Booster, membership for companies and individuals to have training & certification, access to energy community, support to innovative ideas and dissemination of projects.

[Link for more info about Energy Living Lab](#)

Example 15: RedLab – Lausanne, Switzerland

The RedLab brings together players in the fields of energy and mobility to address the challenges of the energy transition in a co-creation approach by organizing Hackathons, supporting ideas, and communicating results to decision-makers and other stakeholders.

The Red lab is a space for exchanges and practical, collaborative experiments, generating new encounters and projects. Start-ups, researchers, private companies, representatives of municipal, cantonal, and federal public administrations, work together on the use of data for the energy transition.

[Link for more info about RedLab](#)

Here you will find inspirational videos from other Living Labs on business models:

- [LiCaLab – Belgium](#)
- [Coventry City Lab – UK](#)

7 Main Findings to Train and Mentor

This section identifies general and specific mentoring requirements for each Living Lab through feedback and lessons learned from the start of the oPEN Lab project in September 2021 to May 2023 and highlights the needs throughout the rest of the oPEN Lab project until March 2026.

7.1 What is a Living Lab?

- A Living Lab means different concepts to different people. It is important to have a common definition that includes key words including **stakeholder participation**, **co-design**, and **social innovation**. Learning and understanding the various definitions and terminology are necessary. Simplifying the theory is important. The Quadruple Helix Model and Three-layer model help to explain and visualise the Living Lab framework and methodology.
- Design Thinking is central to the innovation process. Many people skip to the solution and do not adequately assess the problem. Understanding the challenge through empathising with users, integrating stakeholders and defining barriers is essential. The LLIP provides a framework to develop innovative projects both socially and technically. The methods and tools can be mapped to each step and the Co-creation toolbox can help in deciding what tools to use.
- Aligning the objectives, expectations, and timescale of the overall project to the innovation process and Living Lab activities at an early stage can ensure a participative and co-creative process.
- The amount of information can be overwhelming to participants. It's important to establish the learning needs and to co-design a CBP to meet the needs of a variety of participants. This is an ongoing process as the needs change and are not always known from the start.
- Examples from other Living Labs and practitioners through use cases are essential. These should be integrated into the CBP at an early stage.
- Participants need time to share and exchange their experience and ask questions.
- Revisit the question 'What is a Living Lab?' regularly by demonstrating practically how citizens, private companies, public sector, and researchers come together to drive innovation and social change.
- A better understanding of the Living Lab as an organisation and orchestrator of a dynamic ecosystem, rather than being a project, is important for the long-term sustainability of the Living Lab and potentially the PENs. This is particularly evident in Tartu where the Living Lab is considered a project.
- An organisation such as a Living Lab is institutionalised over time and aims at continuing its activity over the time with a long-term perspective. Establishing the governance and business model are an important step towards institutionalisation.

7.2 How to set up a Living Lab?

- Many Living Labs start from a project (e.g. oPEN Lab), however a long-term perspective is needed to ensure the sustainability of the Living Lab as an organisation by developing a business and governance model with the Quadruple Helix Model of stakeholders (Public, Private, Research and Citizens).
- A Living Lab can have a space for stakeholders' meetings such as the one provided by the start-up Enoki in sustainable neighbourhoods in Switzerland, but a Living Lab is an organisation rather than a laboratory. A physical space is important for the long-term development of the Living Lab for example the PEN Office in the Rochapea Living Lab in Pamplona.
- It is highly important to establish the positioning of the Living Lab from an early stage. This should be driven by the key partners in the Living Lab activities collectively.
- A Living Lab can start with some people covering several roles at the same time (ex. Living Lab manager and Project manager), but it is important to define what roles will be needed for a long-term Living Lab development.
- It is essential to have a communication & dissemination support of the Living Lab activities as early as possible. A strategic communication and engagement plan is an important tool.
- A Living Lab can have a core team (internal group) and some external experts according to specific activities of the Living Lab. For instance, for the PENs' creation, these external experts could be technical specialists and energy technologies.
- General principles and tools used by the Living Lab (such as a Three-layer model or the LLIP) are universal and don't depend on the specific field of the Living Lab. However, there are some elements to consider while developing a Living Lab for PENs, such as active integration of private stakeholders (industrial partners) or working on the co-design of the common vision of future of the neighbourhoods.
- The simplification of the implementation plans to a timeline presented in PowerPoint was applied by all the oPEN Labs. Keeping things simple is an important approach given the complexity of the project. However, it is recommended that the implementation plans are reviewed to help identify lessons learned and how to set up a Living Lab for PENs differently in the future.
- The extension of the stakeholder mapping tool (using the Quadruple Helix Model) should be taken to the next level analysis by using the Interest Influence matrix. This is important not only at the MACRO level for each Living Lab but also at MESO level when integrating stakeholders into new projects in the Living Lab. The change in the Interest Influence Matrix as a result of an intervention or action should be considered. For example, the impact of the Ambassador Programmes that are proposed by oPEN Living Lab Tartu and Genk could be considered in this way.
- It's essential that the governance and business models for the Living Lab are completed and updated regularly to support the set up and sustainability of the Living Lab.

7.3 Co-creation and co-design

- Design thinking approaches are useful for integrating stakeholders and co-designing with users and for users. The LLIP brings together all the elements of Living Lab methodology at the project level (Mastelic, 2019). The Innovation management evaluation process in oPEN Lab should take into account the status of technological, social, business and political innovations in relation to the innovation process and especially the degree of co-creation and co-design which has been part of their development. The level of radicality in the process as well as the innovation itself could be explored.
- Mentoring is required to integrate the Societal Readiness Levels (SRL) methodology defined by the Denmark Innovation Fund into the oPEN Lab project, to test, evaluate and improve the approach and increase the understanding of, and role of stakeholders in co-designing solutions. Further mentoring is needed in social innovation on how it can be considered alongside the traditional approaches to technological innovation.
- Further mentoring is also required on methods and tools for running co-design workshops for energy technologies, that go beyond aesthetics and comfort, so that new business models can be explored, and more radical innovations can be identified.
- The co-creation activities in oPEN Living Lab Tartu have revealed surprising outcomes such as the fact that the residents don't want solar panels, even though it will be placed on the roof and reduce communal charges. It is not clear why this is the prevailing attitude in Annelinn. Further investigation to reveal the reasons for this as well as tools to explore the problems and barriers are needed. New co-creation approaches such as the mural of PV in oPEN Living Lab Genk, may show some promise. Methods on hearing the minority voice and the strategic strength of weak signal analysis and how it can become a source of innovation and acceptance is also of interest in Nieuw Texas (Mendonça, Cardoso, Caraça, 2012).
- Further mentoring on developing a neighbourhood strategy and integrating stakeholders such as architects and other city projects is also proposed in Tartu. Mobility was generally not considered a problem in Annelinn although some dissatisfaction with the availability of parking spaces was noted. Electric car chargers were not favoured as currently there are very few electric cars in Estonia. Raising awareness about the problems of private use could certainly bring benefits to the community in the future. Integrating mobility in PENs is a general mentoring requirement relevant for all oPEN Living Labs. Inspiration can be found in different Living Labs such as the JRC Mobility Lab or the Swiss Post Mobility Lab.
- Given the current market barriers in Estonia, tools on scenario planning relating to interest rates in Tartu could be useful. Innovative Financing seminars with examples from other Living Labs and projects have been identified as a mentoring need.
- The oPEN Lab project is tasked with developing the Toolbox for the project. It may be useful include facilitation guides on how to use the Tools and templates provided here in the handbook, once the oPEN Lab Toolbox is co-design and implemented in collaboration with the users.

7.4 Stakeholder ecosystem management

- The Quadruple Helix Model and Interest Influence Matrix should be updated for each oPEN Lab annually, to identify changes and strategies for stakeholder ecosystem management.
- Ambassador programmes are planned in the oPEN Labs. This is considered an effective tool to integrate stakeholders and improve the uptake of the PEN solutions. The extension of the stakeholder mapping tool, to using the Interest Influence matrix would help to consider how this intervention would benefit the project in light of the current barriers to the project. A key mentoring requirement is how to mobilise and motivate energy ambassadors and the stakeholder assembly group. This can be assisted by finding other Living Labs that have used a similar stakeholder assembly approach through ENOLL and enabling the sharing of experiences and approaches.
- Further projects in oPEN Living Lab Tartu aim to integrate architects to work on how the buildings connect to the surroundings. This co-design of the neighbourhood will also be done by integrating other city projects, which is necessary to identify further funding schemes.
- Better risk assessment methods and tools could assist oPEN Lab in integrating industrial partners. For example, oPEN Living Lab Tartu could assist with construction companies entering the prefabrication market in Tartu.
- How to integrate industrial partners is a key mentoring need identified by oPEN Living Lab Genk, and relevant for all the PENs. The following activities are recommended:
 - Analysis of stakeholders using the Interest Influence matrix may help to establish positioning of partners and an appropriate strategy for management.
 - Raising awareness regionally about PENs and integrating industrial partners into the Communication and Engagement strategy.
 - Having an onboarding strategy that comprises the pitch, values, vision, mission, goals and objectives of the Living Lab and its projects in the medium to long-term.
 - Empathising with partners and understanding their motivations and reasons for participation can be obtained through interviews, focus groups, experience mapping as well as building relationships through community events and co-creation activities. The co-creation toolbox has 16 tools to assist with empathising and integrating stakeholders.
 - The reflexive monitoring tools applied at oPEN Living Lab Genk by Vito Nexus revealed important reasons why partners participate and helped to motivate ongoing involvement.
 - Engaging with other Living Labs through the E&E AOTF, ENOLL and directly through the use cases researched through the oPEN Lab project.
- The assessment of barriers and risks has recently been revealed as a new mentoring need for oPEN Lab. The legal barriers for energy communities, particularly associated with oPEN Living Lab Pamplona require further focus. At the community level, the drivers and barriers for participation and action can be better understood using the barriers tool to ideate on how to remove barriers and facilitate positive practices or add barriers and reduce negative practices.

- Strategic community based social marketing could be explored as an approach to drive behaviour and social change (French, 2019). This could be explored through the oPEN Lab project.
- The extensive human resources necessary for implementing a PEN using participative methods, such as those applied in oPEN Lab and the role played in the success of the PEN solution, need to be considered in the PEN business model, as the cost of replicating the PENs will also depend on how much the Living Lab methods and tools are applied. Tailoring of methods and tools such as the ambassador programme across business models could be a viable approach, however the impact is yet to be demonstrated.
- Sharing of best practices is a clear mentoring need, which can be met through ENoLL and the various existing AOTFs and WGs.
- Mentoring can also be fulfilled through integrating better with the Cities Mission and projects such as Built4People which has a stakeholder forum info@built4people.eu.
- Webinars exclusively with other PENs through focussed exchanges with the LIFE Beckon project on energy communities through ENoLL as well as the sister projects of oPEN Lab such as ARV, Atelier and Energiesprong could help to answer many of the PEN specific questions being asked by the project partners. The Living Labs can orchestrate these exchanges, as facilitation is a key competence and the core activity of Living Labs.

7.5 Governance Model Development

- Living Labs can be of diverse nature (depending on the host organisation, the main activities, the goals), they will have different governance models. A clear model of governance, together with the process to achieve it, is an innovation tool to support sustainability of the project in the long term.
- However, it is not straightforward to adapt experiences from others, each Governance Model requires specific analysis and considering specific cultural, socio-economic and political context. Living Labs are highly contextual and adaptable.
- A Living Lab governance model creation demands time to build trust, which is the fundamental element of development in open innovation (Dupont et al, 2019). It works better if the priorities of different actors are clearly understood.
- A Living Lab governance model is a work in progress rather than a fixed image as it evolves over the time. The tips provided in the inspirational videos advise to start small and expect changes over time. A signed agreement is of fundamental importance as well as bringing all stakeholders along the journey.
- In oPEN Living Lab Genk, the key mentoring requirement is how to integrate industrial partners into the governance model. Further discussions are needed about how the GM of the Thor Living Lab will have an influence on the oPEN Lab governance model. The Interest Influence Matrix could be used to help this discussion and as well as scenario planning and SWOT analysis. The governance model should be developed through the lenses of long-term stability and integrating the quadruple helix mix of stakeholders, enabling innovation, while maintaining the needs of the Vito and Nieuw Dak and its tenants. External facilitation may be helpful.

7.6 Business Model development

- Think about the viability of your Living Lab in the long term. Start from the problem you want to solve and for whom. Try to formulate short and clear value proposition.
- The Value Proposition is a key point of the Business model that helps to solve users' problems or satisfies their needs. The Value Proposition is an aggregation of benefits that a Living Lab proposes, which may represent a new or disruptive offer to its public, or it may be similar to existing products/projects, but with some specific elements.
- Communication is essential, and communication channels are important to disseminate and promote activities of the Living Lab, as well as to find partners. Channels serve such functions as raising awareness, and helping to deliver and evaluate a value proposition.
- While creating a Living Lab, it's important to think about the type of relationships you want to develop with each group of the stakeholders, because the relationships established will influence overall experience of your projects.
- Partnerships are a cornerstone of Living Lab's business models. Creating partnerships can help a Living Lab to optimise its business model, reduce risks, improve projects, co-create value and innovations.
- Business models of Living Labs evolve and change to adapt to its context and to the maturity level of the Living Lab. Sharing of the Use case, research and inspirational videos presented in this handbook as well as direct one-to-one exchanges between the specific Living Labs would assist greatly in mentoring. Exchanges for example between:
 - oPEN Living Lab Tartu and Bristol Living Lab, UK (vulnerable target groups, innovative financing).
 - oPEN Living Lab Genk and NEST Pre-Living Lab, Switzerland, & Başakşehir Living Lab – Istanbul, Turkey (building materials prototyping & data sharing).
 - oPEN Living Lab Pamplona and Citizen Innovation Lab Limerick, Ireland (Digital twin, SME integration).
- Research into the business models of other Positive Energy Neighbourhoods should be undertaken as part of WP7 and the project costs of applying participative methods taken into account to help support replication. This Handbook can help to reduce set up and implementation costs by guiding new Living Labs in methodology and benefiting from the lessons learned in the oPEN-Lab project.
- Mentoring is required generally on the interconnection between the business model of the Living Lab and the business model of the PEN solutions.
- Mentoring on the challenges to financing for PENs and community energy systems, and best practice examples for guiding success are required. Focused webinars could be organised with sister projects.

7.7 Additional Mentoring recommendations

- The question of how to share data and address intellectual property in an open innovation culture has initially been raised by oPEN Living Lab Genk. In terms of opening up the dataset, sensors are installed on equipment and foreground data generated during the project can be shared amongst partners to enable ongoing innovation. Industrial partners have varying levels of willingness to be open about sharing data. Large companies in particular can be reluctant to share data. Best practice in terms of data sharing and open data would be helpful for the oPEN Labs. This is a key mentoring requirement going forward in the oPEN Lab project and should be undertaken in coordination with ENoLL by linking with existing Living Labs who have already faced these issues.
- Mentoring in open innovation could be provided to the oPEN Labs and to industrial partners in particular. Exchanges can be organised with other Living Labs through the ENoLL Network, such as with Basaksehir in Turkey, also presented in the Use Cases, to help determine what models exist for sharing different types of data. The e-learning video on ‘Why Open Innovation?’ explains why and how it would bring added value of openness about the problem and the solution and the importance of a legal frameworks to support it. Exchanges with specific Living Labs working in digitalisation through ENoLL and the task forces could be organised.
- Attending the ENoLL OpenLivingLab Days annual conference is an important way to obtain mentoring and networking opportunities from the Living Lab community, to share best practices and discover new methods and tools as well as engage with professionals working on solutions for the energy transition.

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9 oPEN Lab Partners



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