Interreg Mediterranean

EFFICIENT BUILDINGS

Efficient Building Living Lab Methodology

Work Package 4

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Partners

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1. Executive Summary

Efficient Buildings Community, as a MED hub for Energy Efficiency (EE) innovative and shared solutions, anchors a MED community around energy issues that public organisations face in order to promote Modular Projects' (MPs) outcomes and increase their impact on public policies.

Indeed, in the MED area, the majority of public buildings is not adequately designed to reduce their energy consumption and improve their EE performance. This is partly due to a lack of awareness of owners and managers and knowledge gaps regarding common answers to this transnational challenge.

By establishing a joint transnational framework around energy efficiency in public buildings to propose solutions to energy issues faced by public organizations in the MED area, the Efficient Buildings Community will contribute to increase the capacity of owners and managers of public buildings to design and implement better energy efficiency practices.

On the other hand, the Efficient Buildings Community will promote its results at national and EU levels to influence policies and call for new national and European regulatory framework that take into account MED specificities and the innovative solutions proposed by the community.

The overall objective of the Efficient Buildings project is to promote and support the dissemination and implementation of the instruments developed by the MPs on a large scale in the Mediterranean region. In this context, the MEDNICE Horizontal Project (the 1st generation of the Efficient Buildings project) has already launched the "MED Community of Efficient Buildings". This community is both target group and multiplier.

By establishing a joint transnational framework and transfer the knowledge acquired in the MPs, the Efficient Buildings project will contribute to:

- Increase the visibility and influence of the MED programme
- Capitalize and transfer the knowledge acquired in the MED MP
- Tap the considerable potential for higher energy savings in public buildings in the MED area
- Reinforce the capacity of owners and managers of public buildings to design and implement better energy efficiency practices
- Raise awareness about MED specificities at the EU level.

In order to achieve its overall objective, the consortium of the Efficient Buildings had designed a well-structured Transferring Work Package with several target activities. One of these activities is the "***Detailed design and implementation of Efficient Building Living Labs (EBLL)***" (A4.3).

The present document is the first step of this activity ad presents in detail the "***Efficient Building Living Lab Methodology***" (D4.3.1).

Indeed, the concept of Living Lab (LL) presents a specific trend in open innovation approaches that enables co-creation of novel user-oriented solutions. Its role is likewise deployed within Efficient Buildings project to change the stance of actors and civil society towards EE innovative and shared solutions focusing on public buildings.

With setting up five EBLLs in five different countries (France, Italy, Spain, Portugal and Greece) the project triggers behavioural changes of actors in MED area and beyond in favour of EE of public buildings and eco-innovation with deployment of a user-oriented innovation approach. The EBLLs integrate R&I processes and create a user-oriented open innovation ecosystem that will strengthen transnational cooperation and networking among key stakeholders.

The EBLLs' main objective is to transfer existing knowledge (best practices/tools/methodologies) developed by the MPs of the Community to project stakeholders and target groups. In parallel, Efficient Buildings partners will transfer existing knowledge, which has been already gained through MEDNICE project. The EBLLs will also enable the exchange of experiences and concerns for EE, especially among owners and managers of public buildings who design and implement energy efficiency practices, and so setting the base for further actions.

The EBLLs will consist of different actors, such as public buildings' owners and managers, decision and policy makers, MPs' partners, research institutes and universities, technical chambers, innovative companies and SMEs who can share advanced technological solutions. As a result, EBLLs will raise awareness amongst the involved parties in enhancing the implementation of better EE practices, promote MPs outcomes and increase their impact on public policies.

2. Introduction

The Deliverable 4.3.1 “Efficient Building Living Lab Methodology” consists of two main parts, Part I and Part II. The aim of Part I is to provide general understanding of Living Lab concept, while Part II provides more extensive introduction to Efficient Buildings Living Lab methodology describing step by step the approach for setting up the EBLLs; thus guiding and supporting project partners in their EBLL setup activities.

In Part I, the general understanding of Living Labs concept is established by providing general description and definition of Living Labs. By emphasizing different types, key components and principles of Living Lab environment, partners will gain valuable background knowledge of Living Lab concept. The gained knowledge will assist them to build Living Labs able to address their problems or opportunities throughout innovation process. Alongside definitions of Living Lab also existing methodologies for the formalization or design of Living Lab are presented with special emphasis on Living Lab approach used in CO-EFFICIENT and GRASPINNO project. Several valuable conclusions from studying existing Living Labs are introduced to partners and taken into knowledge while forming Efficient Building Living Lab Methodology.

In Part II, the detailed approach on setting up Efficient Building Living Labs set-up is presented. The set-up of EBLLs will include six phases, each following several steps, whereas the sequence of these steps within the phases can differ based on the demand or environment of the EBLL. Potential Living Lab models can be EE Innovative Solutions Living Lab, EE Fund Living Lab, EE Policy Living Lab. These titles are pretty general and the Efficient Buildings partners can include several results of the MPs which fit better the needs of their stakeholders. On the other hand, some partners may decide that they want to set up an EBLL very target to a result and in this case they can name their EBLL accordingly.

The deliverable concludes with short but valuable conclusion to encourage partners how to be successful in setting up their own EBLL.

3. Part I: Introduction to Living Labs

3.1 Literature Review

According to Tukiainen et al. (2015), the term “living laboratory” was first used by Knight (1749). Nevertheless, the emergence of the contemporary Living Lab movement has been affected by three predecessors of Living Labs (Ballon and Schuurman, 2015). While the terms “Living Lab”, “living laboratory” and “living labbing” have been used interchangeably in the literature, there are two distinguishable approaches to Living Labs: the North American view and the European view. The early North American approach and the more recent European approach share the concept of involving users in innovation activities in real environments. The North American approach, however, considers Living Labs as demo-homes, home labs, or houses of the future; whereas the European approach views them as a platform to study users' everyday habits (Schuurman et al., 2011; Leminen and Westerlund, 2016).

Some studies suggest that the Living Lab concept originated from Prof. William Mitchell of the Massachusetts Institute of Technology (e.g. Bergvall-Kåreborn et al., 2009; Budweg et al., 2011; Schuurman et al., 2011). In addition, ENoLL credits him as the father of the concept (ENoLL, 2018), especially because Mitchell and his team played a significant role in boosting early Living Lab activities in Europe (Leminen et al., 2017a). Other studies (e.g. Følstad, 2008b; Leminen and Westerlund, 2016) identify pioneers in the field prior to Mitchell, such as Abowd and his colleagues at the Georgia Institute of Technology. The Living Lab concept appeared in scholarly discussion in the 1990s, when the EU began funding various large-scale living lab projects (Følstad, 2008a; Veeckman et al., 2013; Leminen et al., 2017a).

Studies of Living Labs have appeared in a broad range of journals and conference proceedings. The publication trend for Living Labs had been accelerating between 2006 and 2014. There was also a significant jump in the number of publication in 2015 and the subsequent three years. A systematic review of Living Lab Literature was carried out by Hossain et al., 2019.

The existing literature considers Living Labs to be a multidisciplinary (Bergvall-Kåreborn et al., 2009) upper-level concept covering diverse activities, typologies and types of open innovation. Prior studies have used the term ‘Living Labs’ in association with innovation systems, experimentation, user

involvement in the product development process, and organizations facilitating an innovation network and offering relevant services (Leminen, 2013).

The definition of Living Labs offered by ENoLL puts forward five key dimensions: innovation settings, operating environments, influence on innovation processes, user engagement and expected outcomes (Edwards-Schachter et al., 2012). Similarly, Bergvall- Kåreborn et al. (2009) point out five key principles: openness, influence, realism, value, and sustainability. Many definitions stress the collaboration between different actors, combining technological research with user research (Rits et al., 2015).

Furthermore, Living Labs include a set of features and principles (Bergvall-Kåreborn et al., 2009; Guimont and Lapointe, 2016), namely technological infrastructure, an ecosystem of stakeholders, an open innovation process, a human-centric design approach, community involvement, and users' natural environments. Bergvall-Kareborn and Stahlbrost (2009) also point out that Living Labs are open innovation environments in real-life contexts for new products and services. Living Labs aim to co-create innovation through the involvement of users in real-life settings (Dell'Era and Landoni, 2014).

3.2 General Description and Definitions

Living Labs present a specific trend in open innovation approaches. In Living Lab approach, external ideas are resources in innovation process. The aim of the Living Lab approach is to support innovation process with a usable solution (product or service) as a result of the innovation process. Different stakeholders are involved in the Living Lab, from researchers, developers and end users aiming to co-create innovative products and services in a real-world environment.

A Living Lab is considered a multidisciplinary phenomenon and it encompasses various research domains. The existing literature views Living Labs simultaneously as landscapes, real-life environments and methodologies, and it suggests that they include heterogeneous stakeholders and apply various business models, methods, tools and approaches.

The Living Lab concept is based on a systematic user co-creation approach integrating research and innovation processes (bringing together users, R&D institutions, producers, service providers and all relevant stakeholders in focused and integrated development process). These are integrated through the co-creation, exploration, experimentation and evaluation of innovative ideas, scenarios, concepts and related technological artefacts in real life use cases, as shown in Figure 1. Such use cases involve users, not only as observed subjects, but also as a source of creation. This approach allows all involved stakeholders to concurrently consider both the global performance of a solution and its potential adoption by users. This consideration may be made at the earlier stage of research and development and through all elements of the solution (e.g. a product) life-cycle, from design up to recycling.
Living Labs usually exploit opportunities of modern ICT and can be seen as "a large, broadly conceptualized laboratory". Cooperation of all stakeholders (from users, to companies, ICT providers, developers, government organizations, universities and other involved institutions) is sought.

Finally, Living Labs face some challenges, such as temporality, governance, efficiency, user recruitment, sustainability, scalability and unpredictable outcomes. In contrast, the benefits include tangible and intangible innovation and a broader diversity of innovation.

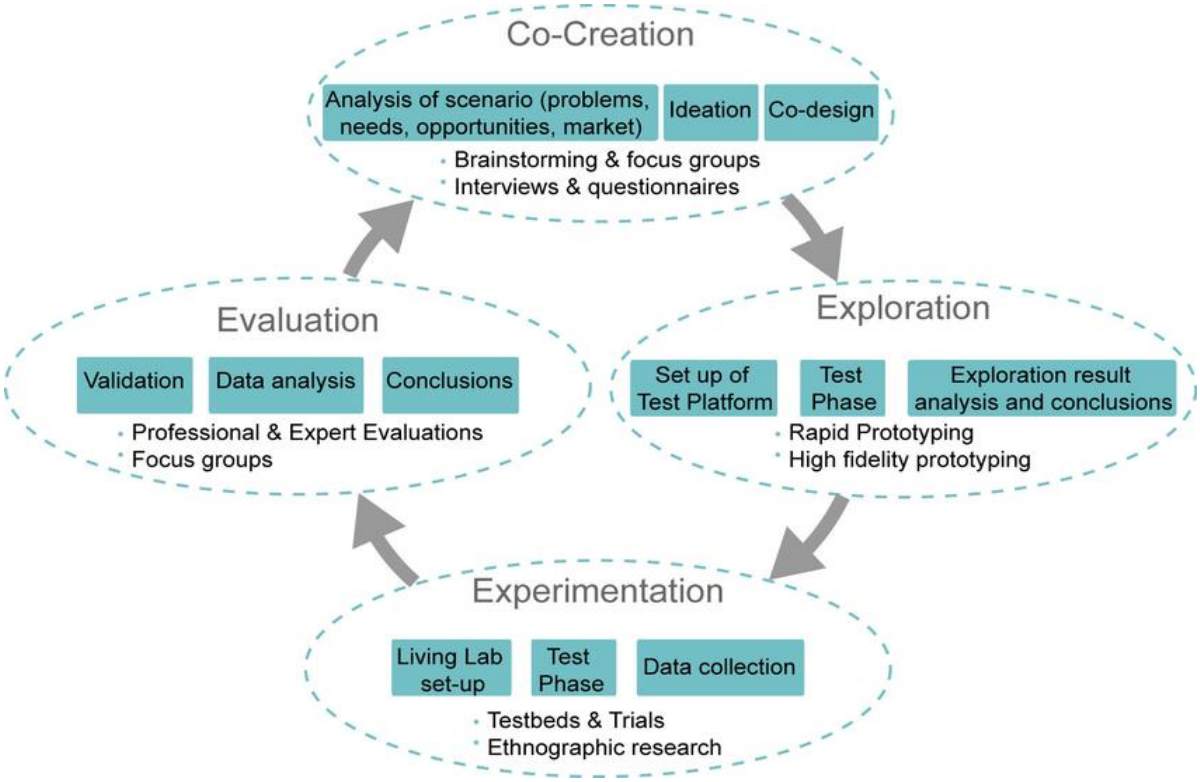


Figure 1. A visual representation of the Living Lab process (Vicini et al. 2012).

3.2.1 Living Lab as an Environment

Living Lab is a real-life environment in which various stakeholders (Guzman et al., 2013) experiment, develop, co-create, validate and test existing products, services and systems, as well as develop new products and services (Følstad, 2008a; Leminen et al., 2012). Unlike conventional laboratory settings, Living Labs assume real-life environments. There is a diverse set of environments, ranging from a single isolated place to broader environments such as educational institutes, people's homes and workplaces, and even a city or a part thereof (Nystrom et al., 2014; Leminen et al., 2017b). In the Living Lab environment researchers, developers and end-users co-create innovative solutions (products or services) in the shortest possible time according to the needs of end-users and test the idea in the real-life environment (a city, a region, a country, an industry or a supply chain).

Many different types of Living Lab environments exist. Below the most common ones are presented:

- ***Research Living Lab*** focusing on performing research on different aspects of the innovation process.

- ***Corporate Living Lab*** focusing on having a physical place where stakeholders are invited to co-create innovations.
- ***Organizational Living Lab*** where the members of an organization co-creatively develop innovations.
- ***Intermediary Living Lab*** in which different partners are invited to collaboratively innovate in a neutral arena.
- A ***time limited Living Lab*** as a support for the innovation process in a project. The Living Lab closes when the project ends.

3.2.2 Living Lab Key Components

As mentioned previously, the term 'Living Labs' covers multiple topics, so its key characteristics have been discussed from various perspectives.

Folstad (2008b) identifies several characteristics of Living Labs: context (e.g. context research, familiar context, real-world context), users (involving users as co-creators), activity (e.g. co-creation, technical testing, evaluation), challenges (discovery), and innovative outcomes (e.g. large-scale solutions). Mulder et al. (2008) in turn propose six elements of Living Labs: user involvement, service creation, infrastructure, governance, innovative outcomes, and methods and tools. Furthermore, Bergvall-Kereborn et al. (2009) point out five key components: ICT and infrastructure, management, partners and users, research, and approaches. They share the views of Folstad (2008b) and Mulder et al. (2008). Leminen and Westerlund (2016), meanwhile, identify four key aspects in nine identified research avenues for Living Labs, namely (i) systems (networks and ecosystems), (ii) milieu (real-life environments) and approach, (iii) user and public involvement, and (iv) the activity, project, or management tool. Finally, Voytenko et al. (2016) list geographical embeddedness, experimentation, learning, participation, user involvement, leadership, ownership, evaluation, and refinement as key characteristics of Living Labs, thus aligning with most of the previously identified key characteristics of Living Labs.

For the purposes of this deliverable, the key components of the Living Lab follow:

- ***Organizational structure*** - The Living Lab environment is viewed as an innovation system. That is based on a sound strategic concept and fronted by suitable representatives with a significant role to play for long term objects.

- ***Approach*** - Represents the methods and techniques for Living Lab practices which are necessary for professional and successful Living Lab operations.
- ***Structured working methods*** - Constituted by the appropriate methods, knowledge and expertise when involving users in their own environments for cooperation in the development process. These methods facilitate the creation of knowledge which is transferable to new areas and new markets.
- ***Management*** – Represents the ownership, organization and policy aspects. A Living Lab can be managed by consultants, companies or researchers.
- ***Stakeholders (Partners & Users)*** - Those who bring their own specific wealth of knowledge and expertise to the collective, helping to achieve boundary spanning knowledge transfer and those who actually use a solution (product or service). This embraces various stakeholders representing the quadruple helix.
- ***Technical platforms*** - Constituted by the sufficient technological equipment in order to facilitate the necessary communication between the user and the innovation system to obtain the view of the user.
- ***ICT & Infrastructure*** – Outlines the role that ICT technology can play to facilitate new ways of cooperating and co-creating new innovations among stakeholders.
- ***Research*** - Symbolizes the collective learning and reflection that takes place in the Living Lab. Technological research partners can also provide direct access to research that can benefit the outcome of a technological innovation.

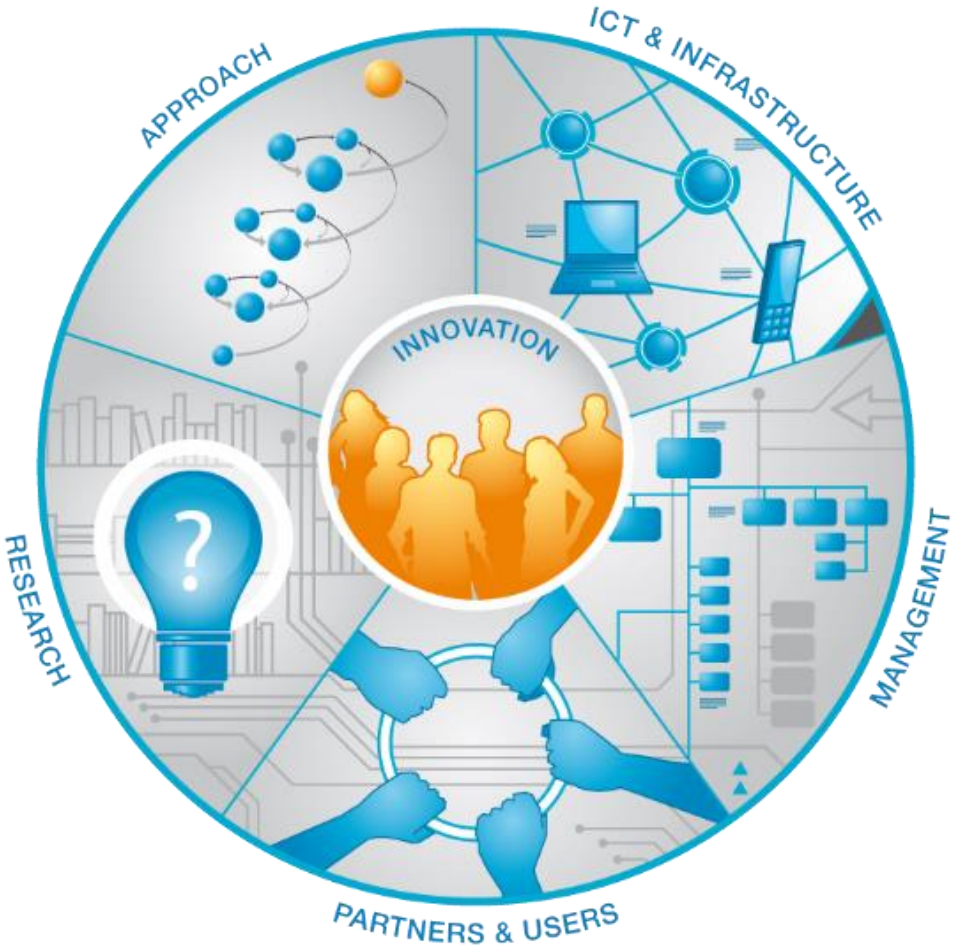


Figure 2. Living Lab key components (Vicini et al. 2012).

3.2.1.1 Stakeholders

Stakeholders can be considered the most important component for the successful implementation of a Living Lab. It is pointed out that Living Labs are built around innovation and structured cooperation. A Living Lab is not similar to a test-bed as its philosophy is to turn users, from being traditionally considered as observed subjects for testing modules against requirements, into value creation in contributing to the co-creation and exploration of emerging ideas, breakthrough scenarios, innovative concepts and related artefacts.

Hence, a Living Lab rather constitutes an experiential environment, where users are immersed in a creative social space for designing and experiencing their own future. Living labs can be used by policy makers and users/citizens for designing, exploring, experiencing and refining new policies and regulations in real-life scenarios in order to evaluate their potential impacts before actual implementation.

The existing literature about Living Labs emphasizes the presence of multiple stakeholders and highlights the makeup of public-private partnerships (3Ps) (e.g. Feurstein et al., 2008; Almirall and Wareham, 2011) or public-private-people partnerships (4Ps) (e.g. Bergvall-Kereborn et al., 2009a; Veeckman et al., 2013). Whereas the former encompasses collaboration with citizens,
companies and public authorities (Almirall and Wareham, 2011), the latter puts forward the notion that companies, public agencies, universities, various institutions, and users participate in innovation activities in Living Labs (Westerlund and Leminen, 2011). In other words, Living Labs assume a quadruple helix (i.e. a collaboration between business, research and education, public administration, and civil society/users) (Hyysalo and Hakkarainen, 2014).

In contrast to many other forms of innovation, Living Labs involve heterogeneous stakeholders such as academics, developers, industry representatives, citizens, and users, as well as various public and private organizations in living lab networks (Ballon and Schuurman, 2015; Schuurman et al., 2011). For example, Living Labs involve users in a way that can be addressed by companies, public organizations, policy makers, and research institutions (Almirall and Wareham, 2008a). Evans et al. (2015) add that Living Labs bring a broad variety of stakeholders-such as researchers, students, citizens, user communities, external people, non-profit organizations, small firms, consultants, university estates, and facilities staff- together to co-create knowledge for sustainable products and services in real-world settings.
According to Westerlund and Leminen (2011), Living Labs comprise four key actors: enablers, providers, users, and utilizers. Enablers refer to the organizations that make it all possible, those that enable the activities of Living Labs and support them by promoting them or allocating financial backing or space for Living Labs. Enablers could be public actors, financiers, or non-governmental organizations (such as towns), municipalities, and regional development organizations (Leminen et al., 2012). Providers, meanwhile, are development organizations such as educational institutes, universities, or consultants that bring knowledge and expertise, as well as innovation support activities (Leminen et al., 2016). Users represent the citizens or end customers, and they are active or passive actors that participate in living labs in various roles. Finally, utilizers are the public or private organizations that will benefit from the results of innovation activities in many ways (Leminen et al., 2012).

Living Labs are used to structure user participation in real-life settings (Schuurman and De Marez, 2012). In so doing, Living Labs involve users in the innovation process by providing cohesion, offering support, developing competencies and promoting participants (Almirall and Wareham, 2008a). They

can be open or closed in terms of participation. Open Living Labs imply that anyone can participate, while in closed living labs, participating users are preselected (Dell'Era and Landoni, 2014). The open approach is simple to implement, and it helps gather diverse feedback. The closed approach, in contrast, enables living labs to remain highly focused, and this approach requires engaging appropriate participants to solve problems.

3.2.3 Living Lab Key Principles

In Living Lab activities there are five Key Principles that should permeate all operations:

VALUE - Living Lab processes support the process of understanding if the customer or user has a need for a service and how intense their attraction or repulsion for that service is in the real-world context. Living Labs can support processes by allowing users to elaborate with the service in their context to determine if it provides a value for them. In addition, a Living Lab can also provide insights about how users perceive value. These insights can guide the innovation process to deliver innovations that are perceived as valuable from a business and a customer perspective.

INFLUENCE – To take the step from participation or involvement to influence, domain experts' and users' needs and ideas should be clearly traceable in concepts, prototypes, and the finished product. One important issue that Living Labs need to manage is how to assure that participation, influence, and responsibility among different partners are balanced and harmonised with each other and with the ideology of the user influence of the project.

SUSTAINABILITY – Focusing on the sustainability of the Living Lab highlights aspects such as continuous learning and development over time. Here, the research component of each Lab plays a vital role in transforming the generated knowledge from Living Lab operations into models, methods and theories.

OPENNESS - The key principle openness emphasises creating an innovation process that is as open as possible with the stakeholders since multiple perspectives bring power to the development process. Openness is crucial for innovation processes in Living Labs to gather a multitude of perspectives in order to develop as attractive an innovation as possible. Opening up innovation processes also offers potential to decrease the time to market and to better utilise collective creativity.

REALISM - When it comes to facilitating realistic use situations, two different approaches can be observed in relation to Living Labs. In the first approach, environments for testing and evaluating

products or services are created in ways that are similar to the real world, while in the second approach, products and services are tested and evaluated in users' real-world environments.

3.2.4 Challenges

The previous literature also suggests the importance of close collaboration between participants in Living Labs in order to accelerate innovation activities. In so doing, stakeholders bring heterogeneous resources and knowledge into joint activities, and there may be a collision of ideas between stakeholders and between a context and stakeholders (Leminen and Westerlund, 2012). Although prior studies are quite unified in their view of close collaboration and the benefits it brings to different stakeholders, they stress challenges related to the methods and concepts of Living Labs. These challenges are diverse and associated with the type of Living Lab and the context in which it operates. They include temporality, governance, unforeseen outcomes, efficiency, the recruitment of user group(s) and the sustainability and scalability of their innovation activities.

The previous literature discusses the temporality of Living Labs and their activities. For example, Leminen et al. (2012) suggest that utilizer-driven Living Labs often have a short-term focus on organizational needs. Key participants may leave living lab activities, and there will be a need to replace such players (Leminen and Westerlund, 2012). The long-term value of Living Labs is also often difficult to demonstrate to businesses, user communities, and society (Guzman et al., 2013).

Next, the governance of Living Labs is challenging due to the multifaceted situation (van Geenhuizen, 2013), and project management tools that assume linear thinking do not support activities (Westerlund and Leminen, 2011). Living Labs comprise multiple stakeholders who are often beyond organizational boundaries, and they cannot manage or control stakeholders but rather just motivate them to engage in innovation activities (Ståhlbrost and Bergvall-Kåreborn, 2011; Leminen and Westerlund, 2012). Diverse competences and the interests of the actors may complicate technology development projects (Hakkarainen and Hyysalo, 2013), and stakeholders may provide negative feedback that may be difficult to embrace (Dvarioniene et al., 2015).

Furthermore, prior studies report that Living Labs steer innovation activities through their results with multiple stakeholders (Ståhlbrost, 2008), and such results often lead to unforeseen outcomes (Leminen et al., 2017b). Hence, Living Labs cannot guarantee the achievement of the anticipated results, and their activities often lead to unforeseen outcomes due to feedback from users. In fact,

Almirall and Wareham propose that a Living Lab faces challenges in gaining support for better products and social readiness.

Moreover, the efficiency of innovation activities depends on learning in the innovation process (Leminen and Westerlund, 2012). Scholars frequently suggest that collaborative learning in real-life environments is one of the main rationales for setting up a Living Lab (Hakkarainen and Hyysalo, 2013). Hence, the success of Living Labs depends on transferring knowledge between different parties. Often, a painful and conflicting effort is required to establish a valuable learning environment. Learning is lost on many occasions as groups disband and the outcomes of a Lving Lab are commercialized by people unrelated to the project.

Furthermore, Living Labs research so far describes both passive and active user participants (Leminen et al., 2015). As regards passive user participants, recruitment of user groups may be challenging because new technologies may attract people with certain personal traits (Bergvall-Kareborn and Stahlbrost, 2009). Conversely, active user participants have their own interest in innovation activities (Nystrom et al., 2014). User participation is high when sustainability is highly relevant to participants. User engagement should therefore not be taken for granted, even if the activities seek to solve real-life problems faced by the participants.

Finally, Living Labs require long-term funding to sustain and scale up their innovation activities (Guzman et al., 2013; Evans et al., 2015). They may rely heavily on public funding, which limits their growth. The underlying assumption is that the intended goal emerges based on the achieved results of living lab activities among the stakeholders. Living Labs face challenges, such as a lack of standardization and insufficient criteria for living lab performance (Schaffers and Turkama, 2012). In summary, the challenges that Living Labs face are diverse and vary significantly from one instance to another.

3.3 Methodologies for Living Lab Set Up

Several methodologies for the formation of Living Labs are proposed in the literature. Some of them are presented in the following sections.

3.3.1 Living Lab business model

The research focus of several researchers is on how the Living Labs business model:

1. stimulates the creation of sustainable partnerships;
2. provides an environment for new business development through service innovation;
3. exploits opportunities to capitalize on network effects.

It is of key importance to distinguish between different phases of Living Labs development and to focus on how in each phase particular aspects are addressed. The key phases in Living Labs evolution are:

- ✓ ***Initialisation and preparation***. In this phase, creating the partnership based on the need to enhance the scope of the regional network and on some form of business plan is crucial and will enable the longer term viability of the Living Lab. Conditions for future business development in later stages are being set in this initial phase.
- ✓ ***Living Labs operation***. This phase is closely connected with the provision of user-centric innovation services that enable new business development. Relations between Living Labs in a network could be established, to generate economies of scale and scope and benefit from larger user communities and complementary innovation services.
- ✓ ***Upscaling and commercialization***. This phase embeds the Living Lab into the regional innovation system. Strategies to capitalize on network effects will become more mature.

Table 1: Business model aspects in different phases of Living Labs development Source: (Schaffers et al., 2007).

	Phase I: Initialization	**Phase II: Operation**	**Phase III: Commercialization**
Living Lab partnership creation	Establish rural Living Lab partnership and shared value system User groups creation	Service provision models, configuration of resources, value capture strategies	Embedding the Living Lab into the regional innovation system
New Business development	Establish product and service offering and value capture	Service provision mechanisms & Core managerial processes	Commercialization of service provision
Synergies and network effects	Synergies in utilising common know-how, methodologies, technologies	Design synergies in providing services in a network of Living Labs	Upscaling in untapped markets; models for IPR exploitation

3.3.2 Seven Steps to Build up a «Cross-border living lab»: The LEADERS Approach

The LEADERS approach represents guidelines for Living Lab establishment (Molinari, 2011). It consists of seven steps, as follow (Clermont et al., 2013):

1. Localise and identify your stakeholders

It is important to be as open and inclusive as possible at this stage. In this step the following items should be considered:

- The thematic domain(s) targeted
- Your policy priorities
- The «cross border» Living Lab model selected ("federated" or "unitary")
- The aims of the whole initiative (your vested interest in doing all this)

2. Establish a Living Lab PPP (Public Private Partnership)

A formal partnership building (e.g. by going to the notary) is recommended at this stage. In addition, it is significant to create mechanisms for governance and engagement of Living Lab stakeholders, e.g.

- A general assembly and/or management board
- Individual working groups (e.g. one per pilot)
- Periodic consultation mechanisms (e.g. frequent stakeholder workshops and an ICT forum – see step 4)
- External communication items (e.g. portal, newsletter, webinars)

3. Assess the relevance of «cross border» issues

This step includes a discussion that is affecting the monitoring and evaluation step (step 7). Be careful about:

- Involving your stakeholders in this assessment
- Including, where possible, selected "champion" users in the same task on a peer (not agency or dependency) basis
- Consulting with other project partners, experts and especially the thematic leaders
- Compliance with the current Regional policy setup is helpful - but not mandatory

4. Deploy an ICT infrastructure

At basic level, it can well be a (permanent) online forum attached to the Regional portal. Best would be a (freely accessible, geo-localised, always-on) mobile platform. In this step care should be taken of:

- User anonymity (by default) and profiling (with privacy protection)
- Structuring the discussions at individual pilot level, to avoid useless and dangerous “noise”
- Alternating on- and off- line initiatives that can bring more users into the platform
- Documentation of pilot results
- Integrating the parallel activities ongoing within and across the borders on the same thematic domain
- Monitoring traffic on a daily basis and keeping contents up to date.

5. Establish a local and/or «cross border» PPPP community (PPP + People)

A number of tools can be attached to the Living Lab’s ICT platform to enhance the power and impact of social innovation, e.g. for

- Crowd sourcing
- Preference aggregation
- Matchmaking
- IPR tracking

In this step care should be taken of:

- Being as inclusive as possible
- Alternating on- and off- line initiatives (see step 4)
- Providing incentives for participation (like small value prizes and awards)
- Segmenting the community according to people’s preferences and skills as well as to the nature of the individual pilots

6. Run one or more User Driven, Open Innovation pilots

Assign goal and content leadership to the stakeholders themselves (e.g. SMEs, larger enterprises) in this step. It is important to consider the IPR aspects and implications (AS IS – TO BE). Care should be taken of the following items:

- User engagement since the early stages
- Openness / Transparency of the whole process
- Documentation and reporting (periodic and final)
- A number of social research methods and tools that can be useful at this stage (e.g. ethnographic observation, facilitation of small group discussions, Delphi, etc.)

7. Summarise and evaluate the results

A monitoring and evaluation system is to be established (and embedded) upfront. Please consider the following as basic targets:

- Community building and proper functioning

- User driven, Open innovation methodology implementation
- Pilot outputs (and outcomes?)
- Stakeholder satisfaction
- Cost / Benefits analysis
- Reuse / Transferability potential
- Policy impact?

Care should be taken of:

- Added value of the «cross border» aspect.

3.3.3 FormIT methodology

FormIT is a methodology that is developed to suit and support Living Lab Activities (Ståhlbröst & Holst, 2011). The methodology is based on the results of the SmartIES project and was evaluated in a Nordic cross-border pilot. The FormIT process is presented as a spiral in which the focus and shape of the design becomes clearer, while the attention of the evaluation broadens from a focus on concepts and usability aspects to a holistic view on the use of the system. In the FormIT process there are three iterative cycles:

- Concept design cycle in the lower part of the figure
- Prototype design cycle in the middle and
- Innovation design cycle in the upper parts of the figure.

Each cycle includes three phases: appreciate opportunities, design and evaluate; the phases include three aspects: use, business and technology. Before and after these three cycles, two additional cycles are included in the process. The first is planning, seen in the lower part of the Figure 3, and the commercialisation, which is visible in the upper part of the figure.

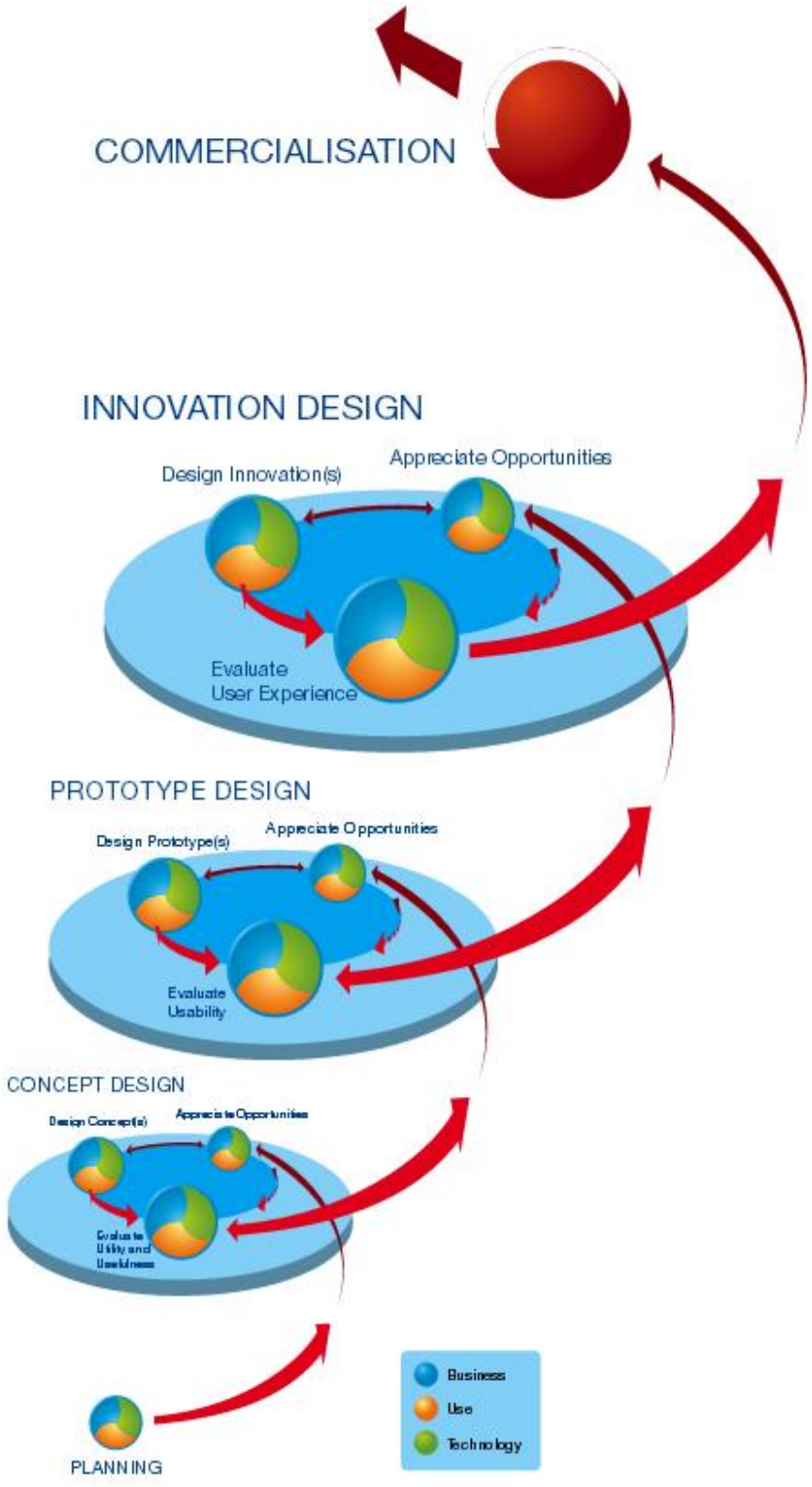


Figure 3. The FormIT Process (Ståhlbröst & Holst, 2011).

3.3.4 The Business Model Canvas

The Business Model Canvas (Osterwalder, 2006), presented in Figure 4, focuses on infrastructure, e.g. the activities necessary to implement the business model, the resources that are necessary to create value, and the partner network in terms of alliances needed. In a cross-border setting, creating partnership agreements may need specific attention in terms of legal arrangements.

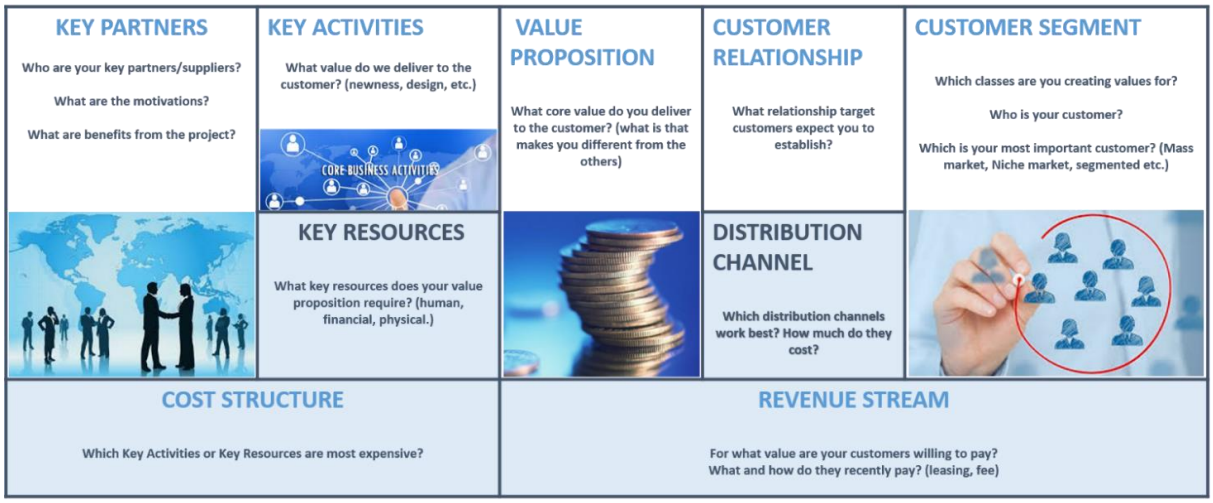


Figure 4. Business Model Template (Osterwalder, 2006)

The Business Model Canvas, presented in Figure 4, is a strategic management and entrepreneurial tool. It allows you to describe, design, challenge, invent, and pivot your business model (Osterwalder & Pigneur, 2010). Initial phase of Living Lab formation is Business Model Canvas. Contributors are active stakeholders of the LL and aim of this phase is to develop a business model of the LL to get an oversight on the current situation and issues of the LL formation. All stakeholders should be invited to participate and the scope of the LL should be clearly explained. It could be presented during workshops or similar.

3.3.5 CO-EFFICIENT Living Lab approach

In CO-EFFICIENT project the partnership opted for Business Model Canvas approach. Living Lab set-up methodology consisted of 6 phases that supported the formation of two Living Labs - Transport optimization (eServices) Living Lab and Energy Efficiency Living Lab based on following phases:

Figure 5. CO-EFFICIENT Living Lab Phases

1. Connect

- Find people and organizations with positive innovation attitude
- Find complementary skilled people to cover the diversity of innovation process
- Form knowledge base of stakeholder ‘s competencies and expertise
- Use web portal to share information
- Use social networks to enable formation of sub networks
- Prepare and sign the Memorandum of understanding (MOU) to define and understand the obligations of the involved stakeholders.

2. Plan

- Push stakeholder to define a problem/opportunity (User Driven definition)
- Define strategy, goals, objectives and expectations
- Define performance indicators for LL process evaluation
- Define time frame

- Determine commitments and leadership, resources
- Plan how to establish trust among network members and engage them
- Identify and form knowledge base of best practice cases

3. Communicate and support

- Define network sponsorship/financing
- Determine role of meetings, workshops and seminars
- Define key knowledge and information input
- Define external expertise needed
- Determine required ICT support
- Use dissemination activities (conferences, newsletters) to extend partnership network and share experiences

4. Act and manage

- Conduct workshop to engage stakeholders in the process of finding the solution
- Develop or use an existing solution
- Present the solution process to stakeholders
- Perform on-site training of stakeholders
- Run one or more User Driven, Open Innovation pilots
- Test the solution ‘s compliance with defined goals and objectives
- Measure performance indicators
- Review responsibilities and commitments of stakeholders

5. Deploy

- Deploy developed solutions
- Communicate and share knowledge

6. Improve

- Evaluate the process based on performance indicators, goals and objectives
- Push stakeholders to generate ideas for improvement of the process
- Evaluate contribution and consolidate network of stakeholders
- Expand network of stakeholders based on identified knowledge gaps
- Consolidate knowledge database
- Summarize the results

In phase 1, stakeholders were connected in a network with a clear insight and role to play in the Living Lab. In phase 2, plan of the Living Lab including objectives, activities, roles, agreements, responsibilities, cost/profit issues and risk management was agreed among partners. This was done via Memorandum of Understanding (MoU) which defined roles and responsibilities of participants. As

the Living Lab was established and financed within project, there were no financial issues. The MoU was kept rather simple not to drive away stakeholders. For those participants there were not interested to participate in Living Lab but were willing to test proposed solutions, Declaration of Participation (DoP) was used. The DoP specified the scope, responsibilities, right and data protection (very important) for those participating in testing of solutions.

Inputs, schedules and dissemination activities were defined in phase 3, followed by the process of solution development and continuous improvement of the user driven innovation process defined in the Living Lab in phase 4. The deployment of the solution, presented in phase 5, aims at sharing knowledge in participating regions and gaining sustainability of the Living Lab which is continuously improved in phase 6, with the aim to support user-driven open innovation process in continuous activities.

For each of the Phases listed above basic information table with responsibilities, aims and methodologies was prepared and used.

CO-EFFICIENT living Lab practical implementation sequential

1. **Desktop research** on existing methodologies, approaches, and tools for energy efficiency improvement and use of renewable resources in production and operations
2. **Identification of key stakeholders**, associations, clusters (and SMEs) and **identification of key added values** for each participant
3. **Definition of strategy**, aims, and objectives of the Living Lab;
4. **Definition of terms of collaboration, ownership of resulting tools, rules for use and further modifications**
5. Via workshops, conferences, in-company visits, one-on-one meetings, **consultations and interviews** involving key stakeholders and SMEs
6. **Identification of areas with large unused capacities** within the energy assemblies installed in SMEs; identification of typical areas with potentials for improved maintenance and management, identification of areas for instalment of renewable resources
7. **Joint development** of analytical tool and indicators for improved energy efficiency and use of renewable resources in production processes (SMEs closely collaborate in the process)
8. **Testing** of the beta version of the analytical tool on a panel of 50 SMEs to test its quality and relevance;

9. Design of final version of analytical tool

10. **Individual consultations** and advice to SMEs in Living Labs on improving energy efficiency and use of renewable resources.

3.4 Living Labs related to Energy

Several business models of Living Labs and pilots exist in the literature. In the following section, we present the Lighting Living Lab, Lightning Living Lab, Apollon, MIT Living Labs and Beer Living Lab.

3.4.1 The Lighting Living Lab

The Lighting Living Lab	
Stakeholders	Ric Agueda (Agueda Innovation and Competitiveness Network) University – Enterprises - Government
Region	Portugal, Aviero Region, centered on the Aguea municipality
Scope	To contribute to the implementation of the European Sustainable Energies Policy, in line with the conclusions of the 2007 Spring European Council which sets out an ambitions EU approach to energy issues and climate changes aiming to ensure the security of energy supply, the increase of energy efficiency and the reduction of carbon dioxide (CO2) emissions.
Goals	To promote innovation and the development of research in new technologies and applications in the field of lighting, focused on the concepts of Smart Lighting and Eco-friendly Lighting, and supported by the ICT sector, giving birth to new services/systems/products and business opportunities.
Operations	In the initial stage, the Lighting Living Lab addresses public spaces lighting, be them exterior or interior and/or located on urban or rural areas, but it will spread its activities into more general applications. This selection is based on common existing problems through European cities/villages, like for instance, the need to illuminate some areas where introduction of linear infra-structures (e.g. electrical network) is neither feasible (e.g. environmental sensitive areas) nor desired (e.g. poor benefit-cost rate).Providing a means for participants to create,

	to test and to demonstrate prototype technologies prior to commitment to real product (NICTA, 2013).
Funding	This network is supported by the European URBACT II Programme.
Results	A group of pilot-projects on streets and other public spaces of Águeda municipality. One of these pilot-projects, implemented through a partnership between some LLL members, namely the Águeda City Council and Exporlux – Iluminação, SA (www.exporlux.pt), will save annually 7,328.6 kW of energy, that represent also less 665.40€ spent on energy and 3.2 tons of CO2 emissions avoided.
More information	Website: http://www.openlivinglabs.eu/pdfs/lighting-living-lab.pdf www.cm-agueda.pt Contact person: Marlene MARQUES Office of Organisation, Planning and Administrative Modernisation Câmara Municipal de Águeda Tel: +351 234 610 070 Email: marlene.marques@cm-agueda.p

3.4.2 Energy Living Lab

Energy Living Lab	
Stakeholders	Chablais Agglo(PA) – University of Applied Science Western Switzerland – Private companies in field of energy - Users
Region	Western Switzerland, French speaking region
Scope	The Energy Living Lab is an open innovation ecosystem dedicated to energy efficiency and the development of renewable energy in Western Switzerland.

Goals	The goal of the Living Lab is to empower the users of energy (citizen of the region, employees of private companies, members of the association of users...) and integrate them into the innovation process, motivating them to participate, putting the right tools in place to enable a bottom-up dialogue, and translating ideas into sustainable commercial products or services.
Operations	The Institute of Entrepreneurship and Management has been conducting applied research in the field of open innovation for the past decade. Its crowd-sourcing platform – www.i-brain.ch – translated into 7 languages, enables a cheap and rapid ideation phase. It has been used for numerous companies such as Romande Energie, the local energy distributor, towards the goal of developing energy efficiency services in line with the needs of their customers. The Energy Living Lab has collected more than 500 ideas and has selected 30 of them, through a process involving internal and external experts. One of these ideas, rated by a community of users, could generate a new business model for this energy company.
Funding	This network is supported by the European URBACT II Programme. The revenue stream is a combination from public and private funding.
Results	Chablais Agglo is conducting a large mobility project, together with the local public transportation company, (TPC) in the region. The idea is to develop physical infrastructure and adequate services necessary to help citizens in the region switch from private to public transport. The Energy Living Lab supported this effort by using a service design toolkit to visualise what could help the customers toward a better travel experience.
More information	Website: http://enoll.org/livinglab/energy-living-lab Contact person: Joëlle Mastelic Project Leader Energy Living Lab, University of Applied Science Western Switzerland TechnoPôle 3 3960 Sierre Switzerland Tel.: +41 27 606 90 93 Email: joelle.mastelic@hevs.ch

3.4.3 Apollon - Energy Living Lab

Apollon - Energy Living Lab	
Stakeholders	30 Organizations from 12 European Countries (Finland, France, Belgium, Germany, Hungary, Italy, Portugal, Slovenia, Sweden, Netherlands, UK) **SME Partners of the experiments** • **ISA** - Intelligent Sensing Anywhere S.A - http://www.isasensing.com • **Instituto Nokia de Tecnologia (INdT)** - http://www.indt.org.br • **Process Vision** - Integrating Systems and Knowledge - http://www.processvision.fi • **Home Aut. Europe** - http://www.homeautomationeurope.com • **Luleå Energi** - http://www.luleaenergi.se
Region	Europe
Scope	Scope of the Apollon project is European Living Lab (cross-border) networks, Network Collaboration and management, Development trend, Methodologies and Success Factors added value. Testing the impact of real time information on energy consumption provided by ICT on user behaviour transformation towards energy efficiency and how can energy metering solutions from diverse SMEs be integrated, from the cross-border point of view, and what are the advantages, best practices and limitations of cross-border activities within the Living Lab network
Goals	To validate the outcomes of four local Living Lab projects on a broader scale by using a common research benchmark and, by doing so, enhance the scalability of Living Lab research.
Operations	The Energy Efficiency vertical experiment will cluster four running local Living Lab projects in four countries dealing with Energy efficiency in general and Smart metering in particular: the Energy Pilot in Sweden, the Pilot for real-time in Finland, the Amsterdam Smart City in the Netherlands and the Lisbon Energy Pilot in Portugal.
Funding	Funded under The Information and Communication Technologies Policy Support Programme

Results	The lessons learned and best practices gained from the cross-border experiments have been used to create the requirements for the Energy Efficiency Thematic Domain Network of APOLLON, which will be adopted by ENoLL and aims at facilitating the cross-border collaboration between Energy Efficiency-related Living Labs.
More information	Website: http://staging.apollon-pilot.eu/overview Contact person: Pieter BALLON pieter.ballon@ibbt.be IBBT Pleinlaan 9 Avenue de la Plaine B - 1050 Brussels Belgium Tel:+32 2 629 16 26 Fax +32 2 629 28 61

3.4.4. Energy Efficient Buildings Hub

Energy Efficient Buildings Hub	
Stakeholders	It includes 24 partner – institutions from industry, academia, National laboratories and private companies, development agencies. The EEB Hub is operated by a consortium of 11 academic institutions, two DOE laboratories, six global industry partners and regional economic development agencies, and is led by the Pennsylvania State University.
Region	Philadelphia, Pensylvania, USA
Scope	The Energy Efficient Buildings Hub team is taking a "Living Lab" approach, working in a 30,000-square-foot building in the Navy Yard, where they are testing how different technologies interact in the building with sophisticated sensors and modelling equipment.

Goals	The goal of the Hub is to improve energy efficiency and reduce carbon emissions of both new and existing buildings while also stimulating private investment and quality job creation.
Operations	Focused on existing average size commercial and multi-family residential buildings, the goal is to transform the retrofit and new construction processes into a systems-delivery industry and demonstrate building operational energy savings of 50 percent by 2015 in a scalable, repeatable and cost effective manner across a broad building stock, while preserving workplace quality. A secondary goal is improving the usability and accuracy of computer models that predict the amount of energy that will be used by different building designs.
Funding	The Energy Efficient Buildings Hub (EEB Hub) was established as an Energy-Regional Innovation Cluster (E-RIC) on February 1, 2011 with funding from the U.S. Department of Energy (DOE), the Economic Development Administration (EDA), the National Institute of Standards and Technology (NIST), the Small Business Administration (SBA), and the Commonwealth of Pennsylvania. More than 90 percent of the Federal funding for the EEB Hub during the first five years ($130 million) comes from DOE. The EDA, NIST, and SBA are collectively providing $7.8 million.
Results	All EEB Hub members are working to help achieve the U.S. government's goal of reducing energy usage in commercial buildings by 20 percent by 2020. Major objectives include developing and deploying a state-of-the-art modeling platform to the building industry to integrate design, construction, commissioning, and operation. In addition, the EEB Hub seeks to demonstrate the market viability of integrating energy-saving technologies for whole building system solutions, and to help drive energy policies in the Greater Philadelphia region.
More information	Website: https://energy.gov/articles/energy-efficient-buildings-hub Contact person: Laurie Actman Email: lactman@engr.psu.edu

3.4.5 iHomeLab Living Lab

iHomeLab Living Lab	
Stakeholders	Lucerne University of Applied Sciences (LUAS) iHomeLab network has currently over 200 partners (In the project Demand-Response the iHomeLab explores together with the Swiss Federal Office of Energy SFOE, Siemens Switzerland AG, BKW Energie AG, Swiss Grid and MeteoSwiss, how to master the changing demands of the future energy market.
Region	Lucerne, Switzerland
Scope	The researchers at the iHomeLab are looking at the question of how to improve energy efficiency in buildings. Their work aims to discover how to use less energy in buildings without compromising on comfort. The research strategy focuses on the three research areas of energy efficiency (EE), ambient assisted living (AAL) and human building interaction (HBI) under the roof of the metaresearch topic "The Building as a System" at the Lucerne University of Applied Sciences.
Goals	Together with its industrial partners, the iHomeLab Living Lab team conducts applied research to increase the energy efficiency, security and comfort in residential as well as commercial buildings.
Operations	The iHomeLab Living Lab Facility provides an integrated, sophisticated, state-of-the-art environment to demonstrate the results to experts and the public. Since opening in November 2008, over 2500 visitors participate in around 150 iHomeLab Living Lab events annually.
Funding	*iHomelab projects are funding* programs of the *swiss federal* government
Results	The platform brings together stakeholders from different domains with the goal to set-up innovative, interdisciplinary research projects for creating applied, mass market ready building and home automation solutions based on open industry standards.

	The iHomeLab Living Lab today is the Swiss think tank for building intelligence and building automation. Built in 2008, it is continuously upgraded and managed by its team. The iHomeLab Living Lab sensitizes experts and public to the increasingly popular topic of building intelligence and intelligent living.
More information	Webiste: https://www.hslu.ch/de-ch/technik architektur/forschung/kompetenzzentren/ihomelab/ Contact person: Dieter von Arx Head of iHomeLab a.I. +41 41 349 35 99 info@iHomeLab.ch

3.4.6 Enhance Living Lab

Enhance Living Lab	
Stakeholders	2 Public sector organisations situated in UK: University of Edinburgh City of Edinburgh council
Region	UK
Scope	The Enhance research project takes a multidisciplinary approach to the study of energy use, and the potential for energy saving through smart digital feedback, in two public sector organisations, that of a University and a City Council. Recognising the complex interactions of infrastructure, organisations and users, the project multidisciplinary team, have backgrounds in data analytics, architecture and social sciences. The project is engaging in a living lab methodology to embrace its holistic approach to understanding energy use in the non-domestic buildings, and uses both quantitative and qualitative data gathering, analysis and feedback. It runs from 2015 to 2017.
Goals	Enhance is a digital innovation project which is taking a Living Lab approach to understanding and reducing energy

	demand in public sector buildings.
Operations	The data collected so far includes qualitative data from meetings and focus groups, organisational structure data, Building Management Systems Data and usage data for lighting and laboratory equipment. Data on other aspects of the Living Lab will be collected as the lab progresses. Analysis is only in the early stages and it is hoped that report findings in 2017.
Funding	This research is funded by EPSRC grant number EP/L024403/1. Data underlying this paper will be made available in anonymised form on the University of Edinburgh archive, Datashare at http://datashare.is.ed.ac.uk.
Results	The project is a collaboration between the School of Informatics, School of Social and Political Science, and Edinburgh College of Art at the University of Edinburgh. It is funded by the Engineering and Physical Sciences Research Council (EPSRC) and is a member of the EPSRC Network of (Build) TEDDI projects known as TEDDINET.
More information	Website: http://www.enhance-project.org/living-labs/ Contact person: Room 3.29, Informatics Forum, Edinburgh EH8 9AB Email: enhance.project@ed.ac.uk

4. Part II: Efficient Building Living Labs

4.1 Efficient Building Living Lab Methodology

Efficient Buildings aims to support energy efficiency by transferring solutions to energy issues faced by public organizations in the MED area; increasing the capacity of owners and managers of public buildings to design and implement better energy efficiency practices; promoting the MPs' outcomes; and influencing policies and calls for new national and European regulatory framework that take into account MED specificities and the innovative solutions proposed by the community.

Through EBLLs, Efficient Buildings intends to change the current thinking in energy management of public buildings in the MED area. In the beginning of Work Package "Transferring", Efficient Buildings consortium systematised and clustered the MPs' results. At the same time, territorial needs have emerged. This process prepared Efficient Buildings partners to start thinking about the content of their EBLL.

The Efficient Building Living Lab methodology will be built mainly on the experience gained through GRASPINNO LLs and it will follow the same phases to the GRASPINNO Living Lab methodology (University of Maribor, 2017). Transferring activities (e.g. educational material, transferring events, B2B meetings) will be complementary, leading to the successful EBLLs implementation. Efficient Building Living Lab methodology will be applicable and replicable by others outside partnership, without modifications. Programme area will benefit since Efficient Buildings will facilitate knowledge exchange between MED stakeholders, supporting them to increase their capacity/competence, promoting transnational synergies, facilitating the development of policies favouring EE in public buildings and the increase of funding/financial opportunities dedicated to this sector.

The Efficient Building Living Lab methodology will be applied in five participating countries and consists of 6 phases i.e. Connect, Educate and train, Implement, Improve, Evaluate and Disseminate, as shown in Figure 6. Within project, 5 BLLs are planned to be set up in different thematic fields that are recognized as the most relevant for the participating stakeholders.

Through Living Lab approach stakeholders need to be involved not only as observed subjects but active contributors and as a source of creation. Namely, innovations (including new approaches and tools) generally face resistance from users especially if users are not sure about benefits to be gained - this might be especially true for public sector. Experiential learning is one of the most powerful teaching

and learning tools to overcome this reluctance and to facilitate change of people behaviours. Experiential learning involves: (i) a "reflective learning phase"; (ii) a learning phase coming from the experimentation; and (iii) a learning phase coming from feedback. These phases are aligned with the phases "Educate and train", "Implement" and "Improve" of the Efficient Building Living Lab approach.

Two main types of stakeholders in particular are to be targeted – namely owners and managers of public buildings, and decision and policy makers. Furthermore, partners from MPs, research institutes and universities, technical chambers, innovative companies and SMEs who can share advanced technological solutions should be members of the EBLLs in order to transfer their knowledge and experience to the stakeholders. As a result, EBLLs will raise awareness amongst the involved parties in enhancing the implementation of better EE practices, promote MPs outcomes and increase their impact on public policies.

In order to implement the Living Lab approach in Efficient Buildings, an informal "EBLL forum" of stakeholders are to be organized per EBLL. This "EBLL forum" will take over the role of EBLL implementing activities without formalisation in terms of legal commitments, formalisation of procedures and management. The informal establishment of EBLL, not requiring establishment of new legal entity but only formal commitment to participation (Declaration of Participation or similar) should ease the involvement of stakeholders.

Nevertheless, the work in "EBLL forum" is structured and led by project partners who will be the EBLLs' initiators following a joint methodological approach. One "EBLL forum" per partner country is mobilized bringing together organisations actively involved in Efficient Buildings implementation (e.g. the MPs), as well as the interested stakeholders. The activities of each "EBLL forum" follow the phases of EBLL as shown below. Some activities above are open to all participants while other activities (individual consultations and individual support with implementation) are given only to organisations actively participating in Efficient Buildings activities.

The national "EBLL fora" will work together following the same methodology and exchanging experiences. Still the final methodology for EBLL implementation will remain open in order to adapt it to national/regional specificities.

Figure 6. Efficient Building Living Lab approach

4.2 Efficient Building Living Labs Set-Up

In the following section the Efficient Building Living Labs set-up is presented in details. The set-up of EBLLs combines six phases, each consisting of several steps. The sequence of these steps within the phases can differ depending on the demand or environment of each EBLL. The EBLL set-up time plan is presented in Figure 7.

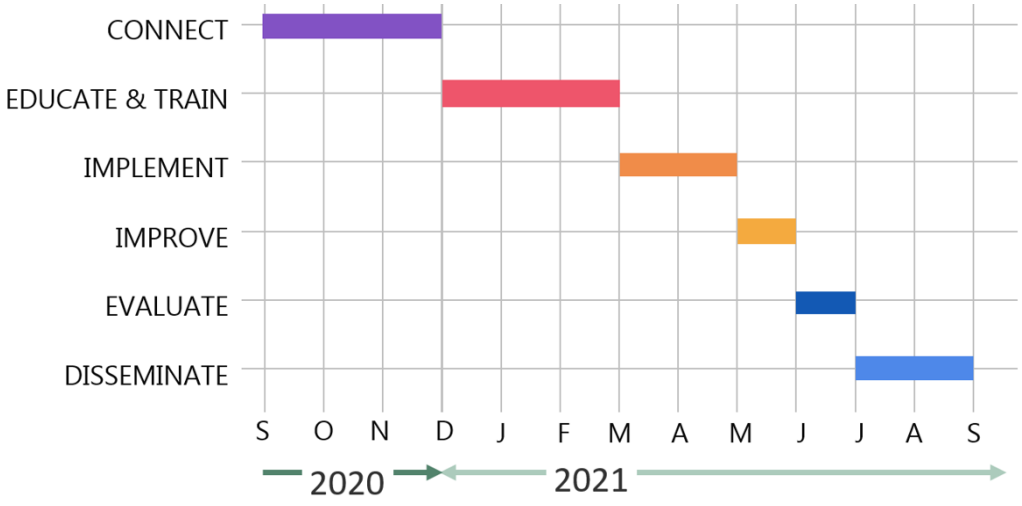


Figure 7. Time plan of the EBLLs' phases set-up.

4.2.1 Phase 1 – Connect

CONNECT	
Start: 01/09/ 2020	End: 30/11/2020

The main elements of Phase 1 – Connect are shown below:

Responsible	Initiator of the LL (Efficient Buildings partners)
Contributors	All participating stakeholders.
Aim	To form the "EBLL forum" of complementary stakeholders addressing a common problem/opportunity with clear understanding of EBLL leadership, stakeholder's commitment, necessary activities and resources.
Methodology	The initiator of EBLL is identified within the project consortium to take over the EBLL set-up activities. Several channels and dissemination tools (website, promotional material, social media, etc.) are used to address potential stakeholders and to identify the stakeholders with interest and appropriate skills to participate in the EBLL. The common problem or opportunity for collaboration is identified and a solid EBLL plan with necessary time frame and resources is established. For more formal

	collaboration, each stakeholder signs the Declaration of Participation (DoP) in EBLL (or similar) to define the purpose and obligation of such collaboration. University of Patras has developed a template for the DoP (attached in Appendix 1).
Deliverables	✓ Identified EBLL initiator ✓ List of stakeholders to participate in EBLL ✓ Define a user driven problem/opportunity ✓ Define EBLL plan ✓ Signed DoPs

The ***step-by-step approach to connect stakeholders*** follows:

➢ **STEP 1:** DEFINE LL LEADERSHIP

Activities	Identify the initiator of EBLL, responsible for coordination of EBLL. The organizations acting as initiators will be the Efficient Buildings partners. Beyond the organization, also a person(s) within the organisation should be identified to lead the set-up and operation activities of EBLL. The EBLL initiator should be responsible to motivate stakeholders to actively engage in EBLL activities, to arrange meetings/workshops/training courses, correspond to stakeholder needs or requirements, coordinate preparation of EBLL plan, DoP, reports (with assistance of all stakeholders), to ensure that activities are carried out with time plan etc.
Deliverables	Identified EBLL leadership (organisation and contact person) The description should be included in the Del. 4.3.4. Reports on EBLLs (chapter 4.1. Connect - 4.1.1 The leader-initiator of EBLL).

➢ **STEP 2:** ADDRESS AND IDENTIFY STAKEHOLDERS

Activities	Identify stakeholders in public sector with positive attitude towards EE of public buildings and related new procedures and innovations. These stakeholders should have time, resources and interest to participate in BLL. Address potential stakeholders by:

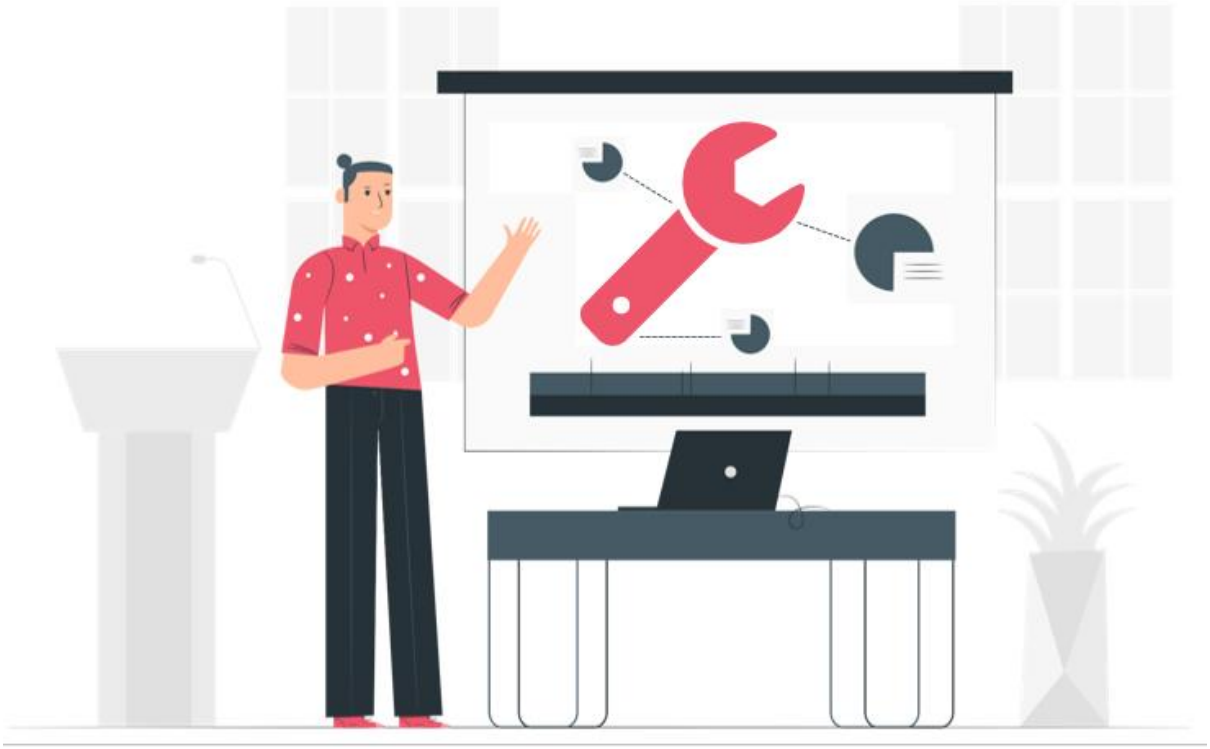
	• Using contacts from stakeholder participated in MEDNICE and previous actions of Efficient Buildings. • Using channels to find people and organizations with positive innovation attitude (business networking, social networking, web, etc.). • Using project website and project promotional material (posters, flyers, public project reports). • Using social media (Facebook, Twitter, etc.) and other e-channels.
Deliverables	List of LL potential stakeholders The list of potential LL stakeholders should be included in Del. 4.3.4. Reports on EBLLs as appendix.

➢ **STEP 3:** DEFINE COMMON PROBLEM OR OPPORTUNITY AND CONNECT STAKEHOLDERS

Activities	Define a user driven problem/opportunity in order to define key areas for improvement (e.g. improvement of EE innovative solutions, funding and mentoring mechanism for EE, public policies for eco-innovation, etc.). The problem can be identified either by desktop research, conclusions from previous activities, in-site visits, consultations, interviews with interested stakeholders and brainstorming evets. The problem will define also the specific name of each EBLL. Some suggestions are EE Innovative Solutions Living Lab, EE Fund Living Lab, EE Policy Living Lab.
Deliverables	Short report on interaction with stakeholders (i.e. report on workshops or meetings organized, public authorities in-site visits, interviews, etc.) and which common problem or opportunity were identified. This short report on interaction with stakeholders should be included in the Del. 4.3.4. Reports on EBLLs (chapter 4.1. Connect - 4.1.2 Potential EBLL stakeholders and 4.1.3. The EBLL scope).
Activities	Propose EBLL plan agreed among the EBLL stakeholders. The plan should provide main EBLL objectives and goals, activities, stakeholders roles, agreements, etc. within the expected time frame (Gantt Chart) including milestones (start date, start of operational test, presentation of intermediate results, end date, etc.).

Deliverables	EBLL plan including objectives, activities, partner roles, agreements and risk issues. The EBLL plan should be included in the Del. 4.3.4. Reports on EBLLs (chapter 4.1. Connect - 4.1.4 EBLL plan).
Activities	The collaboration between stakeholder is define in Declaration of Participation (DoP) which ensures that the collaboration is more former and to make clear agreement on the purpose and obligation of such cooperation.
Deliverables	The signed DoP should be included in Del. 4.3.4. Reports on EBLLs _per partner as appendix.

4.2.2 Phase 2 – Educate and Train



EDUCATE AND TRAIN	
Start: 01/12/2020	End: 28/02/2020

The main elements of Phase 2 – Educate and Train are shown below:

Responsible	Initiator of the LL (Efficient Buildings partners)
Contributors	All participating stakeholders.
Aim	Educate and train stakeholders on existing solutions and results (e.g. best practices, tools, methodologies) developed by the MPs of the community. Phase 2 will enable the transferring of knowledge obtained from the study and the clustering process of the MPs' results.
Methodology	The stakeholders should be educated and trained on available solutions. Education is a process by which people gain knowledge and understanding.

	Training, on the other hand, is the process by which people gain tangible skills that they can start applying immediately. Therefore, different workshops and training courses should be conducted for stakeholders to educate and train them on different topics and to enable transparent communication and support to the EBLL activities.
Deliverables	✓ EBLL educational material (Del. 4.3.2) ✓ Workshops/meetings ✓ Training courses

The ***step-by-step approach to educate and train stakeholders*** follows:

➢ **STEP 1:** EDUCATE STAKEHOLDERS

Activities	The stakeholders should be educated on available tools and methodologies, mainly developed by the MPs of the community. Information and knowledge about energy management of public building facilities and equipment, measurement and assessment of energy consumption, financing schemes for building energy renovation planning are some of the factors for the success of EBLL activities, since EBLL cannot achieve good results without proper input information and knowledge. Several workshops or meetings should be organized to educate stakeholders on EE solutions, funding opportunities and existing policies. In case of several different topics to be addressed in a EBLL, also selection of participants should be made according to the topics.
Deliverables	Workshops/meetings to educate stakeholders on EE solutions, energy management, energy refurbishment, etc. The report on educating stakeholders should be included in the Del. 4.3.4. Reports on EBLLs (chapter 4.2. Educate and train – 4.2.1. Educate stakeholders).

➢ **STEP 2:** TRAIN STAKEHOLDERS

Activities	The stakeholders should also be trained to use available tools/methodologies and to gain necessary skills for further use and their implementation, what will be crucial in next phase of EBLL set up: Implement. Therefore, each partner should organise a training course in his territory to train potential stakeholders to use available tools mainly developed by the MPs of the community. It is recommended to carry out on-site training, for which is typical to: • takes place in premises of one of the stakeholders, which agrees on the usage of his facilities (e.g. rooms, ICT support). • be held by an expert, who is familiar with the solution and was, if possible, involved in the solution's development process (e.g. partners of the MPs), since the developers could gain significant comments and ideas for improvement from stakeholders.
Deliverables	Training courses held among stakeholders for implementing existing methodologies and tools. The report on training stakeholders should be included in the Del. 4.3.4. Reports on EBLLs (chapter 4.2. Educate and train – 4.2.2. Train stakeholders).

4.2.3 Phase 3 – Implement

IMPLEMENT	
Start: 01/03/2021	End: 30/04/2021

The main elements of Phase 3 – Implement are shown below:

Responsible	Initiator of the LL (Efficient Buildings partners)
Contributors	All stakeholders will be involved in the implementation phase in accordance with their role.
Aim	To support wider implementation of solutions, tools and methodologies for EE in public buildings.
Methodology	Motivate stakeholders to implement and test the solutions, e.g. methods, tools and solutions for energy management of public buildings, measurement and assessment of energy consumption, financing schemes for building energy renovation planning, etc. The stakeholders should

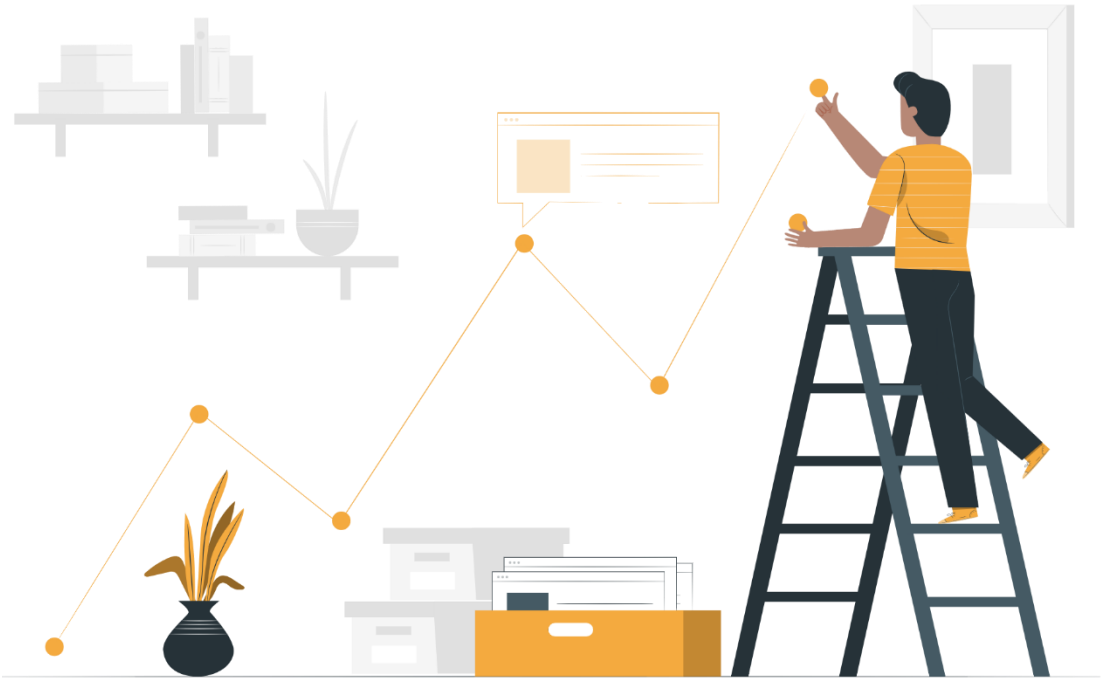
	provide feedback to EBLL initiators if the implemented solutions are a good fit to their problems and environment.
Deliverables	✓ Implementation of solutions

The ***step-by-step approach to implement solutions*** follows:

➢ **STEP 1:** IMPLEMENTATION OF SOLUTIONS

Activities	After stakeholders has been educated and trained about available solutions, tools and methodologies, the most appropriate methods, technical tools and solutions should be implemented in relevance to EBLLs specific cases (e.g. problems or opportunities identified). The use of existing solutions, tools and methodologies is carried out by each stakeholder individually, while the supervision and necessary support can be provided by (internal/external) expert on site or remotely. • On-site guided implementation is carried out in premises of one of the stakeholders, which agrees on the usage of his facilities (e.g. rooms, ICT). It can be supervised and supported by an expert present on-site and who is familiar with the methods, tools and solutions. • In case of remotely guided implementation, expert cannot be present on-site, instead he/she can provide a support via electronic means (via emails, skype conference, telephone, remote access). The methods, technical tools and solutions should be available for free to users and appropriate translation should be provided if/when necessary.
Deliverables	Stakeholders have successfully implemented tools/solutions into their organization/business processes/environment. The report on implementation of solutions should be included in the Del. 4.3.4. Reports on EBLLs (chapter 4.3. Implement – 4.3.1 Process of implementing).

4.2.4 Phase 4 – Improve



IMPROVE	
Start: 01/05/2021	End: 31/05/2021

The main elements of Phase 4 – Improve are shown below:

Responsible	Initiator of the LL (Efficient Buildings partners)
Contributors	All stakeholders will be involved in the implementation phase in accordance with their role.
Aim	To actively engage stakeholders in the improvement process of solutions and specially to encourage them to provide feedback for adoption of solutions to their actual needs. Stakeholders will be encouraged to implement the improved solutions (methods, tools, etc.) in their real environment, if feasible.
Methodology	Motivate stakeholders to participate actively in the improvement of solutions and specially to share their needs and ideas.

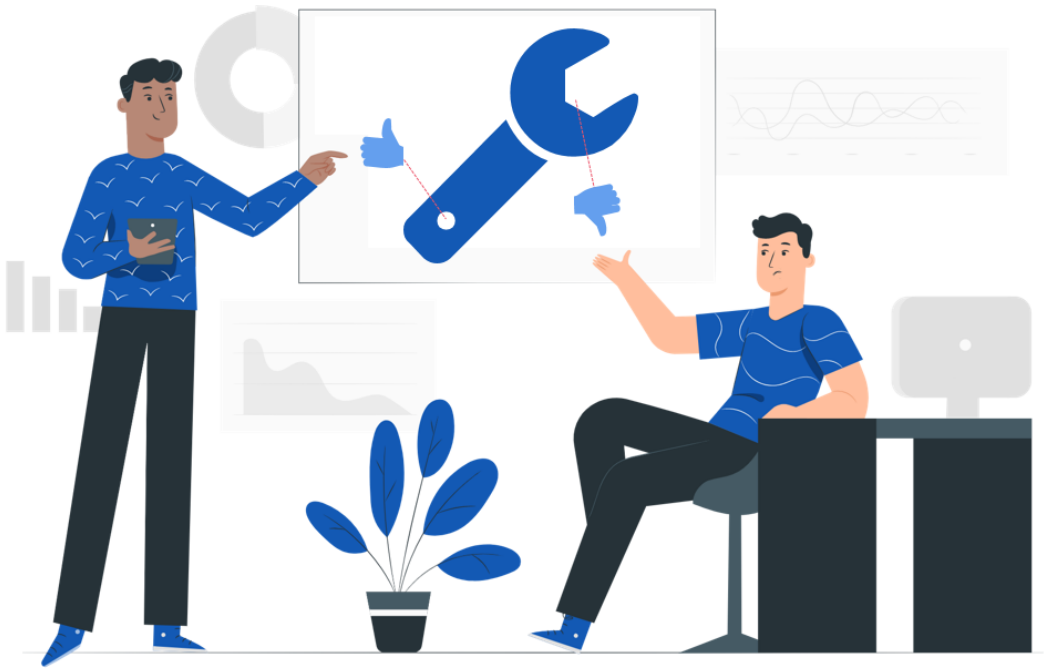
Deliverables	✓ Solution improvements

The ***step-by-step approach to improve solutions*** follows:

➢ **STEP 1:** GENERATE IMPROVEMENTS

Activities	Stakeholders should be motivated to provide ideas how to improve the solutions that they have previously used in phase implement. Stakeholders should closely collaborate in this process - they may be offered consultations by internal/external experts, helping them to better identify possible improvements and to generate ideas for further implementation of solutions. Additionally, an awarding system can be set in place for those participating and generating the improvements (e.g. certificate of participation, certificate of achievement, best idea of the week/month posted on the web portal with an interview with the author etc.). If a lack of ideas is still noticed, a special workshop with stakeholders can be organized to brainstorm the "possible improvements of the EBLL performance". The workshop could be organized by one of the partners as an in-class event or with the help of group decision support software as an online event (e.g. Think Tank software).
Deliverables	Report on potential improvements of the solution The report on implementation of improvements should be included in the Del. 4.3.4. Reports on EBLLs (chapter 4.4. Improve – 4.4.1 Generation of potential improvements).

4.2.5 Phase 5 – Evaluate



EVALUATE	
Start: 01/06/2021	End: 30/06/2021

The main elements of Phase 5 – Evaluate are shown below:

Responsible	Initiator of the LL (Efficient Buildings partners)
Contributors	All stakeholders will be involved in the evaluate phase in accordance with their role.
Aim	The aim is to evaluate the solutions, as well as the overall EBLL performance to enhance it and support the user driven open innovation process.
Methodology	Each EBLL initiator will develop a targeted questionnaire to be shared to the EBLL participants in order to evaluate the specific solutions used by the stakeholders in the previous EBLL phases. Moreover, the process, output

	and stakeholders experience has to be evaluated providing solid and reliable baseline for evaluation of the overall EBLL performance. In this sense, University of Patras will develop an appropriate evaluation questionnaire to support EBLL initiators to evaluate the overall EBLL performance and participants' satisfaction. The conclusions deriving from the evaluation process will provide foundations for developing guidelines and recommendations for improvements and sustainability of EBLL. Last but not least, EBLL initiators and participants will outline guidelines and recommendations for future improvements and sustainability of EBLL.
Deliverables	✓ Efficient Building Living Labs reports (containing Evaluation report) ✓ Guidelines/recommendation for using the improved solutions, mentoring and funding.

The ***step-by-step approach to evaluate EBLL*** follows:

➢ **STEP 1:** EVALUATE USED SOLUTIONS

Activities	The used solutions should be evaluated against set goals and aims of EBLL, only so EBLL initiators will be able to assess if the solutions were able to keep up with EBLL expectations; and to have enough time to recognize possible shortcoming and to overcome them before starting to disseminate the solutions to wider public. Therefore, each EBLL initiator will develop a short targeted questionnaire to be shared to the EBLL participants in order to evaluate the specific solutions. This short targeted questionnaire should be integrated into the questionnaire developed by University of Patras for the evaluation of the overall EBLL performance (see next step). In this way, one overall questionnaire will be shared to the participants; thus they will not be overwhelmed with evaluation questionnaires. The partner should summarize the outcomes of questionnaire in form of a short report and included it in their EBLL report.
Deliverables	Evaluation questionnaire and evaluation report about the used solution(s).

	The evaluation of solution (tools, methodologies, funding mechanism, etc.) should be included in the Del. 4.3.4. Reports on EBLLs (chapter 4.5. Evaluate – 4.5.1 Solution evaluation).

➢ STEP 2: EVALUATE EBLL PROCESS

Activities	The performance of overall EBLL need to be appropriately monitored and assessed to ensure that guidelines and recommendation for sustainability of EBLL can be provided. The evaluation questionnaire, for monitoring process, outputs, stakeholders experience and with this the overall EBLL performance, is established by University of Patras. The partner's responsibility is to answer some questions by himself and share the questionnaire (along with the targeted questionnaire for the evaluation of the used solutions) to the EBLL stakeholders, collect the answers and prepare the evaluation report of the EBLL performance. The EBLL evaluation report should be included in overall report of EBLL.
Deliverables	EBLL evaluation report (i.e. report on the process of LL, outputs, stakeholder experience) The evaluation of EBLL should be included in Del. 4.3.4. Reports on EBLLs (chapter 4.5. Evaluate – 4.5.2 Overall EBLL evaluation).

➢ **STEP 3:** MEASURE KEY PERFORMANCE INDICATORS

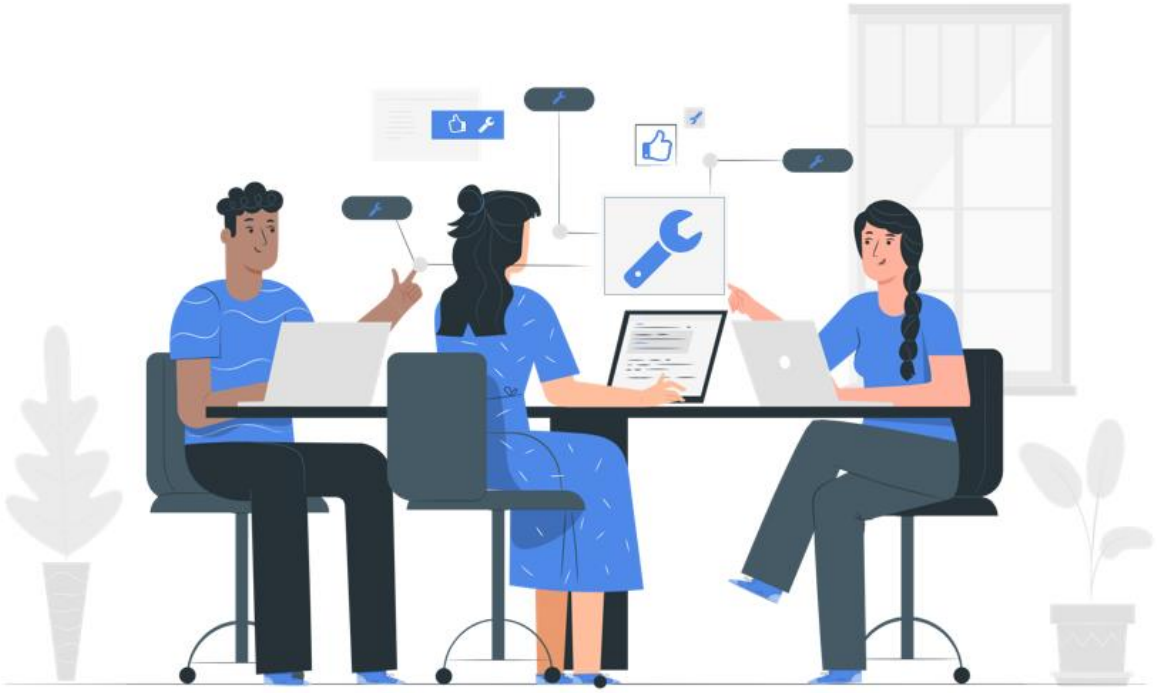
Activities	Specific Key Performance Indicators (KPIs) will be set in place to measure the effectiveness of the proposed solutions/opportunities and the EBLL performance. Choosing the right KPIs relies upon a good understanding of what is important to the EBLL. The KPIs will be developed by University of Patras and partner's responsibility will be to review the proposed KPIs and to propose adoptions or add more KPIs based on the particularities of their EBLL. The measurement of the KPIs will be achieved through the fulfilment of the evaluation questionnaires (described in the 2 previous steps).
Deliverables	Report on the measured KPIs for solutions and EBLL process.

	The measured KPIs should be included in Del. 4.3.4. Reports on EBLLs (chapter 4.5. Evaluate – 4.5.3 Measurement of KPIs).

➢ **STEP 4:** SUMMARY OF THE RESULTS AND DEVELOPMENT OF RELEVANT RECOMMENDATIONS

Activities	All steps of setting up the BLLs and testing the solution should be summarized by each responsible partner in the Reports on EBLLs (Del. 4.3.4) alongside with evaluation of the solution, outputs, stakeholder experience and LL performance. The report should contain also recommendations and guidelines for ensuring future improvements and sustainability of established EBLLs. The template for EBLL reports will be provided by University of Patras and fulfilled by responsible partners. The overall report on EBLLs, presenting the lessons learned, obstacles identified, solution proposed, agreement achieved and recommendation for future improvements, will be produced by University of Patras.
Deliverables	The general guidelines and recommendations should be included in the Del. 4.3.4 Reports on EBLLs (chapter 4.5. Evaluate – 4.5.4 Guidelines and recommendations).

4.2.6 Phase 6 – Disseminate



DISSEMINATE	
Start:01/07/2021	End: 31/08/2021

The main elements of Phase 6 – Disseminate are shown below:

Responsible	Initiator of the LL (Efficient Buildings partners)
Contributors	All stakeholders and project partners are participating in the disseminate phase in accordance with their role.
Aim	The aim is to communicate and deploy results, to share gained knowledge and solutions and to expand the network of stakeholders of EBLL in participating region and beyond.
Methodology	Participants of the EBLLs will be asked to communicate their experience to their colleagues transferring to them the benefits they gained. Actions/events for capitalising on EBLLs' results and transferred solutions

	can be also organised by the partners. Project capitalization events could be used as means to share knowledge and results among involved regions. Final local events are useful to show EBLL results and collect further stakeholders' interests. The phase disseminate can be also integrated into project capitalisation plan.
Deliverables	EBLL communication and dissemination activities

The ***step-by-step approach to disseminate EBLLs*** **and solutions** follows:

➢ **STEP 1:** DEPLOY AND COMMUNICATE EBLLs SOLUTIONS

Activities	The EBLLs results and solutions have to be deployed and communicated to specific stakeholders that can gain benefits by participating in EBLLs. For effective deployment of developed solutions appropriate guidelines and recommendations need to be disseminated. Stakeholders need to clearly understand the functionalities/methodologies of the solutions to be able to use it in appropriate manner. Therefore, the EBLL results alongside with the guidelines and recommendation should be translated to national language to avoid language barriers (if needed). Partner must assure that all materials are available to interested audience (i.e. released in the project platform, disseminated trough their distribution channels, available on request etc.)
Deliverables	EBLL solutions are communicated and disseminated to wider audience. Describe any relevant dissemination activity or suggestion in Del. 4.3.4 Reports on EBLLs (chapter 4.6. Disseminate).

➢ **STEP 2:** EXPAND EBLL WITH NEW STAKEHOLDERS AND RESEARCH AREAS

Activities	For achieving sustainability of EBLLs, it is important to expand the network of stakeholders and a good way to do so is to keep the innovation process in EBLL constantly running by identifying new relevant problems, opportunities and knowledge gaps.

	The establishment of a permanent working/committee group represents the way to support the EBLL sustainability. These meetings or events should allow partners to discover and match stakeholders' needs, map and disseminate best practices, emphasize the importance of EE of public buildings. Periodical meetings (face-to-face or on-line meetings) should be held among EBLLs committee members in order to collect stakeholders' needs, identify themes to analyse and transfer experiences at local level.
Deliverables	Establishment of a permanent working/committee group to ensure suitability of EBLL.

4.3 BLLs and Covid-19

It is more than clear that the successful set-up of a Living Lab and the achievement of its results is mainly based on the EBLL stakeholders' communication and co-creation, as highlighted several time in this deliverable. The face-to-face meetings and the joint EBLL events are fundamental in the EBLL approach. However, the current situation of Covid-19 may affect the activities foreseen and described in the Efficient Building Living Lab methodology, since several restrictions may apply for the organisation of physical meetings at national/regional/institutional level.

For such cases, Efficient Building partners, acting as EBLL initiators, have to investigate the most efficient way to implement the EBLL phases adapting the physical EBLL activities or even replacing them with virtual ones (e.g. on-line meetings, workshops).

This is not generally recommended since the concept of Living Lab is structured on a participatory approach that all participants come together and collaborate closely in real-life environments to achieve a goal, co-creating and transferring ideas and solutions that solve existing problems. The on-line activities can jeopardize the participatory approach and EBLL stakeholders can act only as observed subjects and not active contributors and as a source of creation.

However, Efficient Buildings partners should follow their national/regional/ institutional instructions concerning Covid-19 and should comply with safety measures when implementing physical activities (e.g. physical meeting) ensuring the EBLL participants' safety.

5. Conclusions

Several interesting conclusions derive from our research on Living Labs, as from awareness that it is important to select the appropriate methodology for setting up a living lab, as to the conclusion that methodology is a process of adjusting, i.e. the more is the fit unique to a given set of stakeholders, more relevant will the Living Lab be. Various management models for Living Labs exist, while every approach depends on individual objectives, resources, stakeholders and interests as well as the type and availability of specific user groups. Therefore, the establishment of stakeholders' network in Living Labs *strongly depends on individual initiatives of the partners*. Diverse stakeholders, who individually would not be able to adequately resolve their problem, cooperate in Living Lab that provides working environment in which the solution is found/transferred by tapping into tacit knowledge to be incorporated into solutions, and validates the outcome in real-life environments.

Most Living Lab initiatives depend on national/regional funding while some are established during international (EU) projects. Sustainability of LL after the project/initiative is concluded is the main challenge of every Living Lab. For that purpose, it is of very high importance to involve key stakeholders with true interest in the Living Lab. Usually at the beginning some funding is available in a means of project or sponsorship. In that case it is easier to convince stakeholders to participate. The involvement of stakeholders is of great importance for sustainability of the Living Lab. Some successful stories continue to use sponsorship as a mean of funding for providing LL sustainability.

While setting up Efficient Building Living Labs, the partners should keep in mind that stakeholders need to be involved not only as observed subjects but active contributors and as a source of creation. End-users' involvement is an essential factor for the LL success. Furthermore, EBLLs should address stakeholders' real problems or opportunities; only in this way the common EBLL goal towards EE of public buildings could be achieved. Additional remark is not to neglect potential resistance of stakeholders adopting new solutions or methodologies, as being innovative also requires stakeholders to learn and invest time. Therefore, it is crucial that the benefits of the solutions are well communicated for being appropriately recognized and evaluated.

To conclude, by following Efficient Building Living Lab methodology, we will be able to change the stance of EBLLs stakeholders through their active involvement in innovation process and by spreading existing knowledge. By involving public authorities in the EBLLs, we will increase their capacity in managing their public buildings and motivate them to design and implement better energy efficiency

practices. Also, by involving decision and policy makers, we will increase the impact of MPs' outcomes on public policies at national and EU levels to shape a European regulatory framework that take into account MED specificities. With providing efficient communication, awareness, engagement framework and funding possibilities, the EBLL will be able to outlive the project itself and became a sustainable and living organism.

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Illustrations from: stories.freepik.com

7. Appendix

7.1 Appendix 1: Declaration of Participation

Declaration of Participation

in EBLL Activities of the Efficient Buildings Project

Efficient Buildings aims to support energy efficiency by transferring solutions to energy issues faced by public organizations in the MED area; increasing the capacity of owners and managers of public buildings to design and implement better energy efficiency practices; promoting the Modular Projects' (MPs) outcomes; and influencing policies and calls for new national and European regulatory framework that take into account MED specificities and the innovative solutions proposed by the community. Through Efficient Building Living Labs (EBLLs), Efficient Buildings intends to change the current thinking in energy management of public buildings in the MED area. The EBLLs' main objective is to transfer existing knowledge (best practices/tools/methodologies), enable the exchange of experiences and concerns for EE in public buildings and improve transnational cooperation and deep networking among stakeholders facilitating the transfer of replicable results.
In line with the activities of the Efficient Buildings project, the signatories hereby agree to participate in:

[Option 1] e.g. EE Innovative Solutions Living Lab

which aim is to strength the capacity of public buildings' owners and managers in designing and implementing better energy efficiency practices in their day-to-day business activities and to familiarize public authorities with existing practices to boost EE of public buildings in their territory.

[Option 2] e.g. EE Fund Living Lab

which aims to promote funding mechanism and supporting tools for energy renovation of public buildings.

[Option 3] e.g. EE Policy Living Lab

which aims to improve policies for EE of public buildings and to overcome barriers hindering the sector in MED area by forming policy recommendations.

With this signature of Declaration of Participation, the signatory decides to join the XXX Living Lab and names a representative to communicate with the EBLL regional organization:

_____
(name and address of the organization)

_____ _____
(first and last name of legal representative) (signature of legal representative)

_____
(first and last name of the representative, phone number and e-mail)

_____ _____ _____
(EBLL regional organization) (EBLL regional representative) (signature)

_____
(place and date)

NOTE: This is a voluntary statement and does not imply any financial commitment or any other legally binding commitment.

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