

# Definition of a framework for the creation of a Living Labs network: the case of the European Living Labs and Test Beds Network focused on health care domain

Beatriz Merino-Barbancho, Ivana Lombroni, Cecilia Vera-Muñoz, Silvia de los Rios, Ezequiel Simeoni, Irene Mallo, Gloria Cea, Juan Carlos Martin Guirado, Maria Teresa Arredondo, Giuseppe Fico

**Abstract** — This paper describes the framework for the creation of a Living Labs network based on the experience of the setting up, growth and further consolidation of the European Living Labs and Test Beds Network focused on Health. The manuscript presents how to create an open innovation ecosystem through a network of Living Labs and Test Beds, introducing its value proposition and current status.

## I. INTRODUCTION

During the last years, the healthcare industry has experienced a proliferation of innovations aimed at enhancing life expectancy, quality of life, diagnostic and treatment options, as well as the efficiency and cost-effectiveness of the healthcare system. In this regards, integration of the public in research and development in health care has been pointed out as essential for the advancement of such kind of innovations [1]. This strategy is making a shift in the paradigm from the traditional assumption that innovation is an iterative process triggered by the perception of an opportunity provided by a new market or new service that should have the commercial success of the invent. Pursuing an open innovation strategy recognizes that good ideas can come from almost anywhere, the “outside-in” dimension, however capturing the value created from this approach requires new ways of working and innovative business models [2].

In this sense, the concept of Living Lab emerges based on the philosophy of the open innovation paradigm. The concept directly involves consumers in the development of new products (including applications and services) by providing bilateral access, on the one hand, of the consumer to the new and emerging products, and on the other of the developing enterprises to customer feedback [3]. This ensures a highly reliable evaluation of the market, resulting in a significant reduction of technology and business risks. Insightfully, a Living Lab is a set of public-private

partnerships in which researchers, citizens, professionals, companies or government work together to create and validate new business ideas, services or technologies in a real environment [4]. The main objective of a Living Lab is [5][6], therefore, to have a shared space in which new manners of work can be developed with the end-users in such a way that research and development are stimulated by being those the key core participants in the process of innovation [7].

According to Schaffers et al. (2007), networking is an integral part of Living Labs. Living Labs allow a focus on value generation and distribution in a network of cooperating partners that comprise the Living Labs network. In addition, many Living Labs join large ‘umbrella’ networks of Living Labs such as the European landscape, the European Network of Living Labs (ENoLL) is strong, with almost 400 Living Labs recognized and distributed all across Europe and beyond [8]. Together they create a super network that has the potential to develop and offer network services, as well as exchange and share information, knowledge, and experiences on collaborative development work globally. Moreover, On the other hand, there is Forum Living Labs Santé & Autonomie [9], a network of 38 Living Labs focused on the health field but only comprising the geographical area of France. However, while there is a constant demand for health product and service development there is a lack of emphasis on fostering the Living Labs focus on health and therefore a network of Living Labs all across Europe only focuses on the domain of health that can contribute directly to this type of specialized innovation processes.

The aim of this paper is to describe the definition of the first European network of Living Labs focused on the health care domain reflecting about which were the key elements and aspects to build up the framework for its creation and development.

In the following, we present the methodology followed. We reflect on the results to finally end with a set of concluding remarks.

## II. METHODOLOGY

In this section, the different steps carried out to define and set up the framework for the Living Labs network creation

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B.M.B., I.L., C.V.M., S.R.E.S.I.M.G.C., J.C.M.G., M.T.A.G.F are with the Life Supporting Technologies, Universidad Politécnica de Madrid. (Phone: +34 91 549 57 00 - 3431; fax: +34 91 336 73 19; e-mail: bmerino@lst.tfo.upm.es, ilombroni@lst.tfo.upm.es, cvera@lst.tfo.upm.es, srios@lst.tfo.upm.es, esimeoni@lst.tfo.upm.es, imallo@lst.tfo.upm.es, gcea@lst.tfo.upm.es, jc.marting@sistemapay.es, mta@lst.tfo.upm.es, gfico@lst.tfo.upm.es).

are presented. The methodology consists of four main stages that are presented in the following subsections.

#### A. Phase 1: Co-creation for framework definition

An iterative co-creation process (Fig. 1) was carried out for the definition of the classification criteria to gather Living Labs and Test Beds in a structured and standardized manner.

These co-creation activities [10] were carried out in the form of workshops and feedback sessions with local coordinators of networks, experts and relevant stakeholders in the living labs field and healthcare domain.

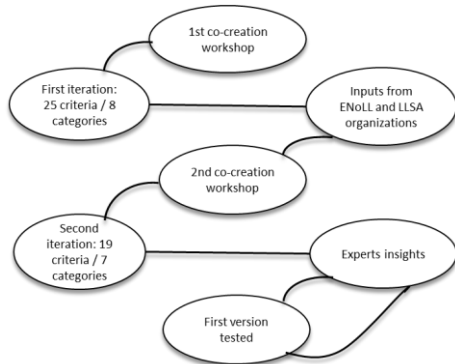


Figure 1. Process implemented to develop the classification criterion

In total, two co-creation workshops were carried out with representatives across Europe. The objectives of these workshops were the following:

- To define a large set of ‘classification criteria’ for Living Labs focused on health.
- To define which sub-set of those ‘classification criteria’ are more important and fit them into relevant categories.

During the first workshop, a total of 12 experts (health professionals, experts in Living Labs, academia, and researchers) from different European countries participated. The main objective of this first workshop was the identification of potential classification criteria through brainstorming techniques and methodologies. In the second workshop, 18 experts participated (health professionals, experts in Living Labs, academia, researchers, and policy makers) whose objective was to make the final selection of the classification criteria of Living Labs. Both, were performed following an iterative approach, in which the results of each workshop were used as a starting point for the following one, increasing this way the level of detail and accuracy of the dimensions and criteria selected.

Thus, outcomes of the first workshop (25 criteria & 8 categories) were refined with feedback from experts of ENoLL (European Network of Living Labs) and the Forum LLSA (French Forum of Living Labs in Healthcare), which and served as input for the second workshop, with the aim of increasing the level of detail and accuracy of the categories and criteria selected. This resulted in 19 criteria and 7 categories, fine-tuned with experts’ insights, and then tested in an iterative process.

#### B. Phase 2: Tools for framework implementation

To communicate and implement the network framework, a cloud-based software, named Optimy, was used. This tool enabled the creation and later enrichment of the repository that builds the network, according to the established classification criteria. Moreover, the tool provided a user-friendly dashboard to see the data collected from each living lab and test bed included, and allowed to visualize, at a glance, the overview of the network.

#### C. Phase 3: Process for selection of network members

Prior to populate the network repository, the process for selection of the new members was described, defining the criteria that allows quality assurance. This process was defined and refined following an iterative approach among the members founding the network.

The process includes an initial application by the potential new member, an off-line analysis of the application, and an online interview. These steps allow to assess different key fields for a Living Lab, where self-assessment and assessment by an expert are combined aiming to evaluate the candidate’s profile and generate a results’ report.

#### D. Phase 4: Populating the network

After the first three phases, the fourth stage involved the population of the repository by inviting the first pool of living labs and test beds and gathering the first new members of the network. For this phase, it is important to rely on previous contacts, experiences, and best practices of existing networks. Our collaboration with other Living Labs networks, such as ENOLL or Forum LLSA, let us to access a first group of potential network members, and to generate this collaborative space where to exchange experiences, best practices and knowledge in order to improve the quality, quantity and resources of the network.

### III. RESULTS

#### A. Classification Criteria.

As a result of the iterative process in the co-creation workshops, a set of seven macro-methodologies finally emerged with their corresponding subcategories for the classification of Living Labs and test beds within the network (Table I). This exploration has allowed us to determine the type of Living Labs/Test Beds that we have in the network, their maturity level, or how they are involved in the different stages of the innovation process, among others.

The aim of this process was to allocate candidates in different categories of members regarding their capabilities, FTE’s experience in living lab service provision, structure & resources, and access to end-users. This process is intimately related with our quality assurance strategy, which is twofold: we assess the quality of candidates in a holistic way; and we assess the quality of our previously accepted members to keep track of opportunities, weaknesses, strengths, and threats. Members are required to fill out a form which covers the following: 1) Project description; 2) Expertise in any of the following: Biotech, MedTech and pharma; 3) Stakeholder network, 4) Type of service offered, 5) Type of

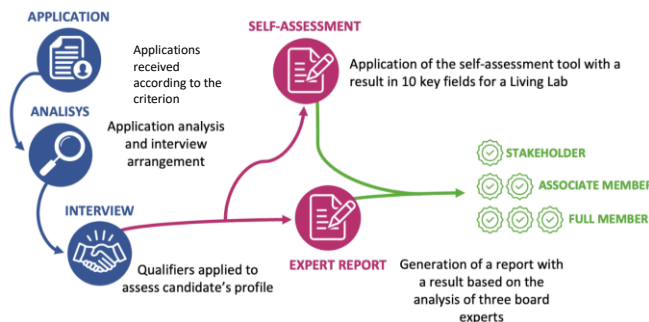
end users (method and capacity of recruiting); 6) Methodology to approach end-users; 7) Proof of experience.

TABLE I. KEY ASPECTS AND SUBGROUPS OF THE CLASSIFICATION CRITERION

Key aspects	Sub groups
Speciality area	Area of specialization
	Maturity level
Ecosystem	Stakeholders
	Type of service
	Context
	Link with other initiatives
Users	Type of users
	Number of users
	End user selection criteria
Resources	Support technology
	Operational readiness
	Infrastructure or setting
Business	Price/cost model
	Market information available
	Regulations and ethics
	IPR principles
Methodology	Methodology
Track Record	Previous activities
	Evidence

Each living lab goes through a evaluation process that consist of two parts (as shown in the Fig. 2 below). The first part is the review of their submitted application in the submitted and identify their services and the potential they have. Once their first application was screened and assessed the second part consists of a 1-hour interview to discuss some of the key elements for a Living Lab and how the applicant addresses those elements.

On a final stage, it is stipulated that each candidate fulfill the self-assessment tool to find out their status on 10 different dimensions which will be an input for knowing whether a training process need to take place before entering the loop. This self-assessment tool is designed to support



living labs in analyzing their performance.

Figure 2. Quality assurance process

The tool provides insights towards these individual living labs on their performances providing a quick assessment of their strengths and weaknesses in different quality dimensions.

The ultimate objective of the self-assessment tool is to improve the quality of the network by using its results to device educational activities. These activities focus on the domains or topics that get a weak(er) score during the self-assessment process.

This self-assessment tool is based on European Foundation for Quality Management (EFQM) [11] model of excellence and it measures the performance of your living lab in 10 important dimensions: 1) Governance of the living lab; 2) Strategy and value proposition; 3) User & stakeholder involvement in the living lab; 4) Real-life dimension of the living lab; 5) Methodology dimension of the living lab; 6) Operational processes in the living lab; 7) Human resources dimension of the living lab; 8) Financial Dimension of Living Labs; 9) Monitoring / quality management of the living lab; 10) Outcomes of Living Labs.

After the interview and the self-assessment activity, a discussion with three Living Labs experts is held where they agree to accept, reject, or offer training to the applicants.

### B. The Network

The network was established in 2016 with the aim of creating a network of excellence bringing together all relevant living laboratories and test beds working and providing innovation support services in the fields of health and healthcare and in accordance with high quality standards at European level. This network was supported by an interactive online tool, provided by EIT Health, allowing ordinary users to have an overview of the entire Living Labs and Test Bed network, classified according to defined criteria (Table I). During the first years of the network's life, around 20 Living Labs were joined, which functioned as critical mass to break with the no knowledge of the mere existence of these facilities or of the things they can do and the services they offer, often compromising their real participation in the innovation process, or collaboration with relevant organizations. Therefore, since its creation, the network has undergone a consolidation process, which began in 2018 experiencing substantial growth and to date is made up of 93 members, including 39 MedTech specialists, 18 biotechnology and pharmacy specialists and 42 dedicated to digital health (Fig. 3). The growth has been steadily due to a common vision of expansion to populate it with skilled, varied, experienced and well-connected organizations throughout Europe. Due to the specific needs of health solution developers, the interest and needs for these open innovation ecosystems are becoming more and more perceptible, and their inclusion in the early stages of innovation developments is already a necessity to collect and allow the information and feedback from healthcare professionals, institutions, and patient-reported outcomes related to technology during the innovation path.

Reason for this growth is also the widespread inclusion of key stakeholders throughout the phases of the innovation chain that makes a clear difference to user-centered design and participatory decision-making approaches, resulting in a clear collaboration between Living Labs and public-private actors. Consequently, private participation for the development of innovations in conjunction with living labs and other members is a key point for the growth and

improvement of the products that are launched on the market.

Over the years, the Living Labs and Test Beds members of the network has supported many clients in ideating, co-creating, validating, or scaling up their healthcare products or services (i.e., development of mobile applications to reduce the use of paper in hospitals, medical devices for chronic patient monitoring, augmentative, and alternative communications services...) with the aim to improve them and ensure that they will make a difference in the daily life of end-users. The value provided by the Living Labs can be summarized three main key points: 1) Verify their business ideas with relevant end-users and stakeholders. 2) Validate their products or services in real environments. 3) Scale up their solutions through a wide European network of innovators.

(medical professionals, formal and informal caregivers, citizens, industry, policymakers, and all types of service providers).

The creation of a European Living Labs network only focused on healthcare such as the one presented aims to promote Living Labs in the validation process of any technological, medical or clinical trial, to foster collaboration between developers, start-ups, industrial companies (pharmaceutical, medical equipment, etc.), end users and every other actor involved in a framework of mutual trust and open innovation and, in particular, to penetrate the world of hospitals and healthcare to equip them with methodologies, tools and solutions that will empower their participation in supporting and launching new healthcare entrepreneurship initiatives in collaboration with industry and the business world, ultimately creating a greater positive impact on the quality of life of all citizens.

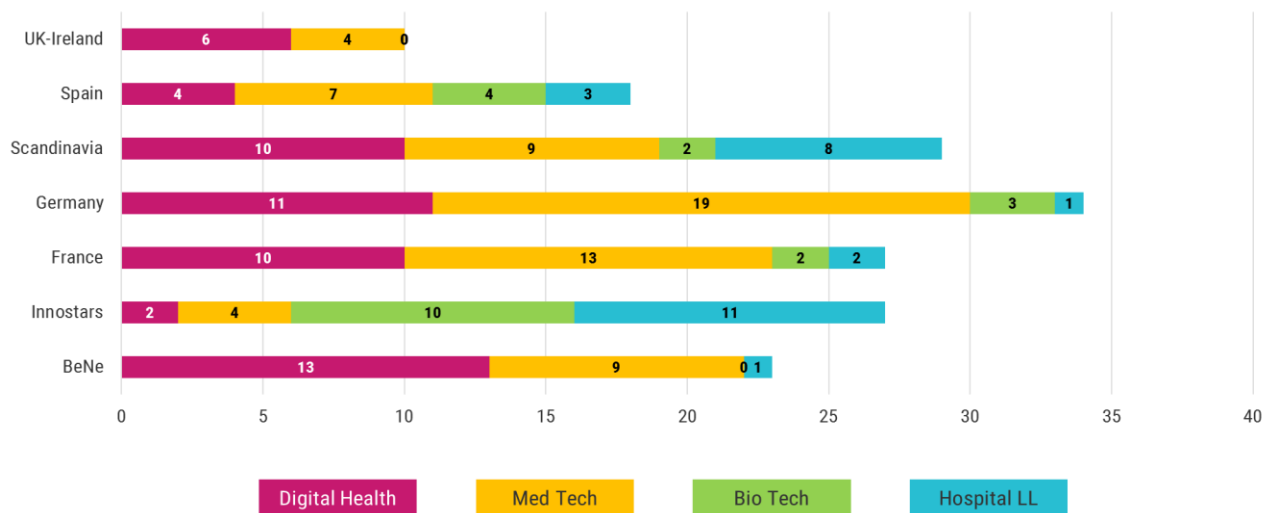


Figure 3. Network overview per European region and type of Living Lab

#### IV. CONCLUSIONS

In this paper, we have shown the different categories created to classify the European Living Labs that specialize in healthcare and are part of a new network, with the aim of helping to describe the current landscape based on the comprehensive analysis and accumulated knowledge.

We found that this analysis of network creation helps to understand how Living Labs are involved in the field of healthcare innovation and what is their added value to continue contributing to the value chain. In addition, we can see a paradigm shift in the field of health innovation where the user is at the center of the process.

Accordingly, we believe that it is necessary to establish the main strategy for Living Labs in the paradigm of the ideal platform for best medical practice to successfully pilot all discoveries and innovation products to be launched, improve medical practice, test all new solutions related to advanced technologies, and ultimately support a better quality of life for citizens. This implies all the mechanisms involved in supporting the different actors in the value chain

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