Interreg

Danube Transnational Programme

D-CARE

D.T2.2.1 Smart Care Lab Strategy

Responsible partner: PP10 – UL LJ, Slovenia

Partners involved:

LP – UMF CJ	Romania
PP1 - Asociatia "Dr. Vasile Micu"	Romania
PP2 – OHE	Hungary
PP3 – IFKA	Hungary
PP4 - DBH	Hungary
PP5 - CEDNET	Hungary
PP6 - UJEP	Czech Republic
PP7 - DC	Czech Republic
PP8 - BioLAGO	Germany
PP9 - Grunderschiff	Germany
PP10 – UL LJ	Slovenia
PP11 – RDA Green Karst	Slovenia
PP12 – OIB	Slovenia
PP13 - RAPIV	Bulgaria
PP14 - NASO	Bulgaria
PP15 - JOAFG	Austria
PP16 - UIV	Austria
IPA1 – Grad Prijedor	Bosnia and Hercegovina
IPA2 – PPK BL	Bosnia and Hercegovina

List of Abbreviations:

4DMC	Quadruple helix multistakeholder mechanism
ASP	Public Authority Partners
EAB	Expert Advisory Board
PP	Project Partner
SCL	Smart Care Labs
LL	Living Lab

List of Figures:

D-CARE is co-funded by the European Union

D-CARE is co-funded by European Union funds (ERDF, IPA, ENI

Contents

SCOPE AND PURPOSE OF THE DOCUMENT

This document provides a strategy for the development of Smart Care Labs (SCL) in eight countries of the Danube region - Romania, Hungary, Czech Republic, Germany, Slovenia, Bulgaria, Austria and Bosnia and Herzegovina. The document – D.T2.2.1 Smart Care Lab Strategy – is the deliverable in D-CARE project under Work Package 2 (WPT2) whose main objective is **to scout, organize, and deploy 8 Smart Care Labs** in the project regions in order to test and validate innovative smart care services for older adults with chronic diseases or cognitive impairments. The smart care pilots that are one of the activities within WPT2 will define different solutions for smart care models that can also be used as business models for creating new businesses and jobs.

The strategy provides a framework – a practical guidance for project partners and SCL coordinators on the processes followed in Smart Care Labs – for setting-up a Lab, selecting and engaging Quadruple helix stakeholders, methodological approaches to forming and running Smart Care Labs – during the D-CARE project and later after the project is completed.

This strategy serves the **overall objective of sustainably generating innovative, effective and well-fit solutions to health and care challenges** in the Danube regions via setting up smart care labs in each project region as a self-sustaining network of stakeholders from the quadruple helix that generate, test and validate these solutions and thereby/parallelly create new business opportunities and jobs.

The strategy will be developed for a 5-year timeframe. Each year, the progress of the strategy will be evaluated by the organization coordinating the lab with the support of the other stakeholders involved. Updates and corrections to the Strategy will be added if needed.

INTRODUCTION

Health and care systems in Europe are facing **major challenges**:
- The ageing population and the increase in chronic diseases are putting pressure on health budgets (costs are rising, funding is inadequate),
- access to healthcare services between and within European countries is unequal,
- there is also a dramatic shortage in healthcare professionals.

Within D-CARE project we have identified the areas where the greatest challenges exist at the regional level. These are for one part region-specific, but we have found that regions face similar problems, to name just a few of the most frequently mentioned: low level of digitization, lack of knowledge transfer between organisations at regional, national and transnational level, lack of cooperation between organisations, lack of adequate long-term financial support from the state.

Various measures are currently being taken in Europe to address these challenges. If we want to build sustainable and efficient healthcare systems in Europe in the future, it is essential that we focus on **innovation, education, and entrepreneurship.**

According to the McKinsey Global Institute (Bughin *et al*., 2019) Europe is falling behind in innovation and most innovation and innovative companies are found elsewhere. Curley and Samelin (2018) also emphasize that the challenges we are facing in Europe now are too big to tackle in isolation, which is why we must strive to strengthen the framework of different approaches to innovation.

The European Commission's goal is to **increase the uptake of innovative solutions**. To achieve this goal "it is necessary to pursue joint collaborative efforts across different multi-stakeholders' organisations that can maximise efforts and attain largescale, sustainable deployment of digitally enabled innovative solutions for improved health and care delivery to the ageing population" (Zurkhulen *et al.,* 2019).

One concept for such collaborative efforts is that of **Living labs**. Living labs are public-private-people partnerships in which stakeholders collaborate to develop/co-create solutions (new products, services, businesses, and technologies) in a real-world environment. Users are involved in all stages of the innovation development cycle. There are many benefits of LL as an innovation concept - ready-to-use and needed innovations (no later administrative hurdles, unmet user needs), stronger partnership and effective

collaboration among stakeholders, sharing experience, knowledge transfer, sharing data, creating new business opportunities etc.

Based on the Living Lab approach, we are planning to establish eight Smart Care Labs in the Danube region with the aim to create new networks and organizational structures in the region, foster innovation through co-creation and open innovation processes, and to define new smart care service models that can be used as new businesses/business models and can create new jobs.

This document provides clear strategic directions on how to respond to key issues in the region through newly established Smart Care Labs. It is also a document that provides guidelines with a set of activities on how to set-up a lab, how to carry out activities within the lab and how to maintain its sustainability.

1. UNDERSTANDING SMART CARE LABS

Smart Care Labs follow the **concept of a Living Lab**. There are many definitions of living labs and there has not been one concept generally accepted yet, as a wide variety of activities are carried out within living labs.

Westerlund and Leminen (2011, p.20) define Living Labs as "Public-Private-People Partnerships (4Ps) of companies, public agencies, universities, users and other stakeholders, all collaborating for the creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts". Consumers/users are getting a new role in the process of innovation – they are being considered as co-producers when developing new services and new use cases for devices and infrastructures, the main process of the lab to benefit society, the environment and the economy is co-creation (Compagnucci et al, 2020).

Figure 1 shows the main characteristics of living labs (Leminen, 2015) that are going to be adapted to the mechanism of the Smart Care Lab:
- the innovation process and its activities are taking place in real-life environment with real end-users;
- stakeholders included in living labs are part of the quadruple helix (companies, researchers, authorities and users);
- collaboration between stakeholders is an essential part of living labs;
- stakeholders are involved in the development process through co-creation;
- the aim of smart care labs: to foster innovation, to increase sustainability, to produce and exchange knowledge.

Figure 1 - Living Lab Dimensions and Criteria
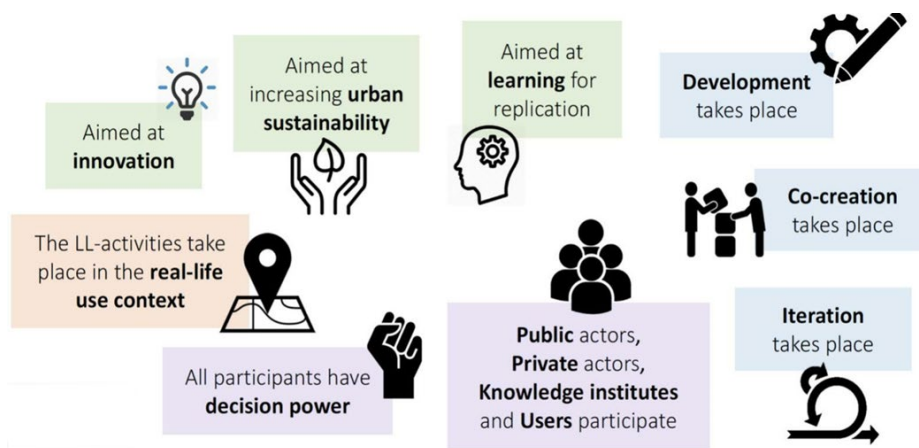
Note. Source of the image: prof. dr. Ellen van Bueren, Power Web Conference 2019, Delft, 2019

Figure 2 shows the process of collaboration between stakeholders within Living Labs. Stakeholders of the quadruple helix multi-stakeholder mechanism (4DMC) engage in a dialogue to search for challenges and define problems to be solved (challenge definition). The next step is ideation – ideas to solve the defined problems/challenges. Once solution ideas have been developed, prototyping of new products/services follows. The prototypes are tested in a real environment with real users (user testing). The processes of

"Living labs are defined as user-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real-life communities and settings (ENoLL, n.d.)

"A Living lab is a physical or virtual space in which to solve societal challenges, especially for urban areas, by bringing together various stakeholders for collaboration and collective ideation. Although the notion has received increasing attention from scholars, practitioners and policy makers, its essence remains unclear to many". (Hossain et al., 2019, p.2)

idea development - prototyping and

user testing are iterative with the goal of eventually obtaining the product/service that fits the market and the targeted user.

Figure 2 - Living Lab Process
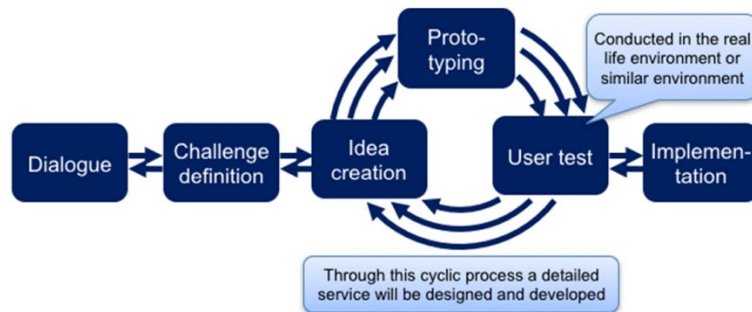
Note. Source of the image: Yasuoka et al., (2018). Living labs as a methodology for service design - an analysis based on cases and discussions from a systems approach viewpoint)

We **define Smart care labs (SCL)** as environments/mechanisms serving as **cooperation structures** in the D-CARE project in which Quadruple Helix stakeholder engagement takes place. SCL bring together stakeholders from public institutions (national and regional), private organizations (companies, SMEs, start-ups), researchers (universities, organizations, schools …) and end-users (citizens, …). The overarching long-term goal of the mechanism is to **co-create disruptive[1] innovative solutions** all along the value chain of integrated care for older adults and medical services, including technological solutions and social innovations, **improving competences, and generating new business models, new businesses, new jobs and new skills.** SCL, as the operational cluster, will coordinate the implementation and exploitation of project results to facilitate the creation, testing, validation and delivery of smart care products/services.

Within D-CARE project 8 Smart Care Labs will be formed. The formation of labs will differ from region to region, it depends on the challenges that will be tackled in each region, but overall goals will remain the same.

---

[1] Disruptive innovations are (EXPH, 2016, p.7) "innovations that create new networks and organisational changes (based on a new set of values) and involve new players, leading to improvements in value as well as changes in the distribution of value between different stakeholders" (Report of the expert panel on effective ways of investing in health on Disruptive Innovation, 2016).

2. SMART CARE LAB GOALS, STRATEGY, APPROACH

Smart Care Labs will address problems related to the **social and health care challenges.** Therefore, a group (mechanism/ecosystem) of stakeholders is formed to actively participate in the Smart Care Lab processes where sustainability is embedded though collaboration, engagement, knowledge and innovation. Despite the specific differences between Labs in D-CARE project, all Labs are formed to follow the same general strategic goals:

> **Goal 1:**
> *To engage and motivate stakeholders to collaborate and to build strong eHealth and eCare ecosystems through "fit for region" smart care models*

Strategy	*Approach*	*Action plan to support SCL objectives*
Connect and establish strong cooperation among stakeholders (from quadruple helix) at regional/national and transnational level	- Invite stakeholders (national and transnational) to collaborate in SCL at the earlier stage of the process - Set stakeholders' role in SCL - Set stakeholders' benefits from SCL - Set priorities of collaboration / set issues to be worked on - Set location of the lab and frequency of the meetings - Sign regional/national MoU and transnational MoU - Select the facilitator to lead and motivate stakeholders - Choose the right methods of collaboration	**Step 1:** Step 1: Engaging stakeholders, exploration, and planning **Activities to follow:** - Engage 4DMC stakeholders and define their roles - Define objectives and key challenges in the region (exploration) - Organise workshops for setting-up and running the lab (operating the lab) - Prepare national workshops reports - Deployment of the lab - Prepare communication and dissemination plan for the lab (see Chapter 8 – Communication)

	between the stakeholders - Set long-term vision of SCL - Define dissemination plans of SCL	
Define key challenges in the region	-Brainstorm / identify key challenges in the region with stakeholders - Gain insight of the end-users' preferences	

Goal 2:

To explore and evaluate new ideas, foster innovation, and usability of innovation in the health and care sector in the Danube region

Strategy	*Approach*	*Action plan to support SCL objectives*
Find new ideas, services, products, and business models through cooperation with 4DMC and end-users (user-centric innovation development)	- set country specific requirements (together with 4DMC) - issue country specific innovation contest and define success criteria (recognition, product launch etc.) - identify innovative solutions and organisations whose products and services respond to regional challenges and invite them to cooperate - connect solutions with distinguished network of influential stakeholders	**Step 2:** Product/service development – Innovation Program **Activities to follow:** - Prepare - Innovation Program Regulation - Prepare a technical document 'Terms of Reference' - Organise virtual meeting to establish country working groups - Country working groups meeting(s)-prepare country specific requirements - Prepare Innovation Call for proposals

Learn, share, exchange and integrate diverse knowledge and skills required to develop smart care service models	- connect and share knowledge, skills for Innovation Program with national and transnational stakeholders (companies, projects, experts etc.)	- Submit the ideas/solutions … - Organize Innovation Expert Panel and assess received proposals - Prepare assessment report - Organise hackathons, innovation days, student contests etc.
Develop new /upgrade existing ideas, services, products, and business models through co-creation	- connect and share knowledge, skills for Innovation Program with national and transnational stakeholders (companies, projects, experts etc.)	

Goal 3:
To provide a working environment for:
- creation, development, prototyping of new ideas, services, products, and business models through co-creation and
- testing and validating the innovation in real environments with real users

Strategy	*Approach*	*Action plan to support SCL objectives*
Develop new /upgrade existing ideas, services, products, and business models through co-creation	- incorporate stakeholders in the innovation process through co-creation - select strategies to manage co-creation process (elaborate co-creation methodology)	**Step 3:** Product/service development – co-creation **Activities to follow:** - Elaborate co-creation methodology - Organize virtual meetings - Form co-creation groups and starting the process of co-creation

	- manage co-creation process and elaborate the report	- Organise transnational workshops - Co-creation process - Prepare co-creation Reports
Implement, test and validate the innovation in real environments with real users (user-driven innovation)	- Getting the insight on users' needs and goals - Getting insight into the products/service quality and its usability in everyday practice - Checking the readiness of the product to be launched or not - Validation of the business perspective for a specific solution - Testing for compatibility with existing solutions as well as legal regulations - Validating the service/product that corresponds to end-users needs	**Step 4:** Pilot testing and validation **Activities to follow:** - Create testing panels - Plan for Pilot test process - Elaborating Testing methodology - Field-test with 'real end-users' - Evaluate and elaborate Testing report - Validate

Goal 4:
To create new business opportunities in eHealth and eCare sector

Strategy	*Approach*	*Action plan to support SCL objectives*
-Increase usability of smart care service models ***- Speed up innovation***	- Making a selected smart care service accessible to end-users	- Prepare/update regional operational plan for SCL in order to keep its sustainability

- Ensure financial support *- Enable the development of Smart Care Labs*	- Finding 'fit for region' new smart care service - Finding financial assets (through municipality etc.) - Utilizing dissemination tools that work best for SCL	- Cooperate with business support organisations and regional innovation centers, create a specific extension to incubation and acceleration programs; cooperate with EIT health hubs. - Participate in strategic documents and financial programs preparation (at regional, national or EU level).

It is important to follow **5 key principles** to be applied in Living Labs as they form the basis for designing Living Lab operations that aim at sustainable development (described in Living Labs Methodology Handbook - Ståhlbröst and Holst, 2012):

- **Value** – economic value, business value and consumer/user value;
- **Influence** – end-user involvement and influence in the innovation and development processes that shape society is essential;
- **Sustainability** - sustainability refers to both the viability of a Living Lab and its responsibility to the wider community in which it operates;
- **Openness** – the innovation process should be as open as possible, innovation occurs in real environments, with this process we can achieve faster and more successful development, new ideas and unexpected business openings in markets;
- **Realism** - one of the cornerstones for the Living Lab approach is that innovation activities should be carried out in a realistic, natural, real environment.

3.   EXPECTED RESULTS

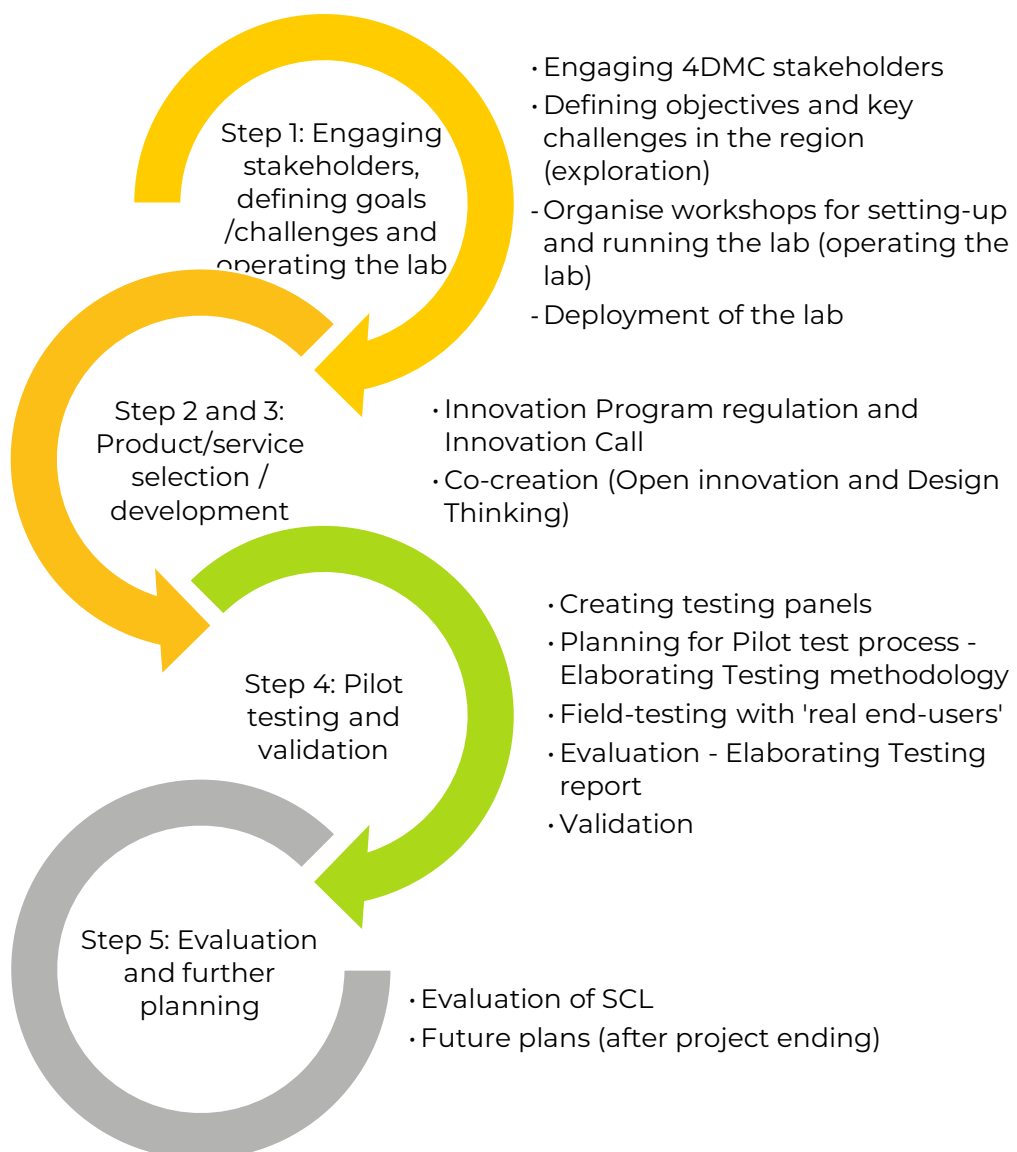| Objectives	Expected results

To motivate stakeholders to collaborate and to build strong eHealth and eCare ecosystems through "fit for region" smart care models	- Involvement of stakeholders in SCL from all four helix branches in each region. - Increased and improved collaboration, cooperation, and awareness among stakeholders. - Continuous exchange of knowledge, skills, good practices among SCL stakeholders as well as with other stakeholders on regional, national, and transnational level. - Selection of the place and the facilitator of SCL, defined frequency of meetings - Preparation of long-term vision of collaboration in SCL. - Management structures are established.
To foster innovation, and usability of innovation in the health and care sector in the Danube region by learning – sharing and exchanging knowledge, and experiences	- Using tools/platforms for sharing knowledge (ILE) - Determined country specific requirements - Availability of new smart care models - Good practice book and transfer of good practices - Transnational strategy and transnational policy centre - Media channels supporting SCL and its operations
To provide a working environment for: - ***creation, development or prototyping of new ideas, services, products, and business models through co-creation and*** - ***testing and validating the innovation in real environments with real users***	- workshops, interviews, or other ways of collaboration during co-creation phase have been conducted - Improved products/services tested by end-users - Increased digitalisation - End-users are involved over the whole innovation process
To create new business opportunities	- in each pilot at least one product has been developed that has at least reached MVP status

	- collaboration between SCL members has led to new business models and products - SCL members continuously scout, coach, test and validate new solutions in the smart care and health sector - number of incubated, accelerated projects volume of investment (pre-seed, seed capital…)

4. SCL PROCESSES – ACTION PLAN TO SUPPORT SCL OBJECTIVES

Smart Care Labs will be established for the duration of D-CARE project and will continue after the end of the project. This chapter will guide you through the process of developing and operating Smart Care Labs. The main process will be in the following steps:

Figure 3 - Smart Care Lab Processes

Step 1: Engaging stakeholders, defining goals /challenges and operating the lab

- Engaging 4DMC stakeholders
- Defining objectives and key challenges in the region (exploration)
- Organise workshops for setting-up and running the lab (operating the lab)
- Deployment of the lab

Step 2 and 3: Product/service selection / development

- Innovation Program regulation and Innovation Call
- Co-creation (Open innovation and Design Thinking)

Step 4: Pilot testing and validation

- Creating testing panels
- Planning for Pilot test process - Elaborating Testing methodology
- Field-testing with 'real end-users'
- Evaluation - Elaborating Testing report
- Validation

Step 5: Evaluation and further planning

- Evaluation of SCL
- Future plans (after project ending)

4.1. Step 1 – Engaging 4DMC stakeholders, defining goals/challenges and planning

Within D-CARE project **eight Smart Care Labs** will be **established** under the leadership of the WP 2 coordinator University of Ljubljana (UL) with the help of PP4 (DBH, Hungary) and PP9 (Gründerschiff, Germany). They will all coordinate the work within the lab and support the regional coordinators. Each lab will operate with its own defined specific goal and scope under the overall goal of the smart care labs as outlined above.

The SCL coordinators will **engage stakeholders from the quadruple helix mechanism** to become active members of the SCL (each member will sign a Memorandum of Understanding) and start the process of collaboration.

4.1.1 Determine key stakeholders and establish their roles

Involving the right stakeholders in the Smart Care Lab is critical to achieving the goals of D-CARE project and the sustainability of the Smart Care Lab. The involvement of not only the potential end-users but also all other stakeholders from the quadruple helix can be considered as the most important element for the successful operation of a SCL.

Stakeholders enter the lab with different sub-goals, but they can bring relevant perspectives, resources and knowledge to start a collective action to achieve the common project goal. The Smart Care Lab will involve stakeholders from the quadruple helix (business, researchers, authorities and users) who have experience, knowledge, and interest in the focus area.

In addition to involving stakeholders from the entire Quadruple Helix and the project partners involved in the Smart Care Lab and its operation, the main focus in the test phase will be on the end users and their participatory aspect.

Stakeholders and their involvement in SCL:

Figure 4 - Stakeholders involved in Living labs
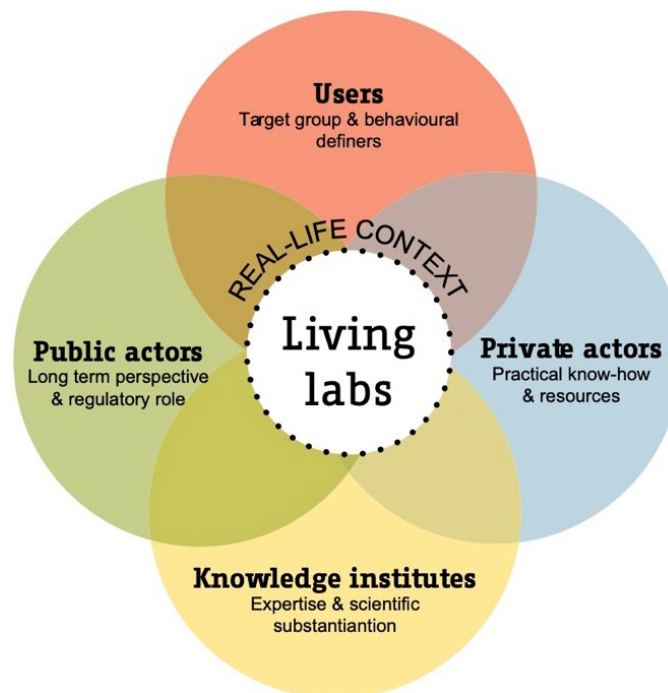
Note. Source of the image: Steen K., van Bueren E. (2017): Urban Living Labs: A Living Lab Way of Working)

Stakeholders	Involvement in SCL
Public sector	• Provide (financial) resources or policy support to establish/maintain SCL and its operations • Define policy goals and prepare policy framework (to foster innovation and entrepreneurship, to respond to end-users needs) • Support Innovation program in the region (financial stimulation, policy support)

Academia/research institutions	• Support innovation and development activities • Provide necessary expertise on user research; provide research on technical topics • Exchange of knowledge • Joint application (with other stakeholders) for research projects
Private sector/industry	• Develop and provide financing, business expertise, test solutions that meet end-users needs, collect data on test-users of their solutions • Exploitation of the solution • New knowledge about users and markets • Exchange of experience, good practices, knowledge • Dissemination • Meeting with other industry players, decision makers (policy)

End-users/end-users organizations:	• Influence on new solutions (engage in co-creation activities: suggest ideas, define challenges, engage in innovation development, test and give feedback)
	• Meetings with other stakeholders:
	  - Industry (access to and gain knowledge about new solutions)
	  - Suggest policy changes,
	  - Provide initiatives to decision-makers
	  - providing inputs on society, community, and target groups' needs, and/or policy effectiveness

4.1.2 Defining objectives and key challenges in the region

To make the living lab successful and tackle the right issues SCL project partners should start with defining goals and key challenges in the region.

Before setting-up a lab project partners from each country/region should brainstorm/discuss:
- What are the health and social care concerns that define discussions in your region?
- What are major regional issues to be solved? Could the SCL be a support to solve some of the issues addressed?
- Which stakeholders from 4DMC to invite and where do we see their contribution in SCL?

- What is the initial vision of the SCL that is going to be established? Aim, processes etc.

4.1.3   Running the lab

After setting-up the lab the management team will work on running the lab and make it a long-term success. Each regional lab will take its own steps for the lab operation. They can choose the process described in this Strategy or find their own, but there are some key elements that needs to be taken into consideration while running a SCL:

(1) Keep multi-stakeholder participation (4DMC) when defining key challenges, collecting data, setting objectives, finding opportunities etc.

(2) Focus on end user engagement – to involve the users at the beginning of the process

(3) Use co-creation methodology – Stakeholders can be engaged through various activities (see chapter 3.2.2 - Co-creation) to propose smart care models or actively work on designing solutions for end-users

(4) Test and validate the solution with end-users in real life setting

(5) Use multi-method approaches

4.2. Step 2 and 3 – Product/Service Selection and Development

After setting up and starting the lab operations the innovation process will begin - development of a new or redesigning of an existing smart care service model. It will follow through the innovation program process and co-creation.

4.2.1   Step 2 - Innovation Program

Innovation Program
After identifying the main challenges, the Innovation Program Regulation and the Innovation Contest will be prepared to scout and select innovative solutions that can generate smart care models. The Innovation program will issue **country specific innovation contests**. The aim of the innovation program is to identify innovative solutions and organisations whose products

and services respond to regional challenges in the health and long-term care area.

The national **members of each Smart Care Lab will**:
- **identify country-specific healthcare challenges** for which innovative solutions will be scouted through an innovation contest. The five most innovative and well-fit solutions per project region will be awarded the D-CARE Innovation Prize in each of the 8 countries of the Danube region. The organizations awarded the D-CARE Innovation Prize gain access to an exceptional network of influential stakeholders in the health and care sector including businesses as well as potential investors, public authorities governing health care regulations, academia with extensive testing resources as well as direct contact to relevant groups of end-users. They may get involved in small-scale or large-scale pilots to test and validate their proposed solutions.
- Within the lab, stakeholders will **review the Innovation call for proposals** and give recommendations on the prepared Innovation call. In the context of D-CARE project eight project regions will issue **country specific innovation contests.**
- Stakeholders from the SCL will be invited **to participate** in the **Innovation Expert Panel**[2] which will be responsible for evaluating and selecting the proposals received based on the ToR (Terms of reference).

4.2.2. Step 3 - Co-creation

The Co-creation process brings together multiple stakeholders and project partners to **work together** to **develop new and improve existing models** (concepts, solutions, products, services, etc.) to tackle health care challenges in the region. The principles of co-creation benefit all stakeholders and lead to new knowledge, information, and innovation. Co-created innovations have a lower risk of market failure. They are the result of a process that involves all the stakeholders relevant to the deployment of the product, namely the end users who will later be customers, the authorities that regulate the sale and use of certain solution, and the businesses that provide the solutions. They already give their inputs during the development process so that a product that sustains the co-creation phase will be fit to user needs and thus generate substantial demand, complies with legal and regulatory requirements, and

---

[2] Innovation Expert Panel will be composed of 1 member of each Project Partner, 1 member from ASP, 3 members from EAB and 3 members from 4DMC.

therefore not pose any problems during the market launch and is interesting from a business case side to the providing companies and organisations.

SCL stakeholders are involved in co-creation activities which are described in detail in deliverable **D.T2.4.1 Co-Creation Methodology**. Not all partners can/need to or will contribute equally, they will contribute according to their own initiative. The main approaches within SCL are:

- **Open Innovation** – the problem focused approach; to identify and solve real problems collaboration between stakeholders is required. Open innovation is an innovation process where different stakeholders (in our case from 4DMC) with different backgrounds (expertise, knowledge, experience) come together to jointly solve a specific problem in the region and develop/improve new solutions.
- **Design thinking** – a people focused approach – It can be used to understand the end-users needs; design thinking approach brings the user in the centre of the discussion.

Actions to be taken as part of the co-creation process within SCL:

- *Organise virtual meetings to explain the co-creation methodology.* Co-creation Methodology will be developed as part of this project as a separate deliverable (deliverable: D.T2.4.1 - Co-Creation Methodology)
- *Form co-creation groups and start the co-creation process* (think about who are your valuable stakeholders for the co-creation group)
- *The co-creation process:*
    The co-creation work is carried out by each co-creation group in the SCL. Goal of the co-Creation groups:
    - To use selected solutions and generate at least 1 integrated smart care service model per Smart Care Lab.
    - Getting understanding of the problem to be solved, develop understanding of the users, and their needs to discover issues and challenges (who the users are, what challenges they face, and what they need).
    - Generate/develop ideas and solutions
    - Define (explore and synthesis) – compile and analyse the information gathered, focusing on gaining understanding and defining the problem.

    Selected methods in the co-creation process:

- **Workshops** (setting up a workshop – determining location, selecting stakeholders to participate in the co-creation process, defining the goal of the workshop, getting the insight of users needs, user involvement to develop/improve ideas, sharing of experiences, feedback to improve a smart care product/service)
- **Interviews** - structured, semi-structured or unstructured
- **Brainstorming**
- **Focus groups**
- **User testing**
- **Survey**
- **Questionnaires**
- **Open hearings**

Selected methods will be described in detail in deliverable: D.T2.4.1 - Co-Creation Methodology.

• *Co-creation reports*
Co-creation reports are documents that provide quantitative and qualitative data on the co-creation work, summarize the steps taken and the main outcomes, and list the inputs received, and the refinement actions carried out. Finally, a brief overview of the key parameters of the developed/prototyped smart care service model ready for the piloting, testing and validation phase is provided.
Deliverable: D.T2.4.2 - Co-Creation Reports.

4.3. Step 4 – Implementation – piloting, testing, validation

This step is dedicated to **piloting, testing and validation of a smart care solution.**
Goals of real-world testing with real end-users:
- Getting insight on users' needs and goals
- Getting insight into the products/service quality and its usability in everyday practice
- Checking the readiness of the product to be launched or not
- Validation of the business perspective for a specific solution

- Testing for compatibility with existing solutions as well as legal regulations
- Validating the service/product that corresponds to end-users needs

Actions to be taken in testing and validation process within SCL:

4.3.1. Pilot testing

Piloting means **putting together a group of end-users** to **test the product/service** before launch in close cooperation and exchange with the provider of the solution as well as the support of other smart care lab members. Pilot testing helps **identifying issues** related to the various components of the new product/service and give us the insight how user-oriented the product/service is. The pilot test also provides the necessary information about what is missing in the innovation.

To develop innovative smart care service models, Smart Care Labs must work closely with end-user communities. The success of the SCL and its innovation processes depends heavily on testing in real-life with real end users.

Each region will select end-users that fit the selected Smart Care model as part of the innovation program. End users will be actively involved in testing the solution in their natural environment. They will test and validate services, ideas and products and provide feedback on their experiences with new solutions.

(1) Recommendations for selecting end users for testing:
- Identify your end users (consider who you want to include in the testing phase, search your database of contacts willing to collaborate, look for organisations that connect relevant end users).
- Decide how many users you want to involve
- Reach your end-users and recruit them
- Choose a User Testing Method (see Deliverable D.T2.5.1 – Testing Methodology)
(2) Preparation of the pilot test:
    • Prepare and provide Informed Consent,
    • Finalise the evaluation tools (interview guidelines, questionnaires …),
    • Test the service product to perform the pilot test,
    • Provide the end-users with all the necessary equipment they need for testing,

- inform/train the participants with the testing and instruct them on how to use the product/service
- Set up a communication channel between the participants, the providers of the solution and the coordinate testing panel for the duration of the testing

(3) Running the test (the phase where participants use the product/perform the test, they work/perform the tasks set by Testing Panels (described in Testing Methodology).

(4) Collecting data and evaluating the pilot test.

(5) Reporting the research findings.

4.3.2. Validation

What is an innovation validation? It is a process of gathering information around an innovation through different tools with real end-users before releasing the final product and putting it into market. It is a confirmation that a product meets its intended use and the end users' needs (validate the viability of a product). Validation reduces the risk of failure, speeds up the market delivery and minimizes the costs.

Within D-CARE project validation of smart care model consists of SCL Testing Reports, that will be reviewed and approved by the EAB.

4.4. Step 5 – Evaluation of SCL and Further Planning

This chapter outlines the general guidelines for monitoring and evaluating SCL activities. A more detailed plan for the first part after SCL deployment is elaborated in specific documents, namely:

- Co-Creation Methodology, which describes the methodological steps and tools to develop the smart care service models in the project countries.
- Testing methodology, a practical guide for testing and evaluating scenarios with the end users or target groups of the smart care service models.

Based on the planned activities and desired outcomes, each SCL should set its own objectives and quality indicators for measuring the outcomes. However, as a general framework, we can follow Geenhuizen (2018) who, based on an extensive literature review, highlighted five questions to consider when evaluating living labs:

> (1) Are the product/service development and design process sufficiently on schedule (work plan and budgets)?
> (2) Are user learning outcomes (user feedback) sufficiently integrated into the design process (De Moor et al., 2010; Sauer, 2013)?
> (3) Are the stakeholders involved in the design sufficiently aligned, do they share a common vision and common interests (e.g. Hakkarainen and Hyysalo (2013)?
> (4) How satisfied are the actors involved with the outcomes and processes to date?
> (5) Is the Living Lab open enough to attract partners in a wider network to provide support for scaling up and implementation (e.g. Evans, 2017)?

The research methodology should focus on participatory research as this type of research requires collaboration with participants and calls for changes in society or communities as a result of the research. Participatory research, also called participatory action research, action research or community-based participatory research (CBPR), actively involves participants in the research process, often with the intention of solving a practical problem in their own situation or community (Creswell & Plano Clark, 2018), which is exactly what SCLs need to achieve.

Two types of evaluations are useful in the SCL context: process and impact evaluations. Both types are equally important for the final evaluation. Process evaluation begins as soon as SCL activities start, and it determines whether program activities have been implemented as intended and resulted in certain outputs. Process evaluation may be conducted periodically. Results of a process evaluation use information to improve future activities. It allows tracking the program information related to Who, What, When and Where questions:
- Whom did the SCL help?
- What has the SCL done/achieved?
- When did SCL activities take place?
- What are the barriers/facilitators to the implementation of the SCL?

The process evaluation will document what 'happens' in the SCLs, to what extent and how consistently the activities are implemented as planned, how well they are implemented and whether the planned activities are accepted by the target groups of the SCL activities. Impact evaluation, on the other hand, looks at what outcomes, changes, impact and effects are achieved by the SCL activities. For example, we are interested in what results are achieved, whether the program achieves the desired effects, whether the target groups are satisfied with the effects, who is affected, how the effects are received, whether they have an impact on the wider environment and so on.

The following performance indicators can be monitored by the SCL lead organisation (adapted from Geenhuizen, 2018):

Overall:
- Was developed a working plan (intended results, budgets) and plan for continuous evaluation at start?

Evolving learning processes (co-creation):
- Were end-users involvement and plan for working with vulnerable groups timely?
- Do actors have sufficient motivation to participate?
- Do actors have adequate capabilities/skills?
- Are multiple approaches and collaboration tools, flexibility in actor roles in place?
- Is gaining and absorption of end-user feed back sufficient?
- Are the processes of project selection, design of business models and decisionmaking transparent

Evolving learning processes: values
- Established rules and regulations about legal issues, like liability, IP issues, data ownership and access
- Established end-user values: highlighting their needs, values of trust, privacy, cultural identity, transparency in decision-making ,...
- Values among managers: commitment, passion, risk-taking
- Societal values, like sustainability and responsibility

Real-life environment
- Shaped an 'inviting' arena where improvisations and tacit knowledge are shared and inventions created and validated
- Settled issues concerning access to places, and implementation of new infrastructure (timing, responding to willingness-to-pay)

Further planning should follow the innovation development stages (as presented in Living Lab Methodology, 2017-2019):

- **Exploration:** getting to know the 'current state' and designing possible 'future states'
- **Experimentation:** real-life testing of one or more proposed 'future states' – developing and experimenting with the new smart care model
- **Evaluation:** assessing the impact of the experiment with regards to the 'current state' in order to iterate the 'future state' – the goal is to launch and implement the innovation.

5. MANAGEMENT AND OWNERSHIP

Ownership in the SCL is assigned to public authorities or ASPs' from each country.

Management in the SCL is described as the **people who design the SCL structure -** establishing and maintaining a Smart Care Lab requires the engagement of project partners and Quadruple helix stakeholders - **and determine how different aspects of the lab will work together.** To ensure project progress, monitor activities, achieve results, and maintain the sustainability of the lab it is important to establish a management structure.

SCL Coordinators
SCL coordinators will be initially selected by the D-CARE project partners. They will take the initiative to start the SCL process – the collaboration between SCL members. Together with the national project partners, they will select and contact the potential regional stakeholders (from the quadruple helix) to:
- set-up a Smart Care Lab and begin the process of solving/addressing regional problems;
- define the roles and responsibilities of each Quadruple Helix stakeholder involved (roles will be defined in the first National workshop);
- convince the 4DMC members that their contribution is very important for the value of the Smart Care Lab and its sustainability;
- to lead, motivate and inspire the SCL stakeholders;
- initiate the various processes and steps within the SCL, especially related to the innovation program;
- to build trust and relationships between stakeholders;
- to initiate and manage the contact and exchange with other national SCLs.

Quadruple helix stakeholders – regional, national and transnational stakeholders
Stakeholders' roles and responsibilities will be defined in more detail as stakeholders express interest in participating in the SCL and when SCL is officially deployed. As Smart care labs structures will vary from region-to-region, the regional management plan won't be the same.

Within the D-CARE project each Smart Care Lab will define stakeholders' roles, their responsibilities and operational plan in National Workshop Reports after the official deployment of the lab.

As part of the management plan, we also suggest that for the future activities the coordinating partners prepare a document to formalise the operation of the labs:

- Basic information about the stakeholders involved and their contribution:
  - Organisation/company involved in the SCL, name of contact person and contact details of partners and stakeholders (address, email, phone number)
  - How does the project in the Smart Care Lab affect the organisation/company?
  - Goal of the organisation/company for the collaboration in the SCL.
  - Contribution of the organisation/company in the SCL.
- It should be clear what the planned tasks, activities, and methods mean, and what exactly is expected from each stakeholder.
- Define the actions to be carried out (review of the innovation call, co-creation process, collaboration with end-users in the piloting phase, testing and validation, tools for testing, analysis, and presentation of results in the innovation process).

The Smart Care Lab is not a closed mechanism, new stakeholders will and can join whenever there is an interest or need of being part of the Smart Care Lab.

Other relevant stakeholders that are not part of the SCL
The Smart Care Lab will also collaborate with stakeholders who are not actively involved in the Lab but are recognised as important stakeholders in the innovation program (see Chapter 4.1.).

6. COMMUNICATION

The communication within SCL will follow the objectives set in the current Strategy. SCL mission and key principles guide the marketing and communication plan.

6.1. Communication objectives

The strategic objectives are:
- To motivate stakeholders to collaborate and to build strong healthcare ecosystems through "fit for the region" smart care models;
- To foster innovation, inclusiveness, usefulness, and usability of an innovation in the health sector in the Danube region by learning – sharing and exchanging knowledge, and experiences;
- To provide a working environment for development of new ideas, services, products, and business models through co-creation and for testing the innovation in real environments with real users.
- To create new business opportunities in the eHealth sector

The marketing goals are:
a. Acquire new stakeholders and interested users
b. Retain existing stakeholders, 4DMC members and users
c. Build and improve awareness on the project
d. Build appropriate partnerships both within private and public sector
e. Implement campaigns, events

The communication plan within SCL is tailored to the activities of the lab. A good communication plan that supports the goals of the lab can contribute to its success. Communication in the SCL will be internal (with SCL stakeholders – project partners and 4DMC members) and external (target group of citizens, authorities, media).

Communication objectives for internal communication:
- Ensure that SCL stakeholders understand the concept of SCL.
- Ensure a regular flow of information for SCL operation;
- Ensure smooth work of SCL;
- Ensure the networking activities between SCLs in PPs countries

Communication objectives for external communication:
- Regularly inform the media about important activities in the lab.
- Regularly inform other target group and stakeholders about important activities.
- Regularly inform the media about operations in the lab and about the achieved goals.

6.2. Target group

The target groups as defined in the D-CARE project are:
- Public authorities (local, regional, national level)
- Sectoral agencies
- Interested groups, including NGOs
- Academia and research
- Educational training centres and schools
- SMEs
- Business support organizations
- International organizations, and
- General public.

6.3. Communication activities

The main strategy is aimed at the **"usership" growth**. There are 3 ways for achieving this goal:
1. Live contact/relationship to the potential stakeholders, 4DMC members and users
2. Creating value for the usership in order to encourage potential members and users to join
3. Building awareness for the SCL and the value of the usership.

Figure 5 – Marketing strategy for SCL
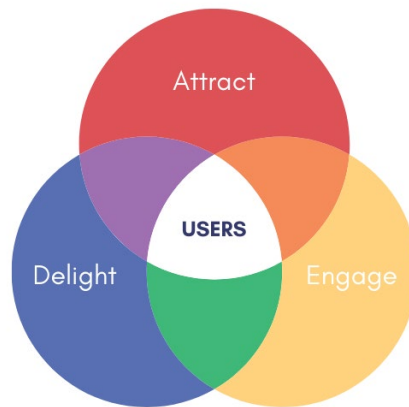
Users – are in this case the defined target groups

Attract - in order to get the flywheel spinning we first need to provide value before extracting value. Providing a diverse portfolio of free content through online learning, webinars, news, campaigns, social media, and more will go a long way in driving usership growth. Not all of the generated content should be gated for users only. It's important for prospects to get an idea of what type of benefits they'll get if they join.

Engage - It's important for prospects to feel engaged with the SCL as they gather information. This requires consistent communication, sharing resources/content, and strong personalization.

Delight - How can SCLs help users to meet their needs? In order to have constant updated information, we should build upon the feedbacks of the users.

Ways to support these tactics:
- Being relevant to the current needs of the targeted users
- Ensuring the SCL is accessible to all interested users, including disabled people
- Demonstrating professionalism and a non-exclusive culture
- Promoting the real benefits accruing to users
- Showcasing the SCLs through:
  - Open events - where the SCL promotes and organizes activities
  - Having a high media profile

Email Campaigns
To make an effective campaign (within the project or later), it is necessary to develop a user communication strategy that delivers a personal and valuable experience to users. An automated email drip campaign can be used in order

to send a series of emails communicating the many benefits of SCLs, all spread over a period of time.

Email Campaigns are also a good way to implement the on-boarding process for new user: they receive a series of emails about the benefits of the usership.

Presence on platforms where the target group is present

An effective relationship should be established with various media. To systematically attain the objective, it is recommended to prepare a comprehensive plan that deals with the available media, focusing on achieving the communication goals with the target groups (see fig. Marketing and communication plan for SCL).

Focus on media interview as an informative way to communicate with target groups can be an effective marketing tool as well.

Events / Meetings

Events are an outreach program that serves multiple purposes for an organization. It can help raise awareness for our activity or for a key issue, it can support knowledge sharing with participants and/or stakeholders, shall serve the networking etc.

Creating a positive media image through diligently prepared marketing communication is a determining factor in successful event management. The communication should be crisp and with an emphasis on the cause. It should be able to make an emotional connection with the target audience and motivate them to participate with enthusiasm in the event. The medium of propagation for the event should be carefully chosen. It should be able to reach the targeted audience effectively. This is one of the most important elements for the event.

Figure 6 - Marketing and communication plan for SCL

Main communication channels and activities for internal and external stakeholders are described at each step of the SCL process:

Step 1: Setting-up the SCL and deployment of the lab
- *Invitation for cooperation in the SCL*
  - Selected stakeholders will receive a formal invitation with the agenda for collaboration in National workshops. Each SCL coordinator will prepare their own agenda.
  - Target group: SCL stakeholders
- *Supporting materials for the workshops*
  - The leader of WP2 (University of Ljubljana) will prepare supporting materials for conducting a workshop. Supporting materials will include a Power Point with the following content: presentation of the D-CARE project, definition and functioning of the Smart Care lab, presentation of the Innovation Contest, presentation on how to conduct a workshop.
  - Target groups: SCL stakeholders
- *Posters*
  - The project partners can use posters to actively present D-CARE project and Smart Care labs in different regional / national / transnational events

- Target groups: SCL stakeholders, media, target group of citizens
- Key message: simple short presentation of D-Care project and regional SCL
- *Press release (for SCL deployment in each region):*
  - Press release will be sent to regional, national media, each project partner will be responsible for disseminating the press release.
  - Press release will be published on the project website, social media (Instagram, FB), and on partners websites.
  - Key message: information about the establishment of the lab, its short and long-term goals, and stakeholders involved.

Step 2: Product/service development

- *Innovation Program Regulation and Innovation Call*
  - Documents published on the project website,
  - Documents sent to potential companies, organisations, and consortia
- *Invitation to submit solutions*
  - Invitation to potential companies, organisations, consortia interested in submitting their solution
  - Target group: potential companies, organisations, consortia
  - (Interested in Innovation Call)

- *Press release*
  - Press release can be prepared to inform the media about the objective of the Innovation Call, who is invited to submit solutions and about important deadlines (we recommend preparing press releases with country-specific content and communicating with the press in their respective countries).
  - Target group: media cannot be a target group in the sense of the current project as they are not potential users or members of the SCL, media are just a source to provide the information to the target group): SMEs, organizations, academia and research
- *Invitation to Co-creation workshops*
  - Invitation to co-creation workshops (with the proposed agenda) will be sent to SCL stakeholders
  - Target group: SCL Stakeholders
- *Promotional video*
  - Aim of the promotional video: to present SCL and its activities to the public
  - The promotional video will be published on You Tube, project partners' websites, and the D-CARE project website
  - Target group: SCL stakeholders public authorities, SMEs, organizations, academia, research, education centres and

schools, general public (as part of the promotional video), media, citizens etc.)

Step 3: Pilot testing and validation
- *Press release*
  - Press release will be prepared inform media about the selected solutions and the pilot phase.
  - Target group: authorities, SMEs, organizations, academia, research, education centres and schools
- *Social media channels of the project (FB, You Tube, LinkedIn) and partners*
  - Key message: inform about activities, inform about the co-creation process as a method and how the piloting is going etc.
  - Target group: SCL stakeholders' public authorities, SMEs, organizations, academia, research, education centres and schools, general public, media, citizens etc.

Step 4: Evaluation and further planning
- *Press release*
  - Key message: Key message: inform the public and stakeholders about the SCLs (results and further planning), the Innovation Program and the developments in D-CARE project
  - Target group: authorities, SMEs, organizations, academia, research, education centres and schools, interested NGOs, international organizations, etc.
- *Social media channels of the project (FB, You Tube, LinkedIn) and partners*
  - Key message: inform the public and stakeholders about the SCLs (results and further planning), the Innovation Program and the developments in D-CARE project
  - Target group: SCL stakeholders' public authorities, SMEs, organizations, academia, research, education centres and schools, general public, media, citizens etc.
- *Events*
  - Key message: inform the public and stakeholders about the SCLs (results and further planning), the Innovation Program and the developments in D-CARE project
  - Target group: authorities, SMEs, organizations, academia, research, education centres and schools, interested NGOs, international organizations, etc.

7.   TIMELINE

Figure 7 - Smart Care Lab timeline
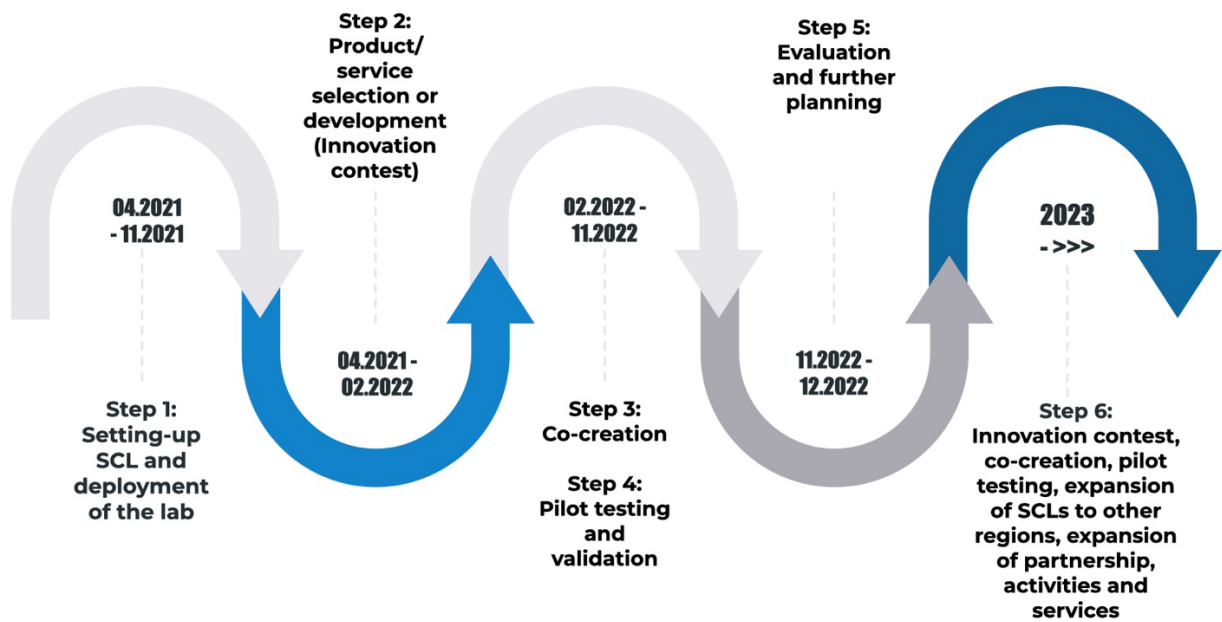
8. CONCLUSION – TIPS FOR A SUSTAINABLE LIVING LAB

A Smart Care Lab is defined as environment/mechanism/ecosystem that serves as a collaborative structure in the D-CARE project involving stakeholders from the Quadruple Helix. Stakeholders/actors from the Quadruple Helix are brought together to innovate - to make valuable contributions to the regional innovation process. As part of the Smart Care Lab strategy, we have outlined the context with key features in four steps that have been adopted for the project and can be used for future Smart Care Lab activities: Step 1 (user engagement and definition of key challenges), Step 2: product/service development (scouting and selection of innovation models), Step 3: co-creation and Step 4: testing and validation of solutions with real end-users.

Over the years, various Living Labs have been established, and we can learn from their experiences on how to successfully run the lab and maintain its sustainability:

The Living Lab methodology (2017-2019) recommends being patient and open-minded (in identifying challenges that need to be addressed in a community), looking for what is already known and what knowledge is needed to understand the challenge when identifying challenges, developing a program that offers a range of activities that can engage all stakeholders (from 4DMC and beyond). If your project involves developing a prototype, develop it iteratively. Address concerns that may arise during the testing phase (take time and steps to explain how the different technologies work), establish a supportive team for stakeholders during the testing phase.

The GRASPINNO project (2018) proposes that to achieve the sustainability of a living lab (LL), it is recommended to:
- organize regular meetings between stakeholders to share experiences, knowledge and new ideas, funding and support issues, tools, etc., but also to get experience, advice and new business opportunities.
- It is useful to identify and address new and innovative topics for each of the stakeholder meetings.
- The meetings are held at the premises of the LL stakeholders, so that there is no or minimal cost.
- The group of existing and potential LL stakeholders must be familiar with the activities of LL and have a vital interest in the outcomes of LL to promote and increase the use of LL.

There are also many other interesting approaches and models on living labs that can be found on internet:

- The SAGE Lab focuses on developing and evaluating the role of technology in creating and supporting the social inclusion and integration of older people, both in residential care homes and in the community, including the promotion of digital citizenship. More info: https://www.uwa.edu.au/schools/Research/SAGE-lab

- Living Lab Social in real environments offers a comprehensive and direct service, providing customised solutions for both research projects and the development of innovative products and services in response to the challenge of ageing. More info: https://livinglabsocial.com/en/index-en.html

- Living Lab in Ageing and Long-Term Care - presents the model of a sustainable and successful interdisciplinary collaboration between scientists, care providers and educators in long-term care. More info: https://link.springer.com/article/10.1007/s12603-019-1288-5

- ACSELL project:
  1) knowledge transfer and mutual learning between regions coping with the same challenges by identifying transferable good practices and hacking regional policy challenges; and
  2) accelerating innovative capacities in the participating regions through improvement of (innovation) policy instruments.
  More info: http://www.interregeurope.eu/ACSELL/

9.   REFERENCES

1. A Quadruple Helix Guide for Innovations (2019). https://northsearegion.eu/media/11651/a-quadruple-helix-guide-for-innovations.pdf
2. Bueren, van E. (2019), Power Web Conference 2019, Delft https://d2k0ddhflgrk1i.cloudfront.net/Websections/Powerweb/Annual%20Conference%202019/Ellen%20van%20Bueren%20Conference.pdf
3. Bellandi, V., Ceravolo, P., Cristiano, A., Damiani, E. Damiani, Sanna, A., Trojaniello, D. (2020). A design methodology for matching smart health requirements. https://onlinelibrary.wiley.com/doi/full/10.1002/cpe.6062
4. Cavallini S., Soldi R., Volpe M. (2016). Using the Quadruple Helix Approach to Accelerate the Transfer of Research and Innovation Results to Regional Growth, https://cor.europa.eu/en/engage/studies/Documents/quadruple-helix.pdf
5. Compagnucci, L., Spigarelli, F., Coelho, J., Duarte, C. (2020). Living Labs and user engagement for innovation and sustainability. https://www.sciencedirect.com/science/article/pii/S095965262035767X
6. Curley, M., Salmelin, B. (2018). Open Innovation 2.0. https://ec.europa.eu/futurium/en/system/files/ged/24-oispgopeninnovation20anewparadigm-whitepaper.pdf
7. ENoLL, European Network of Living Labs. (2021, 10. October) https://enoll.org/about-us/
8. Eschenbächer, J., Thoben, K-D, Turkuma, P.. (2010). Choosing the best model of Living Lab collaboration for companies analyzing service innovations. International Journal of Projectics, pp. 11-39.
9. European Commission (2013). Guidance document on Monitoring and Evaluation (2013) https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/guidance_tor_impact_evaluation_102013.pdf
10. Garcia Robles A., Hirvikoski T., Schuurman D., Stokes L. (2016). IntroducingENoLL and its Living Lab community. https://issuu.com/enoll/docs/enoll-print
11. GRASIPINNO, Deliverable: D.4.2 Findings from Living Labs (2018). University of Maribor https://green-growth.interreg-med.eu/fileadmin/user_upload/Sites/Green_Growth/Projects/GRASPINNO/D.4.4.2_Findings_from_Living_Labs_final.pdf
12. Hossain, M., Leminen, S. & Westerlund, M. (2019). A systematic review of living lab literature. Journ. Of Clearner Production 213 976-988

https://deliverypdf.ssrn.com/delivery.php?ID=78200311702701400512512509101612308905201600605902100602909800012709507201110901709203401002901603304704512406402402407000030970510220300470380280710240230951210240740810090121000151021241120960841110731190880980940170110990960031081030850150971200105117&EXT=pdf&INDEX=TRUE

13. Interaction Design Foundation (n.d.), 5 Stages in Design Thinking Process.Interaction Design Foundation, https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process

14. U4IoT (2019). Living Lab Methodology Handbook (2017-2019). https://www.iscapeproject.eu/project/living-lab-methodology/

15. EXPH (2016). Report of the expert panel on effective ways of investing in health oh Disruptive Innovation. https://ec.europa.eu/health/sites/default/files/expert_panel/docs/012_disruptive_innovation_en.pdf

16. Leminen, S.,; Westerlund, M., Nyström, A-G. (2014). On becoming creative consumers - user roles in living labs networks (International Journal of Technology Marketing (IJTMKT), Vol. 9, No. 1, 2014)

17. Ståhlbröst A., Holst M. (2012): Living Labs Methodology Handbook, https://www.ltu.se/cms_fs/1.101555!/file/LivingLabsMethodologyBook_web.pdf

18. Steen K., van Bueren E. (2017): Urban Living Labs: A Living Lab Way of Working, AMS Institute. https://www.researchgate.net/publication/318109901_Urban_Living_Labs_A_Living_Lab_Way_of_Working

19. Committee of the Regions (2016). Using the Quadruple Helix Approach to Accelerate the Transfer of Research and Innovation Results to Regional Growth. https://cor.europa.eu/en/engage/studies/Documents/quadruple-helix.pdf

20. Vandael K., Dewaele A., Buysse A. (2018): Guide to Co-creation. https://biblio.ugent.be/publication/8653735/file/8653736

21. Westerlund, M., & Leminen, S. (2011). Managing the challenges of becoming an open innovation company: experiences from Living Labs. Technology Innovation Management, (October), 19–25. https://timreview.ca/sites/default/files/article_PDF/WesterlundLeminen_TIMReview_October2011_3.pdf

22. Yasuoka M., Akasaka F., Kimura A. Ihara M. (2018) Living labs as a Methodology for Service Design – an Analysys Based on Cases and Discussions from a Systems Approach Viewpoint. https://doi.org/10.21278/idc.2018.0350

23. Zurkuhlen A., Tageo V., González J., Myriam M., López E., Allegretti N., Zuffada R. (2019). I2M Innovation to market plan https://ec.europa.eu/eip/ageing/file/3092/download_en%3Ftoken=Bv6Kzc1